RYE NYRCR

NY RISING COMMUNITY RECONSTRUCTION PLAN

December 2014

NY Rising Community
Reconstruction Program

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This document was developed by the Rye NYRCR Planning Committee as part of the NY Rising Community Reconstruction (NYRCR) Program within the Governor's Office of Storm Recovery. The NYRCR Program is supported by NYS Homes and Community Renewal and NYS Department of State. The document was prepared by the following consulting firms: AKRF, Inc.; Sasaki Associates, Inc.; CDM Smith, Inc,; Arch Street Communications, Inc.; and Nagle, Tatich, Cranston LLC d/b/a Elan.3.Consulting (E.3)

Foreword

Introduction

In the span of approximately one year, beginning in August 2011, the State of New York experienced three extreme weather events. Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy wreaked havoc on the lives of New Yorkers and their communities. These tragic disasters signaled that New Yorkers are living in a new reality defined by rising sea levels and extreme weather events that will occur with increased frequency and power. They also signaled that we need to rebuild our communities in a way that will mitigate against future risks and build increased resilience.

To meet these pressing needs, Governor Andrew M. Cuomo led the charge to develop an innovative, community-driven planning program on a scale unprecedented and with resources unparalleled. The NY Rising Community Reconstruction (NYRCR) Program, within the Governor's Office of Storm Recovery (GOSR), empowers the State's most impacted communities with the technical expertise and funding resources needed to develop thorough and implementable reconstruction plans to build physically, socially, and economically resilient and sustainable communities.

Program Overview

The NYRCR Program, announced by Governor Cuomo in April of 2013, is a more than $700 million planning and implementation program established to provide rebuilding and resiliency assistance to communities severely damaged by Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy. Drawing on lessons learned from past recovery efforts, the NYRCR Program is a unique combination of bottom-up community participation and State-provided technical expertise. This powerful combination recognizes not only that community members are best positioned to assess the needs and opportunities of the places where they live and work, but also that decisions are best made when they are grounded in rigorous analysis and informed by the latest innovative solutions.

Launched in the summer of 2013 and completed in March 2014, Round I of the NYRCR planning process included 50 NYRCR Planning Areas, comprising 102 storm-impacted localities. In January 2014, Governor Cuomo announced a second round of the planning process, serving an additional 22 storm-impacted localities. Four of these localities were absorbed into existing Round I NYRCR Planning Areas, bringing the number of localities participating in Round I up to 106; the other 18 localities formed 16 new Round II NYRCR Planning Areas. Between Rounds I and II, there are 66 NYRCR Planning Areas, comprising 124 localities. The program serves over 2.7 million New Yorkers and covers nearly 6,500 square miles, which is equivalent to 14% of the overall State population and 12% of the State's overall geography.

In Rounds I and II, the State allotted between $3 million and $25 million to each participating locality for the implementation of eligible projects identified in the NYRCR Plan. The funding for these projects is provided through the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant–Disaster Recovery (CDBG-DR) program.[1]

Each NYRCR Planning Area is represented by a NYRCR Planning Committee composed of local residents, business owners, and civic leaders. Members of the Rye NYRCR Planning Committee

1 Five of the Round I Planning Areas—Niagara, Herkimer, Oneida, Madison, and Montgomery Counties—are not funded through the CDBG-DR program.

were identified in consultation with established local leaders, community organizations and, in some cases, municipalities. The NYRCR Program sets a new standard for community participation in recovery and resiliency planning, with community members leading the planning process. Across the State, more than 650 New Yorkers have represented their communities by serving on Planning Committees. Nearly 650 Planning Committee Meetings have been held, during which Planning Committee members worked with the State's team to develop community reconstruction plans, which identify opportunities to make their communities more resilient. All meetings were open to the public. An additional 250+ Public Engagement Events attracted thousands of community members, who provided feedback on the planning process and resulting proposals. The NYRCR Program's outreach has included communities that are traditionally underrepresented, such as immigrant populations and students. All planning materials are posted on the program's website (www.stormrecovery.ny.gov/nyrcr), providing several ways for community members and the public to submit feedback on the program and materials in progress.

Throughout the planning process, Planning Committees were supported by staff from GOSR, planners from New York State (NYS) Department of State and NYS Department of Transportation, and consultants from world-class planning firms that specialize in engineering, flood mitigation solutions, green infrastructure, and more.

The NYRCR Program does not end with this NYRCR Plan. Governor Cuomo has allotted over $700 million for planning as well as implementing eligible projects identified in NYRCR Plans. NYRCR Planning Areas are also eligible for additional funds through the NY Rising to the Top Competition, which evaluates applications from Round II NYRCR Planning Committees across three categories—Regional Approach, Inclusion of Vulnerable Populations, and Use of Green Infrastructure. The winner of each category will be allotted a share of the competition's $3.5 million to fund additional eligible projects.

In April 2014, Governor Cuomo announced that projects identified in NYRCR Plans would receive priority consideration through the State's Consolidated Funding Application (CFA) process and charged the Regional Economic Development Councils (REDCs), which play an advisory role in the CFA process, to support NYRCR projects. In December 2014, Governor Cuomo announced that 24 NYRCR projects received nearly $12 million in CFA funding. This announcement is an example of the Governor honoring his commitment to leverage the work of the NYRCR Planning Committees to incorporate resilience into other State programs and to find additional sources of funding for NYRCR projects. The NYRCR Program is also working with both private and public institutions to identify existing funding sources and to create funding opportunities where none existed before.

The NYRCR Program has successfully coordinated with State and Federal agencies to help guide the development of feasible projects. The program has leveraged the REDC State Agency Review Teams (SARTs), composed of representatives from dozens of State agencies and authorities, for feedback on projects proposed by NYRCR Planning Committees. The SARTs review projects with an eye toward regulatory and permitting needs, policy objectives, and preexisting agency funding sources. The NYRCR Program is continuing to work with the SARTs to streamline the permitting process and ensure shovels are in the ground as quickly as possible.

On the pages that follow, you will see the results of months of thoughtful, diligent work by the Rye NYRCR Planning Committee, which is passionately committed to realizing a brighter, more resilient future for its community.

The NYRCR Plan

This NYRCR Plan is an important step toward rebuilding a more resilient community. Each NYRCR Planning Committee began the planning process by defining the scope of its planning area, assessing storm damage, and identifying critical issues. Next,

the Planning Committee inventoried critical assets in the community and assessed the assets' exposure to risk. On the basis of this work, the Planning Committee described recovery and resiliency needs and identified opportunities. The Planning Committee then developed a series of comprehensive reconstruction and resiliency strategies, and identified projects and implementation actions to help fulfill those strategies.

The projects and actions set forth in this NYRCR Plan are divided into three categories. The order in which the projects and actions are listed in this NYRCR Plan does not necessarily indicate the Planning Committee's prioritization of these projects and actions. Proposed Projects are projects proposed for funding through an NYRCR Planning Area's allotment of CDBG-DR funding. Featured Projects are projects and actions that the Planning Committee has identified as important resiliency recommendations and has analyzed in depth, but has not proposed for funding through the NYRCR Program. Additional Resiliency Recommendations are projects and actions that the Planning Committee would like to highlight and that are not categorized as Proposed Projects or Featured Projects. The Proposed Projects and Featured Projects found in this NYRCR Plan were voted for inclusion by voting members of the Planning Committee. Those voting members with conflicts of interest recused themselves from voting on any affected projects, as required by the NYRCR Ethics Handbook and Code of Conduct.

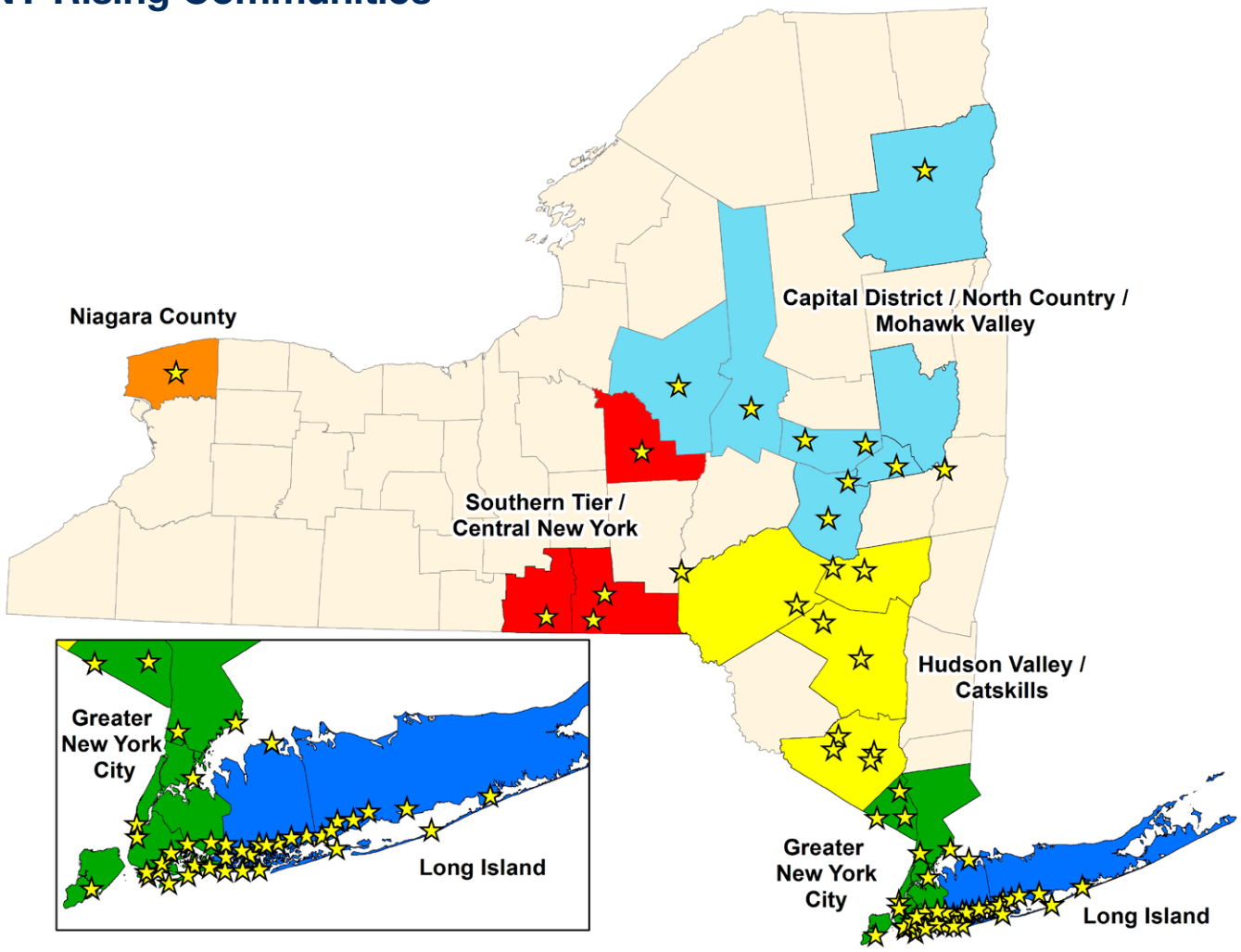
As part of Round II of the NYRCR Program, the Rye NYRCR Planning Area has been allotted up to $3 million in CDBG-DR funds for the implementation of eligible projects identified in this plan.

While developing projects for inclusion in NYRCR Plans, Planning Committees took into account cost estimates, cost-benefit analyses, the effectiveness of each project in reducing risk to populations and critical assets, feasibility, and community support. Planning Committees also considered the potential likelihood that a project or action would be eligible for CDBG-DR funding. Projects and actions implemented with this source of Federal funding must satisfy a Federally-designated eligible activity category, fulfill a national objective (i.e., meeting an urgent need, removing slums and blight, or benefiting low- to moderate-income individuals), and have a tie to the natural disaster to which the funding is linked. These are among the factors that GOSR will consider, in consultation with local municipalities and non-profit organizations, when determining which projects and actions are best positioned for implementation.

The total cost of Proposed Projects in this NYRCR Plan exceeds the NYRCR Planning Area's CDBG-DR allotment to allow for flexibility if some Proposed Projects cannot be implemented due to environmental review, HUD eligibility, technical feasibility, or other factors. Implementation of the projects and actions found in this NYRCR Plan are subject to applicable Federal, State, and local laws and regulations, including the Americans with Disabilities Act. Inclusion of a project or action in this NYRCR Plan does not guarantee that a particular project or action will be eligible for CDBG-DR funding or that it will be implemented. Projects will be implemented on a staggered timeline, and the NYRCR Program will choose an appropriate State or local partner to implement each project. GOSR will actively seek to match projects with additional funding sources, when possible.

In the months and years to follow, many of the projects and actions outlined in this NYRCR Plan will become a reality, helping New York not only to rebuild, but also to build back better.

NY Rising Communities



Note: Map displays the 66 NYRCR Planning Areas from Rounds I and II. (Five of the Round I Planning Areas—Niagara, Herkimer, Oneida, Madison, and Montgomery Counties—are not funded through the CDBG-DR program.)

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Executive Summary - Rye

Overview

New York State's Governor's Office of Storm Recovery received funding from the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant–Disaster Recovery (CDBG-DR) program to create the NY Rising Community Reconstruction (NYRCR) Program.

The NYRCR Program is designed to provide each NYRCR Community with planning assistance to develop an NYRCR Plan that presents a community vision, identifies critical issues, and highlights strategies and projects that will make the Community more resilient in the face of future storms.

In addition to funding this planning effort, the State has allotted $3 million in CDBG-DR funding for the implementation of eligible projects identified in the Rye NYRCR Plan.

The City of Rye is located in Westchester County on the Long Island Sound, 28 miles from midtown Manhattan via the Metro North Rail Station located in downtown Rye. This bedroom community has a population of approximately 16,000 people, who live primarily in single family homes and low-density multifamily housing. Among Rye's greatest assets are its natural features. Tree-lined streets, several beaches, and Blind Brook and Beaver Swamp Brook are just a few environmental assets that allow residents to feel close to nature, despite their proximate location to New York City.

However, Rye's natural features also create hazards during storms. Over the last decade, Rye has been heavily impacted by a series of storms. In 2007, two major storms hit Rye before the spring thaw. In 2011, Hurricane Irene caused significant riverine flood damage in Rye. When Tropical Storm Lee hit a few weeks later, it delayed recovery efforts. In 2012, Superstorm Sandy's strong winds caused considerable and extended power outages and storm surge wreaked havoc along the coast of the Long Island Sound. These storms raised awareness about the Community's vulnerability to flooding and power loss during storm events.

Riverine flooding is the most critical issue facing Rye today. Blind Brook and Beaver Swamp Brook pass through residential neighborhoods, the Central Business District, and several municipal and non-profit properties. Repetitive storm damage and the major repairs that follow have fatigued the Community, and the City is seeking relief.

Community-Driven Process

The Rye NYRCR Plan was developed over the course of a seven month community driven planning process, commencing in June 2014 and formally conducting post-plan development in January 2015. Developed by the Rye NYRCR Planning Committee (Committee), community stakeholders, residents, and State-provided experts, the Rye NYRCR Plan respects the Community's strengths and assets as it seeks to fully recover and to increase resilience and sustainability. The Committee developed the following vision to guide them through the planning process:

The City of Rye is a thriving, suburban, Sound Shore community with a spirit of volunteerism, proximity to New York City, local and regional natural resources, historic landmarks, excellent schools, and access to transit. Our Vision is to preserve and improve Rye to ensure that the community remains economically and environmentally resilient and resistant to storms and floods.

Children and teenagers in Rye participated in an education and outreach session about resilience.

To ensure the Rye NYRCR Plan reflects the views of the entire community, a series of Planning Committee Meetings and Public Engagement Events were held throughout the planning process. In Rye, 10 Planning Committee Meetings were held with the nine members and two co-chairs of the Planning Committee and representatives from the State team. During these meetings, Committee members shared their local expertise and experience to guide the development of the NYRCR Plan. Three Public Engagement Events were held throughout the process to solicit feedback and input from members of the larger Rye community on the Vision, Values, and Community Assets; Needs and Opportunities and Strategies; and Projects. A fourth Public Engagement Event will be held to present the final plan to the Community.

NYRCR Plan as Blueprint for Implementation

The Rye NYRCR Plan focuses on addressing the existing and potential future risks to the Community. The planning and engagement process first identified assets within Rye. Then, Committee members, residents, and stakeholders identified the needs and opportunities of affected assets, as they relate to each of six Recovery Support Functions: community planning and capacity building, economic development, health and social services, housing, infrastructure, and natural and cultural resources. In addition, the potential risk to those assets from future storms was analyzed and documented. Detailed information about the assets and risk assessment process can be found in Section II.

After speaking with Community members about their needs, the Committee used emerging themes to create four strategies to direct reconstruction and resilience efforts. Reconstruction efforts seek to restore, repair, or rebuild what was damaged or destroyed by Hurricane Irene and Superstorm Sandy. Resiliency efforts are about strengthening Rye's ability to rebound quickly from storm-related challenges. The four strategies were developed to protect Rye's riverine assets from flooding; protect Rye's coastal assets from sea level rise, coastal vulnerability, and tidal impacts; increase infrastructure resilience; and improve Rye's preparedness for future storms.

The Committee and Community were guided by these strategies as they identified projects for implementation.

The projects included in the Rye NYRCR Plan are organized into three categories:

- **Proposed Projects** are discrete projects that can be funded with the Community's allotment of CDBG-DR assistance.
- **Featured Projects** are innovative projects where an initial study or discrete first phase of the project is proposed for CDBG-DR funding or other funding resources. Featured Projects also may include regulatory reforms and other programs that do not involve capital expenditure.
- **Additional Resiliency Recommendations** are resiliency projects and actions the Committee would like to highlight and are not categorized as Proposed or Featured Projects.

Within the Rye NYRCR Plan, projects are listed by strategy and then by category, but are otherwise not listed in any particular order. Listed on the next page are the Proposed and Featured Projects identified by the Committee.

Table 1
Strategy: Collaborate Within the Watershed to Address Riverine Flooding at its Source

Project Name	Description	Category	Regional
Modifications to the Sluice Gate at Bowman Avenue Dam	Modifications include moving the stream gauges that trigger the sluice gate's automatic functions further downstream and updating the operational rules of the gate.	Proposed	Y
Stormwater Ponds at Anderson Hill Road (SUNY Purchase)	Two stormwater detention ponds could be created by building earthen berms across the Blind Brook floodplain, with openings at the channel. During heavy rain storms, the berms would constrict the water flow through the channel and would create detention ponds immediately upstream.	Proposed	Y
Bowman Avenue Dam Upper Pond Resizing	Expand the storage capacity of the Upper Pond at the Bowman Avenue Dam by excavating 104,000 cubic yards of material, creating a larger retention basin.	Proposed	Y
Detention Basins at Westchester County Airport	Expand the capacity of two detention ponds at the Airport to increase their storage capacity, minimizing runoff into Blind Brook.	Featured	Y
Bowman Avenue Dam Lower Pond	Resize the lower pond at the Bowman Avenue Dam to increase its flood storage capacity. The project also includes the installation of a spillway as a flood control structure at I-287.	Featured	Y

Table 2
Strategy: Infrastructure Resilience

Project Name	Description	Category	Regional
Improved Milton Road Drainage to Harbor	Install expanded drainage on Milton Road north of the Milton Harbor House to divert flood waters to the Harbor.	Proposed	N
New Entrance to Rye Nature Center	Create a new entrance to the Nature Center that does not cross Blind Brook. The historic bridge on the current access road could be converted into a pedestrian bridge.	Featured	N
Floodproof the Locust Avenue Firehouse	Floodproof the Locust Avenue Firehouse.	Featured	N

Table 3
Strategy: Readiness for Future Storms

Project Name	Description	Category	Regional
Designate Rye Golf Club as a City-Operated Emergency Center	Designate a City-operated emergency center at Rye Golf Club to provide residents a place to regroup during or after storm events which result in the loss of power, flooding, and/or utility interruptions.	Featured	N
Floodproof Non-profit Facilities in the Central Business District	Floodproof non-profit facilities in the Central Business District that have suffered repeated damage during storms.	Featured	N

2014
NY RISING COMMUNITY RECONSTRUCTION PLAN

RYE NYRCR

Section I
Community Overview


the Y
100 YEARS...
Celebrate the
Y in YOU
RYE YMCA 1914–2014
STOP

I: Community Overview

A. Community Overview

Rye was originally settled in the 1660s along the Long Island Sound on the border between Connecticut and New York State. It was formally established as a village in 1904 and a city, the smallest in Westchester County, in 1942. Today, this primarily residential community is home to roughly 16,000 people who live in a mix of single family homes and low-density multifamily housing. Nearly 20% of Rye's six square miles is devoted to recreation and conservation.[1] Tree-lined streets, numerous beaches and marinas along the Long Island Sound and Milton Harbor, and Blind Brook and Beaver Swamp Brook create a feeling of living close to nature throughout the suburban community.

The City is home to five excellent public schools, several private schools, two well-regarded senior living facilities, a medical group, and a clinic. Playland Park, a County-owned amusement park, is a popular regional destination on the City's Long Island Sound shoreline while Rye Town Park provides local access to the waterfront. The City's downtown amenities line Purchase Street, a short walk from the Metro North Rail Station. Midtown Manhattan is less than a 30-mile drive, and trains run approximately twice an hour to Grand Central Station.

Rye is unique in that its residents and City government have been working to manage their surrounding water bodies for nearly half a century. Since the 1960s, the City has been developing plans to manage stormwater runoff to protect the water in the Sound, raising awareness about sustainability and protecting the community from flood risks. Water and the environment have received additional attention in recent years as a series of extreme weather events have brought increased flooding and power outages to the community. With 14 miles of waterfront and two brooks, the City remains vulnerable to flooding during heavy rains, high tides, hurricanes, and nor'easters.

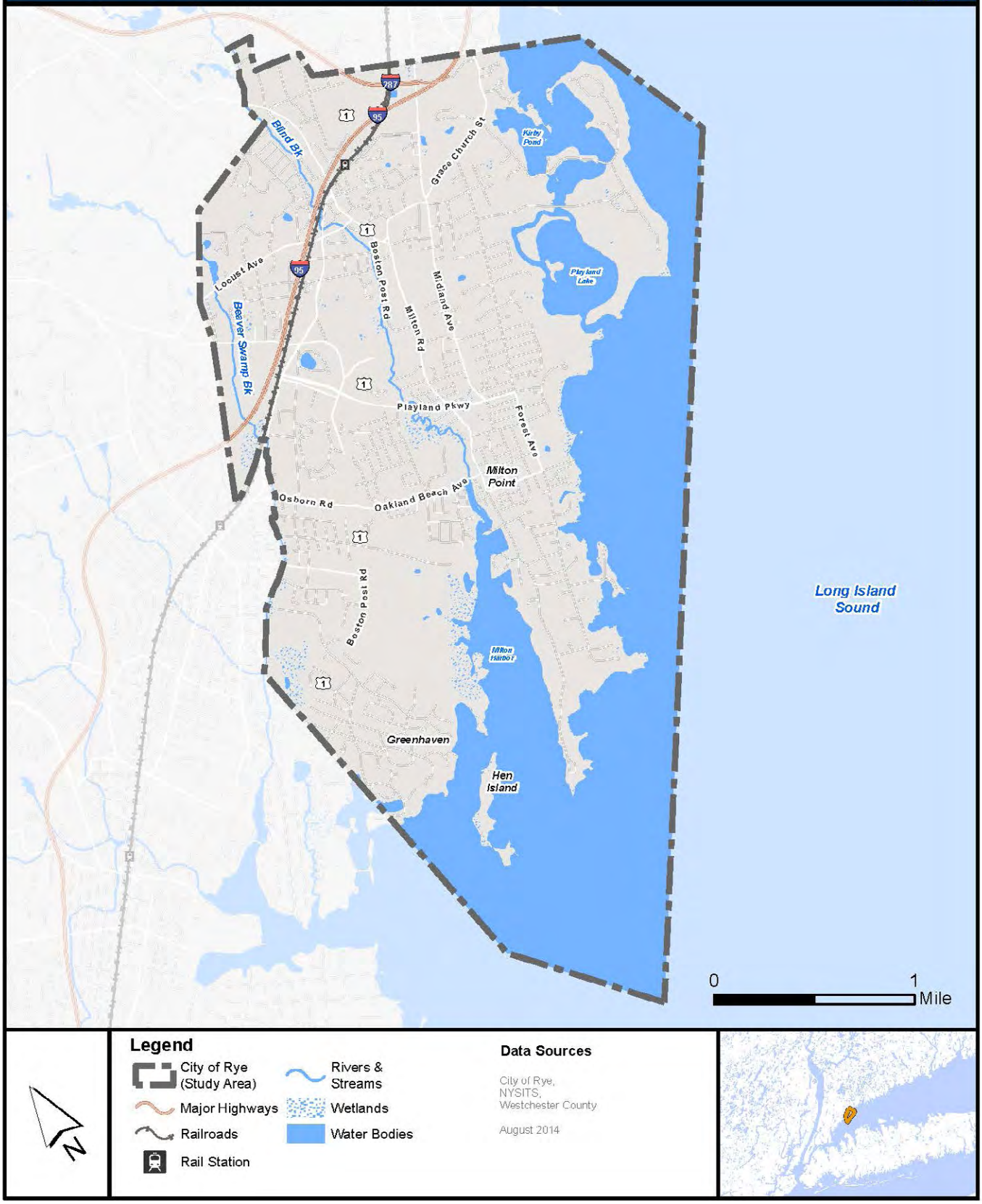
On March 2, 2007, Rye was hit by an intense rain storm while the ground was still frozen. Six weeks later, on April 15, a nor'easter hit the community and left homes, businesses, and roadways flooded and sections of the community without power. On August 28, 2011, Hurricane Irene made landfall in Rye causing extreme riverine flooding. Just over a year later, Superstorm Sandy made landfall on October 29, 2012 bringing coastal flooding and high winds that damaged waterfront assets and knocked down power lines across the City. After each of these storm events, Rye and its residents and business owners immediately began to rebuild.

The NY Rising Community Reconstruction (NYRCR) Program is designed to provide the NYRCR Rye Community (Community) with planning assistance to develop a Rye NYRCR Plan (NYRCR Plan) that presents a community vision, identifies critical issues, and highlights strategies and projects that will make the Community more resilient in the face of future storms.

Section 1 - Community Overview includes the following subsections:

- Geographic Scope defines the physical boundaries of the NYRCR Plan and provides further demographic and political context for Rye.
- Description of Storm Damage outlines how Hurricane Irene, Superstorm Sandy, and other recent weather events have affected the people, the buildings, the ecology, and other assets in Rye.
- Critical Issues highlight overarching themes that this Plan will seek to address in order to be more resilient in the face of future storms. These themes will be elaborated in Section II: Assessment of Risk and Needs.

Figure I-1
Geographic Scope - City of Rye



- Community Vision expresses the Community's aspirations for a more resilient future and the values that the Plan should enshrine.
- Relationship to Regional Plans connects ongoing regional initiatives and past local planning efforts to the projects and strategies that will be included in this plan.

B. Geographic Scope

The geographic scope of the NYRCR Plan is coterminous with the City of Rye, which is less than a mile southwest of the Connecticut state line. The City is bordered to the southeast by the Long Island Sound, though it should be noted that all of the land along the Sound is owned by Westchester County, the Town of Rye, or private property owners. Milton Harbor forms the southwest border. Beaver Swamp Brook runs along most of the western border of the City separating it from the Town of Harrison and Mamaroneck. Short stretches of High Street, Cottage Street, and two shopping centers separate the city on its northern edge from Port Chester and Rye Brook in the Town of Rye. Figure I-1 shows the Geographic Scope of the Community.

The City is located at the bottom of the Blind Brook's 13.6 square mile watershed that drains through Rye and into Long Island Sound. Blind Brook bisects the City, extending 3.5 miles from the City's northern border, through a channel in the downtown, and becoming a tidal estuary before meeting Milton Harbor. Figure I-2 shows the Watershed of the Blind Brook. Although Blind Brook is the primary watercourse running through the center of Rye, peripheral areas of the City are part of adjacent drainage basins, including regions which contribute surface runoff to Long Island Sound to the east and to Beaver Swamp Brook to the west. All of these areas are subject to flooding. Other areas in Rye, such as the Loudon Woods neighborhood, experience groundwater flooding during storm events because of the high water table in Rye.

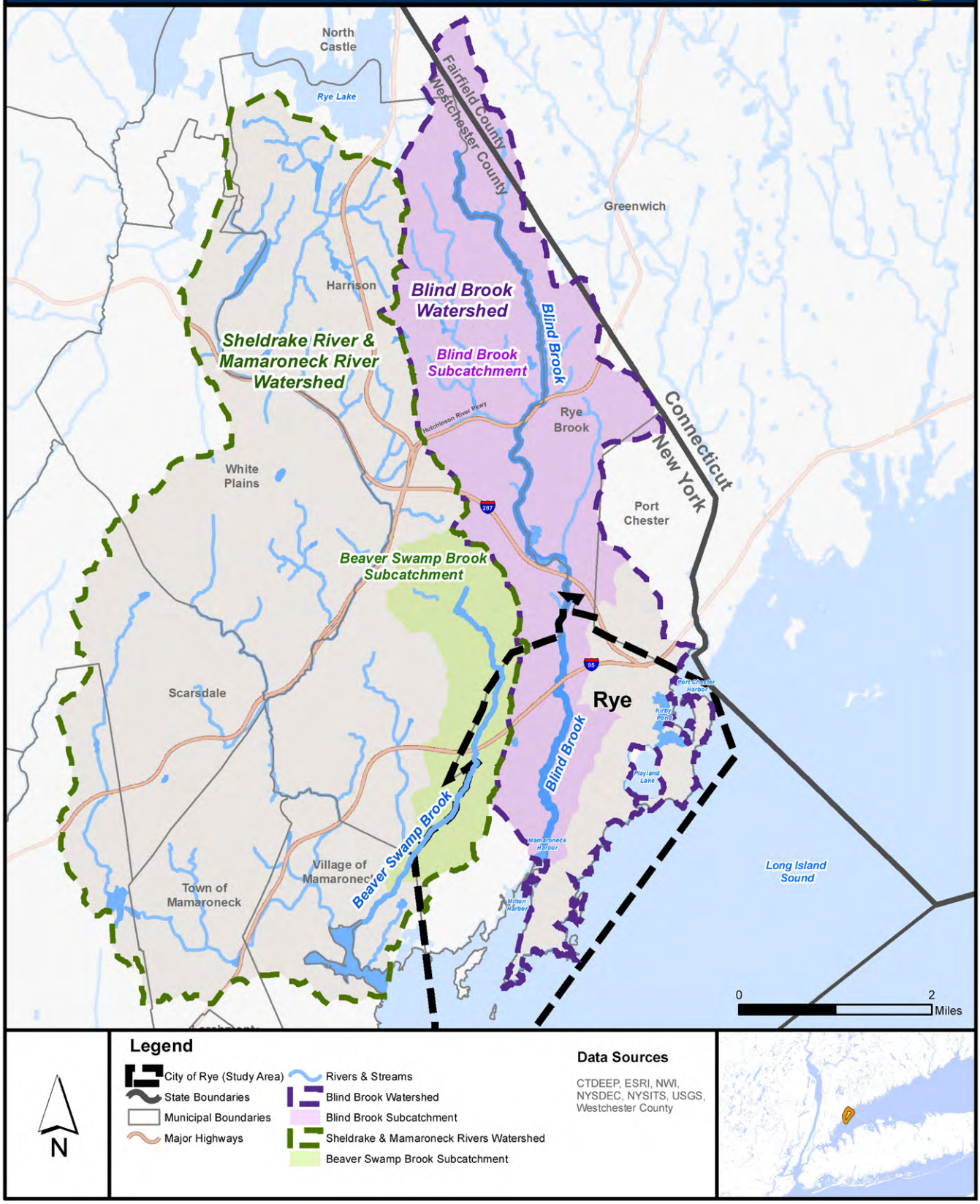
According to the 2010 Census, the population of the Rye was 15,720. With a land area of 5.85 square miles, the population density was 2,687 people per square mile. The demographic makeup was 89.5% White, 1.5% Black or African American, 6.0% Asian American, 1.7% multiracial, and 1.3% identifying with another race.[2] Additionally, 6.5% of the residents identify as Hispanic. The population's median age was 40.8 years old, only slightly older than the State median of 38.0 years old.[3]

The Community is part of the greater New York City metropolitan area and is less than 30 miles north of midtown Manhattan. I-95 and the New Haven Line of Metro-North Railroad (MNR) facilitate trips between Rye and New York City in roughly 45 minutes. Trains stop in Rye twice per hour in each direction from 6 am to 2 am with an average daily ridership of 2,470 passengers in 2006.[4] Boston Post Road and the Cross Westchester Expressway (I-287) also serve to connect the City with other cities in Westchester County and Southern Connecticut.

There are limited industries within the City. Commercial properties and mixed use buildings line Purchase Street with a combination of retail, restaurants, and banks.[5] Predominant industries within the Community are: finance and insurance (22.2%); professional, scientific, and technical services (15.6%); educational services (9.5%); health care (7.3%); construction (5.4%); publishing and motion picture and sound recording (4.1%); and public administration (4.0%).[6] One-third of working residents commute to New York City.[7] As the city is primarily a bedroom community, most other working residents are employed in Westchester County, Connecticut, Long Island, and New Jersey. According to the U.S. Census Bureau's American Community Survey, the population-weighted average median household income is approximately, $143,359, which is nearly 2.5 times the state-wide median.[8]

Rye has 5,520 households, with two thirds of them living in in single family homes that cover about 60% of the area of the City.[9] The remaining housing includes two and three family homes, condominium

Figure I-2
Watersheds and Subcatchment Areas - City of Rye



units, co-ops, and senior living.[10] Nearly 20% of the City's area is covered by recreation and conservation facilities including the Marshlands Conservancy, Edith Read Wildlife Sanctuary, Rye Town Park, Disbrow Park, and the Rye Nature Center. The rest of the Community is comprised of institutions, small businesses, and light industrial uses with little to no developable land remaining.

The Community has a Council-Manager style government with six elected city council members and an elected mayor. The City is served by two public school districts – Rye City School District and Rye Neck School District. The five public schools in the City are the Osborn School, Milton School, Midland School, Rye Middle School, and Rye High School. Rye Country Day School, Westfield Day School, and Resurrection School are private schools in Rye.

C. Description of Storm Damage

Rye has been heavily impacted by a series of recent storms. Two major storms in the spring of 2007 significantly raised awareness about the City's vulnerability to flooding. In 2011 Hurricane Irene brought further riverine flood damage to the Community, which was exacerbated when Tropical Storm Lee shortly followed and delayed recovery efforts. Superstorm Sandy was a different kind of storm with strong winds and high waves but little rain, which led to coastal flooding in limited portions of the Community along with severe wind damage.

2007 Storms

Prior to Hurricane Irene, increased frequency and severity of flood events along Blind Brook and Beaver Swamp Brook had already been observed. On March 2, 2007, while the ground was still frozen, four inches of rain combined with snow melt led to unprecedented flooding unlike anything in recent memory. Residents of the Indian Village neighborhood, where houses have withstood storms for more than a century, were shocked by flooding around and in their houses. Both brooks swelled past their usual capacity and flooded roads and bridges. Park Avenue was impassable, the Rye Fire Department rescued 35 people by pontoon boat, and Exit 21 from I-95 was closed.[11]

In the midst of recovery, a nor'easter arrived on April 15 bringing even more rain and flooding at the 100-year flood level. As Blind Brook neared the top of the spillway at the Bowman Avenue Dam just north of the city, the Rye Police Department issued a reverse 911 call warning residents along the Brook to evacuate. A temporary emergency shelter was opened at Rye Country Day School. Homes in Indian Village were impacted by severe flooding. The YMCA, Rye Free Reading Room, the Locust Avenue Fire Station, and numerous downtown businesses also flooded. The streets downtown, under several inches of water in March, were under several feet of water in April. The grounds of the Rye Nature Center and the streets in Loewen Court were also under water. Even in areas not adjacent to the two brooks, backyards filled with water and drains overflowed. In total, the floods caused $80 million of damage to Rye.[12]

Rye YMCA Front Desk, August 2007 (Gregg Howells)

Since 2007, rains of two to five inches have often led to sewage back-ups. Milton Road is one area that floods in heavy rains. Given the tidal nature of the lower section of Blind Brook, sections of it can overflow during high tides after rain events without impacting the downtown and Indian Village. The City deemed flooding to be a serious enough problem that it formed a Flood Advisory Committee

in 2012 and began studying possible mitigation measures that could be implemented to reduce the risk of riverine flooding in the community.

Hurricane Irene

Two days before Hurricane Irene made landfall on August 28, 2011, Governor Andrew M. Cuomo declared a state of emergency for the State of New York. Local officials in Rye began to prepare for Hurricane Irene.[13] When Hurricane Irene arrived and the rains began, the Blind Brook watershed quickly filled the streambed.

As the Brook overflowed its banks, residents of Indian Village found themselves underwater. Better prepared than they had been for the 2007 storms, many moved furniture and other household items to higher floors but damage to housing still occurred. Some homes, depending on their initial elevation, were under as much as 12 feet of water (including submerged basements). At the end of the block, the residents of the 99-unit Highland Hall faced a ruptured oil tank in their basement that forced them into hotels for six weeks.[14] Government support was provided for these displaced residents, but some sued for health issues that they experienced as well.

The culvert under I-95 filled and water went around it and flowed down adjacent roadways. This resulted in extreme damage to the Central Business District.

Flooding in the Indian Village neighborhood following Hurricane Irene (Alexander Breinin)

Morgan's Fish House, Crozier Gedney Architects, and other businesses along Elm Place were inundated with stormwater as Blind Brook surged as it curved through downtown. The strong flow of water collapsed the Blind Brook retaining wall at Theodore Fremd Avenue.[15] The Rye YMCA and the Rye Free Reading Room, which had been repaired and readied for future storm events after the 2007 storms, were both damaged again. Further downstream, the Rye High School stadium flooded where an artificial turf field had been installed. As water seeped under the field and lifted the surface, it was severely damaged.

In other parts of the City, Hurricane Irene caused flooding on roadways. Milton Road between Hewlett Avenue and Stuyvesant Avenue had enough standing water for a kayak to travel along it past Dock Deli, Rock Island Sound, and the Meeting House.[16] Water rushed along Theodore Fremd Avenue at Locust Avenue by the Mobil gas station.[17] Residents of Midland Avenue and Highland Avenue were stranded on flooded streets waiting for assistance from emergency responders.[18] In addition to its depth, the water was also dangerous because it contained sewage, diesel fuel, and chemicals.

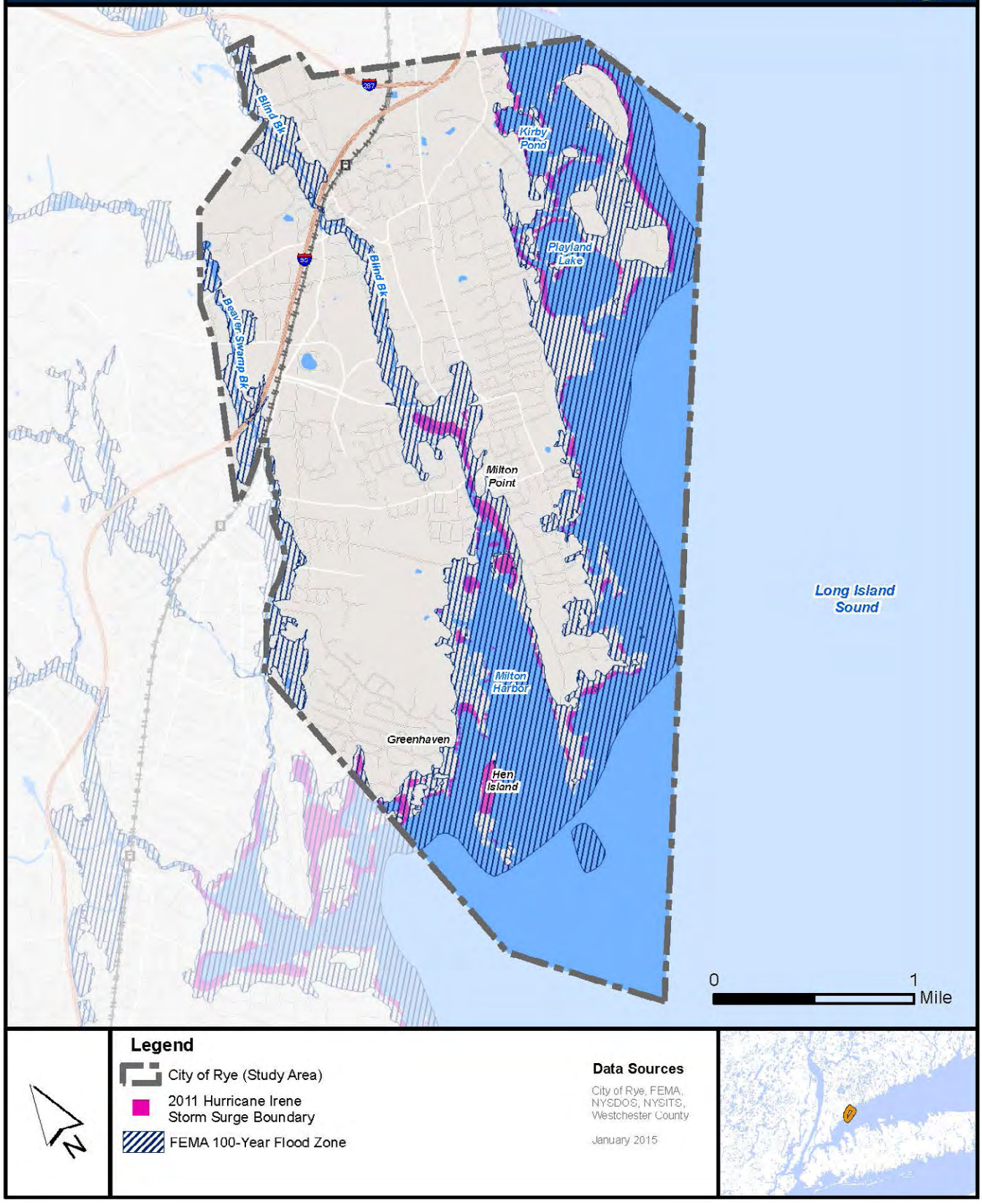
Many Rye residents were among the 50,000 Westchester County customers to lose power.[19] Although not all homes were without electricity, those with electrical utility boxes below the floodwaters lost power, and households with backup gas generators found that ConEd had turned off the gas to avoid leaks and spills. Those parts of the city without power had to wait until fallen trees were removed before it could be reconnected.

By August 31, public officials, including Secretary of State Cesar A. Perales, were gathered in Rye to survey the damage.[20] The water level had subsided somewhat by then, but debris was left along the previously flooded roadways.

Tropical Storm Lee

When Tropical Storm Lee arrived ten days after Hurricane Irene on September 7, 2011, the flood

Figure I-3
Hurricane Irene Storm Surge - City of Rye



waters delayed recovery from Hurricane Irene but did no further damage. Areas without power remained in the dark and the waters receded quickly. Blind Brook did not overflow its banks again. Residents who had been displaced by the previous storm remained out of their homes for months and did not experience the subsequent storm event.

Superstorm Sandy

Superstorm Sandy inflicted tremendous water damage to the South Shore of Long Island and New York City, but by the time it reached Rye, it was primarily a wind and coastal event making it significantly different from the previous storms. Along the coast of the Long Island Sound and Milton Harbor, officials closed piers and parks in anticipation of the storm. Residents witnessed and reported strong winds and high surf. When Superstorm Sandy made landfall in Rye on October 29, 2012 its waves devastated the shoreline and waterfront assets, but there was no flooding along Blind Brook or Beaver Swamp Brook.

By midafternoon on October 29, homes along the coast, Rye Town Beach, and the five major beach clubs along the Sound were battered by the high waves and storm surge. Where Blind Brook meets the Harbor at Milton Harbor House, the storm did $1.6 million of damage to the residential complex. Forest Avenue flooded and Manursing Island was cut off from the mainland as water came over the causeways. Wherever the water arrived, a pile of debris was left in its wake when the flooding receded.

At Rye Playland, the boardwalk was ripped off its pilings leaving parts of it crushed on the beach and other parts floating out to sea. “Part of it was floating eerily just off-shore Friday, complete with lamp posts and benches as if waiting for someone to take a seat,” reported CBS’s Lou Young.[21] The parking lot flooded and waves moved large paving stones. Inundation from salt water damaged the motors, electrical equipment, and metal sections of the amusement park rides.[22] More permanent damage was inflicted on the water rides. When officials

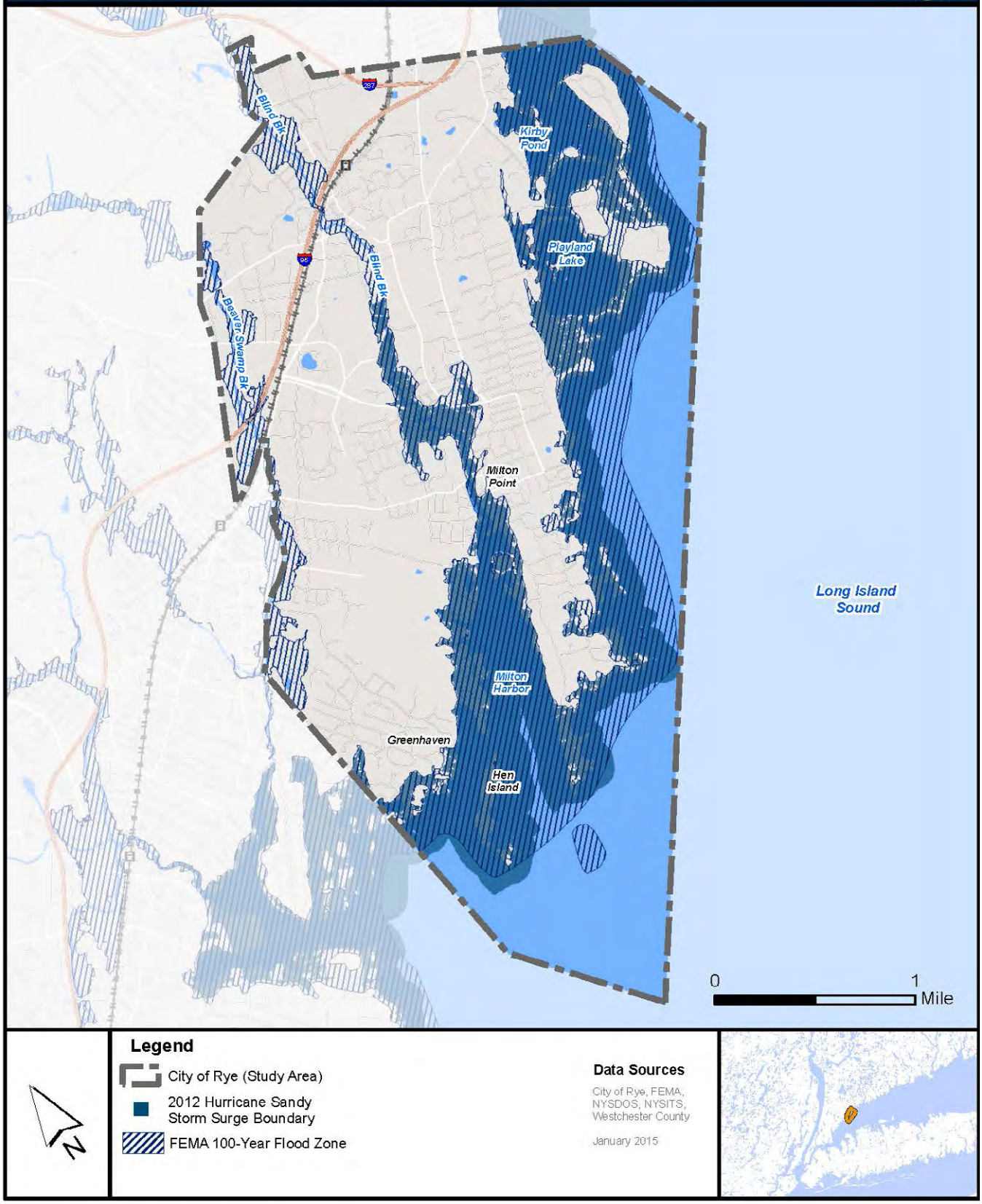
Damage at the Shenorock Shore Club following Hurricane Sandy (Sara Goddard)

opened the doors of the Ice Casino skating rink, they found fish swimming inside.

Bird habitats at Edith Read Wildlife Sanctuary were destroyed and sand dunes that were supposed to protect the marsh were blown across the roadways.[23] The debris-filled sand would later have to be removed leaving the wetlands more vulnerable than before. Portions of the Playland boardwalk and other detritus were blown there, requiring hours of volunteer labor to restore the habitat. According to Michael Gambino, the curator of the Sanctuary, the beach was pushed up 15 feet, covering the adjacent roadway.

Meanwhile, as the water continued to pound the coast, the strong winds that accompanied the storm knocked down trees across the City taking down power lines and blocking roadways. Residents estimate that as much as 85% of the city was without power. Work at many offices based in Rye was stopped at the beginning of the week, and the Rye public schools were closed for the entire week. Osborn Elementary School remained closed part of the following week when it was still without power. Within 10 to 12 days, power was restored to the entire community, but for some residents without generators, this was too long to stay in their homes without heat, since the temperature dropped.

Figure I-4
Superstorm Sandy Storm Surge - City of Rye



Without the same interior flood damage as previous storms, largely due to the relatively minimal rainfall, most of Rye remained dry. The YMCA was able to serve as a major community relief center during and after Superstorm Sandy. Rye Country Day School was opened as an emergency shelter, and the Community served as a staging ground for County-wide emergency response.

Community Recovery from the Storms

In the two years since Superstorm Sandy and the three years since Hurricane Irene, Rye has already done much to protect itself from future storm events. Many individuals have raised their homes through a combination of government funding and personal expenditures. Other homeowners have installed French drains and new roofs in response to these storm events. Rye Nature Center has planted over 300 trees to replace those lost during Hurricane Irene and to rehabilitate the stream bank.

Six months after Superstorm Sandy, Rye Playland reopened with a new boardwalk that was finished ahead of schedule and under budget.[24] Some portions, like the swimming pool, took longer to rebuild, and the northern third of the boardwalk has yet to be replaced, which limits continuous public access along the waterfront. The shop fronts along the beach at Playland Park have been reconstructed but remain empty with signs for the Westchester Children's Museum to be coming soon. A short walk down the coast, a portion of Dearborn Avenue bordering Rye Town Park remains crumbled in disrepair.

The most significant flood mitigation project has been the construction of a sluice gate at the Bowman Avenue Dam. This $2.2 million project represents an intergovernmental collaboration between the City of Rye, the Village of Rye Brook, and Westchester County after years of advocacy by area residents. $400,000 of the project's funding came from New York State. It is unknown whether the gate has effectively prevented flooding since it was completed in June 2013 and the rain events since then have not fully tested its capacity. The City has commissioned a study (currently underway) to determine how or if the gate can operate more efficiently.

Some bridges also remain in vulnerable condition. The entrance to the Rye Nature Center was weakened by the successive storms. A pedestrian bridge linking Milton Road to Disbrow Park also remains damaged two years later.

Sluice Gate at the Bowman Avenue Dam.

D. Critical Issues

Flood and storm events in recent years have uncovered critical issues that affect the residents, business owners, and visitors in Rye. Damage to infrastructure, buildings, natural resources, and other community assets has illustrated the risks that the City faces in the event of future storms. The Rye NYRCR Committee and the members of the public who have attended the Public Engagement Events have highlighted the need to address specific issues in order to make Rye more resilient. Whether it is to prevent damage, protect assets, or ensure that the community can rebound quickly from temporary damage, these critical issues must be considered.

Increased Frequency and Intensity of Flooding

The frequency and intensity of flooding has increased in the City in the last 20 years. Beginning with the 2007 storms, the City of Rye has experienced flooding with an unprecedented severity. Each

successive storm has uncovered new vulnerabilities and done further damage even as homes are raised, businesses are rebuilt, and walls and bridges are repaired. Natural systems have also been impacted. Topsoils, which are highly permeable surfaces, have been washed away and trees along stream banks have been felled by winds and water surges. Today, even a major rain storm with two inches of precipitation, particularly if it follows another heavy rain or occurs at high tide, can cause damage in the community and lead to flooding that was not observed in prior years.

Coupled with an increase in riverine flooding, sea level rise also presents risks along the City's coastline. Over the past decade, major storms have shown a marked change. The path of hurricanes and other serious storm events, which have pummeled the eastern seaboard, have often been moving farther north than they typically did in the past. Storm surge from hurricanes in combination with sea level rise pose a new threat to waterfront assets along the Long Island Sound and Milton Harbor.

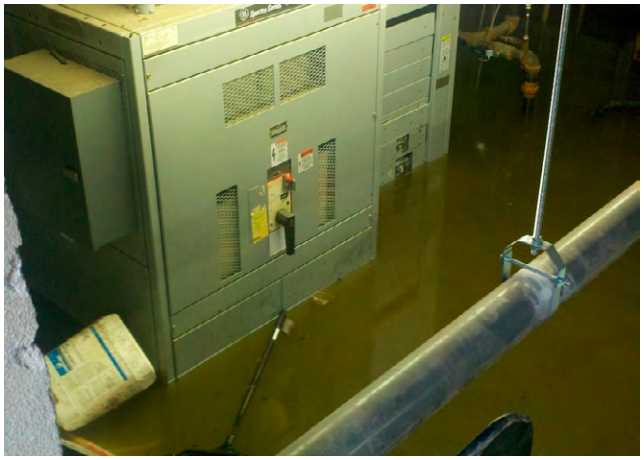
Stormwater and Sanitary Sewer Systems

The sanitary and stormwater sewer systems in Rye are separate with the former connected to the County's Blind Brook Wastewater Treatment Plant and the latter discharging into Milton Harbor and Long Island Sound. During heavy rains, especially the 2007 storms and Hurricane Irene, residents have watched the sanitary system overflow onto flooded streets with toilet paper and other debris rushing out of the manholes and flowing down the street and into the storm drain leading to contamination in the Harbor and the Sound. Meanwhile, in other areas of the City, storm drains are not able to adequately handle the volume of water along the roadway. This problem is particularly severe where the drain is meant to serve both a parking lot and a roadway. When stormwater exceeds the capacity of the drainage system, parking lots flood and cars are damaged.

Additionally, some residents have reported that there are homeowners who have illegally connected their sump pumps to the sanitary sewer system. In these areas, the City's pump stations are unable to meet the demand that they were designed for—a problem exacerbated during heavy rains. This has led to sewage backups in nearby basements with drains or bathrooms.

Vulnerable Community Services

In Rye, both fire stations are located in the flood zone. Milton Avenue and Locust Avenue are strategic locations for quickly putting out fires in the densely packed business districts and are centrally located to residential neighborhoods, but when Blind Brook floods, both fire stations are immobilized. City Hall is also in the flood zone and the Police Station is inaccessible when roadways flood. The threat to public services limits their capacity to serve residents during floods and other storm events. Emergency communications and logistics may be impeded by the immediate need to move vehicles to higher ground before deploying them where they are needed. Currently, there exists no City-operated emergency response center, and one needs to be established on high ground.



Flood damage at the YMCA during Hurricane Irene (Gregg Howell)

More places that can serve as emergency shelters are needed in the community. In order to open Rye Country Day School as an emergency shelter, it must be staffed by the Red Cross, so it is not an available

facility during every storm or flooding event. The local schools and the YMCA that could serve as emergency shelters are both vulnerable to flooding and do not have generators to support residents if there is power loss. The communication systems that serve the community are insufficient to meet residents' needs. Major storms like Hurricane Irene and Superstorm Sandy that are forecasted to affect the region come with warnings and directions up to two weeks in advance, but flooding problems at a local level are often unforeseen. Early warning systems do not reach everyone in Rye. After storms of all sizes, information is usually sparsely available, and communication can be inconsistent among utility companies, government officials, and residents. In the immediate aftermath of Superstorm Sandy, there was no communication about when power would be restored or what resources were available.

During storms, flooded roadways become impassable to most vehicles, including emergency response vehicles. (Sara Goddard)

Transportation and Access

During flood and wind events, Rye is often immobilized. Flooded roadways, fallen trees, and downed power lines make travelling around the City dangerous. After storms, many bridges are compromised if a brook's surge crested them. Additionally, travel is impeded by debris that has washed into roadways. Access to the medical facilities and to the Metro North Station is limited. Clearing debris from the major corridors that lead to these critical locations should be prioritized.

Power Loss

While Rye's residential character and large, beautiful trees are viewed as major assets, the fallen trees and branches tend to exacerbate the number of downed power lines, and the lack of major industry or infrastructure in the City makes it a low priority for repairing and reconnecting power lines. Although ConEd has offices and trucks on Theodore Fremd Avenue and typically uses the Playland parking lot as a staging area for repair trucks, residents without generators have waited up to two weeks to have their power restored. Even those with generators are frustrated by the lack of information about when power may return to the community after an event.

Housing

Housing in Rye is growing increasingly costly as the market for homes proximate to New York City and the Long Island Sound continues to escalate. The City saw very little impact in home values following the recession; however, for some residents living in the floodplain, continuing to live in Rye is becoming too costly. Private investment in repairing, rebuilding, and elevating homes is expensive, with elevation typically costing at least $200,000 for the homes in Rye. For those who want to sell these homes, recouping the cost of the improvements is sometimes challenging. Current residents have been grandfathered into historic rates for federal flood insurance, but prospective new owners would need to be willing to take on much higher rates, particularly near the Sound.

New housing also poses a potential problem to Rye's resilience. While there is no longer space for a major new development to be built, which would go through a detailed environmental review, lots are being subdivided to build new housing and existing housing is being expanded or replaced with larger homes. This kind of development often reduces the amount of permeable surfaces in the City so less water can be retained naturally, and the vulnerability of the new housing may not be fully studied.

Many homes within the floodplain have been elevated, at great cost to the homeowners.

Policy Limitations on Resilience

In some cases, larger State and Federal policies limit Rye's ability to be more resilient. For example, without an active commercial marine industry, Milton Harbor is no longer designated as a "working harbor" and it is difficult to get the correct permits and contractors to dredge the harbor. This limits boating use of the harbor should the working depth of the harbor be significantly reduced due to silt build up. The current construction policies of the New York State Department of Transportation (NYS DOT) and the Thruway Authority require capturing stormwater runoff within the right-of-way, but I-95 and I-287 are older highways that were built before those policies went into effect. Runoff from these highways may cause additional flooding of Blind Brook as stormwater flows off the roadways where they cut through the community.

Watershed Planning

Increased flooding, housing development patterns, and policy limitations are all linked to issues of watershed planning. Upstream development along Blind Brook and Beaver Swamp Brook is increasing the proportion of impermeable surfaces. There is no current mechanism to enable the City of Rye to restrict development or redevelopment in other communities, though many in Rye believe that this is leading to more flooding downstream. The recent construction of the Sluice Gate at the Bowman Avenue Dam represents progress in inter-municipal collaboration with the Town of Rye and the City of Rye. The two municipalities shared funding responsibilities for its completion with Westchester County and New York State. Furthermore, members of the Flood Advisory Committee have been trying to work with Westchester County Airport and SUNY Purchase to reduce their runoff into Blind Brook.

E. Community Vision

Through a visioning exercise by the Committee and with input from Rye community members at the first Public Engagement Event, a vision statement was developed to reflect how the Community sees itself today and where residents want to be in the future. Given the storm recovery focus of the Plan and the breadth of what the Committee aspires to consider in the formation of the Plan, they also proposed a set of values, rather than goals, to guide them in considering strategies, projects, and actions. The vision and values collectively serve as the foundation of the Plan for a stronger and more resilient City of Rye.

The City of Rye is a thriving, suburban, Sound Shore community with a spirit of volunteerism, proximity to New York City, local and regional natural resources, historic landmarks, excellent schools, and access to transit. Our Vision is to preserve and improve Rye to ensure that the community remains economically and environmentally resilient and resistant to storms and floods.

Values

- Safeguard the City against future coastal and riverine storm threats
- Upgrade infrastructure for resilience
- Identify strategies to manage and mitigate stormwater
- Leverage regional opportunities to plan for the Blind Brook and Beaver Swamp Brook watersheds
- Coordinate local and regional communications and services before, during, and after emergencies
- Preserve historic buildings, natural wetlands, and public access to the waterfront
- Maintain connectivity for people using all modes of transportation
- Ensure that the city remains a vibrant and attractive place for people of all ages

F. The Relationship to Regional Plans

The City of Rye, the Blind Brook Watershed Planning Committee, and Westchester County have all prepared relevant plans for designing and developing more resilient communities. These plans have important goals and objectives that have informed this Community Recovery Plan and many suggest projects that have been considered by the Rye NYRCR Planning Committee. Older plans provide a sense of the conscious effort to make the region more environmentally sustainable over the course of several decades while more recent plans represent more recently established strategies for doing so. Local awareness of how stormwater quality impacts the Long Island Sound and how planning should take a watershed-scale approach in order to consider downstream effects is progressive. Yet, with few plans produced since Hurricane Irene and Superstorm Sandy, there is little mention of resilience or planning for a future with higher sea levels. Moreover, although plans frequently propose common regulations and inter-municipal coordination, this has not been implemented consistently.

Regional and local plans can be found in Tables I-1 and I-2, respectively.

Table I-1 Regional Plans

Plan Name	Description	Key Lessons
Watershed Plan for Blind Brook Watershed (1979)	Presents the resource related problems and needs in the Blind Brook Watershed including providing watershed protection, reducing present urban flooding, and addressing areas of critical environmental concern.	Describes historic flood damage done in 1938, by Hurricane Agnes in 1972, and by Hurricane Eloise in 1975. Proposes structural measures including two floodwater retarding structures and four dikes.
Patterns for Westchester: the Land and the People (1996)	The goal of Patterns is to strengthen centers, improve the function of corridors, and protect the County's open space character. Strategies focused on natural resources included relevant goals like enacting wetland, tree preservation, and steep slope protection ordinances; encouraging the use of conservation easements to protect wetland and riparian systems; and preparing and adopting local waterfront revitalization programs in coastal zone communities. It also proposed guidelines for development and redevelopment and to provide coastal resource protection.	Offers a policy framework to guide the County Planning board. It proposes a range of strategies to help County and municipal governments nurture environmental health, economic growth, and quality of life in Westchester.
The Greenprint for a Sustainable Future, the Westchester County Greenway Compact Plan (2004)	Builds on Patterns and the 1991 Hudson River Valley Greenway Act. The County plan focuses on natural and cultural resource preservation, regional planning, economic development, public access, and heritage and environmental education.	Includes this section of the City of Rye Code: "It is the intent of the City of Rye that the preservation, enhancement, and utilization of the natural and man-made resources of the unique coastal area of the city take place in a coordinated and comprehensive manner… Accordingly, this chapter is intended to achieve such a balance, permitting beneficial use of the coastal resources while preventing loss of living estuarine resources and wildlife; …erosion of the shoreline; … losses due to flooding, erosion, and sedimentation; or permanent adverse changes to the ecological systems."
Westchester 2025/Plan Together (2008)	This document reflects the current thinking of the citizen Planning Board and the Department of Planning for Westchester County relative to the planning principles and policies set out in Patterns for Westchester. Addresses stormwater management, sustainability, energy, diversity, mobility, infrastructure, and emergency planning.	The plan calls for collective action in a range of areas. Those particularly relevant to NYRCR Rye include: ▸ Keeping substantial areas of the natural environment intact ▸ Managing stormwater responsibly ▸ Addressing an aging infrastructure with capacity limitations ▸ Addressing energy sources and supplies ▸ Establishing and strengthening regional partnerships ▸ Providing public access and views to and from the waterfront ▸ Diligently emphasizing emergency planning and public safety

Table I-1 Regional Plans

Plan Name	Description	Key Lessons
Westchester County Completed Projects (2012)	Showcases recently completed projects to make County-owned properties in Rye more resilient to future flooding and storm damage.	▸ Along Blind Brook at Rye HS, the County re-graded the stream banks to make them flatter, installed coconut fiber mats and bio-degradable biologs to stabilize the banks, and added shoreline vegetation and shrubs to control erosion. ▸ At Edith Read Sanctuary, a wetland meadow was created as an outdoor classroom, an impermeable membrane was installed underneath the deepest portion of the basin to slow water infiltration through the meadow, and dunes were planted with native plants that now provide nesting and feeding habitat for native shorebirds. ▸ In the Dry Meadow the site was re-planted with native grasses and wildflowers to remove pollutants from stormwater runoff before it reaches Long Island Sound. ▸ A tide gate was reconstructed in 2009 and an intertidal wetland marsh creation project was implemented within Manursing (Playland) Lake in 2012, which created valuable new wetlands and restored upland lakeshore in this State-designated Significant Coastal Fish and Wildlife Habitat. ▸ Stormwater Vault at Playland Park is an underground water quality improvement structure which filters stormwater under the 12-acre parking lot before it drains into Manursing Lake.
Stormwater Reconnaissance Plan for the Coastal Long Island Sound Watershed (2013)	Assesses current conditions and identifies cost-effective projects to directly address flooding and flood damage and impacts in Westchester County. It outlines recently completed and proposed local and County-wide projects that are designed to lessen the risks and impacts associated with flooding.	Information not available.

Table I-2 Local Plans

Plan Name	Description	Key Lessons
City of Rye Development Plan (1985)	The principal goal of the Development Plan is to maintain Rye's present character. The plan sets the groundwork for current planning efforts in the City, particularly around environmental protection, flood control, and coastal resources. The development plan also includes plans for residential development, the Central Business District and business development, traffic and pedestrian circulation, parks and open space, historic preservation, and community facilities.	The plan explicitly includes the following environmental protection components: ▸ Promote conservation of Rye's natural environment including preservation and protection of Rye's coastal shoreline, inland tributaries, and adjacent wetlands with full consideration given to both their passive recreational and ecological importance, as well as their role in drainage and flood control. ▸ Prohibit development in wetlands, tidal marshes, and beaches. ▸ Allow only future development that is responsive to sensitive features such as areas with steep slopes, high erosion hazard, flood hazard, sensitive coastal features, and scenic quality. The plan also had goals, policies and suggested solutions for addressing riverine flooding in the community: Goal: minimize risks to people and damage to property due to riverine and coastal flooding through the enactment and enforcement of appropriate flood control measures. Policy: prevent development in the designated floodways and discourage development in the 100-year flood plains of Blind Brook, Beaver Swamp Brook, and the coastal areas through the use of land acquisition, regulations, and flexible forms of zoning (e.g. clustering). Though more expensive, non-structural solutions have the widest applicability to all flood-prone areas in the City and should be encouraged. The Bowman Avenue dam should be expanded or heightened if the Soil Conservation Service project is not pursued, in order to address flooding from upstream.
City of Rye Local Waterfront Revitalization Program (1991)	Provides a detailed description of Rye's environmental setting and coastal areas. The Plan also provides a series of waterfront revitalization program policies, proposed land and water uses, and projects and techniques for local implementation of the program.	Most of the projects described have been built in the past 23 years and flood protection was not a major focus on the plan. Instead, projects tended to look at protecting ground water, expanding and maintaining water recreation, and ensuring public access to the waterfront.

Table I-2 Local Plans

Plan Name	Description	Key Lessons
City of Rye Flood Mitigation Plan (2001)	Identifies flooding problems and their history. The plan details characteristics of each segment of Blind Brook, Beaver Swamp Brook, and the Coastal Sub-basins; proposes mitigation goals; and proposes an action plan for addressing flooding with structural and non-structural controls.	Potential projects are described below: • Pursue a flood mitigation land acquisition program that targets parcels critical to flood control and maximizes the related goals of passive recreation and environmental protection. • Acquire where possible, through purchase or donation, easements to prevent floodplain encroachment and preserve and restore riparian buffers. • Pursue federal and other grant monies for capital improvements at the City's Bowman Dam facility in Rye Brook. • Identify and make road and bridge improvements recommended in the Project Impact Technical Study and supported by environmental studies to mitigate flood impacts along Blind Brook and Beaver Swamp Brook. The City will work with Westchester County and the US Geological Survey to reactivate the automated early flood warning gauging system installed throughout the county in 1982 including the Blind Brook and Beaver Swamp Brook gauges at General Foods and Short Street, respectively. The City will research, write, and publish a guide for disaster preparation and planning for local residents and businesses.

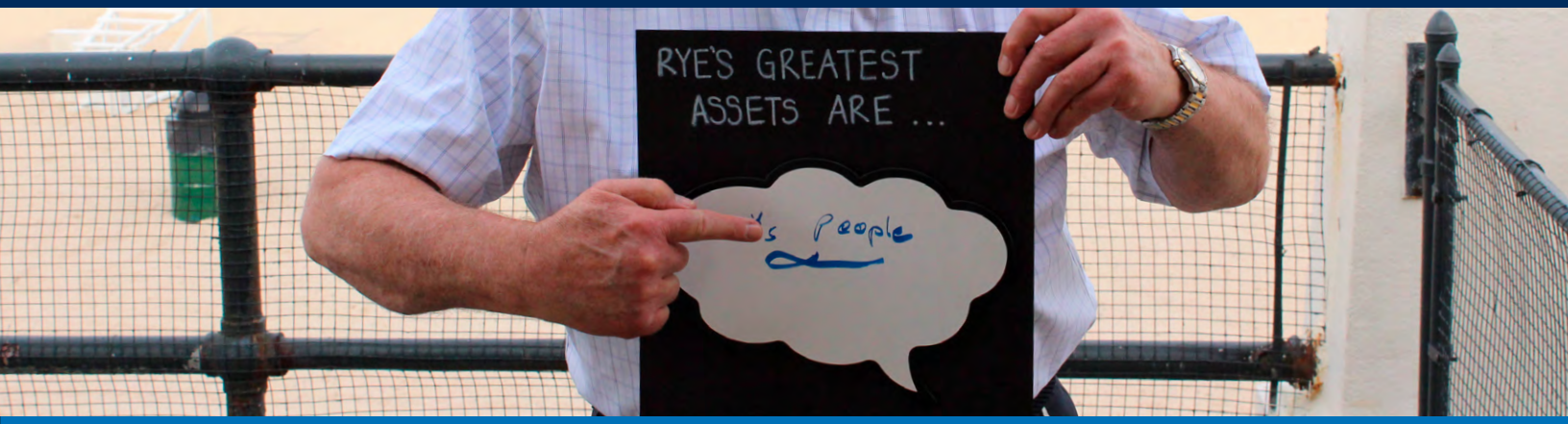
Table I-2 Local Plans

Plan Name	Description	Key Lessons
Hazard Mitigation Plan (2007)	Builds on the Flood Mitigation Plan while analyzing a wider breadth of potential hazards. Profiles the potential hazards that could affect the community and evaluates the ability of the community to respond to each with current systems and proposed strategies.	Key objectives and strategies: ▸ Maintain or reduce the number of structures within FEMA-designated 100-year flood zones. ▸ Acquire property, easements, or development rights to prevent future development within flood prone areas. ▸ Strengthen City regulations to limit future development within floodplains. ▸ Explore modifications to Bowman Avenue Dam property or implementation of other upstream regional flood mitigation projects to enhance flood control. ▸ Increase the number of structures within FEMA-designated 100-year flood zones that are able to withstand flooding hazards. ▸ Amend existing City laws to encourage/require existing structures to comply with current flood mitigation construction measures. ▸ Provide incentives to encourage flood resistant construction for existing structures. ▸ Reactivate early flood warning system (Flood gauging system). ▸ Review or establish evacuation and emergency response plans for major recreational uses such as Playland and beach clubs. ▸ Consider traffic improvements to reduce emergency vehicle response time from Locust Firehouse. ▸ Ensure that critical facilities in the City have backup generation capabilities.
Blind Brook Watershed Management Plan (2009)	A flood mitigation plan for the Blind Brook Watershed that reviewed existing hydrologic and hydraulic models, completed an overall assessment of flood impacts, identified specific flood mitigation alternatives, and formulated a comprehensive plan for short- and long-term flood mitigation improvements within the watershed.	The project with the greatest benefit-cost ratio was the sluice gate on the Bowman Avenue Dam, which has since been installed. An upstream detention pond at Anderson Hill Road on the Purchase College campus was also proposed.
Hydrologic and Hydraulic Analysis Report (2014)	The purpose of this study was to evaluate proposed flood mitigation projects along Blind Brook and their respective costs and flood reduction benefits in certain floodprone parts of the City of Rye. Parsons Brinckerhoff conducted the study, and evaluated several existing studies that proposed detention ponds, detention basins, and modifications to an existing dam. The study also discussed the additional co-benefits of implementing more than one of the proposed projects.	The projects evaluated in this study include resizing the Upper and Lower Ponds at the Bowman Avenue Dam, creating a series of detention ponds on the SUNY Purchase campus, modifying the sluice gate that was recently installed at the Bowman Avenue Dam, and increasing the storage capacity of the detention basins at the Westchester County Airport.

2014
NY RISING COMMUNITY RECONSTRUCTION PLAN

RYE NYRCR

Section II
Assessment of Risk and Needs

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II. Assessment of Risk and Needs

A. Description of Community Assets and Assessment of Risk

As part of the NYRCR process, the risk posed to community assets and systems that have been affected by past flood events or may be impacted by future storms is assessed. This evaluation assists in the development of projects and strategies that mitigate risk and make the community more resilient.

The first step in the risk assessment process is to inventory and map assets and system components that provide essential community functions, mindful of those that are proximate to known flood risk areas. Community assets and systems may consist of places, services, groups, or infrastructure networks, and can be categorized into five Asset Classes related to their role in the community, which are as follows:

- Economic
- Health and Social Services
- Housing
- Infrastructure Systems
- Natural and Cultural Resources

Description of Community Assets

The Rye Community asset inventory was developed by compiling existing digital datasets from multiple municipal, State, and Federal agencies. These asset datasets were cross-referenced and supplemented with aerial imagery and address locators, and collated into an asset inventory listing. To streamline the inventory, assets were grouped together if they served the same community function, were located close to one another, or had similar site characteristics. For example, neighborhood businesses could be grouped into a downtown center or single-family homes into a neighborhood. Asset systems were inventoried by enumerating the principal points and components of those systems, such as treatment plants in the wastewater conveyance system and substations in the electric transmission system.

Information was added for each asset, including address, geographic coordinates, risk area, asset class and subcategory, community value, critical facility designation, and whether the asset served socially vulnerable populations, including children, the elderly, and low-income community members. Addresses and geographic coordinates pinpoint the location of assets for mapping, and once mapped allow for risk area identification. Asset classes and subcategories characterize each asset for grouping, and community values rank the overall importance of each asset to the community. Additionally, FEMA has specific critical facility designations that identify assets considered essential to recovery following a storm event (e.g. emergency operations centers). Identifying assets that provide services for socially vulnerable populations can help to enumerate further assets that are particularly important both before and following a storm. Additionally, spatial analysis was used to capture landscape attributes or features of the landscape that could either mitigate or exacerbate the impacts of flooding and erosion to an asset.

A two-tiered asset inventory methodology was developed and utilized to ensure collection of a comprehensive inventory. The first tier of the methodology involved culling existing digital datasets. This ensured that assets would not hide in plain sight – i.e., assets vital to the Community's health and resilience that go unnoticed on a

day-to-day basis because they are only noticeable when they fail, such as small roadway bridges and satellite government service offices.

The second tier of the methodology capitalized on the intrinsic local knowledge of the Committee and community residents, and identified assets that may have not been captured in the existing digital datasets but could be enumerated by the Committee and the community. The Committee reviewed and refined the preliminary asset inventory, which was then shared with community residents at the first Public Engagement Event to gain their input.

As part of the Asset Inventory process, a Community Value is assigned to the assets. NYRCR Committee members participated in an exercise assigning Community Values of High, Medium, or Low to asset subcategories. Members were asked to give special attention to assets whose loss or impairment would compromise critical facilities or any essential cultural, social, economic, or environmental functions of the Community. The value rankings were consolidated and revealed that assets related to the homes and facilities for vulnerable populations, emergency response, healthcare, and infrastructure (storm sewer, sanitary sewer, electric and gas, communications, and major roads) received the highest community value ratings

Reflecting the Planning Committee Meeting guidance, Committee members' responses were then compiled; the value receiving the most member votes was then assigned to all assets within that subcategory. A summary of the results from the exercise are in Table II-1.

General Criteria for Community Value

High: Asset(s) that are so significant in the support of a community's day-to-day function that the loss of that asset or extended lack of functioning would create severe impacts to the community's long-term health and well-being or result in the loss of life or injury to residents, employees, or visitors.

Medium: Asset(s) that are important to the functioning of a community's day-to-day life that the loss of the asset or extended lack of functioning would cause hardship to the community's well-being, but whose function could be replaced or duplicated in a mid-term time frame without significant burden to a community's long-term health.

Low: Asset(s) that play a role in the functioning of a community's day-to-day life, but whose loss could be managed and overcome within a community without substantial impact to that community's functioning. Can become operational, be replaced, or be temporarily duplicated in a short-term time frame with limited burden to a community's long-term health.

Table II-1 Community Values for Assets

Asset Subcategory	Community Value
Housing	High
Downtown Business District	High
Fire, Police, Emergency Facilities	High
Department of Public Works	High
Medical Centers	High
Storm Sewer Infrastructure	High
Sanitary Sewer Infrastructure	High
Electric and Gas Infrastructure	High
Communications Infrastructure (Internet, Cellular, Telephone, Cable)	High
Major Roads	High
Metro North Railroad	High
Other Business Areas	Medium
Homes and Facilities for Vulnerable Populations*	Medium
Cultural/Community Centers	Medium
Government Buildings	Medium
Elementary and Secondary Schools	Medium
Secondary Roads	Medium
Industrial Areas	Low
Major Employers	Low
Lakes	Low
Wetlands	Low
Creeks, Brooks, and Rivers	Low
Marinas	Low
Historic Buildings	Low
Parks and Recreation Facilities	Low

* Vulnerable Populations are defined as people with disabilities, low and very-low income populations, elderly, young children, homeless, people at risk of becoming homeless, and people with limited English proficiency.

While the asset inventory was developed, maps were also produced to illustrate the geographic distribution of risk areas across Rye. These maps focused the asset inventory on those areas at risk. Risk areas in the riverine portions of Rye are synonymous with the floodplains delineated by the Federal Emergency Management Agency (FEMA), while the risk areas along Rye's coastline are synonymous with those delineated by the New York State Department of State (NYS DOS) Coastal Management Program.

Where the FEMA Flood Map and the NYS DOS Coastal Hazards Composite Risk Map differ in the risk category shown at the location of an asset, the more conservative (higher risk) category was applied to that asset.

The community assets were analyzed to identify the risk areas they may be exposed to and are summarized by recovery support function. A map of all the assets can be found in Figure II-1. A map of risk areas can be found in Figure II-2. A complete community asset inventory is provided in Section V.

Risk Areas

Extreme Risk Area: The most frequently flooded areas are typically found in the 10-year floodplains, which encompass the Extreme Risk Area. In Rye, the 10-year floodplain had not been digitally modeled by FEMA. Input from members of the Committee and the City as to which places have been frequently and repetitively inundated and damaged by flooding was used to identify approximately the Extreme Risk Areas within the City. These areas include portions of the floodplain repeatedly impacted by past storms in the hardest-hit areas of the Community.

High Risk Area: The 100-year floodplains encompass the High Risk Area and are subject to a 1.0% chance of flooding in any given year. These flood zones had been digitally mapped by FEMA in Rye, and can be found throughout the communities along major streams and water bodies. High Risk Areas are the most prevalent of the risk zones in the Rye planning area.

Moderate Risk Area: The 500-year floodplains encompass the Moderate Risk Area, and are subject to a 0.2% chance of flooding on any given year. These flood zones had also been digitally mapped by FEMA in Rye and are typically found on the fringes of High Risk Areas.

Figure II-1
Asset Inventory - City of Rye

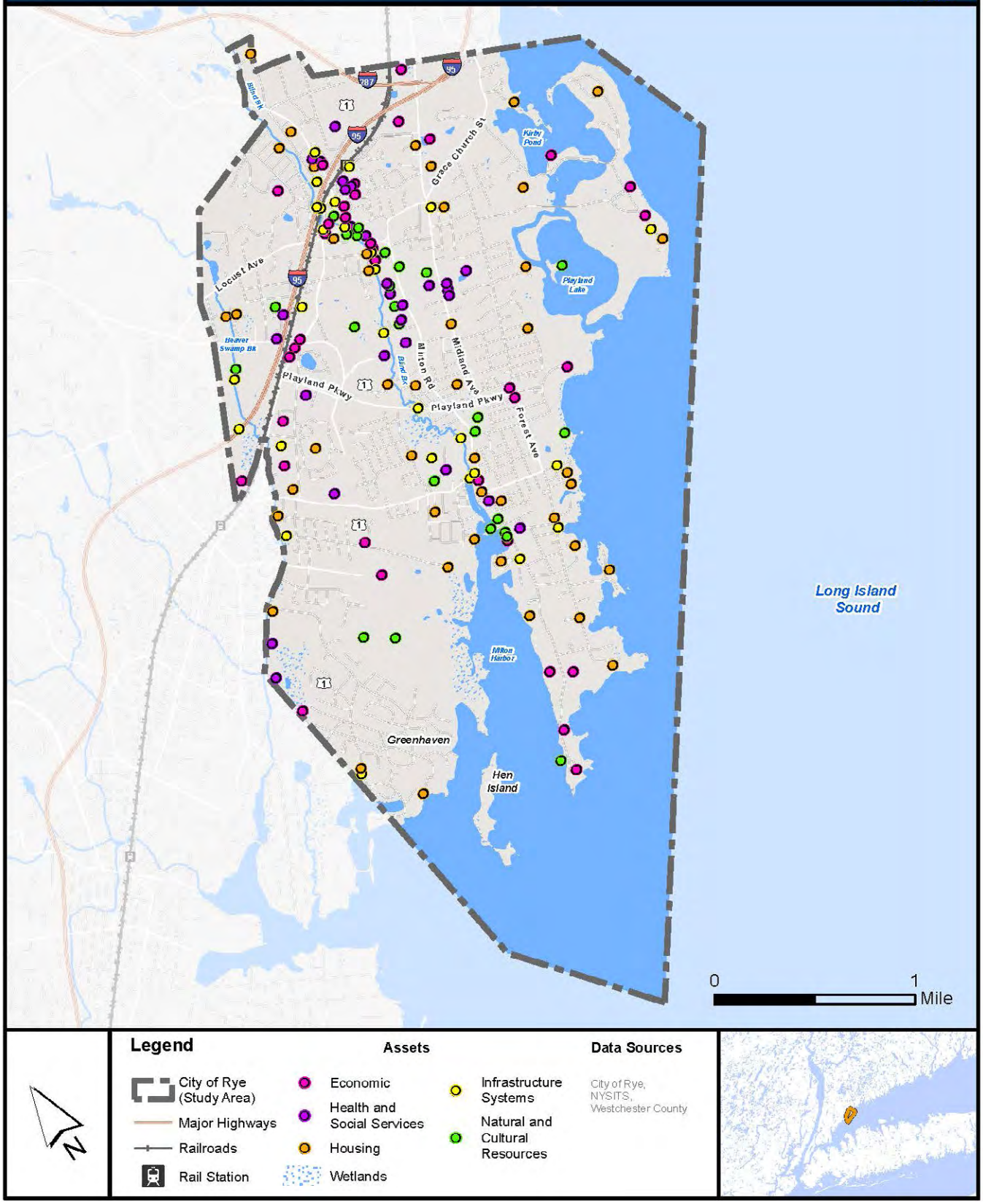
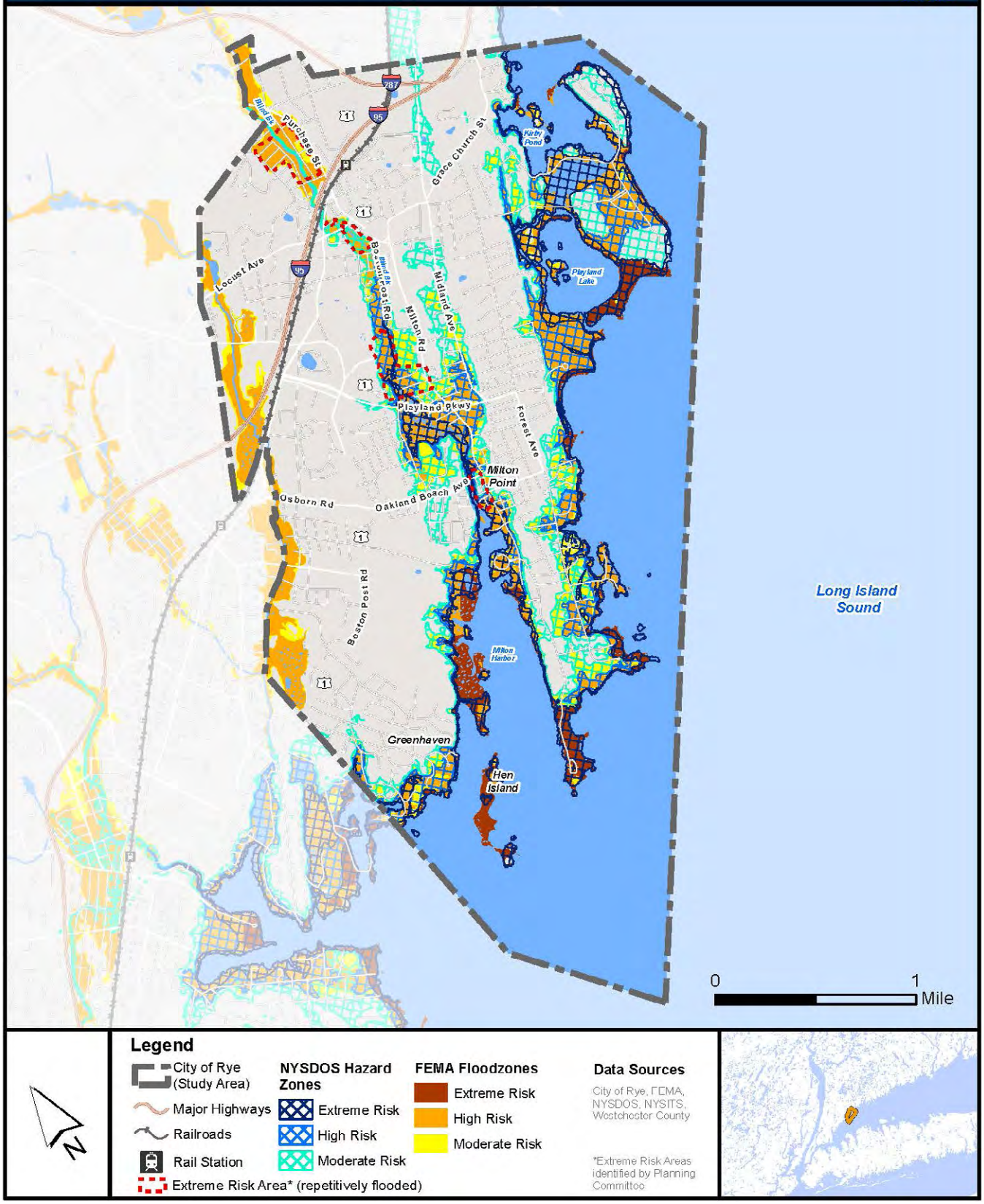


Figure II-2
Risk Areas - City of Rye



Economic

Assets in the Economic category include downtown centers, business clusters, major employers, industrial and manufacturing centers, and tourism destinations. Protecting and enhancing the downtown center and commercial areas from flood impacts is important to the economic health of the City. Eleven assets are located in the extreme risk areas including the Rye Golf Club, Playland Amusement Park, the Tide Mill Yacht Basin, four private beach clubs, and multiple businesses. The Rye Beach Pharmacy and CVS Pharmacy are considered FEMA Critical Facilities. Figure II-3 shows the location of economic land uses in Rye.

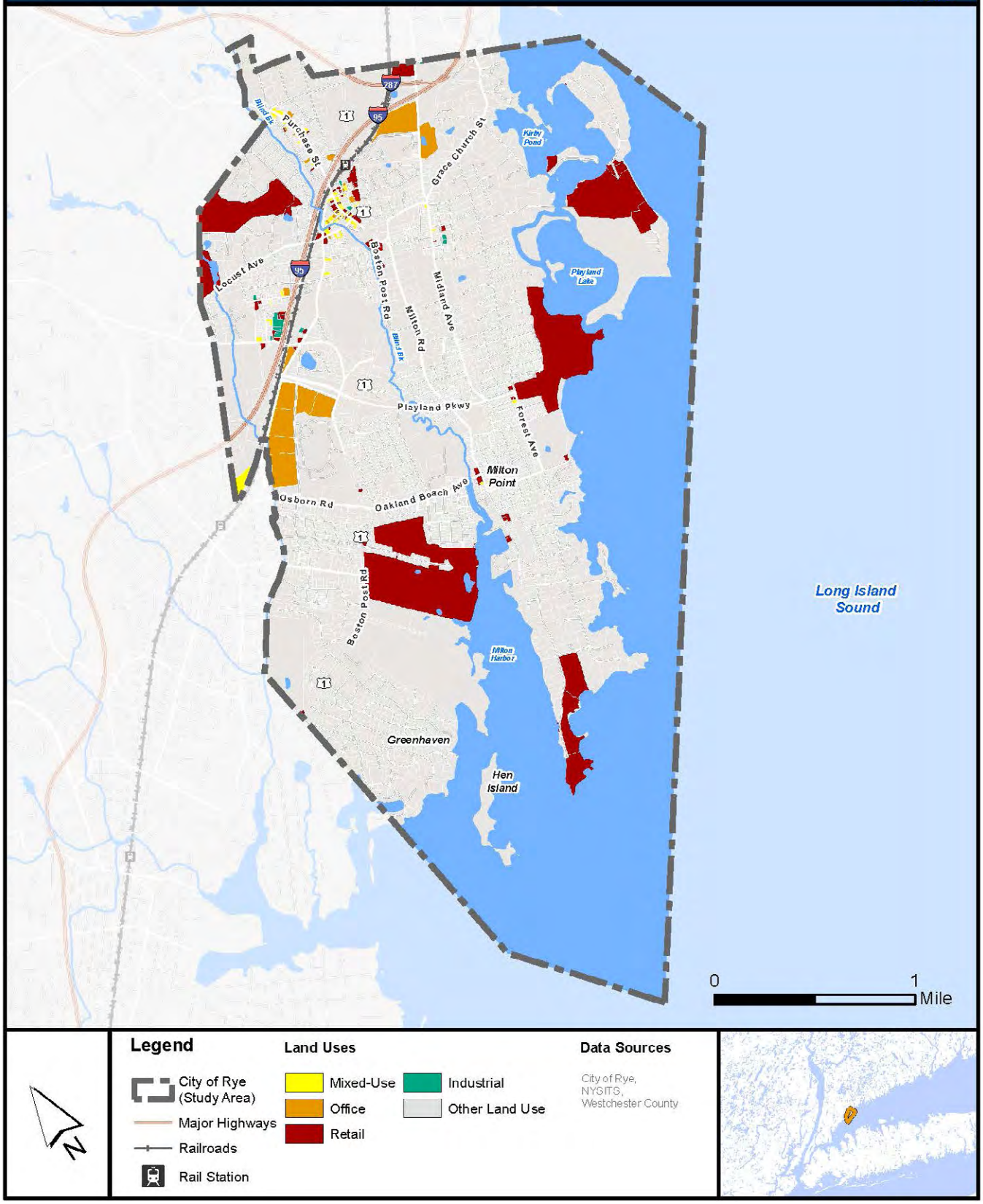
Table II-2 Risk Area for Economic Assets

Asset Name	Risk Area
Downtown Centers, Large Businesses, and Employment Hubs	
Mrs. Green's Natural Market	Extreme
Rye Golf Club	Extreme
Central Business District including Purchase Street Businesses	High
Faros Corporate Center	High
Rye Racquet Club	High
Avon	Moderate
Hansa Office Condominiums	Moderate
411 Theodore Fremd Avenue Offices	Low
Apawamis Club	Low
CVS Pharmacy	Low
Marinas, Lodging, and Tourist Destinations	
American Yacht Club	Extreme
Manursing Island Club	Extreme
Playland	Extreme
Shenorock Shore Club	Extreme
Tide Mill Yacht Basin	Extreme
Westchester Country Club Beach Club	Extreme
Coveleigh Club	High
Courtyard Rye	Moderate
Banks/Financial Services	
US Alliance Federal Credit Union	Moderate
Small Businesses	
Elm Place Businesses	Extreme
Milton Point Business District	Extreme
Row America Rye	Extreme
Rye Brook Service Station	High
Gulf Station	Moderate
Wainwright House	Moderate
Al's Service Station	Low
Exxon Gas Station	Low
Gulf Gas Station	Low
Mobil Gas Station	Low

Table II-2 Risk Area for Economic Assets

Asset Name	Risk Area
Small Businesses	
Playland Market / Rye Service Station	Low
Rye Beach Pharmacy	Low
Rye Execuplaza	Low
Rye Neck Getty Gas Station	Low
Shell Auto Care	Low

Figure II-3
Economic Land Uses - City of Rye



Health and Social Services

Health and Social Services assets include fire protection, police services, hospitals, and emergency operations facilities. Other community assets include administrative and education amenities, which serve a variety of public functions, from health treatment facilities to general purpose shelters in public schools, reception centers, post offices, and City Office Buildings. During a storm event, these facilities may potentially serve as critical disaster response and recovery centers, the identification of which is essential to future disaster management and preparedness. The Locust Avenue and Milton Point Firehouses are located in an extreme risk area, as well as the Rye Middle/High School Athletics Field and medical offices off Purchase Street. Almost all of the Health and Social Services assets inventoried are classified as FEMA Critical Facilities.

Table II-3 Risk Area for Health and Social Services Assets

Asset Name	Risk Area
Schools	
Rye Middle/High School Campus	Extreme
Rye Neck Middle School	High
Rye Neck Senior High School	High
Midland School	Moderate
Resurrection Middle School	Moderate
Rye School of Leadership	Moderate
Community Synagogue of Rye Nursery School	Low
Milton School	Low
Osborn School	Low
Resurrection Grammar School	Low
Rye Country Day School	Low
Rye Presbyterian Nursery School	Low
United Methodist Nursery School	Low
Westfield Day School	Low
Emergency Operations/Response	
Locust Avenue Fire House	Extreme
Milton Point Fire House	Extreme
Police Station & Rye City Court	Low
Government and Administrative Services and Public Works Facilities	
City Hall	Moderate
Rye Board of Education	Moderate
Rye City Offices	Moderate
Rye Department of Public Works	Moderate
Post Office	Low
Healthcare and Daycare Facilities	
Medical Offices off Purchase Street (multiple)	Extreme
Avon Day Care	Moderate
Rye Walk-In Medical Center	Moderate
Rye Country Boarding Kennels	Low

Table II-3 Risk Area for Health and Social Services Assets

Asset Name	Risk Area
Rye Veterinary Hospital	Low
WESTMED Center	Low

Housing

A significant number of residential assets within the City are at risk of future flooding. These assets include single-family and multi-family residential neighborhoods. Assets in extreme risk areas include Milton Harbor House, multiple apartment buildings off Wappanocca Avenue, and thirteen clusters of single-family homes. Affordable, senior, and supportive housing assets are considered FEMA Critical Facilities. Note that only housing assets that are vulnerable to flooding have been mapped.

Table II-4 Risk Area for Housing Assets

Asset Name	Risk Area
Multi-Family Residence	
Apartments off Wappanocca Avenue (multiple)	Extreme
Milton Harbor House Community	Extreme
Orchard Avenue Apartments	High
The Ives at Rye	High
Water's Edge Condominiums	High
Rye Colony Condominiums	Moderate
Rye Castle Apartments	Low
Senior Housing	
Rye Manor	Moderate
The Osborn	Low
Single-Family Residence	
Boston Post Road / Roger Sherman Place Homes	Extreme
Indian Village Neighborhood	Extreme
Martin Butler Court Homes	Extreme
Milton Road / Garden Drive Homes	Extreme
Milton Road / Locus Lane Homes	Extreme
Milton Road / Playland Parkway Homes	Extreme
North Manursing Island Homes	Extreme
Pine Island Homes	Extreme
South Forest Avenue Homes	Extreme
South Manursing Island Homes	Extreme
Wappanocca Neighborhood	Extreme
Waterfront Homes off Grace Church Street	Extreme
Waterfront Homes off Rye Road	Extreme

Table II-4 Risk Area for Housing Assets

Asset Name	Risk Area
Single-Family Residence	
Waterfront Homes off Stuyvesant Avenue	Extreme
Beaver Swamp Brook Flood Zone Homes	High
Brevoort Lane Homes	High
Central Avenue / Loewen Court Homes	High
Crescent Avenue Homes	High
Glendale Avenue Homes	High
Homes off Manursing Way and Kirby Lane	High
Hook Road Homes	High
Johnson Place Homes	High
Midland Avenue / Playland Parkway Homes	High
Midland Avenue Homes	High
Milton Road / Hill Street Homes	High
Parsonage Point Homes	High
Phillips Lane / Hewlett Street Homes	High
Ridge Street Homes	High
Roosevelt Avenue Homes	High
Soundview Avenue Homes	High
Watson Court Homes	High
Bird Lane Homes	Moderate
Hickory Drive Homes	Moderate
Mead Place Homes	Moderate
Midland Avenue / Grace Church Street Homes	Moderate

Infrastructure Systems

Assets in this category include transportation infrastructure, transportation-related facilities, and utilities. Utilities include public water supply, stormwater and wastewater systems, power supply, and telecommunications- the distribution and operational networks of which are dispersed throughout the City. The distributed nature of these systems throughout the extreme, high, and moderate risk areas makes the assessment of risk to the overall systems difficult to categorize. In general, if a principal component of a system is located in a risk area, the entire system is considered vulnerable. As such, it is more useful to assess the risk to specific plants, pump stations, substations, and other key facilities that are critical to the functioning of these networks. Past storms have impacted infrastructure systems in Rye, causing power outages, road washouts, and flooding that hindered travel within the City for residents and emergency service providers. An electric substation, pump station, portion of US Route 1 near the Rye Nature Center, and four bridges are located within an extreme risk area. Principal components of the wastewater, water supply, and power supply networks inventoried are considered FEMA Critical Facilities. These include sewage treatment plants, water resources, telecommunications facilities, and electric substations.

Table II-5 Risk Area for Infrastructure Assets

Asset Name	Risk Area
Power Supply and Telecommunications	
Con Edison Electric Substation – Oakland Beach Ave	Extreme
Verizon Facility	Moderate
Con Edison Electric Plant	Low
Con Edison Electric Substation – Midland Ave	Low
Con Edison Offices	Low
Verizon Wireless	Low
Wastewater	
Forest Avenue Pump Station	Extreme
Blind Brook Sewage Treatment Plant (county-owned)	High
Brevoort Lane Pump Station	High
Glen Oaks Drive Pump Station (county-owned)	High
Stuyvesant Avenue Pump Station	High
Sewer Trunk under I-95 culvert (county-owned)	Low
Stormwater	
Blind Brook Retaining Wall	High
Bowman Avenue Dam on Blind Brook	High
Transportation	
Locust Avenue Bridge over Blind Brook	Extreme
Morehead Footbridge over Blind Brook	Extreme
Oakland Beach Avenue Bridge over Blind Brook	Extreme
Playland Parkway Bridge over Blind Brook	Extreme
US Route 1 (near Rye Nature Center)	Extreme
Cemetery Bridge over Red Oak Swamp Stream	High
Central Avenue Bridge over Blind Brook	High
Interstate 95	High
Metro North Parking Lot – Highland Road	High
Metro North Rail Lines	High
Orchard Avenue Bridge over Blind Brook	High
Metro North Railroad Station	Low
Water Supply	
Dearborn Road at Water's Edge Pump Station	Moderate
Van Rensselaer Road Pump Station (county-owned)	Moderate

Natural and Cultural Resources

Natural and Cultural Resources include natural habitats, wetlands and marshes, recreation facilities, parks, open space, religious establishments, libraries, museums, historic landmarks, and performing arts venues. Hurricane Irene, Tropical Storm Lee, Superstorm Sandy, and other flood events in the last 10 years have impacted multiple recreational, cultural, and historic assets in Rye's natural and built environment. Nine natural resources within the City are in extreme risk areas: the Rye Meeting House/Bird Homestead, Rye Free Reading Room, Rye YMCA Community Center, Edith Read Natural Park and Wildlife Sanctuary, the public fishing dock, the Rye City Boat Basin, Rye Fish and Game Club, Rye Marina, and the Rye Town Park. The Rye Free Reading Room is the only Natural and Cultural Resource asset designated as a FEMA Critical Facility.

Many of the water bodies and waterways of Rye have historically been, and continue to be, a natural and recreational resource; however, these same waters cause flooding damage to infrastructure, businesses, and residences. As the source of flooding, these assets are not at risk for flooding, though protecting their ecological health may be critical to the protection of other nearby assets.

Table II-6 Risk Area for Natural and Cultural Resources Assets

Asset Name	Risk Area
Historic Landmarks and Facilities	
Rye Meeting House/Bird Homestead	Extreme
Greenwood Union Cemetery	High
Knapp House	High
Jay Heritage Center	Low
Square House	Low
Community Centers and Libraries	
Rye Free Reading Room ('Stay Cool' center)	Extreme
Rye YMCA Community Center	Extreme
Rye Arts Center	Low
Cultural or Religious Establishments	
Church of the Resurrection	Moderate
Rye Presbyterian Church	Moderate
Trinity Presbyterian Church	Moderate
Christ's Church	Low
Community Synagogue of Rye	Low
Rye United Methodist Church	Low
Parks and Recreation	
Edith Read Natural Park and Wildlife Sanctuary	Extreme
Public Fishing Dock	Extreme
Rye City Boat Basin	Extreme
Rye Fish and Game Club	Extreme
Rye Marina	Extreme
Rye Town Park	Extreme
Nursery Field	High

Table II-6 Risk Area for Natural and Cultural Resources Assets

Asset Name	Risk Area
Parks and Recreation	
Rye Nature Center	High
Disbrow Park	Moderate
Rye Recreation Park	Moderate
Gagliardo Park	Low
Marshlands Conservancy	Low

Assessment of Risk to Assets and Systems

Rye is at risk from both riverine and coastal flood sources. Blind Brook and Beaver Swamp Brook, as well as their smaller tributaries, present the risk of flooding to inland assets and systems. In order to mitigate flood risk effectively and improve resiliency throughout the community, the causes and magnitude of the risk from each of these flood sources must first be understood. The Long Island Sound coastline, along the City's southern and eastern borders, is tidally influenced and is subject to destructive wind and wave action that can exacerbate storm damage in coastal areas. The risk assessment process seeks to build on local knowledge of flood risk using a standardized framework for identification and analysis of the risk to assets and systems throughout Rye.

The concentrated location of assets within areas that are highly exposed to flooding results in high and severe risk scores for many of the community's important assets. The greatest concentration of high and severe risk assets in Rye is along Blind Brook, particularly in the vicinity of Purchase Street and Boston Post Road. This area includes the Central Business District and multiple residential neighborhoods. There are also clusters of assets in several locations along the Milton Harbor (Milton Business District) and Long Island Sound shorelines, including a variety of natural and cultural resource assets in addition to residential neighborhoods. These locations of concentrated development correspond closely to the identified flood risk areas within the community.

Risk assessment results indicate that there are a handful of Rye assets in the severe risk category, which is intended to represent those assets that may be in imminent danger from flooding. Additionally, more than 25% of the assets located in risk areas scored in the high risk category, indicating that these assets may experience significant negative outcomes from a storm event, including flooding, power outages, and other storm-related damages.

Background

The landscape of Rye is characterized by an irregular coastline along the Long Island Sound and by Blind Brook, which runs through the length of the City before it meets Milton Harbor. The shoreline includes several beaches, marshlands, harbors, and barrier islands, all of which provide important economic and natural resource opportunities in the community. The Blind Brook riparian corridor is highly developed and includes some of the community's most densely developed commercial centers and residential neighborhoods. At its confluence with Milton Harbor, Blind Brook becomes a tidal estuary, surrounded by marshes and tidal wetlands. Land uses bordering and encompassing these natural features include recreation facilities, conservation areas, and residential neighborhoods.

According to the City of Rye, New York Flood Mitigation Plan, "the coastal sections of Rye flood during unusually high tides associated with major storms and hurricanes; large-scale flooding has occurred on numerous occasions.[25] Though the Flood Mitigation Plan was created prior to the large

hurricanes and storms of the last seven years, the coincidence of high tides with high levels of storm-related rainfall in the region, described hypothetically in the plan, was a primary cause of flooding throughout the region during Superstorm Sandy.

The Flood Mitigation Plan lists the primary causes of flooding along Blind Brook as "narrow channel width, obstructed flow, sediment-constricted bridge openings, historical wetland filling and floodplain encroachment, and in the lower reaches, tidal backwater effects."[26] It is noted that tidal influence reaches as far upstream on Blind Brook as the Central Avenue crossing, approximately 1.5 miles from the mouth of the Brook. Flooding of the Beaver Swamp Brook corridor typically occurs during storms that also affect Blind Brook and is driven by the low elevation of adjacent property and the development of natural floodplain areas. Flood damages along Beaver Swamp Brook tend to be less severe because Rye is not at the bottom of this watershed and the City proactively acquired the one flood-prone property located within the greenway.

In combination, these hydrographic, geographic, and topographic factors define Rye's landscape. When storm or flood events occur, these conditions result in flood risk throughout the community. The magnitude of that risk to the identified community assets can be determined through the risk assessment process.

Risk Assessment

The fundamental goal of the NYRCR Program is to reduce impacts to the Rye community as a result of past and future storm events. To accomplish this, the community needs to understand better the risk to, and vulnerability of, its assets to the impact of storms. The standardized risk assessment process strives not only to use local knowledge to identify assets that were damaged during past storms, but also to use available data and maps to identify assets that may be at risk of damage from future storms. The risk assessment tool developed by the NYRCR Program and the NYS DOS enables quantification and comparison of the identified levels of risk to different community assets. Improved understanding of the severity and distribution of risk to assets throughout the community facilitates more effective recovery and resiliency planning.

The risk assessment tool combines information from the asset inventory, flood hazard area maps, national and regional mapping data, and local knowledge into quantitative hazard, exposure, and vulnerability scores. This information is further combined into one quantitative risk score.

The hazard score is a measure of the likelihood that a flooding event will occur and the magnitude or destructive capacity of the event. For the purposes of standardized evaluation, risk scoring for all NYRCR Communities uses the hazard score corresponding to a 100-year storm event (the storm event with an annual 1% chance of occurrence) for all assets. The hazard score corresponding to the 100-year storm is 3, as defined by the risk assessment tool.

Exposure in the risk assessment tool is based on both the risk area within which an asset or asset group is located and the local topographic and geographic conditions of its surroundings or landscape attributes. The asset's risk area is determined by overlaying the FEMA and NYS DOS flood hazard area maps on a map of the identified assets. This indicates whether assets are located within the moderate, high, or extreme risk zones or outside of risk areas altogether.

Assets within risk areas of similar landscape characteristics were grouped to evaluate multiple assets at once. Assets whose landscape characteristics did not conform to those of others nearby were considered individually. The landscape attribute score is determined by evaluating the presence or absence of a certain set of landscape characteristics defined by NYRCR Program guidance that may reduce an asset's exposure to flood risk.

The exposure score, calculated within the risk assessment tool, assigns a numeric score between 1 and 5 based on the asset's risk area and the number of protective landscape attributes determined to be absent. Higher exposure scores correspond to more highly exposed locations.

Vulnerability scores are intended to represent the capacity of an asset to return to service after a storm. In the risk assessment tool, vulnerability scores range from 1 to 5, with a score of 1 corresponding to assets that are minimally affected by floods and a score of 5 corresponding to those assets that may be destroyed or permanently out of service as a result of flooding. The duration of service outages in the wake of past storms was used to determine the vulnerability score for each asset. Information on service outages for each asset was obtained through discussions with the city planner and reviewed by the NYRCR Planning Committee.

The risk score is calculated by multiplying the hazard score, exposure score, and vulnerability score (i.e. Hazard x Exposure x Vulnerability = Risk). Risk scores range from 0 to 75, with the following ranges signifying varying degrees of risk:

- <6: Residual risk;
- 6-23: Moderate risk;
- 24-53: High risk; and
- >53: Severe risk.

The first step in applying the risk assessment tool is to calculate "unmitigated" risk scores, which represent the risk to assets and systems as they presently exist without proposed mitigation projects in place.

To evaluate the risk reduction benefits of proposed storm recovery projects, "mitigated" risk scores were prepared to reflect the degree to which a mitigation project may reduce risk to assets. Mitigated risk analyses were prepared to evaluate the assets affected by proposed and featured projects and included in Section V.

In an effort to focus on those assets that are most at risk, unmitigated and mitigated risk scores were prepared only for assets identified on the asset inventory that are located within high or extreme risk areas as identified on the FEMA or NYS DOS flood hazard area maps. Assets located in moderate risk areas that serve critical functions during emergencies, including hospitals, key infrastructure, and emergency response centers, were also considered in the risk assessment process.

The unmitigated risk scores present a profile of the current risk to assets identified in Rye. It is important to remember that the risk assessment tool is a standardized template that is used State-wide. As with any standardized system, some local effects may not be perfectly reflected. Additionally, within the structure of the risk assessment tool it is difficult to adequately represent assets that are indirectly affected by storm events, such as those that do not flood but are inaccessible due to flooding on key access roads. Despite these limitations, the risk assessment process can be a powerful tool in understanding and delineating the risk profile across a community. Analysis of the unmitigated risk assessment results, in conjunction with an understanding of past storm events and local experiences, can provide insight into the factors driving flood risk in the community and which strategies could be most effective in improving the long-term resiliency of assets community-wide.

Unmitigated Risk Score Results

In total, 95 assets located within high or extreme flood risk areas were identified in Rye and evaluated in the unmitigated risk assessment. These assets are distributed throughout the community, with the highest concentrations along Boston Post Road and Purchase Street near Blind Brook (Central Business District) and along Milton Road at the mouth of Blind Brook (Milton Business District). Of these assets, five scored in the severe risk category and 34 scored

in the high risk category. This outcome is not unexpected, as only those assets in high and extreme risk areas were considered for risk assessment. The unmitigated risk score results presented in Tables II-7 and II-8 are color-coded: red for severe risk, orange for high risk, and yellow for moderate risk. Numerical scores can be found in Section V, Table V-3 Unmitigated Risk Assessment for Community Assets.

Table II-7 Riverine Asset Risk Assessment

Asset Name	Asset Class	Critical Facility	Risk Score
Elm Place Businesses	Economic	No	Severe
Rye YMCA Community Center	Health and Social Services	No	Severe
Rye Free Reading Room	Natural and Cultural Resources	Yes, FEMA	Severe
Central Avenue Bridge over Blind Brook	Infrastructure Systems	No	Severe
Apartments off Wappanocca Avenue (multiple)	Housing	No	High
Central Business District	Economic	No	High
Indian Village Neighborhood	Housing	No	High
Wappanocca Neighborhood	Housing	No	High
Mrs. Green's Natural Market	Economic	No	High
Rye Middle/High School Campuses	Health and Social Services	Yes, FEMA	High
Central Avenue / Loewen Court Homes	Housing	No	High
Locust Avenue Firehouse	Health and Social Services	Yes, FEMA	High
Boston Post Road / Roger Sherman Place Homes	Housing	No	High
Rye Nature Center	Natural and Cultural Resources	No	High
Medical Offices off Purchase Street (multiple)	Health and Social Services	No	High
Cemetery Bridge over Red Oak Swamp Stream	Infrastructure Systems	No	Moderate
Nursery Field	Natural and Cultural Resources	No	Moderate
City Hall	Health and Social Services	No	Moderate
Midland School	Health and Social Services	Yes, FEMA	Moderate
Milton Road / Playland Parkway Homes	Housing	No	Moderate
Locust Avenue Bridge over Blind Brook	Infrastructure Systems	No	Moderate
US Route 1 at Blind Brook	Infrastructure Systems	No	Moderate
Playland Parkway Bridge over Blind Brook	Infrastructure Systems	No	Moderate
Morehead Footbridge over Blind Brook	Infrastructure Systems	No	Moderate

Table II-7 Riverine Asset Risk Assessment

Asset Name	Asset Class	Critical Facility	Risk Score
Rye Neck Middle School	Health and Social Services	Yes, FEMA	Moderate
Rye Neck Senior High School	Health and Social Services	Yes, FEMA	Moderate
Johnson Place Homes	Housing	No	Moderate
Rye Brook Services Station	Economic	No	Moderate
Faros Corporate Center	Economic	No	Moderate
Rye Racquet Club	Economic	No	Moderate
Orchard Avenue Apartments	Housing	No	Moderate
Beaver Swamp Brook Flood Zone Homes	Housing	No	Moderate
Glendale Avenue Homes	Housing	No	Moderate
The Ives at Rye	Housing	No	Moderate
Glen Oaks Drive Pump Station (COR)	Infrastructure Systems	Yes, FEMA	Moderate
Orchard Avenue Bridge over Blind Brook	Infrastructure Systems	No	Moderate
Knapp House	Natural and Cultural Resources	No	Moderate
Greenwood Union Cemetery	Natural and Cultural Resources	No	Moderate
Crescent Avenue Homes	Housing	No	Moderate
Verizon Facility	Infrastructure Systems	Yes, FEMA	Moderate
Ridge Street Homes	Housing	No	Moderate
Midland Avenue / Playland Parkway Homes	Housing	No	Moderate
Metro North Parking Lot – Highland Avenue	Infrastructure Systems	No	Moderate
Blind Brook Sewage Treatment Plant (COR)	Infrastructure Systems	Yes, FEMA	Moderate
Rye Department of Public Works	Health and Social Services	Yes, FEMA	Moderate
Midland Avenue Homes, North of Playland Pkwy	Housing	No	Moderate
Rye Manor	Housing	Yes, FEMA	Moderate
Metro North Rail Lines	Infrastructure Systems	No	Moderate
Interstate 95	Infrastructure Systems	No	Moderate

Table II-8 Coastal Asset Risk Assessment

Asset Name	Asset Class	Critical Facility	Risk Score
Edith Read Natural Park and Wildlife Sanctuary	Natural and Cultural Resources	No	Severe
Playland	Economic	No	High
Milton Harbor House Community	Housing	No	High
Rye City Boat Basin	Natural and Cultural Resources	No	High
Rye Town Park	Natural and Cultural Resources	No	High
Tide Mill Yacht Basin	Economic	No	High
Milton Point Business District and School	Economic	No	High
American Yacht Club	Economic	No	High
Shenorock Shore Club	Economic	No	High
Manursing Island Club	Economic	No	High
Westchester Country Club	Economic	No	High
Milton Road / Garden Drive Homes	Housing	No	High
Martin Butler Court Homes	Housing	No	High
Phillips Lane / Hewlett Street Homes	Housing	No	High
Milton Road / Hill Street Homes	Housing	No	High
Waterfront Homes off Stuyvesant Avenue	Housing	No	High
Rye Golf Club	Economic	No	High
Row America Rye	Economic	No	High
Milton Point Firehouse	Health and Social Services	No	High
Milton Road / Locust Lane Homes	Housing	No	High
South Manursing Island Homes	Housing	No	High
Public Fishing Dock	Natural and Cultural Resources	No	High
Rye Marina	Natural and Cultural Resources	No	High
Rye Fish and Game Club	Natural and Cultural Resources	No	High
Rye Meeting House / Bird Homestead	Natural and Cultural Resources	No	High
North Manursing Island Homes	Housing	No	Moderate
Homes off Manursing Way and Kirby Lane	Housing	No	Moderate
Watson Court Homes	Housing	No	Moderate
Coveleigh Club	Economic	No	Moderate
Water's Edge Condominiums	Housing	No	Moderate
Parsonage Point Homes	Housing	No	Moderate
Waterfront Homes off Grace Church Street	Housing	No	Moderate
Forest Avenue Pump Station	Infrastructure Systems	Yes, FEMA	Moderate

Table II-8 Coastal Asset Risk Assessment

Asset Name	Asset Class	Critical Facility	Risk Score
Con Edison Electric Substation, Oakland Beach Ave.	Infrastructure Systems	Yes, FEMA	Moderate
Oakland Beach Avenue Bridge over Blind Brook	Infrastructure Systems	No	Moderate
Brevoort Lane Homes	Housing	No	Moderate
Pine Island Homes	Housing	No	Moderate
South Forest Avenue Homes	Housing	No	Moderate
Waterfront Homes off Rye Road	Housing	No	Moderate
Brevoort Lane Pump Station	Infrastructure Systems	Yes, FEMA	Moderate
Stuyvesant Avenue Pump Station	Infrastructure Systems	Yes, FEMA	Moderate
Roosevelt Avenue Homes	Housing	No	Moderate
Soundview Avenue Homes	Housing	No	Moderate
Van Rensselaer Road Pump Station	Infrastructure Systems	Yes, FEMA	Moderate
Hook Road Homes	Housing	No	Moderate
Dearborn Road at Water's Edge Pump Station	Infrastructure Systems	Yes, FEMA	Moderate

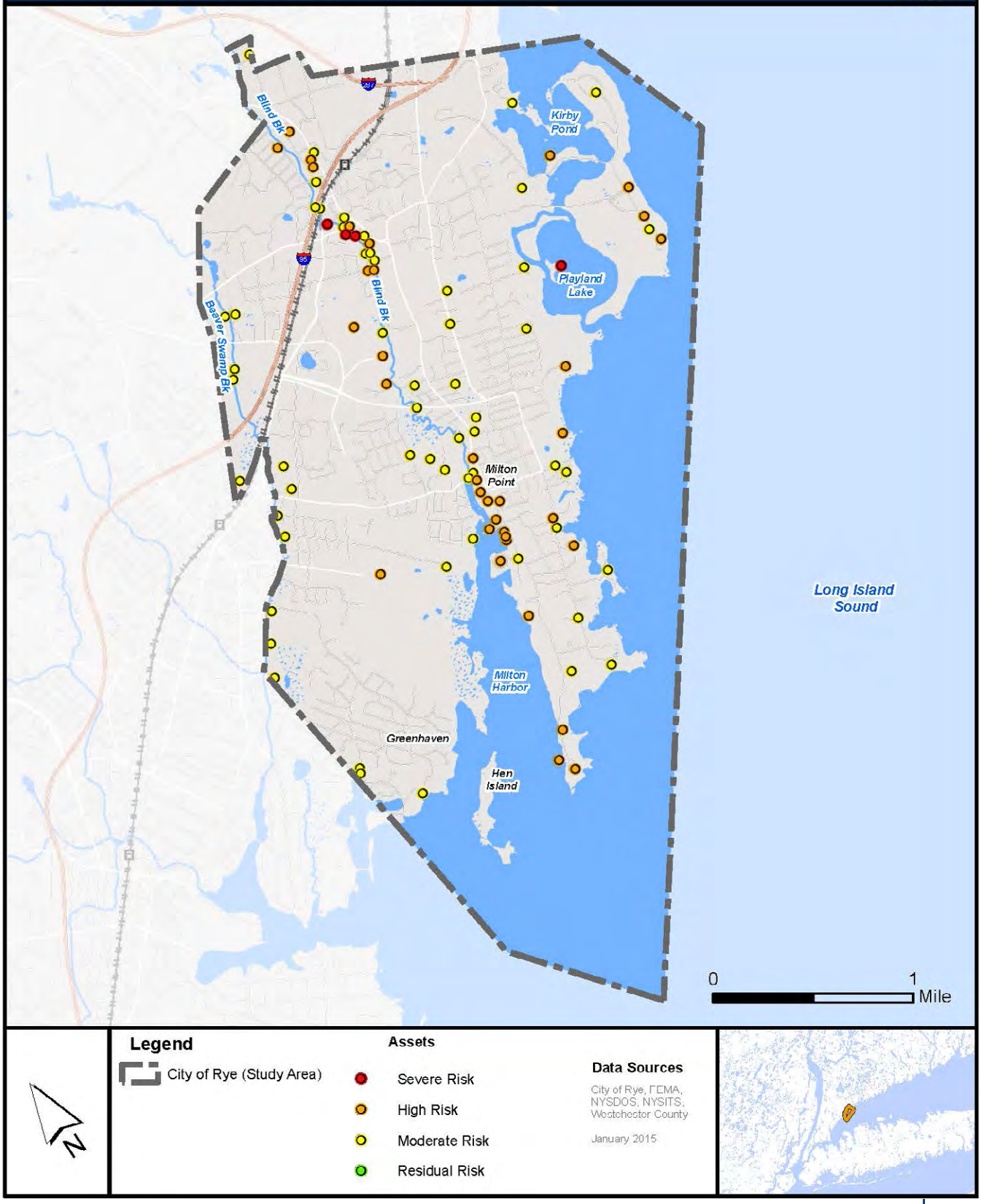
The geographic distribution of unmitigated risk scores is presented in Figure II-4. There is a concentration of assets at severe risk in the downtown area of Rye, including the YMCA, the Rye Free Reading Room, and the businesses along Elm Place. The severe risk scores of these assets are primarily driven by their high vulnerability, as demonstrated by the damage they sustained during past storms. These assets are also in a highly exposed location along Blind Brook, located below the base flood elevation and without defensive flood protection measures or buffering vegetation. Several more assets in the downtown area are at high risk, including some economic assets and the Locust Avenue Firehouse. These assets are also in an exposed location relative to the flood source. These scores are consistent with observations of historic flood events, as reported by the Rye City Planner and the Planning Committee.

There are two additional clusters of high risk assets along Blind Brook. The highest risk cluster of residential assets includes the residential area around the Indian Village neighborhood, the single-family homes that comprise the Wappanocca neighborhood, and apartments off Wappanocca Avenue, including The Highlands at Rye and other multi-family residential assets in the immediate area. Along Milton Avenue, on the east side of Milton Harbor, there is another significant concentration of high risk assets. These include residential, economic, and health and social services assets.

Though flooding in Rye most often occurs along Blind Brook, there is the potential for significant flooding and damage along the Long Island Sound shoreline, as evidenced by the destruction that followed Superstorm Sandy. Accordingly, there are a large number of coastal assets in the high risk category, due primarily to their highly exposed locations. The effect of high tides, storm surge, and wave action can exacerbate flooding in these locations, as was observed during Superstorm Sandy. Many of these assets are inherently located in flood-prone areas, including marinas and boat basins, marsh and coast conservation areas, and beachfront parks.

Key infrastructure systems in the community are at moderate risk, with the exception of the Central Avenue Bridge over Blind Brook, which is at high risk. The identified wastewater collection and treatment assets all scored in the moderate risk category. Though this would indicate that projects targeting such infrastructure assets should not be the highest priority, it is important to consider the interconnected nature of these systems. In system-based assets such as infrastructure, if one component of the system fails, the rest of the system is at increased risk of failure as well. Rye's transportation infrastructure systems serve a critical function not only within the community, but in the broader regional transportation network as well. The portions of the Metro North Rail Lines and Interstate 95 (I-95) within Rye are pieces of much larger transportation systems that serve the entire downstate New York region. Both of these assets scored in the moderate risk category. Six of the automobile and pedestrian bridges identified within the flood zone scored in the moderate risk category as well. The Central Avenue Bridge over Blind Brook scored in the severe risk category.

Figure II-4
Risk to Assets - City of Rye



B. Assessment of Needs and Opportunities

Rye is a flourishing community with the economic and social capacity to bounce back from a single storm, but the repeated pressures of the 2007 floods, Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy uncovered the City's vulnerabilities. When rebuilding happens repeatedly, it presents challenges to residents and business owners as well as non-profits, civic groups, and the local government. Gaps in flood protection, mitigation, and prevention measures as well as communication, coordination, and emergency response have highlighted areas for improvement.

Building on the asset inventory and risk assessment and in order to guide the development of strategies and projects, the Committee worked to identify needs and opportunities for Rye's reconstruction and increased resiliency. They considered the range of threats from storms including flooding from Blind Brook and Beaver Swamp Brook, coastal storm surge, rising high tides, and power outages. They thought about how the community functioned during a storm and recovered immediately after a storm if high water and power loss persisted. It was important to them to weigh measures that kept water out of the community as well as ways to live with water.

The needs and opportunities are organized according to the FEMA National Disaster Recovery Framework's six Recovery Support Functions: Community Planning and Capacity Building, Economic Development, Health and Social Services, Housing, Infrastructure, and Natural and Cultural Resources.

Recovery Support Functions

Community Planning and Capacity Building: This is the recovery function ensuring that communities effectively plan and implement disaster recovery activities, engaging the whole community to achieve their objectives and increase resilience. Nongovernmental and private sector resources should be considered in the public sector's recovery planning process.

Economic Development: The ability to return economic and business activities to a state of health to ensure that a sustainable and economically viable community emerges after a storm event or other disaster is the purpose of this recovery function. It is critical that the community return to self-sufficiency and vitality quickly and effectively after it has been damaged.

Health and Social Services: Restoring and improving health and social services networks in order to promote the resilience, health, independence, and well-being of the whole community is the focus of this recovery function. Recovery efforts may look at public health, health care facilities and organizations, and essential social services.

Housing: Disasters, like flooding and other storm events, require that many years' worth of housing repair, rehabilitation, reconstruction, and new construction occur at an accelerated pace. This recovery support function looks for solutions that are implementable, sustainable, and resilient. It is important to address conflicting policies and programs to integrate all available housing-related resources effectively.

Infrastructure: In order to restore infrastructure systems and services to support a viable, sustainable community and improve resilience to and protection from future hazards, this recovery support function is designed to protect existing infrastructure assets and construct new infrastructure that serves to protect other assets in the event of future storms.

Natural and Cultural Resources: To protect natural and cultural resources and historic properties through appropriate response and recovery actions is the purpose of this recovery support function. It seeks to preserve, protect, conserve, rehabilitate, and restore natural and cultural assets within the community in order to make them more sustainable.

* These descriptions are based on the FEMA Recovery Framework (http://www.fema.gov/recovery-support-functions)

Community Planning and Capacity Building

Prior to Hurricane Irene and Superstorm Sandy, national news and warnings from State agencies helped everyone to prepare for the impacts of both storms. By contrast, there is often less notice before localized flood events, and communication channels are often geared towards single family homeowners and may not reach all residents. Even when storm warnings are informative, communication systems often break down in the aftermath of a flood- especially when power has been knocked out for a large portion of the community. No current communication system effectively conveys which streets are flooded, which stores are still open, and where shelters have been established. With mobile technology, as long as cell towers remain operable, this information could more easily be conveyed if digital communication systems are designed and implemented.

Other communication systems also need to be established and reinforced before the next storm. ConEd developed a "liaison" system a decade ago that allowed them to better identify power outages and to keep municipalities abreast of when the power would be turned on or off by working closely with mayors and city managers; however, this program seems to have dissolved, as ConEd provided out-of-date information to the City and residents in the aftermath of Superstorm Sandy. This resulted in residents being exposed to unnecessary hazards due to a lack of information and unclear expectations about power restoration. Currently, ConEd is working on a resilience plan for the region so communication before, during, and after storms may improve. There are also communication gaps between Rye's first responders and other departments like Public Works. A plan for collaboration and coordination before, during, and after storms needs to be systematized and funded. Opportunities to better communicate with County officials during storm events should also be leveraged.

Being adequately prepared to get through a storm is also critical for residents and municipalities. Cell phone towers should be checked regularly to ensure that battery backup power is storm-ready. Sandbags, batteries, generators, propane tanks, and food should be stockpiled at designated community shelters. Established neighborhood networks can also be bolstered and utilized to ensure that vulnerable residents are able to evacuate or shelter in place and withstand major storms as appropriate.

Severe flooding on Highland Avenue during Hurricane Irene (Alexander Breinin)

Ongoing planning to make the community more resilient is imperative even if Rye is not impacted by another flood or storm in the near future. Locally, education for residents, particularly young residents, about resiliency and emergency preparedness is recommended. This may be led by the City in partnership with a City-based organization such as the Rye Nature Center. On a more regional scale, there needs to be more coordination within the watershed. A Blind Brook Conservancy could advocate, educate, and implement initiatives that would capture stormwater, raise awareness about flooding and polluting the Sound, and push for zoning changes to limit or reduce impermeable surfaces. This group, another organization, or the County should also install flood gauges in Blind Brook so that a better data set can be used for tracking changes in the water levels in the Brook. Currently, there is little more than anecdotal evidence of changes to water levels during different storms and no quantitative measurement of how new development or interventions, such as the sluice gate, have altered the Brook's height and flow.

Community Planning and Capacity Building Needs:

- Communication and warnings about storms for all residents
- System for better communication between utility companies and residents
- Improved coordination between City agencies and utility companies before, during, and after storm events
- Educational opportunities for learning about emergency preparedness and resiliency
- Inter-municipal watershed planning

Community Planning and Capacity Building Opportunities:

- Create communication channels between ConEd, the City, and residents, and plan for electricity restoration and/or shut-downs
- Implement inter-agency emergency preparedness and recovery task force
- Establish watershed conservancy to coordinate Blind Brook initiatives
- Improve data gathering on Blind Brook to track water levels

Economic Development

Rye has been a city applying Smart Growth principles for nearly half a century. With a robust tax base, a scattering of corporate offices, a walkable downtown, neighborhood shops, proximity to mass transit, and a mix of single and multi-family housing, the City is focused more on stability than new development for all sectors of its economy.

In the Central Business District, Blind Brook is channeled, and the constructed walls force the stream to turn at severe right angles. During the 2007 floods and Hurricane Irene, the flow of water in the Brook was so strong that it deviated from the channel, overflowed, and badly damaged the businesses clustered in the area. The businesses near the marina have experienced flood damage with even more frequency since they are also affected by storm surge and tidal flooding.

It is critical that utilities are restored in a timely manner so that businesses can reopen quickly after a storm to serve the community and protect jobs. It is particularly important to the community that small businesses are supported if they have been impacted by flooding in order to preserve the vibrant downtown. With repeated rebuilding, the cost of remaining in Rye quickly becomes unaffordable for the local businesses that are valued for the diversity and vitality that they bring to Purchase Street and other neighborhoods.

Addressing transportation issues is also important to economic stability. The Metro North trains provide a vital link to jobs in New York City for Rye residents and to jobs in Rye for workers across the region. Keeping these trains operable is critical for getting back to business after storms. Parking at the Metro North station is important after storms and on an ongoing basis. Limited parking at the station and downtown could be remedied by structured parking. This would also serve as a safe place to store cars that would otherwise be damaged by flood waters during a storm.

Metro North Station in Rye

Relative to many storm damaged communities, Rye has a strong and extensive donor base that invests heavily in supporting local non-profits and initiatives. This funding pool has been stressed by the repeated floods and storms which have necessitated repairs and reconstruction. Expanded programming and other enhancements to these groups has been limited and efforts to make the community more resilient and floodproof will offset this strain on resources.

Economic Development Needs:

- Support for small business owners vulnerable to flood events
- Expedited electricity restoration for business areas
- Facilitated access to Metro North

Economic Development Opportunities:

- Develop small business assistance program
- Ensure that businesses are able to reopen in a timely manner
- Evaluate options for expanded parking opportunities, including structured parking

Health and Social Services

Rye's community assets include two firehouses, a police station, a medical center, and various medical offices. Many municipally-owned assets are either subject to flooding directly or are cut off from parts of the City by flooded roadways. Both the Locust Avenue and Milton Point Firehouses are directly affected by flooding from Blind Brook and Milton Harbor respectively. Though City Hall and the Police Station have not been flooded by past storms, they are inaccessible from some directions when roadways flood. The library, which could serve as a meeting place or staging area during some emergencies, is adjacent to Blind Brook and was flooded during the 2007 storms and Hurricane Irene. The High School and Middle School buildings, adjacent to each other, lack backup power sources that would enable them to remain open or serve as a shelter, and their athletic facilities have experienced repeated flooding.

The City also has a designated Red Cross Shelter facility at Rye Country Day School situated at one of the highest elevations in the community; however, in order to operate, Red Cross staff must be present, which occurs only when it is deemed necessary by the national organization due to a federally recognized emergency. During smaller but often no less devastating events, the City has opened other facilities to provide temporary shelter. In the past, Whitby Castle at the city-owned Rye Golf Club has been utilized, but it is now being leased to a private group and is not available for use as a shelter without the group's consent. The Rye YMCA has some capacity to provide short-term shelter during some storm events, but it has been vulnerable to flooding from Blind Brook in the past, having also flooded during Hurricane Irene and the 2007 storms. Even if it proves to be impervious to future floods, its location is not ideal as a shelter during a flood event as surrounding roads may be flooded. Rye Recreation has been suggested as a possible shelter, though it is not currently equipped to serve that role and is often used for staging emergency response. In the search for a new shelter location, it should be noted that many Rye residents can go to the house of a family member or friend or to a hotel, but still need a place to regroup, charge phones, and get updated information. Additionally, some Rye residents require public overnight facilities.

Medical services are available in Rye, with additional hospitals and medical offices easily accessible in the surrounding area. During past storms, the Osborn, a senior living facility, provided a variety of health services and temporary accommodations to local seniors who needed to leave their homes due to flooding. No lack of medical services, including mental health and public health facilities, has been noted during past storm events. Nonetheless, if emergency communication systems are improved

for residents, information about available resources for health care, including local organizations providing social service resources during the event, should be shared.

Health and Social Services Needs:

- Facility and systems for emergency response during flooding and power outages
- Emergency shelter location or locations that can be opened by the City without the Red Cross
- Uninterrupted medical services

Health and Social Services Opportunities:

- Ensure that emergency response services are able to continue operations during and after any storm event
- Ensure that people have a safe place to go to receive shelter and information on the recovery efforts

Housing

Over the past seven years, since the spring 2007 flooding, the City has become more resilient as an increasing number of homeowners have invested in making their dwellings more secure against the threat of storms. Many residents living in areas at risk of coastal and riverine flooding have elevated their homes. Others have purchased sump pumps, generators, storm shutters, and other mitigation measures as appropriate. Those who have not made these changes are typically burdened by the high cost of such modifications, the difficulty of short-term relocation during construction (particularly for vulnerable populations), or by restrictions in the existing zoning code. A grant or loan program that offsets a proportion of the cost of home elevation would incentivize further improvements. A local expedited permitting process is already in place to facilitate property elevations.

Elevated home

Although there are limited benefits to collecting and retaining water near the bottom of a watershed, there is still merit to using mitigation techniques such as rain barrels, rain gardens, tree and wildflower plantings, dry wells, and regular storm drain maintenance. These and other techniques make a difference when there is widespread implementation with city-led education, outreach, and support. Similarly, those homeowners with coastal access or who are vulnerable to coastal flooding may receive education and support for home protection and preparation, as well as green infrastructure options such as vegetated buffers or dunes to address storm surge and the threat of higher tides. For new homes or additions, the City may require owners to create more pervious surfaces or retain 50-year stormwater run-off on their property and demonstrate preparedness for potential storm risks.

Within many single-family neighborhoods, residents are connected through years of homeownership and social contact. Before, during, and after storms, neighbors go door to door checking on one another and serving as a local resource for each other. This is not always true in multi-family buildings, where new renters in particular are vulnerable to a lack of information prior to a storm's arrival and may not have local resources to turn to during a storm. Information systems and potential venues for long-term overnight sheltering that serve the needs of all members of the community are requisite.

Working with Westchester County, Rye may soon have the opportunity to participate in FEMA's National Flood Insurance Program Community

Rating System (CRS). While repeated flooding has driven up the costs of flood insurance for community residents, further limiting the funds available for home improvements and repairs, this program would offset that somewhat. The program has set standards for community floodplain management activities that may lead to reduced flood insurance rates for local homeowners.

Housing Needs:

- Revisions to zoning that promote and incentivize resilient building
- Outreach to residents living in different types of housing before, during, and after storms
- Short-term housing for residents displaced by storm events

Housing Opportunities:

- Develop zoning codes that rewards homeowners for on-site water retention and storm/flood resilience
- Subsidize or otherwise assist in reducing the cost of home elevations
- Provide educational resources on preparing for floods
- Designate a shelter location that can accommodate residents overnight or for an extended period of time
- Participate in programs to reduce flood insurance

Infrastructure

Flooding from Blind Brook is viewed as one of the greatest threats to preserving the current condition and character of Rye. With the Brook flowing through the downtown, past numerous community assets and along multiple neighborhoods, the threat of flooding has begun to feel omnipresent. The construction of the sluice gate, which opened in June 2013, was part of a collaborative effort between the City of Rye and the Town of Rye as well as the County and State. No major storm events have tested the sluice gate's efficacy since its installation, but the Community continues to look for additional mitigation measures that can be installed upstream to increase the Brook's capacity to keep water out of the City. Past studies have explored options for holding stormwater for a timed release, increasing the capacity of the upper pond behind the Bowman Avenue Dam, and installing detention ponds of varying sizes along the Brook. Additional measures to divert runoff from the Westchester County Airport have also been explored.

As long as the risk of flooding continues in Rye, a wide range of other needs and opportunities exists for local infrastructure. Heavy rains and riverine flooding often lead to overflows in the sanitary sewer system, which results in untreated waste water mixing with the stormwater system that empties directly into Milton Harbor and Long Island Sound. After major storms, people walking through the streets are often vulnerable to the risks associated with exposure to contaminated water without being aware of the conditions of the flood water. The limited capacity of the sanitary sewer system and the stormwater it collects during flood events also leads to sewer backups in residents' back yards and basements. Both sewer systems should be expanded and the sanitary sewer system should be hardened to prevent overflow and contamination.

Roadways and bridges are particularly vulnerable to storm events. Low-lying roadways and most of the bridges that cross Blind Brook were impacted by the 2007 flooding and Hurricane Irene. Bridges compromised by flooding and damage caused by water pressure and debris have the potential to be reinforced. Damaged and previously flooded roadways may benefit from adjacent green infrastructure or other catchment areas. Roadways at the southeastern tip of Rye are particularly vulnerable to tidal flooding during major storms even when there is limited rainfall. Meanwhile, storm events with strong winds, like Superstorm Sandy, knock trees into roadways. Combined with downed

power lines, these trees make roads impassable even for pedestrians. Determining a clear hierarchy for street clean-up that is shared with the community or an interactive map of safe routes would help people to reach a shelter and medical services safely. Evacuation routes in particular should be prioritized and information about their condition during flood events should be shared using the improved communication system described above.

Trees blocking roadways after Superstorm Sandy (Alexander Breinin)

Power lines are often damaged during flood and wind events, and the power is sometimes shut off during flood events to prevent further damage to the system. Many Rye residents in at-risk areas use sump pumps to keep their homes dry and are unable to protect themselves when the power is disconnected. Though many residents have invested in generators, long outages, like the one after Sandy, strain local access to fuel and are unsustainable in the long-run. Where possible, particularly outside areas at-risk for flooding, utility lines may be buried in conjunction with future road reconstruction in order to protect them. Within risk areas, studies should consider micro-grids that allow for decentralized power production and delivery that could make use of photovoltaic cells or other alternative forms of energy. For the time being, as noted above, an efficient and clearly communicated response from ConEd would improve post-storm conditions for Rye residents and business owners.

Infrastructure Needs:

- Upstream strategies and projects that stop or reduce the flow of Blind Brook north of Rye
- Sanitary sewer system hardening
- Strengthening of major roadways and bridges
- Electrical utility protection

Infrastructure Opportunities:

- Construct catchment areas to capture and hold water from Blind Brook before it reaches Rye
- Expand the capacity and stormproof the access points to the sanitary sewer system
- Ensure that temporary repairs on major roads and bridges are expedited, and more resilient long-term solutions are implemented
- Develop a plan for protecting roadways from flooding and utility lines from damage when they are repaired or redesigned
- Share real-time information about travel and evacuation routes
- Secure electric utilities with buried power lines, smart grid technology, or expedited response

Natural and Cultural Resources

Through a combination of City and County owned land, private organizations, and non-profits, a remarkable proportion of Rye is undeveloped. The combined area of the sports fields, natural areas, beaches, clubs, and parks makes up more than 20% of the City's land area. In addition to preserving marshlands, wetlands, and parklands, the City has a strong record of saving and using historic buildings like Square House, Jay Heritage Center, Knapp House, and Rye Meeting House / Bird Homestead, which have not only been preserved, but also continue to serve the community through educational programming.

Several buildings which are seen as major community gathering places are adjacent to Blind Brook and vulnerable to flooding. These include the Rye YMCA, Rye Free Reading Room, and Rye Nature Center. Each of these has served as community meeting places during storm events with limited flooding, but all three remain vulnerable to the Brook's surges and are unable to offer assistance when the Brook overflows. The bridge leading to the Rye Nature Center remains compromised from past flooding and a new entrance has been proposed that would not require a new bridge and would allow the current bridge to be utilized only for pedestrian access. The Nature Center is another centralized asset that could serve the community during storms provided that residents can reach it.

Open spaces have been affected differently by past storms and flooding. The Edith Read Wildlife Sanctuary was badly damaged by Sandy and has limited public accessibility. Rye Town Park suffered minimal damage during Superstorm Sandy in spite of its position on the Sound, though the south end of the beach is marred by a collapsed portion of the road that has not yet been repaired. Privately held clubs were badly damaged by Superstorm Sandy as well, but they have since been rebuilt.

The County-owned Rye Playland has been reconstructed in the aftermath of Superstorm Sandy, though one section of boardwalk along the northern portion of the park remains in disrepair, which limits public access along the waterfront between the Town Park and Edith Read. Plans to sell or lease the amusement park continue to be discussed.

Along Beaver Swamp Brook, the City invested $255,000 in 2001 to acquire a parcel which allowed them to consolidate ownership of the area with the highest flood risk. Despite this successful precedent, acquisition of at-risk properties along Blind Brook is unlikely, as it would be prohibitively expensive. Should funding become available in the future, investing in a wider right of way along the Brook could allow for a broader flood plain, less channelization, and better absorption of storm impacts. A pilot version of this could be tested between Locust Avenue and Elm Place if the parking lot is converted to open space.

Natural and Cultural Resources Needs:

- Open spaces that can help to solve flood problems instead of being heavily damaged by them
- Open space that is protected and publicly accessible
- Protection of cultural assets along Blind Brook

Natural and Cultural Resources Opportunities:

- Look for ways to maximize the permeable surfaces and preserve the natural flow of Blind Brook along its length from Bowman Avenue Dam to Milton Harbor
- Build structured parking, either as an alternative to paving new surfaces for additional parking or to create space for a new park
- Use permeable paving or a catchment system to divert and collect stormwater in parking lots

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Section III
Reconstruction and Resilience Strategies

III: Reconstruction and Resilience Strategies

The Reconstruction and Resilience Strategies described below were developed with the Rye Planning Committee (Committee) and community members to achieve a resilient future within the City of Rye (Community). The strategies address both regional concerns within the watershed and specific at-risk neighborhoods and buildings identified in the Community's asset inventory. Each strategy is meant to address one or more of the Recovery Support Functions.

Flooded bridge over Blind Brook (Sara Goddard)

Several recurring themes emerged as the Committee and community members identified Rye's needs and opportunities. These themes form the basis of the Reconstruction and Resilience Strategies. Riverine flooding, coastal vulnerability, emergency unpreparedness, and lengthy post-storm recovery times, including multi-day/multi-week power outages, were consistently stated as problems. From these issues, the Committee developed four strategies to address the identified needs and opportunities. The strategies prioritize protection of the most at-risk assets and areas deemed of high value to the Community. The strategies are intended to support projects that can be implemented across a wide range of time horizons and can be funded by a variety of sources. Under each strategy, projects considered by the Committee are listed, starting with capital improvement projects and with studies and policies following.

Shenorock Shore Club after Superstorm Sandy (Sara Goddard)

House elevation in progress (Holly Kennedy)

Collaboration Within the Watershed to Address Riverine Flooding at its Source

The City of Rye is located near the bottom of two watersheds. Blind Brook and Beaver Swamp Brook pass through several less-dense communities before weaving through Rye. As development continues to occur upstream, there exists an opportunity to work collaboratively across jurisdictions in order to protect the broader floodplain. In Rye, development has already encroached on the Blind Brook and Beaver Swamp Brook floodplains.

Proactive stormwater management in future development plans upstream can avoid exacerbating the flooding of critical infrastructure and buildings neighboring Blind Brook and Beaver Swamp Brook.

Recognizing that upstream stormwater mitigation strategies can significantly reduce the riverine flood hazard currently faced by the Community, the Committee seeks to collaborate with other communities in the watershed to resolve the problem at its source.

As part of watershed collaboration, the Community can explore a variety of upstream solutions. Rye could support planned or future stormwater detention projects upstream, which would be more effective at mitigating flooding than similar stormwater detention projects near the bottom of the watershed in Rye. Additionally, a collaborative watershed organization could advocate for or implement policies to reduce stormwater runoff from development projects, roadways, and other impervious surfaces. Watershed collaboration could also reduce the water surface elevation enough that local and hyper-local green infrastructure solutions at strategic sites could decrease the flooding impact of small and mid-size storms on Community neighborhoods and individual property owners.

Table III-1 Collaboration Within the Watershed to Address Riverine Flooding at its Source

Project Name	Description	Estimated Cost	Category	Regional
Modifications to the Sluice Gate at Bowman Avenue Dam	Modifications include moving the stream gauges that trigger the sluice gate's automatic functions further downstream and updating the operational rules of the gate.	$150,000 - $250,000	Proposed	Y
Stormwater Pond at Anderson Hill Road (SUNY Purchase)	Two stormwater detention ponds could be created by building earthen berms across the Blind Brook floodplain, with openings at the channel. During heavy rain storms, the berms would constrict the water flow through the channel and would create detention ponds immediately upstream.	$750,000 - $1 million	Proposed	Y
Bowman Avenue Dam Upper Pond Resizing	Expand the storage capacity of the Upper Pond at the Bowman Avenue Dam by excavating 104,000 cubic yards of material, creating a larger retention basin.	$7.5 million - $8.5 million	Proposed	Y
Detention Basins at Westchester County Airport	Expand the capacity of two detention ponds at the Airport to increase their storage capacity, minimizing runoff into Blind Brook.	$500,000	Featured	Y
Bowman Avenue Dam Lower Pond	Resize the lower pond at the Bowman Avenue Dam to increase its flood storage capacity. The project also includes the installation of a spillway as a flood control structure at I-287.	$13 million - $14 million	Featured	Y

Infrastructure Resilience

Increasing infrastructure resilience in the City of Rye could significantly improve conditions for Community residents and business owners during and after storms. To increase infrastructure resilience, Rye could take measures to protect hard infrastructure such as utilities, bridges, roadways, and sewers from flooding and wind damage; strengthen social infrastructure, including emergency response and communications that help the Community withstand and recover from storms; and increase green infrastructure, such as landscape buffers and other natural systems that protect the built environment. Utility interruptions are a source of major stress during storms, so Rye could urge utility companies to protect and/or floodproof utility lines and substations whenever possible. Addressing stormwater and sanitary sewer system inefficiencies and overloads would prevent localized flooding of property and mitigate sewage overflow into the streets, which presents a health hazard in Rye and occurred during recent major rainstorms.

Blind Brook mostly flows through a channel as it passes through Rye.

Pre-storm maintenance and quick emergency and public works responses during and immediately following storms can further reduce the disruption to residents. Currently, Rye clears storm drains in advance of the spring and summer storm seasons. In addition to this preventative measure, Rye's Department of Public Works could establish priority streets and corridors when clearing debris. This would enable emergency responders and residents to know the best routes to take during emergencies. Additionally, residents would be able to return to normal daily activities more quickly following storms, as they will be able to predict which streets have been cleared and are passable for driving.

In addition to strengthening hard infrastructure and expanding social infrastructure, Rye can make its infrastructure more resilient using green infrastructure techniques. The Community has significant and strategically located open space and parkland at the Rye Nature Center, the Rye High School and Middle School campus, Nursery Field, and Edith Read Sanctuary. These and other open spaces can serve as buffers and absorptive surfaces that can become part of a larger network of green infrastructure protecting houses and businesses in both coastal and riverine floodplains. Green infrastructure can also serve as a major public amenity during times of calm, and it regenerates itself following a storm.

Resilient infrastructure has a fairly successful history in Rye. In some instances, pre-identified parking lots on high ground allowed some residents of Milton Harbor House, a flood-prone area, to park their cars in places safe from harm while they evacuated during Superstorm Sandy. Coastal and riverine wetlands, dunes, and berms protected adjacent private property. Expanding on these existing, successful systems could be an effective way of championing resilient infrastructure projects.

Table III-2 Infrastructure Resilience

Project Name	Description	Estimated Cost	Category	Regional
Improved Milton Road Drainage to Harbor	Install expanded drainage on Milton Road north of the Milton Harbor House to divert flood waters to the Harbor.	$250,000	Proposed	N
New Entrance to Rye Nature Center	Create a new entrance to the Nature Center that does not cross Blind Brook. The historic bridge on the current access road could be converted into a pedestrian bridge.	$250,000 - $300,000	Featured	N
Floodproof the Locust Avenue Firehouse	Floodproof the Locust Avenue Firehouse.	$180,000 - $200,000	Featured	N

Design for Sea Level Rise, Coastal Vulnerability, and Tidal Impacts

Many of Rye's coastal residential buildings benefit from the protection of landscape elements such as dunes, berms, and wetlands during storms. Additionally, many houses have been elevated over time. However, as sea levels rise and Category 3, 4, and 5 hurricanes become more frequent, these protections may need to be bolstered to remain effective. Many of the coastal commercial areas and assets suffered damage during the spring storms of 2007, Hurricane Irene, and Superstorm Sandy. Because many of these businesses (beach clubs, marinas, fishing piers, etc.) inherently must be located at the waterfront, the facilities risk damage from sea level rise and tidal impacts.

It is important to the Community to preserve and enhance the coastal assets and amenities that help form Rye's community identity. Currently, Rye's zoning code specifies that structures built in FEMA-identified floodplains be built to specifications that address flooding and storm damage concerns. Many structures that were grandfathered in under these policies continue to suffer damage. Ultimately, coastal property owners will be required to update these structures to adhere to the zoning code during major renovations following storm damage.

Readiness for Future Storms

Resilient communities operate with minimal interruptions during and immediately following major storms. This can be difficult in communities such as Rye that are home to large old trees, aboveground power lines, significant shorelines, brooks, and low elevations. These attributes make Rye susceptible to flooding, power outages, and blocked roads during and after major storms. However, enabling residents to continue living, working, and learning in Rye through these challenges can be accomplished by readiness for future storms.

Recognizing that it will not be possible to anticipate and prevent all flooding and power outages associated with future storms, the Community can combine precautionary measures with City-sponsored storm emergency services in order to continue typical daily operations during outage periods. Good communication with residents and business owners about recommended precautions and imminent threats can limit storm damages. Local storm emergency response services often can attend to local needs faster than regional, statewide, or federal storm emergency response services. Different storm events can cause different types and levels of damage to the same geographic area due to recent weather conditions, changing conditions on the ground, and other factors. Though identified risk areas can indicate where improvements are needed, it is possible that residents outside of these areas will need assistance after a storm causes unpredictable damage. A designated centralized local emergency response center can respond to the needs of residents who are affected after any storm.

Table III-3 Readiness for Future Storms

Project Name	Description	Estimated Cost	Category	Regional
Designate Rye Golf Club as a City-Operated Emergency Center	Designate a City-operated emergency center at Rye Golf Club to provide residents a place to regroup during or after storm events which result in the loss of power, flooding, and/or utility interruptions.	$250,000 - $500,000	Featured	N
Floodproof Critical Non-profit Facilities	Floodproof non-profit facilities in the Central Business District that have suffered repeated damage during storms.	$500,000	Featured	N

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Section IV
Implementation - Project Profiles

IV. Implementation - Project Profiles

The State has allotted up to $3 million in federal Community Development Block Grant–Disaster Recovery (CDBG-DR) funding to implement eligible projects proposed by the Rye NYRCR Planning Committee (Committee). The Rye Committee developed a list of projects, programs, and actions that intend to increase the resilience of the Community's assets guided by the framework provided by the reconstruction and resilience strategies. The Committee considered cost estimates, a risk reduction analysis, feasibility, and community support for the projects and actions proposed within the NYRCR Plan.

In the NYRCR Plan, projects and actions are listed by category and then by strategy. This order does not indicate the Community's prioritization of these projects and actions. **Proposed Projects** are those which could be funded in whole or in part by the Community's allotment of CDBG-DR funding. **Featured Projects** are projects and actions that the Committee has identified as important resiliency recommendations and has examined in-depth, but has not proposed for funding through the NYRCR Program. **Additional Resiliency Recommendations**, listed in Section V, are projects and actions that the Committee would like to highlight but are not categorized as Proposed Projects or Featured Projects. Implementation of the projects and actions found in the NYRCR Plan are subject to applicable Federal, State, and local laws and regulations, including the Americans with Disabilities Act (ADA). Inclusion of a project or action in the NYRCR Plan does not guarantee that a particular project or action will be funded or implemented.

Upstream Flood Mitigation Efforts

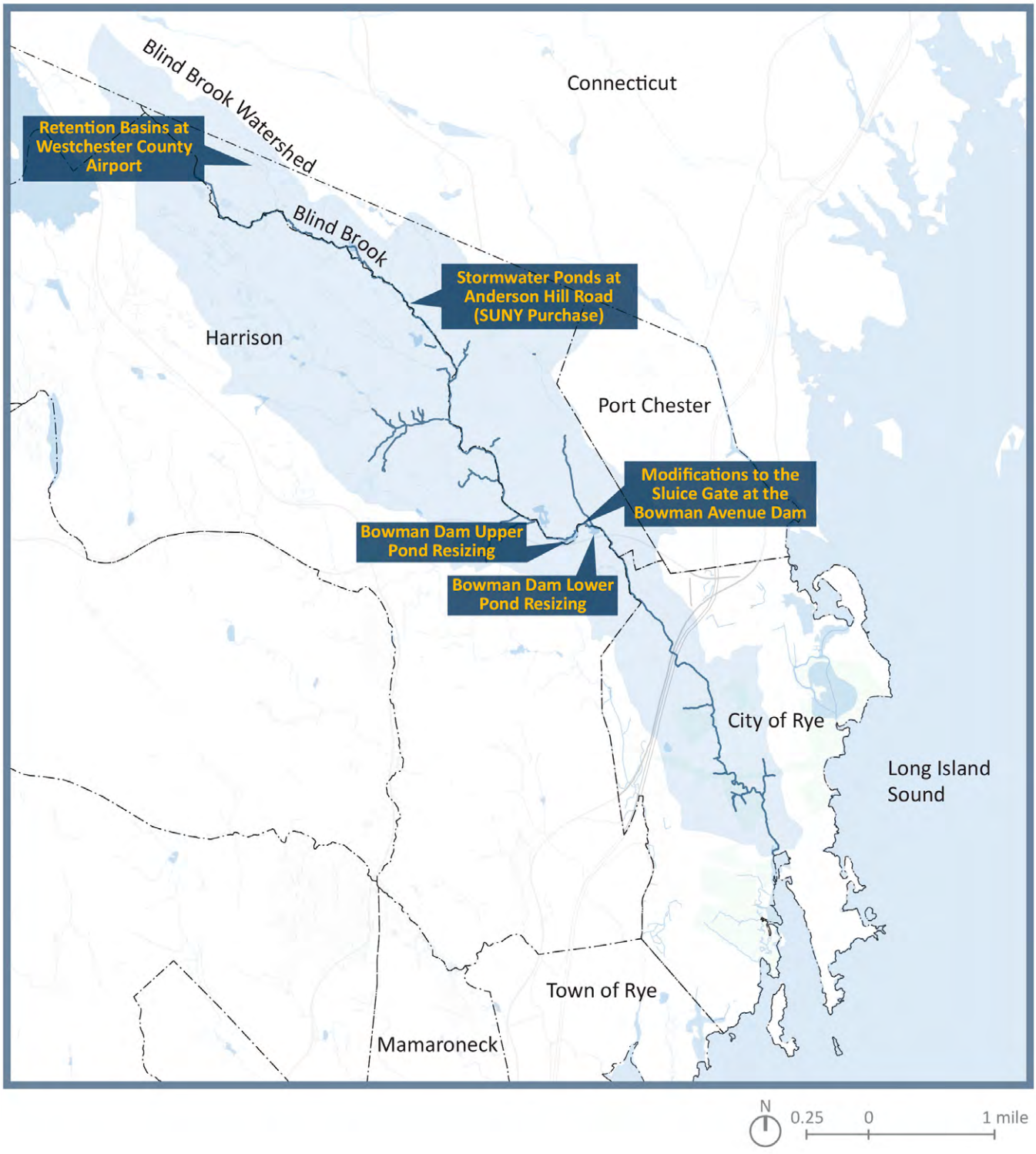
Between 1978 and 2008, Rye had 273 repetitive loss claims, which are the second, third, or more insurance claims for the same property. These repetitive loss claims total $4.5 million, with the average claim exceeding $16,000.[27] A major cause of damage is the flooding of Blind Brook during storm events. In 2007, two spring nor'easters caused more than $85 million in damages in Rye, including over $83 million in damages to private property and over $2 million in damages to public property.[28] During Hurricane Irene, businesses and residents reported three and a half feet of inundation on their first floors due to flooding from Blind Brook. Flooding was the worst upstream of road culverts, such as in the Indian Village neighborhood in Rye, located between I-287 and I-95. Roughly one-third of the repetitive loss claims occurred within Indian Village.[29]

Though Rye is located at the bottom of the Blind Brook watershed, there exist opportunities to mitigate flooding by implementing interventions upstream. Five projects within this plan come from the *Hydrologic and Hydraulic Analysis Report* completed in August 2014: Modifications to the Sluice Gate at the Bowman Avenue Dam; Bowman Avenue Dam Upper Pond Resizing; Stormwater Ponds at Anderson Hill Road; Detention Basins at Westchester County Airport; and Bowman Avenue Dam Lower Pond Resizing. These projects are upstream mitigation projects that seek to provide Rye residents relief from flooding from Blind Brook by reducing the amount of flood water that moves downstream through the Brook and enters the City.

The report includes a risk reduction evaluation for each individual project, and considered the cumulative flood mitigation benefits of certain pairs of projects. Where the cumulative benefits of implementing specific projects in tandem exceed the sum of the flood reduction benefits of the individual projects, the proposed combination of projects is noted in each project's description on the following pages.

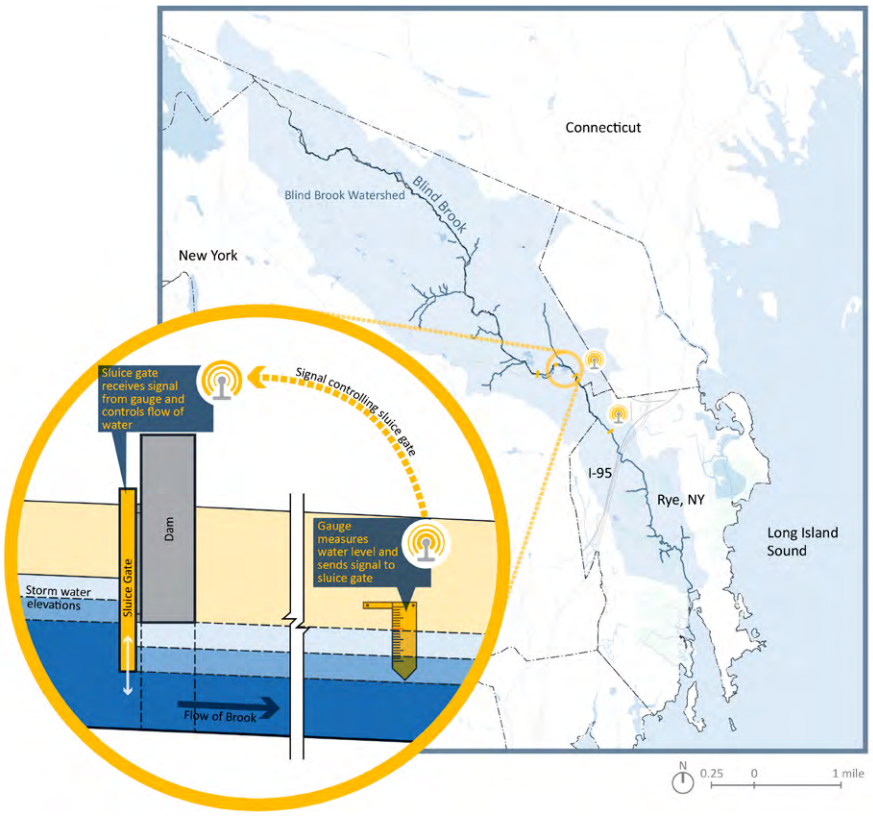
The upstream mitigation projects are located on the map on the next page.

Upstream Projects Suggested to Mitigate Flooding in the City of Rye



Proposed Project

Modifications to the Sluice Gate at the Bowman Avenue Dam



Project Description

In order to reduce the frequency and severity of flooding in Rye, the City installed a sluice gate on the Bowman Avenue Dam on Blind Brook in 2013. The sluice gate is a sliding barrier that controls the amount of water that can pass under the dam at any given time. Offsite gauges measure the Brook's flow rate and water surface elevation (WSE) and send this information to the gate. The gate's operational instructions interpret these readings and regulate the gate's movement so that it can provide maximum protection during every storm.[30]

The automated operational rules of the gate do not currently include stream flow data from Hurricane Irene and Tropical Storm Lee, so it operates inefficiently. Additionally, it was determined that moving the stream gauges further downstream would reduce the maximum WSE at downstream locations.[31]

This project proposes to re-locate the stream gauges to areas downstream that will provide better WSE readings, and to re-program the sluice gate with updated operational rules taking into account the new flow data. Of all of the projects in the *Hydrologic and Hydraulic Analysis Report* that were considered to reduce downstream water surface elevations, the sluice gate is the most cost effective.[32] The greatest WSE reductions would be obtained after implementing these modifications paired with expansion of the Bowman Avenue Dam Upper Pond and the creation of stormwater ponds at SUNY Purchase.[33] The required engineering studies for the sluice gate modifications are underway, but implementation has not yet been funded.

Cost Estimate

The project cost is estimated to be between $150,000 and $250,000.

This cost includes the installation of two or three new stream gauges downstream of the dam, at a cost of approximately $30,000-$50,000 each, depending on telemetry and other functions that might be included. Additionally, the design and implementation of the new sluice gate operating routine is estimated to cost approximately $100,000.

Benefits

Economic Benefits

The project has the potential to reduce public and private expenditures during and after emergencies by reducing the extent of damages sustained as a result of flooding. Though this project would not eliminate exposure to flooding for all assets in a 100-year storm, it would result in a reduced depth of flooding for many assets in Rye, which could in turn result in less flood damage and a faster recovery and restoration of businesses and services. The project would increase the present service capacity of the existing sluice gate, making it more effective at mitigating flood risk. Based on the cost estimate above, the project is estimated to create approximately three full-time equivalent jobs for a period of six months.[34]

Environmental Benefits

The environmental benefits of modifying the sluice gate depend on the reductions in water surface elevation and any reduction in the flow rate of the stream associated with the updated operational rules. A reduction in water surface elevations during storms would result in less flooding outside the stream bank, which would reduce the risk of floodwater becoming contaminated by hazardous materials before making its way further down the watershed and draining into Milton Harbor. In places where the stream bank is not channelized, a reduction in flow rate would reduce stream bank erosion. This could improve the quality and stability of the plant life on the stream banks. Managing peak hydrograph flows to return to more natural conditions helps to preserve channel geometry and associated aquatic habitats.

Cost Benefit Analysis

With an anticipated total cost of approximately $150,000 to $250,000, this project offers risk reduction potential by reducing the depth of flooding for assets along Blind Brook, which also results in economic and environmental benefits to assets between I-287 and I-95, including Indian Village. There may additionally be benefits to assets downstream of I-95, but these effects have not been modeled and are thus uncertain. Pairing the sluice gate modifications with other projects may realize additional benefits and further reduce the risk of flood damage to public and private assets. Leveraging improvements to an existing facility allows more cost-effective and sustainable improvement.

Anticipated Risk Reduction

The WSE reductions projected by existing reports for the 100-year flood, which range from 0.18 to 0.78 feet, are not sufficient to eliminate the exposure to flooding for identified assets, because the existing 100-year WSE is four to six feet above existing ground elevation. There may be some reduction in the vulnerability of assets based on the decreased

depth of flooding. It is important to note that predicted flood elevation reductions are greater for the 50-year storm than the 100-year storm, with reductions ranging from 0.47 to 1.56 feet.[35] Though these flood reductions do not eliminate flood risk, they may contribute to a partial mitigation of risk.

Based on these predicted flood depth reductions, it is clear that this project has the potential to reduce risk to the identified assets located between I-287 and I-95 and potentially to assets further downstream as well. An evaluation of the project effects using the risk assessment tool indicates that the project would move the Medical Offices off Purchase Street from the high risk category to the moderate risk category, thereby securing an asset that serves an important community function.

The sluice gate at the Bowman Avenue Dam

Implementation Timeline:

6- 12 months

Regulatory Requirements

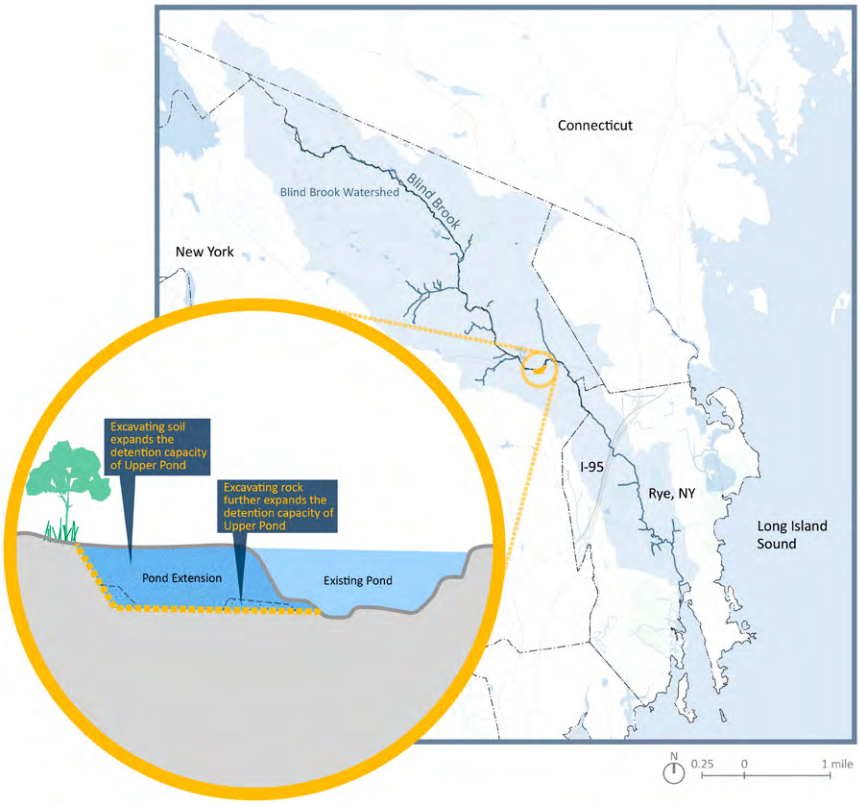
Regulatory requirements may involve New York State Department of Environmental Conservation (NYS DEC) and the U.S. Army Corps of Engineers (USACE). The United States Geologic Survey (USGS) manages stream gauges throughout the country and maintains specific regulatory requirements.

Jurisdiction

City of Rye and Village of Rye Brook

Proposed Project

Bowman Avenue Dam Upper Pond Resizing



Project Description

Because of the extensive flood damage in Indian Village during Hurricane Irene and the spring storms of 2007, the Committee supports resizing the Upper Pond at the Bowman Avenue Dam. The Bowman Avenue Dam Upper Pond is located in Rye Brook, a neighboring community upstream of Rye, though it is located on property owned by the City of Rye. Constructed in the 1900s and rebuilt in 1941, the Upper Pond was originally used for ice production but is now used for water retention to decrease the frequency and intensity of flooding along Blind Brook downstream. Over time, the volume of the Upper Pond behind the dam has significantly decreased due to siltation and collection of debris, with estimates that it is currently one-quarter of its original size.[36]

This project proposes to expand the storage capacity of the Upper Pond at the Bowman Avenue Dam by excavating 97,861 cubic yards of soil and 6,246 cubic yards of rock, creating a larger retention basin.[37] It would be possible to complete this project in two phases, first removing the soil and any debris, and then in a second phase, removing the rock if necessary. Debris removal, as part of this project, would also increase the functionality of the sluice gate at the Bowman Avenue Dam, as large debris such as downed trees can become caught in the gate and cause it to cease operations or even cause it damage.

Cost Estimate

Total project cost is estimated to be between $7.5 million and $8.5 million.

This includes construction costs, estimated to be $6,560,000,[38] and the necessary design and permitting fees. It is important to note that the expansion of the pond is expected to require extensive rock excavation, which significantly increases the cost above the USEPA budgetary estimate of $45,000 per acre-foot and also necessitates geotechnical investigation and specialized design. Project does not require land acquisition, as it is within the existing pond footprint, which is located on land owned by the City of Rye.

Significant permitting costs may be required due to the disturbance of existing wetland areas.

Benefits

Economic Benefits

The project has the potential for reducing public and private expenditures by reducing the extent of damages sustained as a result of flooding. Though this project would not eliminate exposure to flooding, it would result in a reduced depth of flooding for many assets in Rye, which could in turn result in less flood damage and a faster recovery and restoration of businesses and services. Based on the cost estimate above, the project is estimated to create approximately 35 full-time equivalent jobs for a period of one year. [39]

Environmental Benefits

The proposed expansion of the Bowman Avenue Dam Upper Pond could help reduce the frequency and severity of flooding downstream of the Bowman Avenue Dam. This would reduce the risk that floodwaters would become contaminated by hazardous materials before flowing through the rest of the watershed and draining into Milton Harbor. Managing peak hydrograph flows to return to more natural conditions helps to preserve channel geometry and associated aquatic habitats. However, some of the silted area has given rise to wetlands and therefore excavation of this area would necessitate removing habitats and disturbing plant life.

Cost Benefit Analysis

This project has anticipated total costs of $7.5 million to $8.5 million and has risk mitigation potential through the reduction of flood depth for assets along Blind Brook. Reducing the depth of flooding can also lead to economic and environmental benefits for assets in the study area, between I-287 and I-95, including Indian Village. There may be additional benefits to assets downstream of I-95, but these effects have not been modeled and are thus uncertain. Pairing this project with other flood reduction measures could potentially enhance the risk reduction and co-benefits for nearby assets.

Anticipated Risk Reduction

The WSE reductions projected by existing studies for the 100-year flood, which range from 0.18 to 0.78 feet, are not sufficient to eliminate the exposure to flooding of these assets, as the assets are between four and six feet below the existing 100-year flood elevation. There may be some reduction in the vulnerability of assets based on the decreased depth of flooding. It is important to note that predicted WSE reductions are significantly greater for the 50-year storm, with reductions ranging from 0.33 to 1.30 feet.[40] Though these reductions do not eliminate risk, they do mitigate it to a limited extent.

Based on these predicted flood depth reductions, it is evident that this project has the potential to reduce risk to the identified assets located between I-287 and I-95 and potentially to assets further downstream as well. An evaluation of the project effects using the risk assessment tool indicates that the project would move the Medical Offices off Purchase Street from the high risk category to the moderate risk category, thereby securing an asset that serves an important community function.

Implementation Timeline:

Two years

Regulatory Requirements:

Regulatory requirements may involve New York State Department of Environmental Conservation (NYS DEC) and the U.S. Army Corps of Engineers (USACE).

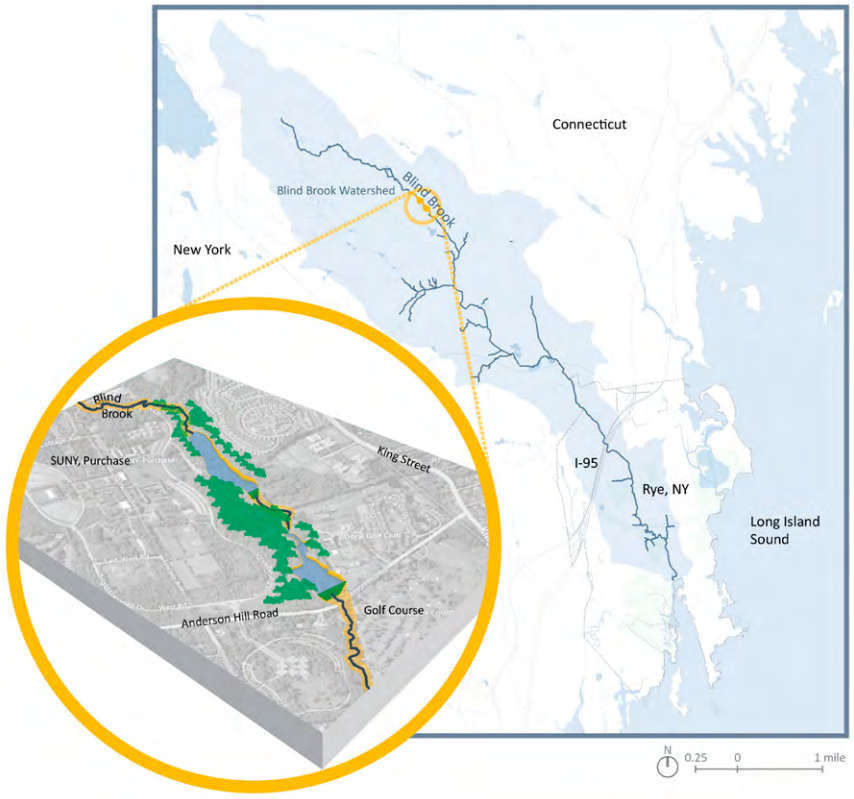
One consideration is that the area surrounding the current footprint of the Pond is a wetland. Due to the protected status of wetland areas there may be limits to excavation for flood-retention purposes on this site.

Jurisdiction:

Village of Rye Brook and City of Rye

Proposed Project

Stormwater Ponds at Anderson Hill Road (SUNY Purchase)



Project Description

The SUNY Purchase campus is an excellent opportunity for upstream intervention. There is significant undeveloped land in the vicinity of Blind Brook that could potentially detain significant volumes of water. This would lessen the volume and decrease the velocity of water that continues through the Blind Brook channel during storm events.

Blind Brook runs along the east side of SUNY Purchase. In order to mitigate flooding downstream from SUNY Purchase, two stormwater ponds could be created by building two low stabilized earthen berms across the Blind Brook floodplain, with openings in the berms at the stream channel. The berms would constrict the water flow through the channel so that during storm events the berms would create spillways or detention ponds immediately upstream. A third berm would be constructed in the spillway to prevent the inundation of a support facility on the SUNY Purchase side of the Brook.[41]

During non-storm events, the detention ponds or spillways would contain only a small amount of water, if any. During and immediately following storm events, the spillways and ponds fill with water and then slowly release it. The first pond at SUNY Purchase would be upstream of the second. The first pond would have an estimated maximum inundation area of 15.5 acres, and would reach a depth of 8 feet. This pond would contain approximately 53 acre-feet of water. The second pond would have an estimated maximum inundation area of 15 acres, and would reach a depth of 13 feet. When full, this pond would contain approximately 66 acre-feet of water.[42] Exact inundation areas and

storage volumes would be determined following a site survey.

Cost Estimate

Project costs are estimated to be between $750,000 and $1 million. This includes estimated construction costs of $511,000,[43] design and permitting fees, and other project soft costs.

This does not include land acquisition costs, as the proposed location is on SUNY Purchase property and a land use agreement has not been determined. The arrangement for land use and the potential cost is a source of significant uncertainty in the estimated cost of the project.

Foreseeable external costs associated with this project are potential disruptions caused on the SUNY Purchase campus during the construction period and the potential for alternate land use in the future, though the current SUNY Purchase Master Plan does not include any designated use for this area.

Benefits

Economic Benefits

The project has the potential for reducing public and private expenditures during and after emergencies by reducing the extent of damages sustained as a result of flooding. Though this project would not eliminate exposure to flooding, it would result in a reduced depth of flooding for many assets in Rye, which could in turn result in less flood damage and a faster recovery and restoration of businesses and services for downstream assets. Based on the cost estimate above, the project is estimated to create approximately 13 full-time equivalent jobs for a period of six months.[44]

Environmental Benefits

The proposed conceptual design for the stormwater ponds on the SUNY Purchase campus is estimated to reduce water surface elevations at downstream locations. This would reduce the frequency and severity of flooding outside of the stream channel, minimizing the risk that the water becomes contaminated by hazardous material before continuing through the watershed and draining into Milton Harbor. The project could also reduce the velocity of water in Blind Brook and thereby reduce scouring effects in downstream locations. Managing peak hydrograph flows to return to more natural conditions helps to preserve channel geometry and associated aquatic habitats. However, this project does essentially create a dam across Blind Brook, and would disrupt not only the natural course of the water, but would disrupt plant life and animal habitats in the area behind the proposed berms.

Cost Benefit Analysis

With an anticipated total cost of approximately $750,000 to $1 million, this project has risk reduction potential through reducing the depth of flooding for assets along Blind Brook, which also provides economic and environmental benefits to assets between I-287 and I-95, including Indian Village. There may additionally be flood reduction benefits to assets downstream of I-95, but these effects have not been modeled and are thus uncertain. There are also some environmental effects associated with altering the natural flow of the stream. There is uncertainty in the projected cost due to the unknown cost of using land not under public ownership. Pairing this project with other flood reduction

measures could potentially result in further risk reduction and co-benefits for nearby assets.

Anticipated Risk Reduction

The WSE reductions projected by existing studies for the 100-year flood, which range from 0.36 to 1.31 feet, are not sufficient to eliminate the exposure to flooding for these assets. The existing 100-year flood elevation is between four and six feet above ground elevation. There may be some reduction in the vulnerability of assets based on the decreased depth of flooding. It is important to note that predicted WSE reductions are greater for the 10- and 50-year storms, with reductions ranging from 0.91 to 1.7 feet for the 10-year recurrence interval and 0.52 to 1.51 feet for the 50-year storm.[45]

Based on these predicted WSE reductions, it is clear that this project has the potential to reduce risk to the identified assets located between I-287 and I-95 and potentially to assets further downstream as well. An evaluation of the project effects using the risk assessment tool indicates that the project would move the Medical Offices off Purchase Street from the high risk category to the moderate risk category, thereby securing an asset that serves an important community function.

Implementation Timeline:

Two years

Regulatory Requirements:

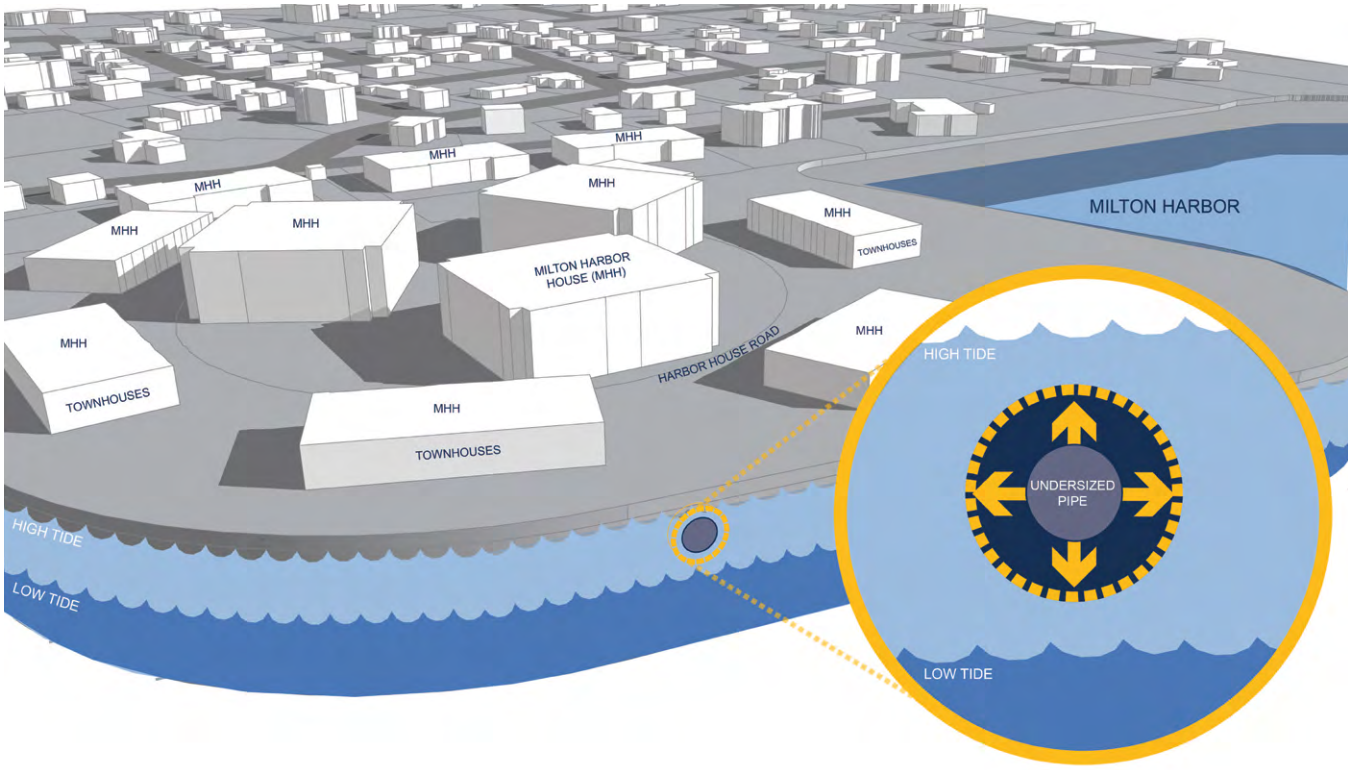
Regulatory requirements may involve New York State Department of Environmental Conservation (NYS DEC) and the U.S. Army Corps of Engineers (USACE).

Jurisdiction:

Town of Harrison and SUNY Purchase

Proposed Project

Improved Milton Road Drainage to Harbor



Project Description

During major storm events, Milton Road often floods, in part due to the limited capacity of the stormwater sewer system in that area. This affects residential, municipal, and commercial properties in the area, including the Milton Point Firehouse and Milton Harbor House, a residential community with 88 units that is home to many senior citizens. When Milton Road floods, the Milton Point Firehouse is inaccessible, which limits emergency response during storm events. During Superstorm Sandy, floodwaters forced the fire department personnel to evacuate the Milton Point Firehouse, though flood doors minimized the damage. Superstorm Sandy inundated Milton Harbor House with a reported three and a half feet of water. The flooding caused significant damage to the electrical and heating systems of Milton Harbor House, and as a result, the complex had no heat or electricity for approximately two weeks following Superstorm Sandy. Some townhouses within the complex did not have gas or heating service restored for seven weeks. Overall, the Milton Harbor House co-op representatives reported that the complex suffered $1.6 million in damages due to Superstorm Sandy. The area also suffers from sewer overflows during rain events.

Some of the drainage issues stem from an undersized city pipe on Milton Harbor House property. Stormwater flows from Milton Road through the undersized pipe to drain into the harbor. The stormwater backs up in the undersized pipe and floods the surrounding areas. At high tide, Milton Road and Milton Harbor House are particularly susceptible to additional flooding. The sewer outfall in Milton Harbor for the undersized pipe is located

below the high tide line. During high tide, the water cannot exit the pipe.

In an effort to alleviate some of the flooding in this area, drainage improvements on Milton Road on the south side of Milton Harbor House were completed in 2013. This has reduced flooding at Milton Harbor House and on Milton Road.

This project would include a review of the hydrology of the area and the hydraulics of the existing drainage system to identify and then correct weaknesses. This would likely include installing larger sewer pipes (including the drainage passing through Milton Harbor House property) and installing a better tide gate on Milton Road north of the Milton Harbor House. This would alleviate flooding of the Milton Harbor House buildings and parking lot and improve the firehouse's ability to respond during emergencies.

Cost Estimate

The total cost of this project is estimated to be $250,000.

This cost includes including design, construction, and permitting costs. This estimate is based on the similar project that was recently implemented on the south side of the Milton Harbor House, which had a total cost of approximately $250,000.

The only foreseeable external cost would be disruption of access to homes and businesses in the area during the construction period, which may be a moderate cost that would be borne by local business owners.

Benefits

Economic Benefits

The project would increase the present service capacity of the stormwater drainage system. The project has the potential for reducing public and private expenditures during emergencies and reducing business expenses or losses associated with a flood event by reducing the extent of damage sustained by those facilities. The project offers an additional economic benefit by enabling local businesses to return to service more quickly after storm events. Based on the cost estimate above, the project is estimated to create approximately two full-time equivalent jobs for a period of six months.[46]

Environmental Benefits

This project would reduce the stormwater sewer and drain backup during storm events that occur during high tides. This would reduce the number of instances when stormwater overflows into the road and onto adjacent properties, collecting urban debris or becoming contaminated with lawn treatment chemicals or fertilizers before draining into the harbor.

Health and Safety Benefits

This project would decrease the incidence of stormwater flooding on Milton Road, which would mitigate a potentially hazardous driving condition and ensure the area is accessible to emergency service providers. The project would also reduce the backup of storm and sanitary sewer systems, which can result in conditions hazardous to public health.

Cost Benefit Analysis

The approximate costs of this project are $250,000; the project would result in additional decreases in disaster recovery costs for local homeowners and business owners. The project is anticipated to have risk reduction and economic benefits for surrounding assets and environmental benefits for the harbor ecosystem. There is little uncertainty associated with this project, as a similar project was recently implemented and was successful in reducing local stormwater flooding.

Anticipated Risk Reduction

This project would significantly mitigate flood risk in the vicinity of Milton Road by alleviating the additional risk of flooding due to stormwater runoff and discharge. This reduces the exposure to flood risk for several assets in the area, and would reduce the risk scores in the risk assessment tool for the Milton Point Firehouse, Row America Rye, the Rye Marina, the Rye Fish and Game Club, and the Rye Meeting House/Bird Homestead from the high risk category to the moderate risk category.

Milton Harbor House is located on Milton Point, a peninsula that juts out into Milton Harbor.

Implementation Timeline:

12- 24 months

Regulatory Requirements:

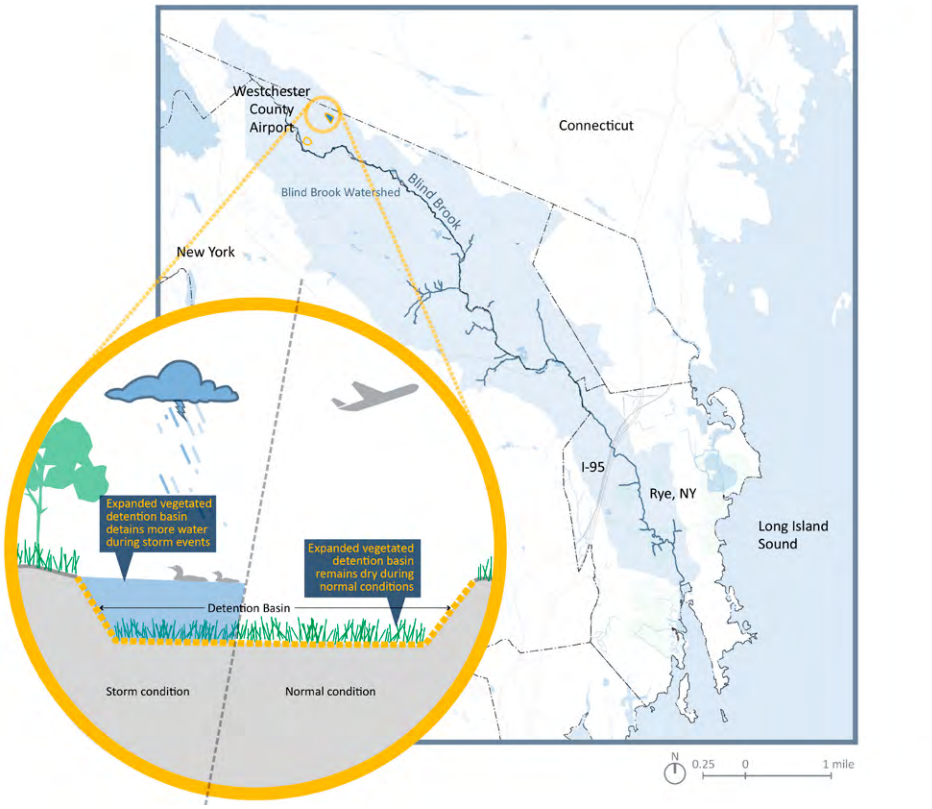
Regulatory requirements may involve NYS Department of Environmental Conservation (NYS DEC), NYS Department of Transportation (NYS DOT), and the U.S. Army Corps of Engineers (USACE).

Jurisdiction:

City of Rye

Featured Project

Detention Basins at Westchester County Airport



Project Description

Westchester Airport has a large parcel of land that could provide space for upstream flood mitigation projects. Upstream protection and detention would help reduce flooding in the City of Rye, and other communities between the Airport and the City.

The Blind Brook headwaters are near Westchester Airport. Two detention ponds currently exist on the Airport site. These ponds mitigate runoff from the impervious surfaces on the property and provide water quality treatment before the remaining runoff is diverted to Blind Brook, and until recently, the Rye Lake drainage area.

The Rye Lake drainage area is home to the Kensico Reservoir, which supplies drinking water to Westchester County and New York City. Per an agreement with the New York City Department of Environmental Protection, water will no longer be diverted from the Airport site to the Rye Lake drainage area.[47]

The Airport has planned to expand the capacity of the existing detention ponds so that they can accommodate additional runoff from planned capital improvement projects at the Airport, as well as the additional runoff to the Blind Brook Watershed as stormwater is directed away from the Kensico Reservoir. Increasing the stormwater detention capacity on this site could decrease the volume of water entering Blind Brook and decrease the frequency and severity of flooding in downstream communities, including the City of Rye.

Cost Estimate

Total project construction cost is estimated to be $500,000.

Construction, design, and permitting of expansion of two detention basins at the Airport are expected to be $383,000 and $117,000; or $500,000 total. Costs are approximated as per USEPA guidance, which indicates that construction, design, and permitting of detention basins costs approximately $45,000 per acre-foot; and the volumes of storage to be expanded in each pond are 8.5 acre-feet and 2.6 acre-feet. Significant costs are not anticipated for the outfall structure or piping as the project is solely the expansion of existing ponds.

External costs associated with this project include potential disruptions caused at the Airport during the construction period and the potential for alternate land use in the future, though the proposed location is an open space and these effects would likely be limited.

Benefits

Economic Benefits

The project has the potential for reducing public and private expenditures during and after emergencies by reducing the extent of damages sustained as a result of flooding. Though this project would not eliminate exposure to flooding, it would result in a reduced depth of flooding for many assets in Rye, which could in turn result in less flood damage and a faster recovery and restoration of businesses and services. Additionally, as this project targets flood management at one of the most upstream points in the Blind Brook watershed, there could be similar economic benefits throughout Rye Brook, upstream of the City of Rye. Based on the cost estimate above, the project is estimated to create approximately three full-time equivalent jobs for a period of six months.[48]

Environmental Benefits

The proposed expansion of existing detention basins on the Airport site would store the projected increased volume of runoff from the Airport site, a result of capital improvement projects and the redirection of water away from the Rye Lake drainage basin. This could reduce the severity and/or frequency of flooding downstream, which would reduce the risk that floodwater becomes contaminated with hazardous material before continuing through the watershed and draining into Milton Harbor. Additionally, these detention basins could provide some additional water quality treatments from the deicing chemicals, fuel spills, and oil that are the natural byproducts of airport sites.

Health and Safety Benefits

This project could potentially attract waterfowl to areas in proximity of planes with jet engines. This presents a concern for passenger and crew safety. If waterfowl become trapped in a plane's engines, they can damage the engines or cause them to shut off entirely during flight. This puts passengers, crew, and people and property on the ground at risk for a crash.

Cost Benefit Analysis

The anticipated cost of this project is approximately $500,000 and it offers risk reduction potential through the limited reduction in flood depth that it is predicted for assets along Blind Brook. These flood depth reductions also provide economic and environmental benefits to assets between I-287 and

I-95. There may be additional benefit to assets downstream of I-95, but these effects have not been modeled and are thus uncertain. Pairing this project with other flood reduction measures could potentially result in enhanced risk reduction and co-benefits for nearby assets.

Anticipated Risk Reduction

The WSE reductions projected in existing studies for the 100-year flood, which range from 0.18 to 0.78 feet, are not sufficient to eliminate the exposure to flooding of these assets because the ground elevation of the assets is between four and six feet below the existing 100-year flood elevation. There may be some reduction in the vulnerability of assets based on the decreased depth of flooding. WSE reductions predicted for the 2-, 10-, and 50-year storms are also limited, with a greatest predicted WSE reduction of 0.26 feet, which corresponds to the 10-year storm.[49]

Based on these predicted WSE reductions, it is clear that this project has the potential to reduce risk to the identified assets located between I-287 and I-95 and potentially to assets further downstream as well. An evaluation of the project effects using the risk assessment tool indicates that the project would move the Medical Offices off Purchase Street from the high risk category to the moderate risk category, thereby securing an asset that serves an important community function.

Implementation Timeline:

Two years

Regulatory Requirements:

Regulatory requirements may involve New York State Department of Transportation (NYS DOT), the Federal Aviation Administration (FAA), New York State Department of Environmental Conservation (NYS DEC), and the U.S. Army Corps of Engineers (USACE).

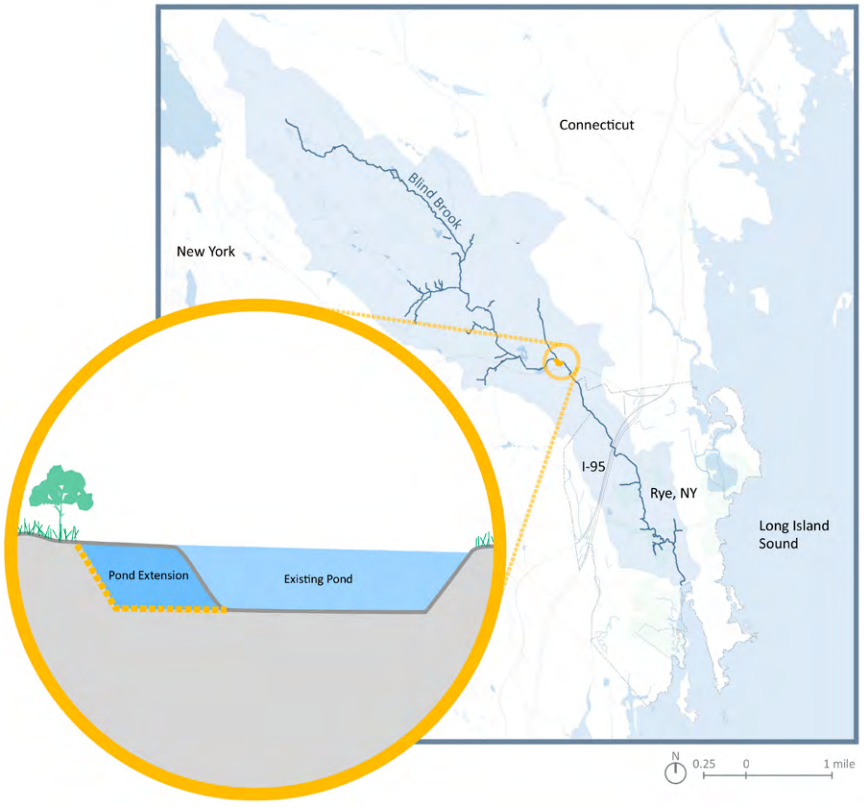
It should be noted that the FAA has clearly identified concern with creating new waterfowl habitat in the vicinity of runways, so implementation potential for this project will be affected by FAA review and decision-making.

Jurisdiction:

City of White Plains and Westchester County.

Featured Project

Bowman Avenue Dam Lower Pond Resizing



Project Description

Detaining stormwater from Blind Brook upstream would mitigate the flooding and subsequent damage that the City of Rye and Indian Village have sustained during the spring 2007 storms, Hurricane Irene, and Superstorm Sandy.

One possibility for upstream intervention is to increase the storage volume at the Bowman Avenue Dam Lower Pond.[50] The Lower Pond was originally a quarry. After it was abandoned in 1976, the quarry was flooded to form the pond which sits on property owned by the City of Rye. The maximum depth of the pond is 30 feet. Flood mitigation benefits are currently minimal, and modifications are required to increase the Lower Pond's flood mitigation benefits.[51]

This project would increase the storage volume of the Bowman Avenue Dam Lower Pond by excavating 35,000 cubic yards of material. An additional spillway, diversion channel, and outlet structure connecting to the Lower Pond would also be built near Interstate 287. This project would be most effective when implemented in conjunction with modifications to the sluice gate at the Bowman Avenue Dam.

Cost Estimate

Total project cost is estimated to be between $13 million and $14 million.

Project cost includes construction cost of $11,880,000[52] and $1.1 million to $2.1 million in design and permitting costs. Project construction costs include the construction of the spillway, estimated to be $5.3 million, construction of the diversion channel, estimated to be $4.8 million, construction of the outlet structure, estimated to be $1.8 million, and excavation costs of the existing pond. This project does not require land acquisition, as it is within the existing pond footprint, which is located on land owned by the City of Rye.

Backwater conditions at the dam could be exacerbated by this project and worsen flooding at private properties located immediately adjacent to the project location, which would be a significant cost to those homeowners. An additional external cost would be a potential disruption of traffic caused during construction of the spillway.

Benefits

Economic Benefits

The project has the potential for reducing public and private expenditures at downstream assets during and after emergencies by reducing the extent of damages due to flooding and by virtually eliminating flooding during the 10 year storm. Though this project would not eliminate exposure to flooding for every storm event, it would result in a reduced depth of flooding for many assets in Rye, which could in turn result in less flood damage and a faster recovery and restoration of businesses and services. Based on the cost estimate above, the project is estimated to create approximately 57 full-time equivalent jobs for a period of one year.[53]

The *Hydrologic and Hydraulic Analysis Report* indicates that a backwater conditions at the pond resulting from the project, as well as the construction of the proposed spillway, would likely exacerbate flooding at properties in the immediate vicinity of the project. This is a considerable economic cost associated with this project that would be borne by local homeowners.

Environmental Benefits

The Bowman Avenue Dam Lower Pond expansion could help reduce the instances or severity of flooding downstream of the Dam. This would reduce the risk that floodwaters become contaminated with hazardous material before flowing through the rest of the watershed and draining into Milton Harbor. However, expanding the size of the Lower Pond could result in a backwater condition that increases the incidence of flooding upstream of the Dam, which would increase the risk of floodwater contamination, increase stream bank erosion, destroy plant and animal habitats, and cause damage to private property.

Cost Benefit Analysis

The total implementation costs of this project are estimated to be between $13 million and $14 million, though there may be considerable external costs associated with expanded flooding in the neighborhood immediately adjacent to the project location, which is predicted by existing engineering reports. These costs may be offset by the risk reduction and economic and environmental benefits associated with reducing the depth of flooding for assets between I-287 and I-95. The project would significantly reduce flooding for those assets for the 10-year storm, with more moderate benefit for less

frequent storm intervals. Effects on assets outside of the I-287 to I-95 reach of Blind Brook have not been modeled and are thus a source of uncertainty. Pairing this project with other flood reduction measures could potentially enhance the risk reduction and co-benefits for downstream assets.

Anticipated Risk Reduction

The flood elevation reductions projected for the 100-year flood, which range from 0.18 to 0.78 feet, are not sufficient to eliminate the exposure to flooding of these assets, as the asset ground elevations are between 4 and 6 feet below the existing 100-year flood elevation. There may be some reduction in the vulnerability of assets based on the decreased depth of flooding. It is important to note that predicted flood depth reductions are significantly larger for 10- and 50-year storms. Projected flood depth reductions for the 10-year storm range from 2.63 to 3.84 feet, and for the 50-year storm range from 1.87 to 3.71 feet.[54] For the 10-year storm, this would virtually eliminate exposure to flooding for assets between I-287 and I-95. The *Hydrologic and Hydraulic Analysis Report* also indicates that backwater effects from implementation of this project would worsen the flooding for assets adjacent to the project area, which would represent an increase in risk for those assets.

Based on these predicted flood depth reductions, it is evident that this project has the potential to reduce risk to the identified assets located between I-287 and I-95 and potentially to assets further downstream as well. An evaluation of the project effects using the risk assessment tool indicates that the project would move the Medical Offices off Purchase Street from the high risk category to the moderate risk category, thereby securing an asset that serves an important community function.

Implementation Timeline:

Two years

Regulatory Requirements:

Regulatory requirements may involve New York State Department of Environmental Conservation (NYS DEC) and the U.S. Army Corps of Engineers (USACE).

Jurisdiction:

Village of Rye Brook and City of Rye

Featured Project

New Entrance to the Rye Nature Center

Project Description

The existing entrance to the Rye Nature Center currently relies on a historic bridge that traverses Blind Brook. Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy contributed to the repeated scouring of the banks and erosion of the channel. During Hurricane Irene, the bridge had to be closed due to severe flooding. Since Superstorm Sandy, the bridge has remained closed to automobile traffic because it became compromised due to the scouring. In response to the storms, the Rye Nature Center has started stream bank rehabilitation along Blind Brook to stabilize the banks. However, returning the bridge to full service for automobiles would cost an estimated $1.1 million.[55]

In lieu of restoring the historic bridge to return it to service for automobiles, a new roadway entrance to the Nature Center that does not cross Blind Brook has been proposed as part of a larger traffic-calming project on nearby Boston Post Road. The current historic bridge could be converted into a pedestrian bridge, and plants and trees could be planted along the roadway and around the Brook to help stabilize the banks. The new entrance road would not become destabilized during a storm event, and it would be able to reopen quickly, even if it temporarily flooded during a storm.

Cost Estimate

Total project cost is estimated to be between $250,000 and $300,000.

Cost includes construction of a new road, relocation of utilities, and grading, estimated to be $150,000 - $200,000. This estimate is based on a preliminary entrance layout drafted by the City, which was used as a basis for comparison to clearing, grading, paving, and utility installation costs for similar projects. An additional $100,000 is included for permitting and design fees. Design and engineering costs for this project include grading, utility relocation, animal habitat relocation, wetland protection or restoration, and other considerations.

Benefits

Economic Benefits

This project would reduce the damage relief expenditures incurred by the Rye Nature Center, as it would alleviate the need for repairs to the existing entrance in the wake of storm events. Additionally, it enables the Nature Center to continue to operate during storm events, thereby mitigating the loss of revenue that is associated with long periods of service outage. Based on the cost estimate above, the project is estimated to create approximately three full-time equivalent jobs for a period of six months.[56]

Environmental Benefits

The Rye Nature Center is a 47-acre property that serves an important environmental function to the community by providing a place for plant and wildlife habitats. The Center serves important regional environmental functions through collaborations with the Audubon Society and the National Wildlife Federation. A new entrance is necessary to ensure continued access by the 15,000 people who typically visit the Nature Center annually.

Cost Benefit Analysis

The total costs of the project are anticipated to be between $250,000 and $300,000, without any anticipated external costs, while providing a reduction in operations and maintenance burden for the Rye Nature Center. The project could result in significant risk reduction for access to the Nature Center and environmental benefits to the community as a whole.

Anticipated Risk Reduction

This project would move the Rye Nature Center from the high risk category to the moderate risk category, as the Nature Center's entrance is its primary point of vulnerability during storm events. Relocating the entrance out of the flood zone would principally eliminate risk to users of the Nature Center. This project is not anticipated to provide risk reduction benefits to any other assets in the community.

Implementation Timeline:

Estimated timeframe for completion is 18 months when implemented as part of the larger Boston Post Road traffic calming project. Should this project be completed separately, the estimated timeframe reduces to 6-12 months.

Regulatory Requirements:

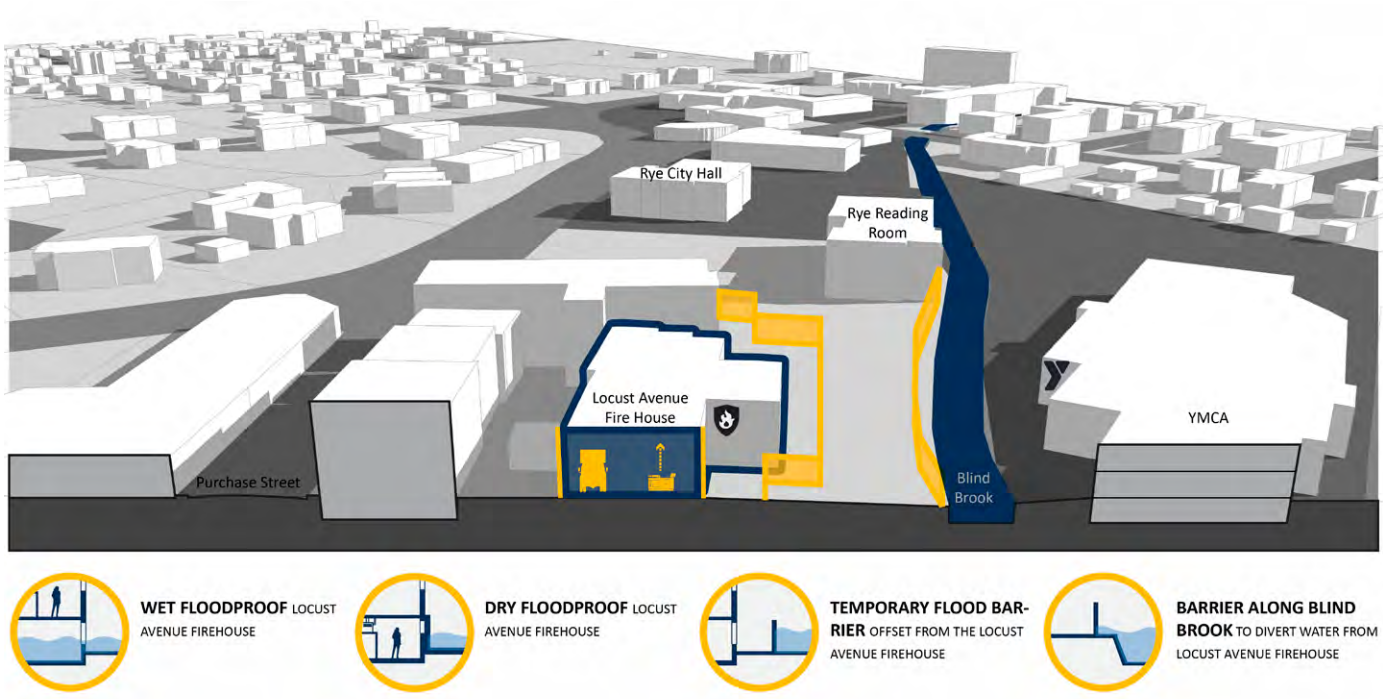
Regulatory requirements may involve New York State Department of Transportation (NYS DOT) and New York State Department of Environmental Conservation (NYS DEC). If this project is completed separately from the Boston Post Road traffic calming project, it may require only City review.

Jurisdiction:

City of Rye

Featured Project

Floodproof the Locust Avenue Firehouse



Project Description

The Locust Avenue Firehouse sits next to Blind Brook in a topographical bowl in Rye's Central Business District. When Blind Brook overflows the stream channel during major storms, the stormwater floods the Firehouse. During Hurricane Irene, stormwater flooded the basement, apparatus floor, and part of the day room and front offices, forcing the fire department to evacuate its headquarters and move equipment off-site.[57] In order to protect the integrity of the emergency services in Rye during and after storms, flood mitigation measures must be taken.

This project calls for floodproofing the Locust Avenue Firehouse. Floodproofing the firehouse would protect non-emergency equipment during storm events and would reduce damage to the building. Emergency response vehicles are typically stored off-site prior to storm events to ensure they are not incapacitated in the event of flooding on Locust Avenue. In cooperation with the City and with the Fire Department, one of the following floodproofing methods could be employed:

- Dry floodproof the Locust Avenue Firehouse by sealing the structure and ensuring that it is watertight. This would prevent floodwaters from entering the building, minimizing damage.
- Wet floodproof the Locust Avenue Firehouse by moving mechanical and utility equipment above the base flood elevation (BFE) and using flood resistant materials below the BFE. This would minimize flood damage within the structure, which is allowed to flood.

- Construct a temporary floodwall or barrier by installing moveable flood barriers offset from the building's exterior before each storm. This would keep floodwater out of the Firehouse, but would require human action before every storm.
- Construct a barrier along Blind Brook to contain, control, or divert the flow of water away from the Locust Avenue Firehouse. This would keep floodwater out of the Firehouse, but could potentially divert floodwater in the direction of other buildings in the vicinity, such as the Rye Reading Room or Rye YMCA.

Cost Estimate

Total project cost is estimated to be $180,000 to $505,000. Since the cost can vary widely depending on the method selected, for purposes of this plan the cost is estimated to be $200,000, which would cover any method excepting the equipment replacement for the wet floodproofing method.

Cost includes floodproofing the firehouse structure, replacing equipment that is vulnerable to flooding, and design fees associated with these updates. The cost of floodproofing and equipment vary significantly depending on the floodproofing method selected. Dry floodproofing measures are estimated to cost approximately $55,000, estimated as per FEMA guidance as described below. Under the wet floodproofing method, fixed equipment within the firehouse may need to be replaced with water-resistant technologies to prevent damages or outages from future storms. The replacement of equipment may cost between $100,000 and $350,000, depending on the extent of equipment to be replaced or relocated. Additionally, design fees associated with the project are estimated to be between $25,000 and $100,000, again depending on the floodproofing method selected. For example, the selection of a movable barrier system may be inexpensive, while the construction of a floodwall along Blind Brook would require significant design work.

Floodproofing costs are estimated based on FEMA guidance. Dry floodproofing, which is the most cost-effective permanent measure, costs $3.50 per square foot of exterior building surface below one foot above base flood elevation (BFE), with an additional $2.50 per linear foot for caulking. For below-grade waterproofing, caulking costs $20 per linear foot and extends to a depth of 6 feet below grade. At an approximate building perimeter of 400 feet and approximately 3 feet of building less than 1 foot above BFE, the costs of dry floodproofing for above-grade surfaces is estimated to be approximately $7,000. With the additional caulking requirements for the below-grade surfaces, construction costs are expected to be approximately $55,000.

Benefits

Economic Benefits

The project has the potential for reducing public expenditures during emergencies by mitigating damages sustained to the firehouse, which may result in significant cost savings. The project also has the potential to reduce losses of public property by enabling the fire department to continue to respond quickly to emergency calls during storm events. Based on the cost estimate above, the project is estimated to create approximately two full-time equivalent jobs for a period of six months.[58]

Environmental Benefits

Floodwaters can become contaminated after coming into contact with hazardous materials at the site of the flood. By dry floodproofing the firehouse,

floodwater will not become contaminated with any hazardous materials stored in the firehouse before continuing through the watershed into Milton Harbor.

Health and Social Benefits

This project has significant health and social benefits for the community. The project reduces the degree of damage sustained by the firehouse during storm events, which enables the fire department to focus on emergency operations for Rye residents, homes, and businesses rather than on its own recovery.

Cost Benefit Analysis

The cost of this project is likely between $180,000 and $505,000, though there is some uncertainty in this estimate due to the unknown condition of equipment within the firehouse and the extent of equipment replacement that may be necessary. This floodproofing project would result in significant public cost savings over time by reducing the need to rebuild or repair firehouse facilities after storm events. The project also has risk reduction potential and provides health, social, and environmental benefits for the community.

The Locust Avenue Firehouse in the topographical bowl.

Anticipated Risk Reduction

This project would significantly reduce the vulnerability of the Locust Avenue Firehouse by mitigating the degree of damage it sustains during storm events, resulting in a reduction of its risk from the high risk category to the moderate risk category in the risk assessment tool. This presents indirect benefits to assets throughout the community, which benefit from the services that the firehouse provides.

Implementation Timeline:

6-12 months

Regulatory Requirements:

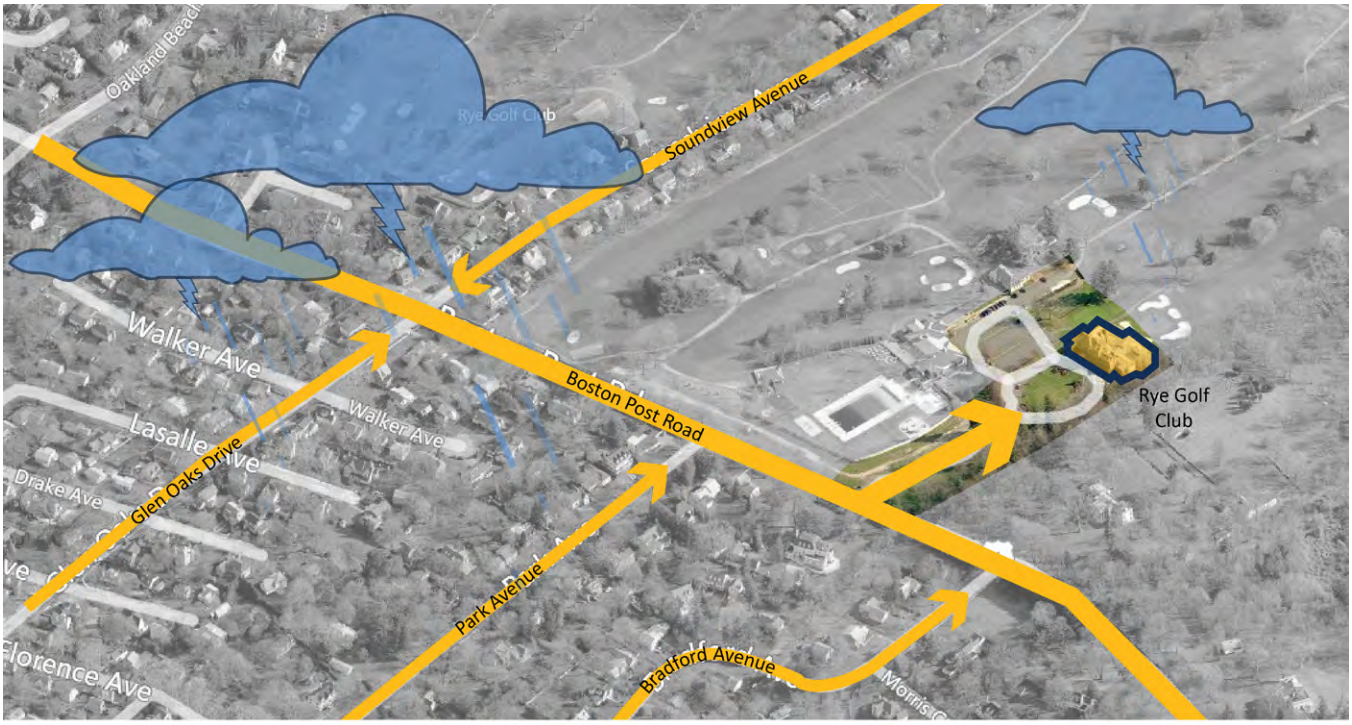
No regulatory requirements related to this project.

Jurisdiction:

City of Rye

Featured Project

Designate Rye Golf Club as a City-Operated Emergency Center



SLEEPING COTS AND FIRST AID KITS TO BE PURCHASED

SHOWER FACILITIES AND CHARGING STATIONS PROVIDED AT CENTER

BACK-UP GENERATOR TO BE PURCHASED AND INSTALLED

EMERGENCY VOLUNTEER STAFF TO BE TRAINED

Project Description

During federally-declared emergencies, the Red Cross operates an emergency center at Rye Country Day School. Following Superstorm Sandy, 90% of the City's electricity was knocked out, and 50 people, mostly the elderly and young families, stayed overnight at Rye Country Day School to use the emergency center.[59] During non-federally-declared emergencies, the Red Cross does not provide this service, and the City of Rye does not have the ability to operate the emergency center at Rye Country Day School.

This project would designate a city-operated emergency center to provide residents a place to regroup during or after storm events which may have resulted in loss of power, flooding, and/or utility interruptions. This could increase Rye's resilience by reducing disruption to daily life functions during and following storms. Rye Golf Club is an existing City-owned facility which could provide this service during storm events. It is well-equipped with showers and locker rooms, is located outside of the floodplain, and is accessible by car during storm events. In order to function as a shelter during a storm emergency, a backup electric generator, sleeping cots, and additional first aid and other emergency supplies need to be purchased. Additionally, staff must be trained to manage the emergency shelter during storm events.

Cost Estimate

Total cost of the project is estimated to be between $250,000 and $500,000.

Project costs include necessary retrofits of the selected facility, which would cost between $100,000 and $250,000. Such retrofits would likely include installation of a fixed generator and may include modifications to the facility intended to secure it against storm damage. Examples of such modifications are roof and window reinforcements, which would protect the facility against high winds often associated with hurricanes. The necessity of any such modifications to the facility would be determined through a detailed condition assessment. Shelter supplies, including cots, bedding, and medical supplies, are estimated to cost between $100,000 and $200,000. Staff training is also required and may vary depending on what services are determined to be necessary at the facility. Staff training costs may be up to $35,000. Additionally, legal fees for the establishment of an operating agreement are estimated to cost up to $15,000.

Benefits

Economic Benefits

The availability of a shelter would reduce expenses for households utilizing the shelter, as staying in hotels or other temporary lodgings can be very expensive. Based on the cost estimate above, the project is estimated to create approximately three full-time equivalent jobs for a period of six months.[60]

Health and Safety Benefits

This project would benefit all citizens of Rye, and would be particularly beneficial to socially vulnerable populations. By providing a local emergency shelter, those Rye residents who are physically or financially unable to secure alternate accommodations are given a safe evacuation location. The shelter would also provide services for those residents whose homes are not damaged but have lost power, as it would provide a place to charge cell phones or take a hot shower.

Cost Benefit Analysis

The initial implementation costs of this project are likely between $250,000 and $500,000. The required retrofits and associated cost will depend greatly on what improvements may be needed. This project reduces risk to vulnerable populations within Rye and provides significant health and social benefits.

Anticipated Risk Reduction

Creation of a city-operated emergency center would reduce the risk to citizens of Rye by providing a safe, local space for evacuation during non-federally designated emergency events. This project would not result in a reduction of risk to any existing assets within the flood zone.

Implementation Timeline:

A structure to serve as the emergency-operations facility already exists, so implementation for retrofits and training is estimated to take six months.

Regulatory Requirements:

No regulatory requirements related to this project.

Jurisdiction:

City of Rye

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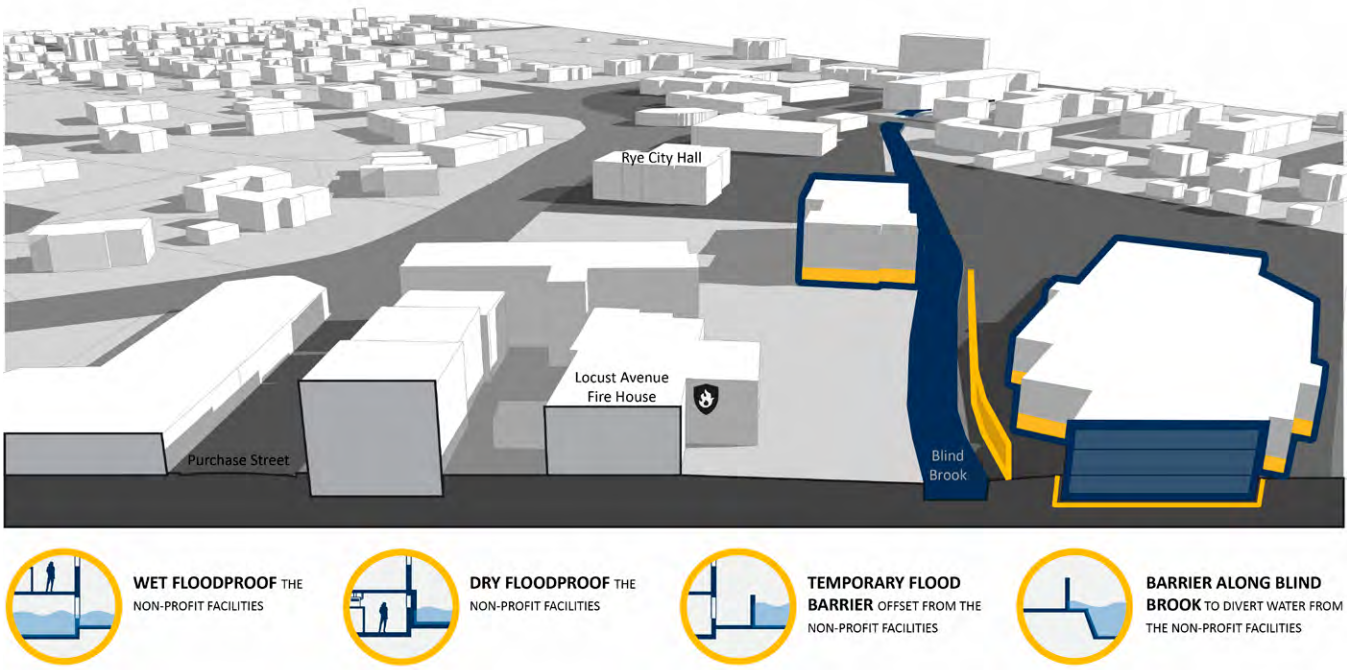
Featured Project

Floodproof Non-profit Facilities in the Central Business District



Project Description

Several of Rye's non-profit facilities along Blind Brook in the Central Business District regularly flood or suffer extended power outages during storms. Extensive repairs have drained budgets and exhausted donor bases who seek to improve services or resources rather than fund reconstruction projects. Some of these non-profits serve vital community functions and support socially vulnerable populations.

Floodproofing facilities that have suffered repeated damage during storms would protect important community assets and ensure continued philanthropy that enriches Rye. One or more of the following floodproofing methods could be employed:

- Dry floodproof the buildings by sealing the structures and ensuring that they are watertight. This would prevent floodwaters from entering the buildings, minimizing damage.
- Wet floodproof the buildings by moving resources and mechanical and utility equipment above the base flood elevation (BFE) and using flood resistant materials below the BFE. This would minimize flood damage within the structures, which are allowed to flood.
- Construct a temporary floodwall or barrier by installing moveable flood barriers offset from the buildings' exteriors before each storm. This would keep floodwater out of the buildings, but would require human action before every storm.
- Construct a barrier along Blind Brook to contain, control, or divert the flow of water away from the buildings. This would keep floodwater out of the protected buildings, but could potentially divert floodwater in the direction of other buildings in the vicinity.

Cost Estimate

This project proposes to allot $500,000 for floodproofing measures at non-profit facilities in the Central Business District.

The $500,000 allotment is intended to cover physical floodproofing measures and replacement of vulnerable mechanical equipment in flood-prone locations within these facilities, as well as the associated design fees.

Dry floodproofing costs can be estimated using FEMA methodology. According to FEMA, dry floodproofing costs $3.50 per square foot of exterior building surface below one foot above base flood elevation, with an additional $2.50 per linear foot for caulking. For below-grade waterproofing, caulking costs $20 per linear foot and is applied to a depth of 6 feet below grade. The specific total costs can be elucidated as facilities are selected and floodproofing measures are designed.

External costs associated with this project may include disruption in service of the non-profit facilities during construction. However, this cost is more than offset by the gains in service continuity during storm events that can be realized through effective floodproofing.

Benefits

Economic Benefits

The project could result in a reduction of future expenditures by non-profits for emergency situations by mitigating the extent of damage to their facilities. Additionally, floodproofing measures will enable non-profits to continue operations during storm events or return to service quickly after storm events, a significant economic benefit. Based on the cost estimate above, the project is estimated to create approximately two full-time equivalent jobs for a period of six months.[61]

Environmental Benefits

Dry floodproofing of at-risk assets would reduce the risk of flood waters entering the facilities. This would reduce the possibility that floodwaters become contaminated with hazardous materials. Additionally, flooding often damages these assets. Floodproofing would minimize the need for additional construction materials for building repairs.

Health and Safety Benefits

Floodproofing of vital community facilities enables those assets to continue service during and after flood events. These assets provide key health and social service functions within the community, many of which directly benefit specific young, elderly, or otherwise vulnerable populations.

Cost Benefit Analysis

This project includes a $500,000 allotment for floodproofing measures at non-profit facilities. The actual floodproofing costs could vary widely, depending on the requirements of each facility, which are yet to be assessed. The project would result in significant risk reduction benefits for the assets included, and there are also significant public health and economic benefits to be realized. Additionally, the project would specifically benefit socially vulnerable populations by protecting assets that serve these groups.

Anticipated Risk Reduction

This project could reduce the risk to the nonprofit assets selected for floodproofing, and result in the reassignment of the assets from the severe risk

category to the high risk category. By floodproofing or otherwise improving the resiliency of nonprofit facilities, their vulnerability to damage or service outage as a result of flooding is greatly reduced.

Implementation Timeline:

12-18 months

Regulatory Requirements:

Regulatory requirements may involve local permits.

Jurisdiction:

Non-profit organizations within the Central Business District.

2014
NY RISING COMMUNITY RECONSTRUCTION PLAN

RYE NYRCR

Section V
Additional Materials


Ruby's
OYSTER BAR & BISTRO
NO STOPPING BUS STOP
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V: Additional Materials

A. Additional Resiliency Recommendations

Throughout the NYRCR Planning process, the Rye Planning Committee developed the Additional Resiliency Recommendations listed in Table V-1. These recommendations were developed as projects or actions that the Planning Committee would like to highlight and that are not categorized as Proposed or Featured Projects.

Table V-1 Additional Resiliency Recommendations

Project Name	Description	Estimated Cost	Regional Project
Collaboration within the Watershed to Address Riverine Flooding at its Source			
Stormwater Runoff Retention on Interstates Study	Study if runoff from two major interstates (I-95 and I-287) can be captured or mitigated before flowing through Rye. These roadways do not capture all of the stormwater that falls on them, and instead they divert water to Blind Brook, Beaver Swamp Brook, and other waterways.	$200,000	Y
Support for the Watershed Committee & Green Infrastructure Program	Form a conservancy to support the Blind Brook Watershed Committee so that the City of Rye and neighboring communities can work together toward preventative solutions. The conservancy would ideally work together in implementing projects and educating the public.	$200,000	Y
Infrastructure Resilience			
Renewable Energy Program for the City of Rye	Implement a series of solar power pilot projects around Rye, including streetlights along critical roadways and generators at community and municipal facilities.	$5 million	N
Enrichment and Expansion of the Wetlands and Open Space Along City Brooks	Convert municipal parking lots to open space along the brooks, and replace the lost parking spaces with centralized structured parking on high ground. The first phase would be a study to determine available land in strategic floodplain locations.	$200,000	N
Power Line Stabilization Along Major Corridors Study	Collaborate with ConEdison on a resilience plan for the region to identify major power lines and/or power grids to secure, which would protect the larger City grid during a storm. Rye could work with utility companies to identify particularly vulnerable areas.	$200,000	N
Improvment of Municipal and Rye City School District Facilities	Floodproof City Hall, Rye Middle School, Rye High School, and the Midland School, which are vulnerable to flooding from Blind Brook. Floodproofing these facilities entails capital improvements to the buildings and moving mechanical and utility systems above the Base Flood Elevation.	$500,000 per building	N

Table V-1 Additional Resiliency Recommendations

Project Name	Description	Estimated Cost	Regional Project
Design for Sea Level Rise, Coastal Vulnerability, and Tidal Impacts			
Participation in FEMA's Community Rating System	Participate in FEMA's CRS, a voluntary incentive program that encourages community floodplain management activities that exceed the minimum National Flood Insurance Program requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk. This project proposes for Rye to participate in this program.	$0 -$100,000	N
Coastal Zone Improvements Study	Study the creation of a coastal waterfront coalition of residential and commercial property owners along the Long Island Sound to determine potential for economies of scale when implementing flood mitigation projects.	$200,000	N

B. Master Table of Projects

Table V-2 presents all projects developed by the Rye Planning Committee throughout the NY Rising planning process. This comprehensive list includes Proposed Projects and Featured Projects, which may be funded through the NYRCR Program. Projects are listed by Reconstruction and Resiliency Strategy. Projects are not ranked or prioritized, and are presented in no particular order of importance.

Table V-2 Master Table of Projects

Project Name	Description	Project Category	Estimated Cost	Regional Project
Collaboration within the Watershed to Address Riverine Flooding at its Source				
Modifications to the Sluice Gate at Bowman Avenue Dam	Modifications include moving the stream gauges that trigger the sluice gate's automatic functions further downstream and updating the operational rules of the gate.	Proposed	$150,000 - $250,000	Y
Stormwater Ponds at Anderson Hill Road (SUNY Purchase)	Two stormwater detention ponds could be created by building earthen berms across the Blind Brook floodplain, with openings at the channel. During heavy rain storms, the berms would constrict the water flow through the channel and would create detention ponds immediately upstream.	Proposed	$750,000 - $1 million	Y
Bowman Avenue Dam Upper Pond Resizing	Expand the storage capacity of the Upper Pond at the Bowman Avenue Dam by excavating 104,000 cubic yards of material, creating a larger retention basin.	Proposed	$7.5 million - $8.5 million	Y
Detention Basins at Westchester County Airport	Expand the capacity of two detention ponds at the Airport to increase their storage capacity, minimizing runoff into Blind Brook.	Featured	$500,000	Y
Bowman Avenue Dam Lower Pond	Resize the lower pond at the Bowman Avenue Dam to increase its flood storage capacity. The project also includes the installation of a spillway as a flood control structure at I-287.	Featured	$13 million - $14 million	Y
Stormwater Runoff Retention on Interstates Study	Study if runoff from two major interstates (I-95 and I-287) can be captured or mitigated before flowing through Rye. These roadways do not capture all of the stormwater that falls on them, and instead they divert water to Blind Brook, Beaver Swamp Brook, and other waterways.	Additional Resilience Recommendation	$200,000	Y
Support for the Watershed Committee & Green Infrastructure Program	Form a conservancy to support the Blind Brook Watershed Committee so that the City of Rye and neighboring communities can work together toward preventative solutions. The conservancy would ideally work together in implementing projects and educating the public.	Additional Resilience Recommendation	$200,000	Y

Table V-2 Master Table of Projects

Project Name	Description	Project Category	Estimated Cost	Regional Project
Infrastructure Resilience				
Improved Milton Road Drainage to Harbor	Install expanded drainage on Milton Road north of the Milton Harbor House to divert flood waters to the Harbor.	Proposed	$250,000	N
New Entrance to Rye Nature Center	Create a new entrance to the Nature Center that does not cross Blind Brook. The historic bridge on the current access road could be converted into a pedestrian bridge.	Featured	$250,000 - $300,000	N
Floodproof the Locust Avenue Firehouse	Floodproof the Locust Avenue Firehouse.	Featured	$180,000 - $200,000	N
Renewable Energy Program for the City of Rye	Implement a series of solar power pilot projects around Rye, including streetlights along critical roadways and generators at community and municipal facilities.	Additional Resilience Recommendation	$5 million	N
Enrichment and Expansion of the Wetlands and Open Space Along City Brooks	Convert municipal parking lots to open space along the brooks, and replace the lost parking spaces with centralized structured parking on high ground. The first phase would be a study to determine available land in strategic floodplain locations.	Additional Resilience Recommendation	$200,000	N
Power Line Stabilization Along Major Corridors Study	Collaborate with ConEdison on a resilience plan for the region to identify major power lines and/or power grids to secure, which would protect the larger City grid during a storm. Rye could work with utility companies to identify particularly vulnerable areas.	Additional Resilience Recommendation	$200,000	N
Improvement of Municipal and Rye City School District Facilities	Floodproof City Hall, Rye Middle School, Rye High School, and the Midland School, which are vulnerable to flooding from Blind Brook. Floodproofing these facilities entails capital improvements to the buildings and moving mechanical and utility systems above the Base Flood Elevation.	Additional Resilience Recommendation	$500,000 per building	N
Readiness for Future Storms				
Designate Rye Golf Club as a City-Operated Emergency Center	Designate a City-operated emergency center at Rye Golf Club to provide residents a place to regroup during or after storm events which result in the loss of power, flooding, and/or utility interruptions.	Featured	$250,000 - $500,000	N
Floodproof Critical Non-profit Facilities in the Central Business District	Floodproof non-profit facilities in the Central Business District that have suffered repeated damage during storms.	Featured	$500,000	N

Table V-2 Master Table of Projects

Project Name	Description	Project Category	Estimated Cost	Regional Project
Design for Sea Level Rise, Coastal Vulnerability, and Tidal Impacts				
Participation in FEMA's Community Rating System	Participate in FEMA's CRS, a voluntary incentive program that encourages community floodplain management activities that exceed the minimum National Flood Insurance Program requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk. This project proposes for Rye to participate in this program.	Additional Resilience Recommendation	$0 -$100,000	N
Coastal Zone Improvements Study	Study the creation of a coastal waterfront coalition of residential and commercial property owners along the Long Island Sound to determine potential for economies of scale when implementing flood mitigation projects.	Additional Resilience Recommendation	$200,000	N

C. Public Engagement Process

The projects and strategies outlined in the Rye NYRCR Plan (NYRCR Plan) will most benefit those who live and work in Rye. Creating opportunities for residents, business owners, and community leaders to contribute to the development of strategies and project ideas is critical to meeting the community's needs. The Rye Planning Committee and Consultant Team have worked to provide a variety of opportunities for public participation and community engagement, including four Public Engagement Events, surveys, and online outreach.

NYRCR Planning Committee

The Committee – comprised of 11 community representatives – dedicated their time, experience, and expertise to work closely with representatives from the Governor's Office of Storm Recovery and the Consultant Team. The Committee guided the overall development of the material within the NYRCR Plan and the public engagement process. The Committee members defined the geographic scope for the NYRCR Plan (co-terminus with the City of Rye) and developed a vision for their community. The Committee and Community, as well as local officials, were integral in the development of the asset inventory. The Committee identified the community-wide development of Rye's list of resilience and recovery needs and opportunities.

Early on, the Committee shared many concerns, and the conversations focused on issues relating to riverine flooding and enduring power outages, caused by Superstorm Sandy, Tropical Storm Lee, Hurricane Irene, and two big nor'easters that hit Rye in the spring of 2007. Because Rye has a long history of vulnerability to major storms, members of the Committee were familiar with the many recent studies and flood mitigation efforts that the City has taken on in recent years, in part because many of them serve on the Rye Flood Advisory Committee.

The Committee was interested in seeking solutions that would alleviate riverine flooding along Blind Brook and Beaver Swamp Brook and coastal flooding along the coast of Long Island Sound, but that did not detract from Rye's natural beauty. Decades earlier, a flood mitigation plan by the U.S. Army Corps of Engineers relied on significant hard infrastructure development, but that plan faced much opposition because it proposed to create tall flood barriers along Blind Brook, walling off one of Rye's defining features from the community. Because of the importance placed on preserving Rye's aesthetics, the Committee developed strategies that would not just alleviate flooding, but would minimize disruptions faced by the community should flooding occur. The community vision, asset list, identified needs and opportunities, and strategies were vetted by the community before the Committee began formulating a final list of proposed and featured projects and additional resiliency recommendations. The comprehensive list of projects reflect input from the community, the Committee, the Consultant team, and recent studies conducted by engineering experts hired by the City.

Public Engagement Events

Community residents and other stakeholders participated in three Public Engagement Events to review work done by the Committee and Consultant Team. These events were widely publicized on the City website and in local media outlets, and were critical to ensuring that voices throughout the community were heard and acknowledged throughout this process. A final Public Engagement Event will be held to share the final NYRCR Plan with the Community.

Community members and stakeholders gathered at the beach for the first Public Engagement event.

Public Engagement Event 1: Geographic Scope, Community Vision, and Assets

The first Public Engagement Event was held in July 2014. The event was an informal open house style meeting at Rye Town Park overlooking Rye Beach. The event introduced community members to the NYRCR Program and provided the community the opportunity to review the community vision developed by the Committee and identify community assets. This input was used to refine and add detail to the NYRCR Plan and inform the risk assessment process.

Rye residents provided feedback on the list of Rye's community assets

Public Engagement Event 2: Needs, Opportunities, and Strategies

The second Public Engagement Event was held in September 2014 at the Rye Free Reading Room. The meeting was a presentation followed by an open house where community members could have informal discussions with members of the Committee and Consultant Team. Specific feedback from the community was solicited to identify community needs and opportunities and suggest strategies that reflect values held by the community.

Public Engagement Event 3: Project Ideas

The third Public Engagement Event was held in November 2014 at the Rye Middle School. After a brief presentation by the Consultant Team, community members circulated throughout the multipurpose room, viewing boards describing each project under consideration by the Committee

Committee members and community members discuss Rye's needs and opportunities at the second Public Engagement Event.

for inclusion in the NYRCR Plan. They were invited and encouraged to submit their feedback on Project Passports. Committee members, representatives from the Governor's Office of Storm Recovery, and members of the Consultant Team were available to answer questions. Following the third Public Engagement Event, an online survey was sent to Rye residents where community members who were unable to attend the event could learn about the proposed projects and provide feedback. Nearly 350 people viewed the survey, with about two thirds of viewers leaving feedback. All of this information was used to inform the project descriptions and understand community support for the proposed projects.

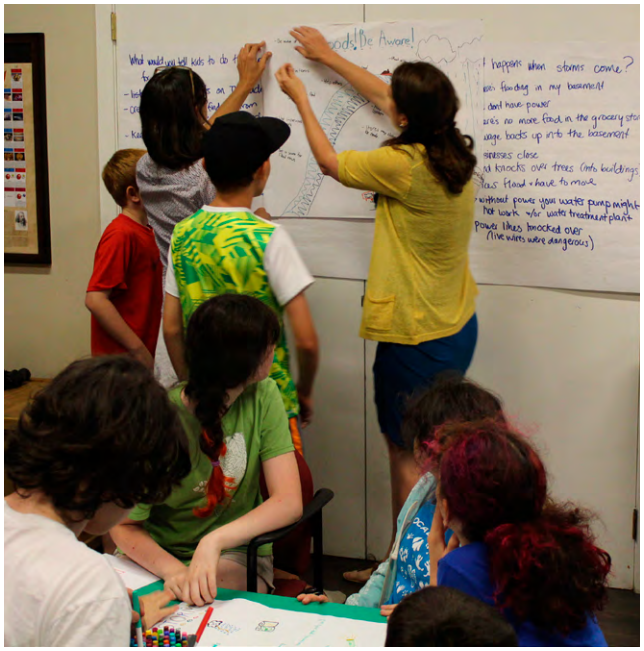
At the meeting, community members filled out project passports to add information or show support for a project. An online survey enabled community members who could not attend the third Public Engagement Event to provide feedback.

Public Engagement Event 4: The Rye NY Rising Community Reconstruction Plan

The fourth and final Public Engagement Event will be held in January 2015. At this meeting, the Committee and Consultant Team will present the completed NYRCR Plan to community members and stakeholders, laying the foundation for implementation.

Community Outreach

In addition to the four Public Engagement Events, Committee members and the Consultant Team participated in several outreach events. During the summer, the Consultant team worked with the Rye Nature Center camp to educate campers about Resilience in Rye. In advance of the third Public Engagement Event, Committee members and representatives from the Governor's Office of Storm Recovery staffed a table at the Rye Farmers' Market during the annual Halloween Window Painting event to invite community members to attend the Event and to answer any questions community members had. A member of the Governor's Office of Storm Recovery also made a brief presentation to the Rye Chamber of Commerce. Committee members gave



Community outreach with children at the Rye Nature Center camp.

presentations to the Rye School Board and City Council, and representatives from the City Planning Office conducted a significant outreach effort through local media outlets and by publicizing information through local e-mail listservs.

D. Community Asset Inventory

In order to understand the community's assets that might be impacted by future storms, information was collected on assets that best represent the City of Rye. As detailed in Section II, this comprehensive inventory contains information on each asset, including the risk area where the asset is located, the asset class, whether the asset serves socially vulnerable populations, whether it is a critical facility, how highly the community values the asset, whether the asset is protected from storm damage by landscape attributes, and the hazard, exposure, and vulnerability scores associated with each asset. These scores were calculated following the risk assessment methodology outline in Section II of this plan. These assets were then run through the risk assessment tool to determine each asset's unmitigated risk score. Following the creation of the project lists, the assets were run through the risk assessment tool again, this time to determine the change in risk to each asset after a particular project is implemented. The assets are listed in order of their unmitigated risk score, beginning with the asset with the highest score, Elm Place Businesses with a score of 68 points, and ending with Rye Manor which has a risk score of 6 points.

An example calculation of the risk score is as follows: the Rye Free Reading Room, listed in the second row of the table below, is located within the extreme hazard area and scored "Yes" on five of the six identified landscape attribute evaluations. Location within the extreme hazard area contributes 2 points to the exposure score, while each of the "Yes" responses for landscape attributes contributes an additional 0.5 points, for a total exposure score of 4.5. The hazard score for all NYRCR Community assets is 3, as described in Section II. Based on input from city officials, it was determined that, after past storms, the asset was out of service or operating at reduced capacity for more than one month, which corresponds to a vulnerability score of 4. The hazard, exposure, and vulnerability scores (3, 4.5, and 4, respectively) are multiplied together and rounded to the nearest whole number to produce the risk score (54). The risk score of 54 for the asset corresponds to the severe risk category.

Unmitigated Risk Assessment for Community Assets

Table V-3 Unmitigated Risk Assessment for Community Assets

Asset Name	Asset Class	Risk Area	Socially Vulnerable Populations	Critical Facility	Community Value	Lack of Defensive Flood Protection Measures	Elevation Below BFE
Elm Place Businesses	Economic	Extreme	No	No	Medium	Yes	Yes
Rye Free Reading Room	Natural and Cultural Resources	Extreme	Yes	Yes, FEMA	High	Yes	Yes
Rye YMCA Community Center	Health and Social Services	Extreme	No	No	High	Yes	Yes
Edith Read Natural Park and Wildlife Sanctuary	Natural and Cultural Resources	Extreme	No	No	Low	No	Yes
Central Avenue Bridge over Blind Brook	Infrastructure Systems	High	No	No	Medium	Yes	Yes
Milton Harbor House Community	Housing	Extreme	Yes	No	High	No	No
Apartments off Wappanocca Avenue (multiple)	Housing	Extreme	No	No	High	Yes	Yes
Wappanocca Neighborhood	Housing	Extreme	No	No	High	Yes	Yes
Indian Village Neighborhood	Housing	Extreme	No	No	High	Yes	Yes
Playland	Economic	Extreme	No	No	Medium	No	No
Rye City Boat Basin	Natural and Cultural Resources	Extreme	No	No	Low	No	No
Rye Town Park	Natural and Cultural Resources	Extreme	No	No	Low	No	No
Rye Middle/High School Campuses	Health and Social Services	Extreme	Yes	Yes, FEMA	Medium	Yes	Yes
Mrs. Green's Natural Market	Economic	Extreme	No	No	Medium	Yes	Yes
Tide Mill Yacht Basin	Economic	Extreme	No	No	Low	No	Yes
Phillips Lane / Hewlett Street Homes	Housing	High	No	No	High	No	No
Martin Butler Court Homes	Housing	Extreme	No	No	High	No	No
Milton Road / Garden Drive Homes	Housing	Extreme	No	No	High	No	No

Occupied <= 2 ft. above BFE	Confluence of Two or More Streams	Flood Risk from Storm Water	Lack of Vegetated Stream Bank Buffer	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Yes	Yes	No	Yes	2.5	3	4.5	5	68
Yes	Yes	No	Yes	2.5	3	4.5	4	54
Yes	Yes	No	Yes	2.5	3	4.5	4	54
Yes	Yes	Yes	Yes	2.5	3	4.5	4	54
Yes	Yes	No	Yes	2.5	3	3.5	5	53
Yes	Yes	Yes	Yes	2	3	4.0	4	48
Yes	No	No	Yes	2	3	4.0	4	48
Yes	No	No	Yes	2	3	4.0	4	48
Yes	No	No	Yes	2	3	4.0	4	48
Yes	Yes	Yes	Yes	2	3	4.0	4	48
Yes	Yes	Yes	Yes	2	3	4.0	4	48
Yes	Yes	Yes	No	1.5	3	3.5	4	42
Yes	Yes	No	Yes	2.5	3	4.5	3	41
Yes	Yes	No	Yes	2.5	3	4.5	3	41
Yes	Yes	Yes	Yes	2.5	3	4.5	3	41
Yes	Yes	Yes	Yes	2	3	3.0	4	36
Yes	Yes	Yes	Yes	2	3	4.0	3	36
Yes	Yes	Yes	Yes	2	3	4.0	3	36

Table V-3 Unmitigated Risk Assessment for Community Assets

Asset Name	Asset Class	Risk Area	Socially Vulnerable Populations	Critical Facility	Community Value	Lack of Defensive Flood Protection Measures	Elevation Below BFE
Milton Point Business District and Milton School	Economic	Extreme	No	No	Medium	No	No
Manursing Island Club	Economic	Extreme	No	No	Low	No	No
American Yacht Club	Economic	Extreme	No	No	Low	No	No
Shenorock Shore Club	Economic	Extreme	No	No	Low	No	No
Westchester Country Club	Economic	Extreme	No	No	Low	No	No
Central Avenue / Loewen Court Homes	Housing	High	Yes	No	High	Yes	Yes
Milton Road / Hill Street Homes	Housing	High	No	No	High	No	No
Waterfront Homes off Stuyvesant Avenue	Housing	Extreme	No	No	High	No	Yes
Locust Avenue Firehouse	Health and Social Services	Extreme	No	Yes, FEMA	High	Yes	Yes
Boston Post Road / Roger Sherman Place Homes	Housing	Extreme	No	No	High	Yes	Yes
Rye Nature Center	Natural and Cultural Resources	Extreme	No	No	Medium	Yes	Yes
Medical Offices off Purchase Street (multiple)	Health and Social Services	Extreme	No	No	High	Yes	Yes
Milton Road / Locust Lane Homes	Housing	Extreme	No	No	High	No	No
South Manursing Island Homes	Housing	Extreme	No	No	High	No	No
Milton Point Firehouse	Health and Social Services	Extreme	No	No	High	No	No
Rye Golf Club	Economic	Extreme	No	No	Medium	No	Yes
Rye Marina	Natural and Cultural Resources	Extreme	No	No	Low	No	No
Rye Meeting House / Bird Homestead	Natural and Cultural Resources	Extreme	No	No	Low	No	No
Row America Rye	Economic	Extreme	No	No	Low	No	No
Rye Fish and Game Club	Natural and Cultural Resources	Extreme	No	No	Low	No	No

Occupied <= 2 ft. above BFE	Confluence of Two or More Streams	Flood Risk from Storm Water	Lack of Vegetated Stream Bank Buffer	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Yes	Yes	Yes	Yes	2	3	4.0	3	36
Yes	Yes	Yes	Yes	2	3	4.0	3	36
Yes	Yes	Yes	Yes	2	3	4.0	3	36
Yes	Yes	Yes	Yes	2	3	4.0	3	36
Yes	Yes	Yes	Yes	2	3	4.0	3	36
Yes	Yes	No	Yes	2.5	3	3.5	3	32
Yes	Yes	Yes	Yes	2	3	3.0	3	27
Yes	Yes	Yes	Yes	2.5	3	4.5	2	27
Yes	Yes	No	Yes	2.5	3	4.5	2	27
Yes	Yes	No	Yes	2.5	3	4.5	2	27
Yes	Yes	No	Yes	2.5	3	4.5	2	27
Yes	No	No	Yes	2	3	4.0	2	24
Yes	Yes	Yes	Yes	2	3	4.0	2	24
Yes	Yes	Yes	Yes	2	3	4.0	2	24
Yes	Yes	Yes	Yes	2	3	4.0	2	24
Yes	Yes	Yes	No	2	3	4.0	2	24
Yes	Yes	Yes	Yes	2	3	4.0	2	24
Yes	Yes	Yes	Yes	2	3	4.0	2	24
Yes	Yes	Yes	Yes	2	3	4.0	2	24
Yes	Yes	Yes	Yes	2	3	4.0	2	24

Table V-3 Unmitigated Risk Assessment for Community Assets

Asset Name	Asset Class	Risk Area	Socially Vulnerable Populations	Critical Facility	Community Value	Lack of Defensive Flood Protection Measures	Elevation Below BFE
Public Fishing Dock	Natural and Cultural Resources	Extreme	No	No	Low	No	No
North Manursing Island Homes	Housing	Extreme	No	No	High	No	No
Central Business District	Economic	High	No	No	Medium	Yes	Yes
Cemetery Bridge over Red Oak Swamp Stream	Infrastructure Systems	High	No	No	Medium	Yes	Yes
Nursery Field	Natural and Cultural Resources	High	No	No	Low	Yes	Yes
Homes off Manursing Way and Kirby Lane	Housing	High	No	No	High	No	Yes
Watson Court Homes	Housing	High	No	No	High	No	No
Parsonage Point Homes	Housing	High	No	No	High	No	No
Water's Edge Condominiums	Housing	High	No	No	High	No	No
Coveleigh Club	Economic	High	No	No	Low	No	No
Midland School	Health and Social Services	Moderate	Yes	Yes, FEMA	Medium	Yes	No
Milton Road / Playland Parkway Homes	Housing	Extreme	No	No	High	Yes	Yes
Locust Avenue Bridge over Blind Brook	Infrastructure Systems	Extreme	No	No	High	Yes	Yes
US Route 1	Infrastructure Systems	Extreme	No	No	High	Yes	Yes
Playland Parkway Bridge over Blind Brook	Infrastructure Systems	Extreme	No	No	High	Yes	Yes
Rye City Hall	Health and Social Services	Extreme	No	No	Medium	Yes	Yes
Morehead Footbridge over Blind Brook	Infrastructure Systems	Extreme	No	No	Medium	Yes	Yes
Waterfront Homes off Grace Church Street	Housing	Extreme	No	No	High	No	No
Forest Avenue Pump Station	Infrastructure Systems	Extreme	No	Yes, FEMA	High	No	No
Con Edison Electric Substation, Oakland Beach Ave.	Infrastructure Systems	Extreme	No	Yes, FEMA	High	No	No

Occupied <= 2 ft. above BFE	Confluence of Two or More Streams	Flood Risk from Storm Water	Lack of Vegetated Stream Bank Buffer	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Yes	Yes	Yes	Yes	2	3	4.0	2	24
No	Yes	Yes	Yes	1.5	3	3.5	2	21
Yes	Yes	No	Yes	2.5	3	3.5	2	21
Yes	Yes	No	Yes	2.5	3	3.5	2	21
Yes	Yes	No	Yes	2.5	3	3.5	2	21
Yes	Yes	Yes	No	2	3	3.0	2	18
Yes	Yes	Yes	Yes	2	3	3.0	2	18
Yes	Yes	Yes	No	1.5	3	2.5	2	15
Yes	Yes	Yes	No	1.5	3	2.5	2	15
Yes	Yes	Yes	No	1.5	3	2.5	2	15
Yes	No	No	No	1	3	1.5	3	14
Yes	Yes	No	Yes	2.5	3	4.5	1	14
Yes	Yes	No	Yes	2.5	3	4.5	1	14
Yes	Yes	No	Yes	2.5	3	4.5	1	14
Yes	Yes	No	Yes	2.5	3	4.5	1	14
Yes	Yes	No	Yes	2.5	3	4.5	1	14
Yes	Yes	No	Yes	2.5	3	4.5	1	14
Yes	Yes	Yes	Yes	2	3	4.0	1	12
Yes	Yes	Yes	Yes	2	3	4.0	1	12
Yes	Yes	Yes	Yes	2	3	4.0	1	12

Table V-3 Unmitigated Risk Assessment for Community Assets

Asset Name	Asset Class	Risk Area	Socially Vulnerable Populations	Critical Facility	Community Value	Lack of Defensive Flood Protection Measures	Elevation Below BFE
Oakland Beach Avenue Bridge over Blind Brook	Infrastructure Systems	Extreme	No	No	High	No	No
Johnson Place Homes	Housing	High	No	No	High	Yes	Yes
Rye Neck Middle School	Health and Social Services	High	Yes	Yes, FEMA	Medium	Yes	Yes
Rye Neck Senior High School	Health and Social Services	High	Yes	Yes, FEMA	Medium	Yes	Yes
Waterfront Homes off Rye Road	Housing	Extreme	No	No	High	No	No
Brevoort Lane Pump Station	Infrastructure Systems	High	No	Yes, FEMA	High	No	Yes
Pine Island Homes	Housing	Extreme	No	No	High	No	No
Brevoort Lane Homes	Housing	High	No	No	High	No	Yes
South Forest Avenue Homes	Housing	Extreme	No	No	High	No	No
The Ives at Rye	Housing	High	No	No	High	Yes	Yes
Glen Oaks Drive Pump Station (COR)	Infrastructure Systems	High	No	Yes, FEMA	High	Yes	Yes
Orchard Avenue Apartments	Housing	High	No	No	High	Yes	Yes
Beaver Swamp Brook Flood Zone Homes	Housing	High	No	No	High	Yes	Yes
Glendale Avenue Homes	Housing	High	No	No	High	Yes	Yes
Orchard Avenue Bridge over Blind Brook	Infrastructure Systems	High	No	No	Medium	Yes	Yes
Rye Brook Services Station	Economic	High	No	No	Medium	Yes	Yes
Faros Corporate Center	Economic	High	No	No	Medium	Yes	Yes
Rye Racquet Club	Economic	High	No	No	Medium	Yes	Yes
Greenwood Union Cemetery	Natural and Cultural Resources	High	No	No	Low	Yes	Yes
Knapp House	Natural and Cultural Resources	High	No	No	Low	Yes	Yes
Verizon Facility	Infrastructure Systems	Moderate	No	Yes, FEMA	High	Yes	No
Metro North Parking Lot	Infrastructure Systems	High	No	No	High	Yes	Yes

Occupied <= 2 ft. above BFE	Confluence of Two or More Streams	Flood Risk from Storm Water	Lack of Vegetated Stream Bank Buffer	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Yes	Yes	Yes	Yes	2	3	4.0	1	12
Yes	Yes	Yes	Yes	3	3	4.0	1	12
Yes	Yes	Yes	Yes	3	3	4.0	1	12
Yes	Yes	Yes	Yes	3	3	4.0	1	12
Yes	Yes	Yes	No	1.5	3	3.5	1	11
Yes	Yes	Yes	Yes	2.5	3	3.5	1	11
No	Yes	Yes	Yes	1.5	3	3.5	1	11
Yes	Yes	Yes	Yes	2.5	3	3.5	1	11
No	Yes	Yes	Yes	1.5	3	3.5	1	11
Yes	Yes	No	Yes	2.5	3	3.5	1	11
Yes	Yes	No	Yes	2.5	3	3.5	1	11
Yes	Yes	No	Yes	2.5	3	3.5	1	11
Yes	Yes	No	Yes	2.5	3	3.5	1	11
Yes	Yes	No	Yes	2.5	3	3.5	1	11
Yes	Yes	No	Yes	2.5	3	3.5	1	11
Yes	Yes	No	Yes	2.5	3	3.5	1	11
Yes	Yes	No	Yes	2.5	3	3.5	1	11
Yes	Yes	No	Yes	2.5	3	3.5	1	11
Yes	Yes	No	Yes	2.5	3	3.5	1	11
Yes	Yes	No	Yes	2.5	3	3.5	1	11
No	No	No	Yes	1	3	1.5	2	9
Yes	No	No	Yes	2	3	3.0	1	9

Table V-3 Unmitigated Risk Assessment for Community Assets

Asset Name	Asset Class	Risk Area	Socially Vulnerable Populations	Critical Facility	Community Value	Lack of Defensive Flood Protection Measures	Elevation Below BFE
Ridge Street Homes	Housing	High	No	No	High	Yes	Yes
Stuyvesant Avenue Pump Station	Infrastructure Systems	High	No	Yes, FEMA	High	No	No
Crescent Avenue Homes	Housing	High	No	No	High	Yes	Yes
Midland Avenue / Playland Parkway Homes	Housing	High	No	No	High	Yes	Yes
Blind Brook Sewage Treatment Plant (COR)	Infrastructure Systems	High	No	Yes, FEMA	High	Yes	Yes
Roosevelt Avenue Homes	Housing	High	No	No	High	No	No
Van Rensselaer Road Pump Station (COR)	Infrastructure Systems	Moderate	No	Yes, FEMA	High	No	No
Soundview Avenue Homes	Housing	High	No	No	High	No	No
Rye Department of Public Works	Health and Social Services	Moderate	No	Yes, FEMA	High	Yes	Yes
Hook Road Homes	Housing	High	No	No	High	No	No
Dearborn Road at Water's Edge Pump Station	Infrastructure Systems	Moderate	No	Yes, FEMA	High	No	No
Interstate 95	Infrastructure Systems	High	No	No	High	Yes	No
Metro North Rail Lines	Infrastructure Systems	High	No	No	High	Yes	No
Midland Avenue Homes	Housing	High	No	No	High	Yes	No
Rye Manor	Housing	Moderate	Yes	Yes, FEMA	Medium	Yes	No

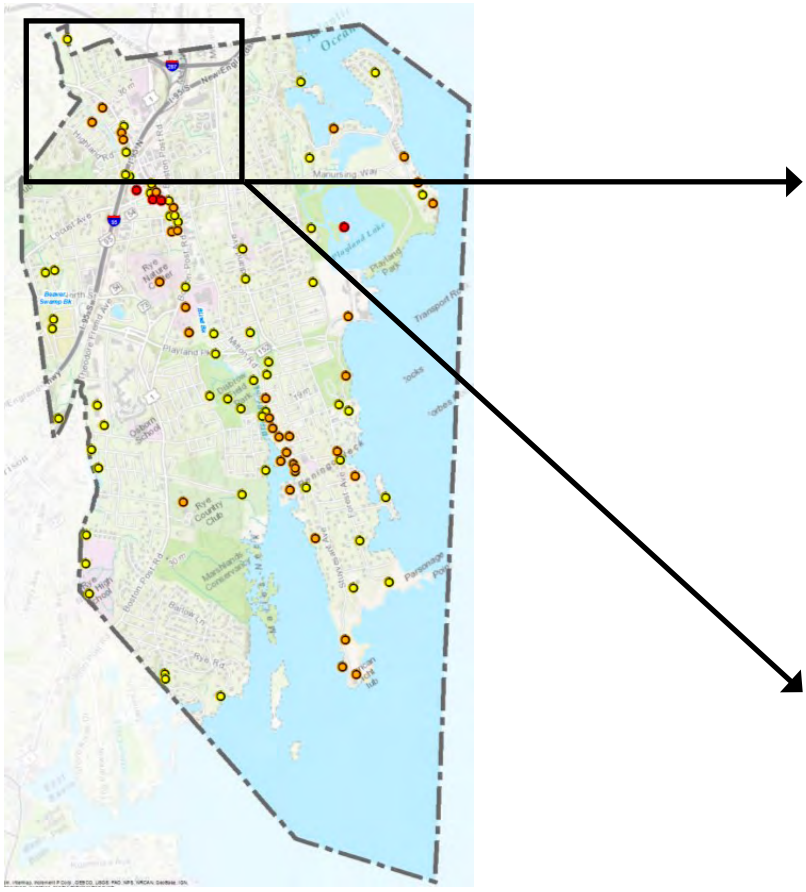
Occupied <= 2 ft. above BFE	Confluence of Two or More Streams	Flood Risk from Storm Water	Lack of Vegetated Stream Bank Buffer	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Yes	No	No	Yes	2	3	3.0	1	9
Yes	Yes	Yes	Yes	2	3	3.0	1	9
Yes	Yes	No	No	2	3	3.0	1	9
Yes	Yes	No	No	2	3	3.0	1	9
Yes	Yes	No	No	2	3	3.0	1	9
Yes	Yes	Yes	No	1.5	3	2.5	1	8
Yes	Yes	Yes	Yes	2	3	2.5	1	8
Yes	Yes	Yes	No	1.5	3	2.5	1	8
Yes	Yes	No	No	2	3	2.5	1	8
Yes	No	Yes	No	1	3	2.0	1	6
Yes	Yes	Yes	No	1.5	3	2.0	1	6
No	No	No	Yes	1	3	2.0	1	6
No	No	No	Yes	1	3	2.0	1	6
Yes	No	No	No	1	3	2.0	1	6
No	Yes	No	Yes	1.5	3	2.0	1	6

Mitigated Risk Assessment for Community Assets

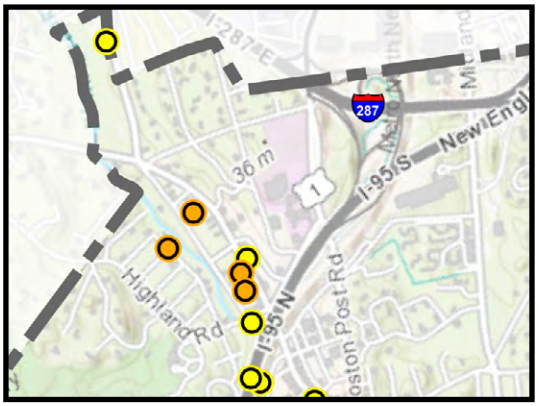
Table V-4 Modifications to the Sluice Gate at the Bowman Avenue Dam

Asset	Risk Area	Asset Class	Socially Vulnerable Populations	Critical Facility
Apartments off Wappanocca Avenue (multiple)	Extreme	Housing	No	No
Indian Village Neighborhood	Extreme	Housing	No	No
Wappanocca Neighborhood	Extreme	Housing	No	No
Medical Offices off Purchase Street (multiple)	Extreme	Health and Social Services	No	No
Verizon Facility	Moderate	Infrastructure Systems	No	Yes, FEMA
Ridge Street Homes	High	Housing	No	No
Metro North Parking Lot	High	Infrastructure Systems	No	No
Metro North Rail Lines	High	Infrastructure Systems	No	No
Interstate 95	High	Infrastructure Systems	No	No

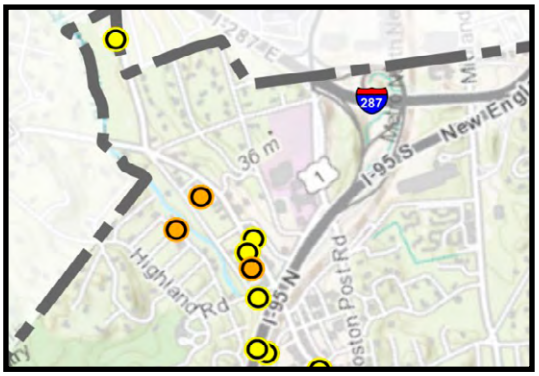
Key Map



Unmitigated (Existing Conditions)



Mitigated (After Project Implementation)



Community Value	Hazard Score	Exposure Score	Vulnerability Score	New Risk Score (Mitigated)	Previous Risk Score (Unmitigated)	Change in Risk Score*
High	3	4.0	3.5	42	48	6
High	3	4.0	3.5	42	48	6
High	3	4.0	3.5	42	48	6
High	3	4.0	1.5	18	24	6
High	3	1.5	1.5	7	9	2
High	3	3.0	1	9	9	0
High	3	3.0	1	9	9	0
High	3	2.0	1	6	6	0
High	3	2.0	1	6	6	0

Summary

This project proposes to optimize the operations of the sluice gate that is installed at the Bowman Avenue Dam. This project was evaluated as part of the *Hydrologic and Hydraulic Analysis Report* (2014). That analysis predicts that the project will lower the water surface elevation for the 100-year flood by 0.18 to 0.78 feet for assets between I-287 and I-95. As the ground surface of most of these assets is 4-6 feet below the existing BFE, reductions of this magnitude would not reduce the exposure of the assets for the 100-year flood as a stand-alone project.

Though the reduction in flood elevation still exposes the assets to significant flood risk, the reduction in flood depth may partially mitigate the vulnerability of the assets. Flood depth is considered by the USACE to be correlated to degree of damage, so a lessened flood depth may correlate to a lessened vulnerability. To reflect this, the vulnerability scores were lowered by 0.5 points for assets between I-287 and I-95 with an unmitigated vulnerability score greater than 1. Assets that already had a vulnerability score of 1 were not altered.

Important Notes

The assets listed in the table above are those that would be directly affected by the project. It is important to note that the effects were modeled only for the stretch of Blind Brook between I-287 and I-95. There may be positive risk reduction effects for assets outside of this area, but as it has not been modeled, those effects are as yet undetermined.

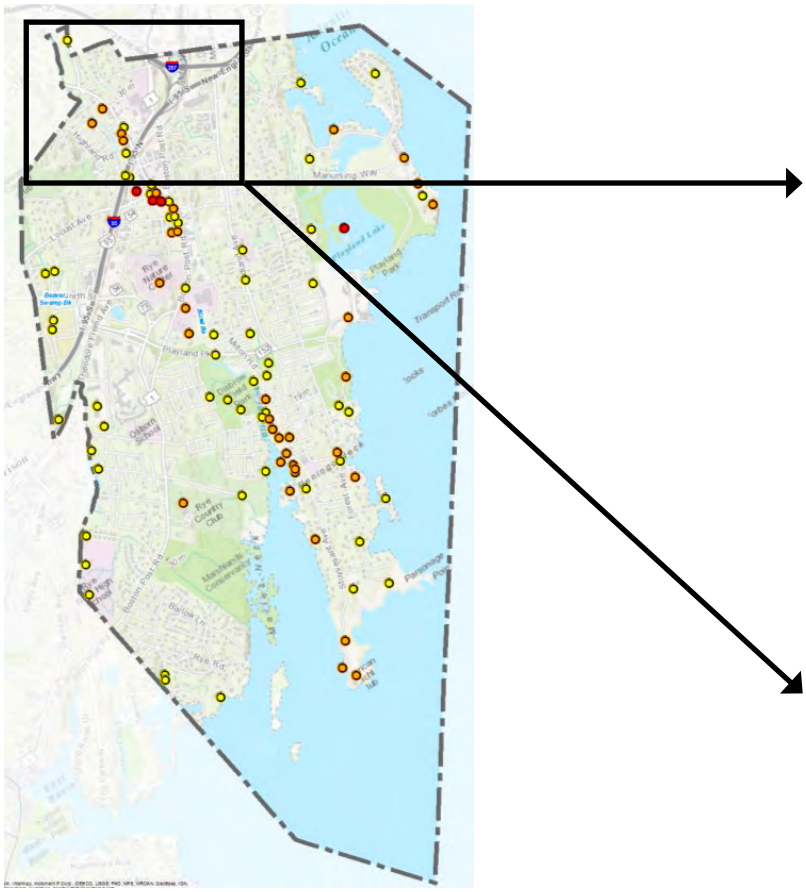
Any hazard, exposure, and/or vulnerability scores that would change as a result of project implementation are shown in dark gray shaded cells.

Though the water surface elevation (WSE) reductions predicted for the 100-year flood are not sufficient to reduce exposure, the projected WSE reductions for the 50-year storm are considerably larger. Projected WSE reductions for the 50-year recurrence interval range from 0.47 to 1.57 feet. As above, this could considerably improve the vulnerability of assets in the vicinity. Although this risk reduction analysis is based solely on the 100-year recurrence interval, improvements may also increase the resiliency of assets in the area for more frequent recurrence intervals.

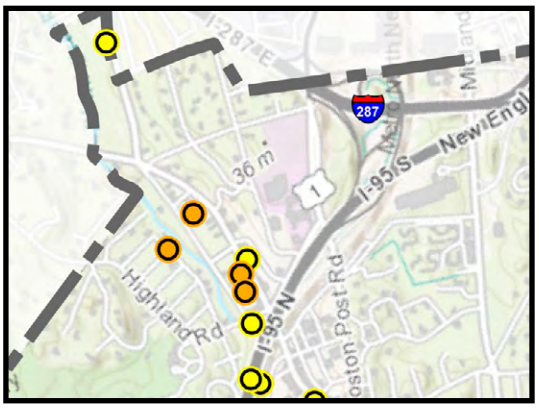
Table V-5 Stormwater Pond at Anderson Hill Road, SUNY Purchase

Asset	Risk Area	Asset Class	Socially Vulnerable Populations	Critical Facility
Apartments off Wappanocca Avenue (multiple)	Extreme	Housing	No	No
Indian Village Neighborhood	Extreme	Housing	No	No
Wappanocca Neighborhood	Extreme	Housing	No	No
Medical Offices off Purchase Street (multiple)	Extreme	Health and Social Services	No	No
Verizon Facility	Moderate	Infrastructure Systems	No	Yes, FEMA
Ridge Street Homes	High	Housing	No	No
Metro North Parking Lot	High	Infrastructure Systems	No	No
Metro North Rail Lines	High	Infrastructure Systems	No	No
Interstate 95	High	Infrastructure Systems	No	No

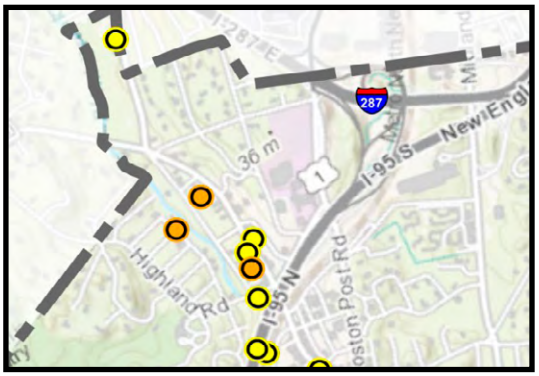
Key Map



Unmitigated (Existing Conditions)



Mitigated (After Project Implementation)



Community Value	Hazard Score	Exposure Score	Vulnerability Score	New Risk Score (Mitigated)	Previous Risk Score (Unmitigated)	Change in Risk Score*
High	3	4.0	3.5	42	48	6
High	3	4.0	3.5	42	48	6
High	3	4.0	3.5	42	48	6
High	3	4.0	1.5	18	24	6
High	3	1.5	1.5	7	9	2
High	3	3.0	1	9	9	0
High	3	3.0	1	9	9	0
High	3	2.0	1	6	6	0
High	3	2.0	1	6	6	0

Summary

This project proposes to reduce the volume of water in the downstream reaches of Blind Brook during flood events by installing two detention ponds on the SUNY Purchase campus. This project was evaluated as part of the *Hydrologic and Hydraulic Analysis Report* (2014). That analysis predicts that the project will lower the water surface elevation for the 100-year flood by 0.36 to 1.31 feet for assets between I-287 and I-95. As the ground surface of most of these assets is 4-6 feet below the existing BFE, reductions of this magnitude would not reduce the exposure of the assets for the 100-year flood as a stand-alone project.

Though the reduction in flood elevation still exposes the assets to significant flood risk, the reduction in flood depth may partially mitigate the vulnerability of the assets. Flood depth is considered by the USACE to be correlated to degree of damage, so a lessened flood depth may correlate to a lessened vulnerability. To reflect this, the vulnerability scores were lowered by 0.5 points for assets between I-287 and I-95 with an unmitigated vulnerability score greater than 1. Assets that already had a vulnerability score of 1 were not altered.

Important Notes

The assets listed in the table above are those that would be directly affected by the project. It is important to note that the effects were modeled only for the stretch of Blind Brook between I-287 and I-95. There may be positive risk reduction effects for assets outside of this area, but as it has not been modeled, those effects are as yet undetermined.

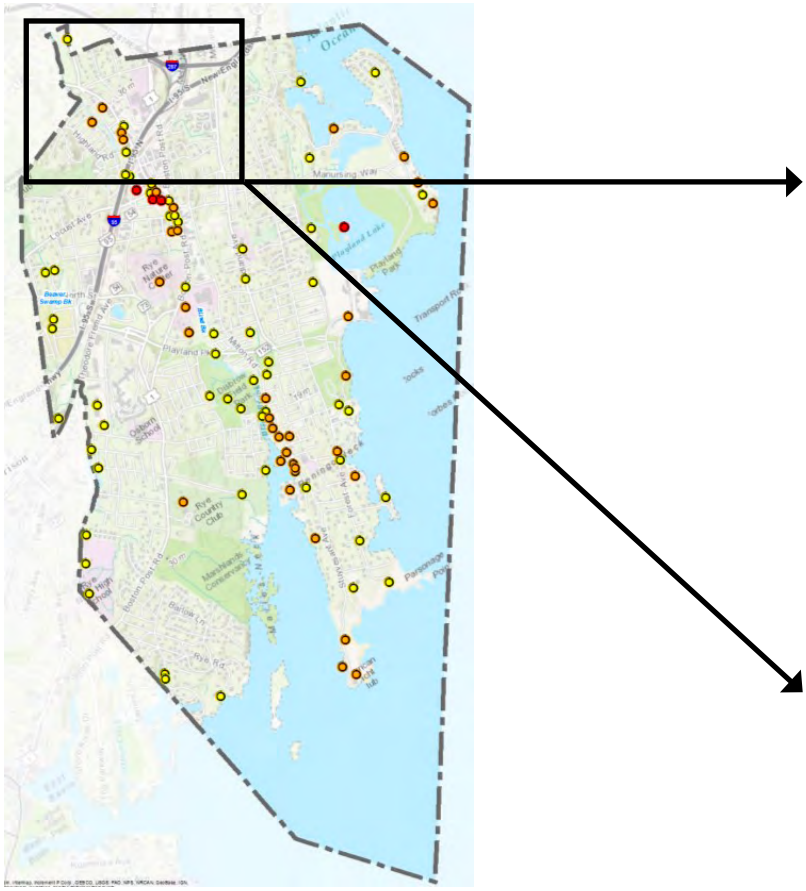
Any hazard, exposure, and/or vulnerability scores that would change as a result of project implementation are shown in dark gray shaded cells.

Though the water surface elevation (WSE) reductions predicted for the 100-year flood are not sufficient to reduce exposure, the projected WSE reductions for the 10- and 50-year storms are larger. Projected WSE reductions for the 10-year recurrence interval range from 0.91 to 1.7 feet, and for the 50-year recurrence interval range from 0.52 to 1.51 feet. As above, this could considerably improve the vulnerability of assets in the vicinity. Although this risk reduction analysis is based solely on the 100-year recurrence interval, improvements may also increase the resiliency of assets in the area for more frequent recurrence intervals.

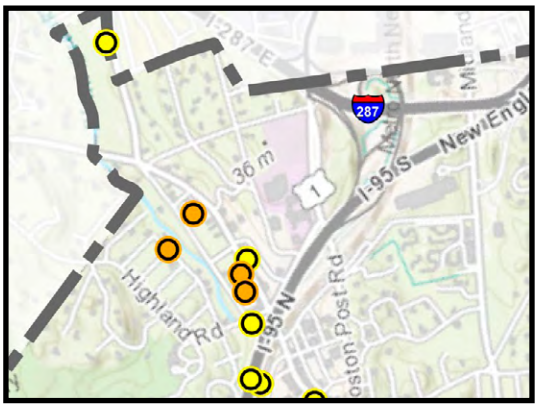
Table V-6 Detention Basins at Westchester County Airport

Asset	Risk Area	Asset Class	Socially Vulnerable Populations	Critical Facility
Apartments off Wappanocca Avenue (multiple)	Extreme	Housing	No	No
Indian Village Neighborhood	Extreme	Housing	No	No
Wappanocca Neighborhood	Extreme	Housing	No	No
Medical Offices off Purchase Street (multiple)	Extreme	Health and Social Services	No	No
Verizon Facility	Moderate	Infrastructure Systems	No	Yes, FEMA
Ridge Street Homes	High	Housing	No	No
Metro North Parking Lot	High	Infrastructure Systems	No	No
Metro North Rail Lines	High	Infrastructure Systems	No	No
Interstate 95	High	Infrastructure Systems	No	No

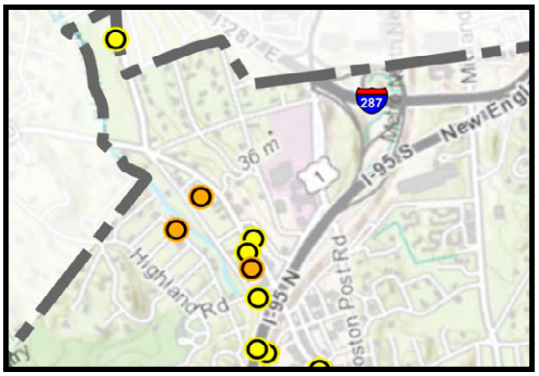
Key Map



Unmitigated (Existing Conditions)



Mitigated (After Project Implementation)



Community Value	Hazard Score	Exposure Score	Vulnerability Score	New Risk Score (Mitigated)	Previous Risk Score (Unmitigated)	Change in Risk Score*
High	3	4.0	3.5	42	48	6
High	3	4.0	3.5	42	48	6
High	3	4.0	3.5	42	48	6
High	3	4.0	1.5	18	24	6
High	3	1.5	1.5	7	9	2
High	3	3.0	1	9	9	0
High	3	3.0	1	9	9	0
High	3	2.0	1	6	6	0
High	3	2.0	1	6	6	0

Summary

This project proposes to reduce the volume of water in the downstream reaches of Blind Brook during flood events by expanding the detention ponds at the Westchester County Airport. This project was evaluated as part of the *Hydrologic and Hydraulic Analysis Report* (2014). That analysis predicts that the project will lower the water surface elevation for the 100-year flood by 0.06 to 0.22 feet for assets between I-287 and I-95. As the ground surface of most of these assets is 4-6 feet below the existing BFE, reductions of this magnitude would not reduce the exposure of the assets for the 100-year flood. Any flood or damage mitigation effects from this as a stand-alone project are likely to be minor.

Though the reduction in flood elevation still exposes the assets to significant flood risk, the reduction in flood depth may partially mitigate the vulnerability of the assets. Flood depth is considered by the USACE to be correlated to degree of damage, so a lessened flood depth may correlate to a lessened vulnerability. To reflect this, the vulnerability scores were lowered by 0.5 points for assets between I-287 and I-95 with an unmitigated vulnerability score greater than 1. Assets that already had a vulnerability score of 1 were not altered.

Important Notes

The assets listed in the table above are those that would be directly affected by the project. It is important to note that the effects were modeled only for the stretch of Blind Brook between I-287 and I-95. There may be positive risk reduction effects for assets outside of this area, but as it has not been modeled, those effects are as yet undetermined.

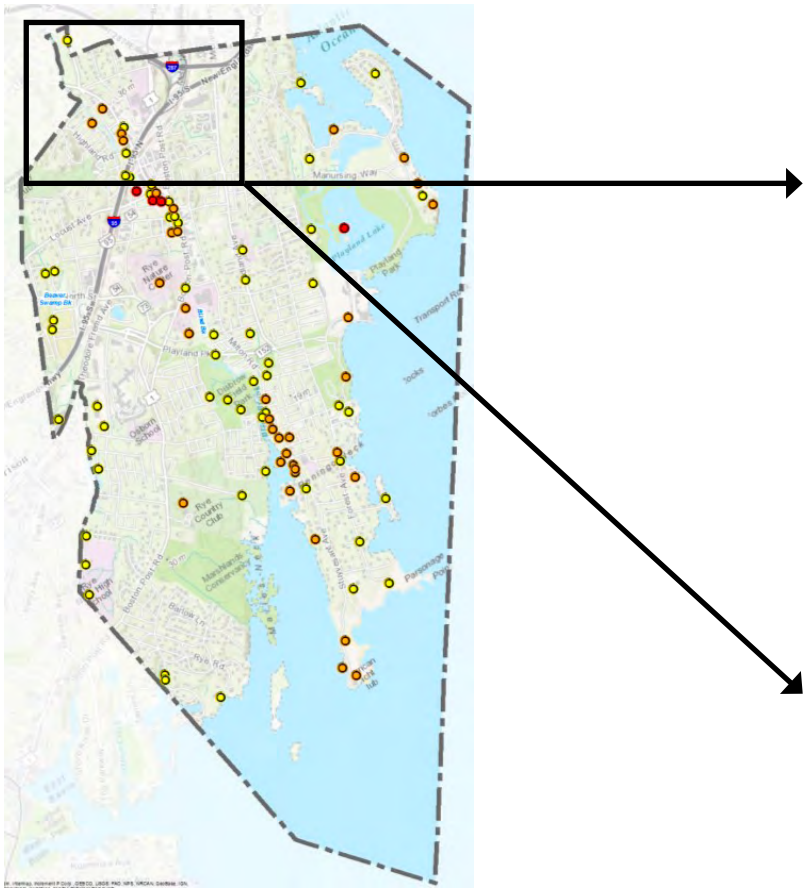
Any hazard, exposure, and/or vulnerability scores that would change as a result of project implementation are shown in dark gray shaded cells.

There are also projected water surface elevation (WSE) reductions for the 2-, 10-, and 50-year storms. Projected WSE reductions for the 2-year recurrence interval are roughly 0.03 feet, for the 10-year recurrence interval range from 0.13 to .26 feet, and for the 50-year recurrence interval range from 0.08 to 0.23 feet. As above, this could potentially improve the vulnerability of assets in the vicinity, though the improvements would likely be minor. Although this risk reduction analysis is based solely on the 100-year recurrence interval, improvements may also increase the resiliency of assets in the area for more frequent recurrence intervals, though increases in resiliency for all recurrence intervals are estimated to be minor.

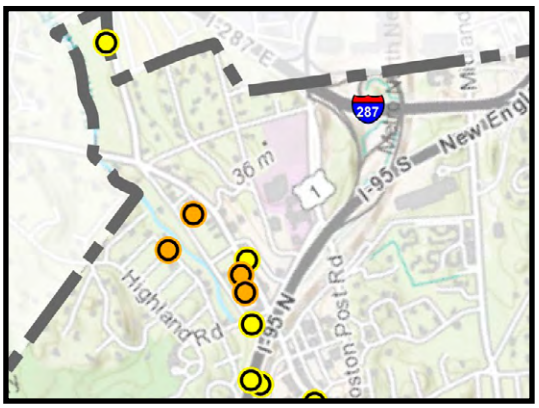
Table V-7 Bowman Avenue Dam Upper Pond Resizing

Asset	Risk Area	Asset Class	Socially Vulnerable Populations	Critical Facility
Apartments off Wappanocca Avenue (multiple)	Extreme	Housing	No	No
Indian Village Neighborhood	Extreme	Housing	No	No
Wappanocca Neighborhood	Extreme	Housing	No	No
Medical Offices off Purchase Street (multiple)	Extreme	Health and Social Services	No	No
Verizon Facility	Moderate	Infrastructure Systems	No	Yes, FEMA
Ridge Street Homes	High	Housing	No	No
Metro North Parking Lot	High	Infrastructure Systems	No	No
Metro North Rail Lines	High	Infrastructure Systems	No	No
Interstate 95	High	Infrastructure Systems	No	No

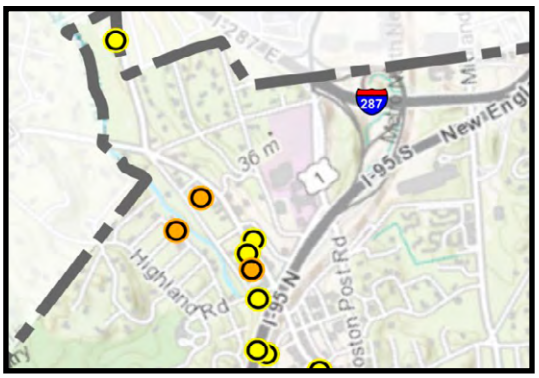
Key Map



Unmitigated (Existing Conditions)



Mitigated (After Project Implementation)



Community Value	Hazard Score	Exposure Score	Vulnerability Score	New Risk Score (Mitigated)	Previous Risk Score (Unmitigated)	Change in Risk Score*
High	3	4.0	3.5	42	48	6
High	3	4.0	3.5	42	48	6
High	3	4.0	3.5	42	48	6
High	3	4.0	1.5	18	24	6
High	3	1.5	1.5	7	9	2
High	3	3.0	1	9	9	0
High	3	3.0	1	9	9	0
High	3	2.0	1	6	6	0
High	3	2.0	1	6	6	0

Summary

This project proposes to enlarge the upper pond of the Bowman Avenue Dam site to improve its retention volume. This project was evaluated as part of the *Hydrologic and Hydraulic Analysis Report* (2014). That analysis predicts that the project will lower the water surface elevation for the 100-year flood by 0.10 to 0.63 feet for assets between I-287 and I-95. As the ground surface of most of these assets is 4-6 feet below the existing BFE, reductions of this magnitude would not reduce the exposure of the assets for the 100-year flood as a stand-alone project.

Though the reduction in flood elevation still exposes the assets to significant flood risk, the reduction in flood depth may partially mitigate the vulnerability of the assets. Flood depth is considered by the USACE to be correlated to degree of damage, so a lessened flood depth may correlate to a lessened vulnerability. To reflect this, the vulnerability scores were lowered by 0.5 points for assets between I-287 and I-95 with an unmitigated vulnerability score greater than 1. Assets that already had a vulnerability score of 1 were not altered.

Important Notes

The assets listed in the table above are those that would be directly affected by the project. It is important to note that the effects were modeled only for the stretch of Blind Brook between I-287 and I-95. There may be positive risk reduction effects for assets outside of this area, but as it has not been modeled, those effects are as yet undetermined.

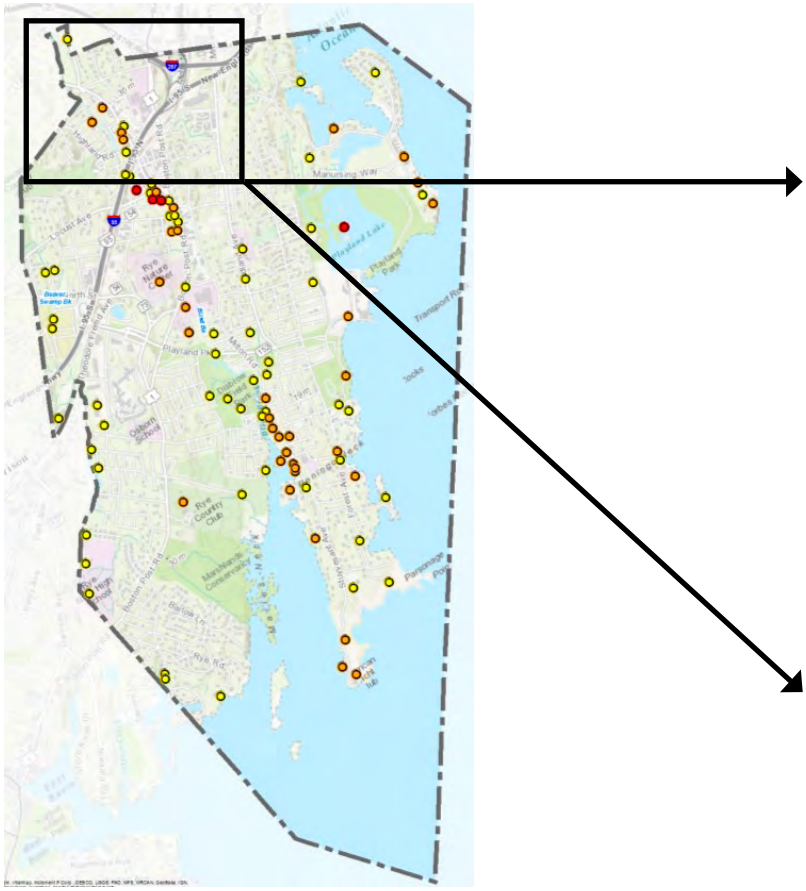
Any hazard, exposure, and/or vulnerability scores that would change as a result of project implementation are shown in dark gray shaded cells.

Though the water surface elevation (WSE) reductions predicted for the 100-year flood are not sufficient to reduce exposure, the projected WSE reductions for the 50-year storm are considerably larger. Projected WSE reductions for the 50-year recurrence interval range from 0.33 to 1.30 feet. As above, this could considerably improve the vulnerability of assets in the vicinity. Although this risk reduction analysis is based solely on the 100-year recurrence interval, improvements may also increase the resiliency of assets in the area for more frequent recurrence intervals.

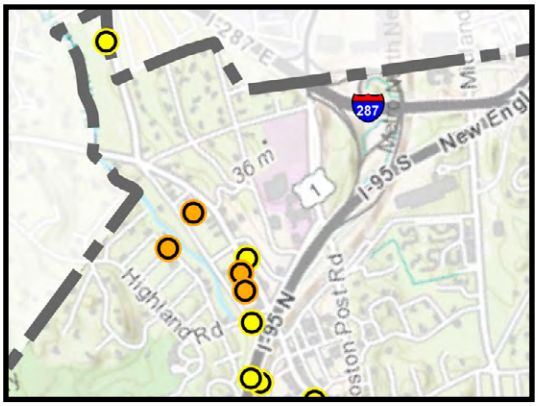
Table V-8 Bowman Avenue Dam Lower Pond Resizing

Asset	Risk Area	Asset Class	Socially Vulnerable Populations	Critical Facility
Apartments off Wappanocca Avenue (multiple)	Extreme	Housing	No	No
Indian Village Neighborhood	Extreme	Housing	No	No
Wappanocca Neighborhood	Extreme	Housing	No	No
Medical Offices off Purchase Street (multiple)	Extreme	Health and Social Services	No	No
Verizon Facility	Moderate	Infrastructure Systems	No	Yes, FEMA
Ridge Street Homes	High	Housing	No	No
Metro North Parking Lot	High	Infrastructure Systems	No	No
Metro North Rail Lines	High	Infrastructure Systems	No	No
Interstate 95	High	Infrastructure Systems	No	No

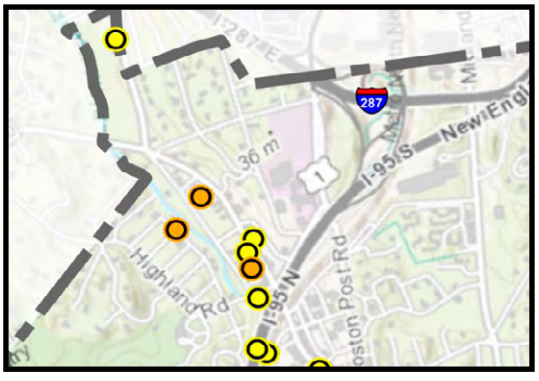
Key Map



Unmitigated (Existing Conditions)



Mitigated (After Project Implementation)



Community Value	Hazard Score	Exposure Score	Vulnerability Score	New Risk Score (Mitigated)	Previous Risk Score (Unmitigated)	Change in Risk Score*
High	3	4.0	3.5	42	48	6
High	3	4.0	3.5	42	48	6
High	3	4.0	3.5	42	48	6
High	3	4.0	1.5	18	24	6
High	3	1.5	1.5	7	9	2
High	3	3.0	1	9	9	0
High	3	3.0	1	9	9	0
High	3	2.0	1	6	6	0
High	3	2.0	1	6	6	0

Summary

This project proposes to enlarge the lower pond of the Bowman Avenue Dam site to improve its retention volume. This project was evaluated as part of the *Hydrologic and Hydraulic Analysis Report* (2014). That analysis predicts that the project will lower the water surface elevation for the 100-year flood by 0.33 to 1.24 feet for assets between I-287 and Highland Road. The report predicts a slight increase in WSE for assets just upstream of I-95. As the ground surface of most of these assets is 4-6 feet below the existing BFE, reductions of this magnitude would not reduce the exposure of the assets for the 100-year flood as a stand-alone project.

Though the reduction in flood elevation still exposes the assets to significant flood risk, the reduction in flood depth may partially mitigate the vulnerability of the assets. Flood depth is considered by the USACE to be correlated to degree of damage, so a lessened flood depth may correlate to a lessened vulnerability. To reflect this, the vulnerability scores were lowered by 0.5 points for assets between I-287 and I-95 with an unmitigated vulnerability score greater than 1. Assets that already had a vulnerability score of 1 were not altered.

Important Notes

The assets listed in the table above are those that would be directly affected by the project. It is important to note that the effects were modeled only for the stretch of Blind Brook between I-287 and I-95. There may be positive risk reduction effects for assets outside of this area, but as it has not been modeled, those effects are as yet undetermined.

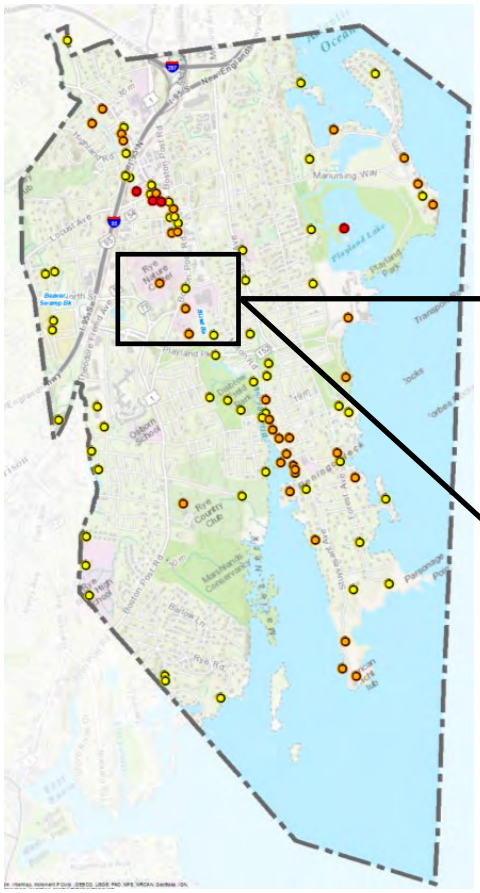
Any hazard, exposure, and/or vulnerability scores that would change as a result of project implementation are shown in dark gray shaded cells.

Though the water surface elevation (WSE) reductions predicted for the 100-year flood are not sufficient to reduce exposure, the projected WSE reductions for the 10- and 50-year storms are considerably larger. Projected WSE reductions for the 50-year recurrence interval range from 1.87 to 3.71 feet. For the 10-year recurrence interval, projected WSE reductions range from 2.63 to 3.84 feet. As above, this could considerably improve the vulnerability of assets in the vicinity. Although this risk reduction analysis is based solely on the 100-year recurrence interval, improvements may also increase the resiliency of assets in the area for more frequent recurrence intervals.

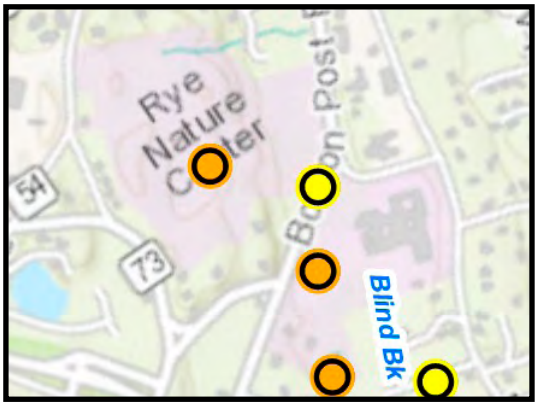
Table V-9 New Entrance to Rye Nature Center

Asset	Risk Area	Asset Class	Socially Vulnerable Populations	Critical Facility
Rye Nature Center	Moderate	Natural and Cultural Resources	No	No

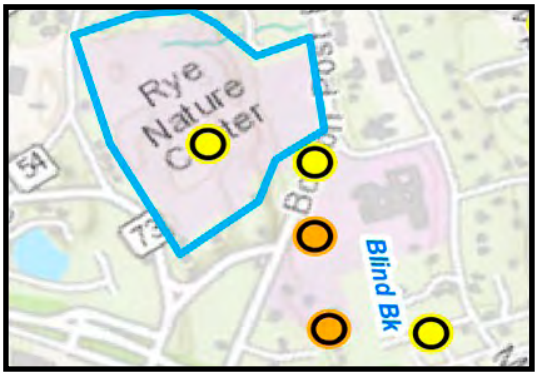
Key Map



Unmitigated (Existing Conditions)



Mitigated (After Project Implementation)



Community Value	Hazard Score	Exposure Score	Vulnerability Score	New Risk Score (Mitigated)	Previous Risk Score (Unmitigated)	Change in Risk Score*
Low	3	3.0	1	9	27	18

Summary

This project offers significant risk reduction potential for the Rye Nature Center. The Nature Center is located almost entirely outside of the flood zone, with the exception of its access road. The existing access road crosses Blind Brook, and is subject to frequent and sustained flooding, which eliminates access to the Nature Center.

This project proposes to replace that access road. The new access road would be located outside of the flood zone and would not require crossing Blind Brook. By making this change, the vulnerability of the Nature Center would be reduced, as it would be able to function during flood events. Its risk area is also improved, as the access road was the primary element located within the extreme flood risk area.

To reflect these improvements, the vulnerability score of the asset was reduced by 1 point. The risk area was changed from “Extreme” to “Moderate”, which results in a lower exposure score.

Important Notes

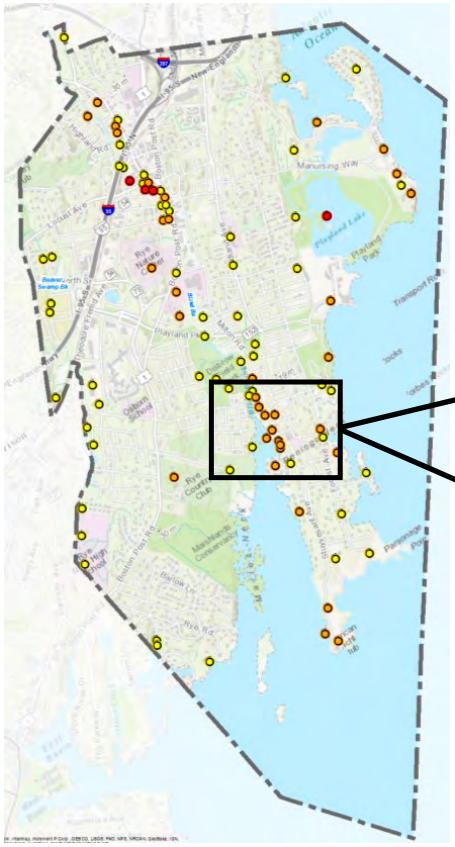
The assets listed in the table above are those that would be directly affected by the project. Any hazard, exposure, and/or vulnerability scores that would change as a result of project implementation are shown in dark gray shaded cells.

Further engineering analysis is necessary in order to design the new entrance for the Nature Center. Detailed analysis must be performed prior to construction to ensure that there are no detrimental environmental consequences of the proposed entrance.

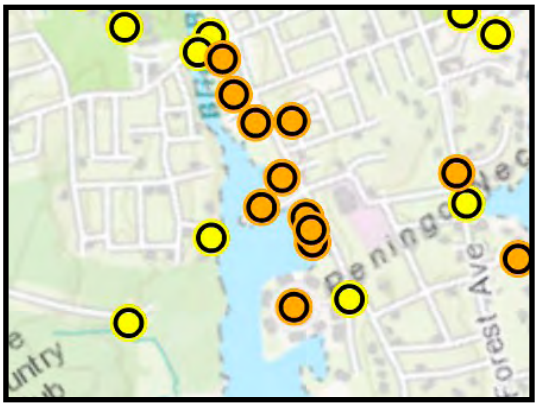
Table V-10 Improved Milton Road Drainage to Harbor

Asset	Risk Area	Asset Class	Socially Vulnerable Populations	Critical Facility
Milton Harbor House Community	Extreme	Housing	Yes	No
Rye City Boat Basin	Extreme	Natural and Cultural Resources	No	No
Milton Road / Garden Drive Homes	Extreme	Housing	No	No
Milton Point Fire House	Extreme	Health and Social Services	No	No
Row America Rye	Extreme	Economic	No	No
Rye Marina	Extreme	Natural and Culture Resources	No	No
Rye Fish and Game Club	Extreme	Natural and Cultural Resources	No	No
Rye Meeting House / Bird Homestead	Extreme	Natural and Cultural Resources	No	No
Stuyvesant Avenue Pump Station	High	Infrastructure Systems	No	Yes, FEMA

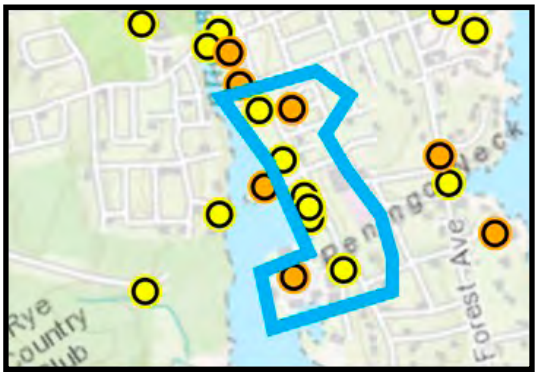
Key Map



Unmitigated (Existing Conditions)



Mitigated (After Project Implementation)



Community Value	Hazard Score	Exposure Score	Vulnerability Score	New Risk Score (Mitigated)	Previous Risk Score (Unmitigated)	Change in Risk Score*
High	3	3.5	4	42	48	6
Low	3	3.5	4	42	48	6
High	3	3.5	3	32	36	5
High	3	3.5	2	21	24	3
Low	3	3.5	2	21	24	3
Low	3	3.5	2	21	24	3
Low	3	3.5	2	21	24	3
Low	3	3.5	2	21	24	3
High	3	2.5	1	8	9	2

Summary

This project proposes to improve the stormwater drainage system along Milton Road north of the Milton Harbor House Community. Though the project requires further study, it is likely that the recommended measures would be similar to the improvements made in 2013 on the south side of Milton Harbor House. These improvements included installation of a tide gate on the stormwater outfall pipe to prevent backflow at high tide and expansion of the drainage capacity of the stormwater system.

By improving the stormwater collection and discharge system, this project would reduce the exposure to the assets along Milton Road north of Milton Harbor House. To reflect this, the response for the stormwater discharge question for these assets was changed from "Yes" to "No," which reduces the exposure score by 0.5 points for each asset.

Important Notes

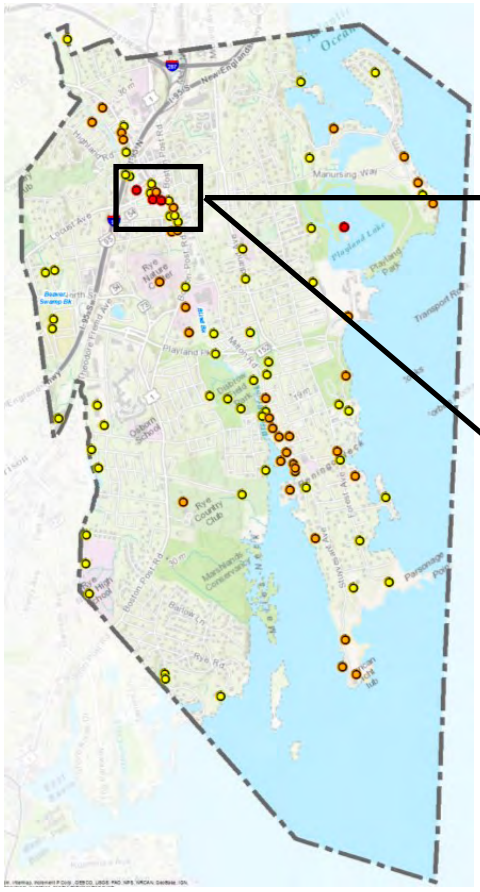
The assets listed in the table above are those that would be directly affected by the project listed above. Any hazard, exposure, and/or vulnerability scores that would change as a result of project implementation are shown in dark gray shaded cells.

This preliminary analysis has not incorporated any engineering evaluation of proposed measures or benefits. Further, detailed engineering study is necessary prior to implementation of project.

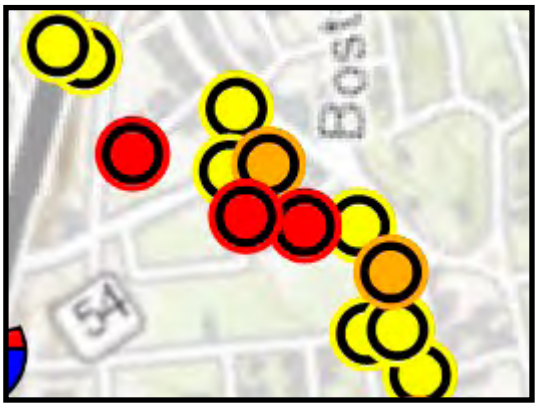
Table V-12 Floodproof the Locust Avenue Firehouse

Asset	Risk Area	Asset Class	Socially Vulnerable Populations	Critical Facility
Locust Avenue Fire House	Extreme	Health and Social Services	No	Yes, FEMA

Key Map



Unmitigated (Existing Conditions)



Mitigated (After Project Implementation)

Community Value	Hazard Score	Exposure Score	Vulnerability Score	New Risk Score (Mitigated)	Previous Risk Score (Unmitigated)	Change in Risk Score*
High	3	4.5	1	14	27	14

Summary

This project would protect the firehouse against future flooding and reduce the degree of damage sustained by the asset during future storm events. The project could include structural modifications to the firehouse to improve its ability to withstand flooding and reduce intrusion of floodwater into the facilities. These improvements would be paired with an existing operational strategy that moves key equipment to alternate locations outside of flood zones in advance of storm events. This enables the fire department to continue operations during storm events.

As this project improves the asset's ability to withstand and recover from flooding, as well as to operate during storm events, it improves the asset's vulnerability. To reflect this, the vulnerability score for the asset was decreased by 1.

Important Notes

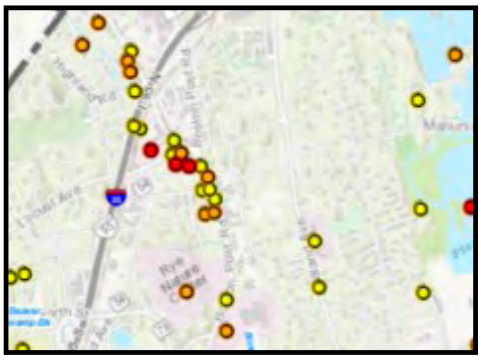
The asset listed in the table above would be directly affected by the project. Any hazard, exposure, and/or vulnerability scores that would change as a result of project implementation are shown in dark gray shaded cells.

This project would provide indirect benefits to many other assets and to citizens of Rye by enabling the fire department to focus on critical emergency response operations, rather than its own recovery, during and after storm events.

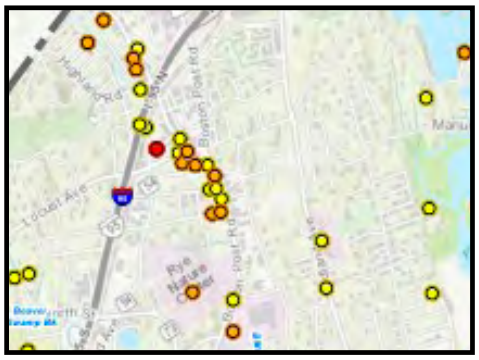
Table V-13 Improve Critical Nonprofit Facilities

Asset	Risk Area	Asset Class	Socially Vulnerable Populations	Critical Facility
Rye YMCA Community Center	Extreme	Health and Social Services	Yes	No
Rye Free Reading Room	Extreme	Natural and Cultural Resources	Yes	Yes, FEMA

Unmitigated (Existing Conditions)



Mitigated (After Project Implementation)



Community Value	Hazard Score	Exposure Score	Vulnerability Score	New Risk Score (Mitigated)	Previous Risk Score (Unmitigated)	Change in Risk Score*
High	3	4.5	3	41	54	14
Medium	3	4.5	3	41	54	14

Summary

This project proposes to improve the resiliency of critical nonprofit assets located in the central business district by floodproofing the facilities against flooding. This project would reduce vulnerability of assets by enhancing their ability to withstand flooding and enabling them to return to service more quickly in the wake of a storm.

To reflect this, the vulnerability scores were lowered by 1 point.

Assets included in this project are those identified nonprofits that are located within the flood zone and within the central business district.

Important Notes

The assets listed in the table above are those that would be directly affected by the project. Any hazard, exposure, and/or vulnerability scores that would change as a result of project implementation are shown in dark gray shaded cells.

This project would provide indirect benefits to citizens of Rye by enabling key community functions to continue during a storm or to return to service more quickly after a storm.

E. End Notes

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Cover

Milton Harbor (Holly Kennedy)

Rye Town Park

Executive Summary

Blind Brook

Blind Brook

Section I

Rye Boardwalk

Purchase Street in Rye

Section II

First Public Engagement Event in Rye

Milton Harbor Marina

Section III

Impassable roads at Manursing Island (Sara Goddard)

Rye Town Park

Section IV

Rye Nature Center

Sluice Gate at the Bowman Avenue Dam

Section V

Rye Boardwalk

Purchase Street in Rye

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F. Glossary

BFE: Base Flood Elevation

CBA: Cost Benefit Analysis

ConEd: Con Edison of New York

CDBG-DR: Community Development Block Grant - Disaster Recovery

CRS: Community Rating System

CZM: Coastal Zone Management

FAA: Federal Aviation Administration

FEMA: Federal Emergency Management Agency

FHWA: Federal Highway Administration

GOSR: Governor's Office of Storm Recovery

HUD: U.S. Department of Housing and Urban Development

MTA: Metropolitan Transportation Authority

NFIP: National Flood Insurance Program

NYRCR: NY Rising Community Reconstruction

NYS: New York State

NYS CMP: New York State Coastal Management Plan

NYS DEC: New York State Department of Environmental Conservation

NYS DOS: New York State Department of State

NYS DOT: New York State Department of Transportation

RSF: Recovery Support Function

SFHA: Special Flood Hazard Area

USACE: U.S. Army Corps of Engineers

WSE: Water Surface Elevation