Resilient Neighborhoods

EAST VILLAGE LOWER EAST SIDE TWO BRIDGES

NYC PLANNING

This study was funded through the *U.S. Department of Housing and Urban Development (HUD)* Community Development Block Grant Disaster Recovery Program (CDBG-DR), as part of the *New York City Department of City Planning's* Resilient Neighborhoods Initiative.

Mid-rise and tower residential buildings, East 10th Street between Avenues B and C

Resilient Neighborhoods

EAST VILLAGE
LOWER EAST SIDE
TWO BRIDGES

THE CITY OF NEW YORK
MAYOR BILL DE BLASIO

DEPARTMENT OF CITY PLANNING
CARL WEISBROD, DIRECTOR

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www.nyc.gov/resilientneighborhoods

FOREWORD

The East Village, Lower East Side and Two Bridges are among Manhattan's most socioeconomically and culturally diverse neighborhoods. Frontiers of New York's affordable housing developments beginning in the 1930s, these waterfront communities have welcomed generations of immigrant and low-income families. But because the neighborhoods' affordable housing developments are largely concentrated in low-lying areas near the waterfront, thousands of residents living within these residential towers and tenement-style mid-rise buildings are vulnerable to coastal storms.

Hurricane Sandy clearly demonstrated both the hazards facing New York City's coastal communities and their ability to recover and better prepare for the next storm. Since Sandy, the Department of City Planning (DCP) has been working with other agencies to further strengthen the resiliency of these and other neighborhoods throughout the city. DCP's work includes a citywide flood resiliency zoning text amendment that changed zoning in the floodplain to make it easier for property owners to retrofit their buildings, and guidelines, such as *Retrofitting Buildings for Flood Risk* and *Urban Waterfront Adaptive Strategies*, that help designers, planners, and residents plan for and adapt to flood risk.

This report is part of Resilient Neighborhoods, a local initiative funded by the U.S. Department of Housing and Urban Development, through which DCP is working with communities and various City agencies to enhance neighborhood resiliency by identifying local needs and opportunities for regulatory changes and targeted investments. The focus here is on the challenges of floodproofing multifamily residential buildings and improving regulatory and programmatic tools that could help protect them and reduce risk to residents. Helping the existing and future stock of affordable housing to withstand storms and flooding, and informing building owners about cost-effective strategies to mitigate flood risks, will support the City's initiatives to promote economically diverse neighborhoods through the creation and preservation of affordable housing.

This report is the culmination of two years of working with community organizations, local building owners, and residents in the East Village, Lower East Side and Two Bridges. The issues facing these neighborhoods are intertwined with a range of laws and regulations at various levels of government. This study is the beginning of the conversation and a commitment to continuing to work alongside City, State and Federal partners as well as the local community to support the ongoing vibrancy and resiliency of the East Village, Lower East Side and Two Bridges.

Carl Weisbrod, Director, Department of City Planning

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EXECUTIVE SUMMARY

In October 2012, Hurricane Sandy brought unprecedented flooding to the East Village, Lower East Side and Two Bridges neighborhoods in Lower Manhattan. Storm surges flooded the mechanical and electrical systems of many buildings, causing damage and financial losses and greatly disrupting the lives of tens of thousands of residents and numerous businesses.

Through the Resilient Neighborhoods initiative, the Department of City Planning (DCP) has been working with local stakeholders and agency partners to identify strategies to support the ongoing vitality and resiliency of communities in New York City's floodplain. In the East Village, Lower East Side and Two Bridges study area, DCP is focusing on the challenges of enabling multifamily buildings, many of which provide affordable housing to a range of low- and moderate-income residents, to become more flood-resilient. A large majority of the building stock was built well before current floodplain construction standards were established in 1983. In addition to the challenges posed by the costliness and complexity of full-compliance with these standards, there are further challenges to improving resiliency while preserving affordability because of myriad Federal, State and City regulations that affect multifamily buildings in the floodplain, especially those with affordable and rent-regulated dwelling units.

These challenges exist not just in the East Village, Lower East Side and Two Bridges neighborhoods, but across the city's floodplain and throughout the region. Therefore, broad, coordinated action across al levels of government is needed that recognizes unique challenges and opportunities to mitigating flood risk in each community.

Three primary goals have guided the East Village, Lower East Side and Two Bridges Resilient Neighborhoods study:

Reduce flood risk

Promote cost-effective and feasible options for retrofitting multifamily buildings to minimize flood risk in the near-term.

Plan for adaptation over time

Though investments in coastal protection may reduce the chance of future flooding, rising sea levels and ongoing flood risk from extreme events will require an improved regulatory framework to support community adaptation.

Foster resilient, vibrant neighborhoods

Support the continued affordability of housing and support social resiliency.

Through case studies of representative building types, DCP and partner agencies have identified a selection of retrofitting strategies that reduce risk, are cost-effective, and can be feasible for multifamily buildings. Implementation of many of these strategies is hampered by a range of financial and regulatory constraints. Therefore this report outlines a series of potential changes to City, State and Federal regulations and tools that would support both resilient retrofits for multifamily buildings and the preservation of affordable housing.

The report's key recommendations focus on:

Federal Reform

- Expanding the range of available feasible, federally-approved floodproofing strategies and National Flood Insurance Program (NFIP) premium credits
- Urging the Federal Emergency Management Agency (FEMA) to develop flood insurance products that better address needs of multifamily buildings

Financing and Implementation Strategies

- Exploring new financial assistance and incentive programs at multiple levels of government to assist property owners to mitigate flood risk, including incorporating floodproofing opportunities into affordable housing preservation finance programs
- Encouraging floodproofing financing programs be structured to work with existing energy efficiency programs to enable property owners to combine measures in improvement projects

Enabling Retrofits through Zoning

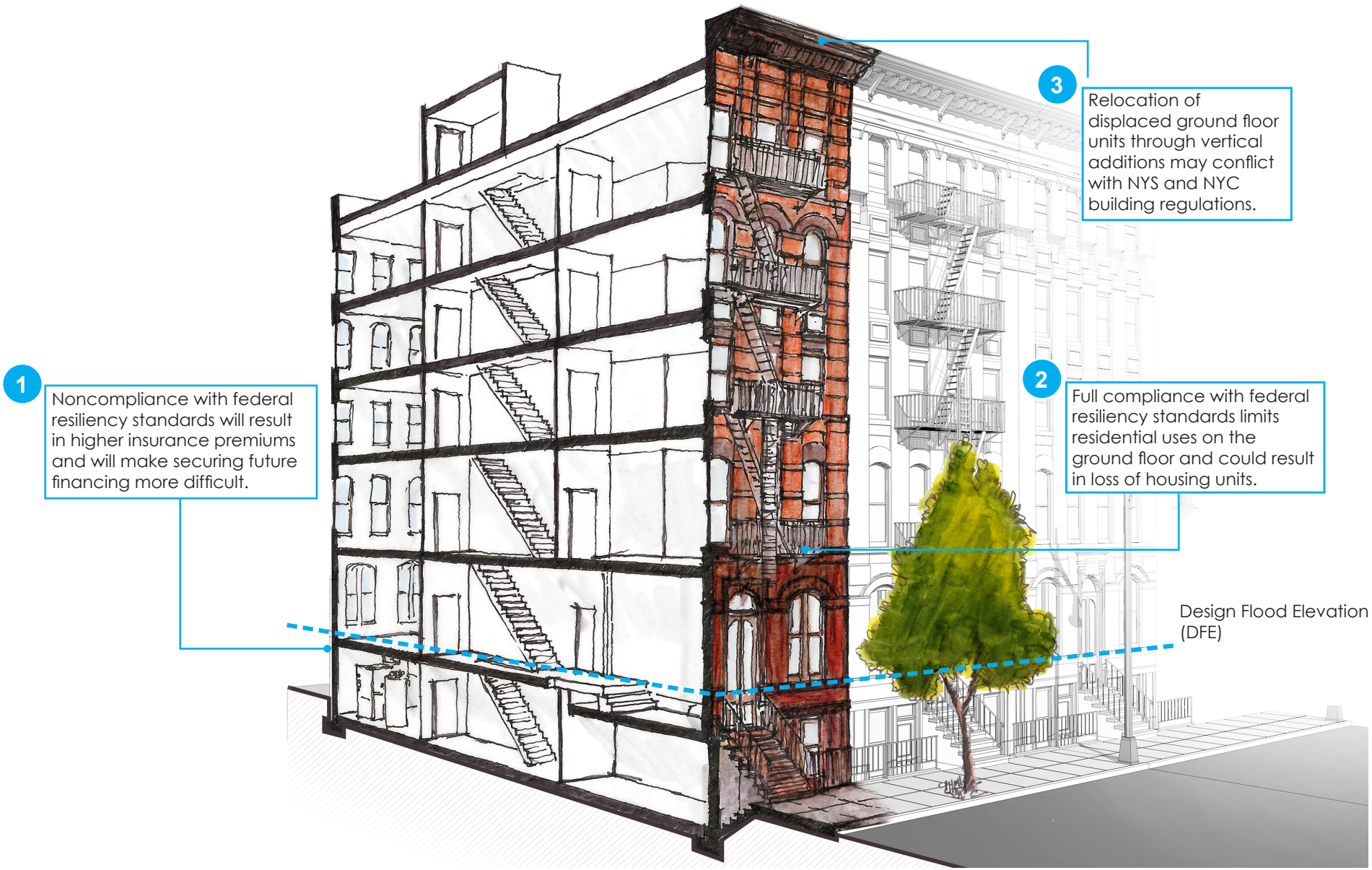
- Reviewing and updating City zoning regulations to further support floodproofing of both new and existing buildings

Coordination and Outreach

- Coordinating among Federal, State and City agencies to develop educational guidance on flood risk, flood insurance, and flood mitigation strategies for multifamily buildings

Based on this analysis, the City will continue to work with communities, including the East Village, Lower East Side and Two Bridges, as well as State and Federal partners, to align policies and regulations to ensure that resiliency goals can be met while maintaining equity, livability, and safety for residents.

The Challenges of Floodproofing Multifamily Buildings



INTRODUCTION

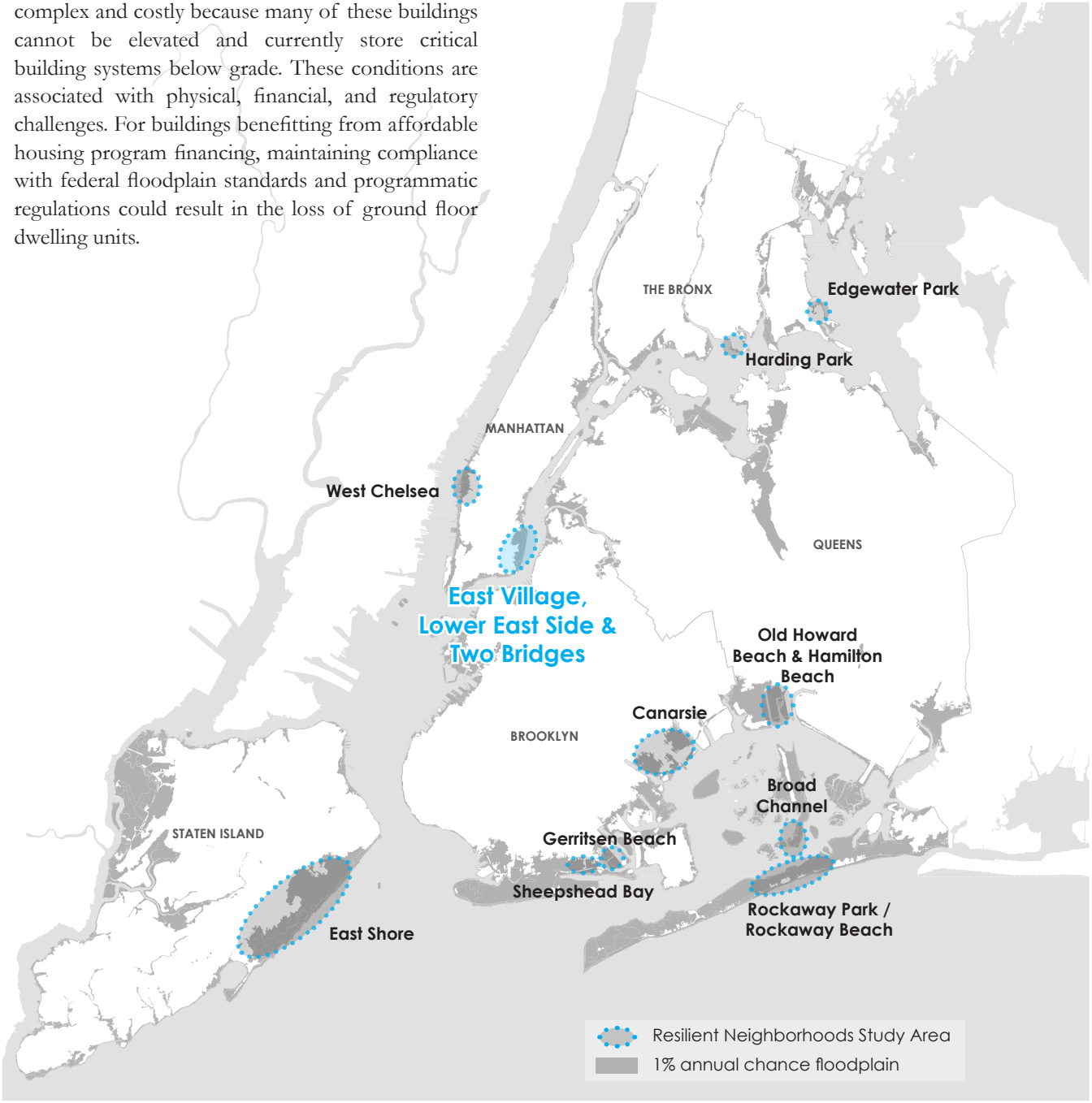
Resiliency Planning in New York City

Following Hurricane Sandy in October 2012, the City developed *A Stronger, More Resilient New York*, which laid out a detailed action plan for rebuilding post-Sandy and making the city's coastal communities, buildings, and infrastructure more resilient in the long-term. The City has made significant progress implementing the plan, including funding a $20 billion climate resiliency program, advancing housing recovery through the Build it Back program, and making long-term resiliency a reality by investing in infrastructure upgrades. Drawing on this work and earlier planning efforts, the City released in Spring 2015 *OneNYC: The Plan for a Strong and Just City*, a long-term strategy to address the city's most pressing challenges, including a rapidly growing population, rising inequality, aging infrastructure, and climate change.

Resilient Neighborhoods

One of the projects described in *OneNYC* is Resilient Neighborhoods, a place-based planning initiative to identify tailored strategies, including zoning and land use changes, to support the vitality and resiliency of communities in New York City's floodplain. Based on collaboration with residents, stakeholders, elected officials, and other City agencies, the initiative focuses on ten study areas located in all five boroughs that represent a variety of demographic and built conditions. The Department of City Planning (DCP) identified these study areas because they present specific land use, zoning, and other resiliency issues that cannot be fully addressed by citywide zoning changes.

Aging multifamily buildings, many of which provide affordable housing to low-income residents or those in supportive or assisted living programs, predominate in the East Village, Lower East Side and Two Bridges. Hurricane Sandy exposed the acute vulnerability to coastal storms and flooding facing these neighborhoods and their dense multifamily building stock. Retrofitting is complex and costly because many of these buildings cannot be elevated and currently store critical building systems below grade. These conditions are associated with physical, financial, and regulatory challenges. For buildings benefitting from affordable housing program financing, maintaining compliance with federal floodplain standards and programmatic regulations could result in the loss of ground floor dwelling units.



The East Village, Lower East Side and Two Bridges study is a product of collaboration between DCP and other City agencies, including the Department of Housing Preservation and Development, the New York City Housing Authority, and the Mayor's Offices of Recovery and Resiliency and Housing Recovery Operations. Valuable input was also provided by the Department of Buildings, the New York City Housing Authority and the Mayor's Office of Sustainability. In addition, the process built on public input previously generated through other initiatives, such as New York State's Community Reconstruction Program and the U.S. Department of Housing and Urban Development's Rebuild by Design competition.

A view looking southwest with the Freedom Tower in the background

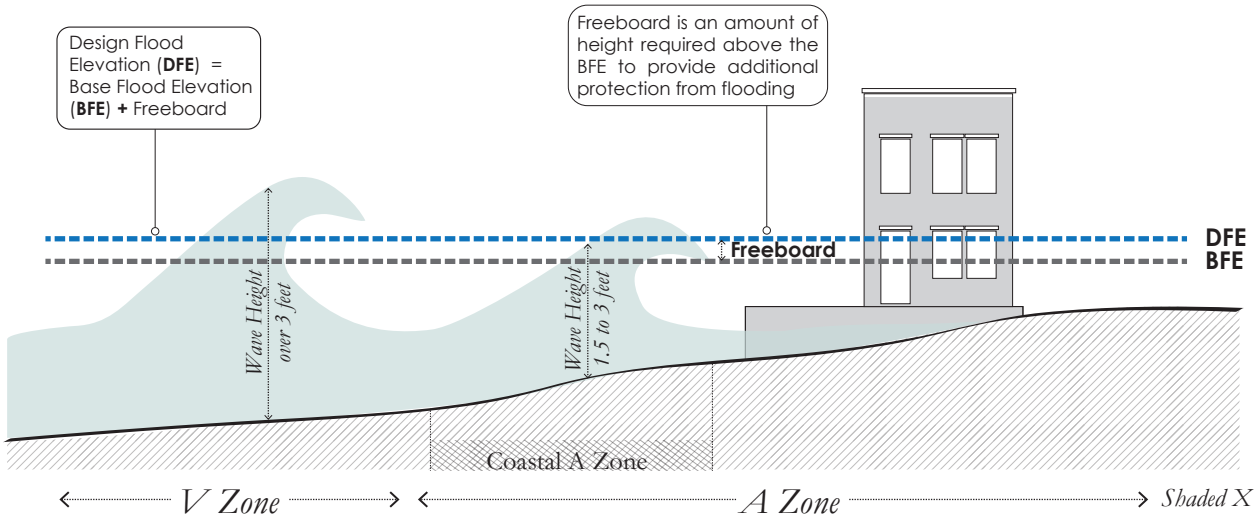
Regulatory Context

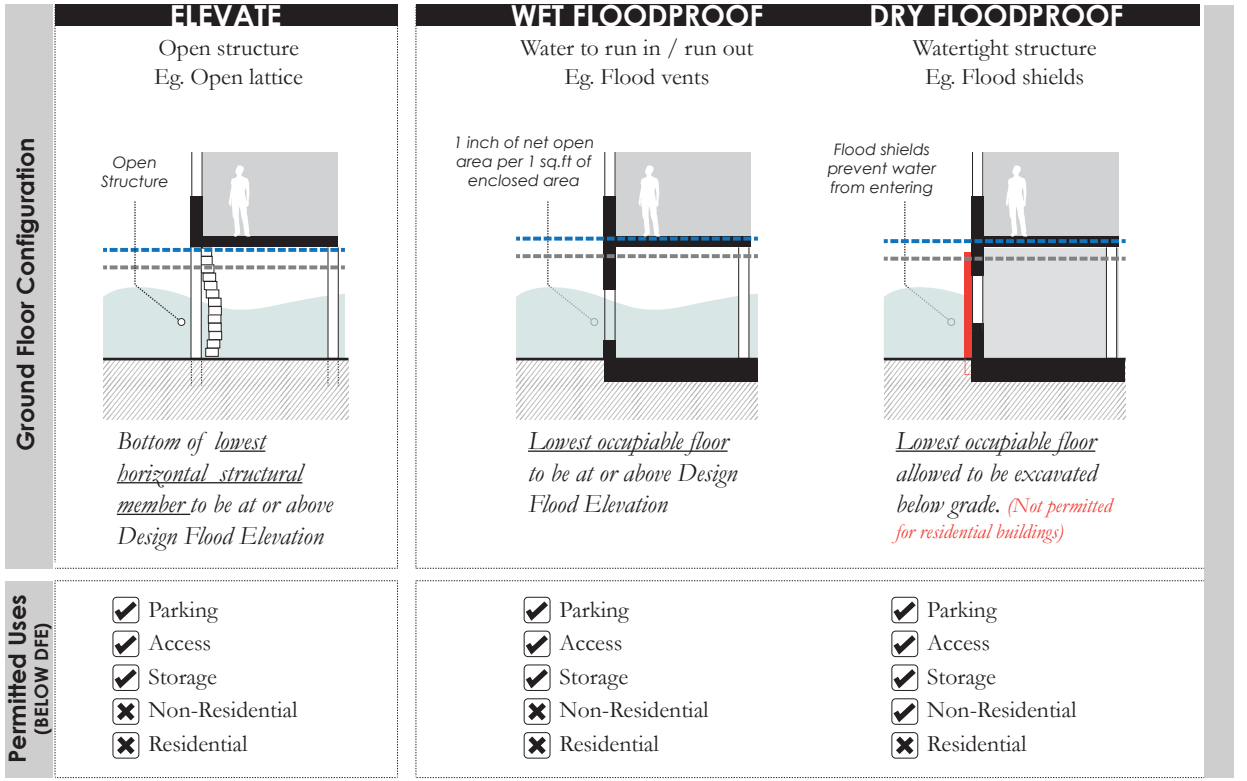
A wide array of programs and regulations at various levels of government shape the City's approach to managing flood risk and promoting resilient development. In the United States, floodplain regulation begins with Flood Insurance Rate Maps (FIRMs), which the Federal Emergency Management Agency (FEMA) creates and maintains. The maps show the extent and elevation to which flood waters are expected to rise during a 100-year flood or a flood that has a 1% chance of occurring in any given year. The elevation of the expected 1% annual chance flood is called the Base Flood Elevation or BFE. FIRMs also show the 500-year or 0.2% annual chance floodplain, which is shown as the Shaded X Zone.

The 1% annual chance floodplain is divided into three areas -- the V Zone, Coastal A Zone, and A Zone -- each associated with a different degree of flood risk. The diagram to the right illustrates these zones and the types of flood risk in each.

The 1% annual chance floodplain is also the area where property owners with federally-regulated or federally-insured mortgages are required to carry flood insurance. For residential structures, flood insurance premiums under FEMA's National Flood Insurance Program (NFIP) are determined by the relationship between the lowest occupied floor of the structure and the BFE shown on the FIRMs at the structure's location, as well as other factors. Homes built before the FIRMs were established have historically been offered subsidized insurance rates. However, due to recent federal legislative changes, those subsidized rates are gradually increasing to come in line over time with actuarial rates more closely reflecting the flood risk a home faces.

For the past several years, FEMA has been in the process of updating the FIRMs for New York City, which were implemented in 1983 and most recently





updated in 2007. As part of the mapping update, FEMA issued updated Preliminary FIRMs (PFIRMs) in December 2013 with another revision in January 2015. In most places, these PFIRMs show an expanded 1% annual chance floodplain. The maps also heighten Base Flood Elevations for much of the city. The City has filed an appeal of the PFIRMs because they overstate the size of the city's 1% annual chance floodplain due to inaccuracies in FEMA's underlying analysis. The City is committed to resolving the appeal and adopting accurate flood maps as quickly as possible.

Flood Resilient Construction and Building Design

The primary purpose of the FIRMs is to establish parameters for NFIP, based on present-day flood risk. However, the same maps also establish where federal minimum standards for flood resistant construction apply. These standards are enacted through the New York City Building Code's Appendix G on "Flood-Resistant Construction," which as of 2013 applies to the 1% annual chance floodplain shown on FEMA's PFIRMs or the 2007 effective FIRMS, whichever of the two is more restrictive. Appendix G includes different elevation and floodproofing requirements for each flood zone, as well as separate requirements for residential and non-residential structures. Appendix G also includes rules requiring that most residential and commercial developments be floodproofed an additional one or two feet of "freeboard" above the FEMA-designated BFE. The elevation of the BFE plus freeboard is called the Design Flood Elevation (DFE).

To fully comply with Appendix G requirements, residential buildings must elevate all living space to be at or above the DFE, and any enclosed space below the DFE must be wet floodproofed. Non-residential buildings (any building that contains non-accessory non-residential floor area) have the option of elevating and wet floodproofing, or dry floodproofing. Where there is a mix of residential and non-residential uses, dry floodproofing is allowed, but no dwelling units may be located below the DFE. Full compliance with Appendix G results in lower NFIP premiums.

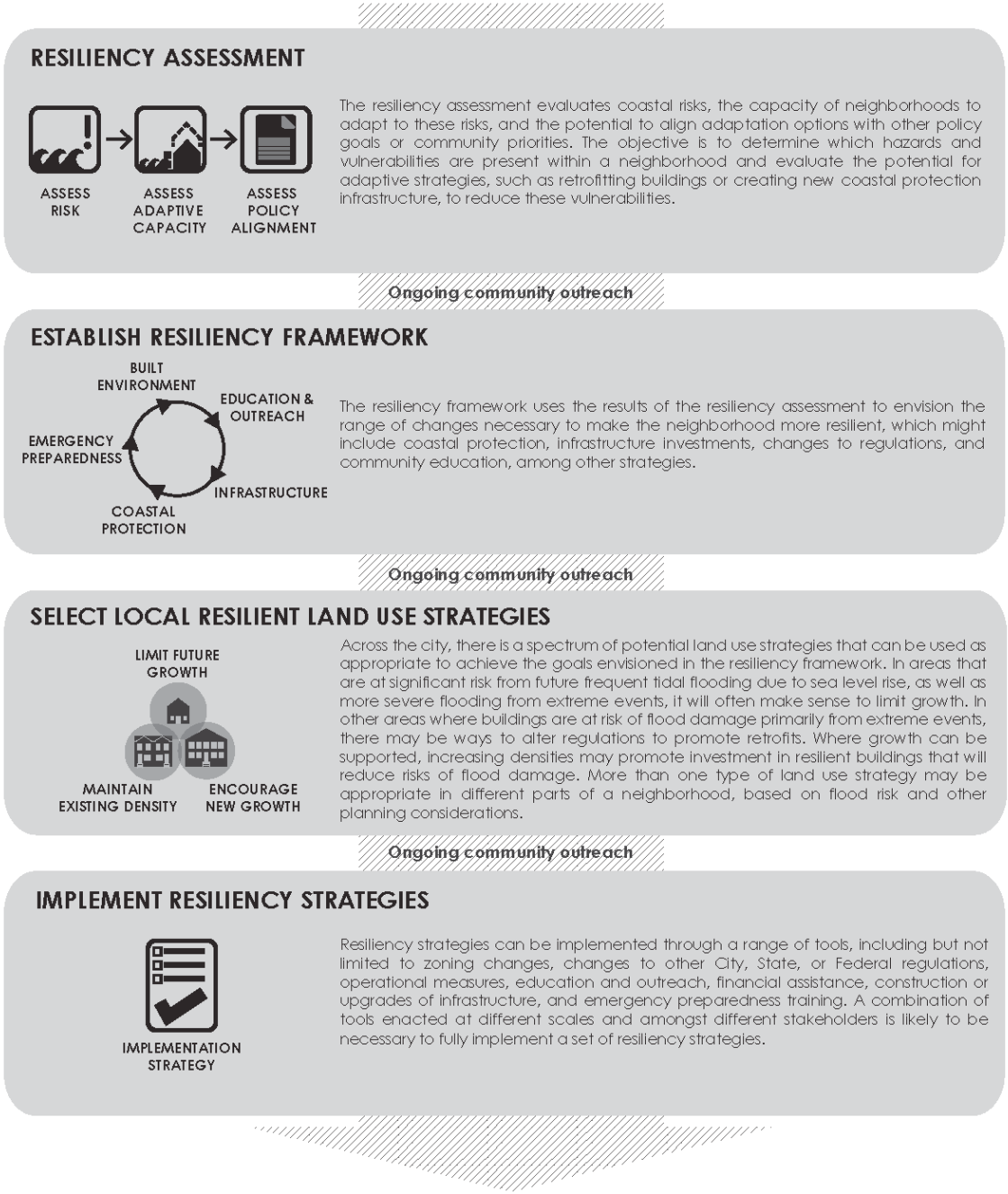
Buildings that are neither new, "Substantially Damaged," nor "Substantially Improved" (see glossary) are not required to meet Appendix G requirements as long as any changes to the building do not increase the level of noncompliance, but owners may voluntarily choose to implement partial flood mitigation strategies including elevating or floodproofing a building's mechanical systems. These measures may not currently result in lower NFIP premiums, but will reduce a building's overall vulnerability to future floods and enable the building to be reoccupied more quickly in the aftermath of a flood.

Citywide Zoning for Flood Resiliency

The City has instituted a series of zoning changes that remove impediments to retrofitting residential and commercial properties and accommodate many of the aforementioned building regulations. The first of these changes was an emergency Executive Order, issued in January 2013, which suspended height and other restrictions to the extent necessary for property owners to rebuild after Sandy. The City Council adopted many of these changes as the Flood Resilience Zoning Text Amendment in October 2013. This text amendment created allowances for measuring building height from the latest FEMA flood elevations (including freeboard required by building code), providing access from grade to elevated buildings, locating mechanical systems above flood levels, accommodating off-street parking requirements, and allowing reallocation of floor space that is abandoned and wet floodproofed. It also incorporated provisions to mitigate adverse streetscape impacts.The rules, still in effect, apply to all buildings in the PFIRM 1% annual chance floodplain.

Regulatory Context Summary

- The Federal Emergency Management Agency (FEMA) creates Flood Insurance Rate Maps (FIRMs) that show the extent and elevation of the 1% and 0.2% annual chance floodplains.
- FEMA also administers the National Flood Insurance Program (NFIP).
- The New York City Building Code's Appendix G on Flood-Resistant Construction applies within the 1% annual chance floodplain.
- The Department of City Planning works to create zoning, which controls the size and use of buildings, to accommodate flood resilient building regulations and remove impediments to flood resilient construction.



The 2013 Flood Resilience Zoning Text Amendment was conducted as an emergency measure to facilitate ongoing rebuilding and retrofitting following Sandy, and included a sunset provision, so will expire a year after new flood maps are adopted by the City. DCP anticipates advancing another amendment that will make permanent the basic provisions set forth in the 2013 text, and potentially address resiliency challenges identified since then to make it easier for property owners to make existing and new buildings resilient to current and future flood risks, while supporting the vibrancy and character of neighborhoods.

Planning Approach for Resiliency

The ten Resilient Neighborhoods study areas each exhibit a variety of physical, environmental, social, and economic conditions, the combination of which creates a distinct set of resiliency challenges, and different potential strategies for addressing them. To account for this diversity of contexts and to ensure that a consistent planning approach underpins the City's resilient land use goals, DCP developed a four-step process for coordinated analysis to guide risk-based decision-making. The diagram shown to the left explains this approach and the latter half of this report details the strategies and recommendations generated for the East Village, Lower East Side and Two Bridges study area through this process.

Several of the organizations consulted in outreach for the East Village, Lower East Side and Two Bridges Resilient Neighborhoods study

Outreach Process

The Department of City Planning's outreach for this study sought to bring in a broad spectrum of community members and non-profit organizations involved in recovery and long-term mitigation planning efforts. In the wake of Hurricane Sandy, active organizing efforts during and after the storm gave residents a direct role alongside Federal, State and City agencies, together with non-profit and private aid organizations.

DCP's outreach effort included meetings with and presentations to LES Ready! (a coalition of over thirty community-based organizations and institutions organized around emergency response, community engagement, and preparedness planning), and Manhattan Community Board 3, along with other public agencies. Reaching out to non-profit loan servicers, affordable housing financing firms, and other community partners provided further clarity on the challenges facing multifamily buildings with affordable housing in flood-prone areas. Additional meetings were held with local property owners and advocacy organizations including Nazareth Housing, Lower East Side People's Mutual Housing Association (LESPHMA), Asian Americans for Equality (AAFE), and others. Combined, these stakeholders own or manage over 100 buildings within the study area.

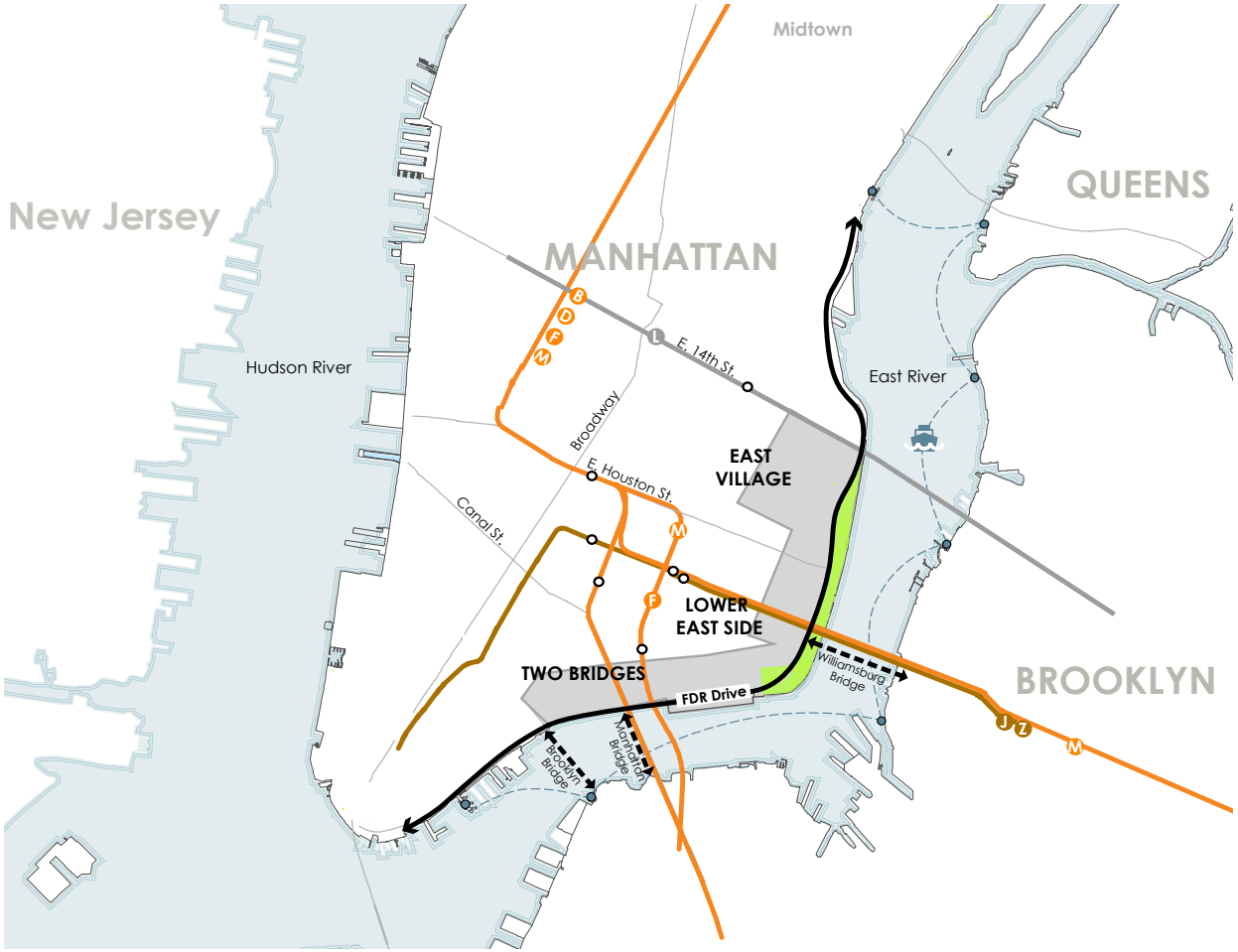
These discussions contributed to a multi-layered understanding of how these communities were affected by Hurricane Sandy—from the macro perspective of the neighborhood, to the micro-scale of individual buildings.

COMMUNITY RISK PROFILE

Community Character and History

The East Village, Lower East Side and Two Bridges study area is located in Manhattan Community District 3, and includes the 1% annual chance floodplain and surrounding portions of the three neighborhoods. Altogether, the study area encompasses approximately fifty-four square blocks that span over two miles of the East River between East 14th Street and the Brooklyn Bridge. The East Village extends from 14th Street at the northern end down to East Houston Street. The Lower East Side neighborhood continues down to the Manhattan Bridge. Two Bridges surrounds the Manhattan and Brooklyn Bridges, overlapping with parts of Chinatown. Combined, the study area is also part of what is sometimes collectively referred to as the "Lower East Side." It is characterized by a concentration of multifamily mid-rise walk-up and taller tower in the park buildings that house nearly 70,000 residents. Altogether, the area includes nearly 600 residential buildings with more than 26,000 dwelling units.

The study area is primarily served by bus transit, with subway service available further west and ferry service to the south. The Williamsburg, Manhattan, and Brooklyn Bridges also provide important multi-modal connectivity for these neighborhoods along with the FDR Drive, which flanks Manhattan's eastern side and connects to the Bronx, Queens, and Brooklyn.



Study Area Context Map

Historical Development

The Lower East Side has been home to many generations of immigrants throughout its history. To accommodate a rapidly growing economy and create more land mass, much of Manhattan's coastline along the East River was filled and expanded throughout the 18th and 19th centuries. In the late 19th and early 20th centuries, mid-rise walk-up buildings were constructed quickly to house an exploding population driven by immigration and industrial growth along the lower Manhattan waterfront.

As New York City transitioned away from maritime commerce, once well-trafficked boat slips were loaded with man-made fill. These areas created through landfill are lower lying than the original coastline, which makes them more vulnerable to coastal storms and flooding. The early 20th century brought with it further changes to the urban environment. Subway construction and other transit improvements enabled the dispersal of a population that had become overcrowded, while tenement laws established more rigorous requirements for light and air.

Though tenements remain the primary building form in much of the area, other portions of the study neighborhoods were redeveloped. Particularly in the postwar period, factories and tenements were replaced with a range of affordable housing developments, often as tower in the park configurations with residential towers surrounded by open space and parking. While retaining only a fraction of their peak population density, these neighborhoods remain heavily populated. Their exposure to flood risk resulted in widespread impacts during Hurricane Sandy affecting thousands of residents.

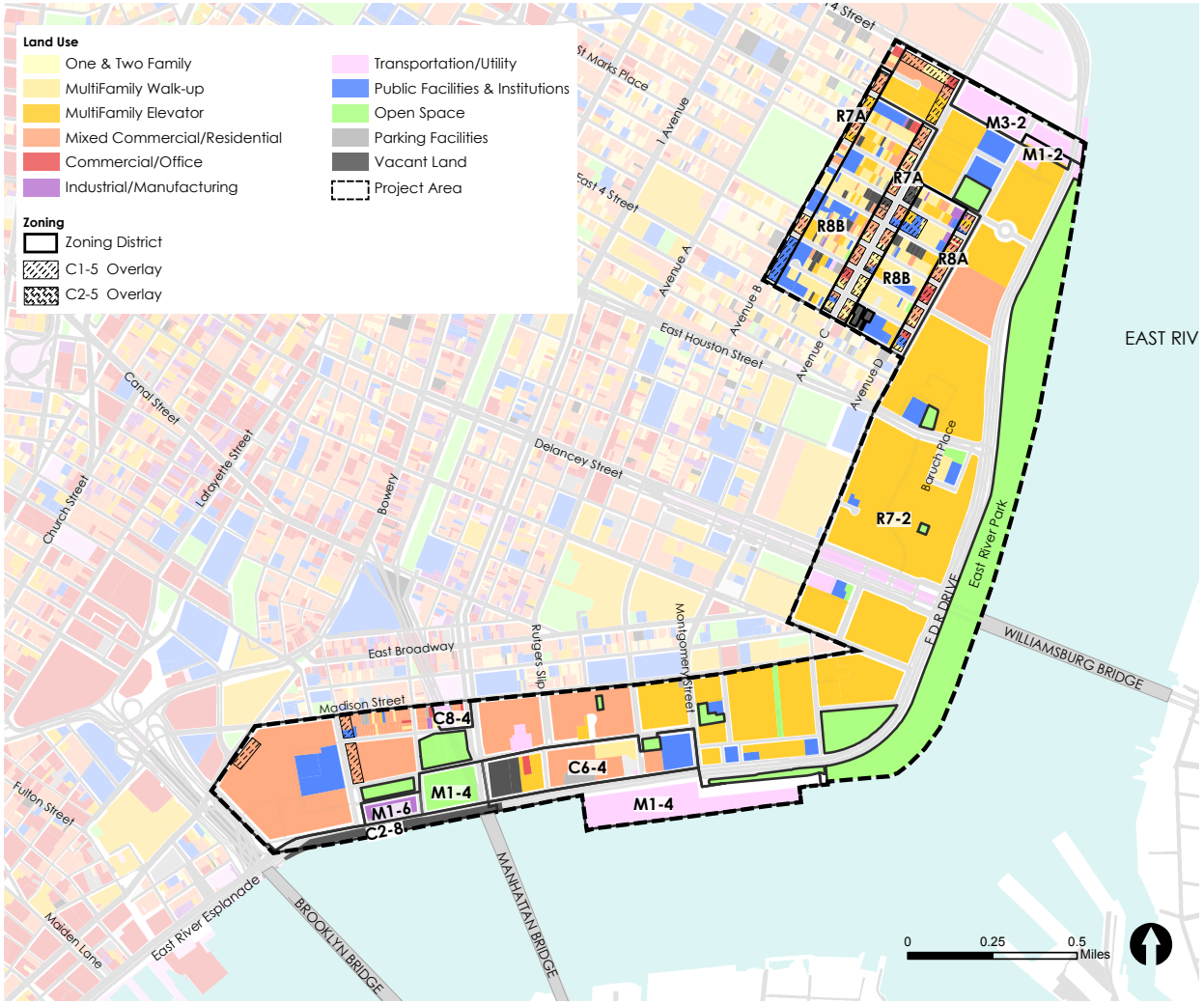
Select transit lines and stops within and adjacent to study area

Land Use and Zoning

The map at the right shows land use and zoning in the East Village, Lower East Side and Two Bridges study area. The neighborhoods are predominantly residential with commercial corridors along the avenues containing mixed-use buildings with ground floor retail or community facility uses. Examples of such mixed-use corridors are Avenues B, C, and D in the East Village and Madison Street in Two Bridges.

Throughout the study area, high rise tower in the park buildings are generally located along the water's edge. These buildings are located within residential height factor zoning districts which have no height limits and facilitate the tower building typology. Inland portions of the East Village and Two Bridges neighborhoods are generally developed with multifamily mid-rise walk-up buildings up to six stories in height. These areas are within contextual zoning districts, which include height limits to ensure that development remains consistent with a neighborhood's existing built character.

The local zoning presents several challenges to promoting resilience throughout the study area. In particular, height restrictions within contextual zoning districts and certain sections of state-regulated provisions present obstacles that will be discussed in subsequent sections.



Parks and Open Space

As greater efforts have been put into activating waterfront spaces citywide, the East Village, Lower East Side and Two Bridges have been the beneficiaries of a number of open space improvements. The largest is East River Park, which spans Montgomery Street to East 12th Street, and is a year-round amenity that offers fifty-seven acres of waterfront. Along with Corlears Hook Park at Jackson and Cherry Streets, the revitalization of these parks has improved community connection to the waterfront while providing much-needed open space.

Composed of two miles of city-owned public open space stretching from Montgomery Street south to the Battery Maritime Building, the East River Waterfront Esplanade and nearby Pier 42 are additional public amenities. They provide a range of open spaces for recreation and social interaction, including park space, publicly-accessible exercise equipment, an educational pavilion, community space, and sports areas.

Design work is also underway on the East Side Coastal Resiliency project, an integrated flood protection system that will also provide improved year-round open spaces throughout East River Park from Montgomery Street up to as far north as East 25th Street. Different options for coastal protection are being explored to provide flood protection.

Flood Risk

Damage from Hurricane Sandy that occurred in the East Village, Lower East Side and Two Bridges highlights the importance of identifying neighborhood-based strategies to facilitate citywide resilience. In these low-lying neighborhoods, multifamily buildings primarily experienced damage to critical building mechanical, electrical, or plumbing (MEP) systems, along with ground floor businesses, residences and lobbies. Overall, buildings in the area suffered minimal structural damage.

The FEMA Flood Insurance Rate Maps (FIRMs), originally adopted by the City in 1983 and subsequently updated in 2007, had not been revised further prior to the storm. New Preliminary FIRMs (PFIRMs) have significantly increased the number of dwelling units and buildings in the 1% annual chance floodplain. According to figures compiled through the City's land use data and the Furman Center, the recent PFIRMs show over 20,000 units across 500 multifamily buildings within the study area's floodplain. Of those, approximately 15,000 are rent-regulated.

The flood height of the 1% annual chance storm on the Preliminary FIRMs, or the Base Flood Elevation (BFE), ranges from one to six feet above grade throughout the study area. Lots with BFEs exceeding six feet are primarily located in Two Bridges along the waterfront between the Brooklyn and Manhattan Bridges and in sections of the East Village (see map on page 15).

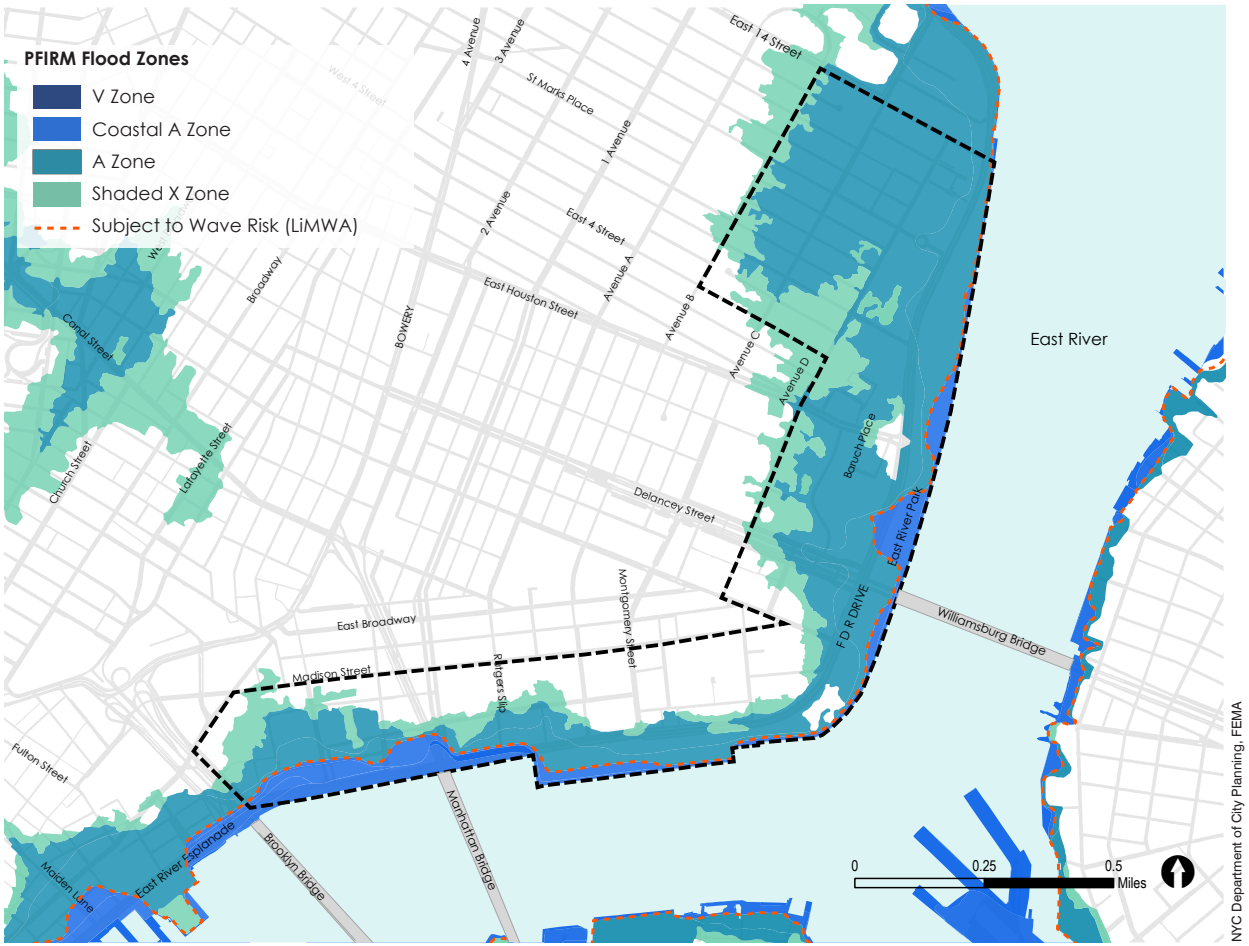
In order to comply with FEMA floodplain requirements for new or Substantially Improved buildings, or to receive lower flood insurance premiums, buildings must be floodproofed to the BFE plus additional freeboard height (one foot for multifamily buildings). Even low BFEs can lead to significant physical and financial challenges, particularly for buildings with ground floor dwelling units.

East River Park between Delancey and Houston Streets

Exercise equipment along East River Esplanade north of the Manhattan Bridge

In response to Hurricane Sandy and in anticipation of the intensifying consequences of climate change, the City is taking a multi-layered approach to protecting neighborhoods and infrastructure from future storms. In addition to protecting multifamily buildings and vulnerable populations from current and future risks through building- and neighborhood-scale strategies, another component of this framework is to fortify the waterfront with coastal protection where it is feasible.

The East Side Coastal Resiliency project, currently under design, will significantly reduce flood risk for a substantial portion of the study area. The proposed series of berms and flood walls, integrated with parks and existing infrastructure, will span as for north as East 25th Street, down to Montgomery Street along the East River. The City is currently examining the feasibility and funding opportunities available to construct additional coastal protections further south to provide flood protection to the rest of Lower Manhattan. Although these projects are being designed to incorporate sea level rise projections and will offer substantial protection from significant flood events, they do not negate the need for pursuing resiliency improvements at the building or neighborhood site level. Rather, resiliency strategies at multiple scales complement each other to provide additional protection in case future storms exceed projected heights, flood defenses do not function as designed, or other residual risks present themselves over time.



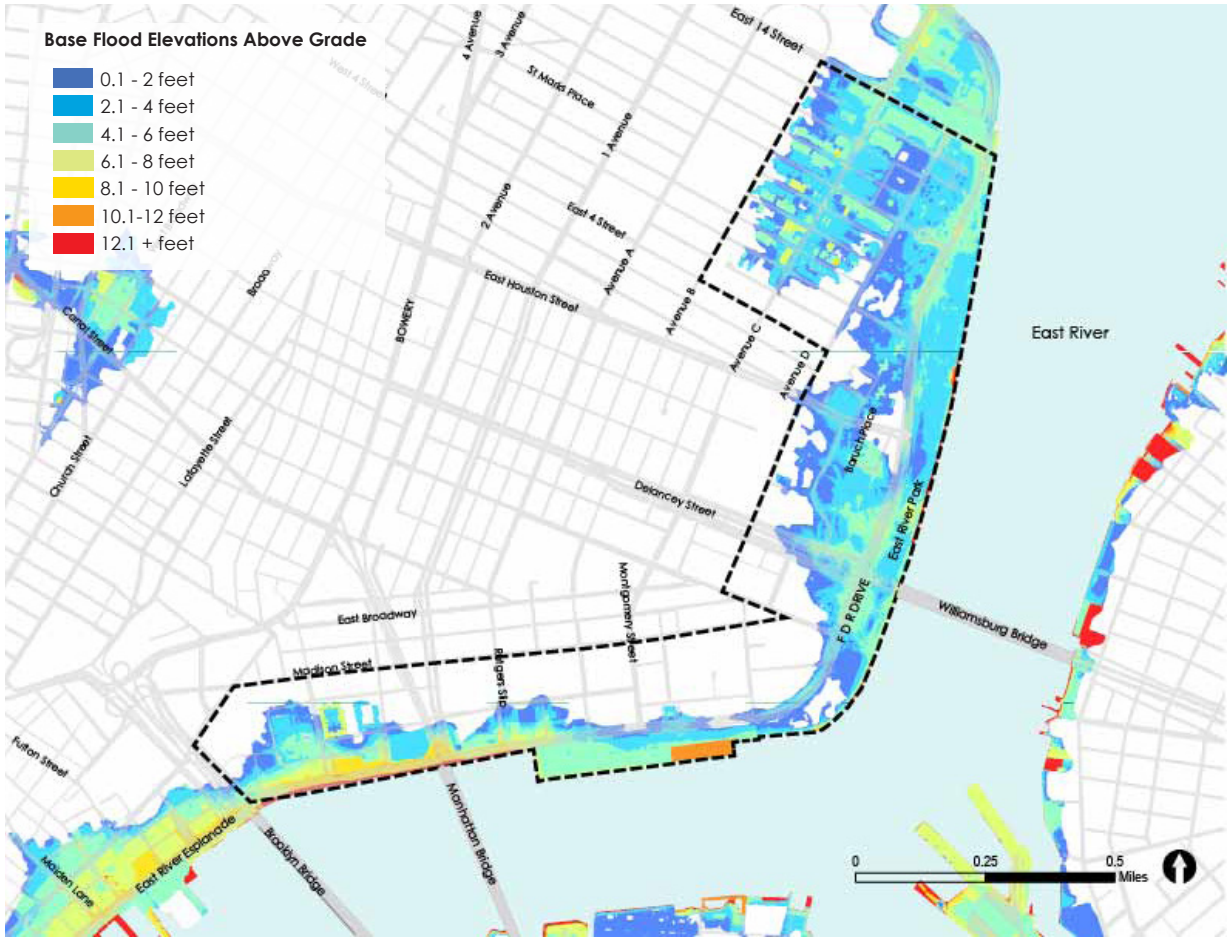
Boundaries of the 1% and 0.2% Annual Chance Floodplains in the East Village, Lower East Side and Two Bridges

Sandy Impacts

As noted earlier, multifamily building residents experienced significant hardship during Hurricane Sandy. Post-storm assessments revealed significant damage to below-grade critical building systems, along with some exterior building damage. Because few older buildings were required to carry flood insurance and portions of the area inundated by Sandy were not mapped into the 1% annual chance floodplain at the time, many property owners were under-insured and sought funding from federal, state and local disaster recovery programs.

According to many area property owners and tenants engaged during outreach for this study, the various post-Sandy assistance programs were difficult to access and navigate. Many property and business owners, including cooperatives which were initially considered companies and only eligible for SBA business loans, were left with significant unmet financial costs related to flood damages, post-storm repairs, tenant displacement and business interruption.

FEMA records indicated that damage to multifamily buildings filed through the National Flood Insurance Program (NFIP) following Hurricane Sandy valued over $200 million for nearly 1,100 structures citywide. Of that, over $68 million was reported in Manhattan.



Height of PFIRM Base Flood Elevations above ground in the East Village, Lower East Side and Two Bridges

In the study area, where flood insurance take-up is low, nearly ninety multifamily buildings filed NFIP claims for approximately $9.5 million. However, as the Mayor's Office of Recovery and Resiliency's *Multifamily Flood Insurance Affordability Study* and other sources indicate, this data may insufficiently indicate the extent of Sandy damage because so few multifamily buildings carried NFIP policies. In addition to the filed NFIP claims, FEMA's Post-Sandy Individual Assistance disaster recovery program inspected nearly 800 claimants in the study area immediately following Sandy with visible storm damage. Build it Back's Multifamily Storm Recovery Program, administered by HPD, has assessed nearly $21 million in storm damages within the study area.

The Multifamily Storm Recovery Program plans to invest over $60 million in Federal disaster recovery funds citywide to implement comprehensive resiliency retrofits for affordable housing developments and low-moderate income buildings. This ongoing work serves as a key source of information on the physical challenges, costs, and regulatory complexity involved in retrofitting New York City's multifamily building stock.

Flood Insurance

Properties with a Federally-backed mortgage in the 1% annual chance floodplain are required to carry flood insurance. Financing entities and loan servicers may also require flood insurance coverage, sometimes beyond NFIP's maximum, which necessitates looking to the private insurance market. For properties not required to carry flood insurance, owners may remain uninsured, either by choice or a lack of understanding of flood risk. Others do not have coverage due to policy lapses that lenders failed to check. Lack of knowledge about building vulnerability is another reason many property owners were under-insured.

Another critical challenge to buildings is the low ceiling for NFIP flood insurance coverage. For most of its existence, NFIP only offered $250,000 in maximum allowable building coverage for all residential buildings—it subsequently doubled to $500,000 in June 2014 for multifamily buildings (coverage limits may vary for cooperatively-owned buildings), an amount still far below the coverage many buildings require. For all residential policies, there remains a $100,000 maximum for contents coverage, well below the $500,000 contents cap for commercial properties.

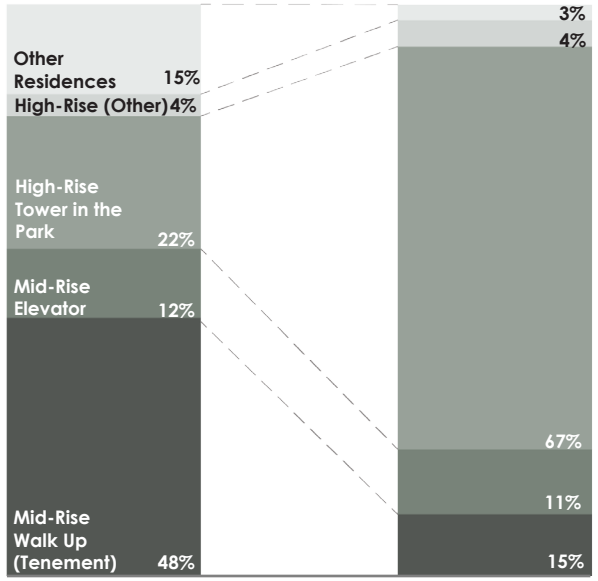
Although these thresholds are low for multifamily buildings, active NFIP policies for multifamily buildings increased nearly thirty percent citywide, fifty percent in Manhattan, and over ninety percent in the study area between February 2013 and June 2015. This was likely due to a clearer understanding of current risk and requirements to hold an NFIP policy to receive Federal Sandy aid.

Building Typology Profile

The predominating multifamily building types in the East Village, Lower East Side and Two Bridges are mid-rise walk-up and tower in the park buildings. Multifamily mid-rise walk-up buildings, historically known as "tenements," are typically wood frame with brick facades and generally six stories or under in height. Tenements were built in the 19th and early 20th centuries prior to passage of the 1929 Multiple Dwelling Law (MDL). There are over 250 such buildings with nearly 4,000 total dwelling units throughout the study area. Another 65 mid-rise buildings are served by elevators and house 2,900 residential units.

Tower in the park buildings are generally tall, high-rise masonry buildings with large footprints surrounded by open space. Often times they are clustered in a campus on a single large parcel of land. There are over 120 tower in the park buildings that contain nearly 18,000

Distribution of Buildings and Residential Units, by Building Type



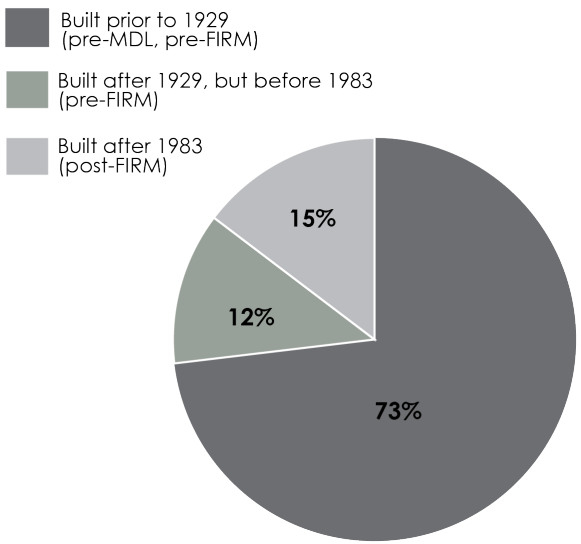
Source: PLUTO 2014

Mid-rise walk-up buildings on Avenue C in the East Village

total dwelling units in the study area. An additional 20 or so high-rise buildings, built on separate lots rather than in an open campus, house about 1,200 residential units.

The large majority (85%) of residential building types within the study area were constructed before 1983 and are considered "Pre-FIRM" structures by FEMA. These buildings likely do not currently comply with building codes for construction within the floodplain. Additionally, the vast majority of pre-FIRM structures (and 73% of all area buildings) were constructed prior to adoption of the Multiple Dwelling Law, which redefined construction standards for multifamily buildings in New York State, and therefore face even more structural and regulatory challenges to retrofitting. (For more on how Multiple Dwelling Law affects floodplain buildings see page 27). Only 15 percent of study area residential buildings were constructed after floodplain compliance became mandatory in New York City.

Year of Residential Building Construction



Source: PLUTO 2014

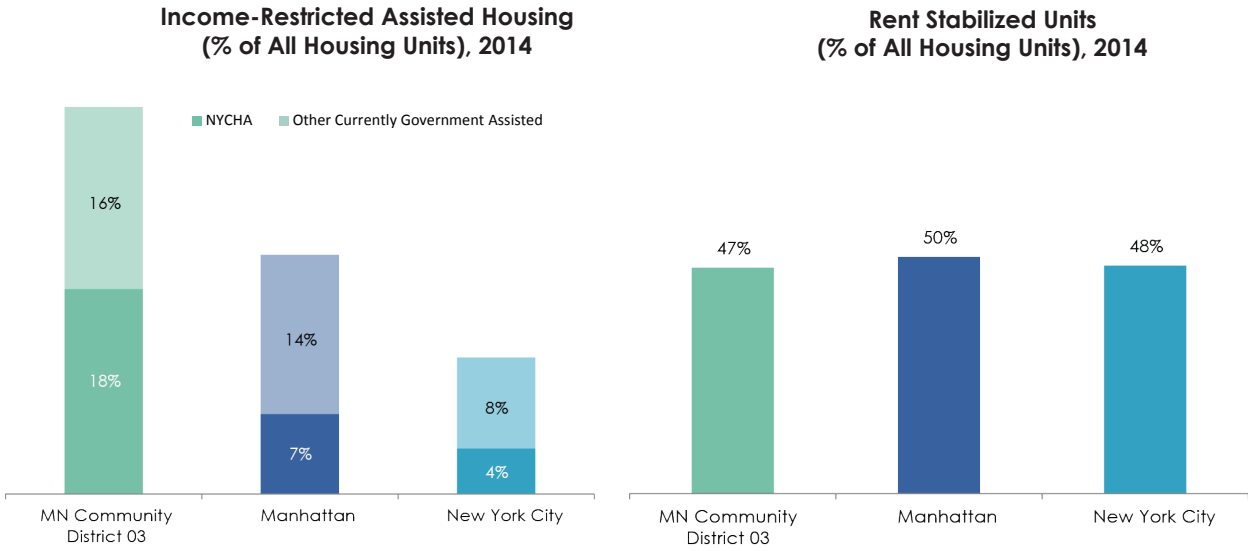
Tower in the park buildings along Rutgers Slip between Madison and Cherry Streets

Affordable Housing

Since the early 20th century, City, State and Federal governments have made tremendous investments in affordable housing throughout the city, including in the East Village, Lower East Side and Two Bridges neighborhoods. Thirty four percent of all Community District 3 (CD3) household units are income-restricted affordable housing, nearly three times the citywide rate. Additionally, 47 percent of CD3's housing units were rent stabilized in 2014, a level similar to that of Manhattan and the city as a whole, and possibly an important source of stable, affordable housing for area tenants. Some rent stabilized units may also be government assisted and subject to additional requirements, including tenant income restrictions. Given rising housing costs and the financial vulnerability of local residents, preserving the current supply of affordable housing is a top priority.

A wide variety of programs created the current stock of publicly and privately owned government assisted affordable housing. The timeline on page 19 traces the history of the city's major housing subsidy programs and the agencies that administer them. The New York City Housing Authority (NYCHA) owns about 18 percent of housing units in the community district; many of these properties lie along the coastline. Another 16 percent of the community district's housing units are under private ownership and provide affordable housing through several governmental assistance programs (subsidies and financing) including but not limited to project-based Section 8 rental assistance, the Low-Income Housing Tax Credit (LIHTC), and City property tax exemptions.

Each program may serve a different range of incomes, and developments may layer multiple subsidies with different requirements in the same development. Requirements for rent stabilization may also pose unique challenges to floodproofing retrofits, which this report explores in the **Regulatory Challenges** section.



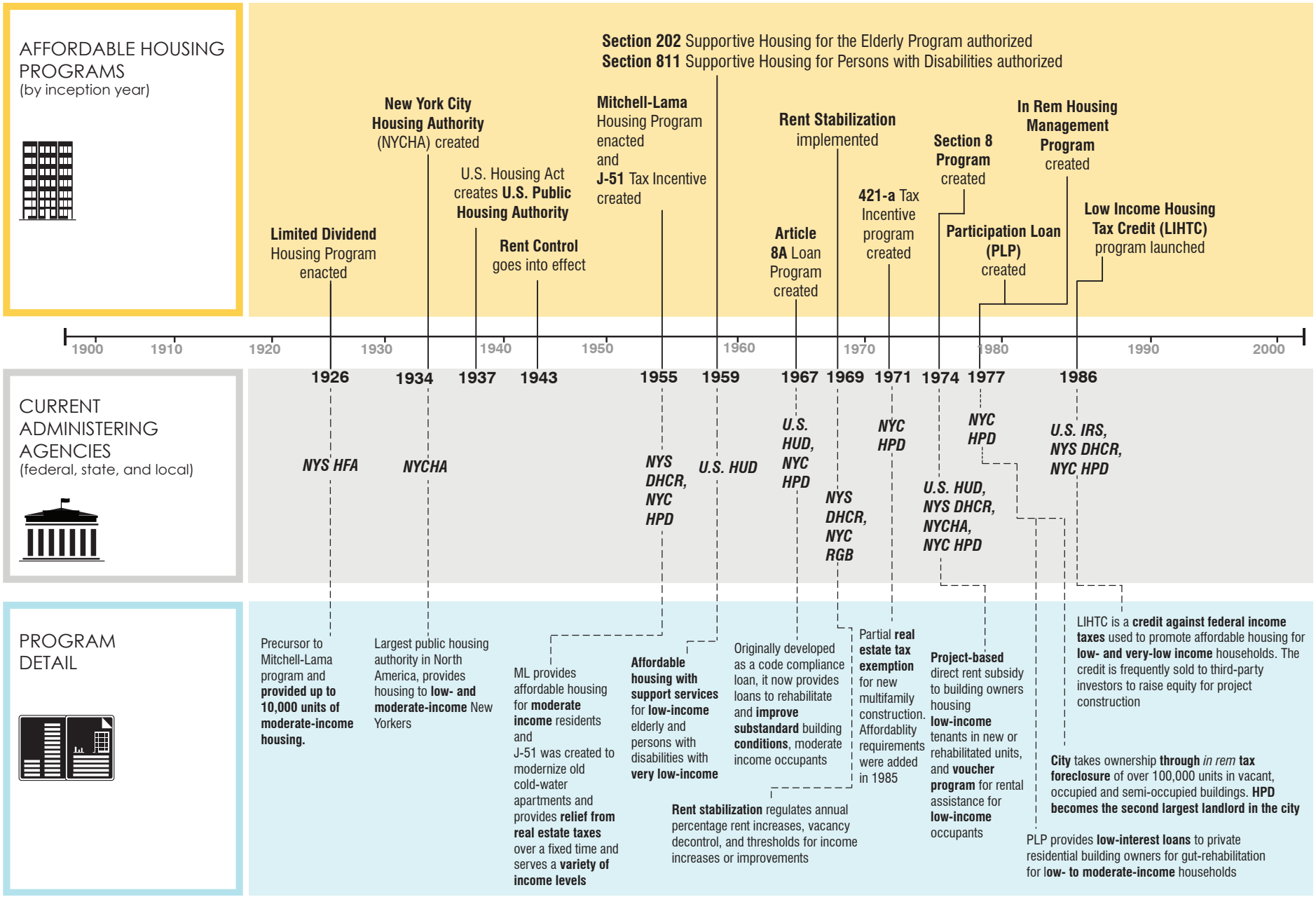
Sources: New York City Housing Authority, NYU Furman Center Subsidized Housing Information Project Database, HPD historical data (1800-2003), HPD NHMP/HNY databases (2004-2014)
Note: Data represent sub-borough area 302, which approximates Manhattan community district 3. "Other currently government assisted" housing programs include HPD programs, Mitchell-Lama, the Low-Income Housing Tax Credit, and HUD rental assistance.

Other units are market rate and do not receive subsidy or aid for rental payments. Due to the high costs of area market-rate housing, choices for many low-income area residents are limited. This may be especially true for elderly populations who rely largely on fixed-incomes.

Ownership of multifamily buildings also varies broadly. NYCHA manages approximately fifty-two percent of the income-restricted assisted housing stock in the study area, and though retrofitting costs remain significant, the agency is utilizing a $3 billion grant from FEMA for improving Sandy-damaged buildings. Many other affordable multifamily buildings, however, are owned or managed by much smaller-scale or less-capitalized entities, including several mission-driven non-profit organizations with limited budgets. These added constraints on resources for retrofitting buildings to current floodproofing standards make the process even more challenging.

Community District 3, including the East Village, Lower East Side and Two Bridges neighborhoods

Affordable Housing Programs in the Study Area



Sources: U.S. Department of Housing and Urban Development (US HUD), U.S. Internal Revenue Service (IRS), NY State Department of Homes and Community Renewal (NYS HCR), NY State Housing Finance Agency (NYS HFA), New York City Housing Authority (NYCHA), NYU Furman Center, NYC Rent Guidelines Board (RGB), and New York City Housing Preservation and Development (NYC HPD)

Financial and Social Vulnerabilities

A diverse range of households of varying ethnic and socioeconomic backgrounds comprises the East Village, Lower East Side and Two Bridges study area. As housing prices have risen citywide, increases in the cost of living in these communities have reinforced the importance of preserving the current stock of affordable housing. According to US Census figures, the study area median household income (MHHI) is approximately $31,000, reflecting the many low income households. The graph at lower right on page 21 compares the MHHI of the study area to Manhattan and citywide, showing the wide gap between the study area neighborhoods, the borough, and the city. Additionally, over thirty percent of families in the study area are living below the federal poverty line - twice borough and city levels.


Typical multifamily mid-rise buildings

Tenant Vulnerability

Ninety percent of study area households are renter-occupied. Like much of Manhattan, these neighborhoods have low vacancy rates, suggesting few options for resettlement within the surrounding community for displaced renter households.

Although renters within Manhattan Community District 3 are somewhat less likely to be rent burdened than renters citywide or in Manhattan, a considerable proportion of tenant households face unaffordable housing costs with 47 percent of them cost burdened (spending more than thirty percent of annual household income on housing costs), including 24 percent that are severely rent burdened (spending over fifty percent on housing costs).

Less affluent residents who are cost burdened are paying a large portion of an already small pool of money toward housing costs, which leaves little disposable income for other needed expenses. The combination of high rent burden, low household income, and a reliance on limited rent-regulated housing suggest that many residents would have a difficult time locating affordable rents elsewhere were dwellings units lost.

The chart at the top of page 21 shows age distribution, highlighting that the study area has higher concentrations of residents over 65 years. According to US Census data, nearly eighteen percent of residents are over 65 years old and nearly forty percent of that population is living below the federal poverty level, twice the borough and city rates. Many residents also have deep roots in the area (as indicated in the lower left table on page 21). Half of the area's renter household have lived in these neighborhoods since before 2000, and a third since before 1990. Both rates are significantly higher than in Manhattan and citywide.

Despite the area's vulnerability to flooding, local residents may prefer to remain in their community. As housing costs and demand for government assisted housing remain high, renters with low incomes may find limited affordable housing options in the area, particularly if they require supportive housing or assisted living.

Neighborhoods with vulnerable and aging populations also face mobility challenges, which create difficulties obtaining daily goods and services. This is felt most acutely in the Lower East Side and Two Bridges neighborhoods where transit access is more limited. As elsewhere in Manhattan, the majority of households do not own a vehicle and over half rely on public transit for commuting needs. But because there is no subway connectivity directly within the study area, with the nearest subway stop, the East Broadway F Train, just north of the boundary in Two Bridges, this adds another

layer of hardship for residents. MTA bus service varies throughout the study area with limited crosstown and uptown access available to residents, particularly in the Two Bridges neighborhood.

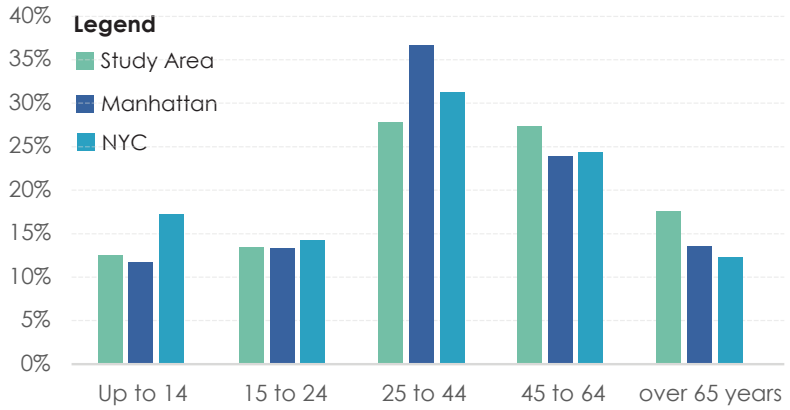
Property Owner Vulnerability

Building owners may also be in a precarious financial position when retrofitting buildings especially if such buildings include affordable housing. In order to finance building upgrades, property owners must keep buildings occupied to receive rent, and if applicable under government assistance, comply with assisted housing program and contract requirements. These property owners may have limited resources for repairing storm damage or retrofitting, and in many cases prior to Hurricane Sandy, they might not have budgeted for floodproofing, mitigation strategies, or recovery funds.

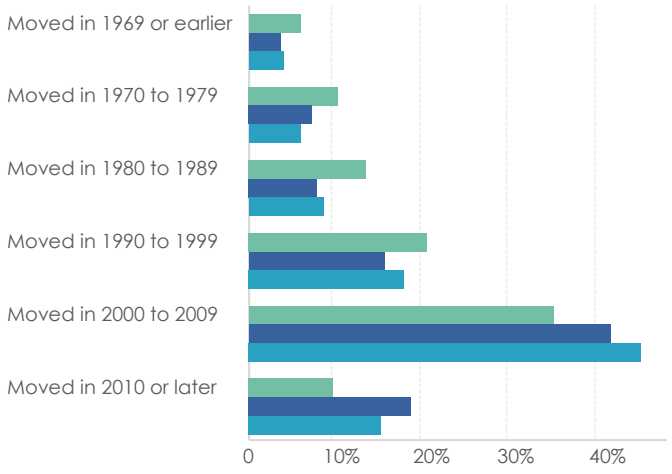
In order to make recovery or retrofitting possible, many building owners would be forced to shift funds planned for other purposes, such as building maintenance, operations, or capital upgrades. Ultimately, they may be forced to choose between the risks of financial distress and vulnerability to coastal hazards.

The study area also contains a number of cooperative multifamily developments (or co-ops) and condominium associations. Co-ops frequently have limited access to capital and usually must raise additional funds through assessments on shareholders. If too many individual co-op shareholders are financially distressed, and the cooperative building defaults, all shareholders may lose their homes. The National Flood Insurance Program also treats cooperative buildings differently, as individual co-op units are unable to purchase building coverage for their property. Likewise, condominium owners, while able to purchase individual unit policies, may not always be fully aware of coverage requirements as they differ from what is required of other multifamily buildings.

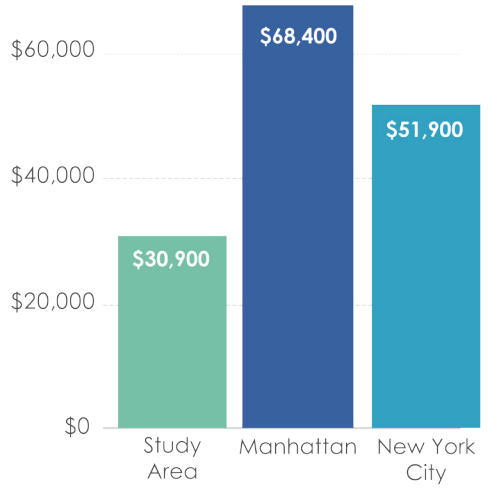
Age Distribution in Study Area, Manhattan, and New York City



Renter Housing Tenure in Study Area



Median Household Incomes in Study Area, Manhattan, and New York City



All Sources: Census ACS 5-Year Estimates 2008-2012

RESILIENCY CHALLENGES

In order to make multifamily buildings with affordable housing more resilient, property owners and their tenants must navigate a complex system of requirements that overlap and sometimes conflict. This creates a battery of physical, financial, and regulatory challenges. The ultimate goal is to clarify and resolve existing conflicts and provide clearer guidance on how best to promote resilient floodplain construction and mitigation strategies that work in parallel with the financial and regulatory realities of New York City's multifamily building stock.

Madison Street between Jefferson Street and Rutgers Street

Physical and Structural Challenges

Because the majority of buildings in the study area were built before 1983 when the City first adopted flood-resistant construction standards, they likely do not comply with Federal flood-resistant construction standards. These conditions place buildings at greater flood risk and will lead to increased National Flood Insurance Program (NFIP) flood insurance premiums as rates increase over time. Since multifamily buildings are primarily masonry construction and are either attached or consist of tall towers, structural elevation—FEMA's preferred floodproofing method to bring buildings into compliance by lifting the lowest occupied floor above the BFE —is unrealistic. In addition to not being feasibly elevated, such buildings frequently store critical systems below the BFE in basements.

Ground floor and basement dwelling units are often most problematic for multifamily buildings because they are at greater risk of flood damage and trigger higher insurance premiums. Though ground floor residences could be protected through dry floodproofing when a building is not Substantially Improved, owners would not receive reduced flood insurance premiums because FEMA does not currently permit residential spaces to be dry floodproofed. Additionally, to be fully compliant with floodplain construction codes, a property owner would be required to provide an additional entrance or reconstructed lobby connection to the residential entrance, which would create additional cost and may not be spatially feasible on the property. Though mid-rise buildings with ground floor commercial or community facility uses have slightly more flexibility because dry floodproofing is permitted, they would still need to provide emergency egress for residential units over the dry floodproofed walls or via a separate wet floodproofed residential entryway.

Non-structural elevation, as an alternative, would require vacating all occupied floors beneath the BFE and reserving the area solely for storage, parking or access to the building. This could result in the loss of residential units as well as other accessory non-residential uses, including laundry services or health and educational facilities serving the residents, located below the BFE. Such services are critical to the well-being of residents in many multifamily buildings, including a variety of

assisted living and transitional housing facilities, and often need to be located on-site. Other times the retail services often unavailable elsewhere in a neighborhood locate within buildings to provide the range of needs and services residents require. Such businesses cannot afford the separate dry floodproofing provisions required for Federal and City floodplain compliance.

In addition to installing flood vents to wet floodproof the floor space below the BFE, any construction and finishing materials would have to be replaced with flood damage-resistant materials that can be submerged within flood waters with minimal damage. This would require removal of most gypsum and fiberboard products, any water soluble or non-acid resistant adhesives, sheet-type floor or wall coverings, any wood or metal products that may deteriorate or be adversely affected by water, and many types of structural building components.

Beyond vacating the lowest ground floor, property owners would be required to fill the basement to lowest adjacent grade, resulting in the loss of significant space utilized by property owners and tenants for storage, critical systems, auxiliary building services, and for other purposes. Additional design considerations must factor in lateral force of the fill load on neighboring walls, which may still be hollow and require structural reinforcement.

Individual buildings within tower in the park developments and mid-rise buildings have similar physical challenges; both may have critical systems and residential units located below the DFE, and neither is able to be structurally elevated. Being surrounded by open space can benefit towers, however, because there may be opportunities for perimeter protections that include grading up the site to an elevation above the BFE, integrating mitigating site improvements like walls into the landscape, or locating space for new elevated structures to house critical systems for a group of buildings. The additional space and lack of shared party walls with adjoining buildings can also make dry floodproofing more feasible, though still not compliant with FEMA standards. Additional expense is required to floodproof the elevator pit and accompanying equipment. More detail on specific floodproofing methods will be illustrated in the **Case Study** section.

Financial Challenges

Retrofitting multifamily buildings is complex and cost-prohibitive for many property owners. The floodproofing investments discussed in this report are based on estimates under the Build it Back Multifamily Program, a Federally-funded Sandy recovery program which serves buildings with five or more units through the Department of Housing Preservation and Development (HPD). Due to various costs associated with implementation of a Federal program, including prevailing wage requirements and program oversight and administration, costs for mitigation may be higher in the cases described in this report than in the private marketplace. Additional labor costs related to limited contractor availability in a competitive housing construction market, and a lack of available experts in reinforcing building foundations and excavation in areas with high water tables and porous soils, compound those costs.

According to estimates from HPD, retrofitting costs for multifamily mid-rise buildings and tower in the park developments under the Multifamily Build it Back Program vary greatly. Values range depending on building conditions, viability, the extent of floodproofing required, the BFE of the structure, and materiality of surfaces among other variables (See "Build it Back Examples" on page 25 for more information).

Jefferson Street and Madison Street

Study Area Resiliency Challenges

- The 1% annual chance floodplain encompasses significant portions of low-lying neighborhoods and housing stock.
- The East Village, Lower East Side and Two Bridges neighborhoods contain many multifamily buildings with affordable housing.
- Multifamily buildings are difficult and costly to floodproof, and may lead to loss of residential units.
- FEMA's approved and creditable floodproofing standards are not feasible for multifamily buildings in a dense urban context.
- Regulatory conflicts between resiliency standards and other programs must be addressed in order to cost-effectively retrofit multifamily buildings while preserving affordable housing.

Multifamily Mid-Rise

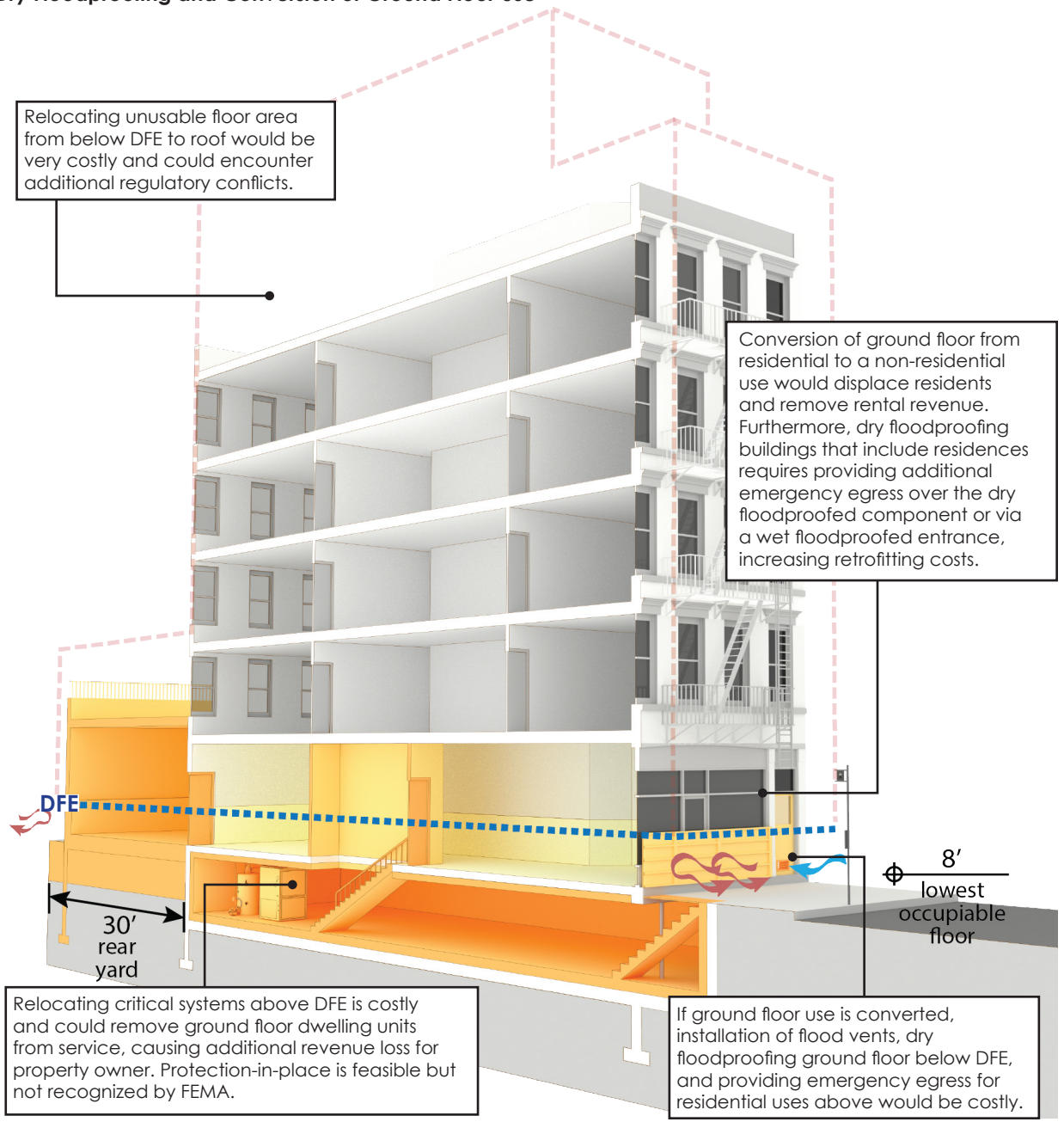
For a typical 3-6 unit multifamily mid-rise walk-up building, a comprehensive retrofit that includes floodproofing structural, electrical, mechanical, and plumbing components could cost at least $200,000 and increase to $1 million or more. There are effective, lower cost alternative or partial mitigation strategies for mid-rise buildings that include combinations of proven floodproofing approaches, but are not currently recognized per FEMA standards. For example, such strategies may include installing a platform or enclosure for critical building equipment remaining below the DFE which could cost at least $30,000. Dry floodproofing the cellar and raising the boiler pit could cost $18,000 or more, and encapsulating the boiler room could begin at $14,500. Backflow prevention devices are an important component as well, and could start at $3,000 per device.

These strategies would not necessarily bring a building into full compliance with FEMA standards, but would provide substantial protection against flood events. Full compliance with FEMA standards could add more costs and potentially contribute to a loss in revenue if units had to be eliminated.

Tower in the Park

Floodproofing costs for tower in the park buildings can vary widely because a development may range from one tower to multiple tall towers or varying heights. Retrofitting strategies for this building type may include installing flood panels or other deployable barriers which may begin at $200,000 and very quickly increase depending on height of the barrier, material, quantity, and other factors. Fully floodproofing a tower in the park development to include structural, electrical, mechanical, and plumbing elements begins as high as $2.5 million. Per-unit resiliency costs for tower in the park buildings range from $1,300 to over $10,000, depending

Potential Retrofit of Mid-rise Building:
Dry Floodproofing and Conversion of Ground Floor Use



Source: *Retrofitting Buildings For Flood Risk*, 2014

Build it Back Retrofit Examples

Mid-rise Tenement

Building Characteristics	15 units. Built 1900 (estimated) Concrete footing, rubble stone foundation walls, exterior brick load-bearing walls, wood floor joists. Situated on a very narrow lot.
BFE	11 Feet (2015 pFIRM)
Sandy Damages	Not Substantially Damaged. Flooding approx. 3' in cellar, water entered from street flooding the elevator pit and cellar. Boiler, electrical equipment and elevator were submerged. No electricity/gas for 4-5 days, no gas service for 2 months.
Ground Floor Uses	Laundry room, staff office, toilet, lobby Elevator, elevator machine room.

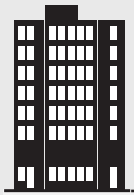
Mitigation Strategy

• Relocate boiler and hot water heater to new rooftop boiler room

• Dry floodproof service rooms in the cellar

• Install generator tap, disconnect switches, distribution panels, and wiring for emergency service

• Total estimated costs: $776,000 or approximately $50,000/dwelling unit



High-rise Tower in the Park

Building Characteristics	1,590 units in eleven 13-story and one 10-story brick buildings. Situated within an open campus,
BFE	10 to 11 Feet (2015 pFIRM)
Sandy Damages	Not Substantially Damaged. Half of the buildings had flooding at 2' in boiler room, 6' in basement, and other half between 6" and 2' in basement. No full electricity or hot water (2 weeks), no full gas (7 weeks).
Ground Floor Uses	Basement uses include boiler room and electrical and mechanical uses Ground floor residential units and a community daycare center.

Mitigation Strategy

• Dry floodproofing equipment in place and installing deployable flood walls at entryways

• New bulkhead over boiler room with stairs for below grade access will be constructed

• Generator for public lighting and power equipment

• Connections for portable generator for apartments

• Total estimated costs: $32,000,000 or approximately $20,000/dwelling unit

Source: NYC Department of Housing Preservation & Development, Build it Back Multifamily Storm Recovery

on location in the floodplain, building condition, and materials. Dry floodproofing also bears additional costs related to limiting groundwater seepage into cellars, and pile driving where required by soil conditions in order to provide needed structural support. For larger high-rise buildings, the total costs could be in excess of $30 million. The table to the left highlights two examples outlining retrofitting strategies for repairing and mitigating future flood risk to buildings enrolled in Build it Back's Multifamily Storm Recovery Program.

Partial mitigation or alternative floodproofing strategies for tower in the park buildings may occur at different scales. Strategies at the building-scale are similar to those for the mid-rise because of the focus on individual vulnerabilities. These measures become costlier in taller buildings because of scale, building structure, and the combination of multiple measures for comprehensive site protection. Cost-effective mitigation plans may be created by combining strategies. For example, installing backflow prevention valves and encapsulating critical systems in a dry floodproof vault could provide adequate flood protection.

Paired with programmatic changes, alternative mitigation strategies could provide a level of increased protection for multifamily buildings. Although these strategies are not currently compliant with Federal standards and would not reduce flood insurance premiums, they could significantly reduce potential damage and allow the building to be reoccupied following a flood event much more quickly.

Regulatory Challenges

Local governments, property owners, and households all have roles to play in balancing affordable housing preservation with making buildings more resilient. Challenges to implementing alternative or partial mitigation strategies for existing multifamily buildings

are further compounded when regulations associated with affordable housing financing are analyzed alongside FEMA floodproofing standards and the current state of the NFIP.

Federal – FEMA & NFIP

As a broad-stroke policy, FEMA's requirements for structures in the 1% annual chance floodplain are too restrictive for multifamily buildings, many of which are financed to provide affordable housing, are un-elevatable, and often host ground floor dwelling units that may be lost when a building is wet floodproofed. Rigid NFIP standards on buildings required to hold flood insurance compound the challenge of seeking to combine flood resilience with financial solvency.

FEMA's current floodplain building requirements provide few cost-effective options for owners of multifamily buildings to implement mitigation strategies that will protect tenants, critical systems, and buildings. At the same time, by only permitting storage, access, or parking below the DFE, this narrow array of options could create a cycle of disincentive by discouraging property owners from making retrofits. For buildings with affordable housing, the possibility of removing ground floor dwelling units is another financial burden.

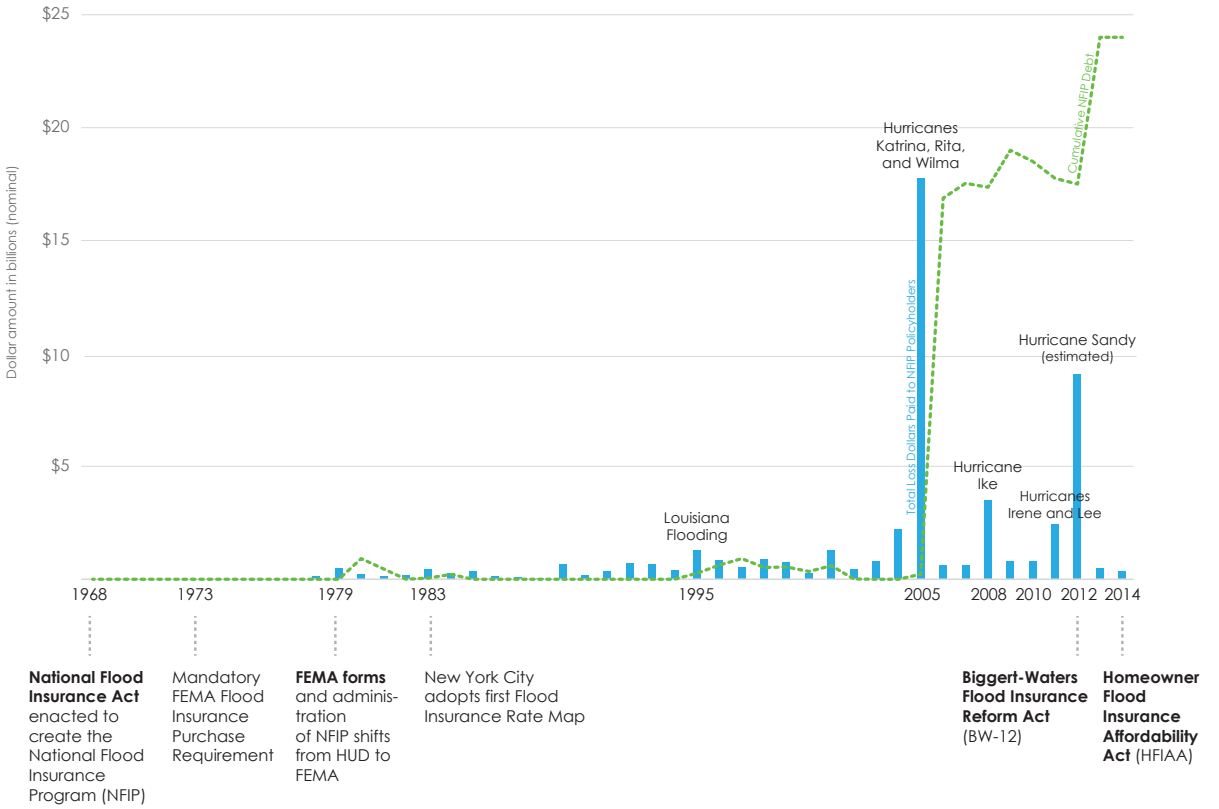
The coverage threshold for NFIP flood insurance is also limited for multifamily buildings. Building coverage presently offers $500,000 maximum for the structure and $100,000 for contents. For many tower in the park buildings, these low coverage thresholds often necessitate purchasing additional private flood insurance coverage. Understanding federal requirements and how to navigate coverage options is also lacking, putting property owners and managers at a disadvantage.

Many households and property owners do not understand what are the federally mandated insurance requirements, how recent subsidy rollbacks for NFIP coverage are expected to increase premiums, nor what is actually covered by NFIP policies. If properties are required to carry flood insurance beyond NFIP offerings, another issue is that the private insurance market does not provide products that the majority of multifamily building owners are able to afford, or that provide adequate levels of coverage.

The National Flood Insurance Program has been updated since its inception in 1968 to reflect shifting political and financial attitudes towards subsidizing and regulating floodplain construction. The chart above illustrates the growth of the program's recent increased debt, with specific reference to years with particularly damaging hurricanes or storms. The blue columns that indicate billions of dollars paid out to NFIP policyholders in a given year. The green dashed line shows the progression of the program's debt alongside policyholder payouts. Recent storms listed on the right-hand side illustrate the severity with which costs related to recent storm events have impacted the financial stability of the NFIP.

Key Events in the Evolution of the National Flood Insurance Program

Including select legislation, major Atlantic and Gulf Storms, total annual loss dollars paid to policyholders, and cumulative debt



Data sources: FEMA, Congressional Research Service, The National Flood Insurance Program: Status and Remaining Issues (Rawle O. King, 2013)

The 2012 Biggert-Waters Flood Insurance reform act sought to bring insurance policy premiums closer in line with the program's costs over time by phasing out subsidized rates. In 2014, Congress enacted the *Homeowner Flood Insurance Affordability Act* (HFIAA) capping annual premium increases to 18%. HFIAA also tasked FEMA with providing guidance on feasible economical alternative mitigation methods for urban areas where buildings' structural attributes prohibit elevation.

The September 2015 release of FEMA's document *Reducing Flood Risk to Residential Buildings That Cannot Be Elevated* was a response to that task. Although the document acknowledges viable alternative mitigation strategies that apply to multifamily buildings, the NFIP's underwriting framework does not currently recognize many of the strategies identified for partial credit toward reduced flood insurance premiums.

Federal – Affordable Housing

Investing in flood mitigation presents a range of additional challenges for multifamily building owners looking to maintain and preserve affordable housing. Depending on whether an affordable housing program is administered at the Federal, State or City level, different requirements, qualifications, and timeframes apply.

For example, the Low Income Housing Tax Credit (LIHTC)—a Federal tax incentive program—requires that a set number of affordable units be maintained in a building through a fixed tax credit compliance period (usually fifteen to thirty years). This means that if a building benefits from this program, but the number of affordable units decreases before the end of that compliance period, credits allocated may be taken back in a process known as "Credit Recapture," depending on where the building is in its tax compliance. This reclamation of credits would be proportional to the number of affordable units lost or the percentage of the property no longer offering affordable residences per the initial agreement by the administering agency. This may result in financial penalties for the property owner and loss of tax credits for LIHTC investors.

Another program that complicates resilient retrofitting is HUD-administered (and either NYC HPD or NYCHA-managed) Project-Based Section 8. This program requires a building owner or property manager to obtain HUD approval if a unit will be taken out of service. This is similar to re-negotiating the building's program contract.

According to figures compiled through the City's land use data and the Furman Center, approximately 30 percent of multifamily and mixed use rental buildings in the Preliminary FIRMs' 1% annual chance floodplain citywide contain income-restricted or rent stabilized affordable housing. This includes NYCHA properties, rental subsidies through a variety of tax-subsidy programs, and rent stabilized and controlled units—in total, over 100,000 units across approximately 1,700 buildings citywide. Many of these are within the East Village, Lower East Side and Two Bridges study area.

State

In addition to these Federal-level obstacles, some State policies create tension between resilient retrofits and maintaining current rent stabilized units. The New York State Department of Homes and Community Renewal (HCR) regulates rent stabilized housing, a significant portion of the study area's housing stock.

HCR also manages the Major Capital Improvement (MCI) Program, which provides incentives for landlords to improve the conditions of rent-stabilized buildings; these improvements may include upgrades related to flood resiliency. In return for these alterations, HCR determines whether property owners are permitted to increase the rent of stabilized units. While funding for resilient retrofits, such as retrofits financed by the Build it Back Program, can offset those costs for landlords and prevent MCI rent increases, outside funding may not always be available.

The New York State Multiple Dwelling Law (MDL) presents another challenge to retrofitting the housing stock within the study area in alignment with current FEMA standards. Codified in 1929, MDL was enacted to ensure sufficient light, fire protection and ventilation for tenement buildings in a context of over-crowding, unsanitary and unsafe conditions. While MDL presents several challenges to retrofitting multifamily mid-rise buildings known as tenements, it remains an important tool to ensure the safety and quality of life of the city's housing stock. Because tenements are non-fireproof, the majority of the issues stem from MDL's restrictions on height, which impact the fire-rating of the building's framing system and the second means of egress directly from the dwelling units. The law's requirements are therefore likely to deter FEMA-compliant retrofitting in these buildings because they generally make new additions to replace the lost residential space cost-prohibitive.

The older housing stock within the study area comprises distinct building types that present different retrofitting challenges as they relate to MDL. These include Old Law tenements, New Law tenements and converted dwellings. Old Law tenements, constructed before 1901, are typically five stories with two units per floor. New Law tenements, built between 1901 and 1929, are usually larger six-story buildings with elevators and four or more apartments per floor. Converted dwellings are buildings that have been converted from single to multifamily dwellings (no more than three families) that are three stories or less in height.

Tower in the park development within the Lower East Side

Attempting to retrofit an Old Law tenement by adding a vertical enlargement to replace lost residential space would trigger a range of additional costly improvements. If it were possible to add an enlargement to a five-story Old Law tenement, installation of a fireproof framing system would be required. This enlargement would also require installation of an elevator. Because expanding the building horizontally is prohibited by zoning and the configuration of the existing building on the lot, the insertion of a 2014 Building Code compliant elevator would therefore take space from dwelling units. Any four-story Old Law tenements seeking to add a vertical enlargement must have a fire-retarded cellar ceiling.

Because most New Law tenements are larger six-story buildings, adding a vertical enlargement would likely be cost-prohibitive to most property owners. New Law tenements also typically contain a fire passage through the cellar that provides egress to the street for residents at the back of the building. Because the fire passage is below the DFE, another means of egress above the DFE would need to be provided, which would also take space from residential units. Because New Law tenements usually have elevators with machinery located in the cellar, these components would need to be relocated to the roof.

MDL prohibits any increase in height or number of stories to a converted dwelling. These buildings therefore have no option to replace any lost units below the DFE resulting from a FEMA-compliant retrofit. The New York City Board of Standards and Appeals can modify the MDL's requirements in certain circumstances; however there is no generally applicable relief offering flexibility to property owners.

City

As discussed earlier, NYC Building Code must incorporate Federal guidelines where required into Appendix G, which delineates requirements for construction in the floodplain. This section specifically applies to properties within the 1% annual chance floodplain that are determined, as per FEMA guidelines, to be either Substantially Damaged or Substantially Improved, as well as to all new construction. Although non-Substantially Improved buildings within the floodplain are not required to fully comply with Appendix G of the NYC Building Code, alterations made to pre-FIRM structures cannot increase the degree of noncompliance with Appendix G. Further, a series of certifications from NYC Department of Buildings (DOB) may be required depending on building type and a property's location in the floodplain that range from wet or dry floodproofing certifications to utility certification.

Multifamily buildings, like other buildings, are also subject to limits imposed by the City's Zoning Resolution. To address some of the challenges related to retrofitting, the City adopted the Flood Resilience Zoning Text Amendment in October 2013 to enable buildings to meet new flood-resilient construction standards throughout the floodplain. This zoning amendment helped expedite recovery by removing regulatory barriers that would either inhibit or deter resiliency measures.

The Flood Resilience Zoning Text Amendment aimed to assist existing multifamily buildings in a number of ways. It allowed buildings to measure height from the Design Flood Elevation (DFE) rather than the curb and exclude floodproofed floor area below DFE from bulk limits; it exempted interior stairs, ramps and elevators from floor area calculations to encourage wet floodproofing; it allowed deployable flood panels and lifts as permitted obstructions during flood events; it granted more flexibility in relocating mechanical equipment from below the BFE, including within rooftop bulkheads in flood zones; and to encourage

active ground floor commercial uses, it allowed building owners to exempt commercial or community facility floor area that was dry floodproofed. The Department of City Planning is continuing to assess opportunities to ease zoning restrictions where they may inhibit flood-resilient retrofitting or construction.

In many cases, evacuating floor space below the DFE to a new additional story at the top of the building would conflict with zoning height limits. Regulations potentially in conflict with such a measure include contextual height limits, the height-factor regulations for non-contextual buildings, and other regulations including the sliver rule which restricts the height of narrow buildings to the width of the street on which they front in certain medium and high-density zoning districts. With no room for an additional story to replace lost space, retrofitting would result in a reduction in the amount of usable space in the building. This is significant disincentive to resiliency improvements that comply with Appendix G, and may make such improvements economically infeasible.

Multifamily Affordable Housing: Financial and Regulatory Controls

Partners	FINANCIAL CONTROLS	REGULATORY CONTROLS
PRIVATE MARKET Lenders Banks Private Insurers Developers (non-profit and private)	Most housing, including affordable housing, is constructed through **private for-profit** or **non-profit** developers. Private **financing** drives most housing development in the City.	**Private lenders** often require a certain level of flood insurance to cover possible future damage, while investments in resilient design generally add cost to new projects. **Private market flood insurance** costs can be much higher than NFIP or WYO policies, but may offer extra coverage.
FEDERAL U.S. Dept. of Housing & Urban Development (HUD) Federal Emergency Management Agency (FEMA) Internal Revenue Service (IRS) Congress	Federal tax credit programs such as the **LIHTC** encourage private investment in affordable housing. Credits are allocated to developers that sell to investors to raise equity for projects. Grant programs such as the **CDBG grants** support the creation and maintenance of affordable housing, while direct subsidies to individuals and landlords, like **Section 8 and 202**, assist in purchases. **Federal tax codes** regulate deduction of mortgage interest and other housing costs, tax credits, and bond issuance for housing construction.	**FEMA** sets construction standards in the floodplain and administrers **NFIP** which provides flood insurance to buildings. Federal legislation, like the **Homeowner Flood Insurance Affordability Act** (2012), establishes costs and policy but has not addressed multifamily buildings. Retrofits may trigger **credit Recapture** in **LIHTC** buildings through constraints on reprogramming floodable areas.
STATE NYS Homes and Community Renewal (HCR) NYS Housing Finance Agency (HFA) NYS Attorney General NYS Department of Taxation and Finance	The New York State **legislature** approves guidlines for assessing and changing tax assessment. **State agencies** support financing and maintaining affordable housing; **DHCR** regulates rent-stabilized housing and administers a portion of the **Mitchell-Lama program**, while **HFA** helps finance affordable housing, like the **80/20 Housing** program.	To make resilient retrofits, owners of **rent regulated** buildings may have to create new agreements with **NYS DHCR** and **NYC HPD**. **NYS Multiple Dwelling Law (MDL)** could compromise viable retrofit strategies by limiting opportunities for altering multifamily buildings and relocation of housing units.
CITY NYC HPD NYC Housing Authority (NYCHA) Rent Guidelines Board NYC CIty Council NYC DCP NYC BSA	**NYCHA** maintains the City's public housing, while **HPD** and **HDC** partly administer the **Mitchell-Lama program** and finance the restoration and new construction of affordable housing units. The **Rent Guidelines Board** sets rent increases upon renewal across stabilized apartments. City **property tax credits and exemptions** encourage affordable housing in new construction.	**Appendix G** of the NYC Building Code, enforced by DOB, guides construction in the City's Special Flood Hazard Area. Existing City **regulatory housing agreements** rarely account for resilient retrofit costs. **Zoning constraints** may inhibit resilient retrofits or new construction in the floodplain.

When considering resiliency improvements to affordable housing, the additional layers of Federal-, State-, or Locally-administered funding or credit allocation requirements add layers of complexity. The infographic above shows the range of entities often involved in financing and administering affordable housing. While not an exhaustive list, it illustrates the multiple jurisdictions and relationships that must be considered when retrofitting.

RESILIENCY FRAMEWORK

Hurricane Sandy revealed how vulnerable significant portions of the East Village, Lower East Side and Two Bridges neighborhoods are to coastal flooding, and highlighted the urgent need to develop mitigation strategies that will protect residents in the short- and long-term. With multifamily mid-rise walk-up buildings concentrated inland and tower in the park buildings located close to the low-lying coastline, there is also a critical need to protect a dense building stock home to thousands of New Yorkers, many of whom rely on affordable housing.

Opportunities for coastal protection within the waterfront parks are underway, and when complete, these projects will greatly benefit the surrounding neighborhoods. While reducing flood risk, these projects will also be integrated into existing open areas to function as shared spaces that will also help promote the neighborhoods' social vitality. Together with future coastal protections, neighborhood and building-scale floodproofing strategies will ensure a long-term multi-layered plan for reducing flood risks.

The diagram on the following page is an illustrative section of an east-facing corridor in the study area that includes the variety and density of multifamily buildings along the shoreline. While coastal flood protections such as the East Side Coastal Resiliency project will protect neighborhoods against storm surge, zoning and physical mitigation strategies are needed to enable individual mid-rise walk-ups and tower in the park buildings to lower their own flood risk. The full scope of flood mitigation investments must still connect with existing park lands and streetscapes to reflect the surrounding community fabric.

In many cases, alternative flood mitigation, such as dry floodproofing mechanical systems or wet floodproofing certain occupiable spaces below the BFE, is more cost-effective than full compliance strategies and may still offer the advantage of reduced flood risk. Most multifamily buildings in the study area are structurally sound, and damage from Sandy was largely limited to mechanical and electrical systems. By promoting alternative strategies for partial mitigation through policy reform at the Federal, State and local levels multifamily buildings can be made more resilient while maintaining their affordability.

With the Build it Back program, the City is repairing Sandy-damaged buildings throughout the floodplain and implementing resiliency improvements where feasible. In the East Village, Lower East Side and Two Bridges, the program is working with over twenty multifamily properties representing 2,400 households to complete resiliency retrofits. Additional funding tools and programs are necessary to make buildings in this neighborhood, and others citywide, more resilient and better prepared for future floods.

The following illustrative case studies take an in-depth look at retrofitting strategies for mid-rise walk-up buildings, tower in the park buildings, and an individual high-rise tower with elevator. First, fully NFIP-compliant strategies are explored, in part to show how infeasible they are for multifamily buildings. Next, three alternative mitigation measures are shown for each building type. Any retrofitting strategy should include an engineering feasibility analysis to ensure buildings remain safe and structurally sound.

Although currently ineligible for flood insurance premium reduction, the illustrative partial mitigation strategies inform the City's advocacy for regulations that encourage a resilient multifamily building stock and support much-needed updates to the current regulatory framework.

Reducing Flood Risk through a Multi-Layered Resiliency Strategy

Enable tower in the park buildings to become more resilient by developing **alternative floodproofing strategies** that focus on **perimeter or individual building protection.**

Maintain and improve **connections between neighborhoods and waterfronts** for the use and enjoyment of the park in non-storm conditions.

Support **possible alternative uses for ground floor sub-BFE spaces** beyond storage, parking and access to include **building amenities or commercial space.**

Enable **multifamily mid-rise** buildings to become resilient by developing feasible **floodproofing strategies for critical systems.**

Coastal protection should be **integrated into** the **existing infrastructure** of shoreline parkland.

Provide guidance to property owners and managers for **operational preparedness** planning **to support partial mitigation strategies.**

Preserve existing **affordable housing** to maintain affordability for area residents.

CASE STUDY 1: Multifamily Mid-Rise Walk-Up

Multifamily mid-rise walk-up buildings, or tenements are typically sixty to seventy feet in height. Since many were constructed before 1929, a great deal of these buildings are non-fireproof, wood frame with unreinforced masonry construction, and have brick exteriors and shallow foundations.

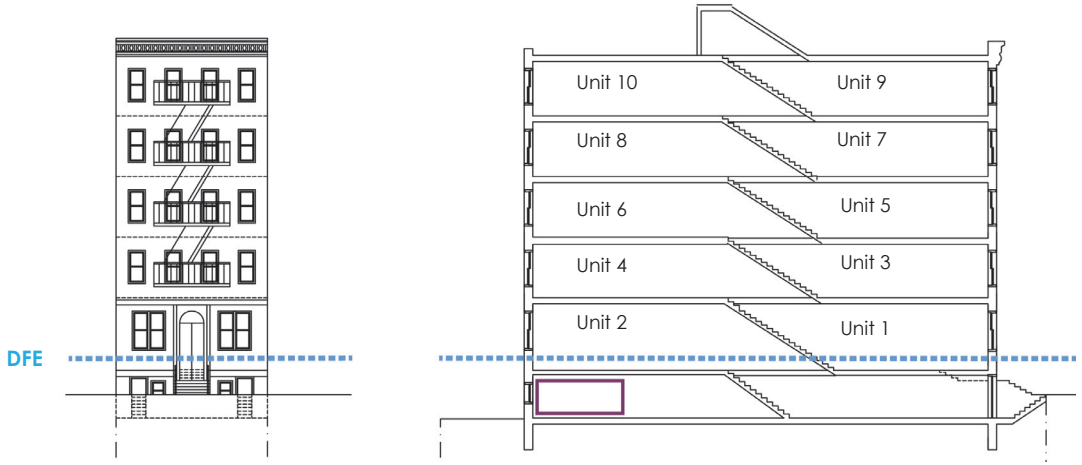
In the study area, the Base Flood Elevation (BFE) of lots with this building type are up to four feet above grade, often encroaching upon the first floor. Retrofit strategies for this typology are limited by the current Federal resiliency standards, as well as by the NYS Multiple Dwelling Law (MDL) and zoning regulations.

In most buildings, damage from Sandy was primarily to below grade critical systems and first floor areas. Strategies that may qualify for NFIP flood insurance premium reductions, or that could be required if the building is Substantially Improved (illustrated on pages 33-34) include: filling the basement to lowest adjacent grade, wet floodproofing former residential areas below the Design Flood Elevation (DFE), or relocating unusable floor area below the DFE to the roof, which recent zoning amendments now allow.

Many of these options, however, are not cost-effective and are very difficult to implement. More economical approaches, such as the partial mitigation strategies listed on page 35, could reduce risk and would be more workable, but would not necessarily lower insurance premiums or be permitted in Substantially Improved buildings. Since many mid-rise buildings host ground floor dwelling units, fully NFIP-compliant retrofitting strategies would also likely lead to a loss of dwelling units, causing displacement and rental income loss that could require restructuring building financing.

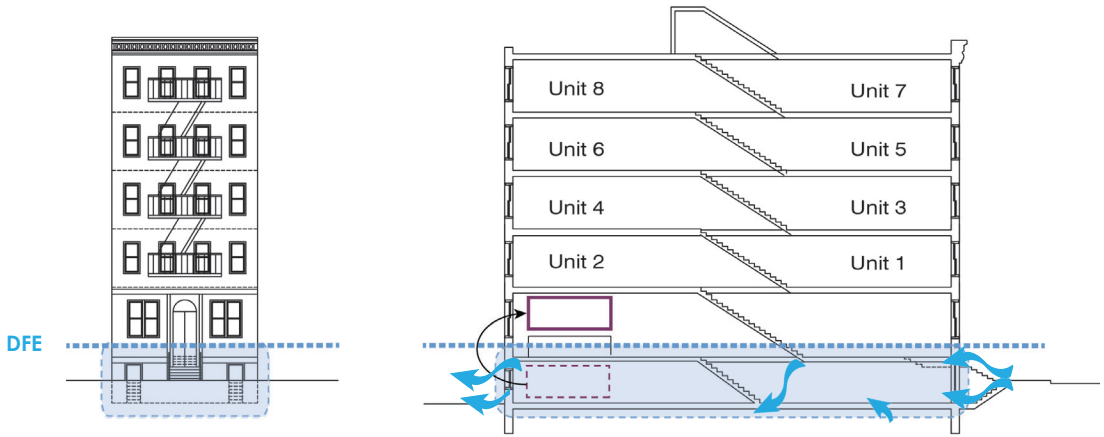
For buildings with affordable housing, there are additional challenges depending on program financing requirements.

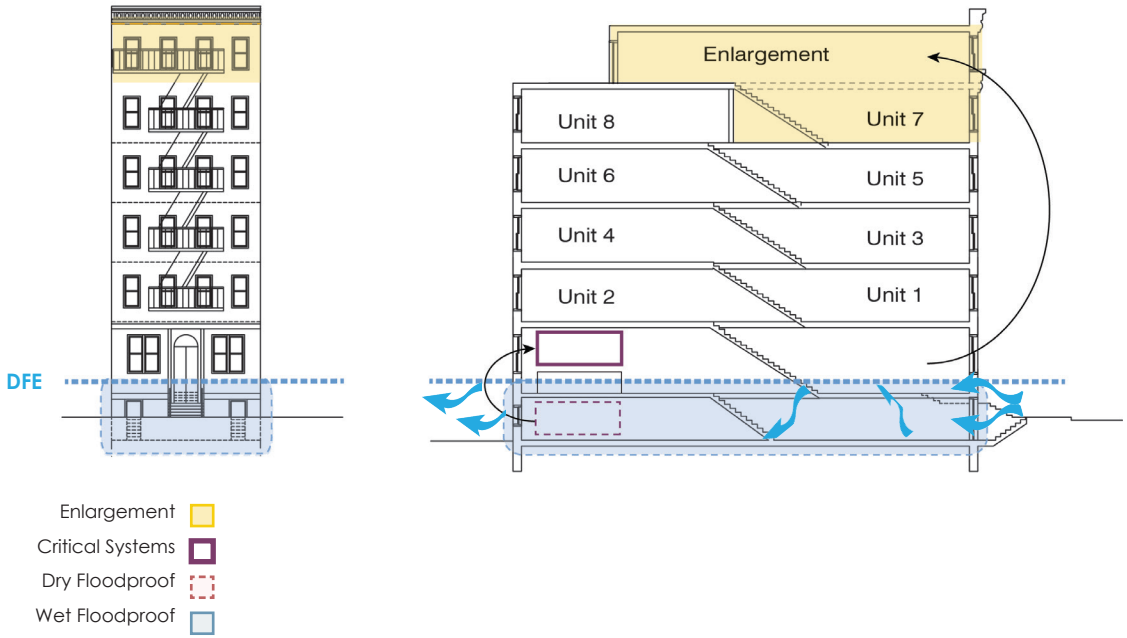
Existing Conditions



KEY CHARACTERISTICS

Site Conditions	
Construction Type	Masonry w/ wood joists
Stories	5 + basement
Max FAR	4
Built FAR	4.17
Residential Units	10
Elevator	No
Zoning District	R8B
Street Width	60'
Flood Risk	
Flood Zone	AE
Base Flood Elevation	11'
Grade Elevation	7.5'
Design Flood Elevation	12'
Critical Systems Location	Basement





Fully NFIP Compliant Retrofit Strategy 1

One option to retrofit a multifamily mid-rise building that would be fully compliant with NFIP requirements would include wet floodproofing the area below the DFE, and making structural reinforcements to neutralize hydrostatic and hydrodynamic pressures as necessary, seen top left. Non-structural elevation of critical building systems could be accomplished by relocating them to a platform or electrical closet above DFE.

This strategy is fully compliant with FEMA floodproofing standards, NYC Building Code Appendix G, and the Zoning Resolution. However, ground floor dwelling units would be removed from use and residents would be displaced. Loss of rental revenue would make paying debt service difficult for building owners and could trigger recapture if this building benefits from the Low Income Housing Tax Credit program.

Fully NFIP Compliant Retrofit Strategy 2

A second option builds upon the previous strategy by relocating unusable basement floor area to the rooftop, as illustrated at lower left. Such an enlargement would benefit from the 2013 Flood Zoning Text Amendment provision on exempted floor area below the DFE.

This strategy is fully compliant with Appendix G, but neither MDL nor zoning regulations. Per existing regulations, dwelling units below DFE would be permanently removed. MDL does not permit converted dwellings to increase in height or stories (with some exception). If a non-fireproof Old Law tenement, MDL would also require the lowest occupiable floor to be fireproofed. Areas below DFE are required to be wet floodproofed. Loss of residential rental revenue could trigger credit recapture if this building benefits from the LIHTC program. Conversion of the first floor to a dry floodproofed commercial or community facility may be an alternative for the property owner to recoup lost rental revenue.

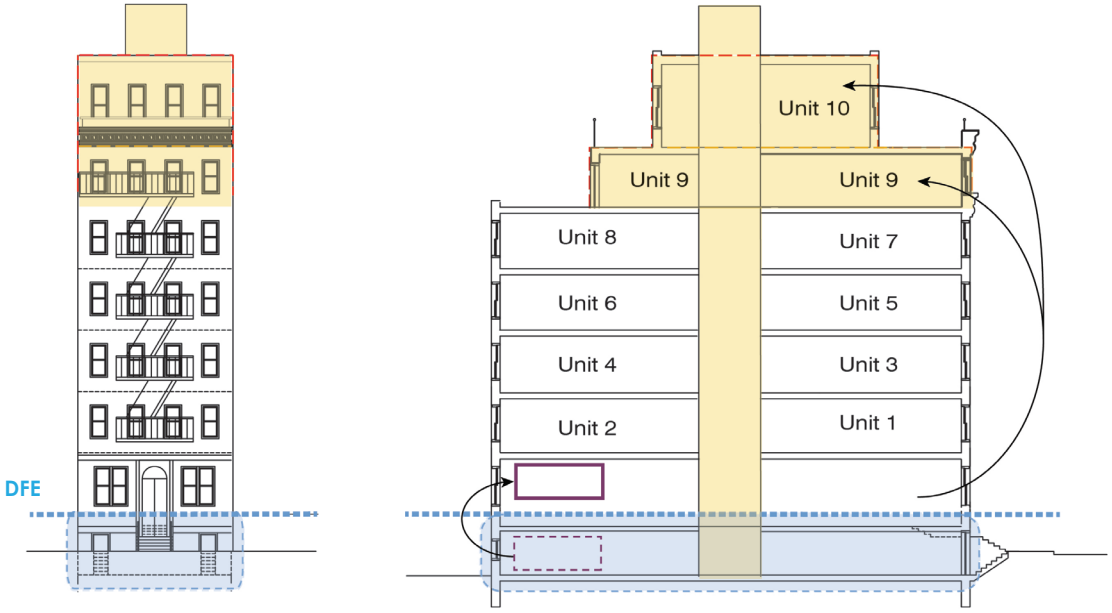
Fully NFIP Compliant Retrofit Strategy 3

A third option for retrofitting mid-rise buildings to fully comply with NFIP builds upon preceding strategies by relocating unusable floor area to the roof for an enlargement and duplex addition. Changing the height from five stories to a partial sixth would require elevator installation and the relocation of critical building systems to the first floor above DFE. Additional forms of egress would also be required.

The exterior walls of the elevator shaft would also be reinforced to offset hydrostatic and hydrodynamic pressures. Elevator shafts below BFE would then be constructed of reinforced masonry block or the concrete pit built to withstand inundation and easily drain.

This strategy is fully compliant with NYC Building Code Appendix G. The installation of the elevator satisfies Building Code requirements for additional building height. However, it conflicts with MDL and certain height regulations in the Zoning Resolution. MDL states that if an alteration is being done to a building classified as a non-fireproof Old Law tenement, the lowest occupiable floor would have to be fireproofed. FEMA would then require that everything below the DFE be wet floodproofed.

This structure fronts on a 60-foot wide street in a contextual R8 district. Zoning restrictions limit building heights 45 feet wide or less to the width of the street on which it fronts. This building was approximately 60 feet in height before the alteration. There would be no room in the building envelope for replacement of eliminated floor area even though total floor area would not be increased. In addition, ground floor units would be taken out of service.



Full NFIP Compliance: Challenges & Conflicts

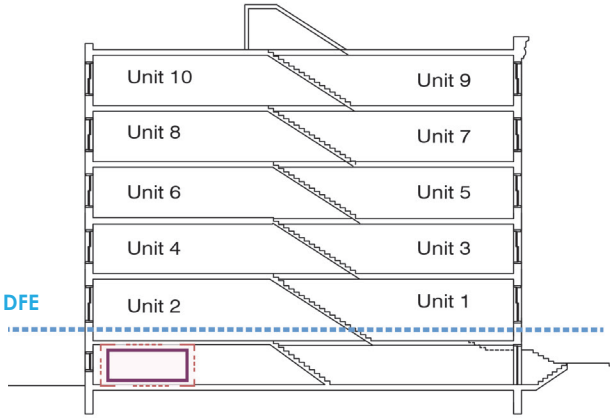
- FEMA compliance may conflict with New York State MDL and NYC zoning regulations
- NYS MDL requires that alterations to Old Law tenements fireproof the lowest occupiable floor.
- Zoning height regulations may restrict the ability to make vertical enlargements.
- Relocation of unusable floor area to a roof for enlargement, and other retrofit strategies, may be very costly.
- Retrofitting ground floors can lead to the lose of affordable housing units.
- Vacating ground floors also breaks the critical connection between the building and the street, resulting in poor urban design.

Alternative Strategies

Because they do not comply with Federal floodplain construction standards, the following alternative mitigation strategies are not currently permitted for buildings that are Substantially Damaged or Substantially Improved. Although non-Substantially Improved buildings within the floodplain are not required to fully comply with Appendix G of the NYC Building Code, alterations made to pre-FIRM structures cannot increase the degree of noncompliance with Appendix G. This may allow for some flexibility in adapting buildings for flood resilience. It would also maintain the important connection between the building and street, critical to access and good urban design.

The following strategies could, however, lower the risk for multifamily buildings and are practical adaptation options. Flood damage-resistant materials should be used whenever possible when wet floodproofing a property for resiliency. Dry floodproofing of residential spaces and entrances is not currently recognized for flood insurance premium reduction and is a very costly mitigation measure. It can also present physical constraints on mid-rise buildings. Nonetheless, it is a feasible floodproofing option. If the lowest occupiable floor is left below the DFE, life safety must be considered. Buildings should develop a clear evacuation and resident notification plan to ensure that there will be minimal if any risk to life safety. Residents should always follow evacuation procedures.

According to currently published rate guidelines, the following alternative strategies will likely provide no—or at best partial—reduction in NFIP flood insurance premiums. General conditions for this building type include ground floor residential, DFE approximately five-feet above grade, and location in the 1% annual chance floodplain.

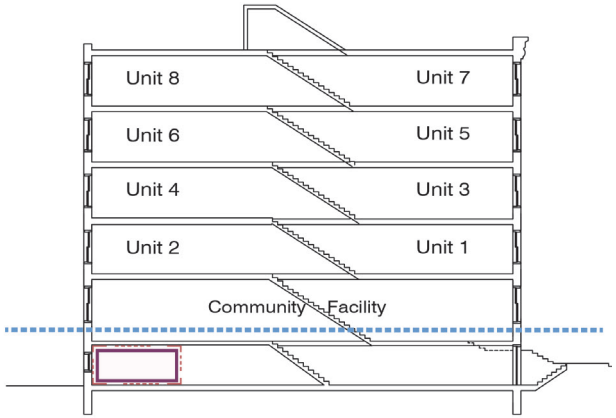


Dry Floodproof Critical Systems In Place

No or partial reduction in NFIP premiums.

One alternative strategy would be for critical building systems to remain below the DFE and be protected-in-place by encasing in a dry floodproofed vault. If a building owner opted to only encapsulate a boiler room located in the basement, the cost may begin at $15,000. Although dwelling units remain below the DFE in this scenario, in the event of a flood building systems would be protected.

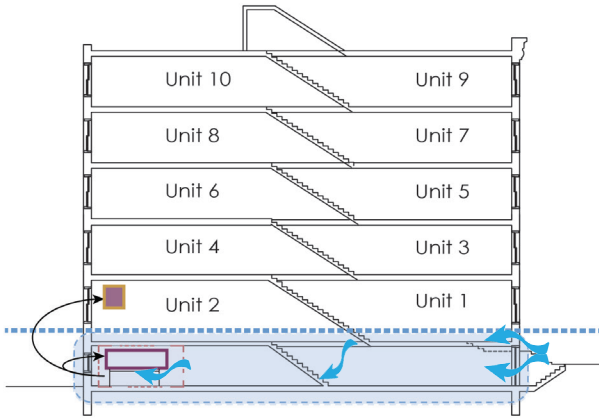
Critical Systems
Electrical Panels
Dry Floodproof
Wet Floodproof



Dry Floodproof Critical Systems & Convert Use

No or partial reduction in NFIP premiums.

As with the previous alternative, critical building systems remain in basement below the DFE and will be protected-in-place by encasing in a dry floodproofed vault. Additionally, ground floor use is converted to a community facility. This will displace tenants, but if the building benefits from the LIHTC program, it may be possible to avoid credit recapture with this conversion. Building owners would be able to recoup some lost residential rental revenue through rental fees from the new ground floor use.



Wet Floodproof & Relocate Critical Systems

No or partial reduction in NFIP premiums.

A third alternative floodproofing strategy would be wet floodproofing the area below DFE with flood damage-resistant materials and installing flood vents at exterior and interior walls to enable water entering the basement to flow into the rear yard because of slight grade change. Critical systems are relocated to a raised platform in basement and electrical panels moved to first floor above DFE. Although dwelling units remain below the DFE in this scenario, in the event of a flood, building systems would be protected.

CASE STUDY 2: Multifamily Tower In The Park

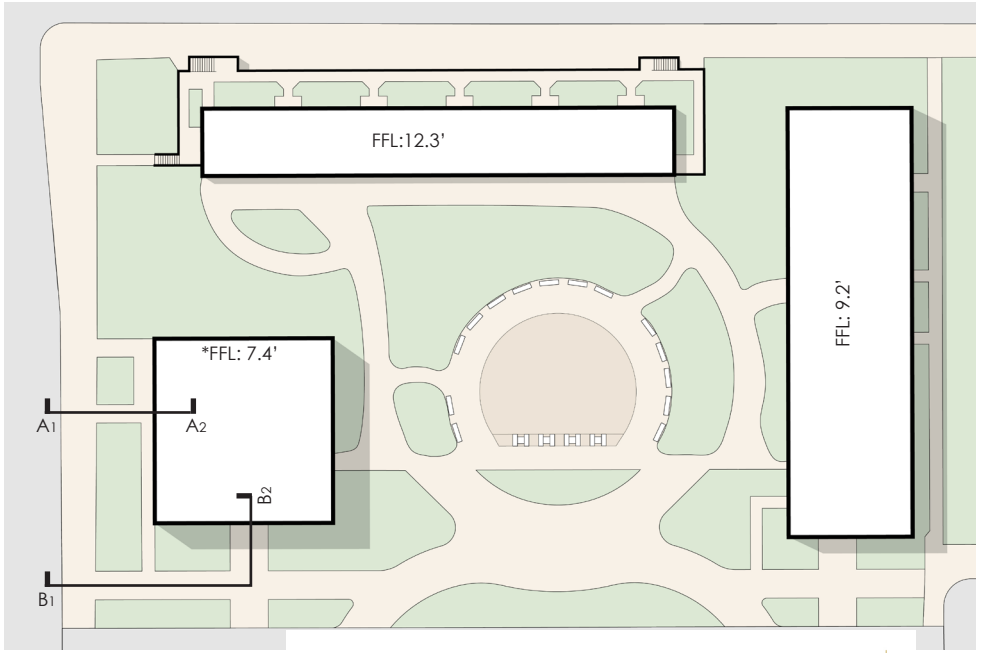
This tower in the park case study is a typical development comprised of multiple residential and mixed-use buildings ranging in height, density, and ground floor use. Preserving ground floor dwelling units is a priority, which somewhat limits retrofit options. However, a building with a ground floor commercial or community facility has more flexibility since dry floodproofing a non-residential ground floor is permitted. In mixed-use buildings, the residential lobby entrance must be wet floodproofed.

Damage was primarily to critical systems located below grade, ground floors, and open spaces following Hurricane Sandy. In this scenario, critical building systems are centralized below grade in one building. Although this centralizes power, it also makes protection critical for that structure and its connections. Elevator pits and equipment were also affected, making it difficult for residents that sheltered-in-place to remain in buildings. Lack of elevator service also affected ailing or elderly residents.

Sections A1-A2 and B1-B2 illustrate current site conditions at the building identified in the right-hand diagram. Elevations for each building are provided in parentheses. The DFE is between two to five feet above grade, which encroaches upon the ground floor.

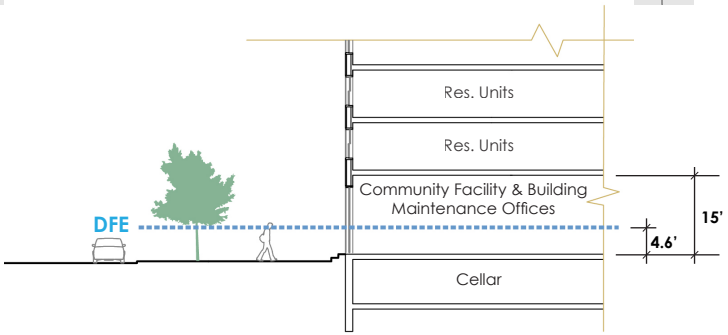
KEY CHARACTERISTICS

Site Conditions	
Number of Buildings	3
Stories	2-26
Max FAR	3.44
Built FAR	3.26
Residential Units	149
Elevator	Yes
Zoning District	R7-2
Flood Risk	
Flood Zone	AE
Base Flood Elevation	9'
Grade Elevation	4'-5'
Design Flood Elevation	10'
Critical Systems Location	Basement

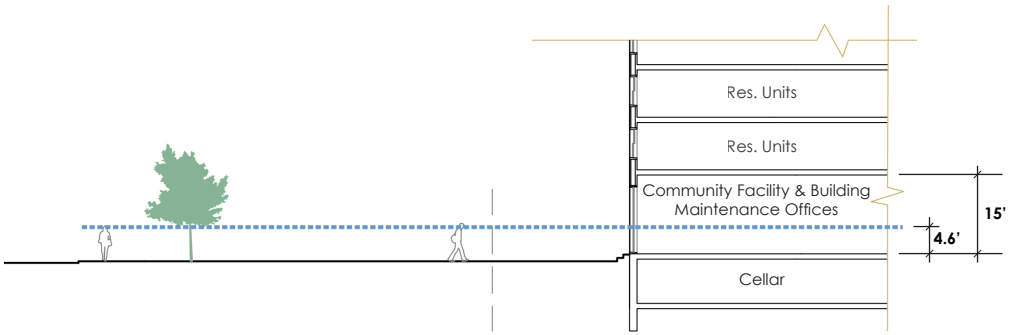


*FFL is Finished Floor Level

Existing Conditions



SECTION A1 - A2



Diagrams are meant to be illustrative only

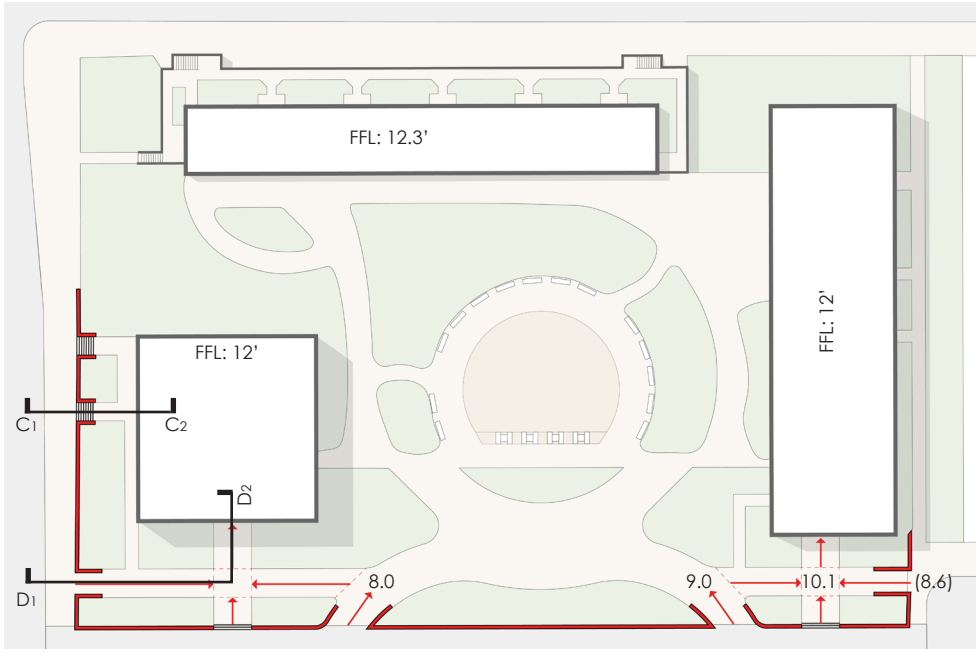
SECTION B1 - B2

Fully NFIP Compliant Retrofitting Strategy

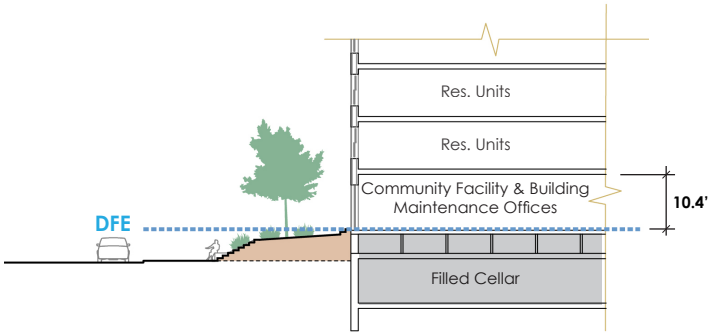
A non-structural elevation strategy for tower in the park developments, illustrated in the top plan view diagram and in section diagrams C1-C2 and D1-D2 below, would require vacating the ground floor up to the DFE, and constructing a new interior platform up to the elevated height. Though compressed, there would likely still be enough floor-to-ceiling height to utilize the area as a community facility or building maintenance office. The floor may also be converted to residential use as it now begins at the DFE. Flood insurance premiums should be lowered to reflect elevation of the lowest floor.

The section diagrams to the lower right indicate the gradual incline that results from re-grading the site. In addition to its role in mitigating flood risk, the slope has a positive impact on the public realm by creating opportunities for additional seating along the sidewalk and extra soil depth for plantings. The former cellar and remaining ground floor area below the DFE would need to be filled. Alternatively the area could be dry floodproofed if the building contained non-residential uses below the DFE.

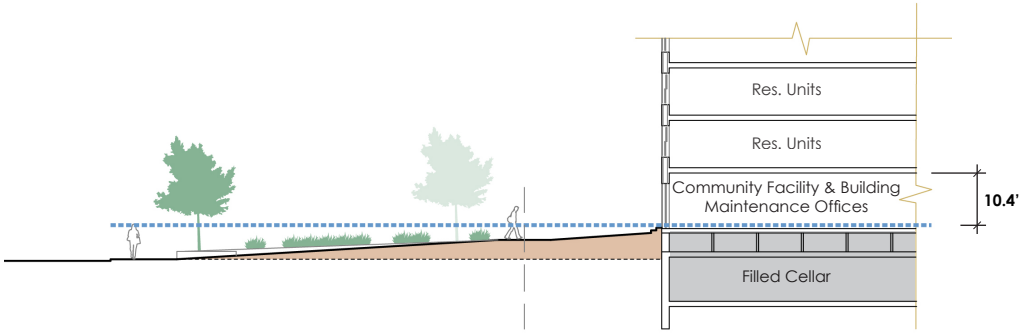
The increased elevation indicated in sections C1-C2 and D1-D2 creates a raised condition that has dual function: it assists in flood protection by diverting floodwaters away from the building and enhances the surrounding area design while maintaining access to the building entrance. The effects of grade change can be mitigated by a planted slope or terracing of retaining walls.



*FFL is Finished Floor Level



SECTION C1 - C2



SECTION D1 - D2

LEGEND

- Retaining Wall
- Ramp
- Landing

Diagrams are meant to be illustrative only

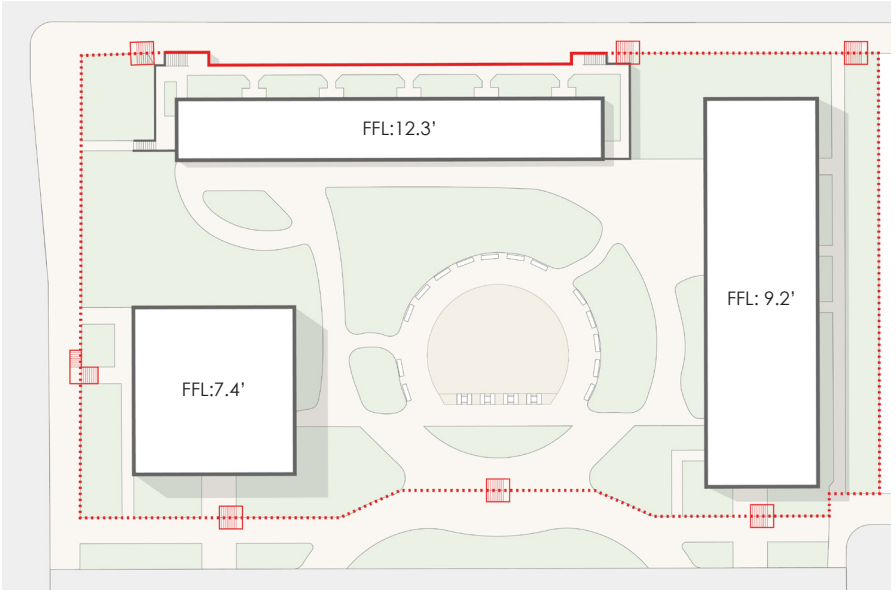
Alternative Strategies

Because they do not comply with Federal floodplain construction standards, the following alternative mitigation strategies are not currently permitted for buildings that are Substantially Damaged or Substantially Improved. Although non-Substantially Improved buildings within the floodplain are not required to fully comply with Appendix G of the NYC Building Code, alterations made to pre-FIRM structures cannot increase the degree of noncompliance with Appendix G. This may allow for some flexibility in adapting buildings for flood resilience.

The following strategies lower the risk for multifamily buildings and are practical adaptation options. Dry floodproofing residential spaces is not permitted and is very costly, but may still be a feasible option for this building typology. If the lowest occupiable floor is left below the DFE, life safety must be considered. Residents should always follow evacuation procedures.

These alternative strategies offer options for two types of protection: perimeter and individual building scale. The following partial mitigation strategies, as per NFIP's guidance, will likely provide no—or at best partial—reduction in flood insurance premiums. Nuances of difference are highlighted based on individual vulnerabilities.

In this typology, elevator systems present further complexity in determining cost-effective mitigation measures regarding equipment location, shaft placement and materiality, as well as detection systems.



*FFL is Finished Floor Level

Diagrams are meant to be illustrative only

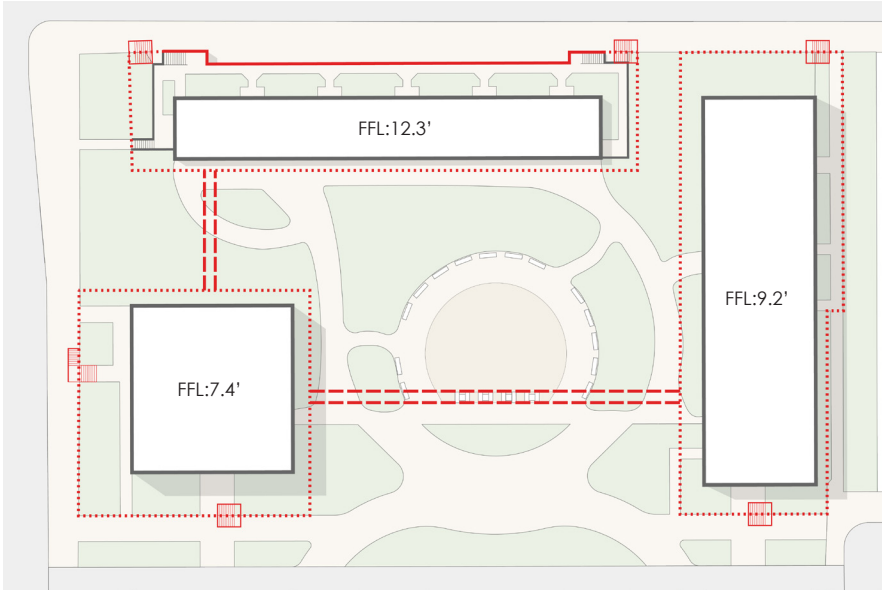
Dry Floodproof at Site Perimeter

No or partial reduction in NFIP premiums.

One option would be to deploy continuous flood shields around the site perimeter. Mechanical, electrical, and plumbing (MEP) penetration points between buildings would be sealed. Each building would provide the required number of egress routes up and over deployable flood shields.

LEGEND

- Dry Floodproof
- Dry Floodproofed mech. connections
- Deployable flood shields/gates
- Dry Floodproofed Ingress/Egress

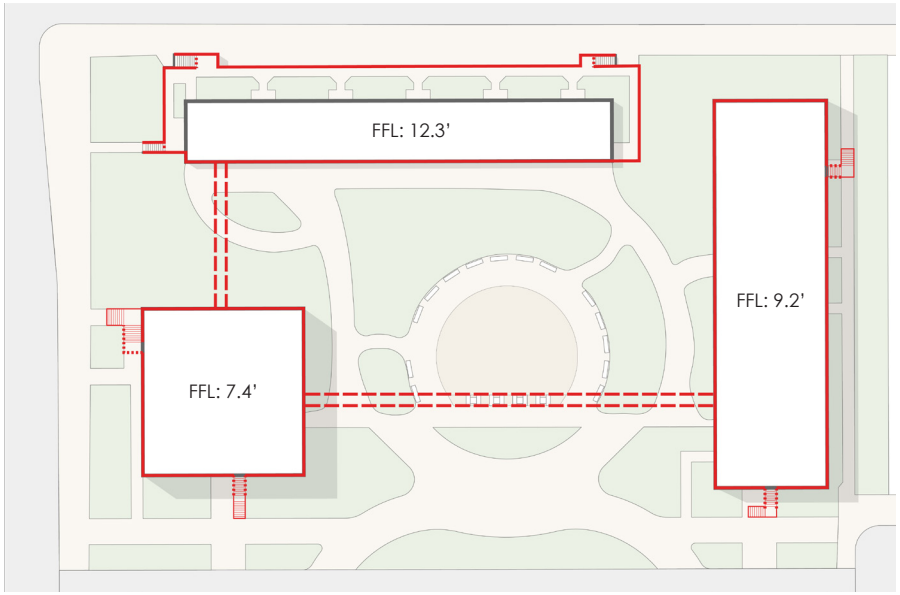


*FFL is Finished Floor Level

Dry Floodproof at Building Exterior

No or partial reduction in NFIP premiums.

Another option would be to deploy flood shields at the building perimeter and set back from building exterior wall. MEP connections between buildings would be dry floodproofed and penetration points sealed. Each building would provide the required number of egress routes up and over the deployable flood shields.



*FFL is Finished Floor Level

Diagrams are meant to be illustrative only

Dry Floodproof at Individual Buildings

No or partial reduction in NFIP premiums.

A third option would be to harden the building exterior wall and install deployable flood shields at all openings (doors, windows, etc). Installing a waterproof membrane at the building facade would provide additional redundant protection and impermeability. Floodproofing sub-grade spaces and MEP lines between buildings would be required to secure flood protection below grade. Install sewer backflow valves, but allow easy access for maintenance. Elevator equipment would be protected by either elevating essential systems above DFE or encasing in floodproof enclosure below DFE.

LEGEND

- Dry Floodproof
- Dry Floodproofed mech. connections
- Deployable flood shields/gates
- Dry Floodproofed Ingress/Egress

CASE STUDY 3: Multifamily Tower with Elevator

The strategy for an individual residential tower builds from the conditions illustrated in the preceding tower in the park case study. This case study explores an option for floodproofing that is fully NFIP compliant and three alternative mitigation strategies. Although the partial mitigation strategies provide protection, they would likely not receive reduced flood insurance premiums under the current regulatory framework. Residential towers may only have commercial or community facility uses below the BFE. This case study explores these different conditions and viable, cost-effective retrofitting strategies for each scenario.

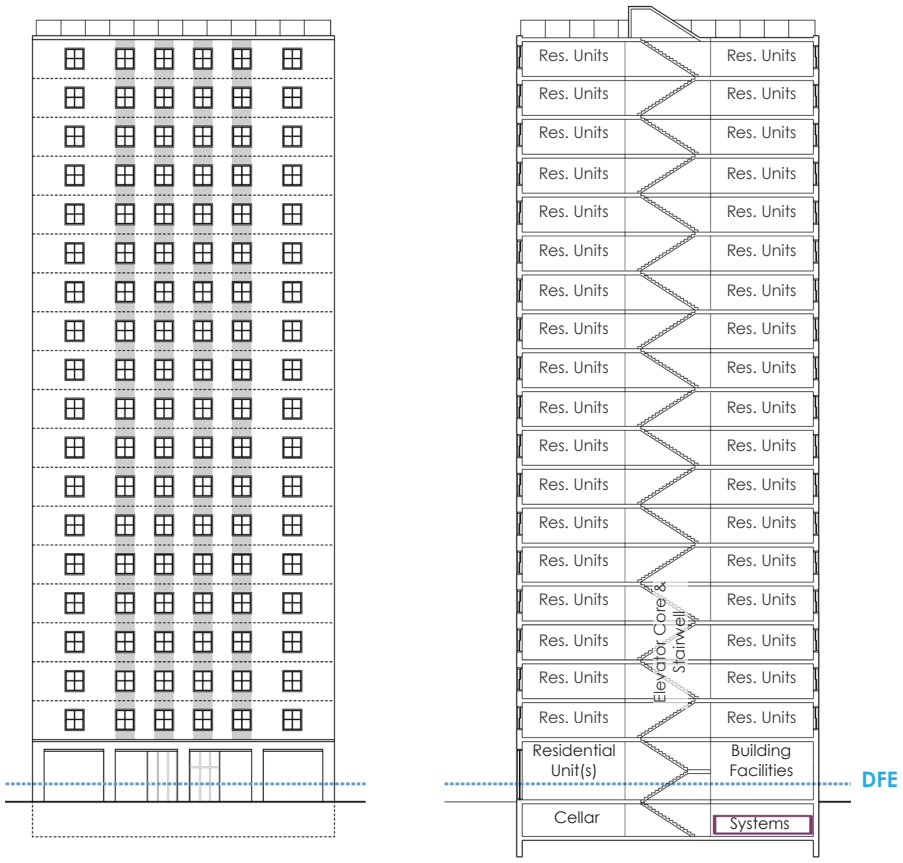
Full Compliance Retrofit Strategy

The basement of this building would be filled to lowest adjacent grade, resulting in a loss of usable below-grade floor area. Critical systems would be relocated and elevated to a new mezzanine floor level that would be constructed above the DFE. The ground floor would also be vacated of any active uses, including any residences, and it would be wet floodproofed using FEMA-approved flood damage-resistant materials.

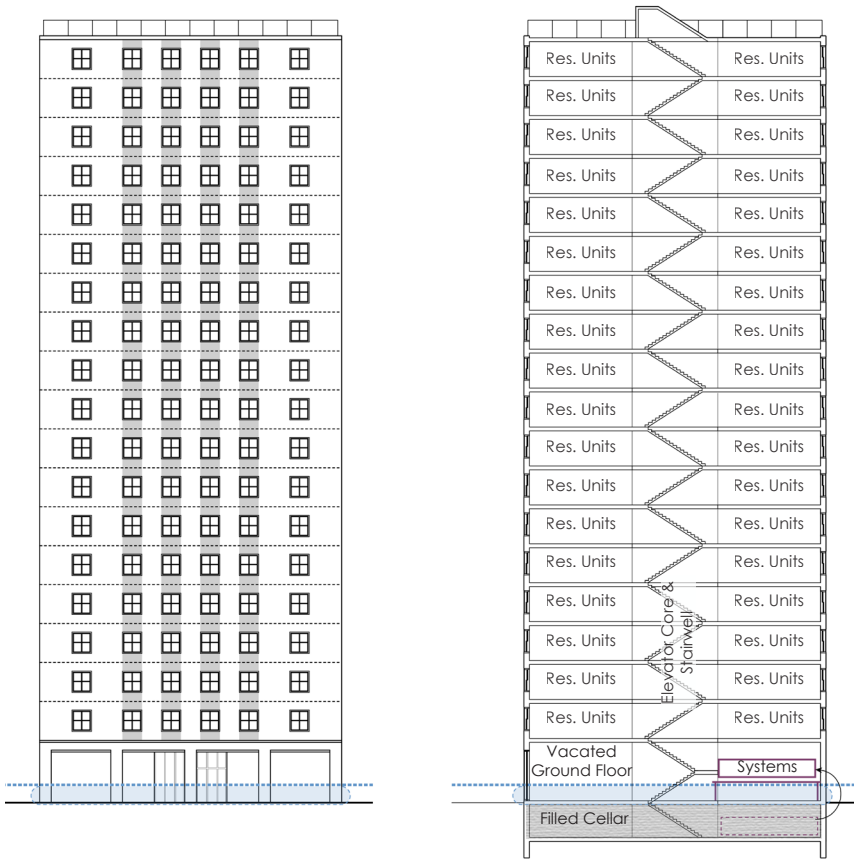
KEY CHARACTERISTICS

Site Conditions	
Stories	19
Elevator	Yes
Zoning District	R7-2
Flood Risk	
Flood Zone	AE
Base Flood Elevation	9'
Grade Elevation	4'-5'
Design Flood Elevation	10'
Critical Systems Location	Basement

Existing Conditions



Fully Compliant NFIP Retrofitting Strategy



Alternative Strategies

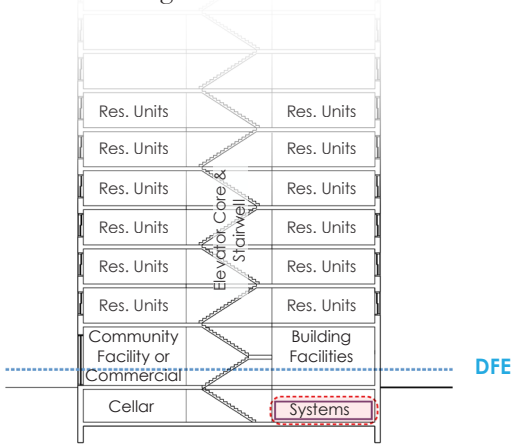
The following alternative mitigation strategies are based on buildings that are neither Substantially Damaged nor Substantially Improved and are specific to multifamily residential tower with elevator. Although non-Substantially Improved buildings within the floodplain are not required to fully comply with Appendix G of the NYC Building Code, alterations made to pre-FIRM structures cannot increase the degree of noncompliance with Appendix G. This may allow for greater flexibility in adapting buildings for flood resilience. These partial mitigation strategies lower the risk for multifamily buildings and provide practical pathways for adaptation. Flood damage-resistant materials should be used whenever possible when wet floodproofing a property for resiliency.

If the lowest occupiable floor remains below the DFE, life safety must be considered. Residents should always follow evacuation procedures. These strategies offer different permutations for reprogramming the ground floor and below grades spaces, which may result in loss of first floor dwelling units in some cases. Elevators and accompanying systems present complexity regarding equipment location, shaft placement and materiality, and detection systems. FEMA provides guidance on protecting elevators in *Elevator Installation for Buildings Located Special Flood Hazard Areas in accordance with the National Flood Insurance Program* (Technical Bulletin 4, November 2010).

Protect systems in place & Convert Ground floor Use

No or partial reduction in NFIP premiums.

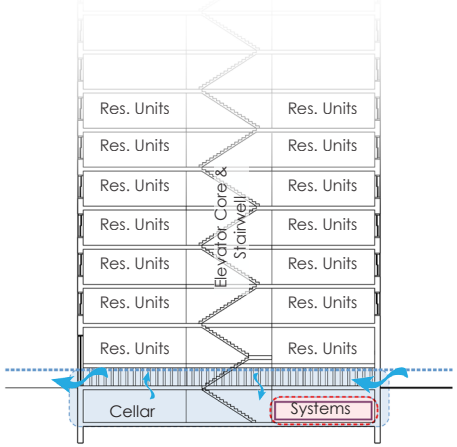
One option would be for critical systems to remain below the DFE encased in a dry floodproofed vault. Care would need to be taken to minimize buoyancy pressures on the encased systems. If there is ground floor residential, it may be relocated elsewhere within the building and the area converted to community facility space or a commercial frontage designed to minimize flood risk while serving area resident needs.



Wet Floodproof Below DFE & Dry Floodproof Systems

No or partial reduction in NFIP premiums.

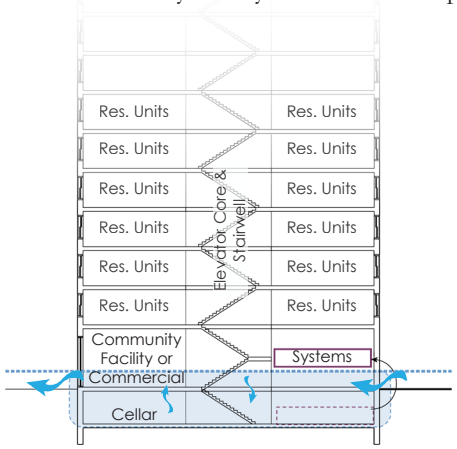
A second option would be to wet floodproof up to the DFE. The first floor could be raised to the DFE by installing a concrete sub-floor if clearance allows. Critical building systems would remain in the basement and be protected in place by encasing in a dry floodproof vault. Existing ground floor uses could be maintained along the sub-floor, though floor-to-floor heights would likely constrain non-residential uses.



Wet Floodproof Below DFE & Relocate Systems to Mezzanine

No or partial reduction in NFIP premiums.

A third option would be to wet floodproof below the DFE using flood damage-resistant materials. Construct a new mezzanine if floor-to-floor heights allow, access to be provided by constructing a staircase in existing lobby. Below grade critical systems would be relocated to the mezzanine level above the DFE. Any existing ground floor residential units would be converted to wet floodproofed community facility or commercial spaces.



Critical Systems Dry Floodproof Wet Floodproof

Summary of Partial Mitigation Strategies

Since multifamily buildings cannot be structurally elevated, the preceding case studies identified options for feasible alternative partial mitigation strategies. Although they are not currently recognized by FEMA for NFIP premium reductions, in many cases they preserve ground floor dwelling units and rental revenue streams for property owners. Key takeaways from the case studies focus on the building scale and site scale.

For multifamily mid-rise and tower in the park buildings, alternative strategies for partial credit at the **building scale** should include the following:

- **Dry floodproofing mechanical systems in place** below BFE; or

- **Wet floodproofing** community facility or commercial space **below the BFE** using flood damage-resistant materials and filling basements to the lowest adjacent grade.

For tower in the park developments, alternative strategies for partial credit at the **site scale** should include:

- **Site improvements to mitigate flooding along the perimeter** of a site by installing continuous deployable flood shields or passive flood gates; or

- **Dry floodproofing** each **individual building** by installing deployable flood shields or passive flood gates and sealing vulnerable mechanical, electrical, and plumbing ducts that may run between buildings.

Characteristic early 20th century tenements found throughout the East Village, Lower East Side and Two Bridges neighborhoods

CONCLUSION

Hurricane Sandy demonstrated the significant risks that the East Village, Lower East Side and Two Bridges neighborhoods face from coastal storms and floods—risks which will only increase with climate change. The study area is home to many residents, including large numbers of low-income and elderly households, many of whom live in rent-regulated affordable units in multifamily buildings.

While continued capital investments, such as the East Side Coastal Resiliency flood protection project and mitigation investments by the New York City Housing Authority (NYCHA) and New York City's Build it Back Program, will significantly reduce these risks, there is an ongoing need to advance more retrofitting options. These buildings are uniquely challenging to retrofit since elevation is not feasible and they face additional costs and regulatory barriers. To realize a more resilient housing stock in these neighborhoods, and the city and region overall, there is a need to develop cost-effective funding mechanisms specifically for multifamily buildings with rent-regulated units and to align policies at all levels of government.

A busy intersection in the Two Bridges neighborhood

Federal Reform

The Federal Emergency Management Authority (FEMA) should expand its catalog of feasible, approved floodproofing strategies and offer National Flood Insurance Program (NFIP) premium reduction.

Current floodproofing standards are not appropriate for the dense multifamily building stock found in New York City and many other older, dense coastal towns and cities. Since they cannot be physically elevated and many have ground floor dwelling units or accessory non-residential uses critical to the well-being of the residential tenants and surrounding communities, alternative mitigation strategies identified in this report should be permissible. Local building codes would then allow for a broader range of partial mitigation measures that are more appropriate.

Despite acknowledging that there are alternative mitigation investments for multifamily property owners, FEMA neither recognizes the cost savings of many of these strategies nor matches these investments with credit towards lower NFIP premiums. Thus, many legitimate mitigation pathways remain closed to property owners without any financial or regulatory incentive at the Federal level. Additionally, rates should consider the inherent durability of the masonry and steel frame construction techniques that characterize much of New York's multifamily building stock.

FEMA should develop flood insurance products that address the needs of multifamily buildings. FEMA's existing floodproofing guidance and the NFIP's current underwriting framework do not provide appropriate coverage for multifamily buildings. Underwriting must consider relevant variables and thresholds which differ from those for single-family structures in the types of damage they experience during a flood. In addition, insurance products for multifamily buildings should better incentivize landlords and homeowners to lower their flood risk. Even after adjusting for a closer actuarial cost of insuring multifamily buildings in the floodplain, improved insurance coverage should offer:

• **Partial credit for partial flood mitigation** investments

that provide a real measure of flood protection and are better than doing nothing to mitigate flood risk;

• **Increased coverage caps to better match flood exposure of multifamily buildings** and provide a more meaningful insurance product that will increase buy-in from building owners and residents; and

• **Business interruption coverage** for property owners impacted by rental income loss from displaced tenants or lost dwelling units.

Financing and Implementation

To make resiliency improvements to multifamily buildings while sustaining a commitment to continued affordability, additional sources of funding will be needed.

Retrofitting existing multifamily buildings can be an expensive undertaking for any building. Affordable housing faces particular challenges because it has more constrained access to capital to undertake these measures. Like other improvements to buildings, capital improvements for resiliency would typically need to be supported by future building revenues, which implies increases in rents, or for coops, assessments on shareholders, measures that would be in tension with the goal of sustaining the building's affordability. Much as preservation of affordable housing in general sometimes requires public or institutional support, resiliency improvements may require similar types of investment to prevent housing stock deterioration, financial strain on property owners, potential foreclosure, loss of affordable housing units, and residential displacement.

Investments in resiliency improvements to these buildings could not only help preserve affordability by avoiding flood insurance premium increases that may be unsustainable for a building with fixed revenues, but would also be consistent with Federal strategies for hazard mitigation. These investments can reduce the need for future flood insurance payouts and Federal recovery assistance resulting from future floods, as well as protect against the risk to government-sponsored enterprises and taxpayers posed by the potential for default on Federally backed mortgages.

Other types of financial programs that could be explored to support resiliency investments include:

• Low interest loan programs and revolving loan funds;

• Property, income or sales tax credits for retrofits, or expansion of the existing property tax freeze on improvements stemming from flood mitigation measures to include retrofits in multifamily buildings;

• A transferable credit program that allows property owners investing in mitigation to transfer or sell surplus credits exceeding their tax liability to other multifamily or commercial projects needing to offset costs of retrofitting.

Certain low-interest loan or grant programs exist today, including NYSERDA's Green Jobs, Green New York Program which provides low-interest financing and workforce development opportunities tied to energy upgrades. New York City already offers grants to encourage stormwater mitigation by developing various green infrastructure systems through the New York City Department of Environmental Protection (DEP). Additionally, loan banks aimed at spurring energy resilience and flood mitigation have been implemented in Connecticut and New Jersey.

Floodproofing financing programs should be structured to work with existing energy efficiency programs to enable property owners to combine such measures in other planned improvement projects.

Flood resilience should be combined, especially when timely and financially practical, with programs that support structural or non-structural investments such as energy-efficiency, water conservation improvements, or stormwater management practices. On the State level,

Madison Street between Market and Pike Streets

this may include looking to programs offered through the New York State Energy Research and Development Agency (NYSERDA) such as *Combined Heat and Power* (CHP) *Acceleration,* the *Multifamily Performance Program*, or the recently expired *Advanced Submetering Program* for guidance. On the Federal level, supporting the expansion and continued sponsorship for tax abatements such as the federal *Energy Efficient Commercial Building Tax Deduction* (IRS 179D) may offer a workable model.

Affordable housing preservation finance programs at the Federal, State and City level should incorporate resiliency by accounting for future insurance costs and assessing opportunities for floodproofing.
Resiliency should be considered when assessing for and financing preservation needs and building systems upgrade opportunities in existing multifamily buildings with affordable housing. For buildings benefiting from affordable housing financing or tax subsidy, these improvements are important for reducing risk as well as improving building and living conditions, but present additional complications.


East River Waterfront, between Manhattan and Brooklyn Bridges

Enabling Retrofits through Zoning

The City should explore updates to zoning rules to further facilitate floodproofing measures.
As noted, the City adopted the Flood Resilience Zoning Text Amendment in 2013 to address the most pressing conflicts preventing existing and new buildings in the floodplain from complying with new flood resistant construction standards. This text was adopted on an emergency basis and will expire if not extended.

In addition to making the text changes permanent, DCP is exploring ways to further support building improvements that mitigate flood risk. An issue of particular significance for multifamily buildings is whether greater flexibility should be allowed for replacing lost floor area below the DFE within an added story. Building on the analysis presented here, DCP will collaborate with partner agencies and reach out communities to explore ways to identify potential appropriate avenues to ease restrictions that prevent or deter resiliency improvements.

Based on the resilient designs that NYCHA and New York City Housing Preservation and Development (HPD) have been working to incorporate into multifamily buildings impacted by Hurricane Sandy, some additional zoning challenges have already been identified. DCP will work to resolve these zoning issues in partnership with surrounding communities and other agencies engaged in flood resiliency.

Coordination and Outreach

Federal, State and City governments should coordinate on developing better educational guidance on flood risk, flood insurance, and flood mitigation strategies for multifamily buildings.
Education and outreach are critical to clarifying the level of risk and conveying the need for flood insurance and implementation of feasible retrofitting measures. An expanded effort across Federal, State and City agencies

should assist multifamily property owners in better understanding flood risk based on their location in current and projected future flood zones.

On the state level, some floodproofing strategies for mid-rise buildings conflict with New York State Multiple Dwelling Law (MDL) because it does not permit vertical enlargement of converted dwellings. Additionally, if floor area that cannot be used below the DFE is relocated to the roof for an enlargement, MDL requires additional egress. Guidance on how these conflicts impact retrofitting options of existing buildings should be made available so property owners are fully aware of their options.

Additionally, building owners, particularly those that manage affordable housing, need more clarification on NFIP's flood insurance purchase requirements and how to equip themselves to speak with brokers to understand coverage options. According to property owners and building managers consulted for this report, echoed by the City's *Multifamily Flood Insurance Affordability Study*, there is general confusion about NFIP flood insurance coverage. These concerns include questions over coverage requirements, coverable assets and what is included in the coverage. How legislation such as the *Biggert-Waters Flood Insurance Reform Act* (2012) and the *Homeowner Flood Insurance Affordability Act* (2014) will affect property owners is also complicated.

Some very helpful resources have been released since Hurricane Sandy to help property owners understand their level of risk and options for mitigation, such as Center for New York City Neighborhoods *Flood Help NY* website, Enterprise Community Partners *Hurricane Sandy Recovery and Rebuilding* program tools, and FEMA's *Homeowner's Guide to Retrofitting* (2014) and *Reducing Flood Risk to Residential Buildings That Cannot Be Elevated* (2015).

Providing guidance to building owners and property managers on operational preparedness planning that supports partial mitigation strategies is also important. This may include creating emergency preparedness and evacuation plans for all residents, especially those in dwelling units located below the Base Flood Elevation (BFE) prior to and during a storm event, maintaining sand bags and other materials to construct flood walls, or relocating belongings and storing back-up power and pumps above the BFE.

While flood risk remains a significant concern throughout all floodplain neighborhoods, coordinated action among agencies across multiple levels of government can help to address the risks facing predominantly multifamily communities, such as the East Village, Lower East Side and Two Bridges. By partnering with Federal and State agencies to align policies and programs to support floodproofing investments in multifamily buildings while pursuing coastal protection and community capacity building, the City can support their long-term resiliency and vitality.

Market Street between Henry and Madison Streets, Two Bridges

GLOSSARY OF KEY TERMS

Base Flood Elevation (BFE)
The computed elevation in feet to which floodwater is anticipated to rise during the 1% annual chance storm shown on the Flood Insurance Rate Maps (FIRMs) issued by the Federal Emergency Management Agency (FEMA). A building's flood insurance premium is determined by the relationship between the BFE and the level of the lowest floor of a structure.

1% Annual Chance Floodplain (100 Year Floodplain)
The area that has a 1% chance of flooding in any given year. It is indicated on FEMA's Flood Insurance Rate Maps (FIRMs). See "Special Flood Hazard Areas," below.

Design Flood Elevation (DFE)
As defined by the New York City Building Code, the Design Flood Elevation (DFE) is the minimum elevation to which a structure must be elevated or floodproofed. It is the sum of the BFE and a specified amount of freeboard (see definition below) based on the building's structural category.

Flood Insurance Rate Maps (FIRMs)
The official flood map, on which FEMA has delineated the Special Flood Hazard Area (SFHA), 0.2% annual floodplain (Shaded X Zone), Base Flood Elevations (BFEs), and floodways.

Preliminary Flood Insurance Rate Maps (PFIRMs)*
The PFIRMs are the best available flood hazard data. FEMA is in the process of updating the Flood Insurance Rate Maps (FIRMs) for New York City and issued PFIRMs in December 2013 and again in 2015 as part of this process. The New York City Building Code requires new and substantially improved buildings to use the PFIRMs (unless the effective FIRMs are more restrictive) until the maps become effective. The PFIRMs, however, are not used to guide the requirements of the National Flood Insurance Program.

Floodproofing, Dry
For non-residential buildings, a flood mitigation technique that results in the building resisting penetration of flood water up to the DFE, with walls substantially impermeable to the passage of water and structural components having the capacity to resist specified loads.

Floodproofing, Wet
A flood mitigation technique designed to permit parts of the structure below the DFE to intentionally flood, by equalizing hydrostatic pressures and by relying on the use of flood damage-resistant materials. With this technique, parts of the building below the DFE are only to be used for parking, storage, building access, or crawl space.

Freeboard
An additional amount of height above the BFE to provide a factor of safety to address the modeling and mapping uncertainties associated with FIRMs, as well as a degree of anticipated future sea level rise. It is a risk reduction requirement found in Appendix G of the Building Code and recognized by NFIP as an insurance premium reduction factor. In New York City, one foot of freeboard is required for commercial and multi-family buildings, and two feet for single- and two-family buildings.

* In summer 2015, the City submitted a formal appeal to FEMA, citing internal technical analysis that showed a smaller 1% annual chance floodplain across much of the city. As part of the public review of the PFIRMs, FEMA will review the appeal and determine if a re-mapping of the floodplain is necessary.

National Flood Insurance Program (NFIP)
Federal program that makes flood insurance available to municipalities that enact and enforce floodplain management regulations that meet or exceed the criteria established by FEMA. Under this program, properties within the SFHA with a federally-backed or -regulated mortgage are required to buy flood insurance. Communities participating in the NFIP must incorporate flood-resistant construction standards into building codes.

Special Flood Hazard Areas (SFHA)
Area of the floodplain that has a 1% chance, or greater, of flooding in any given year. Also referred to as the 100-year floodplain or the 1% annual chance floodplain. The SFHA is separated into zones depending on the level of hazard:

V Zone
The area of the SFHA subject to high-velocity wave action that can exceed three feet in height.

Coastal A Zone
A sub-area of the A Zone that is subject to moderate wave action between one-and-a-half and three feet in height.

A Zone
The area of the SFHA that is subject to still-water inundation by the base flood.

Substantial Damage
Damage sustained by a building whereby the cost of restoring the structure to its pre-damaged condition would equal or exceed fifty percent of the market value before the damage occurred. When a building is substantially damaged or substantially improved (see below), it is required to comply with Appendix G of the Building Code as if it was a post-FIRM structure.

Substantial Improvement
Any repair, reconstruction, rehabilitation, addition or improvement of a building with cost equaling or exceeding fifty-percent of the current market value of the building. When a building is substantially improved, it is required to comply with the flood-resistant construction requirements of Appendix G of the Building Code.

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Urban Homesteading Assistance Board

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