

NYC's Floodplain by the Numbers

October 2020





Coney Island, Brooklyn

Defining the Floodplain

Throughout this document the floodplain is defined as the combined geography for the 1% annual chance floodplain established by the U.S. Federal Emergency Management Agency (FEMA) 2007 Flood Insurance Rate Maps (FIRMs) and the FEMA 2015 Preliminary Flood Insurance Rate Maps (PFIRMs). Where the 0.2% annual chance floodplain is referenced, it likewise refers to the combined 0.2% annual chance floodplain geographies. For more information, see 'Defining the Floodplain' on page 24.

Note: The information presented in this report reflects the best available data describing the residents and housing stock in the city's floodplain. This data predates the COVID-19 pandemic and related economic shock, and thus does not reflect any of its short-term or potential long-term effects on the city's neighborhoods and their residents.

For more information on how NYC DCP defines the various types of flood risk, as well as additional resources on the regulatory and operational programs that play a role in planning for current and future flood risk, please visit DCP's [Climate Resiliency](#) page.

New York City's 520 miles of shoreline encompass dozens of unique and diverse neighborhoods. The NYC Department of City Planning (DCP) engages with these communities to better understand the local conditions that inform our waterfront planning and policy work. Through extensive and on-going conversations and detailed analytical work we have learned that the city's waterfront is a microcosm of the rest of the city in terms of the diversity of its population and the variety of building types. We have also learned that New Yorkers take pride in living by the water and have enthusiastically shared local knowledge to inform our work.

A key consideration that distinguishes waterfront communities is the need for policies and planning that respond to the challenges of living in a coastal floodplain. DCP uses zoning as a tool to help ensure that the buildings where people live and work in can be designed to address the challenges of being located at or near the coast. Through a framework of science-based land use planning, building-scale resiliency, and coordination on strategic investment in infrastructure, our work can help reduce the city's vulnerability to coastal flooding and manage the risks and benefits of living near the coast. Together, these strategies support vibrant neighborhoods that can recover quickly from future coastal storms.

This document provides quantitative information about who lives in the city's floodplain, how their communities were impacted (and continue to be shaped) by Hurricane Sandy, and an overview of what the City is doing to address the complex built environment along the waterfront and its exposure to current and future coastal flood risk.

KEY TAKEAWAYS

WHO LIVES IN THE FLOODPLAIN?

pg. 2

Much like the rest of NYC, our floodplain communities are racially and demographically diverse, with a mix of renter and owner-occupied households across all income levels contributing to the vitality of each neighborhood.

WHAT IS CURRENTLY BUILT IN THE FLOODPLAIN?

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The building stock in the floodplain varies from low, medium, and high density residential, to commercial, industrial, and community facility buildings. Vulnerabilities across each typology vary and addressing those will require multilayered approaches balancing community engagement, land use, and infrastructure strategies.

WHAT DID WE LEARN FROM HURRICANE SANDY'S IMPACT ON HOUSING STOCK?

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During Hurricane Sandy, homes built prior to modern building codes suffered the most damage, while those built to flood-resistant construction standards were less likely to experience structural damage. To support resilience, no one solution will work alone. Single- and two-family homes will require greater ease in making structural adaptations and elevating living spaces, while multifamily buildings need greater flexibility to relocate critical building systems.

POST-SANDY RECOVERY AND ADAPTIVE LAND USE PLANNING

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Post-Sandy neighborhood reconstruction and development trends reflect the need to ensure that waterfront communities remain diverse, mixed-income, and resilient. Adaptive land use planning strategies will allow the City to address current and future flood risk while also recognizing local development patterns and vulnerabilities.

WHO LIVES IN THE FLOODPLAIN?

The population of the floodplain is as diverse as the rest of New York City.

New York City is a coastal city with over 15% of our land area in the 1% annual chance floodplain. By the 2050s, the future 1% annual chance floodplain (approximately equal to today's 0.2% annual chance floodplain) is projected to cover one quarter of the city's total landmass and be home to nearly 1 out of every 10 New Yorkers¹.

All five boroughs have sizable populations within the floodplain. With over 300,000 residents, Brooklyn contains the largest population living within both the 1% and 0.2% floodplains. On the lower end, the Bronx's floodplain population more than triples to nearly 60,000 when factoring in the 0.2% floodplain.

It is important to note that though our waterfront is comprised of many racially and economically diverse neighborhoods, citywide disparities in access to affordable housing, community resources, and the financial means to invest in flood protection persist and contribute to the challenges of ensuring a safe and resilient city.

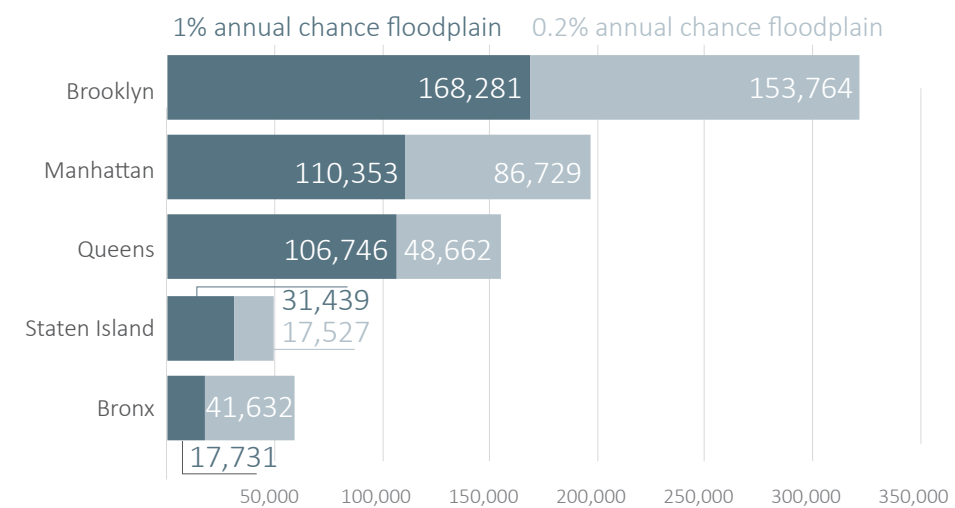
One of the goals of DCP's resiliency work is to support the full range of community typologies by updating the City's zoning to encourage flood-resistant construction throughout the city's current and future floodplains. Through a proposed zoning text amendment called Zoning for Coastal Flood Resiliency (ZCFR), the geography where flood resilient zoning applies would be expanded to include the current 0.2% floodplain. This will allow residents and business owners across our waterfront communities to proactively meet the challenges to mitigate future flood risk.

1. Future floodplain projections are based on the New York City Panel on Climate Change (NPCC). The 2050s future floodplain referenced here represents the high-end 90th percentile projection, approximately equivalent to the 2100s low-end 25th percentile projection. For more information on the NPCC, see "Defining the Floodplain" on Page 24.



Williamsburg Waterfront, Brooklyn

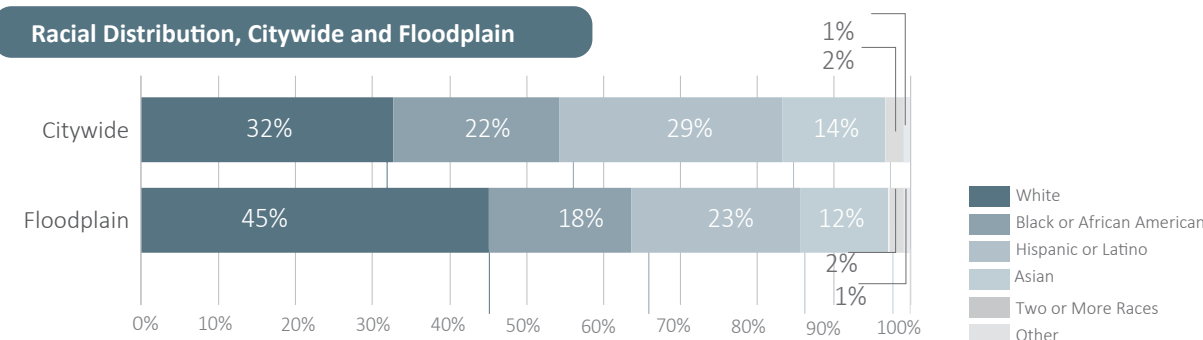
Total Population in the 1% and 0.2% annual chance floodplains



Source: 2010 US Census

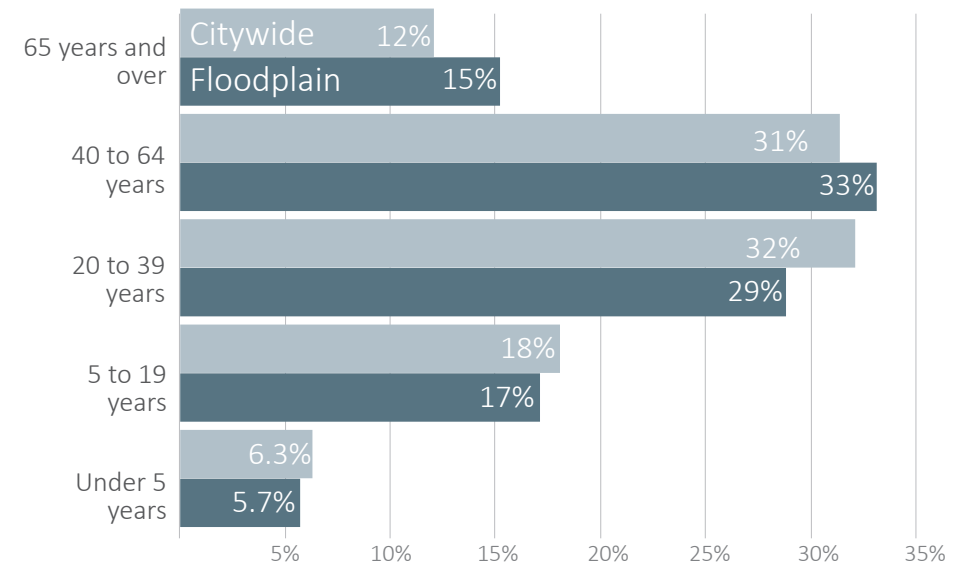
Today, over **400,000** people live within the 1% annual chance floodplain. This number nearly doubles to over **780,000** when adding the population in the 0.2% annual chance floodplain.

Racial Distribution, Citywide and Floodplain



Source: American Community Survey (ACS) 2013-2017 5-year estimates

Age Distribution, Citywide and Floodplain



Source: American Community Survey (ACS) 2013-2017 5-year estimates

Much like NYC, floodplain communities are multi-generational and demographically diverse.

WHO LIVES IN THE FLOODPLAIN?

NYC's floodplain is also a microcosm of citywide housing characteristics.



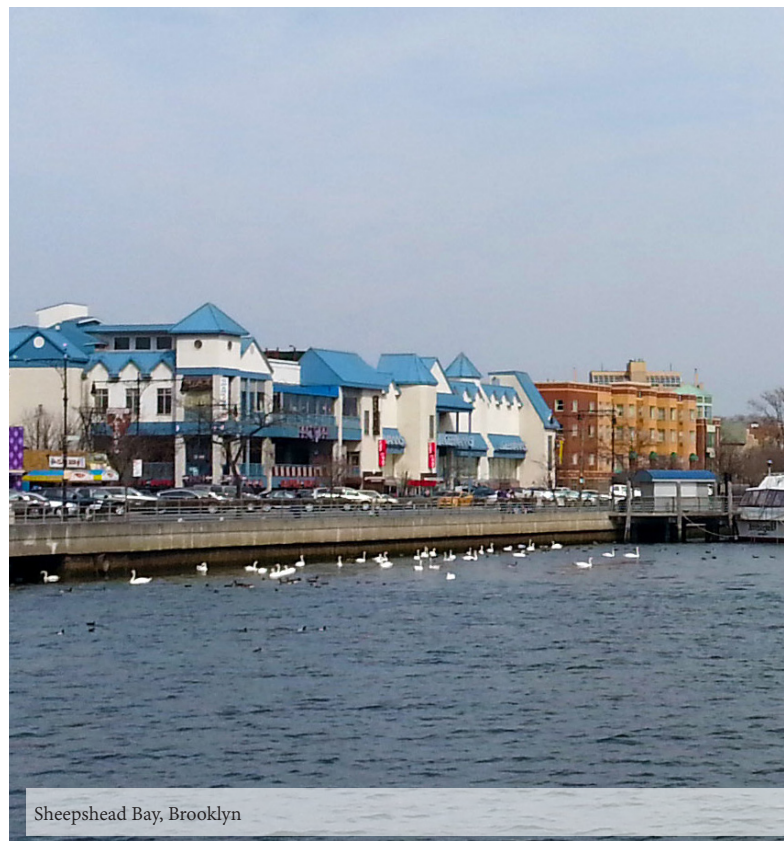
Lower East Side, Manhattan



Co-op City, Bronx



Old Howard and Hamilton Beach, Queens



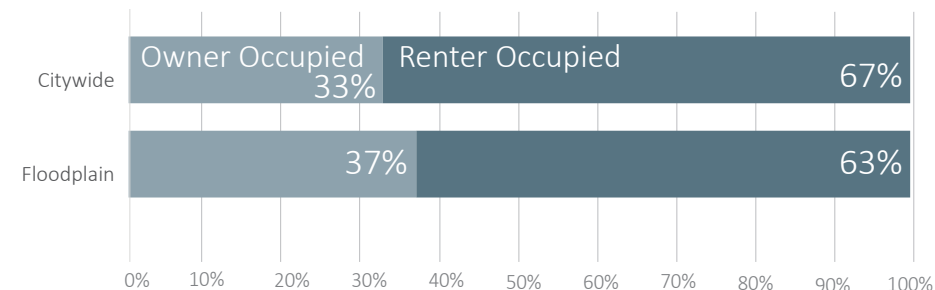
Sheepshead Bay, Brooklyn

While some floodplain communities can be characterized by either owner-occupied homes or renter-occupied multifamily buildings, most neighborhoods include a combination of closely-intertwined housing tenancy across multiple building types. Land use policy, infrastructure, coastal protection investments, and risk communication must be calibrated to support every community type. DCP's [Resilient Neighborhoods](#) and [Retrofitting Buildings for Flood Risk](#) studies demonstrated the opportunities for aligning resilience strategies that can support the city's multitude of housing types, whether single-family homes, multifamily structures, housing campuses, or mixed-use structures.

Compounding the challenges of addressing resilience across different building forms are the related costs of retrofitting structures. Like the rest of NYC, the floodplain is largely developed. Tenants and property owners alike, already facing high rates of housing cost-burden, are often financially limited in investing in resilience measures. Additionally, there are over 55,000 rent regulated housing units in the 1% annual chance floodplain providing critically needed affordable housing options for floodplain communities¹.

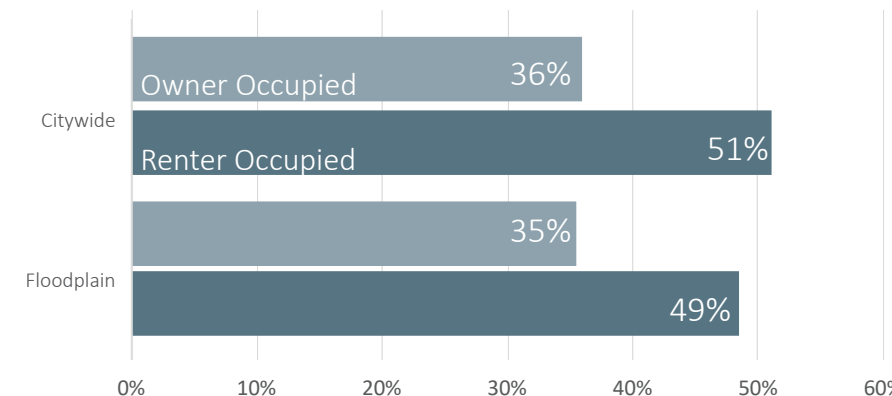
The City is supporting strategies to minimize flood damages and maximize insurance savings, such as expanding flexibility for relocating mechanical equipment above the flood level and modifying regulations to support elevating or relocating living spaces. The City also continues to advocate to FEMA for recognition of partial mitigation strategies for flood insurance savings.

Tenancy Distribution, Citywide and Floodplain



Source: American Community Survey (ACS) 2013-2017 5-year estimates

Housing cost-burdened* households, Citywide and Floodplain



Source: American Community Survey (ACS) 2013-2017 5-year estimates

* DCP defines a cost-burdened owner or renter household as one that spends more than 35% of income on housing costs, including any combination of mortgage, rent, utilities, real estate taxes, and homeowners insurance costs.

Nearly **two-thirds** of floodplain households are renters, mirroring the citywide average. Although most of these households are in multifamily buildings, a third of households in two- or three-family buildings also rent.

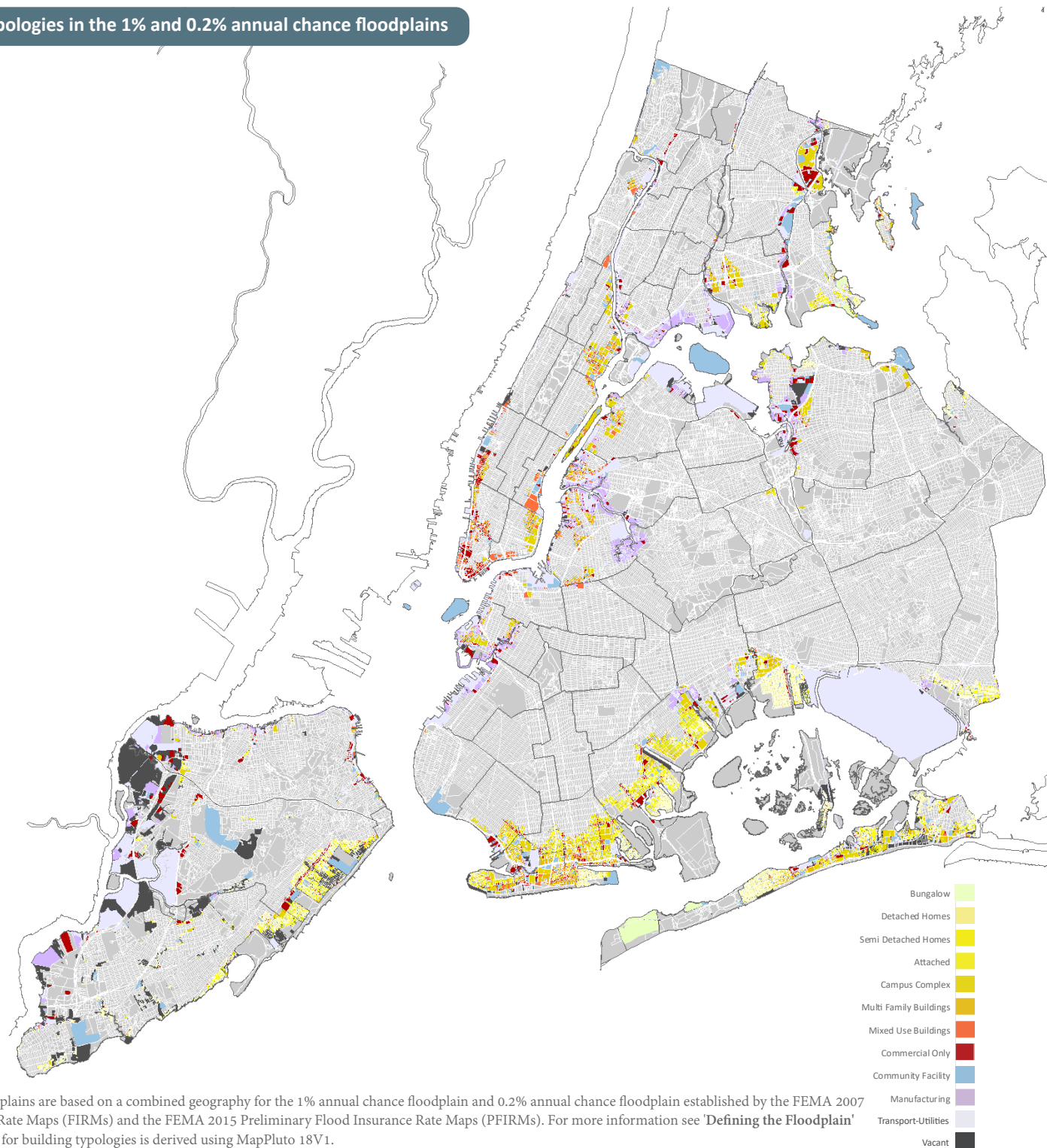
Floodplain homeowners and renters both face high rates of housing cost-burden which can make investing in resiliency improvements even more difficult.

¹ Based on 2107 data provided by NYC Department of Housing Preservation and Development and the Furman Center's Subsidized Housing Information Project (SHIP).

WHAT IS CURRENTLY BUILT IN THE FLOODPLAIN?

Buildings and land use patterns in the floodplain are representative of the city's varied building stock.

Building Typologies in the 1% and 0.2% annual chance floodplains



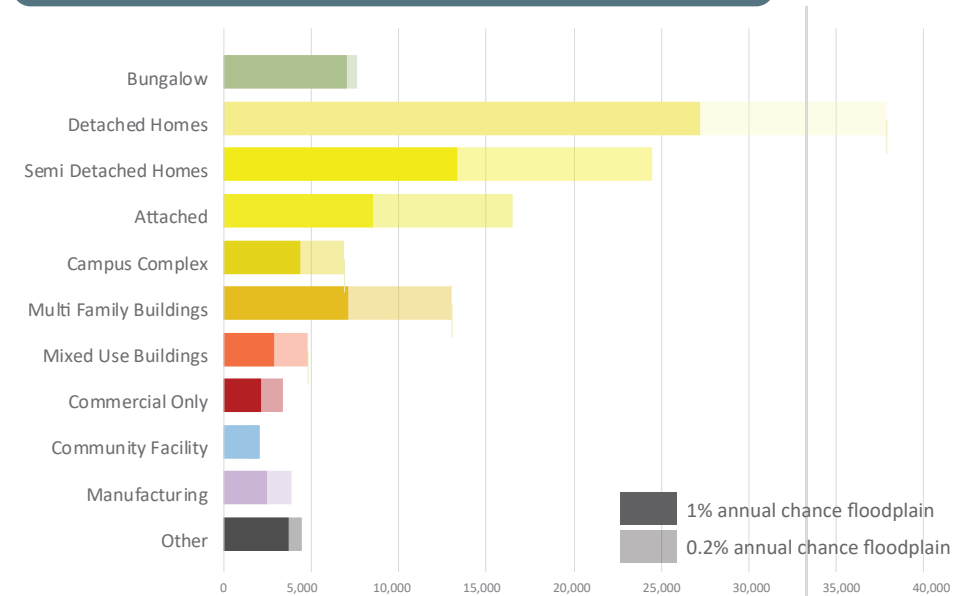
Source: The floodplains are based on a combined geography for the 1% annual chance floodplain and 0.2% annual chance floodplain established by the FEMA 2007 Flood Insurance Rate Maps (FIRMs) and the FEMA 2015 Preliminary Flood Insurance Rate Maps (PFIRMs). For more information see 'Defining the Floodplain' on page 24. Data for building typologies is derived using MapPluto 18V1.

Development patterns in the floodplain vary across the city; therefore there is no one-size-fits-all solution for adapting buildings. Single- and two-family residences dominate the landscape in many coastal areas, including a number of smaller-scale bungalow communities, while other neighborhoods are characterized by higher density residential, mixed-use, and commercial buildings. In addition, significant parts of our waterfront remain predominantly industrial.

While most buildings in the floodplain, about 70%, are single- and two-family structures, those only encompass a fifth of all household units in the floodplain. About 80% of residential units in the floodplain are located within multifamily buildings. Low density residential homes are commonly found throughout coastal neighborhoods in Brooklyn, Queens, Staten Island, and the Bronx.

Multi-family buildings, including campus complexes and mixed-use buildings, are more common throughout Manhattan, and some higher density neighborhoods including portions of North Brooklyn, Coney Island, and the Rockaways.

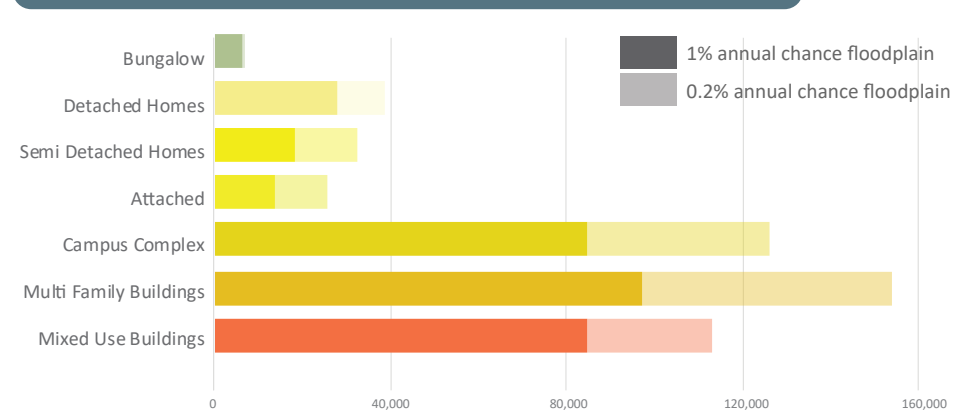
Buildings in the 1% and 0.2% annual chance floodplain by Type



Source: Data for building typologies is derived using MapPluto 18V1.

While **70%** of all buildings in the combined 1% and 0.2% annual chance floodplains are single- and two-family homes, they include only a fifth of the area's total housing units.

Housing Units in the 1% and 0.2% annual chance floodplain by Type



Source: Data for building typologies is derived using MapPluto 18V1.

80% of all housing units are located in multifamily buildings and distributed across a range of building typologies.

WHAT IS CURRENTLY BUILT IN THE FLOODPLAIN?

Floodplain buildings face unique adaptive challenges when mitigating flood risk.

While retrofitting or altering any building type can be complex, floodplain property owners face additional challenges when retrofitting to reduce flood risks and meet flood-resistant construction standards. Basements and other below grade spaces are common throughout the floodplain in Brooklyn, Queens, and Staten Island, and are highly vulnerable to coastal flooding. While filling and relocating basements can significantly limit flood damages and losses, doing so can be structurally challenging and costly. Elevating buildings also raises accessibility issues and requires ramps or lifts to access homes on often constrained sites.

Attached and semi-detached buildings face greater challenges to retrofitting than those that are detached and more easily elevated. Some challenges are structural, such as shared party walls, while others relate to the complexity of coordinating among adjoining property owners or managing zoning height and floor area limits. Emergency zoning relief provided after Hurricane Sandy ("Flood Text I") to support reconstruction and retrofits focused mostly on single- and two-family detached homes.

Zoning for Coastal Flood Resiliency includes a framework that better accommodates resiliency investments for all building types, including those that are fully or partially attached, have sub-grade spaces or mechanical systems in need of relocation, and buildings that were previously not permitted to elevate more than a few feet.

See **Zoning for Coastal Flood Resiliency** (pg. 20) for more information on how the upcoming zoning text amendment will support building-scale resiliency or visit nyc.gov/zcfr.

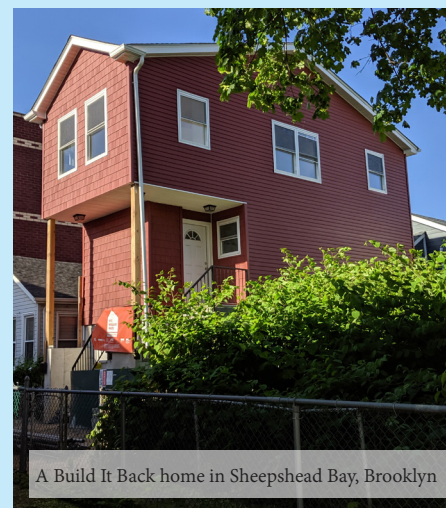


Attached homes in Canarsie, Brooklyn

Build It Back Program

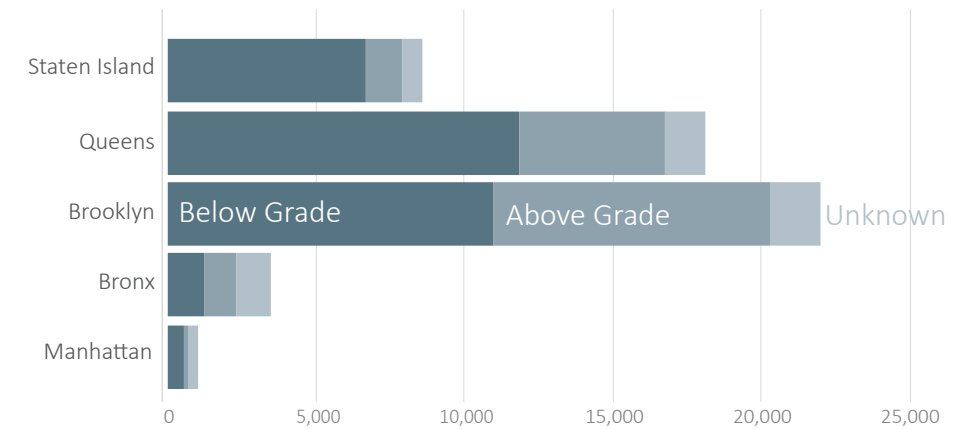
In the wake of Hurricane Sandy's devastation, New York City launched a citywide program to repair, elevate, rebuild, and acquire thousands of damaged homes throughout the city's flood-impacted communities. To date, Build It Back's (BIB) Single-Family Program has helped over 8,300 one to four-unit homeowners and landlords – representing 12,500 households – pay for repairs or rebuild their homes to flood-resistant construction standards. The Build It Back Multi-Family Program has assisted an additional 19,800 households living in multifamily buildings through repairs, resiliency upgrades, and reimbursements.

While some homeowners were able to rebuild on their own, BIB supported the vast majority of resilient reconstruction in many waterfront communities, including directly supporting most of the one to four-unit home elevations in lower density neighborhoods.



A Build It Back home in Sheepshead Bay, Brooklyn

Basement Conditions of 1-3 Family Homes in the 1% annual chance floodplain

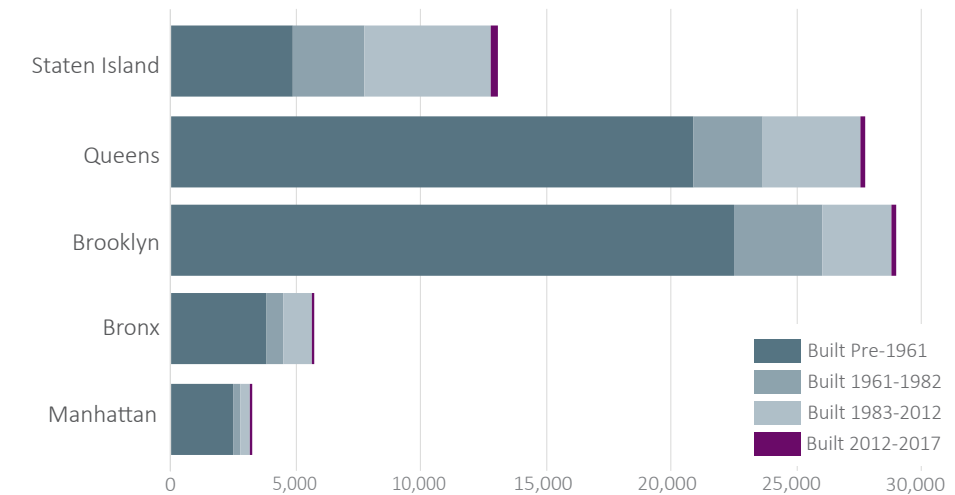


Source: MapPluto 18v1

Note: Below grade refers to basements that are fully submerged below grade. Above grade refers to basements which are not fully submerged below grade. Counts are available for 1-3 family homes only.

85% of single- to three-family homes in the floodplain have sub-grade spaces such as basements or cellars that increase vulnerability to flooding.

Building Age in the 1% annual chance floodplain

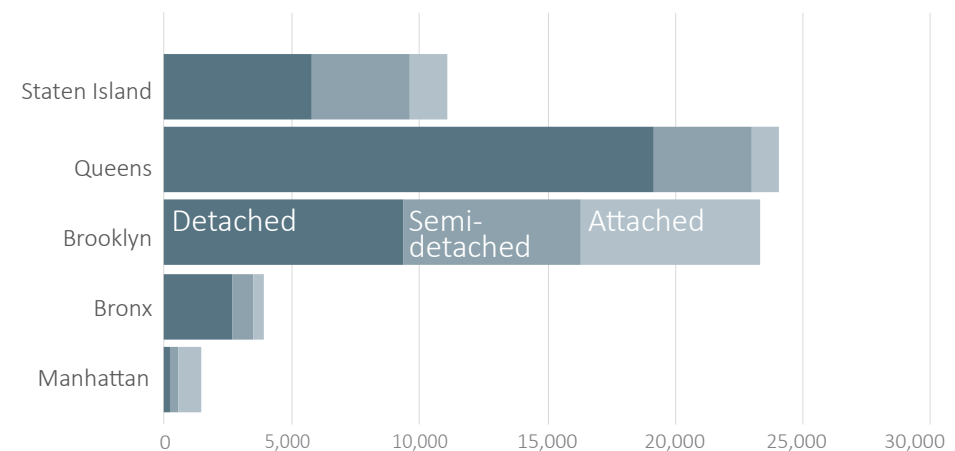


Source: MapPluto 18v1

70% of all floodplain buildings were built before 1961 when NYC adopted modern building codes.

Only **18%** were constructed after 1983 when the City adopted the Flood Insurance Rate Maps requiring flood-resistant construction standards.

Building Adjacency in the 1% annual chance floodplain



Source: MapPluto 18v1

For more information visit: <https://communityprofiles.planning.nyc.gov/>

40% of all single- and two-family homes in the city's floodplain are either attached or semi-detached buildings, adding additional structural and regulatory retrofit challenges.

WHAT DID WE LEARN FROM HURRICANE SANDY'S IMPACT ON HOUSING STOCK?

Hurricane Sandy was catastrophic and highlighted the vulnerability of the city's building stock.



Neighboring homes devastated by Hurricane Sandy flooding

Federal Emergency Management Agency (FEMA) Individual Assistance (IA)

FEMA Individual Assistance (IA) is a post-disaster aid program available to households and businesses to help cover expenses in the wake of a disaster. The program provides financial support (up to \$33,000) or direct services to impacted households including housing support or reimbursements for temporary housing, such as hotel stays, and repair or replacement of disaster-related damages.

For more information please visit the [FEMA Individual Assistance Program and Policy Guide \(IAAPPG\)](#), or the [FEMA IA fact sheet](#).

How this information helps us: Using anonymized data provided by HUD in early 2015, and aggregated at the Census block level, DCP created snapshots of impacted households that received FEMA IA aid. This data provides us with information regarding tenant and owner-occupied households, inspected flood depths, and flood insurance uptake.

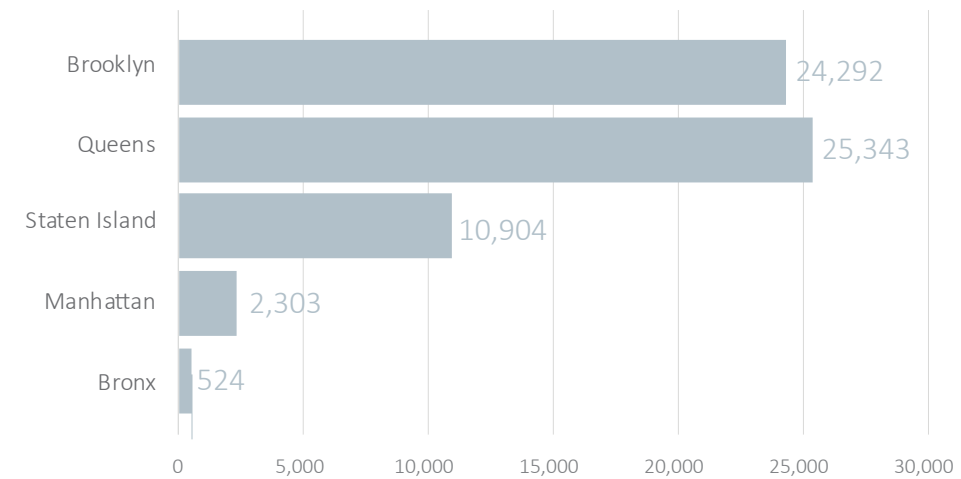


Elevated home along a flooded street, Staten Island

Source: NYC HPD

Citywide cost estimates of Hurricane Sandy's impacts range from \$15 Billion to \$19 Billion, including damage to public and private property, infrastructure and utilities. To evaluate building damages, the City relied on disaster recovery estimates based on building inspections done by the New York City Department of Buildings (DOB) and FEMA. While these figures do not show the full scale of damage, they provide valuable insight into how building damages were distributed across Sandy's inundation area.

Post-Sandy FEMA Individual Assistance (IA) Inspections by Borough

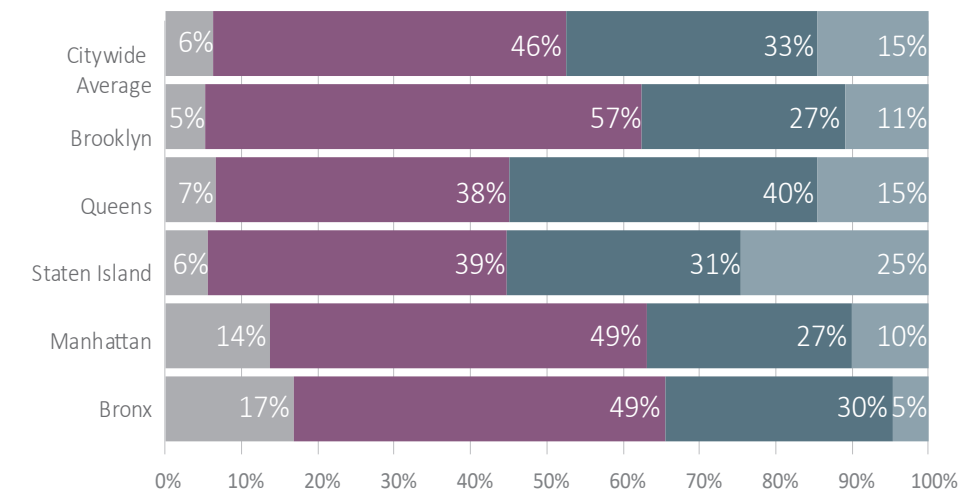


Source: FEMA Individual Assessment (IA) Inspections

For more information, see "Federal Emergency Management Agency (FEMA) Individual Assistance (IA)" on Page 10.

Although damage was widespread and affected people and infrastructure across all five boroughs, Brooklyn and Queens had the majority of FEMA IA Inspections.

Post-Sandy FEMA IA Inspected Damages by Level of Flooding



Source: FEMA Individual Assessment (IA) Inspections

Most of the Sandy-related damage to buildings was non-structural, affecting mostly building systems and equipment located on ground floors or in basements.

- Damaged without Flooding
- Basement Flooding
- First Floor Flooded up to 4 ft
- Living Space Flooded 4 ft or more

WHAT DID WE LEARN FROM HURRICANE SANDY'S IMPACT ON HOUSING STOCK?

Low-density buildings built prior to modern codes suffered the most severe damage, but higher density buildings incurred higher average damage costs.



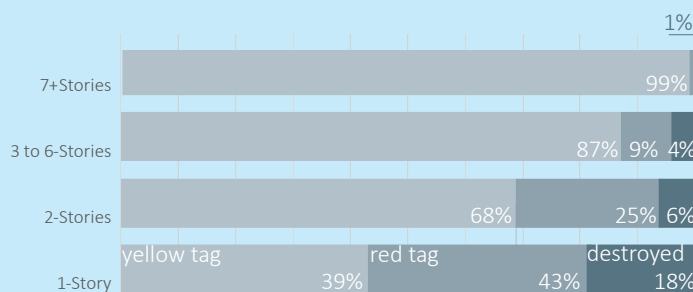
A detached single-family home destroyed by Sandy, Rockaway Beach

Department of Building (DOB) Rapid Assessment

In the wake of Sandy, DOB conducted door-to-door assessment inspections of damages to the structural stability of buildings affected, and tagged these building with placards based on their conditions. Those recorded placard ratings helped guide the City's repair and reconstruction assistance programs.

How this information helps us: Placard ratings, particularly 'red tagged' buildings, denoting unsafe structural conditions, provide important information on how building typologies and construction standards handle disaster conditions differently. Furthermore, [analyses of these inspections](#) can be used to guide building code revisions and best practices in the future.

Buildings Assigned Yellow, Red, and Destroyed Tags

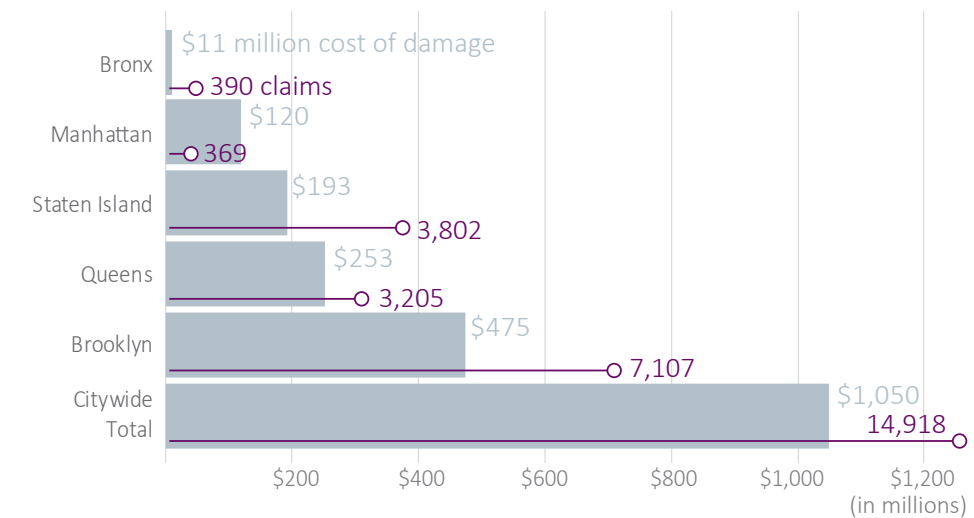


Source: NYC Special Initiative for Rebuilding and Resiliency (SIRR) report

Data on claims filed after Sandy provide a helpful insight into building vulnerabilities, though NFIP coverage and uptake vary by building type and purchase requirements are based on the 2007 FIRMs. Higher density residential buildings accounted for only 4% of the total NFIP damage claims, but constituted 12% of the total costs. This reflects the higher damage coverage limits permitted under the NFIP for such structures and higher expenses associated with the repair and/or replacement of complex mechanical systems that multifamily and commercial buildings require. However, few multifamily buildings suffered significant structural damage.

Single- to four-family homes, more common throughout the floodplain and likelier to hold NFIP policies, filed a greater number of claims but suffered lower average damages. They were, however, much likelier to experience structural damage, particularly if built prior to modern flood resistant construction standards.

Post-Sandy NFIP Total Cost of Damage and Number of Claims

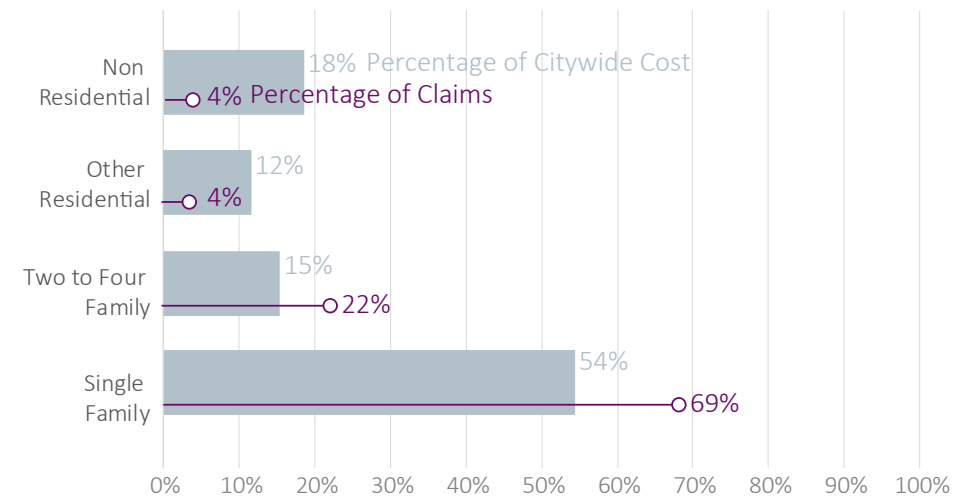


Source: FEMA NFIP Hurricane Sandy Claims Filed, as of May 2015

Citywide, nearly 15,000 NFIP claims were filed, exceeding \$1 billion across all buildings types. Brooklyn and Queens accounted for almost 70% of the city's damage costs. Manhattan, where NFIP uptake is far less common, had the highest average costs but fewest claims.

See inset on National Flood Insurance Program (NFIP) on Page 16

Post-Sandy NFIP Claims by Residential Unit type



Source: FEMA NFIP Hurricane Sandy Claims Filed, as of May 2015

Single-family homes constituted a majority of NFIP filed claims and total citywide damage costs, but higher density multifamily and non-residential buildings had higher average filed costs.

WHAT WAS THE IMPACT OF HURRICANE SANDY ON NYC'S HOUSING STOCK?

Homes built to flood-resistant construction standards show reduced costs of damage across all flood depths.

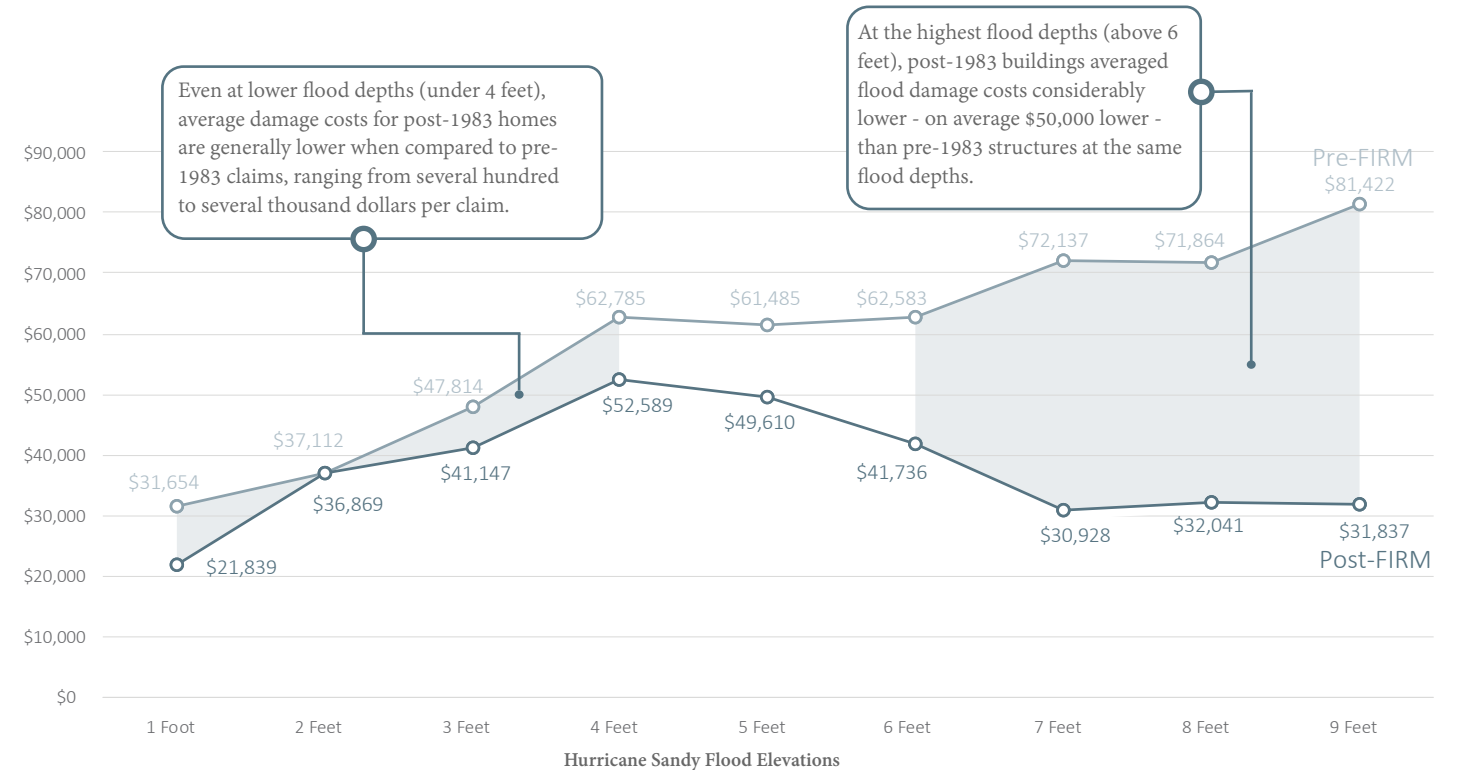


Gerritsen Beach, Brooklyn

In 1983, New York City joined the federal National Flood Insurance Program (NFIP), adopting the Flood Insurance Rate Maps (FIRMs) along with federal construction standards for buildings in the floodplain. For residential buildings, these requirements mandated elevation of the first livable floor and all mechanical, electrical and plumbing equipment above the Base Flood Elevation (BFE), and prohibited residential basements and other subgrade spaces. An additional 1-2 feet of "freeboard" are typically required to meet the Design Flood Elevation (DFE). These codes are now part of Appendix G of the NYC Building Code. Our analysis shows that buildings that were constructed to these flood-resistant construction standards fared far better during Hurricane Sandy than buildings that were not.

Many of the homes constructed prior to 1983, or "pre-FIRM," had basements or crawl spaces and active uses below the BFE. The presence of basements, cellars, living spaces and mechanical equipment below the BFE resulted in the buildings suffering increased damage costs overall across all Sandy flood depths. Buildings constructed after 1983, or "post-FIRM," including those being built today, are required to be constructed to the adopted flood-resistant construction standards. These buildings showed greater resilience in managing increased flood depths with fewer damages and significantly lower average flood claim costs.

Average NFIP Claims for Pre- and Post-FIRM Buildings by Flood Elevation



Source: FEMA NFIP Hurricane Sandy Claims Filed, as of May 2015

Note: Difference in average damages is likely underestimated. Average damages calculated for all Sandy-impacted buildings, including some built after 1983 but outside the effective and preliminary FIRMs and thus not required to meet Appendix G building code.

WHAT WAS THE IMPACT OF HURRICANE SANDY ON NYC'S HOUSING STOCK?

Elevating a home to the Base Flood Elevation (BFE) or higher can both minimize damages from flooding and lower annual flood insurance premiums.

National Flood Insurance Program (NFIP)

The NFIP is a federal flood insurance program run by FEMA. Thousands of buildings throughout NYC are required by federal law to purchase and maintain flood insurance as a condition of receiving a federally-guaranteed mortgage, business loan, or disaster aid. Rates are set based on a building's lowest habitable floor elevation relative to the BFE; location relative to the floodplain; construction date; design, including the presence of subgrade space and NFIP-approved floodproofing measures; and the coverage level and policy deductible. Many other property owners not required to do so choose to purchase an NFIP policy to insure against an eventual flood event.

For more information please visit the FEMA's FloodSmart.gov page.

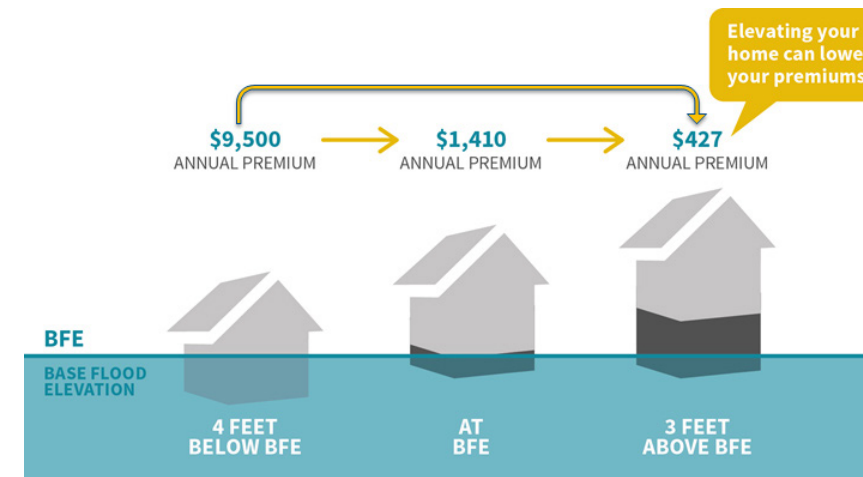
How this information helps us: Post-Sandy, filed NFIP claims and aggregated information on NFIP insurance premiums and deductibles provided important insight into the damages sustained by NFIP policyholders. While NFIP insurance uptake is limited in parts of the city (particularly within areas more recently mapped into preliminary Flood Insurance Rate Maps (PFIRM)), the data provided offers important information on how different building types sustained flood damage, the financial extent of those damages, and how building elevations and other flood-resistant building features can lower NFIP annual premiums.



Across all five boroughs, post-FIRM homeowners have significantly lower annual NFIP flood insurance premiums, on average, than those in pre-FIRM homes constructed prior to 1983. According to FEMA, elevating your home can amount to tens of thousands of dollars of savings over a decade, and significantly more over the life of a mortgage, on standard flood insurance premiums compared to a similar unelevated house built at grade. The savings are even greater when compared to homes with basements or cellars.

By changing zoning regulations in the floodplain, DCP aims to provide homeowners the building height and floor area flexibility that is necessary to raise living spaces and relocate sub-grade spaces to well-above the BFE, allowing current and future flood-risk levels to be taken into consideration.

Average Annual NFIP Premiums in the Floodplain



Source: Rising Tides, Rising Costs, CNYCN

Homeowners whose living spaces are elevated to 3 feet or more above the BFE pay NFIP premiums on average **less than half** that of unelevated homeowners, and **less than a tenth** of those located 4 feet or more below the BFE.

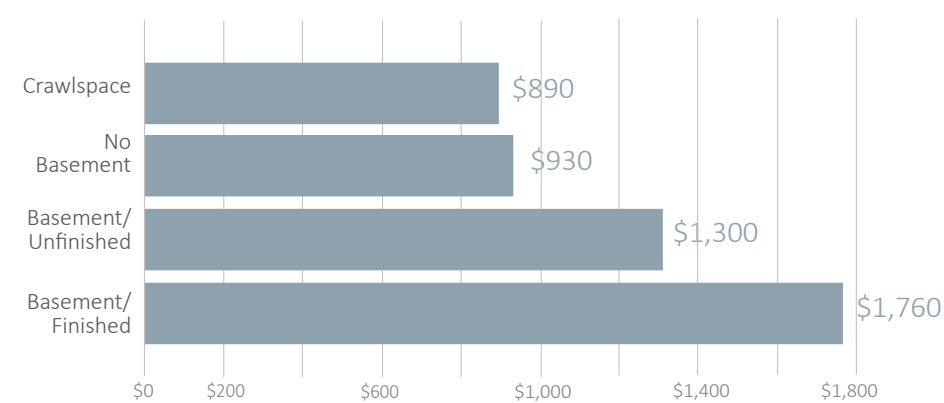
NFIP and Zoning Relief

Managing costs associated with rising NFIP insurance premiums is a growing challenge for property owners in the floodplain, particularly those with pre-FIRM or "subsidized policies" issued for buildings constructed prior to 1983 and without Elevation Certificates. Repairing flood-related damages can be very expensive and having a federal flood insurance policy to help cover those costs can be critical in determining whether a residence or business is able to quickly recover from a flood event. However, recent changes to federal policies governing the NFIP have resulted in steeper annual premium increases for many policyholders.

Zoning for Coastal Flood Resiliency's proposed height and floor area allowances to help homeowners maximize savings on their annual NFIP insurance premiums. According to FEMA, homes elevated three feet above the BFE can save up to 60% on their premiums. These allowances would further help families and businesses elevate their first occupiable floor while minimizing the loss of usable space for a household or business.



Average Premiums in the 2007 1% Annual Chance FIRM floodplain by Basement Condition



Source: FEMA NFIP Active Policy File, 2015; 2007 Effective Flood Insurance Rate Maps (FIRMs)

Note: NFIP premiums, established by FEMA, consider multiple property-specific factors such as: the building's lowest habitable floor elevation relative to the BFE; the building's location relative to the floodplain; the building's construction date; the building's design, including the presence of subgrade space and NFIP-approved floodproofing measures; and the coverage level and policy deductible. Average premiums shown here represent an aggregate of citywide NFIP policies effective in June 2015 for one- and two-family buildings located in the 2007 Effective FIRM 1% annual chance floodplain and limited to policies with full available coverage (\$250,000/\$100,000 for buildings/contents, respectively) and a \$5,000 deductible. For more information, see "National Flood Insurance Program (NFIP)" on Page 16.

While multiple property characteristics influence flood insurance costs, average premiums for homes with basements are **1.5 times higher** compared to homes without basements.

Visit FloodHelpNY.org to learn more about flood insurance.

RECONSTRUCTION AFTER SANDY

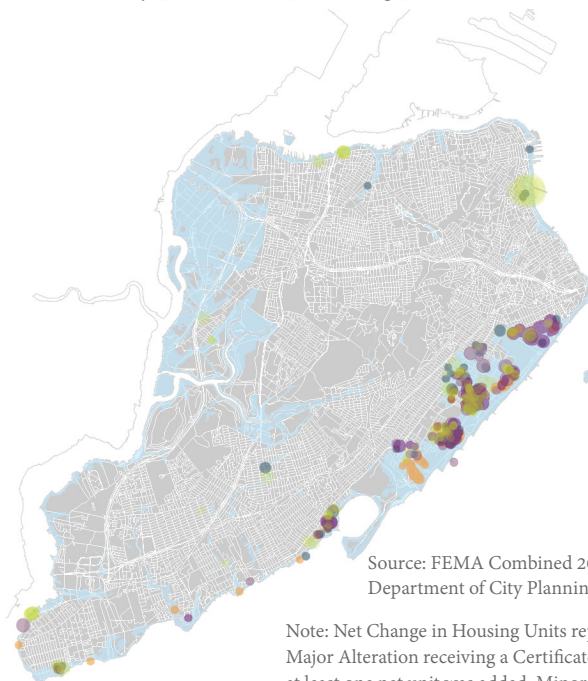
Post-Sandy Floodplain Development

Residential construction and major alterations in the floodplain, 2013-2018

Development and reconstruction across the floodplain since Hurricane Sandy has been varied. While a number of market and neighborhood factors affect development patterns across the city, Hurricane Sandy's imprint has strongly influenced development and land use trends in the floodplain. In many neighborhoods, older homes were demolished and rebuilt to higher elevations and flood-resistant construction standards through both private financing and support from the City's Build It Back program.

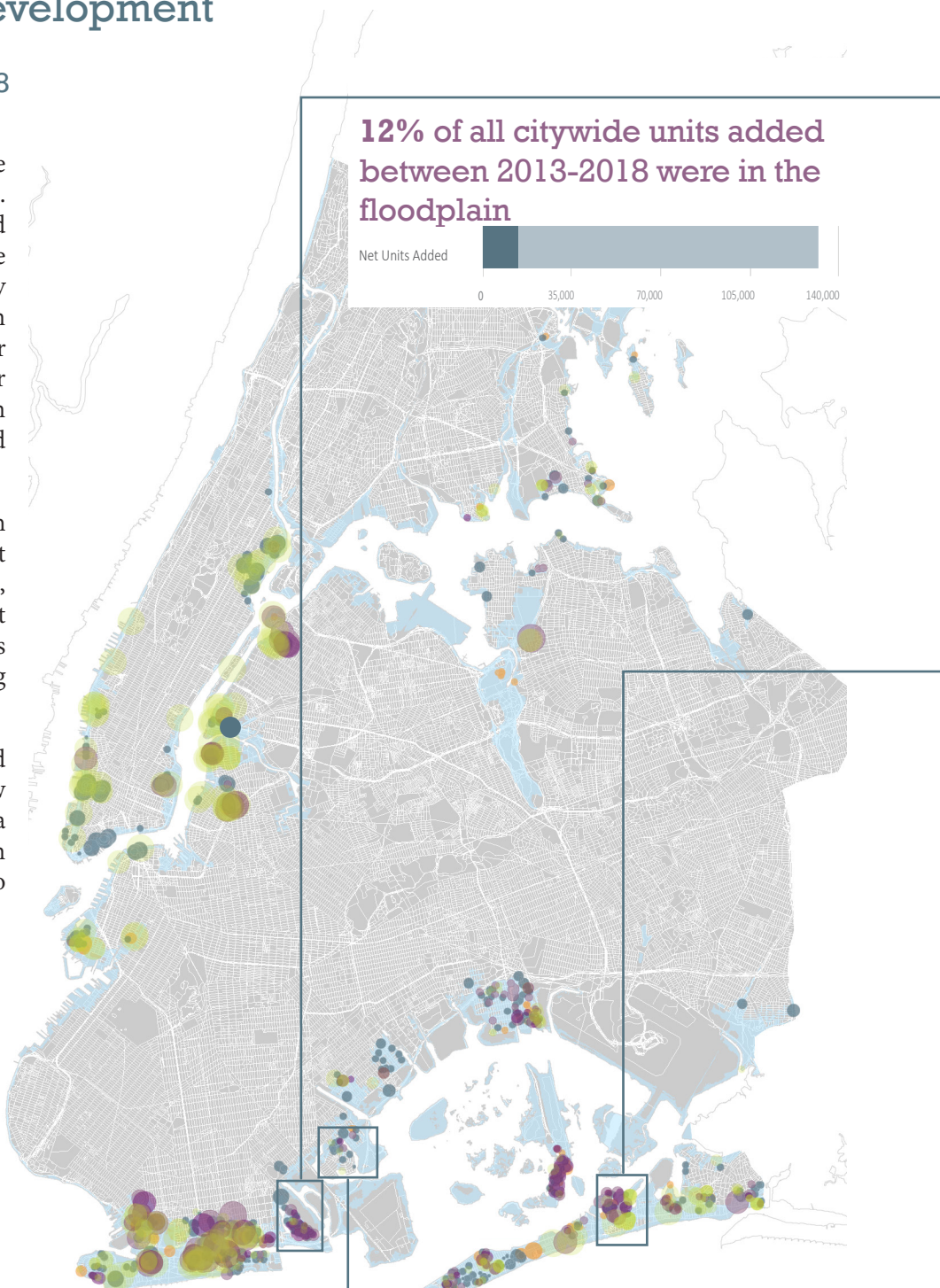
Other areas have seen redevelopment through new mixed use and multifamily construction that provides denser housing, community facilities, and commercial services in flood-resistant buildings. In other neighborhoods, the focus has been primarily on repairs and retrofits of existing buildings.

While community input, local coordination, and market conditions will continue to shape how our waterfront communities adapt over time, a forward-thinking land use framework that can address current and future flood risks needs to be a key part of the planning process.



Source: FEMA Combined 2007 EFIRM and 2015 PFIRM, Department of City Planning Housing Database 19v1

Note: Net Change in Housing Units represents the net change for each New Building and Major Alteration receiving a Certificate of Occupancy between 2013 and 2018 where at least one net unit was added. Minor alterations or modifications, including some elevations for non-demolished buildings, where no net units were added are not shown. Multiple developments tied to the same tax lot may not all be visible.



12% of all citywide units added between 2013-2018 were in the floodplain



- New Construction
 - Alterations
 - Redevelopment (Demolition and Construction)
 - Redevelopment (Under Construction)
 - Demolitions
- 1
 - 2
 - 5
 - 25
 - Over 25
- 1% annual chance floodplain

Rebuilding Resilient Homes



New resilient two-family home reconstructed in Gerritsen Beach, Brooklyn

Over 1,100 single- and two-family floodplain homes comprising 1,240 housing units, most of which were significantly damaged by the storm, were demolished between 2013 and 2018. Most of these homes were "pre-FIRM" and did not comply with flood-resistant construction standards.

Those homes were replaced by nearly 900 new flood-resistant single- and two-family buildings totaling 1,108 housing units. Much of this reconstruction was coordinated through the City's Build It Back Program. Creating the flexibility to support new homes with elevated living spaces, not vulnerable to basement flooding, and constructed with mechanicals systems safe from future storms is a key component of supporting long-term resilience across our waterfront communities.

Approximately 260 demolished lots were still vacant as of end of 2018. Most of these sites were part of buyout programs that require they be conserved as open space. An additional 469 resilient single- and two-family homes (704 units) were constructed on other vacant sites.

Supporting Housing Growth and Access to Goods and Services



New multifamily housing building in Edgemere, Queens

Some demolished homes were reconstructed with new multifamily and mixed-use residential buildings. Approximately 80 multifamily buildings comprising 935 units of housing were reconstructed in place of demolished storm-damaged homes as of the end of 2018. An additional 164 new multifamily buildings were completed elsewhere across the floodplain providing 13,500 new housing units.

This trend reflects growing neighborhood housing needs, including the construction of a significant amount of affordable housing where flood risks are less severe and where older housing stock was insufficient in meeting the growing demand for housing in neighborhoods. Mixed-use buildings constructed to flood-resistant construction standards also provide resilient sites for the critical retail goods and services, including supermarkets, pharmacies, hardware stores, and banking services, that are so crucial to storm preparedness and recovery efforts.

Retrofitting Existing Building Stock



House retrofitted to comply with Appendix G in Bergen Beach, Brooklyn

Retrofitting existing buildings is a key part of ensuring our floodplain building stock meets long-term flood-resiliency challenges. Between 2013 and 2018, hundreds of floodplain homes underwent significant retrofits or major alterations that included elevations and enlargements to reduce flood vulnerabilities. In some cases the process of redesigning and modifying existing homes led to a loss of tenant units, particularly where there was no additional floor area or room permitted on the zoning lot to reconstruct lost space.

New zoning relief through Zoning for Coastal Flood Resiliency will support proactive investments in retrofitting and elevating existing homes, while easing obstacles to retaining the rental units that support the families they house and contribute to financing homeownership.

RECOVERY AND RESILIENT LAND USE PLANNING

Post-Sandy neighborhood reconstruction and development trends reflect the need to ensure that waterfront communities remain diverse, mixed-income, and resilient, while also recognizing local development patterns and vulnerabilities.

The City’s resiliency planning seeks to address a range of conditions found across the floodplain. On a citywide level, land use policies will aim to support the existing planned density and uses located in the floodplain. However, in certain neighborhoods, zoning regulations may be amended to either limit density in areas where coastal risk is exceptional, or encourage density in areas more equipped for it. Additionally, many waterfront communities have seen changes since Hurricane Sandy, and this section aims to portray this land use rationale accounting for these changing waterfront trends.

Where flood risk is high, including where sea level rise will lead to future daily tidal flooding

Where risk from extreme events can be managed through infrastructure and context can support growth

Flood risk and Land Use Considerations

Limit Density

In some areas, there is a need to limit future density, as to decrease the exposure to damage and disruption.

Support Planned Density

Adjust zoning to allow all buildings to meet resiliency standards, by providing flexibility and removing zoning obstacles.

Encourage Density

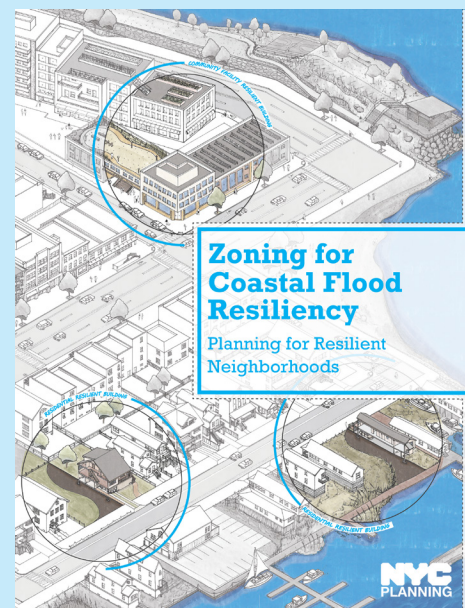
In other areas, the city can encourage new development, as to increase the resilient building stock.

Zoning for Coastal Flood Resiliency

Zoning for Coastal Flood Resiliency seeks to enable and help promote resilient buildings throughout the city’s current and future floodplains by expanding available zoning flexibility and incentives within the 1% annual chance floodplain and introducing flexibility to the 0.2% annual chance floodplain.

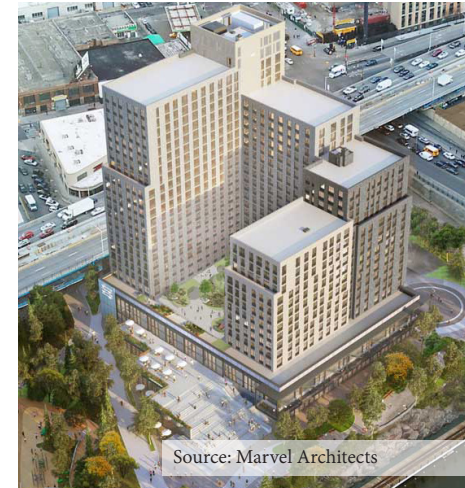
Buildings in the floodplain can be designed or retrofitted to reduce damage from future flood events and save on insurance costs. For this to happen, zoning needs to allow homeowners, business owners, and builders workable options for their buildings. Based on DCP’s engagement with communities throughout the floodplain since Hurricane Sandy, DCP has drafted a proposal to make zoning more supportive of resilient buildings. More information about this effort can be found in the [Zoning for Coastal Flood Resiliency: Planning for Resilient Neighborhoods](#) document, located at nyc.gov/zcfr.

These recommendations were developed based on analysis of resilient construction in the floodplain, through extensive coordination with partner City agencies, and community feedback as laid out in the [Community Outreach Summary](#) document released in 2018.

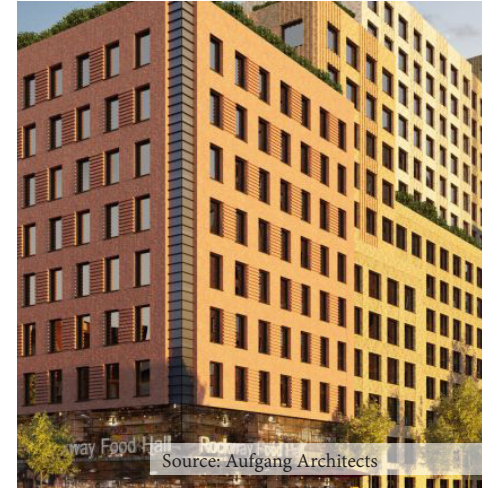


Encouraging Density

In certain parts of the city, where there remains a significant risk of flooding but infrastructure and neighborhood context would support opportunities for growth, the City can encourage construction of new buildings that provide a higher standard of flood protection or offer incentives for pursuing more costly strategies, such as dry floodproofing, that promote both resiliency and high quality streetscape design. Such strategies would need to include community outreach, local coordination, and attention to the full range of neighborhood planning issues.



Mott Haven, Bronx



Arverne, Queens

Supporting Planned Density

Where neighborhood context has remained relatively consistent, albeit with homes rebuilt and elevated, such as through the City’s Build It Back program (See “Build It Back Program” Page 8), the City will continue to support planned density. Likewise in neighborhoods that have continued to support new multifamily and mixed-use development, policies should support investments in the retrofitting of existing buildings through installation of deployable flood panels and backup generators, and replacement or relocation of vulnerable mechanical equipment above flood elevations.



Red Hook, Brooklyn



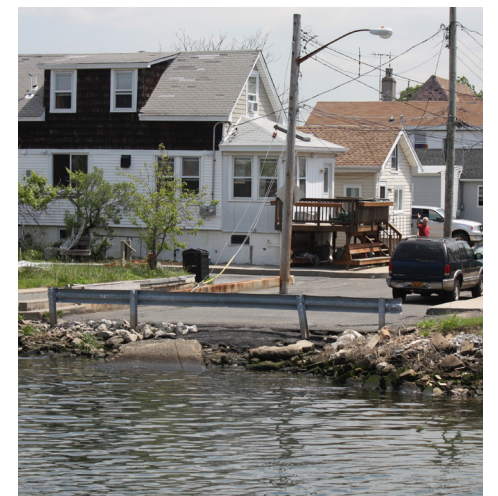
Long Island City, Queens

Limiting Density

In other areas of the city, where flood risks are exceptional in their magnitude and frequency and cannot be managed through infrastructure investment, the City can seek to limit exposure to damage and disruption by limiting future development. Such strategies were pursued in neighborhoods like Oakwood Beach where, following a post-Sandy buyout program, land was set aside for permanent open space conservation, and Hamilton Beach in Queens where daily tidal flooding from projected future sea level rise led to establishment of a local Special Coastal Risk District to limit future growth.



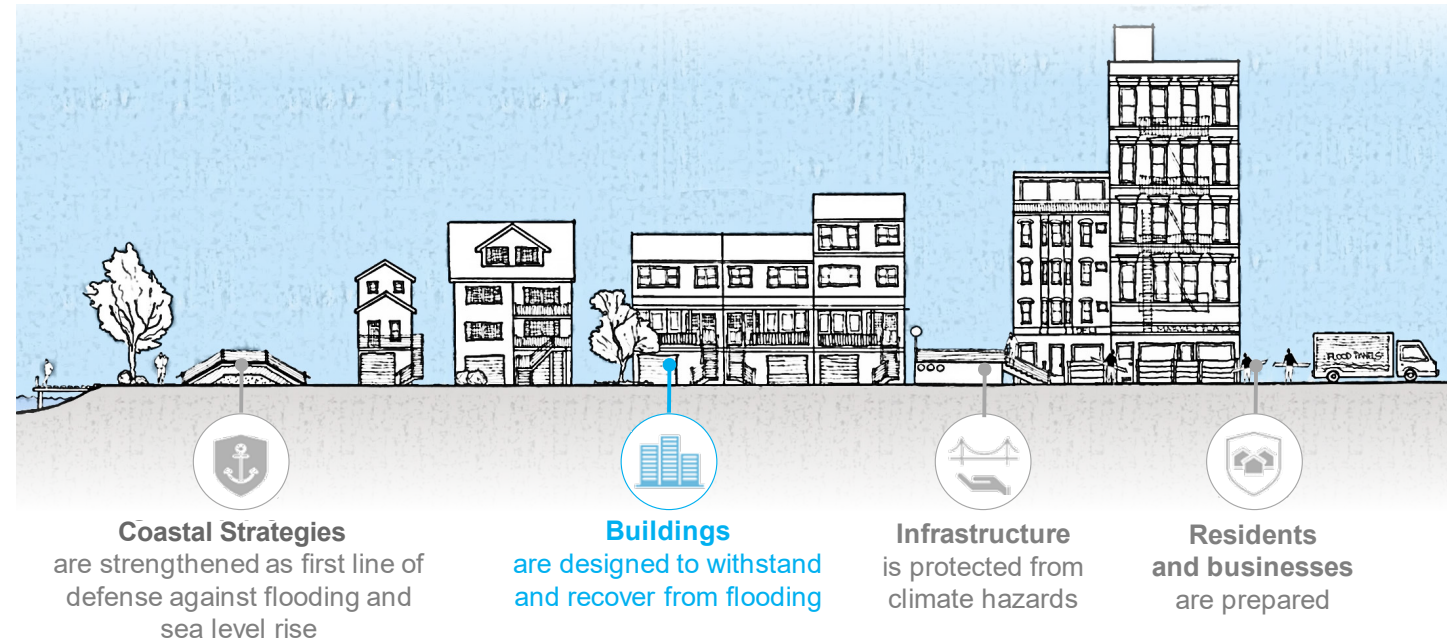
Oakwood Beach, Staten Island



Hamilton Beach, Queens

RECOVERY AND RESILIENT LAND USE PLANNING

OneNYC, the City's long-range plan for a stronger, sustainable, resilient, and equitable city, builds on New York City's history of comprehensive thinking around planning for climate change. To ensure a robust strategy to manage coastal flood risks and other climate hazards, OneNYC advocates for a multilayered approach to ensure that the City remains resilient and prepared for future flood events.



Coastal Protection Strategies

Where feasible, coastal protection strategies can greatly support resiliency efforts in neighboring communities. Flood barriers are under development on the East Shore of Staten Island, the Rockaways, and along Lower Manhattan's waterfront. Meanwhile, the City and State are collaborating on a series of living breakwaters to protect Staten Island's South Shore. These flood protection systems can reinforce long-term land use planning and investments in coastal infrastructure. The City is also continuing to cooperate with State and Federal partners on funding and siting local and regional coastal protection to protect our waterfront neighborhoods.



Source: U.S. Army Corps of Engineers

East Shore Seawall Project. Future Conditions: Buried Seawall with new elevated promenade, Midland Beach area looking north



Source: NYC Department of Design and Construction

East Side Coastal Resiliency. Future condition view from Delancey Overlook

Infrastructure

As NYC continues to assess the long-term impacts of climate change on our coastal infrastructure, targeted capital investments in our coastal infrastructure, such as roads, sewers, bulkheads, and other systems, will help communities adapt and ensure neighborhoods retain access to critical public services. The City is also working with Federal, State, and private partners to ensure that our transportation, logistics, and energy infrastructure meet critical resiliency standards.



Source: NYC Department of Environmental Protection

Proposed resiliency upgrades at the Bowery Bay Resource Recovery Facility



Source: NYC Housing Recovery Office

Home elevations and street reconstruction, Sheepshead Bay, Brooklyn

Residents and Businesses

Ensuring New Yorkers are informed and prepared for future storm events is an integral part of the City's multi-layered approach to managing flood risk. Community-based outreach events on flood regulations have been a central piece of planning for a more resilient future. Programs like FloodHelpNY and Business PREP have served nearly 700 households and over 530 businesses, respectively, with custom resiliency audits and grants to implement resiliency measures. These programs have also provided hundreds of thousands of New Yorkers with information on flood risks, insurance, and home and business retrofit strategies.

For more information on flood resiliency strategies that support NYC's retail and industrial businesses, please see DCP's [Resilient Retail](#) and [Resilient Industry studies](#).



Source: Abe Halpert/CNYCN

An engineer takes measurement of a home in Far Rockaway, Queens during a resiliency audit performed through FloodhelpNY



Community workshop on flood resilient design strategies, Throggs Neck, Bronx

Defining the Floodplain

The floodplain referenced throughout this study is based on the combined geography for the floodplain established by the FEMA 2007 Flood Insurance Rate Maps (FIRMs) and the FEMA 2015 Preliminary Flood Insurance Rate Maps (PFIRMs).

1% and 0.2% annual chance floodplain

FEMA was in the process of creating new maps when Sandy hit. These Preliminary Flood Insurance Rate Maps (PFIRMs) were released in 2013 and updated in 2015. The City conducted a review of the PFIRMs and found errors in FEMA's modeling and filed a technical appeal of the maps. In October 2016, FEMA accepted the City's appeal and announced that it would revise the maps to better reflect the city's flood risk. These new maps are targeted for release in 2024.

Until these new maps are released, both the 2007 FIRMs and 2015 PFIRMs will continue to be used, though for different purposes. Flood insurance rates will continue to be based on the 2007 FIRMs, saving coastal households tens of millions of dollars per year. Building code and zoning will continue to refer to both the 2007 FIRMs and 2015 PFIRMs, whichever is more conservative. These maps are used in this way to ensure that buildings are better prepared for the physical and financial impacts of future coastal storms.

The **1% annual chance floodplain**, also known as the 100 year floodplain or the Special Flood Hazard Area, is the area that will be inundated by a flood event having a 1-percent chance of being equaled or exceeded in any given year, and is designated on the U.S. Federal Emergency Management Agency's (FEMA) and the Flood Insurance Rate Maps (FIRMs).

In instances where the **0.2% annual chance floodplain**, or 500 year floodplain, is referenced, it is also the combined geography for the 0.2% annual chance floodplain established by the FEMA 2007 Flood Insurance Rate Maps (FIRMs) and the FEMA 2015 Preliminary Flood Insurance Rate Maps (PFIRMs).

Current and Future 1% annual chance floodplain

Where referenced, the 2050s 1% annual chance floodplain is based on FEMA's Preliminary Flood Insurance Rate Map (PFRIMs) data and the New York City Panel on Climate Change's (NPCC) 90th Percentile Projections for sea level rise in the 2050s.

The current 0.2% annual chance floodplain's geography has a similar extent to the city's future 2050's 1% annual chance floodplain. Because sea level rise is continuing to expand our 1% annual chance floodplain, it is critical to study this area of moderate risk flood risk which will be subject to heightened future flood vulnerabilities.

In addition, the City is creating a new set of maps that use the best-available scientific projections for sea level rise to depict future conditions. When completed, the future flood risk maps (FFRMs) may be used to inform City capital construction projects and potentially incorporated into the New York City Building Code. The FFRMs are expected to be complete in 2022.

