

Resilient Neighborhoods

Canarsie



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Resilient Neighborhoods

Canarsie

THE CITY OF NEW YORK
MAYOR BILL DE BLASIO

DEPARTMENT OF CITY PLANNING
MARISA LAGO, DIRECTOR

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www.nyc.gov/resilientneighborhoods

FOREWORD

Canarsie is a community along Jamaica Bay in Brooklyn with a long history tied to its extensive waterfront and park network. These amenities remain a vital part of Canarsie's identity. However, Hurricane Sandy in 2012 took many Canarsie residents by surprise as, prior to the storm, the neighborhood had not been mapped into the floodplain. Today, nearly five years after Sandy, residents are continuing to grapple with how to adapt their neighborhood to face a future storm.

The Resilient Neighborhoods initiative was launched by the Department of City Planning (DCP) shortly after Hurricane Sandy. This report is the culmination of over three years of research, outreach, and hard work by DCP, working closely with Canarsie residents and local leaders to identify strategies to reduce flood risk and build a more resilient and vibrant neighborhood.

This report includes recommendations for updating specific zoning and land use regulations, as well as investments in coastal infrastructure and other programs. The conclusions of this report will guide updates to the citywide flood resiliency text amendment that DCP is currently developing.

This plan is the beginning of a conversation and a commitment to work with Canarsie to ensure the community's ongoing vibrancy and resiliency.

A handwritten signature in cursive script that reads "Marisa Lago".

Marisa Lago
Department of City Planning

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EXECUTIVE SUMMARY

Hurricane Sandy's devastating impacts on New York City in 2012 served as a vivid reminder of how vulnerable the city is to coastal storms and flooding. With climate change, storms like Sandy are expected to increase in frequency and severity in the future, putting New Yorkers living and working on the waterfront at even greater risk. Yet, as Sandy also demonstrated, resilient building design can significantly reduce the damage caused by flooding and enable homes to be reoccupied sooner. By combining resilient building design with careful land use planning and strategic investment in infrastructure, the city can adapt to challenging environmental conditions over time and shape neighborhoods that are both vibrant and able to withstand and recover quickly from future floods.

Resilient Neighborhoods is a place-based planning initiative, led by the New York City Department of City Planning in collaboration with communities and other agencies, to identify neighborhood-specific strategies for the continued vitality and resiliency of ten neighborhoods in the city's floodplain. This report provides details on Canarsie, Brooklyn. Canarsie was selected for this study not only because it was heavily impacted by Sandy, but also because revisions to federal flood maps will add a significant portion of the neighborhood new to the floodplain. In addition, Canarsie has a high concentration of attached and semi-detached buildings that present both physical and financial challenges to retrofitting for resiliency.

The City's work in Canarsie has been guided by three primary goals:

Reduce flood risk

Promote building retrofits and resilient development by providing sufficient flexibility in zoning to accommodate a range of solutions for new and retrofitted attached and semi-detached buildings. DCP is developing a set of proposed zoning changes to ensure that existing buildings are able to be retrofitted and that new developments can more easily be built to resilient standards that support the quality of the surrounding environment.

Plan for adaptation over time

With sea level rise and climate change flood risks will increase in the future. The City is planning for multiple lines of defense by combining flexible, resilient building regulations with short- and long-term coastal protection strategies where these may be achievable.

Create resilient, vibrant neighborhoods

Resilient local retail can provide access to important services that can help accelerate recovery by providing critical services in the aftermath of future floods. DCP is also working with partner agencies such as Small Business Services to help increase the capacity of local businesses in the floodplain.

In addition, this report provides a detailed description of the outreach, research, and analysis conducted, as well as an overview of the planning framework and regulatory context for these efforts. A glossary of key terms is provided following the conclusion.

The recommendations outlined in this report include specific actions to be undertaken in the short term, as well as broader strategies that can guide an ongoing response to evolving risks and changing conditions, to promote equity, livability, and safety.



Residential space below the DFE is relocated in a vertical addition that is set back

Design Flood Elevation (DFE)

Parking and storage area is wet floodproofed and outfitted with flood vents

Resiliency Planning in New York City

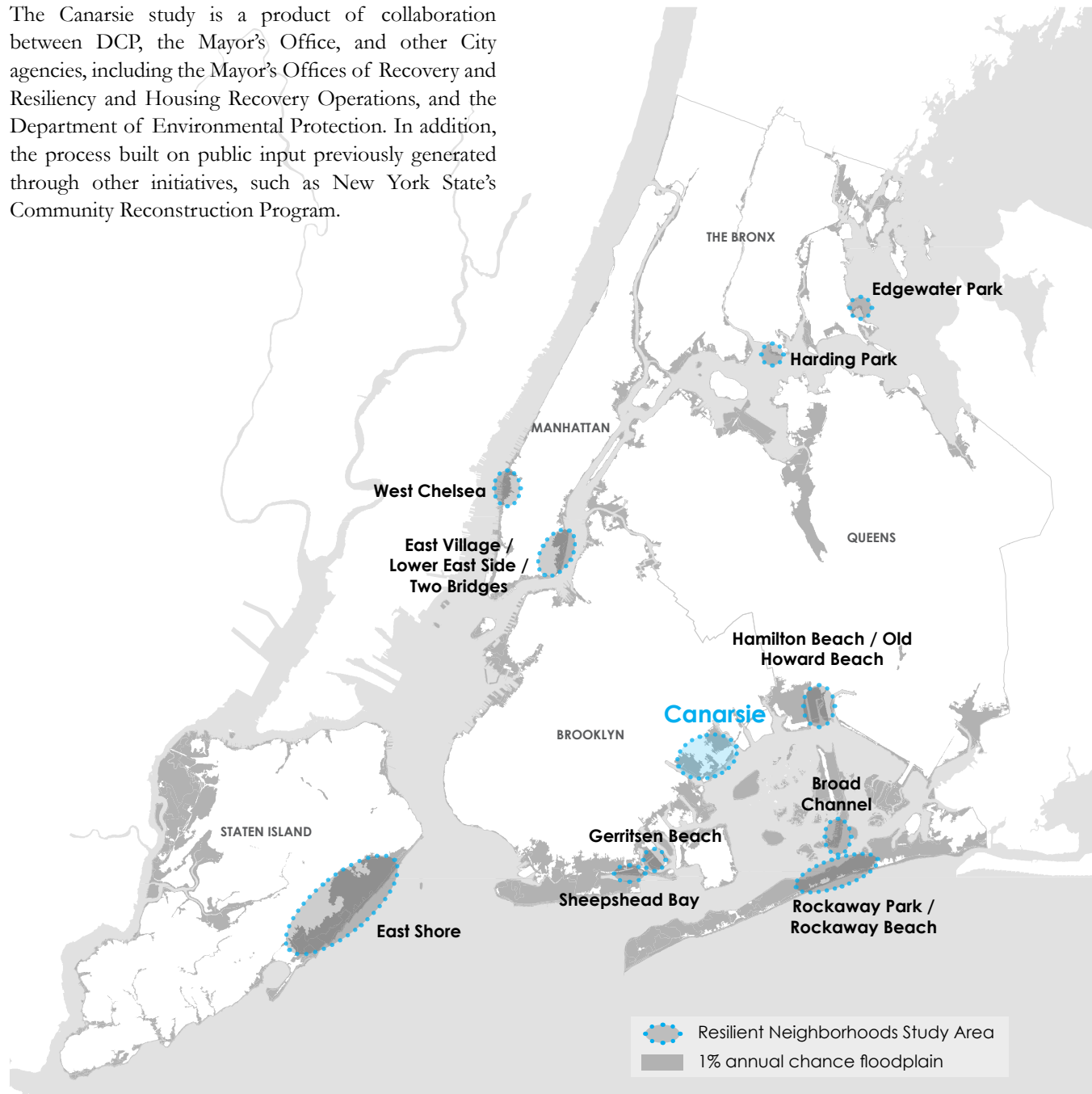
Following Hurricane Sandy in October 2012, the City developed *A Stronger, More Resilient New York*, which laid out a detailed action plan for rebuilding post-Sandy and making the city's coastal communities, buildings, and infrastructure more resilient in the long-term. The City has made significant 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.

Canarsie was selected for this study because the neighborhood was severely flooded with waters reaching five to seven feet above grade. Furthermore, residential buildings in Canarsie present retrofitting challenges that are not easily resolved under existing federal and local regulations.

The Canarsie study is a product of collaboration between DCP, the Mayor's Office, and other City agencies, including the Mayor's Offices of Recovery and Resiliency and Housing Recovery Operations, and the Department of Environmental Protection. In addition, the process built on public input previously generated through other initiatives, such as New York State's Community Reconstruction Program.



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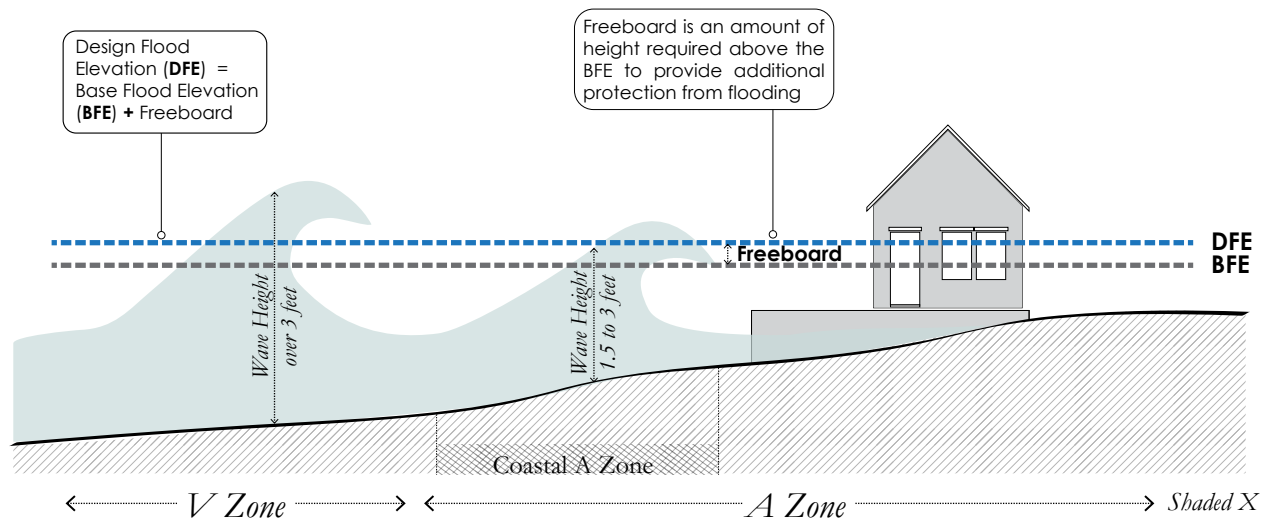
Regulatory Context

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.



	ELEVATE	WET FLOODPROOF	DRY FLOODPROOF
	Open structure Eg. Open lattice	Water to run in / run out Eg. Flood vents	Watertight structure Eg. Flood shields
Ground Floor Configuration	<p><i>Bottom of <u>lowest horizontal structural member</u> to be at or above Design Flood Elevation</i></p>	<p><i><u>Lowest occupiable floor</u> to be at or above Design Flood Elevation</i></p>	<p><i><u>Lowest occupiable floor</u> allowed to be excavated below grade. (Not permitted for residential buildings)</i></p>
Permitted Uses (BELOW DFE)	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Parking <input checked="" type="checkbox"/> Access <input checked="" type="checkbox"/> Storage <input checked="" type="checkbox"/> Non-Residential <input checked="" type="checkbox"/> Residential 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Parking <input checked="" type="checkbox"/> Access <input checked="" type="checkbox"/> Storage <input checked="" type="checkbox"/> Non-Residential <input checked="" type="checkbox"/> Residential 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Parking <input checked="" type="checkbox"/> Access <input checked="" type="checkbox"/> Storage <input checked="" type="checkbox"/> Non-Residential <input checked="" type="checkbox"/> Residential

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 City found inaccuracies in FEMA's underlying analysis that resulted in overstating the size of the city's current 1% annual chance floodplain. Following a successful appeal of the PFIRMs, New York City is working with FEMA to create a set of new flood maps for the city. There will be one map for insurance purposes based on current flood risk, and another for planning purposes that incorporates climate change. In the meantime, the PFIRMs remain in use for building code, planning, and zoning, as described below, while flood insurance still refers to the 2007 effective FIRMs.

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 after a flood.

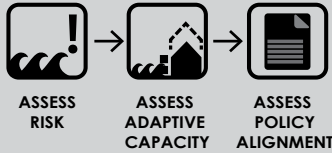
Citywide Zoning for Flood Resiliency

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. Many of these provisions, plus additional regulation, were included in a subsequent zoning text amendment to make the emergency order part of the City's legislation. 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

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.

RESILIENCY ASSESSMENT



The resiliency assessment evaluates coastal risks, the capacity of neighborhoods to adapt to these risks, and the potential to align adaptation options with other policy goals or community priorities. The objective is to determine which hazards and vulnerabilities are present within a neighborhood and evaluate the potential for adaptive strategies, such as retrofitting buildings or creating new coastal protection infrastructure, to reduce these vulnerabilities.

Ongoing community outreach

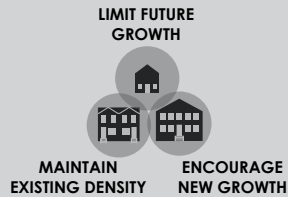
ESTABLISH RESILIENCY FRAMEWORK



The resiliency framework uses the results of the resiliency assessment to envision the range of changes necessary to make the neighborhood more resilient, which might include coastal protection, infrastructure investments, changes to regulations, and community education, among other strategies.

Ongoing community outreach

SELECT LOCAL RESILIENT LAND USE STRATEGIES



Across the city, there is a spectrum of potential land use strategies that can be used as appropriate to achieve the goals envisioned in the resiliency framework. In areas that are at significant risk from future frequent tidal flooding due to sea level rise, as well as more severe flooding from extreme events, it will often make sense to limit growth. In other areas where buildings are at risk of flood damage primarily from extreme events, there may be ways to alter regulations to promote retrofits. Where growth can be supported, increasing densities may promote investment in resilient buildings that will reduce risks of flood damage. More than one type of land use strategy may be appropriate in different parts of a neighborhood, based on flood risk and other planning considerations.

Ongoing community outreach

IMPLEMENT RESILIENCY STRATEGIES



Resiliency strategies can be implemented through a range of tools, including but not limited to zoning changes, changes to other City, State, or Federal regulations, operational measures, education and outreach, financial assistance, construction or upgrades of infrastructure, and emergency preparedness training. A combination of tools enacted at different scales and amongst different stakeholders is likely to be necessary to fully implement a set of resiliency strategies.

space that is abandoned and wet floodproofed. It also incorporated provisions to mitigate adverse streetscape impacts. The rules, now part of the Zoning Resolution, remain in effect and apply to all buildings in the PFIRM 1% annual chance floodplain. 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, now part of the Zoning Resolution, remain in effect and apply to all buildings in the PFIRM 1% annual chance floodplain.

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

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 Canarsie using this process.



Presentation to Fresh Creek Civic Association

Community Outreach

In order to better understand the various challenges that homeowners in Canarsie face, the Resilient Neighborhoods team met with a variety of stakeholders including residents, community boards, local elected officials and community-based organizations. In the summer of 2014, the team presented the study to Community Board 18 and other local officials to inform residents and to gather early questions and concerns. This was also a chance to identify local challenges that needed further study.

A Community Advisory Committee (CAC) was formed with representatives from organizations such as the Canarsie Merchant Association, Canarsie Disaster Recovery Coalition, and the Fresh Creek Association. Following Hurricane Sandy, Canarsie residents developed several locally based recovery groups; many of which built upon existing civic associations. During several meetings the CAC identified areas of Canarsie that were the most vulnerable during Hurricane Sandy, community services that were lacking immediately following the storm, and long-standing neighborhood issues that were exacerbated because of the storm.

A planning framework was developed with input from the CAC, Community Board, elected officials, and through detailed flood risk and land use analysis. The framework helped to identify land use and policy recommendations to address neighborhood resiliency issues and provide a menu of retrofitting solutions that address Canarsie's challenging building stock. Community participants recognized the implications of flood risk, and that solutions to make buildings more resilient can come with substantial costs and that buildings may need to be reconfigured in significant ways.

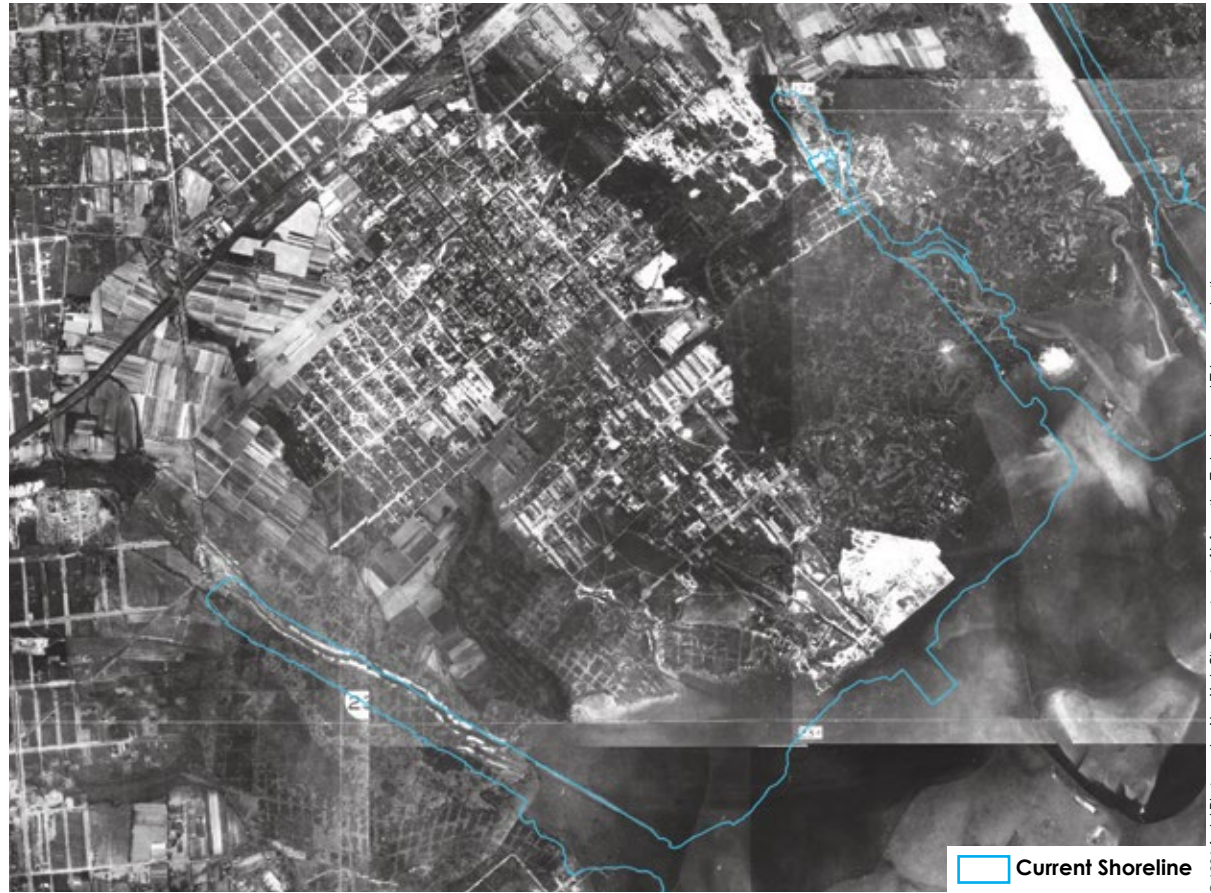
COMMUNITY RISK PROFILE

Community Character and History

Canarsie is a large community with more than 83,000 residents. The building stock is characterized by one- and two-family detached and semi-detached buildings, row houses, and local commercial corridors crisscrossing through the center of the neighborhood. It is bounded by Paerdegat Basin, Fresh Creek, and Jamaica Bay along the southeast Brooklyn waterfront. The area is surrounded by an extensive park network, which includes the 132-acre Canarsie Park, Paerdegat Basin Natural Area Park and Fresh Creek Nature Preserve. Not only do these areas offer many recreational opportunities for the community, they also serve as a natural buffer to the waterfront.

Prior to Dutch settlement in the early 17th century, most of the territories surrounding Jamaica Bay were inhabited by local Native American tribes. In the early 1600s Canarsie was an unincorporated village that was a part of the Town of Flatlands; one of the oldest of the five original Dutch towns on Long Island. Canarsie started as a farming village that provided food goods to higher density areas along the Hudson and East River. Following the Civil War, Canarsie Landing, which today is the site of Canarsie Pier, became home to a significant commercial fishing and boat building industry.

In 1865, the Brooklyn and Rockaway Beach Railroad opened, connecting Canarsie to East New York and other areas in Brooklyn. The following year the railroad company opened a ferry service connecting the Rockaway Peninsula to Canarsie Landing. The ferry service helped position Canarsie as a waterfront destination and over the next century the waterfront changed from a primarily fishing economy to a popular waterfront recreation area with summer bungalows, yacht clubs, restaurants, and hotels. In 1907, the waterfront also became the home of Golden City Amusement Park, which rivaled Coney Island.



Historic 1924 Aerial Photograph of Jamaica Bay Shoreline

© 1924 Aerial Photography, New York City Department of Information Technology and Telecommunications.

Prior to the early 20th Century, most of Canarsie east of Rockaway Parkway was marshland (see image above). Beginning in the early to mid-1900s, areas surrounding Jamaica Bay underwent infill development; over one square mile of shoreline was filled in the New York City Department of Docks and Ferries developed a 600-square-foot municipal pier, called Canarsie Landing, in 1926. By this time, Canarsie's population was rapidly growing and the area evolved into a residential community. In 1934, the Golden City Amusement Park shut down and the Belt Parkway was constructed soon afterwards, connecting the neighborhood to other areas

of Brooklyn and Queens. Infill development on former wetlands continued into the 1950s paving the way for several large scale residential developments, including Seaview Village, Breukelen Houses, and Bay View Houses.

In the 1970s, Canarsie Pier was incorporated into the National Park Service's Gateway National Recreation Area, the first urban national park in the country. The park remains a popular fishing and recreational area attracting visitors from the neighborhood as well as the rest of the city.

Canarsie Study Area



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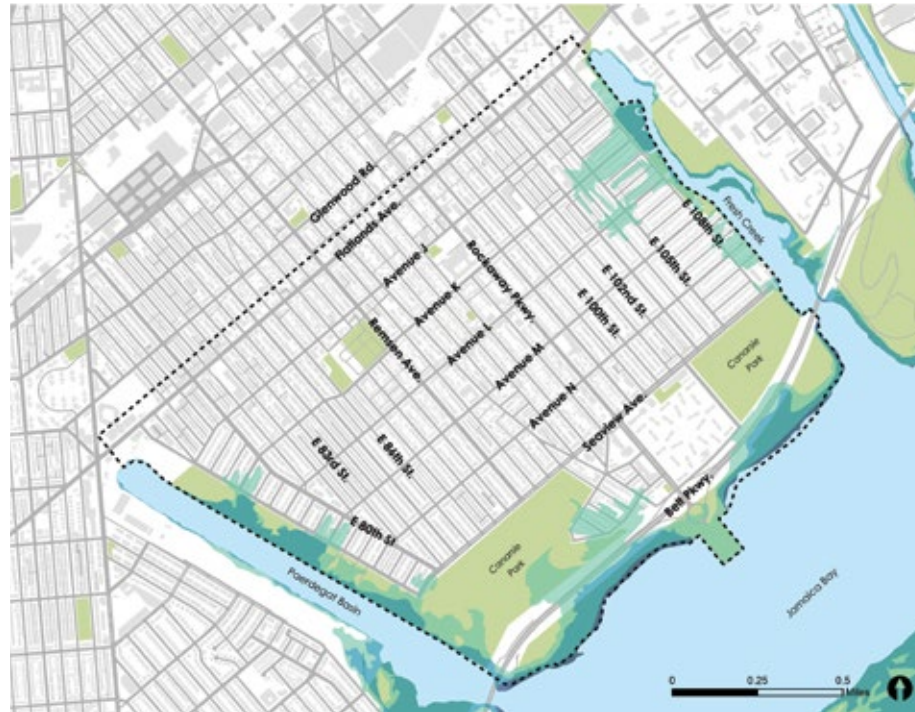
Flood Risk Vulnerabilities

Only a small portion of Canarsie was in the federally designated floodplain prior to FEMA's release of the Preliminary Flood Insurance Rate Maps (PFIRMs) in 2013. Using an updated methodology, the PFIRMs map greatly expanded the 1% annual chance floodplain, increasing the number of buildings in Canarsie floodplain from approximately twenty-six to 5,000. Over 10,000 residential units are now located in the floodplain.

In addition to showing the extent of the 1% annual chance floodplain, the PFIRMs also show Base Flood Elevations (BFE). As mentioned earlier, the BFE is the computed elevation in feet to which floodwater is anticipated to rise during the 1% annual chance storm. A building's flood insurance premium under the National Flood Insurance Program (NFIP) is largely determined by the relationship between the BFE and the level of the lowest occupied floor of a structure.

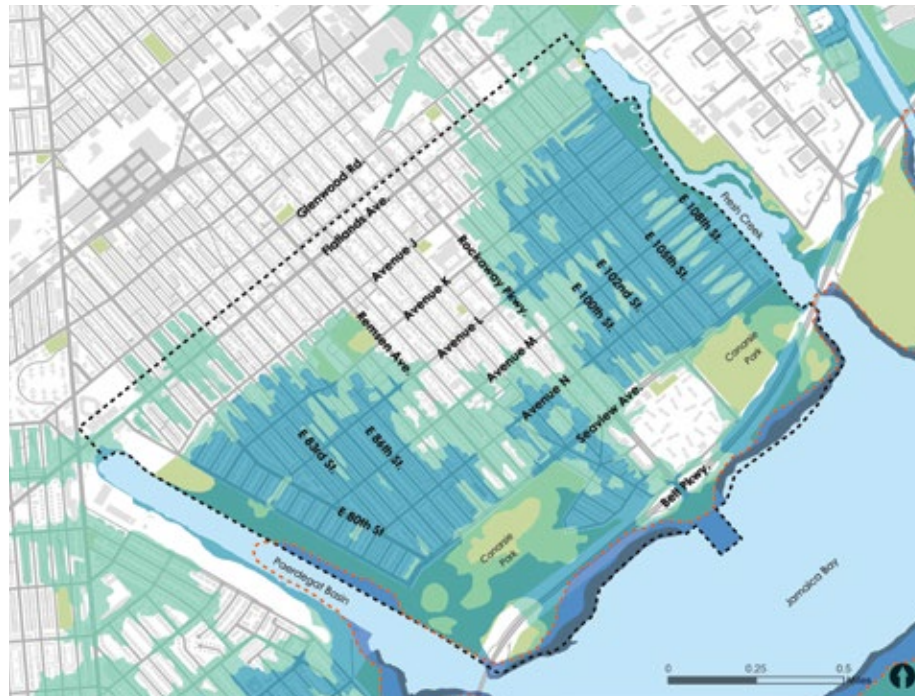
According to the PFIRM, in Canarsie's residential areas, BFEs generally range between one and six feet above grade. Only in small pockets, especially along Fresh Creek and Canarsie Park, do BFEs exceed six feet. During Sandy there was extensive flooding that entered the neighborhood from the Fresh Creek and Paerdegat Basin inlets, with floodwaters reaching elevations of five to seven feet above grade. This caused significant damage to basements and ground floors in areas with higher BFEs in Canarsie.

Wave risk is not a major concern in Canarsie as the existing waterfront park network shields the neighborhood from wave action generated within Jamaica Bay.



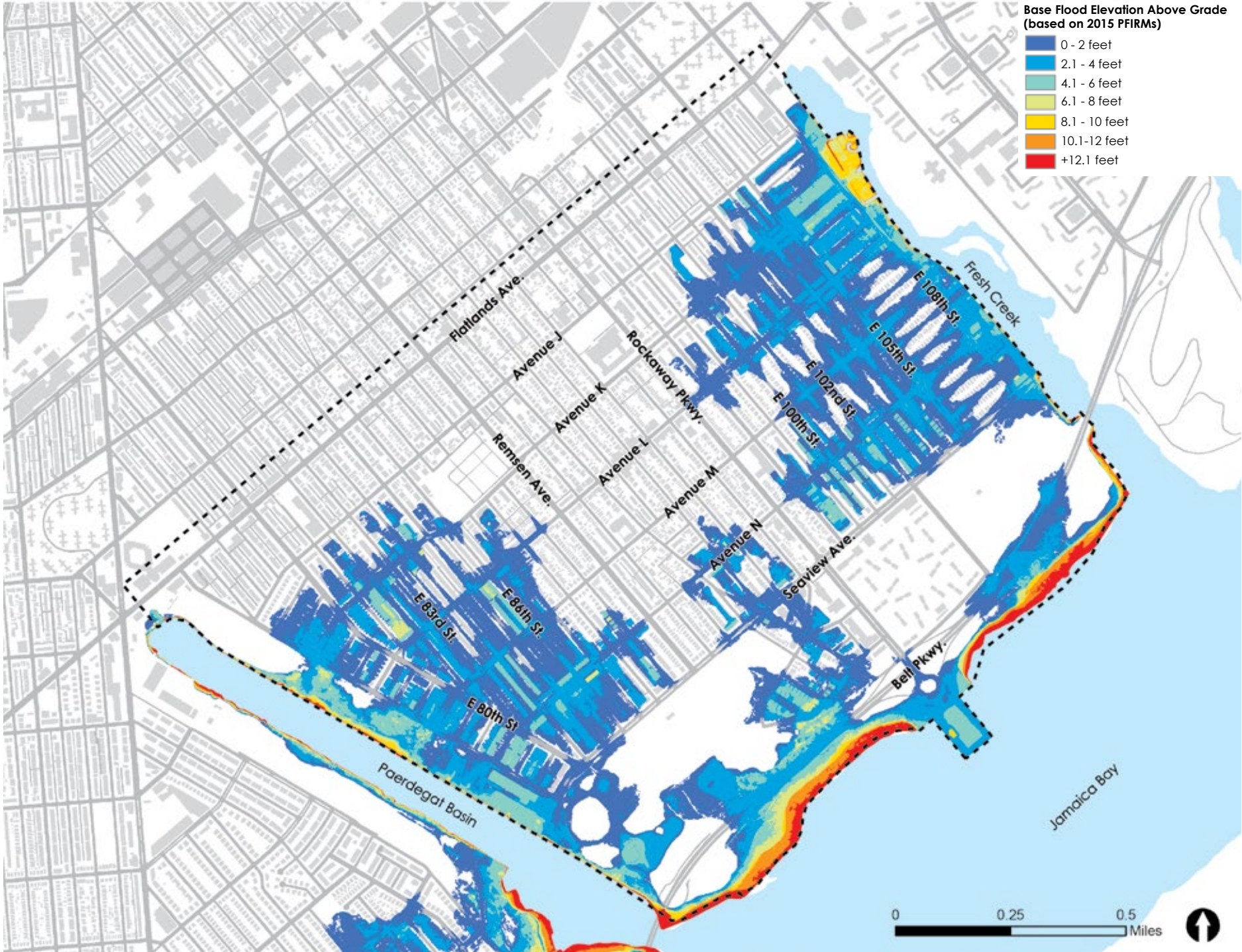
1983 Flood Insurance Rate Map

- A Zone
- Shaded X Zone



Preliminary Flood Insurance Rate Map (Released in 2015)

- V Zone
- Coastal A Zone
- A Zone
- Shaded X Zone
- Subject to Wave Risk (LimWA)



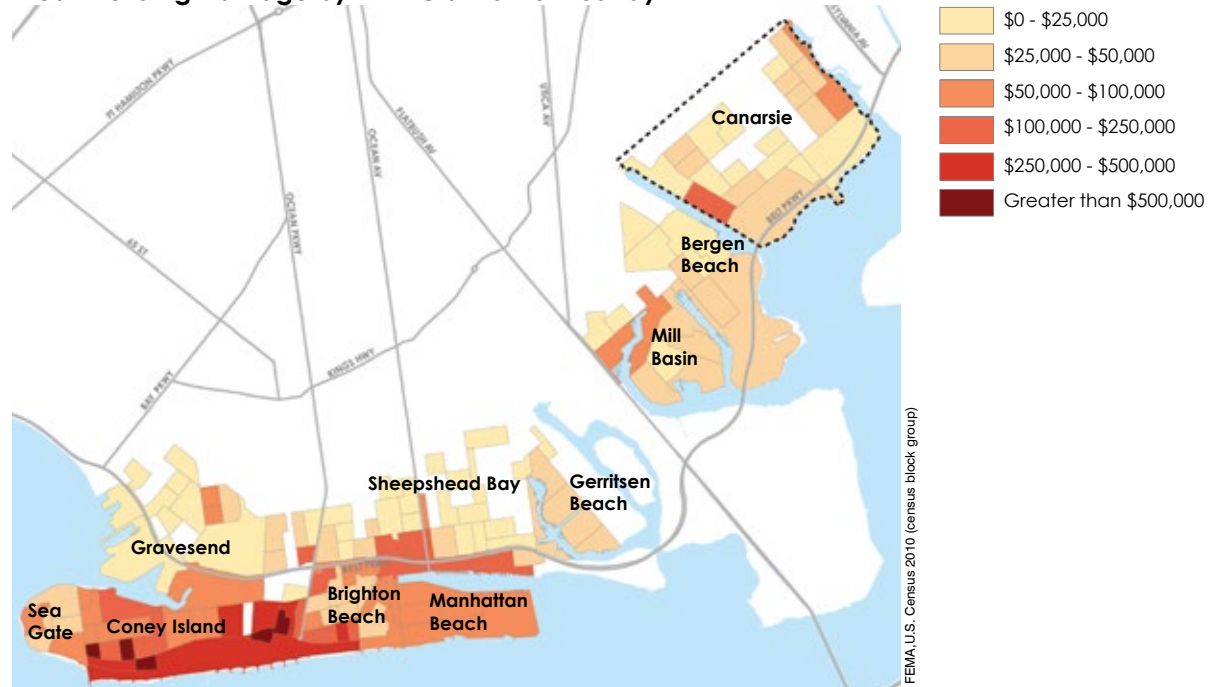
Sandy Flood Damage

As alluded to earlier, Canarsie has undergone one of the City's greatest expansions of the 1% annual chance floodplain following the issuance of FEMA's PFIRMs. Homeowners are starting to grapple with the ramifications of flood risk and carrying flood insurance. At the time of Sandy, only five percent of residential buildings neighborhood-wide, and less than eight percent of homeowners with inspected flood damage, had flood insurance according to FEMA's Individual Assistance Damage Inspections data.

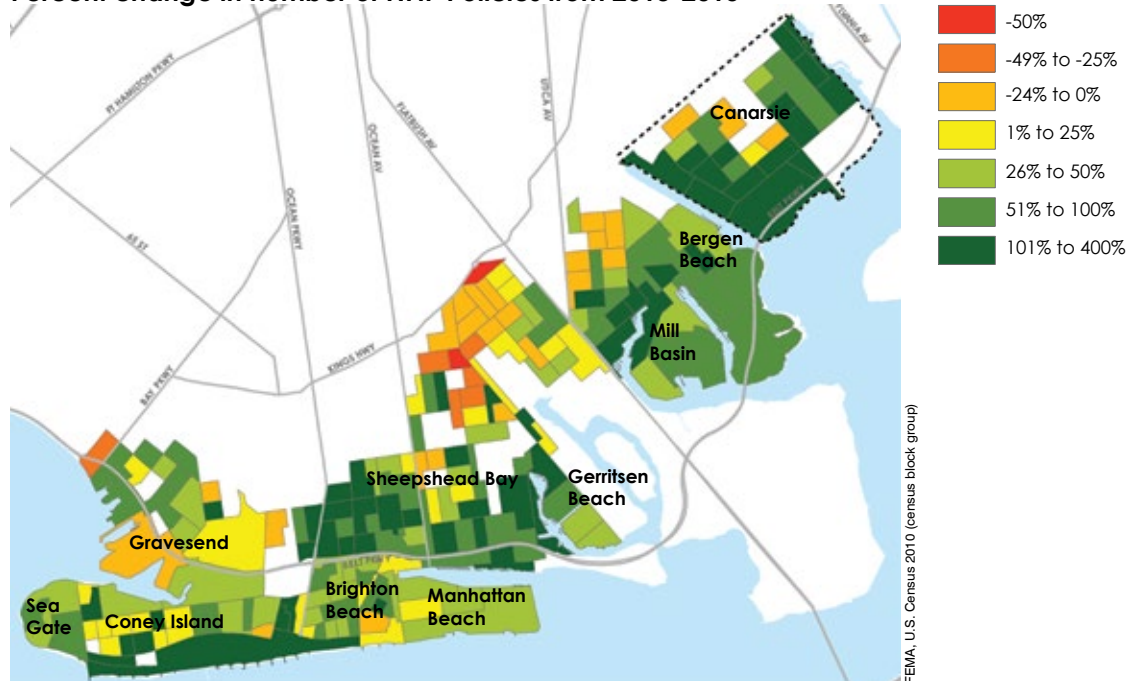
While most coastal neighborhoods have seen increases in flood insurance take-up rates since Sandy, Canarsie has seen the number of active policies skyrocket by 123 percent, compared to less than fifty percent across Brooklyn and thirty percent citywide. Many of these newly insured homeowners are currently benefiting from lower rates because the PFIRMs are not in effect for insurance purposes. However, when new FIRMs are adopted, rates will increase sharply as premiums rise towards full rates in the coming years due to national changes in the flood insurance program.

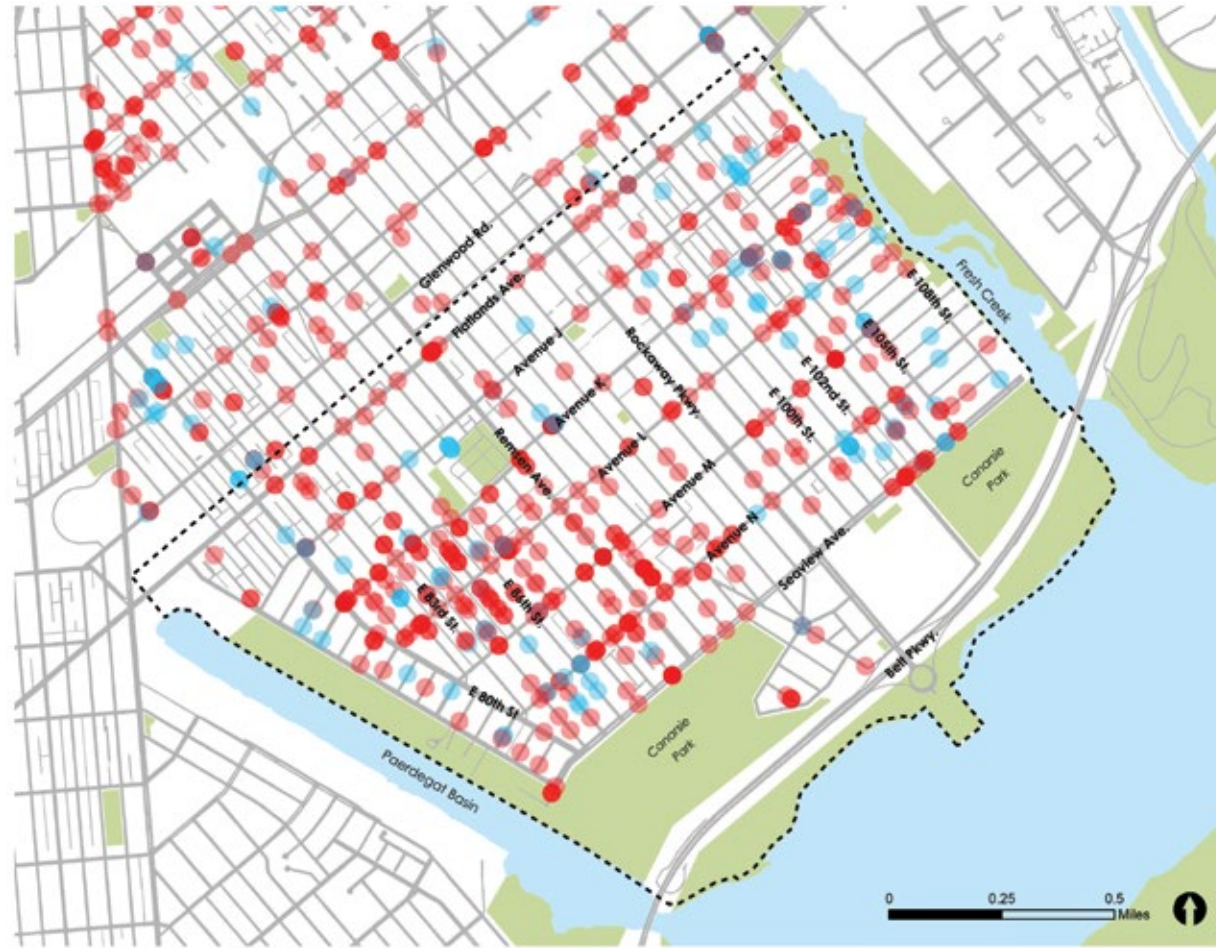
Although only about a third of study area residents reported damages from Sandy, ninety-eight percent of those experienced at least some flooding, and almost thirty percent of inspected households reported the entire basement level flooded. Because many below grade spaces have become used as a separate residential unit, the life and safety risks from floods is even higher.

Mean Building Damage by NFIP Claims From Sandy



Percent change in number of NFIP Policies from 2013-2015





311 Sewer Complaints 2011-2013

- Catch Basin Clogged/Flooding
- Street Flooding

Storm Sewer Infrastructure

Throughout the entire neighborhood, the capacity of the sewer system is a concern to residents. Prior to Sandy the community often experienced drainage issues and flooding in basements during heavy rain events. During Sandy there was flooding not only from Fresh Creek and Paerdegat Basin but also from blocked sanitary sewers, which caused water to back up through drains into homes and businesses. Many residents reported up to seven feet of flooding in basements. Residents have also reported significant ponding in the streets and minor flooding in their basements during less severe rain. Ponding is exacerbated by sunken front yards, which are typical throughout the neighborhood.



Typical Sunken Front Yard in Canarsie

Household Characteristics

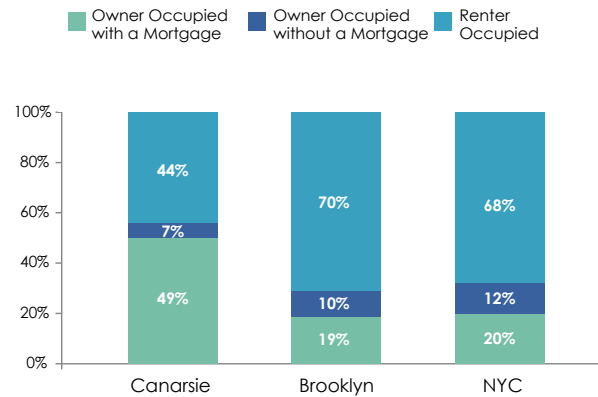
There are about 12,000 residential buildings in Canarsie; roughly two-thirds of these buildings are currently in the floodplain. The median household income is \$66,500, which is above the median for Brooklyn and New York City as a whole. Canarsie also has a sizable first and second generation Caribbean population, many of whom settled in the neighborhood in the 1990s and 2000s. Ninety percent of owner-occupied homes have mortgages, significantly higher than the respective rate for Brooklyn and New York City (see chart).

Canarsie was heavily impacted by the subprime mortgage crisis. In 2006, during the lead-up to the housing crisis, over fifty percent of mortgages issued in Canarsie were considered “high-cost” or subprime, nearly double the borough- and citywide rates (see chart). In 2011 the neighborhood had the highest foreclosure rate in New York City. Following Sandy, foreclosure risk has remained a serious issue. Even two years after the storm, with thirty-three foreclosures for every 1,000 properties, Canarsie’s rate remained fifty percent higher than the borough’s.

Roughly eighty percent of all Canarsie mortgages issued in the aftermath of Sandy were government backed (see chart), primarily insured by the Federal Housing Administration (FHA). Such loans have lower qualification standards, including a significantly lower down payment, but generally come with higher mortgage insurance costs and higher overall APR rates that result in greater costs to the borrower over the life of the loan.

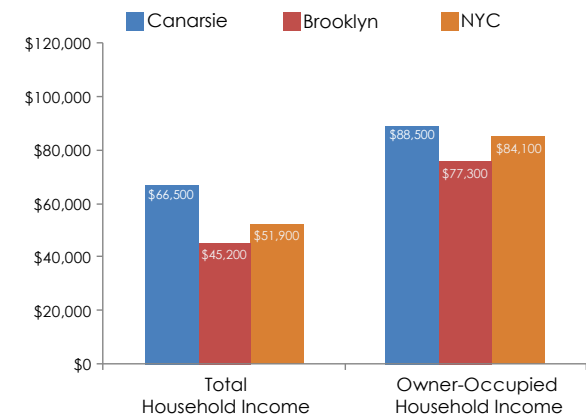
The high rate of mortgages still in repayment, a legacy of subprime lending, and new flood insurance purchase requirements leave few homeowners with the financial resources and available equity to afford the high cost of elevating or retrofitting their homes. This financial challenge is complicated by the fact that many residential buildings in Canarsie have converted basement units. These units have been rented out both formally and informally over the last ten years, and they are often a

Housing Units By Occupancy



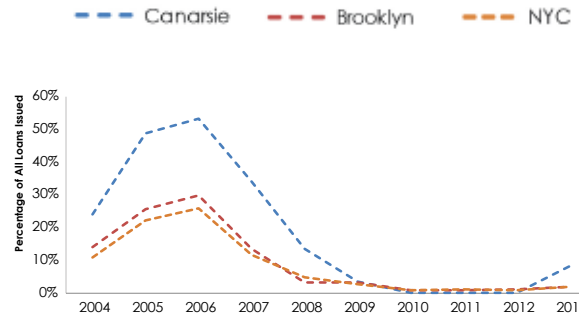
Source: US Census American Community Survey, 2012 5-Year

Median Household Income



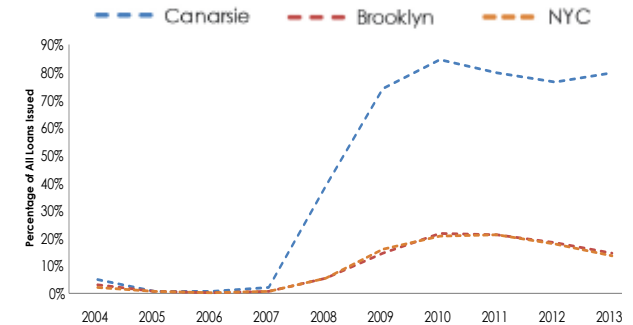
Source: US Census American Community Survey, 2012 5-Year

Percentage all 1–4 Unit Home Purchase Loans that are “High-Cost” or Subprime 2004 – 2013



Source: HMDA, TRF

Percentage all 1–4 Unit Home Purchase Loans that were Government-Insured



Source: HMDA, TRF

source of supplemental income that help homeowners make mortgage payments. While most entry floors in Canarsie are above the Design Flood Elevation (DFE), residential spaces in basements or cellars are below the DFE. Homeowners with mortgages that are required to purchase flood insurance are faced with a difficult choice: vacate their rental unit and lose the supplemental source of income in order to lower the cost of their flood insurance premiums, or maintain the unit and face flood insurance premiums that are increasingly becoming prohibitively expensive as long-

standing premium subsidies are phased out. While most buildings in Canarsie retained their structural integrity during Sandy, as mentioned, the cost of retrofitting to comply with FEMA standards to lower flood insurance premiums, as well as New York City Department of Buildings Appendix G Flood-Resistant Construction regulations might be prohibitively expensive for some residents. Preliminary cost estimates for retrofitting construction to meet these standards are between \$50,000 and \$100,000. Actual costs will vary widely depending on individual building conditions.



Attached Buildings along Paerdegat 11th Street



Semi-detached Buildings along East 91st Street



Detached Buildings on Flatlands 9th Street



Avenue L Commercial Corridor

Canarsie. Many residential buildings in these areas were built in the late 19th/early 20th centuries and predate current zoning regulations. The building typology is varied, consisting of semi-detached buildings and bungalows generally at grade. Very little of this area is in the floodplain today.

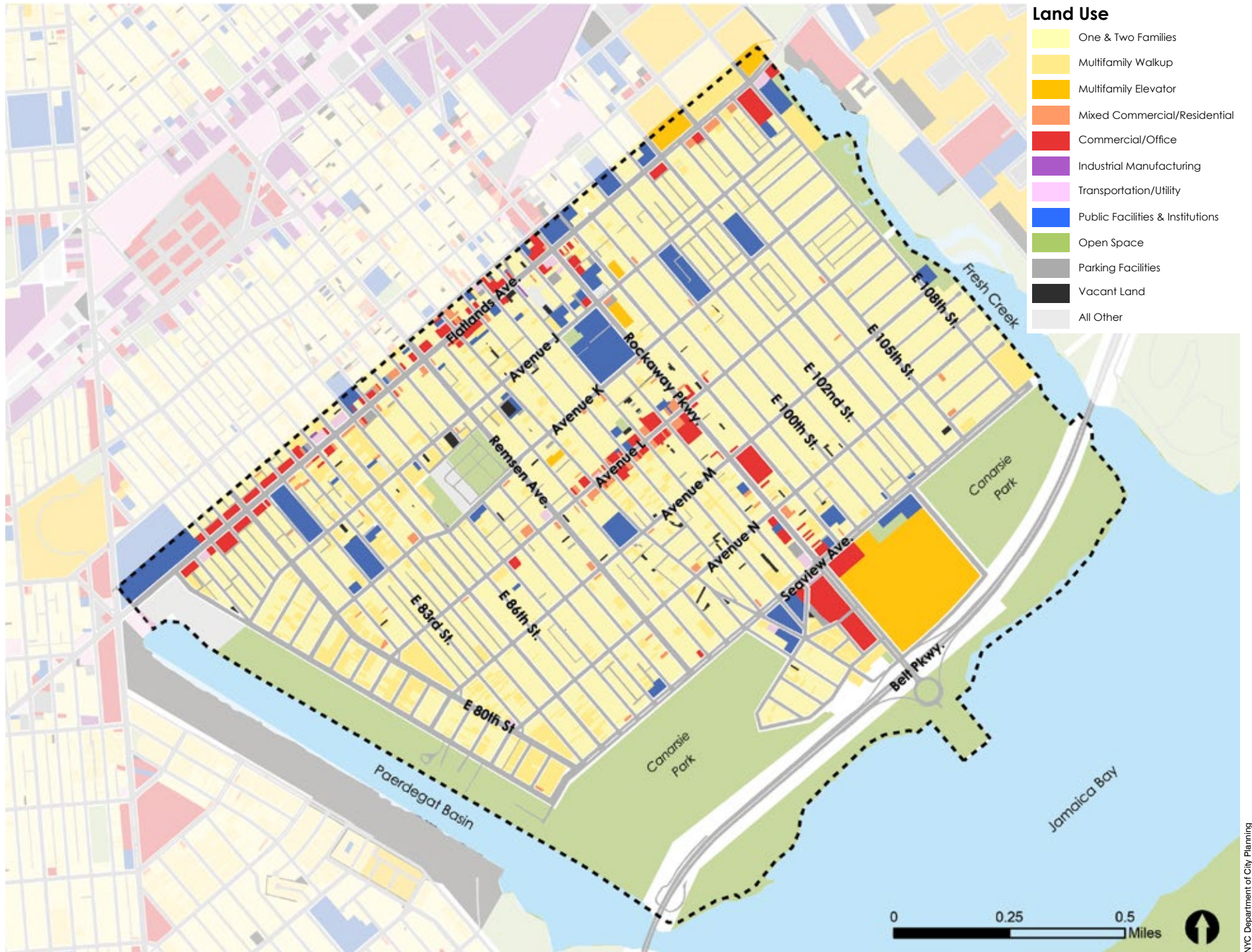
The one- and two-family detached and semi-detached residential character is generally found between Rockaway Parkway and Fresh Creek, south of Avenue L. These homes are also built on regular lots ranging in width between twenty and fifty feet with a depth of a hundred feet. They are typically up to three feet above grade. These areas of Canarsie were primarily built in the 1950s and 1960s following the filling of the surrounding marshland along Jamaica Bay. Attached buildings are concentrated between Paerdegat Basin and Remsen Avenue as well as between Rockaway Parkway and Fresh Creek, north of Avenue L. These row houses are on regular lots of up to twenty feet in width with a depth of a hundred feet and generally have front yards sloping downward one to four feet leading to a garage and sometimes a residential space such as a den or a separate rental unit. Backyards are also often several feet below grade and lead to shared alleyways in certain areas or to yards that may be several feet below the sidewalk level.

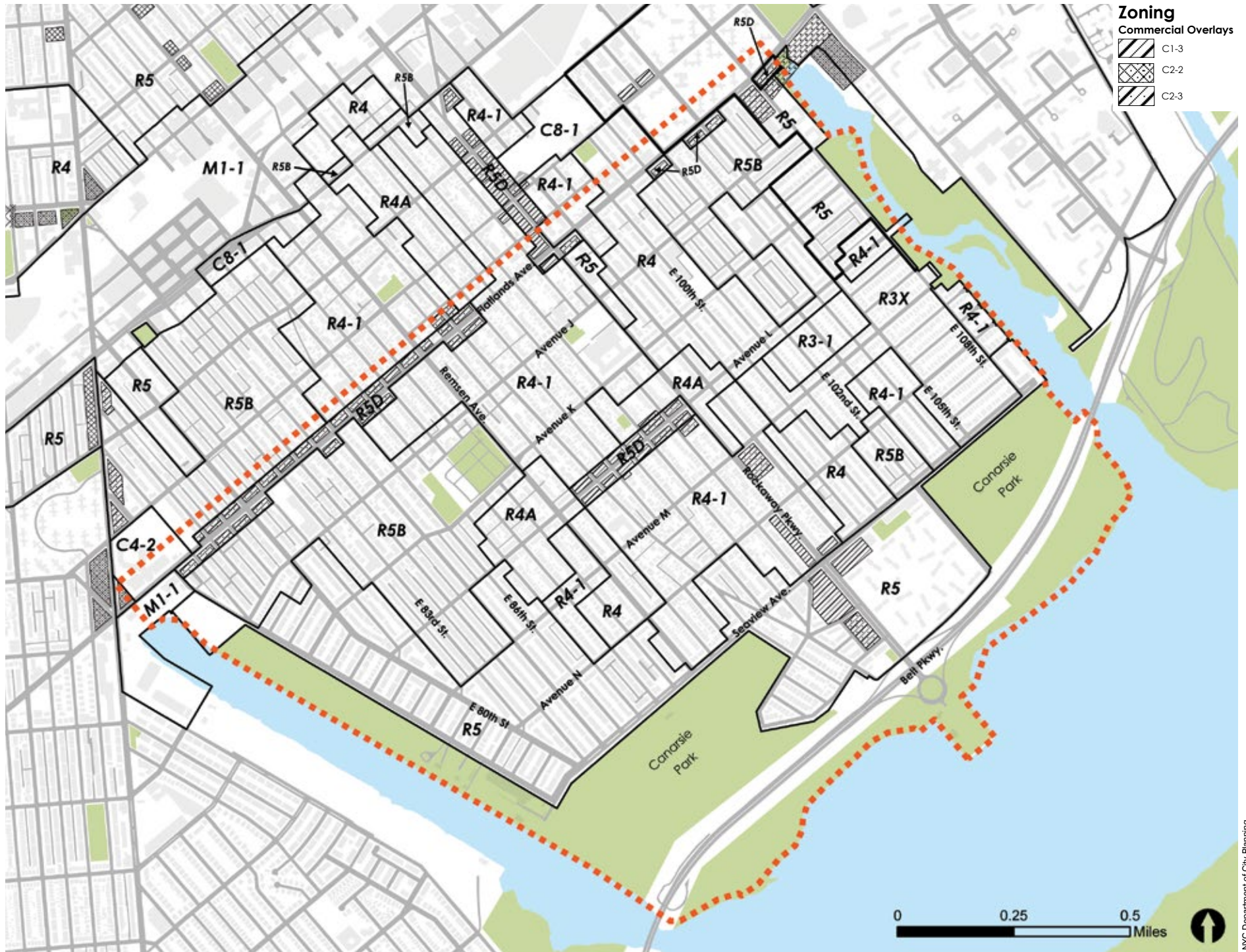
In 2009, the area was rezoned to respond to concerns about buildings that were not consistent with the area's built character. There are eight different residential zoning districts within the study area, ranging from R3X to R5D. Of all the buildings in the floodplain, seventy-five percent of the residential buildings in the flood zone are in R4, R5, and R5B districts, which primarily have attached buildings. The other twenty-five percent of buildings in the flood zone are in R3-1, R3X, R4-1, and R4A districts, consisting primarily of detached and semi-detached buildings. R3-1, R3X, R4-1, and R4A districts allow only one-and two-family homes, while the other districts also allow multi-family buildings. The zoning analysis will focus on zoning districts in the floodplain.

Building and Zoning Analysis

Canarsie has a variety of land uses and housing types; the building scale is predominantly low-rise with the residential portions of the neighborhood containing attached, detached, and semi-detached buildings one- to three-stories in height. Most homes in Canarsie were built before the 1970s. According to the zoning then in effect, the lowest story of a residential building was excluded from floor area calculations, provided that it contained a basement or garage and that the

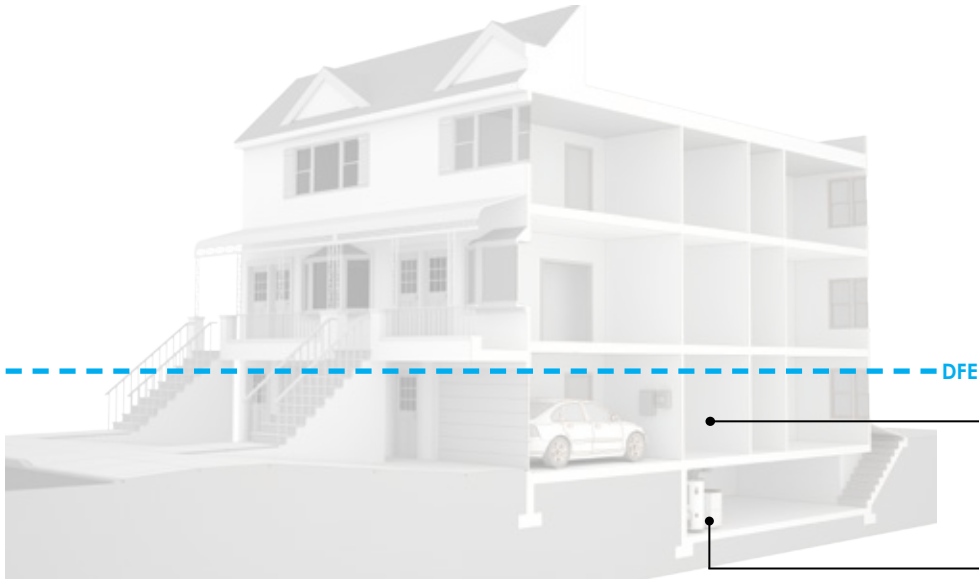
total building height was not more than three stories. Thus many buildings were designed with a garage at the front with a recreation room behind it. Commercial and mixed use buildings are primarily located along portions of Flatlands Avenue, Rockaway Parkway, and Avenue L buildings typically range from one- to three-stories. These areas are mapped with C1-3, C2-2, and C2-3 overlays which allow for local retail. Between Remsen Avenue and Rockaway Parkway is the old section of





Retrofitting Under Current Zoning

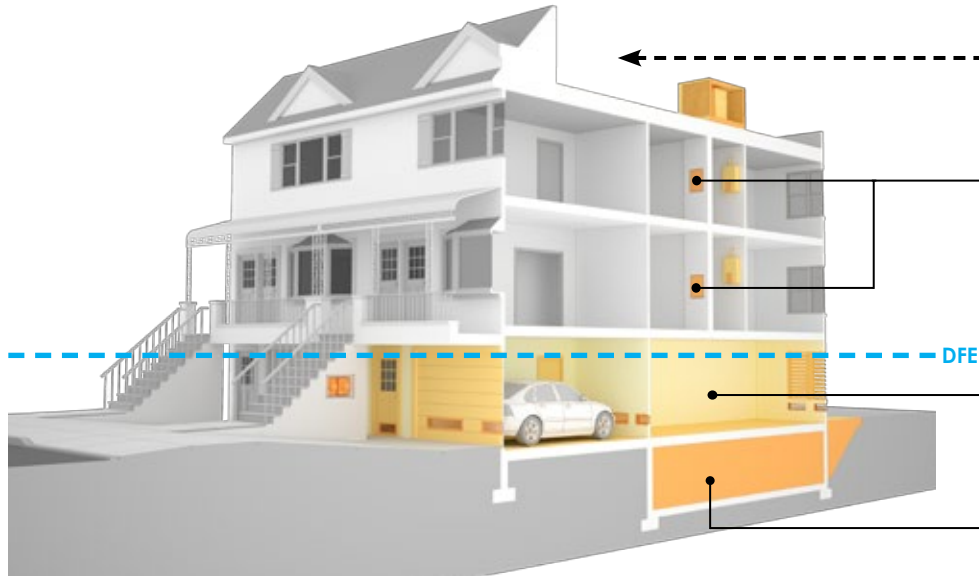
Based on analysis conducted for DCP's *Retrofitting Buildings for Flood Risk* guide, the diagram to the left depicts the challenges and potential solutions for retrofitting a typical attached building in Canarsie. To come into compliance with NYC Building Code and FEMA NFIP regulations, below-grade spaces need to be filled in to the nearest adjacent grade and mechanical equipment must be relocated above the DFE. In some cases where there is residential space on the ground floor below the DFE, there may not be enough floor area or building envelope height to relocate this space in an addition. This could lead to a significant loss of floor space.



Typical Attached Building in Canarsie

Some homeowners have used garages and storage spaces as residential areas such as dens or separate residential units.

Many homes in Canarsie have critical systems, such as heaters, in cellars and basements that are below the DFE and subject to flooding.



Attached Building Retrofitted to NYC Building Code and FEMA Regulations

Critical systems are elevated to roof and within units.

Residential space is converted into storage and outfitted with flood vents.

Below-grade spaces are filled to lowest adjacent grade to come into full compliance with FEMA NFIP regulations.

Lost space could be replaced through the addition of another story. However, in many instances homeowners lack documentation to prove the space was exempted from floor area calculations. Under the current zoning there may not be enough height and floor area for an as-of-right addition. In addition, where space had been converted to an additional unit, replacing it may not comply with zoning, building code, or the State Multiple Dwelling Law.

Partial Mitigation Strategies

Existing non-substantially damaged buildings within the floodplain are not necessarily required to come into full compliance with Flood Resilient Construction Standards of the New York City Building Code. This allows for greater flexibility in adapting to current and future risks. In Canarsie the attached and semi-detached typology limits alternative adaptation strategies, but homeowners may want to consider elevating critical systems to minimize damage during a storm and disruption following the storm. If the DFE is within a few feet of the first floor, homeowners may consider keeping the structure in place and protecting systems by dry floodproofing in place, while also using flood-resistant materials below the DFE. Even though these measures are helpful in improving the resiliency of homes in the floodplain, under current NFIP regulations, they may not result in lower insurance premiums. It is also important to note that if residential spaces are left below the DFE, life safety must be considered. Residents should always follow evacuation procedures.



Floodproofed mechanical systems (shown in red) in place, floodproofed garage (shown in blue)



Floodproofed ground floor (shown in blue) in place, Filled in basement and elevated mechanical systems (shown in red) above the DFE

R3X, R4A Districts

Within R3X and R4A districts in Canarsie, there are approximately 500 detached residential buildings in the floodplain. The maximum permitted floor area ratio (FAR) for residential buildings in R3X is 0.6 while in R4A it is 0.9. Most homes in these districts comply with floor area requirements. The BFE above grade in these areas ranges between zero and four feet. Unlike row houses, detached buildings are structurally easier to elevate. Under the existing zoning, a building's allowable height is generally measured from the DFE. However, in cases where the DFE is at least six feet above grade, height can be measured starting at nine feet above curb level. This provision allows for a full story at the ground floor that can be used for parking, storage or access—uses that may be displaced when a cellar is filled in to bring a building into compliance with flood resistant construction standards. However, in areas of the city where the DFE is less than six feet above grade, like Canarsie, height is measured from the DFE. Because there isn't enough room in the building envelope to elevate the lowest floor any higher than the DFE, the result is a low-ceilinged crawl space that is less functional and may not allow room for off-street parking.

R3-1, R4-1 Districts

Within the R3-1 and R4-1 districts, there are approximately 500 semi-detached residential buildings as well as 150 detached residential buildings in the floodplain. The maximum permitted FAR for residential buildings in R3-1 is 0.6 while in R4-1 it is 0.9. Most homes in these districts comply with floor area requirements. Within R3-1 districts, the DFE above grade is fairly low, ranging between less than a foot and three feet. The ground floors of these buildings also tend to be elevated two to four feet above grade. In R4-1 districts, the DFE ranges between zero and six feet above grade. Ground floors vary from being used strictly for parking or storage to being utilized as a residential area. In some cases where the ground floor is already elevated and the DFE is low, a homeowner trying to come into compliance with Appendix G regulations may only need to fill in the crawl space that is below grade. In cases where the DFE is higher and the



Detached buildings R3X



Semi-detached buildings R4-1



Attached buildings with ground floor unit R4



Attached buildings with residential space below the DFE R5

ground floor has residential floor area, the ground floor would need to be vacated and wet-floodproofed, as semi-detached buildings cannot be easily elevated. Residential floor area can be relocated above the DFE as a vertical addition to the home, however, similar to the detached buildings, in both R3-1 and R4-1 districts, many buildings are at or near the height limits and have DFEs less than six feet. In some cases there may not be enough room in the zoning envelope to fit an vertical addition to the building.

R4 Districts

Within the mapped R4 zoning districts, there are approximately 680 buildings in the floodplain, primarily two-story attached buildings at grade with a garage and residential space on the ground floor. R4 district regulations allow for a maximum building height of thirty-five feet above DFE under the current Citywide Flood Resilience Zoning Text Amendment, with a twenty-five foot perimeter wall. The maximum permitted FAR for residential buildings in R4 is 0.9. Attached buildings in this district largely comply with current FAR limits. However, because these buildings are now in the floodplain, to come into full compliance with building code regulations and qualify for the lowest flood insurance premiums, a homeowner can choose to vacate the ground floor unit, wet floodproof the space and use the area below the DFE as storage. With the adoption of the Citywide Flood Text Amendment in 2013, homeowners of attached properties in this zoning district are permitted to relocate the lost floor area above the DFE through an addition within the permitted zoning envelope. Though this may not always be a practical solution.

R5, R5B Districts

Within R5 and R5B districts, there are approximately 1,890 buildings in the flood zone, primarily three-story attached buildings with a sloping front yard that leads to a garage and basement. In many instances, these basements have been used as residential space, such as a den or a separate rental unit. Buildings in R5 districts can be built to a maximum street wall height of 30 feet. Above the maximum street wall, the building must be set back at least

fifteen feet and can reach a maximum height of forty feet. The maximum FAR is 1.25. Blocks that are not partially located within contextual districts can take advantage of R5 Infill regulations, which allow new developments to be built to a maximum FAR of 1.65 and allow a maximum building height of thirty-three feet. As explained earlier, many homes in the R5 districts have residential floor area that has historically been excluded from zoning floor area calculations, resulting in a 1.03 average FAR for an attached building in this district. However, under current regulations the average built FAR would be 1.49, above the maximum permitted FAR of 1.25. To come into full compliance with FEMA standards, a homeowner would have to vacate their ground floor unit, wet-floodproof the space and may only use this area for storage, parking or building access.

While this floor area could theoretically be relocated to a unit above the DFE, this is challenging in practice. To obtain Department of Buildings (DOB) approval to relocate the floor area from the basement unit to an addition above the DFE, a homeowner would need to document that the home was built to the 1961 floor area definition based on historical building plans and permits. Without historical proof, a homeowner trying to build an addition would not be able to obtain plan approval from DOB. In addition, many of these units were converted without complying with zoning or other code requirements. Most residents in the R5 districts in Canarsie moved into the area in the past fifteen to twenty years, and there was significant documentation loss following Sandy. Therefore, it is unlikely that many homeowners have the historical documentation necessary to retain this floor area exemption and thus would not be able to relocate the lost floor area.

Homeowners in the R5B districts face similar challenges with floor area and height. There are approximately 858 buildings in the flood zone in this district. Similar to the R5 areas, this district is primarily comprised of three story attached buildings that have two units above the DFE as well as a basement that may have been used as a den or

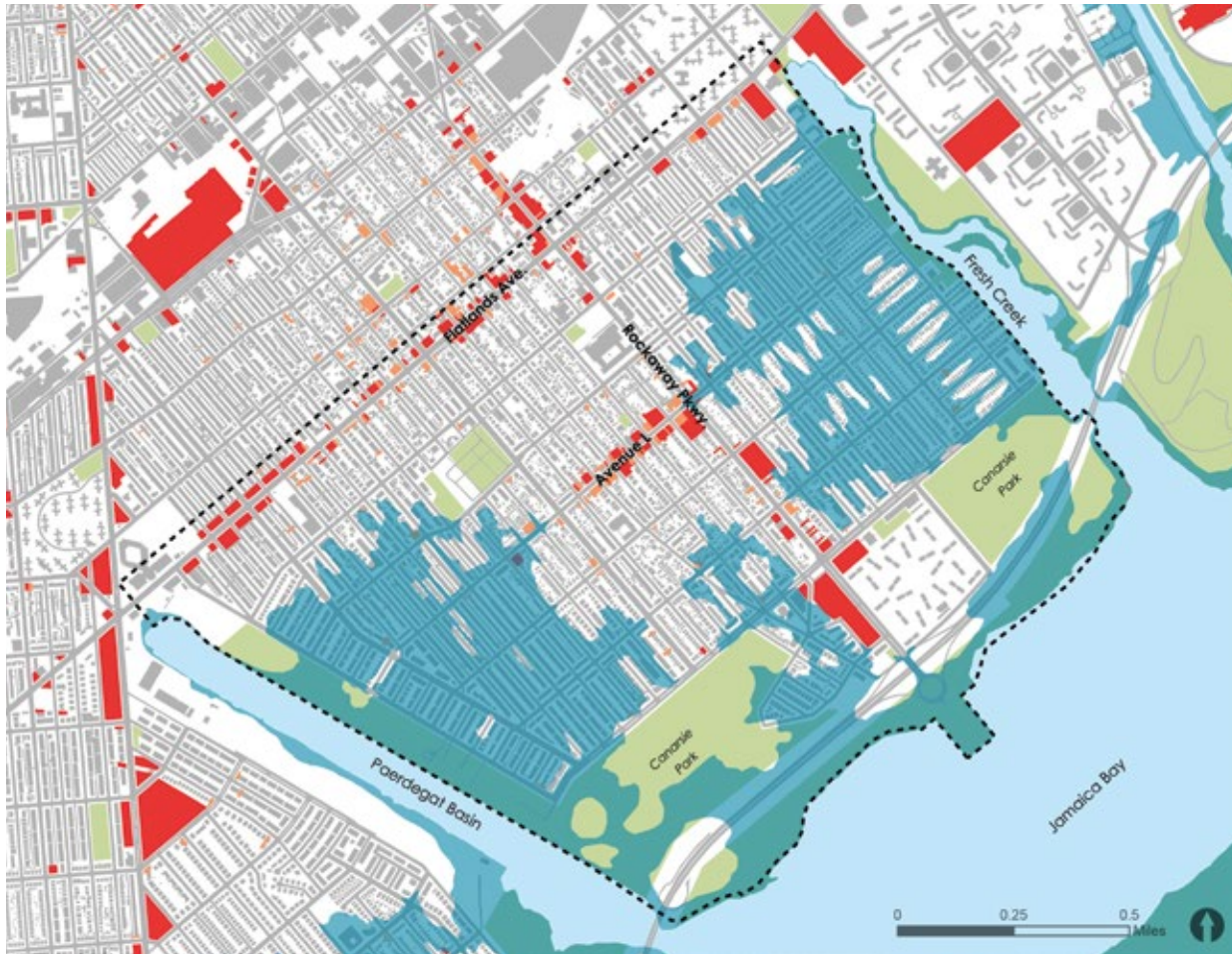


Attached Buildings with residential space below the DFE R5B

Floodplain Zoning Summary			
DISTRICT	CURRENT BUILT CONDITION	# OF BUILDINGS IN FLOODPLAIN	TYPICAL CHALLENGE
R3X, R4A	Detached 1 & 2 Family	500	Elevation might result in loss in square footage
R3-1, R4-1	Semi-detached 1 & 2 Family	650	Difficult to elevate, vertical addition may not fit within the existing zoning envelope
R4	Attached with ground floor unit	680	Difficult to elevate, ground floor would need to be relocated above the DFE
R5,R5B	Attached with residential space below the DFE	1890	Not enough floor area and/or height to relocate residential area above the DFE

separate residential unit on the ground floor. The BFE above grade in R5B districts in Canarsie ranges between zero and four feet. Buildings in R5B districts can build to a maximum street wall height of thirty feet and a maximum overall height of thirty-three feet; the maximum FAR

allowed is 1.35. Furthermore, with the maximum height of thirty-three feet in R5B districts, many buildings are at or near their height limit and would not have enough room in the zoning bulk envelope to relocate the ground floor unit above the DFE as an addition.



Retail Corridors

Though the housing stock in Canarsie faces many retrofit challenges, its retail properties provide a community asset that is already quite resilient. There are over 400 retail properties within the study area along Avenue L, Rockaway Parkway, and Flatlands Avenue. These corridors are not in the floodplain and experienced minimal damage during Sandy. With limited vehicular access following the storm, many of these corridors provided residents with access to essential services such as supermarkets, laundromats, and hardware stores. While the corridors have many vacancies and compete with nearby destination commercial developments, such as Kings Plaza and Gateway Mall, they have the physical conditions and a regulatory environment that is generally conducive to resiliency.

Commercial Uses

- Mixed Commercial/Residential
- Commercial/Office
- PFIRM 1% Annual Chance Floodplain

NYC Department of City Planning



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Several cars are parked along the street, including a silver sedan, a dark SUV, and a white car. In the background, a traffic light and more buildings are visible.

Summary of Resiliency Challenges

1 Significant Flood Risk and Expansion of the Floodplain

Roughly two-thirds of Canarsie is in the floodplain according to the most recent FEMA maps — a significant increase over the previous maps. During Hurricane Sandy, floodwaters reached five to seven feet above grade. The area also experiences routine street and basement flooding due to drainage issues.

2 Zoning Challenges to Retrofitting Attached Buildings and Ground Floor Residential Spaces

Many homes in Canarsie have residential spaces below the DFE, many of which may not comply with existing regulations. Complying with new flood resiliency standards would require eliminating these spaces. This poses financial, regulatory, and practical challenges. A concern is that these challenges may result in inaction, and a failure to reduce vulnerabilities to flooding.

3 Economic Hardship

Canarsie was heavily impacted by the subprime mortgage crisis throughout the last decade. The new Flood Insurance Rate Maps, in combination with rising insurance premiums, will add significant new costs for property owners. Coming into compliance with FEMA and NYC Building Code regulations can lower flood insurance premiums but attached and semi-detached buildings are difficult and costly to retrofit. Currently there are few retrofitting options that comply with FEMA standards and are likely to be financially feasible for more homeowners.

4 Retail Corridors

Canarsie is fortunate to have several retail corridors just outside of the floodplain which provide local retail and services. These corridors were important lifelines following Sandy, but many businesses are currently struggling to stay open.

RESILIENCY FRAMEWORK

Canarsie is a well-established neighborhood with a diverse housing stock and an expansive park network that surrounds the area. While homeowners experienced extensive damage on the ground floor of their properties, most buildings fared well structurally during Sandy. Future flood risk puts residents, homes, and infrastructure in Canarsie at significant risk, but even during less severe, more frequent storms, street flooding and sewer backups can cause minor damage and inconvenience for residents and businesses. Opportunities exist to support the ongoing economic and social vitality of the neighborhood while increasing resilience. With these guiding principles, the following framework map identifies zoning recommendations as well as larger policy considerations to guide further efforts.

ZONING STRATEGIES

Attached/Semi-detached Housing

In areas that have a concentration of attached and semi-detached properties, citywide zoning modifications should be considered to facilitate retrofitting solutions that include the relocation of floor space above the DFE.



Detached Housing

In areas with detached buildings with low DFEs where an elevation would lead to the loss of usable ground floor space, citywide zoning modifications should be considered to facilitate elevation and the retention of usable floor space for storage and parking in the ground floor.



ADDITIONAL RESILIENCY STRATEGIES

Potential for Retail Corridor Revitalization

Canarsie's commercial corridors are not in the floodplain which make them a resiliency asset. Strategies should be pursued to support the vitality of existing businesses while incentivizing new business development.



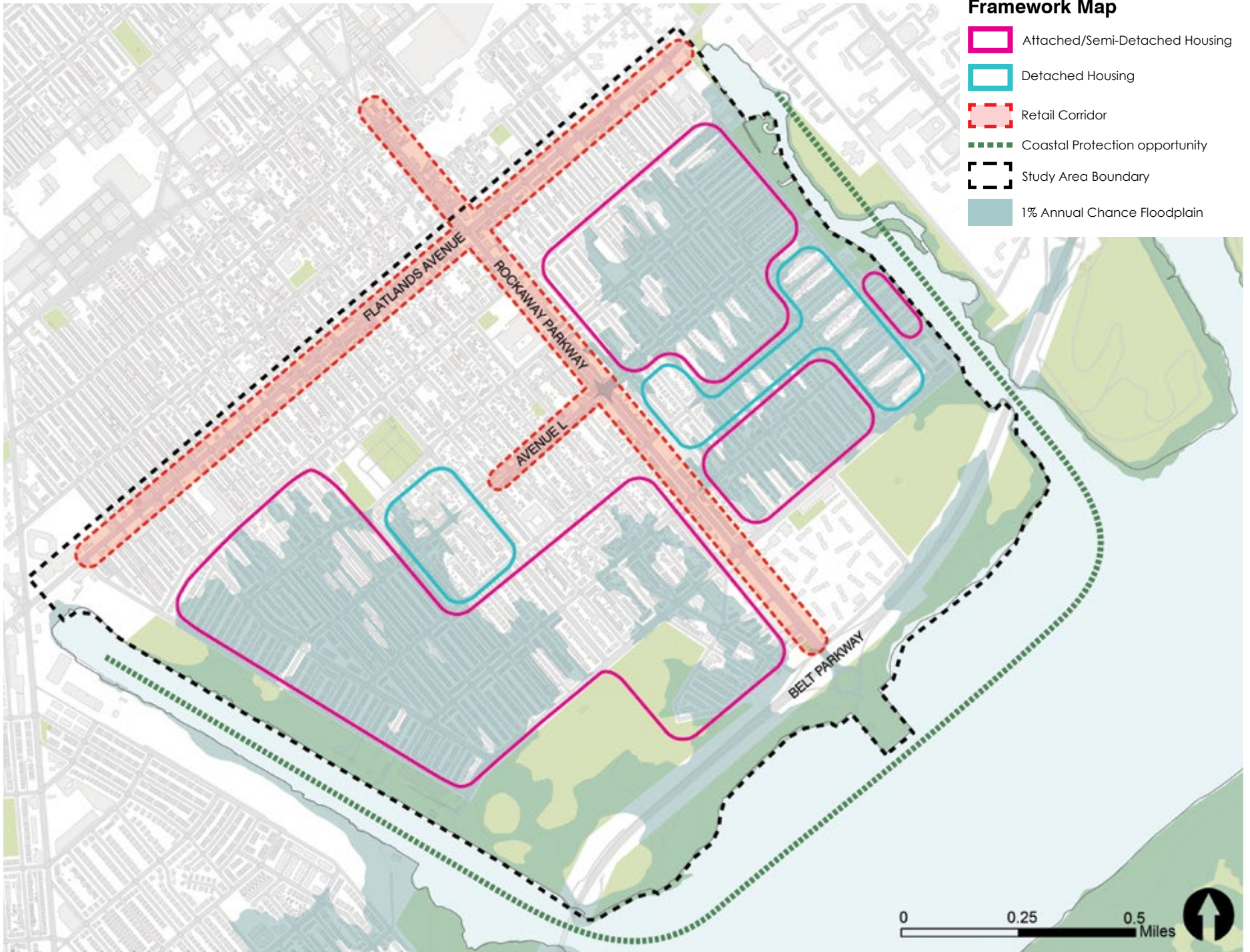
Potential for Coastal Protection

Canarsie is surrounded by city and federally owned parkland which may be possible to be leverage to create coastal protection against serious flooding events.



Framework Map

- Attached/Semi-Detached Housing
- Detached Housing
- Retail Corridor
- Coastal Protection opportunity
- Study Area Boundary
- 1% Annual Chance Floodplain



Zoning Text Modifications

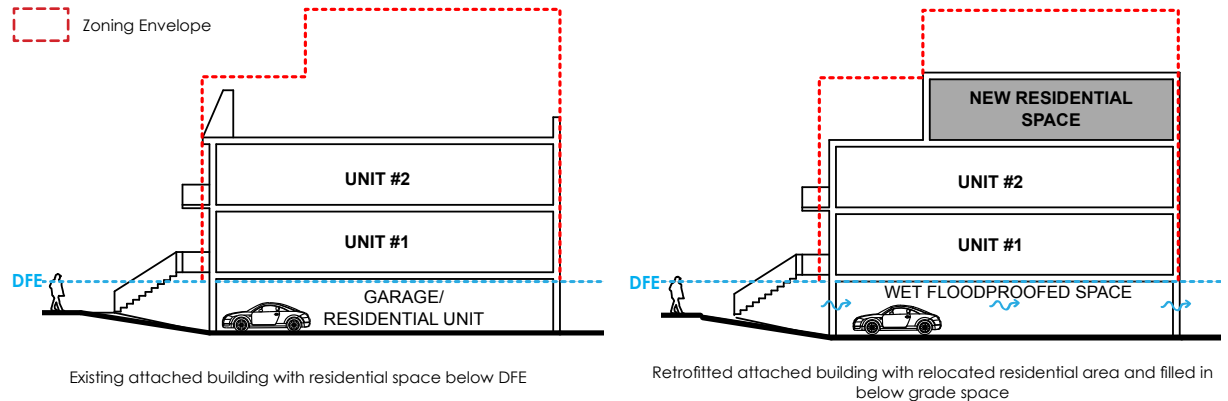
On October 9, 2013, a year after Sandy, the City Council adopted the Citywide Flood Resilience Zoning Text Amendment, developed by DCP, to modify zoning regulations to better enable rebuilding and retrofitting according to FEMA and NYC Building Code standards. The text was adopted on an emergency basis and is time limited. The text provided zoning solutions to facilitate retrofitting and resilient redevelopment including measuring building height from the latest FEMA flood elevations plus freeboard, accommodating building access to elevated buildings, locating mechanical systems above flood levels and accommodating off-street parking requirements.

The City Council also adopted the Special Regulations for Neighborhood Recovery text amendment in the summer of 2015 which was developed by DCP in partnership with the Mayor's Office of Housing Recovery Operations (HRO) and the Department of Housing Preservation and Development (HPD). The text amendment was made applicable in certain areas of the city, including Canarsie, where a high concentration of damaged homes within the Build it Back program had more difficulty getting building permits to rebuild or retrofit because they were originally constructed prior to zoning regulations and often were located on irregular, substandard lots or had other non-compliances with current regulations. With the amendment, the process was simplified and alternative forms of documentation were accepted for verifying the existence, prior to current zoning regulations, of older structures that were damaged during Hurricane Sandy.

In areas with attached buildings that are more challenging to retrofit, such as Canarsie, there are still lingering zoning impediments to resiliency. As previously discussed, most existing buildings in Canarsie were built before the current zoning regulations were in place. At the time, the lowest story did not count towards floor area provided that it contained a basement or garage and that the total



Typical Attached Building in Canarsie with Residential Space on the Ground floor



Existing attached building with residential space below DFE

Retrofitted attached building with relocated residential area and filled in below grade space

building height was not more than three stories. The Citywide Flood Resilience Zoning Text Amendment rules allow floor area that is wet-floodproofed to be relocated elsewhere in the building, even for buildings that predate the current zoning, provided they can prove their zoning non-compliance legally existed before current zoning regulations were in place. Without

the ability to prove their legal non-complying status, buildings that already exceed the maximum permitted floor area may not be able to wet-floodproof a lower story and relocate that space above the DFE. DCP is working to make the 2013 zoning changes permanent, and will be making additional adjustments to address the issues identified in Canarsie.



The following are zoning modifications DCP is exploring to address the impediments to retrofitting in Canarsie as well as other areas in the flood zone where they would support resiliency investment:

- **For attached and semi-detached buildings that are losing floor space on the ground floor, provide zoning relief to buildings that fully comply with NYC Building Code Appendix G regulations by allowing them to rebuild a vertical addition and relocate floor space above the DFE.**
- **For detached buildings that have low DFEs and are losing floor space, such as a cellar or storage on the ground floor, provide more flexibility to allow buildings to elevate to the height necessary to allow for practical use of the ground floor for parking and storage.**

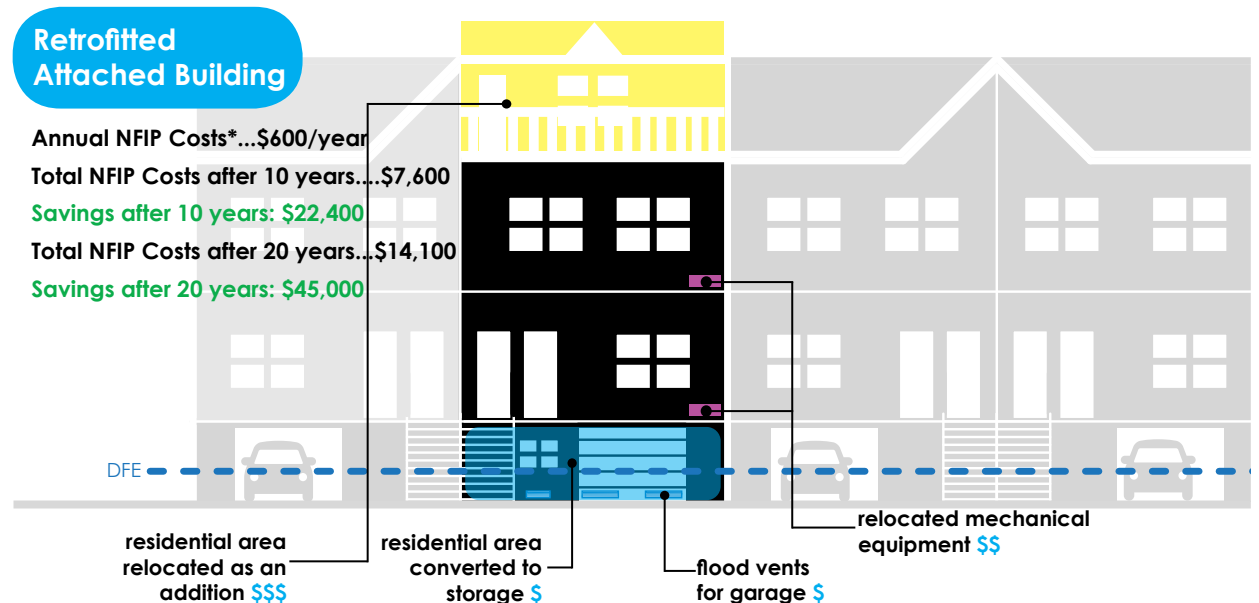
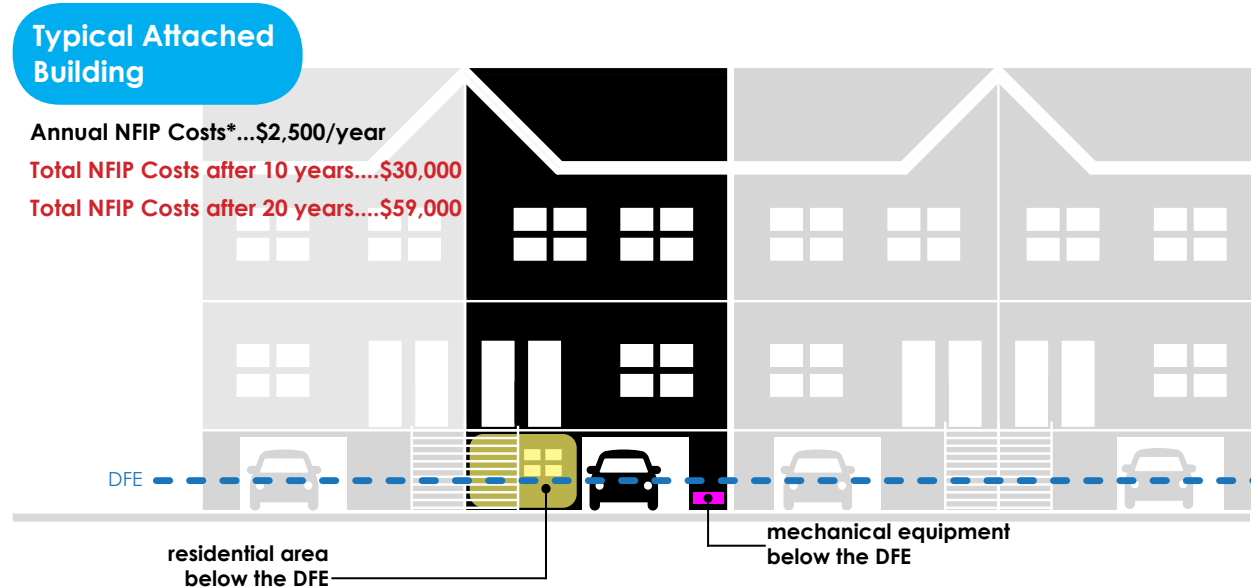
These changes would help address some common resiliency challenges in Canarsie. However, the existence of homes that have been converted to three or more units raises issues of additional complexity. The State Multiple Dwelling Law and fire safety laws make 3-family homes difficult to construct, and retrofits can be challenging. If resiliency is to be addressed at the building scale, it may require more significant departures from the existing set of buildings types.

NFIP Affordability, Impact and Advocacy

In 2012, Congress passed the Biggert-Waters Flood Insurance Reform Act, which is gradually increasing subsidized premiums for structures built prior to the adoption of the FIRMs to full risk actuarial rates. As a result, many property owners, especially in older cities such as New York, are paying more for flood insurance. With widespread concern that many homeowners in the floodplain would be unable to afford the significantly higher actuarial policy rates, the Homeowners Flood Insurance Affordability Act was passed in 2014, slowing the rate at which premiums increase on an annual basis. Policyholders still face increasing premiums over time but can qualify for reduced premiums by retrofitting their buildings for full compliance with current standards for flood resistant construction. Homeowners in newly mapped areas in the floodplain, such as those in Canarsie, can also purchase a Preferred Rate Policy at a significantly lower rate for up to a year after new FIRMs are officially adopted. In both cases, premiums will increase on a regular basis until the policy reaches its full risk rate.

Attached buildings are costly and challenging to retrofit. In order to avoid high insurance premiums (if a homeowner is unable to purchase a Preferred Rate Policy) a homeowner might have to spend up to \$100,000 to retrofit their building. Given eighty-six percent of homeowners in Canarsie having mortgages, the additional cost associated with retrofitting can strain household finances. Through the City's Build it Back program many attached homes in Canarsie are currently in the pipeline for resilient retrofits. To help facilitate lower insurance premiums, and reduce flood risk, the City will continue to advocate for federal regulatory reforms, including means-tested vouchers and federal grants or loans to offset the costs of those retrofits. Additionally, based on findings from *The Cost and Affordability of Flood Insurance in New York City*, a recently released study on Flood Insurance commissioned by ORR, the City is advocating that FEMA explore more cost-effective block and neighborhood retrofitting strategies.

The two diagrams below compare estimated NFIP premium costs for an attached building that has mechanical equipment and residential area below the DFE (top) versus a building that has been retrofitted (bottom). While retrofitting a building can have substantial upfront costs, over the life of the building and the mortgage, the cost savings from the retrofit and subsequently lower NFIP premiums is significant.



*Estimated Premium is for a 1 - 4 unit home located within the 1% Annual chance floodplain. Total Costs include Reserve Fund, HFIAA Surcharge, and Federal Policy fees and assume a fixed premium over the period referenced.



Rockaway Parkway Retail Corridor

Retail Corridors

The retail corridors in Canarsie were a vital lifeline for local residents following Sandy, providing access to important services such as banks and grocery stores. While the neighborhood is fairly car-oriented like the rest of southern Brooklyn, residents in the neighborhood have expressed the desire for better retail options and streetscape improvements along the existing retail corridors, particularly along the transit-oriented Rockaway Parkway and Flatlands Avenue intersection, which is an important gateway into the neighborhood with connections to the L train and several bus lines. DCP, and City agencies such as the Department of Small Business Services have been working to build emergency preparedness expertise within local business communities near the city's floodplain. This work with local business and property owners helps to strengthen the role of the corridors as community centers and to ensure that critical retail and services are available to support neighborhood recovery following natural disasters.



Right of Way Bioswale installed through NYC Green Infrastructure Program

Green Infrastructure

Concerns about wastewater and stormwater drainage predate Hurricane Sandy. During regular rain storms, sewer backup is a major issue in the area, leading to ponding on roadways and flooding in basements. The State-led NY Rising program has proposed a study for green infrastructure opportunities, such as bioswales, that NYC Department of Environmental Protection is now leading. The proposed bioswales will mitigate flooding from regular rain events, as well as enhance streetscapes and improve water quality.

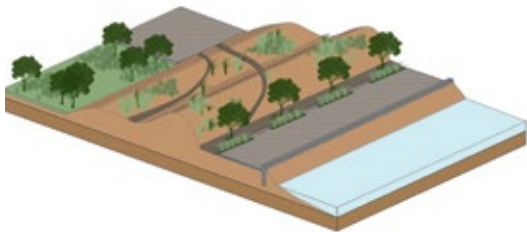
Coastal Protection

Canarsie is surrounded by City, State, and federally owned parkland. Area-wide protection is a potential long-term strategy that should be explored further along with resilient building strategies. Currently, there are two major coastal protection initiatives in the area. Canarsie was part of the second round of the state-led New York Rising Community Reconstruction Program. Through this initiative, the Canarsie New York Rising Planning Committee allocated \$7.7 million towards the study and implementation of coastal protection measures along Fresh Creek to reduce flood risk from more frequent storm along the lowest lying areas of the creek. Area-wide coastal protection solutions that could potentially provide protection from more serious storm events are also currently being studied through the Jamaica Bay Coastal Storm Risk Management Feasibility Study by the U.S. Army Corps of Engineers (USACE). While the initiatives represent different levels of coastal protection (see next page), the City will work with Federal partners to ensure that these efforts compliment each other. These initiatives can also strengthen the existing park network by enhancing waterfront public access while being sensitive to the local ecology.



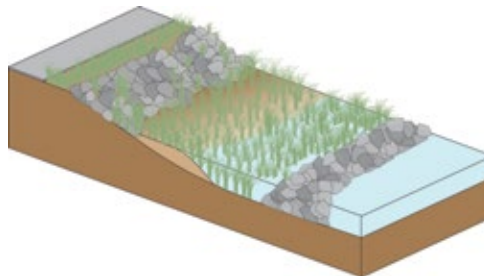
Canarsie Park Shoreline

Examples of Coastal Protection Strategies



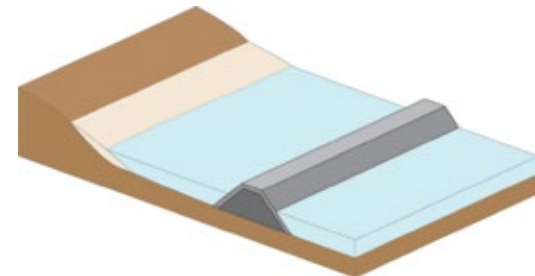
Waterfront Parks

The waterfront parks that separate much of Canarsie from the bay can be designed with features that can reduce the height of storm surge from a coastal flood and protect upland communities.



Living Shorelines

Incorporating living shoreline strategies, such as irregular rocky edges, plants, and gradual slopes, can reduce erosion and wave risks while creating additional wetland habitats.



Breakwaters

Offshore breakwaters, which reduce coastal storm threats by reducing the force of waves, could be an appropriate strategy for some sections of Canarsie's coast.

Urban Waterfront Adaptive Strategies, 2013



USACE Potential Coastal Protection Alignment Options

CONCLUSION

Hurricane Sandy significantly impacted the Canarsie community and highlighted the neighborhood's risk to coastal flooding, a risk that until very recently was not fully understood. With the pending revisions to the federal flood maps, roughly two-thirds of the community is now believed to be vulnerable to coastal flooding. Despite this vulnerability, Canarsie remains a viable coastal community and there are many opportunities to build on the strengths of the neighborhood and geography to promote long-term resiliency. However, homeowners are grappling with difficult financial and structural challenges of retrofitting their homes.

The resiliency framework for Canarsie will guide the Department of City Planning's future flood resiliency efforts and inform other agencies' activities as well. In summary, the recommendations include:

Zoning Changes to Enable Resilient Buildings

Encourage building retrofits by proposing zoning changes that allow greater latitude for resilient retrofits. For attached and semi-detached buildings that are losing floor space on the ground floor by coming into compliance with NYC Building Code Appendix G, allow for the relocation of floor space above the DFE. For detached buildings that are losing floor space, such as a cellar or storage on the ground floor, provide zoning relief that allows buildings to elevate to height necessary to allow for better use of the ground floor for parking and storage.

NFIP Affordability Advocacy

In addition to the Build it Back program, support the City's efforts to identify additional resources and programs to help facilitate retrofitting, along with advocacy for reforms to NFIP to allow for more cost-effective retrofitting strategies.

Retail Corridor

Promote business development and streetscape improvements through City agency efforts to build emergency preparedness and flood resiliency in local business. Work with local businesses and property owners to develop strategies that strengthen the role of the corridors to ensure that critical retail services are available to following natural disasters.

Green Infrastructure

Support State and City strategies to mitigate flooding from regular rain storms.

Coastal Protection

Help facilitate ongoing short-term and long-term coastal protection projects, including smaller projects along Fresh Creek and larger, regional longterm solutions.

The Resilient Neighborhood recommendations for Canarsie represent input from the community and work with other City, State, and Federal agencies. The Department of City Planning will continue to work on advancing the resiliency goals listed in this report and remains committed to working with the community to identify appropriate strategies to promote resiliency while meeting housing needs. This also includes exploring retrofit financing opportunities, promoting business development, and furthering future infrastructure and coastal protection strategies.



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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Data Sources

Federal Emergency Management Agency
NYC Panel on Climate Change
U. S. Department of Housing and Urban Development

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RESOURCES

TECHNICAL GUIDANCE

New York City Department of City Planning

Retrofitting Buildings for Flood Risk

nyc.gov/retrofittingforfloordrisk

Designing for Flood Risk

nyc.gov/designingforfloordrisk

Urban Waterfront Adaptive Strategies

nyc.gov/uwas

Flood Resilience Zoning Text Amendment

nyc.gov/assets/planning/download/pdf/plans/flood-resiliency/flood-resiliency.pdf

Special Regulations for Neighborhood Recovery

nyc.gov/site/planning/plans/special-regulations-neighborhood/special-regulations-neighborhood.page

New York City Department of Buildings

Building Code Appendix G Flood-Resistant Construction

nyc.gov/site/buildings/codes/2014-construction-codes.page

Federal Emergency Management Agency

Flood Insurance Rate Maps

region2coastal.com

National Flood Insurance Program

floodsmart.gov

INFORMATIONAL RESOURCES

OneNYC

nyc.gov/onenyc

Mayor's Office of Recovery and Resiliency

www.nyc.gov/html/planyc/html/resiliency/resiliency.shtml

New York City Panel on Climate Change

onlinelibrary.wiley.com/doi/10.1111/nyas.2015.1336.issue-1/issuetoc

