

# **Special Initiative for Rebuilding and Resiliency**

New York City Council Hearing

June 27, 2013



# Agenda


- Overview
- Question 1: What Happened During Sandy and Why?
- Question 2: What Could Happen in the Future?
- Question 3: How Should the City Address Climate Risks?
- Implementation and Funding



## Overview

In response to Hurricane Sandy, Mayor Bloomberg set up a special initiative (“SIRR”) to answer three key questions.

Question 1	Question 2	Question 3
What happened during Sandy and why?	What could happen in the future?	How do we rebuild post-Sandy and prepare for a future with climate change?



*SIRR was staffed by 35+ full-time professionals, consulting with experts from government, academia and private and not-for-profit sectors*



## Overview

SIRR devoted significant energy to outreach to elected officials, community groups and the public.

	Outreach Mechanism	Metric	Status
Elected Officials	SIRR presentation and Q&A	# of collective/individual briefings	30+
		# of elected offices briefed	65+
		# of community boards briefed	~20
Organizations	SIRR presentation and Q&A	# of community-based, business, environmental, faith, labor, policy organizations briefed	320+
Public Workshops	SIRR overview and facilitated discussion	# of public workshops	11
		# of attendees	1,000+



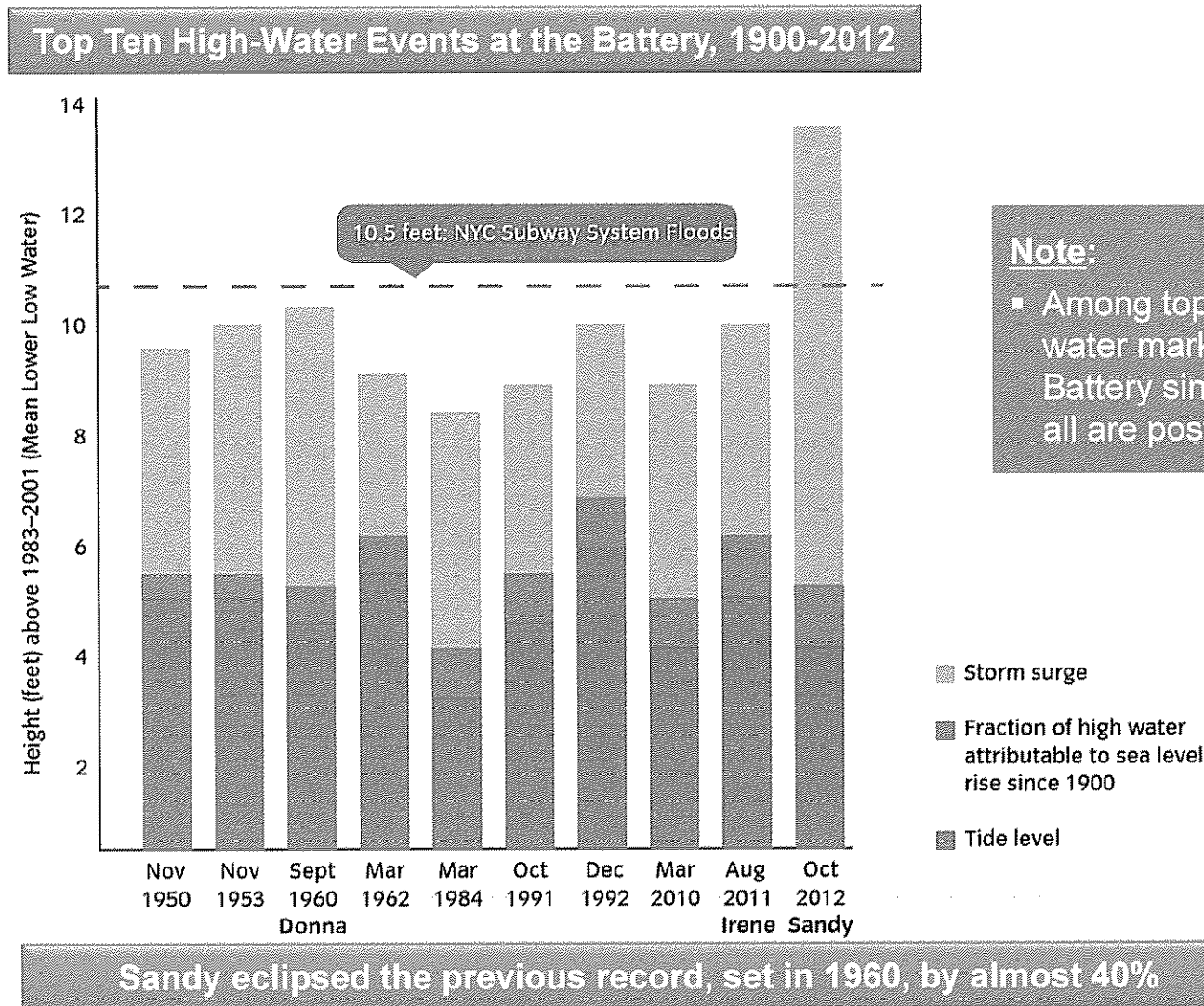
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## Question 1: What Happened During Sandy?

Hurricane Sandy's most distinctive feature was its record-shattering surge (and relatively low wind and rain), caused by the confluence of highly unusual factors.

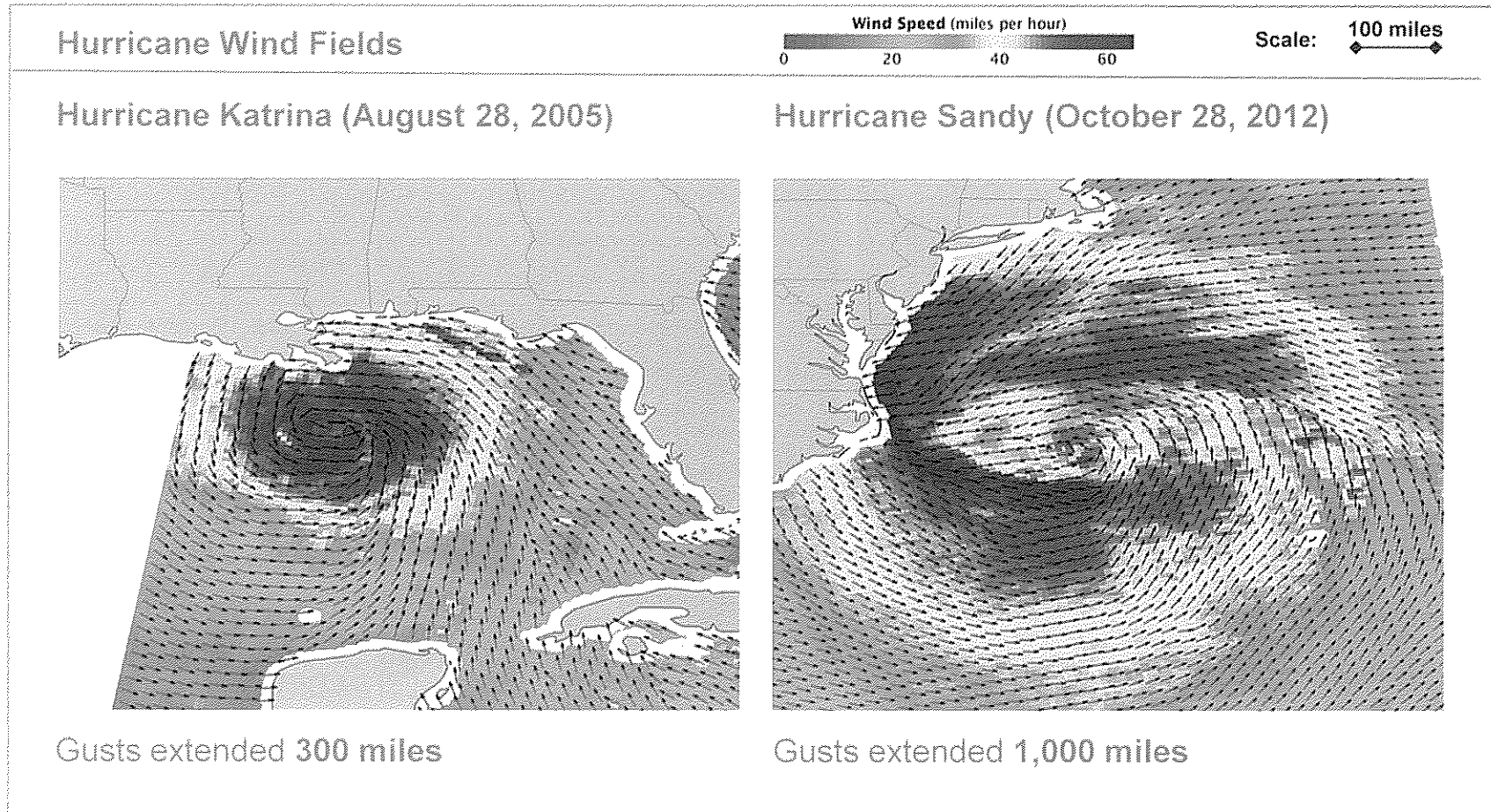


Source: UCAR/NCAR/NOAA



## Question 1: What Happened During Sandy?

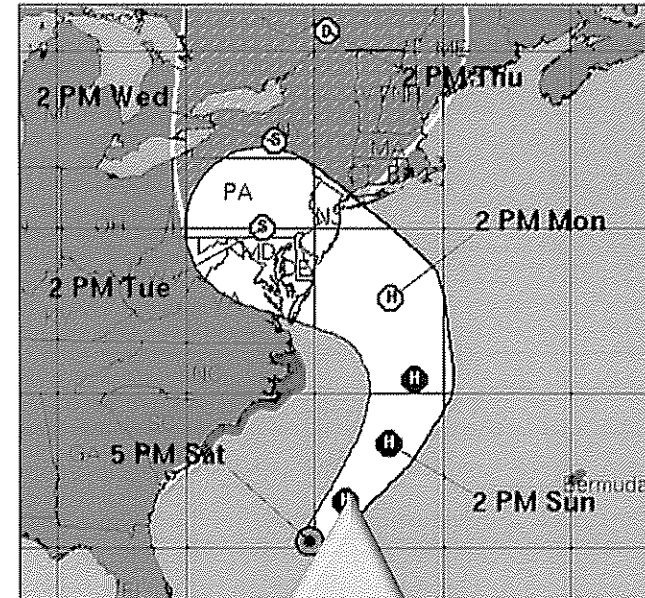
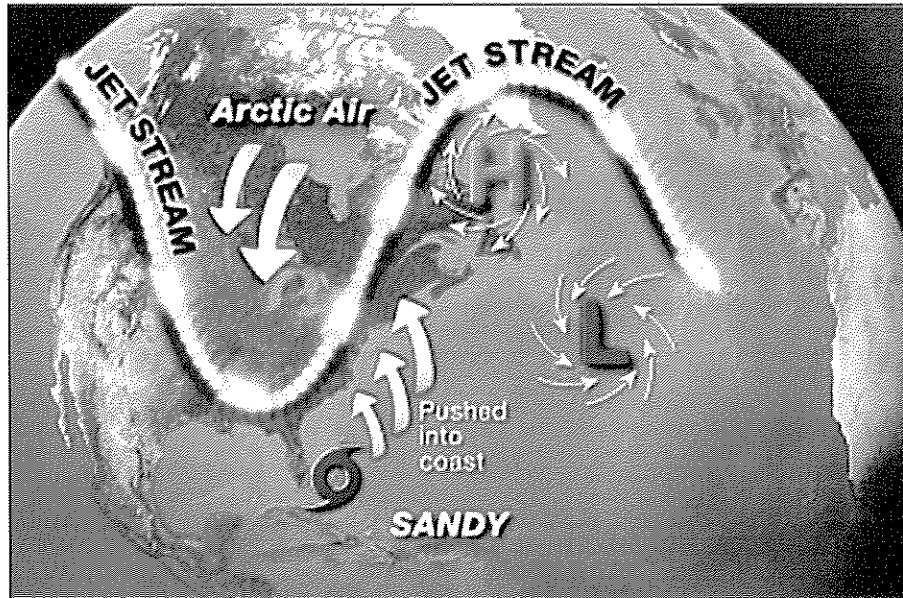
Among Sandy's distinctive features was a wind field that was more than three times that of Katrina...



Source: NASA, NOAA, AGU Blogosphere.

## Question 1: What Happened During Sandy?

...Sandy also took a path that included a rare “westward hook,” rather than a more traditional northeasterly path, putting the city in the path of its onshore winds...



### *Cause of the Westward Hook:*

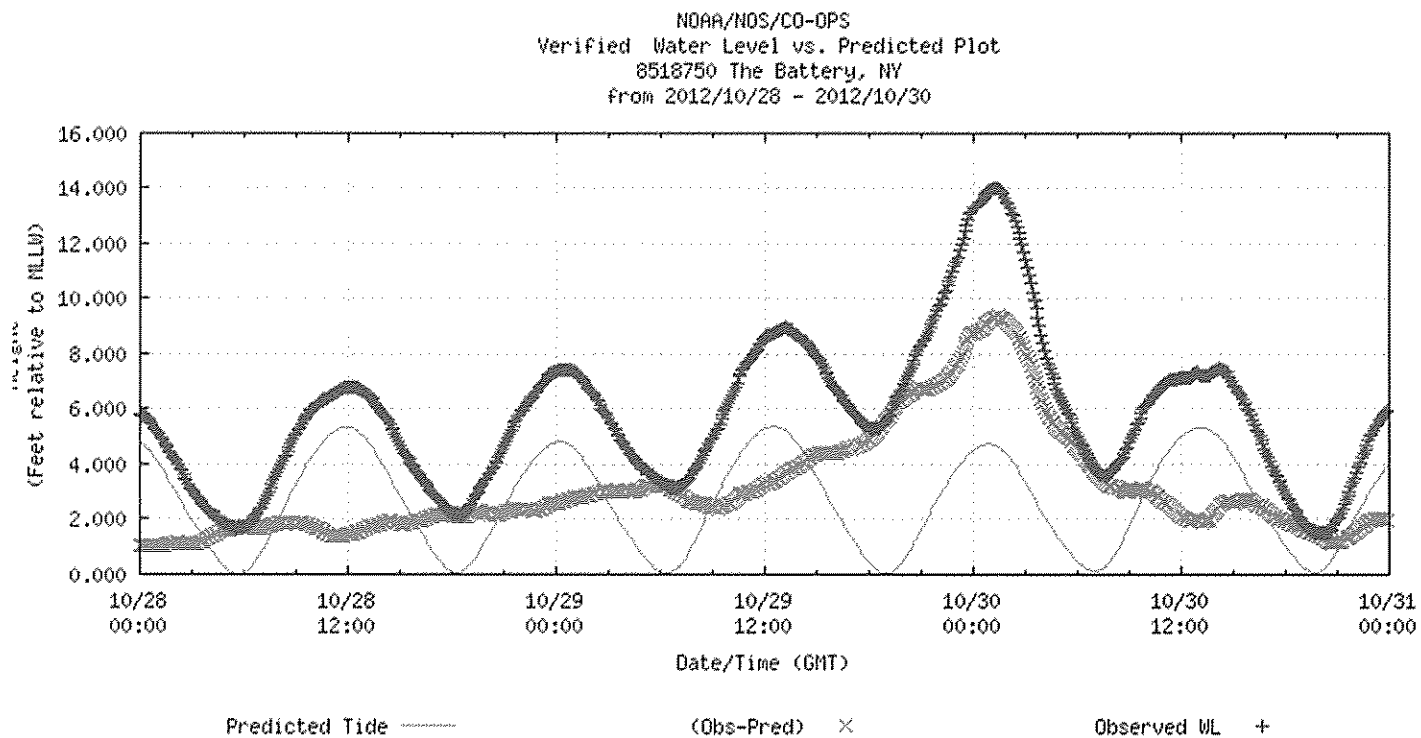
- **Jet stream:** Hurricane Sandy was steered between a blocking high pressure system in northern Canada and a low pressure trough over the Southeast U.S.

If Sandy had not been reclassified a “post-tropical cyclone” shortly before crossing the NJ coast, it would have been only the third hurricane to hit NJ since 1878

## Question 1: What Happened During Sandy?

...Sandy's specific timing also played a significant role in determining the extent of damage in different parts of the city...

### The Battery: Water Levels (Tide + Surge)

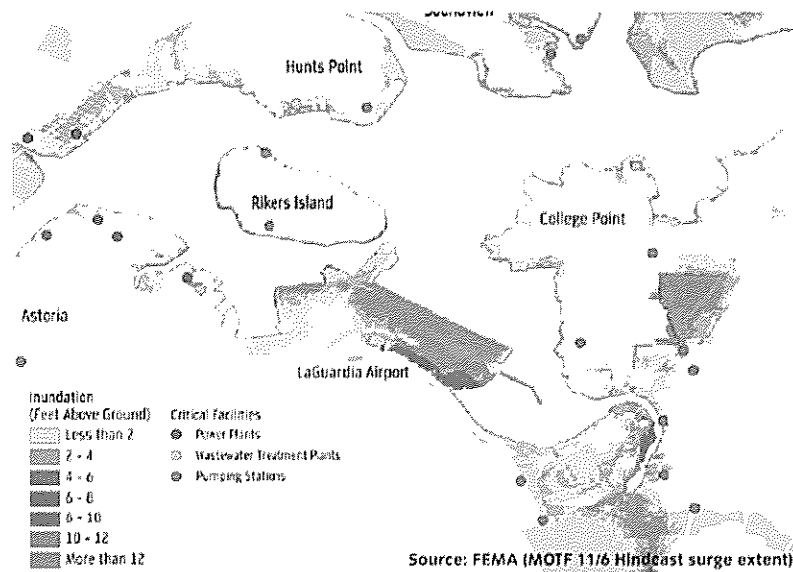




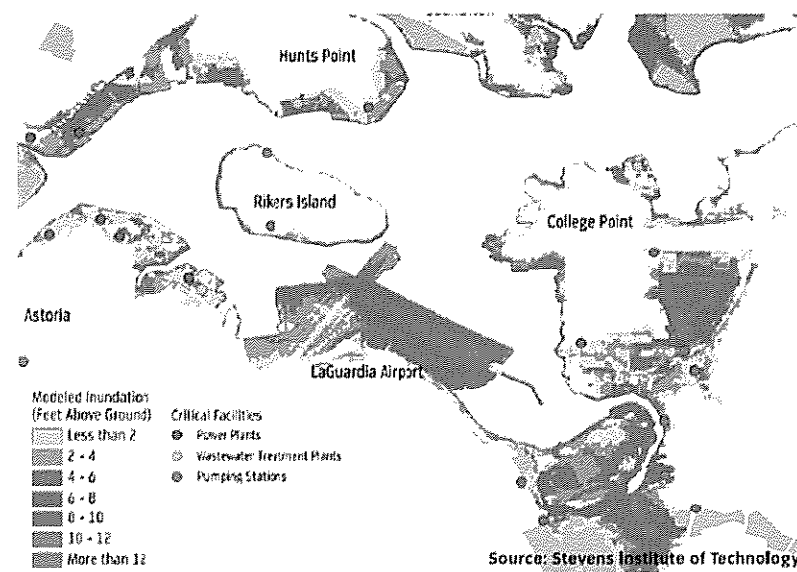
## Question 1: What Happened During Sandy?

...In fact, had Sandy arrived nine hours earlier, it likely would have had a significant impact on communities and infrastructure in the Bronx and Northern Queens.

**Sandy Inundation: Actual**



**Sandy Inundation: Simulated 9 Hrs Earlier**



## Question 1: What Happened During Sandy?

Sandy's massive, but idiosyncratic, impact on New York City teaches three important lessons.

### Lessons of Hurricane Sandy



1. The City **should not focus on** preparing for “the **next Sandy**”
  - An exact repeat of Sandy is highly unlikely (though not impossible)
2. That said, **Sandy devastated many of those impacted** and the City must help them rebuild
3. And, even if it may not repeat again exactly, **Sandy serves as a harbinger** of a *type* of risk to which New York is (and will increasingly be) vulnerable

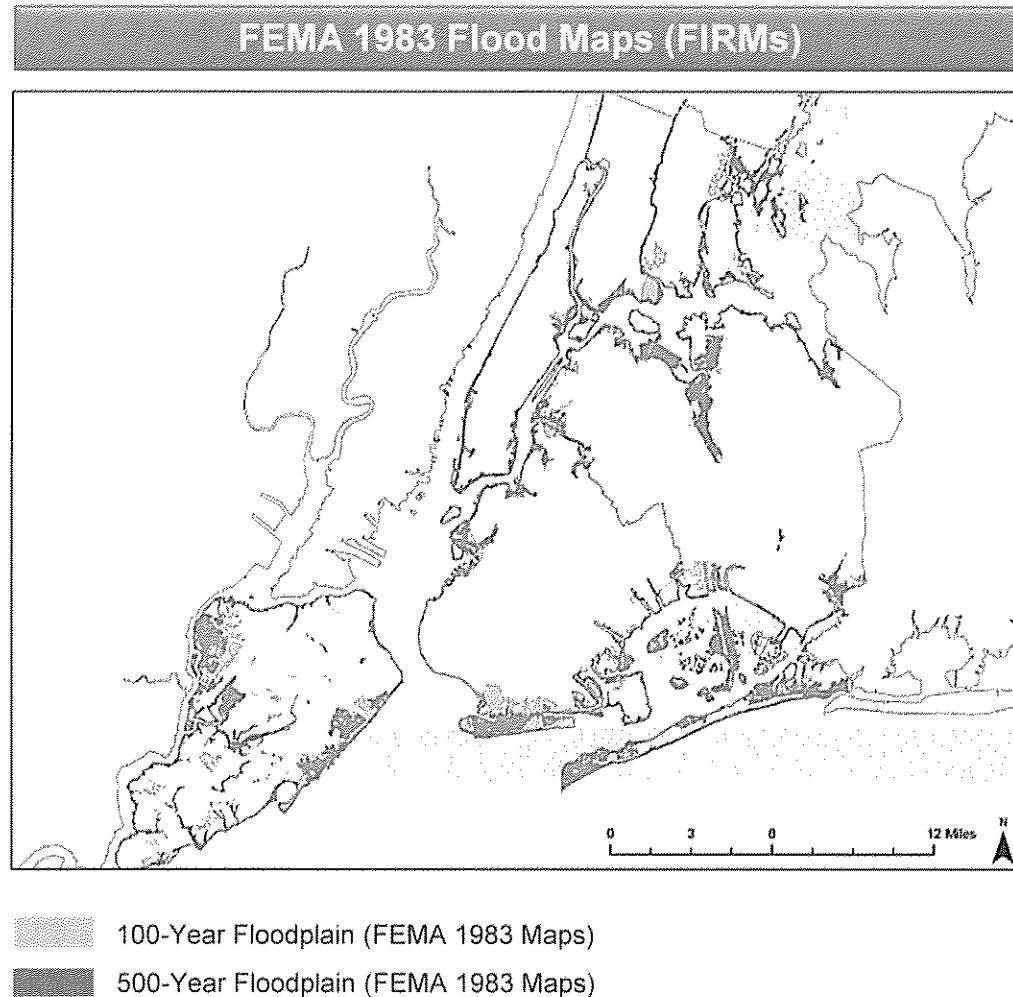


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## Question 2: What Could Happen in the Future?

Prior to Sandy, the best indicator of New York's vulnerability to extreme weather could be found in FEMA's 1983 flood maps.



- The 100-year floodplain as mapped in 1983 today covers about:\*
- **218,000 residents**
- **214,000 jobs**
- **36,000 buildings**
- **377MSF of floor area**

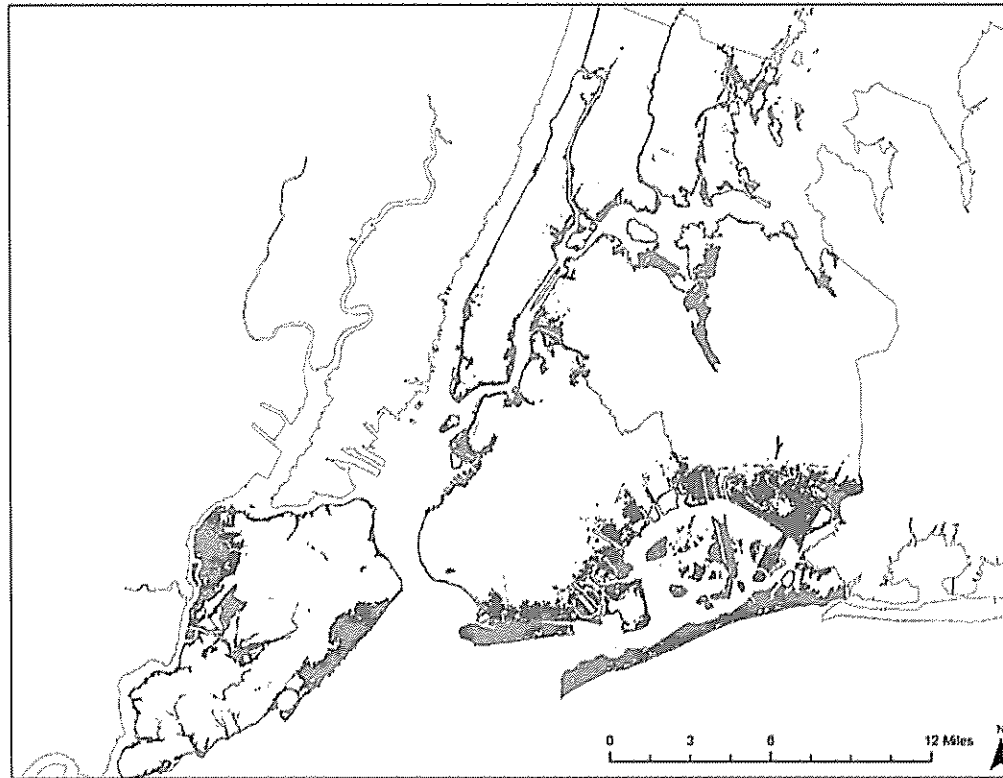
\* Numbers are rounded for clarity



## Question 2: What Could Happen in the Future?

However, Sandy demonstrated that New York is actually even more vulnerable than previously thought...

**FEMA 1983 Flood Maps vs. Sandy Inundation Area**



- 100-Year Floodplain (FEMA 1983 Maps)
- Sandy Inundation Area

### Share Outside 100-Year Floodplain

- > 1/3 of red- & yellow-tagged buildings
- ~ 1/2 of impacted residential units
- > 1/2 of impacted buildings

## Question 2: What Could Happen in the Future?

...This greater vulnerability was shown in June 2013 interim maps from FEMA that built on work done to update the 1983 maps, which had been begun before Sandy.

**FEMA June 2013 Preliminary Work Maps (PWMs)**



- 100-Year Floodplain: V Zone (FEMA 2013 PWMs)
- 100-Year Floodplain: A Zone (FEMA 2013 PWMs)
- 500-Year Floodplain (FEMA 2013 PWMs)

\* Numbers are rounded for clarity

100-YEAR FLOODPLAIN*			
	1983 FIRMs	2013 PWMs	Change (%)
Residents	218,000	398,000	82%
Jobs	214,000	271,000	27%
Buildings	36,000	68,000	89%
Floor Area (SF)	377M	534M	42%

- FEMA is scheduled to release the first draft of regulatory flood maps ("pre-FIRMs") before YE 2013



## Question 2: What Could Happen in the Future?

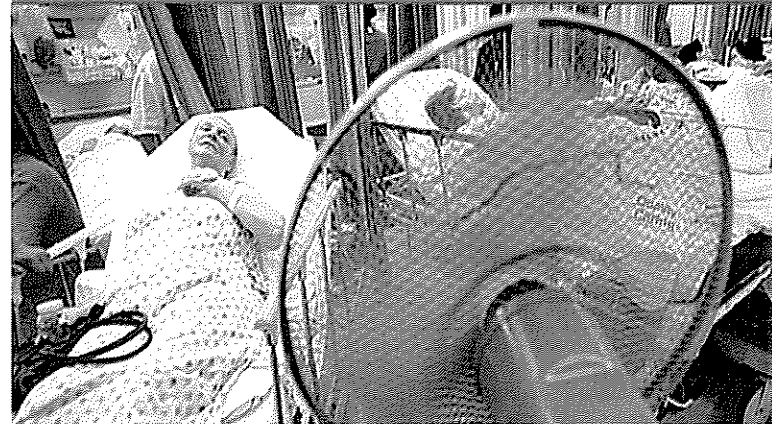
FEMA's new Preliminary Work Maps, though, are only one of the pieces needed to solve the city's climate risk puzzle.

PWMs Maps are based on historic data and do not address...

Future Risks of Downpours



Future Risks of Heat Waves



Future Risks of Drought

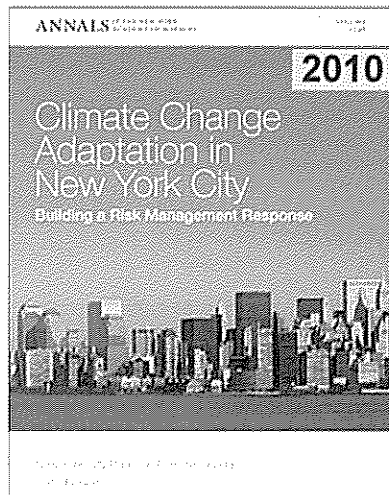
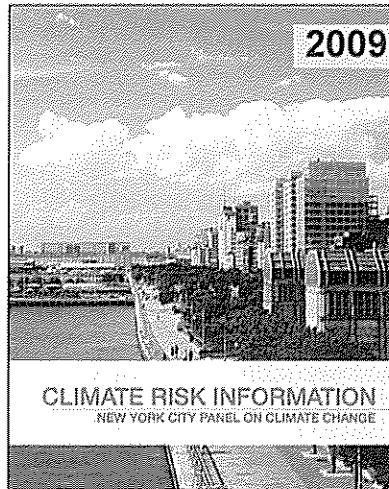


Future Risks of Sea Level Rise



## Question 2: What Could Happen in the Future?

An important tool for understanding the risks facing the city from climate change is the New York City Panel on Climate Change (NPCC), created out of PlaNYC...



### Background

- Advises City on latest climate science
- Codified in August 2012 legislation, requiring regular updates

### Institutions Represented

- Columbia University
- CUNY
- NASA
- Princeton University
- Rutgers University
- SUNY
- University of Pennsylvania
- Wesleyan University

## Question 2: What Could Happen in the Future?

...At the Administration's request, the NPCC updated a groundbreaking 2009 analysis of how climate change might impact New York for SIRR.

Chronic Hazards	Baseline (1971-2000)	2020s		2050s	
		Middle Range (25th - 75th percentile)	High End (90th percentile)	Middle Range (25th - 75th percentile)	High End (90th percentile)
Average Temperature	54 °F	+2.0 to 3.0 °F	+3.0 °F	+4.0 to 5.5 °F	6.5 °F
Precipitation	50.1 in.	+0 to 10%	+10%	+5 to 10%	+15%
Sea Level Rise <sup>1</sup>	0	+4 to 8 in.	+11 in.	+11 to 24 in.	+31 in.

Sea levels likely to rise 1-2 ft. and could rise by > 2 ½ ft. (on top of 1 ft. since 1900)

Extreme Events		Baseline (1971-2000)	2020s		2050s	
			Middle Range (25th - 75th percentile)	High End (90th percentile)	Middle Range (25th - 75th percentile)	High End (90th percentile)
Heat Waves and Cold Events	Number of days per year at or above 90°F	18	26 to 31	33	39 to 52	57
	Number of heat waves per year	2	3 to 4	4	5 to 7	7
	Average duration (days)	4	5	5	5 to 6	6
	Number of days per year at or below 32°F	72	52 to 58	60	42 to 48	52
Intense Precipitation	Days per year with rainfall exceeding 2 inches	3	3 to 4	5	4	5
Coastal Floods at the Battery <sup>1</sup>	Future annual frequency of today's 100-year flood	1.0%	1.2% to 1.5%	1.7%	1.7% to 3.2%	5.0%
	Flood heights from a 100-year flood (feet above NAVD88)	15.0	15.3 to 15.7	15.8	15.9 to 17.0	17.6

# of 90+ degree days could double (or triple), to current level of Birmingham, AL

<sup>1</sup> Baseline period for sea level rise projections is 2000-2004.

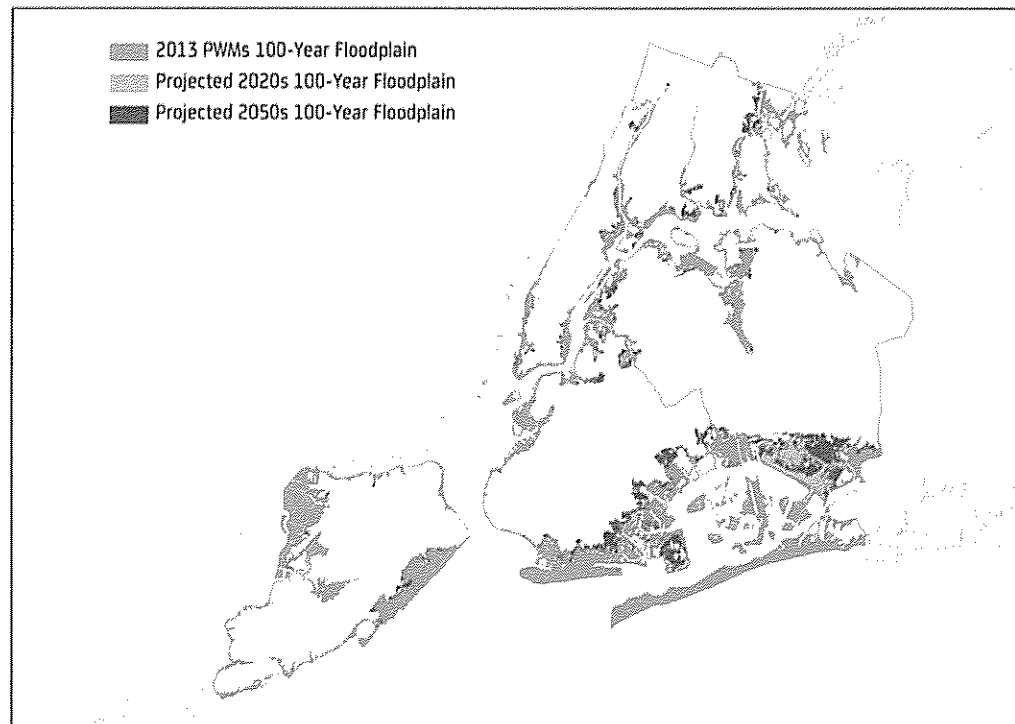
Like all projections, the NPCC climate projections have uncertainty embedded within them. Sources of uncertainty include data and modeling constraints, the random nature of some parts of the climate system, and limited understanding of some physical processes. The NPCC characterizes levels of uncertainty using state-of-the-art climate models, multiple scenarios of future greenhouse gas concentrations, and recent peer-reviewed literature. Even so, the projections are not true probabilities, and the potential for error should be acknowledged.



## Question 2: What Could Happen in the Future?

Using the NPCC projections, the City, with the CUNY Institute for Sustainable Cities, developed maps showing how floodplains will expand by the 2050s...

### FEMA PWMs, with 2020s and 2050s Floodplain Growth

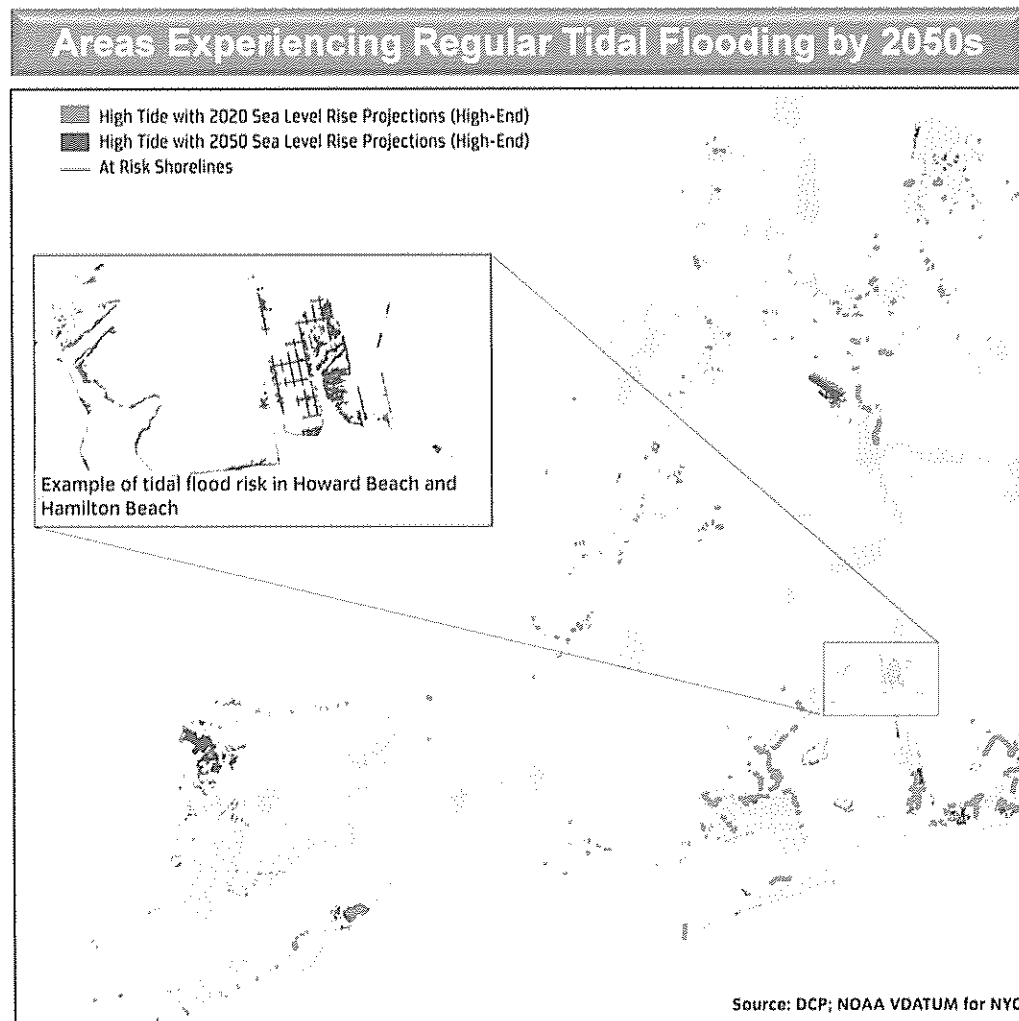


100-YEAR FLOODPLAIN*			
	2013 PWMs	2050s Projected	Change (%)
Residents	398,000	801,000	101%
Jobs	271,000	430,000	59%
Buildings	68,000	114,000	68%
Floor Area (SF)	534M	855M	60%

\* Numbers are rounded for clarity

## Question 2: What Could Happen in the Future?

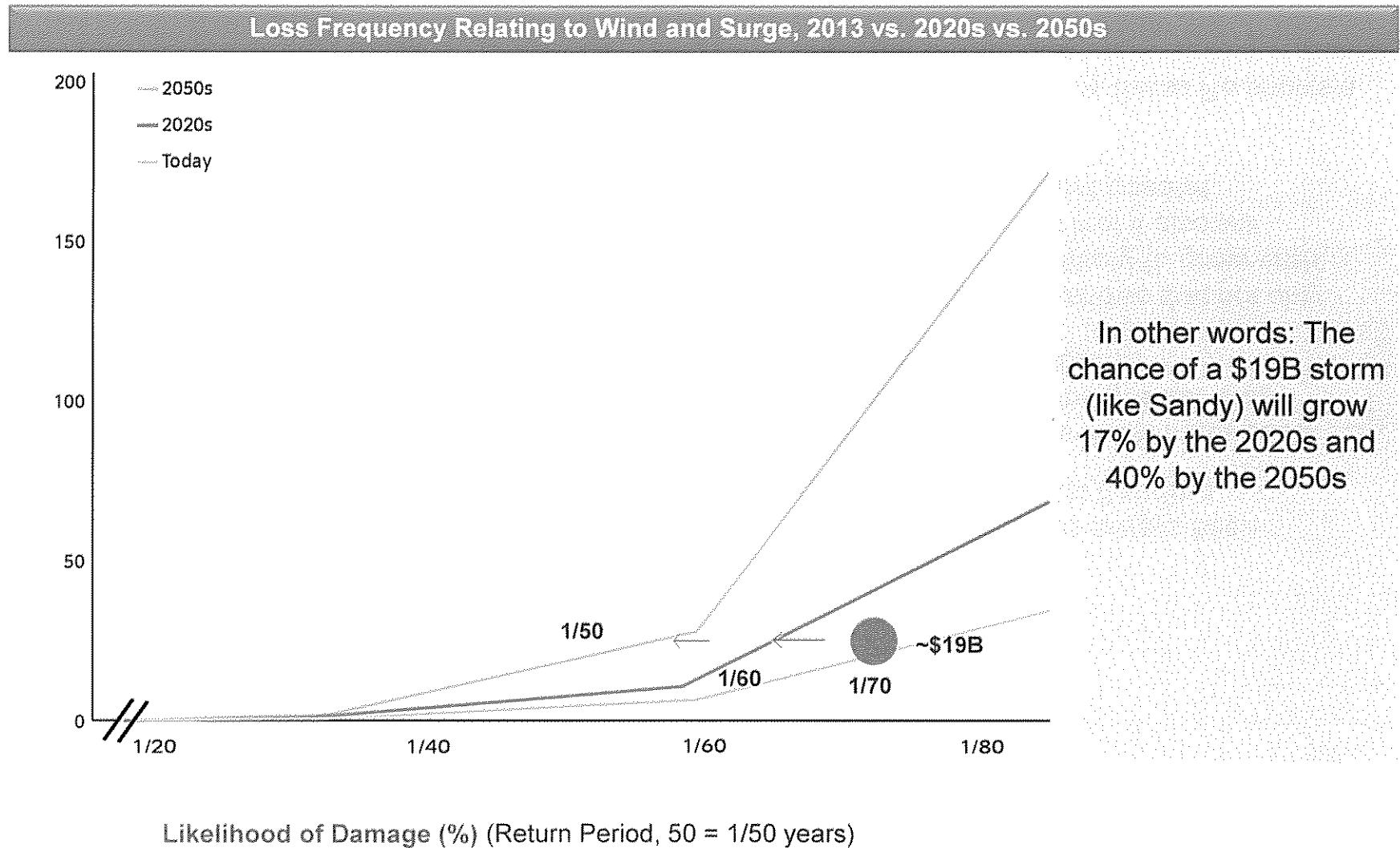
...The City's analysis also shows that much of New York's coast will be subject to regular tidal flooding by the 2050s, even without storms.



POTENTIAL SEA LEVEL RISE IMPACTS			
Borough	Waterfront (miles)	Risk of Tidal Flooding (miles) (%)	
Bronx	86.7	6.2	7%
Brooklyn	113.3	11.5	10%
Manhattan	44.8	1.3	3%
Queens	155.1	21.4	14%
Staten Island	120.1	2.6	2%
<b>Total</b>	<b>520</b>	<b>43</b>	<b>8%</b>

## Question 2: What Could Happen in the Future?

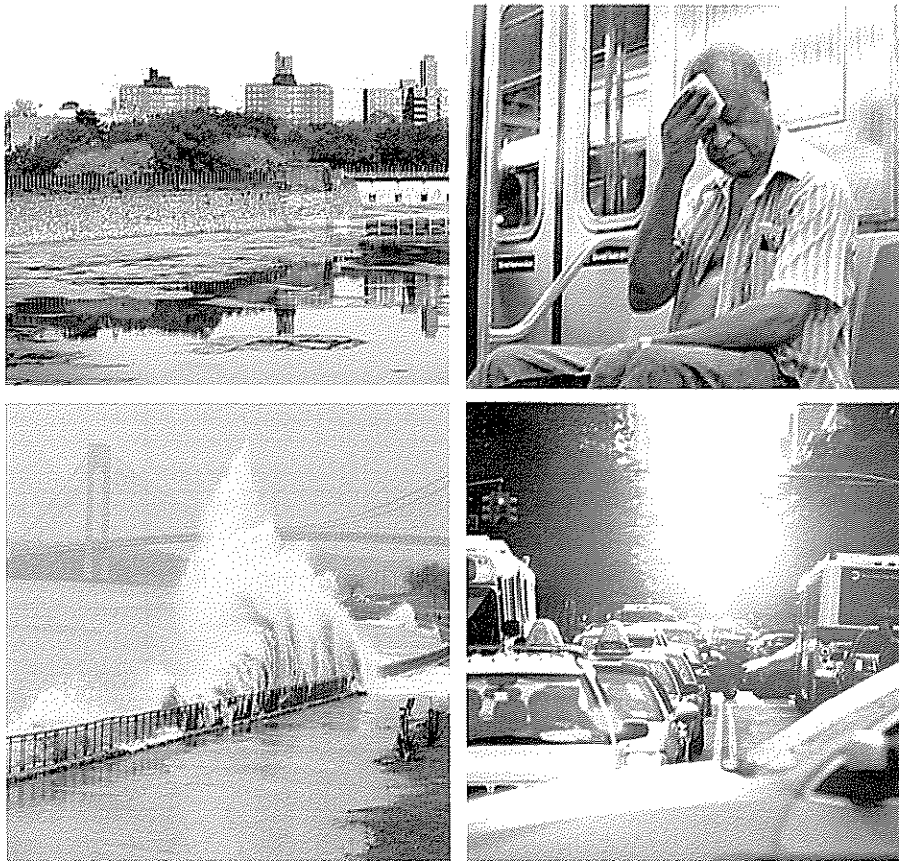
Working with Swiss Re, the City also was able to quantify how climate change might change the monetary impacts and frequency of damaging storms





## Question 2: What Could Happen in the Future?

In short, even if unlikely to recur in precisely the same way, the experience of Sandy serves as a wake-up call to all New Yorkers.



- Though New York has always been **vulnerable to coastal flooding...**
- ...Sandy and FEMA's PWM maps show this **vulnerability to be greater than previously understood...**
- ...The NPCC's work shows that not only is this **vulnerability likely to grow with climate change**, but that it also will involve **more than just coastal storms...**
- ...While the analysis by Swiss Re shows a **real cost of inaction**

**The City must start taking steps immediately to address its long-term challenges**

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## Question 3: How Should the City Address Climate Risks?

To address the risks of climate change, the Administration has developed a plan that adheres to four core principles.

- 1 Be ambitious, but seek achievability**
  - Can be significantly more resilient
  - Aim for the stars, but do not fail to launch
- 2 Acknowledge resource limits, but seek to stretch resources**
  - Maximize benefits per dollar (including non-monetary benefits, such as vulnerability of population)
- 3 Create multiple defensive layers (reduce impacts, while allowing faster recovery)**
  - First Layer: Coastal defenses (less flooding; less impact)
  - Second Layer: Buildings (less serious damage; faster rehabilitation)
  - Third Layer: Infrastructure and critical systems (fewer outages; faster restoration)
- 4 In impacted areas, do not abandon the waterfront (rebuild and, where possible, improve)**
  - Fight for coastal neighborhoods



## Question 3: How Should the City Address Climate Risks?

The Administration's plan focuses on both citywide and neighborhood-specific challenges.

### Citywide Systems and Infrastructure

- Coastal Protection
- Buildings
- Insurance
- Utilities
- Liquid Fuels
- Healthcare
- Telecommunications
- Transportation
- Parks
- Water and Wastewater
- Food Supply
- Solid Waste
- Economic Recovery
- Community Preparedness and Response
- Environmental Protection and Remediation

### Most Heavily-Impacted Communities

- Brooklyn-Queens Waterfront
- East and South Shores of Staten Island
- South Queens
- Southern Brooklyn
- Southern Manhattan

### Report contains:

- Nearly **450** pages
- Over **250** initiatives

### Question 3: How Should the City Address Climate Risks?

The Administration's plan includes detailed recommendations for protecting the City's coastline...

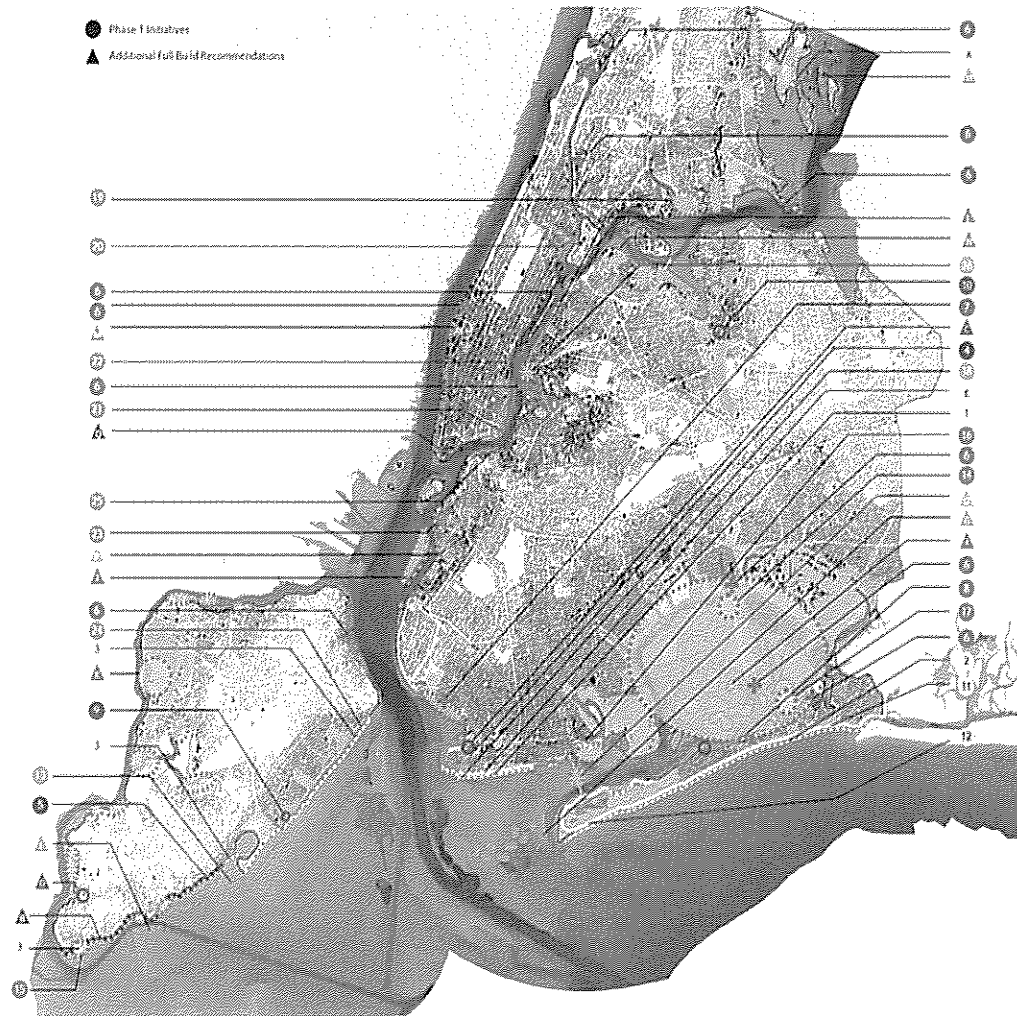


#### Proposals

- Build **\$3.7BN 1<sup>st</sup> phase** protecting vulnerable areas from waves and inundation, including:
  - Beach Nourishment and Dunes;
  - Bulkheads;
  - Levees;
  - Restored Wetlands;
  - Local Storm Surge Barriers; and
  - Integrated Flood Protection Systems

### Question 3: How Should the City Address Climate Risks?

The Administration's plan includes detailed recommendations for protecting the City's coastline...



#### Proposals

- Build \$3.75B 1<sup>st</sup> phase protecting vulnerable areas from waves and inundation, including:
  - Beach Nourishment and Dunes;
  - Bulkheads;
  - Levees;
  - Restored Wetlands;
  - Local Storm Surge Barriers; and
  - Integrated Flood Protection Systems
- Build defenses for entire City as additional resources secured



## Question 3: How Should the City Address Climate Risks?

...The Administration's plan also includes detailed recommendations for protecting the City's building stock...



### Proposals

- **Strengthen City building code** to increase flood and wind resiliency **for new buildings**
- For 68K existing buildings in floodplain, **\$1.2BN retrofit incentive for protection** of building systems and, for most vulnerable buildings, structural integrity
  - **Funds reserved** for small homes and affordable housing, ea. borough
  - **Mandate** key system protection **for largest buildings** in City by 2030

## Question 3: How Should the City Address Climate Risks?

...For dealing with issues relating to the National Flood Insurance Program, or NFIP...



### Proposals

- Call on FEMA to **address affordability issues** from Biggert-Waters and flood maps:
  - **Launch** legislatively-mandated **study re: subsidies for low-income Americans**
  - **Provide premium credits for urban-friendly mitigation** measures (i.e., measures other than elevation)
- Call on FEMA to **increase insurance uptake** with high-deductible, low-premium policies

## Question 3: How Should the City Address Climate Risks?

...For making the City's healthcare system more resilient...



### Proposals

- **Strengthen City building code** to increase resiliency for **new hospitals, nursing homes and adult care facilities** in vulnerable areas
- **Mandate resiliency retrofit for existing vulnerable facilities** by 2030
  - **\$50MM incentive program** for vulnerable nursing homes and adult care facilities

## Question 3: How Should the City Address Climate Risks?

...And for making the City's energy networks more resilient.



### Proposals

- **Work with** and call on **utilities to:**
  - **Harden existing infrastructure** to increase flood and heat resiliency
  - **Reconfigure networks** for greater redundancy
- **Call on regulators** to reflect climate risk in system **designs** and to include **extreme weather** when evaluating performance
- **Work to reduce energy demand** and **increase energy options** for City consumers



### Question 3: How Should the City Address Climate Risks?

Elsewhere, the Administration's plan includes recommendations for making a variety of additional critical systems that serve the City more resilient.

**Water and Wastewater**

**Food Supply**

**Liquid Fuels**

**Solid Waste**

**Parks**

**Economic Recovery**

**Telecommunications**

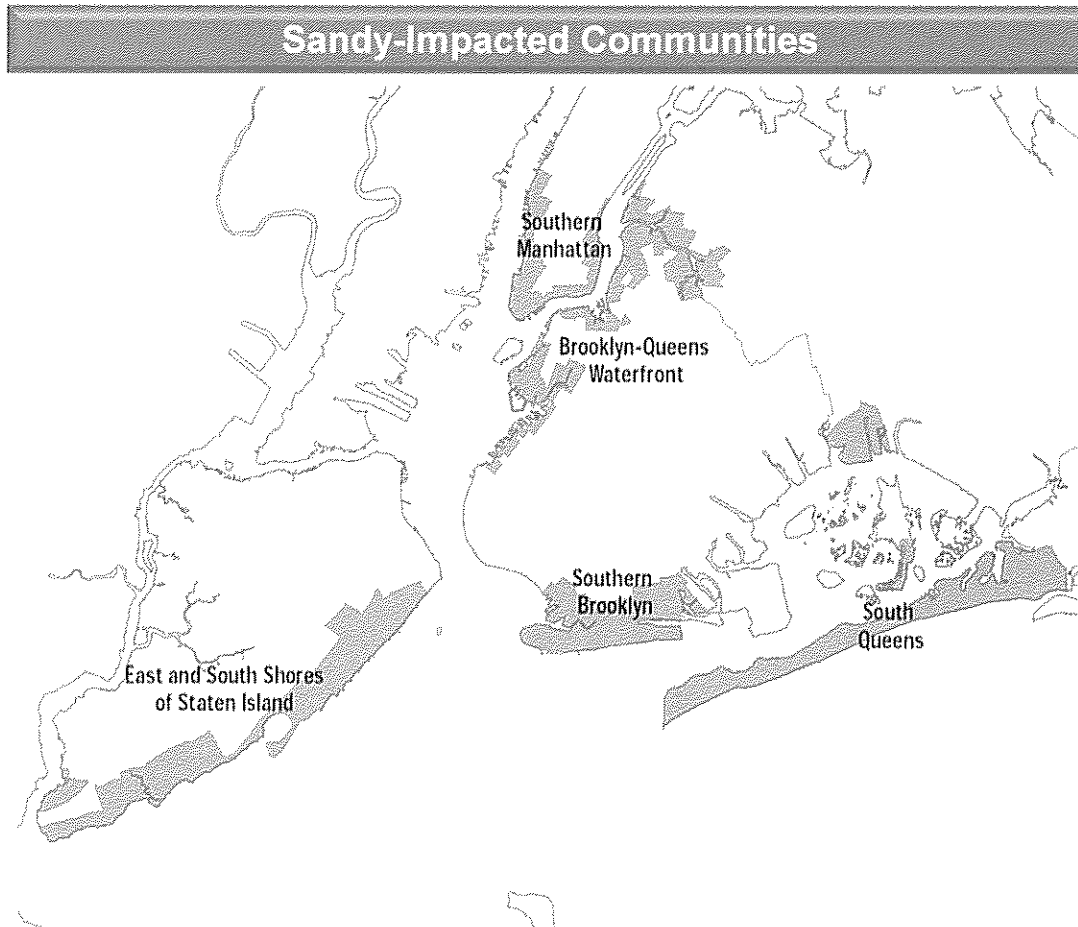
**Community Preparedness  
and Response**

**Transportation**

**Environmental Protection  
and Remediation**

### Question 3: How Should the City Address Climate Risks?

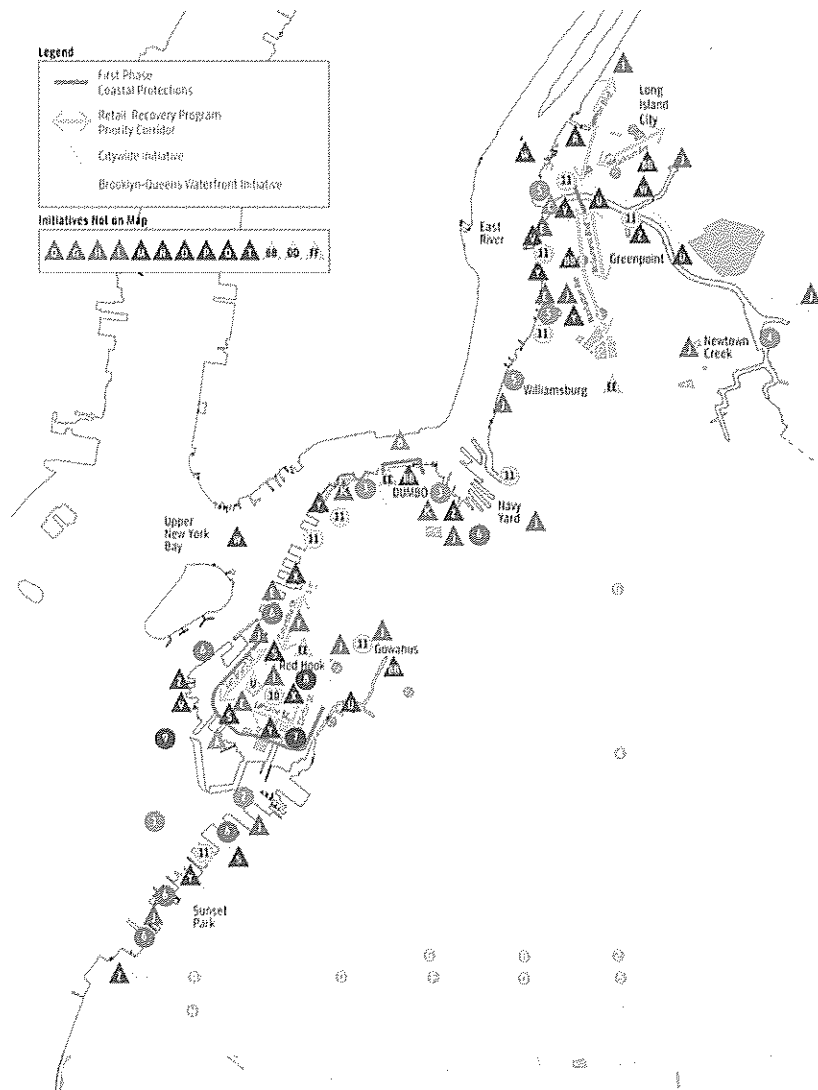
Acknowledging the particular needs of areas hard-hit by Sandy, the Administration's plan also creates proposals tailored to these neighborhoods.



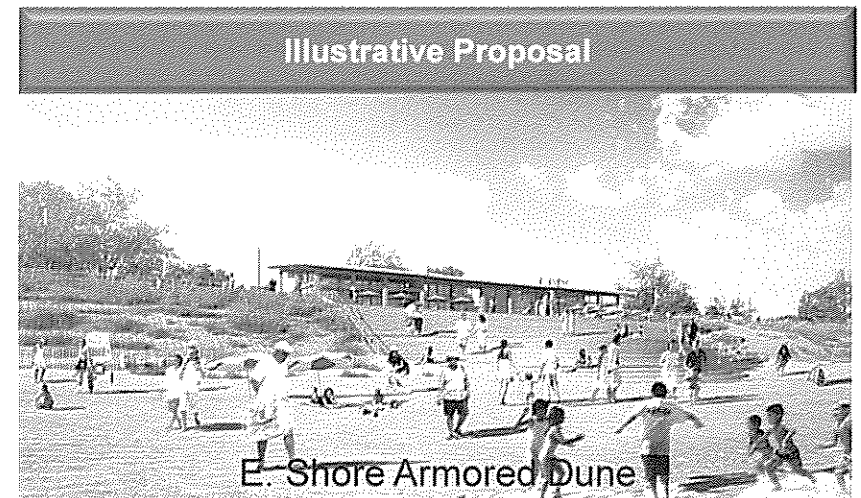
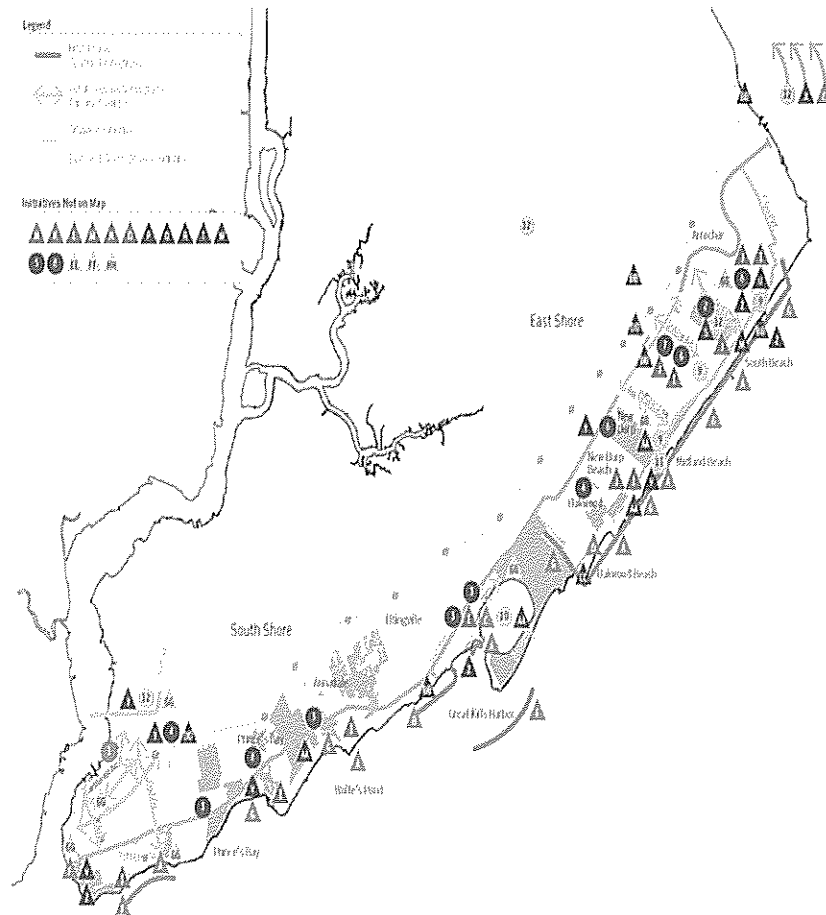
- Focus on areas where physical damage has lingered
- Incorporate Citywide resiliency initiatives
- Tailor plans to each area, looking at coastal protection, infrastructure and economic redevelopment

### Question 3: How Should the City Address Climate Risks?

The Administration's plan, therefore, contains proposals for the Brooklyn-Queens Waterfront...



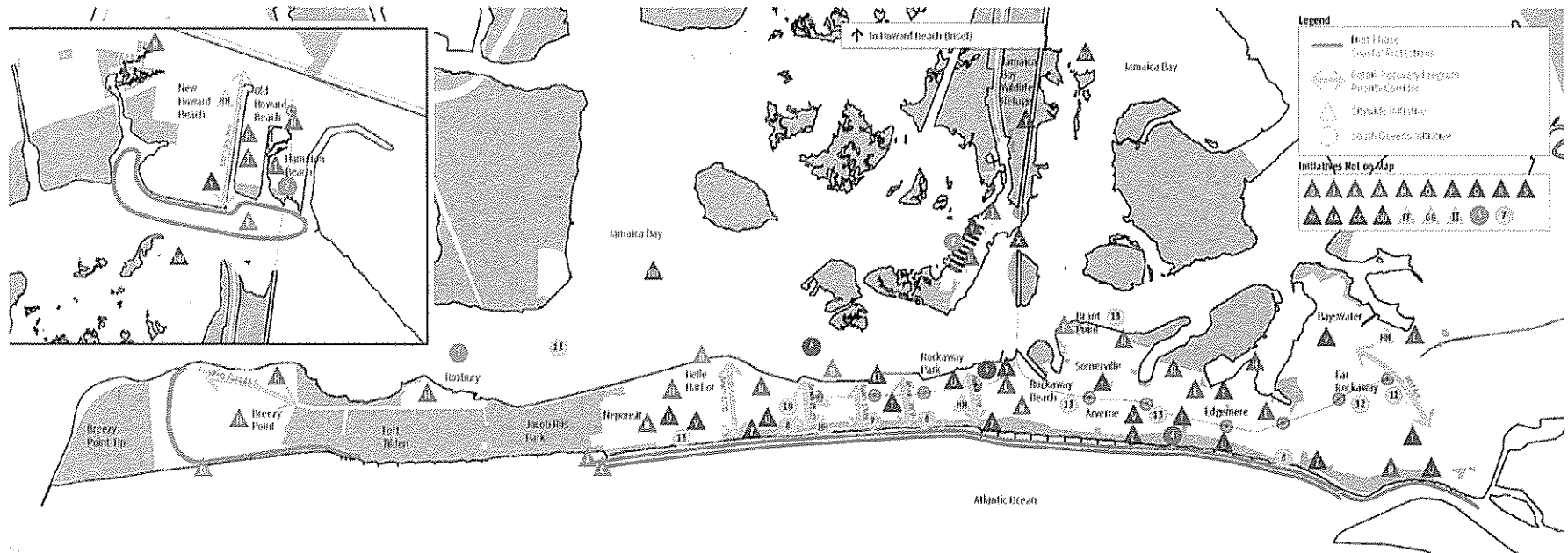
...the East and South Shores of Staten Island...





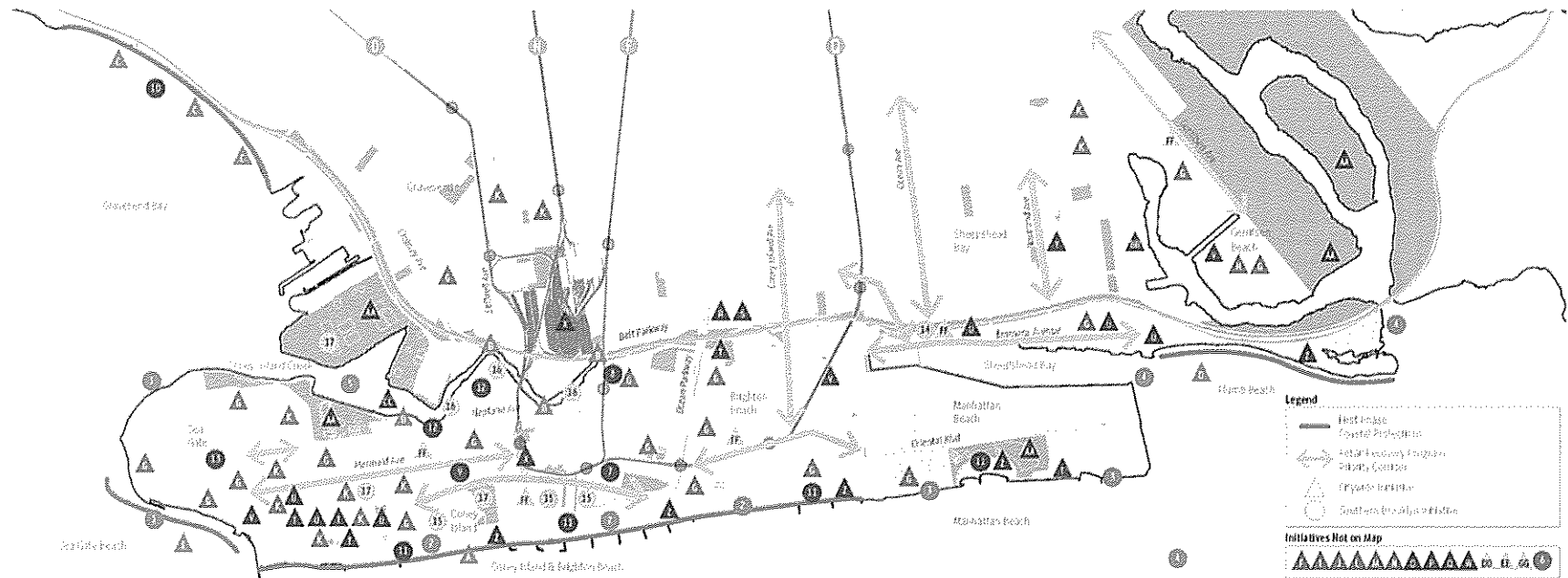
# Question 3: How Should the City Address Climate Risks?

...South Queens...

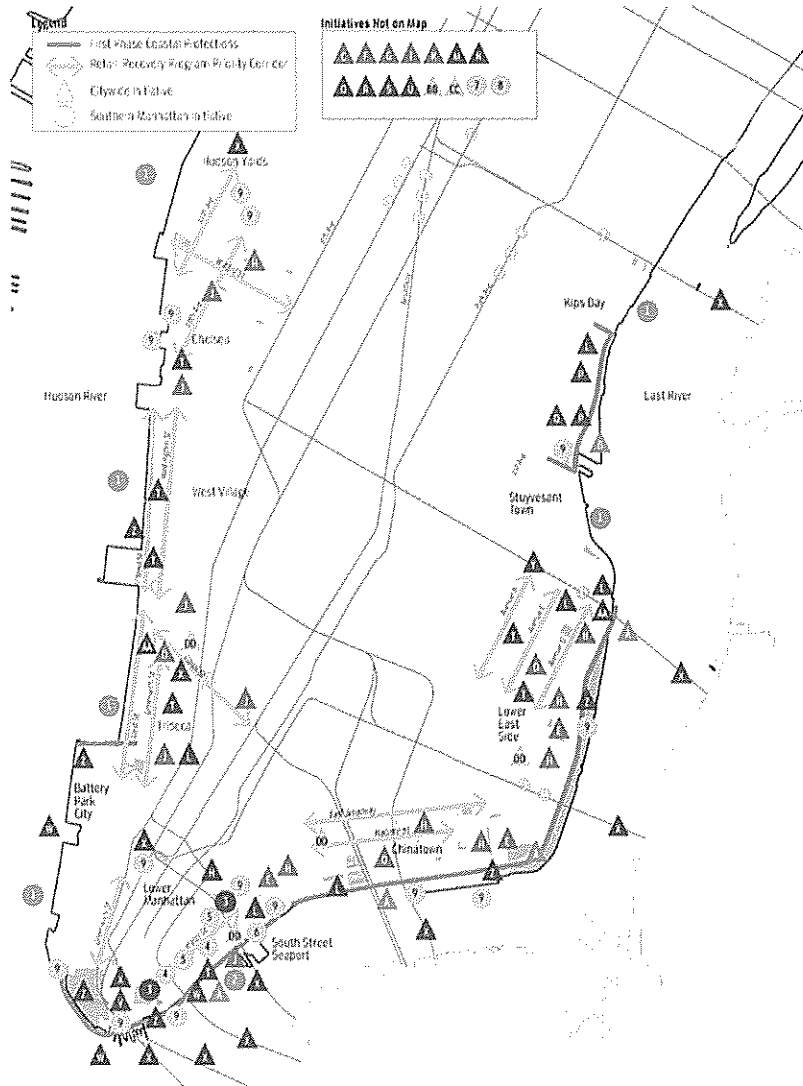


# Question 3: How Should the City Address Climate Risks?

## ...Southern Brooklyn...



# Question 3: How Should the City Address Climate Risks? ...and Southern Manhattan.





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- Implementation and Funding



# Implementation and Funding

The Administration will make significant progress on its plan before year-end, with a structure and sources in-place allowing the plan to advance thereafter.

## Plan is largely funded...

- **10-yr. cost: \$19.5BN**
  - **\$10BN in-hand** (City capital and federal sources)
  - **\$5BN reasonably likely** (mostly federal sources)
  - **Strategies for remaining \$4.5BN** (including up to \$1BN in City capital; supplemental federal appropriation per Katrina)

## Implementation has begun...

- **Nearly 60 concrete steps by YE2013**
  - Launch studies
  - Begin design work
  - Begin construction
  - Secure additional funding
  - Amend key regulations and laws

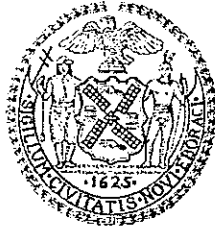
## Implementation will be enshrined in law...

- **New Director of Resiliency within OLTPS, with regular plan updates required by law**



**Special Initiative for  
Rebuilding and Resiliency**

<http://www.nyc.gov/resiliency>



John Lee, RA  
Deputy Director, Office of Long Term Planning and Sustainability  
New York City

At the New York City Council  
Committee on Housing and Buildings  
Committee on Environmental Protection  
Committee on Parks and Recreation  
Committee on Transportation  
Committee on Waterfronts

Respecting Proposed Intros. 0983-2012, 0990-2012-A, 1085-2013, 1086-2013,  
1087-2013, 1088-2013, 1089-2013, 1090-2013, 1092-2013, 1093-2013,  
1094-2013, 1095-2013, 1096-2013, 1097-2013, 1098-2013, 1099-2013,  
1100-2013, 1101-2013, 1102-2013, and T2013-6556

June 27, 2013

Good morning, Chairs Dilan, Gennaro, Mark-Viverito, Vacca, Koo, and members of the committees. I am John Lee, Deputy Director in the Mayor's Office of Long Term Planning and Sustainability and a registered architect in the State of New York. Thank you for the opportunity to testify today on twenty introductory bills related to design, construction, and operational practices that will make New York City's buildings stronger and safer in the face of extreme weather events.

First, I would like to acknowledge the leadership that each of these committees has demonstrated on issues of sustainability since the release of PlaNYC in 2007 and the urgent emphasis you have placed on climate resiliency by scheduling today's hearing immediately following the release of the City's reports.

PlaNYC in 2007 created an ambitious agenda for New York City to accommodate its growing population and enhance the quality of life for all New Yorkers towards a more sustainable future – and to address climate change. Six years ago, climate change was not on the agenda of most municipal governments. While our best scientists reached consensus that the impacts of climate change were potentially severe, and that sea-level rise and more frequent coastal storms could threaten New York City with its 520 miles of coastline, we had an imprecise understanding of what our local risks truly were. We also knew that as a leading global City, New York had a responsibility to reduce its impact on climate change.

In the intervening years, thanks in part to the leadership of the City Council, the experts and scientists that make up our New York City Panel on Climate Change have helped us to develop a much better understanding of our local climate risks. The City's Climate Adaptation Task Force analyzed coastal storm surge and addressed the risks in ways that made us better prepared for Superstorm Sandy.

The City created a 1.2 billion dollar green infrastructure strategy and expanded its network of Bluebelts to reduce the impacts of heavy downpours; the Cool Roofs volunteer program has painted four million square feet of rooftops in order to stem heat gain; and through our waterfront development policies, major projects that receive public support must take climate risks into account in their design and construction.

Superstorm Sandy has made it clear that while we are on the right track, much more needs to be done to protect the city against the risks of climate change and extreme weather. For this reason, even while the City was in the midst of



unprecedented storm relief efforts, Mayor Bloomberg convened the Special Initiative for Rebuilding and Resiliency (S-I-R-R), as you have heard from Seth Pinsky, Marc Ricks, and Tokumbo Shobowale. SIRR's mission was to analyze the impacts of the storm on buildings, infrastructure, and communities; to assess our future risks, and to outline an ambitious, comprehensive, and achievable strategy for increasing resiliency citywide. The result of this effort—and the latest incarnation of PlaNYC—is A Stronger, More Resilient New York.

Sandy inundated an area that affected over eighty-eight thousand buildings, far exceeding the risks that are reflected by FEMA's current Flood Insurance Rate Maps which date from 1983. Several weeks ago FEMA released its Preliminary Work Maps for New York City that are based on substantially improved analysis of coastal flood risks. These maps indicate that an additional thirty thousand buildings will be newly defined as at risk for coastal flooding from a 100-year storm, taking the total amount to 68 thousand buildings. We know this number will grow significantly as sea levels rise by up to three feet by mid-century.

Coastal flooding is not the only threat brought on by the effects of climate change. Our buildings will be exposed to more heavy down pours, more frequent storms with wind effects, and building inhabitants will have to contend with greater frequency of heat waves. To address all of these impacts, PlaNYC, A Stronger, More Resilient New York set forth initiatives to "strengthen new and substantially rebuilt structures to meet the highest resiliency standards moving forward" and to "retrofit as many buildings as possible so that they will be significantly more resilient than they are today."

To thoroughly address the needs of buildings, Mayor Bloomberg and Speaker Quinn launched a partnership with the Urban Green Council to convene the Building Resiliency Task Force. The Task Force was charged with developing proposals on how to change New York City's codes and rules to increase the resiliency of buildings in both operational and structural terms.

The Building Resiliency Task Force brought together over 200 professional leaders in the architecture, engineering, construction, and real estate sectors, working together with city agencies, to develop these proposals. The task force was subdivided by expertise in building type: commercial, residential, critical facilities, and homes.

Today, I will provide some observations and recommendations about each of these bills, organized into the main categories of the Task Force: stronger buildings, backup power, essential safety, and better operational planning.

These introductions could help achieve PlaNYC's resiliency goals in measureable ways. On behalf of the Office of Long Term Planning and Sustainability, I am pleased to testify in general support of today's introductory bills, although our support is tempered by certain caveats or suggestions for refinements that would help make the bills more workable or that would address inconsistencies with local, federal or state requirements. We are looking forward to hearing the testimony of today's other witnesses to ensure that we fully understand the issues raised by each of them.

In the category of stronger buildings, the following introductions will help our buildings manage floods, resist high winds, and prevent emergencies.

Intro 983 in relation to flood-resistant construction requirements for health facilities: this proposal must be revised in its entirety to address our better understanding of the impending risks that hospitals face even outside the boundaries of the 100-year floodplain. The current bill would treat hospitals similarly to residences for flood-resistant construction standards. In the months since this bill was first introduced, we have more closely studied the risks faced by our health facilities. We will work with the council to revise the standards that will serve the needs of our health facilities along our waterfronts.

Intro 990-A in relation to the adoption of best available flood maps: the Office of Long term Planning and Sustainability urges you to adopt this proposal with the amendments. The effects of Superstorm Sandy clearly demonstrated the inadequacies of the current effective floodplain maps, and if we are to build stronger going forward, we must rely upon the best available data, developed in partnership with the federal government.

Intro 1087 in relation to using cool roof surfaces to reduce summer heat: this proposal will expand the roof reflectivity requirements to sloped roofs to reduce the internal heat gains during hot summer days, which in turn will also reduce the energy demands of the building and help reduce costs over time.

Intro 1088 in relation to water retentive sidewalks and a study on absorptive street and sidewalk materials and alternative street angulation: this proposal would require city agencies to engage in a study to determine the potential for permeable surfaces as a water retention strategy. We respectfully request that council work with the agencies so that they are properly identified between the departments of

transportation, environmental protection, and buildings, each to their areas of expertise.

Intro 1089 in relation to allowing elevation of certain building systems in flood-prone areas: this proposal is intended to allow for *flexibility* in design solutions to protect telecommunications systems and fuel oil supplies. We urge the council to ensure that bill not limit the options available to design for flood protection.

Intro 1090 in relation to studying the effects of wind on certain buildings: this proposal is extremely important in order for us to better assess the risks that our buildings will likely face with increased future storm activity.

Intro 1093 in relation to removing barriers to usage of temporary flood control and response devices: this proposal while necessary to address an important means of flood protection, must not compromise the use of the public right of way and must not impede the safe egress from a building. We urge the council to work with the affected departments of transportation and buildings to refine the language that preserves the safety of the building and its occupants.

Intro 1095 in relation to creating a manual on flood construction and protection standards: this proposal will make information more readily available to affected property owners and we offer our support.

Intro 1096 in relation to relocating and protecting building systems in flood-prone areas: this proposal will ensure that the most essential life safety systems are rendered flood resistant. While this proposal clarifies aspects that are generally



addressed by the current code, we offer to work with the council to resolve technical issues with the language.

Intro 1097 in relation to requiring backup power sources for fire and life safety communications systems: this proposal adds an added element of resiliency to an essential life safety function; however, some of the technical language needs refinement and proper location within the code should be reconsidered.

Intro 1098 in relation to preventing the backflow of sewage: we recommend that further specifications be considered to ensure that the valve types do not inadvertently cause blockages which can undermine the building's internal sewer system and that the valve type specifications allow for affordable options.

Intro 1099 in relation to preventing wind damage to existing buildings: this proposal addresses very important protection measures for buildings and we will work with council to resolve minor technical language issues.

Intro 1102 in relation to improving hazardous materials storage pursuant to the New York city community right-to-know law: this proposal is necessary for us to protect our neighborhoods and waterways; however we ask that council take special consideration for our wastewater treatment plants and work with us to properly address toxic materials at those sites.

In the category of backup power, the following introductions will allow our buildings to have immediate access to temporary power sources, to have hallways and stairs that are safely illuminated during prolonged power outages, and to diversify the fuel sources for emergency power.

Intro 1092 in relation to the installation of external electrical hookups: this proposal would provide for a quick connection for roll up temporary generators, and while we are in support of the intent, there are technical issues yet to be resolved with the introduction, especially with regard to the degree to which it affects hospitals.

Intro 1100 in relation to keeping residential stairwells and hallways lit during blackouts: In this proposal, careful considerations must be taken for how to define the lighting levels and their application so that the safety and security of building residents are preserved. We can work with council to reach proper standards that address all of these concerns.

Intro 1101 in relation to voluntarily installed emergency power systems and natural gas usage: this proposal will have significant positive effects on the types of power systems that buildings will use for backup and emergency power that can result in cleaner emissions and more flexible uses of voluntary systems. This proposal has much merit but is highly technical and we can assist council with the proper engineering expertise to refine the language.

In the category of essential safety, the following introductions are intended to ensure access to sanitation facilities and potable water in the event of prolonged power loss.

Intro 1086 in relation to requiring that toilets and faucets be capable of operating without an external supply of electrical power: this proposal is intended to ensure that for those toilets and faucets that rely on electric power to operate, such as a motion sensor to activate, then that within a given facility, at least one

faucet and one toilet are able to operate without the electronic sensor. The language of the bill implies that the requirement would include fixtures in buildings where an electrically powered pump is necessary to fill a tank or deliver pressure, and that is not the intent of this bill. We can work with council to refine the language to specifically address the electrically operated valves that may fail in a prolonged power loss.

Intro 1094 in relation to requiring residential buildings to provide drinking water to a common area supplied directly through pressure in the public water main: For many large multi-family buildings, this proposal would be very easy to solve. However, we urgently request that smaller buildings be provided with additional considerations as the costs are more onerous to absorb by fewer residents.

In the category of better operation planning, the following introduction will help reduce the impacts of an emergency and allow for rapid recovery.

Intro 1085 in relation to emergency plans for residential and commercial buildings and the posting of emergency information in certain residential buildings: this proposal names city agencies to help develop the guidelines for emergency planning and should clearly convey that the responsibility of proper planning and information distribution to the building occupants ultimately resides with the property owner.

In addition to these nineteen proposals, the report from the Special Initiative for Rebuilding and Resiliency has brought forth for your consideration an

introduction to institutionalize resiliency policy into the core function of the Office of Long Term Planning and Sustainability.

T2013-6556 intends to establish resiliency as a core function of the Office of Long Term Planning and Sustainability and establish a director of resiliency within the office. While our office has studied the risks brought on by climate change for quite some time, it is now time to take the necessary steps to build resiliency to confront the effects of climate change. Resiliency is a fundamental component of sustainability. We will ensure that our city continues to grow in a sustainable method while also protecting our assets towards a stronger and more resilient future.

By incorporating resiliency into the responsibilities of the Office of Long-term Planning and Sustainability, the City will build upon the foundation established in PlaNYC to ensure that resiliency planning is informed by clear metrics and transparent reporting; rigorous policy analysis; the best available science; and extensive stakeholder involvement. We will ensure that this vital work to the city is sustained and held accountable beyond any one mayoral administration

The Office of Long Term Planning and Sustainability generally supports all these proposals, with suggestions for minor technical revisions in some, and other more substantive suggestions that are intended to protect against inadvertent consequences. We look forward to working with council in the coming weeks to formulate legislation that will best serve the needs of New Yorkers.

Thank you for the opportunity to testify on this important legislation. I am happy to answer any questions that you may have at this time.



**Subject:** Transportation Committee – Sandy Infrastructure Bill Hearing  
**Location:** Chambers

**Start:** Thurs 6/27/2013 10:00 AM  
**End:** Thurs 6/27/2013 12:00 PM  
**Organizer:** Legislative Director, Edwina Martin

## **FOR THE RECORD**

My name is Glenda Bellinger, this is my testimony and account of my experience during Hurricane Sandy. I have been a Staten Island resident for over 30 years my foundational years have been in South Beach Projects (18 years). I have heard a lot of different accounts of the Hurricane Sandy, but there is one of many that have not been told. Here is my Untold Story, I hope it will help to provide a look closer to equip all in authority to make changes in the face of emergencies and natural disasters.

My father, William Bellinger, lived in South Beach Projects and I finally received a transfer to be closer to him for he was of failing health. This happen at the end of October 2012, I was in the process of moving when Hurricane Sandy hit New York. Everything was put to a halt. My father was not taking the blackouts and chaos very well which caused my older siblings to bring him to SI University Hospital North on October 31, 2012.

On October 31, 2012 my sister and I tried to find out where a gas station would be open. During this time people was on line for hours or days to get gas. My sister and I found a gas station on Bay Street Hess Station near Edgewater Plaza that would open early November 1, 2012 at 6:00am. We arrived at 5:00am not to far from the front of the line. Around 6:00am police officers from 120 precinct started to reroute drivers and started to allow others to cut in. Frustrated customers in front of us started leaving. We stayed because that was not an option, since we had trucks with hardly any gas.

While waiting my older brother called my sister informing us that SI University Hospital North called and said our father was put on a respirator and he was on his way to the hospital. It was around 6:40 am and we were getting closer to the pumps, but the officers were still allowing people to cut in. My sister asked an officer to please allow us to get gas because our father has taken a turn for the worse. He allowed us to come in front but we still had to wait. Another call came in from my brother saying my father had another set- back and the medical team brought him back and we had to hurry.

Around 7:10 am still no gas my sister pleaded and cried for help to let us just be able to go to the hospital to say goodbye...over 6 police officers and many gas customers watched all this unfold. My niece came (my sisters youngest daughter who owned the truck) even asked the officers to please just take my sister and I to the hospital in time to say goodbye...their response was they could not leave their post. One officer provoked the situation by telling my niece we was lucky we got this close and he could prevent or delay us longer. My sister received another call...OUR FATHER IS DEAD! She broke down for all to see I tried to calm her down and at the same time, I tried to control my feelings. Plus I was trying to calm my niece down from that officer who displayed very poor judgment.

At this point, my focus was gas and getting us out of there so we can see our father before they moved the body. We finally received gas and left.. WE DIDN'T GET A CHANCE TO SAY GOODBYE... WILLIAM BELLINGER died @7:32 am November 1, 2012..in SI University Hospital North.. so close..

I am the youngest of his children.. I remained in my previous apartment in Mairners Harbor Projects, where I was graciously permitted to continue to reside by NYCA management, because the situation at hand continues to be overwhelming for me.

Sincerely, Glenda O. Bellinger

09/05/2007

TESTIMONY OF TERENCE O'BRIEN, DEPUTY  
DIRECTOR OF THE PLUMBING FOUNDATION  
CITY OF NEW YORK, INC. BEFORE THE HOUSING  
AND BUILDINGS & ET AL COMMITTEES ON  
IMPROVING THE CITY'S INFRASTRUCTURE.

JUNE 27, 2013



FOR THE RECORD

I am Terence O'Brien, Deputy Director of the Plumbing Foundation City of New York. The Plumbing Foundation is the umbrella organization for the plumbing industry. Our membership includes large licensed plumbing firms, small firms, union firms, non-union firms, Plumbers Union Local 1, representatives of engineering societies, manufacturers and supply houses. In the aftermath of Super Storm Sandy, NYC licensed plumbers were instrumental in repairing a significant portion of the City's infrastructure, hospitals, office buildings and the homes of countless New Yorkers. Plumbers replaced boilers, installed heating and cooking gas, as well as repaired sanitary and water lines from the Rockaways, all throughout lower Manhattan, to the southern tip of Staten Island. The Foundation has been working with the Mayor's Office, this Committee, and the City's Resiliency Task Force managed by the Urban Green Council from the moment the recovery efforts started. Whatever measures that can be implemented to better ensure the ability to retain clean drinking water, the capacity to operate toilets, and to avoid flooding and interaction with sewage when major disasters occur should be enacted. The Foundation is pleased to offer this testimony in support of many of the introductions and resolutions being

introduced before this Committee some of which we suggested. These 24 intro. bills and resolutions are a great start and the Foundation is fully supportive of any and all measures that strive to guarantee that the unfortunate incidents of last October will not occur again. However, as you will hear over and over again throughout my testimony, in order to have an impact these Laws should apply retroactively to existing buildings. Without retroactive requirements many of the problems from last October are destined to happen all over again when the next major storm hits. We understand that not every adjustment can or should be retroactively performed or installed within the next year. But we strongly believe that most, if not all, should be required to be completed within the next 18-30 months. Otherwise these recommendations are pointless.

In particular the Foundation would like to single out a few bills and submit additional comments:

Intro. 1086 - which seeks to amend the Plumbing Code in relation to requiring toilets and faucets to operate within a building without power is extremely important. This bill currently does not apply retroactively to existing buildings. It should at least apply to high rise residential buildings.

Intro. 1094- which seeks to amend the Plumbing Code and Administrative Code in relation to requiring residential buildings to provide emergency drinking water to its tenants/occupants if the building is not connected to the public water main. This bill has a date by which all applicable buildings must comply; January 1, 2019. However, we feel that



the compliance date, which is over 5 years away, should be sooner. These are high rise/ multi-family buildings and this work can be performed in less than 5 years.

Intro. 1098- which seeks to prevent sewage from reentering a building in a flood hazard area by requiring the installation of backflow/rpz devices. This is another wonderful idea in theory but without a retroactive requirement and a date by which buildings must comply with this regulation, this law will not become effective for another 50 years!

Intro. 1101- which seeks to establish requirements for the installation of voluntary emergency power systems and natural gas usage appliances. It should be noted and stated in the bill that whenever gas generators, appliances, etc. are installed, a licensed plumber is required to install these systems and obtain the proper permitting from the Department of Buildings as per the Building Code.

Res. 1171- which encourages the NYS Legislature and the Governor to sign S3942/A4380- the "Good Samaritan Act." The "Good Samaritan Act" is a fine bill, though we feel there is a better piece of legislation out in circulation, the "Emergency Responder Act"

A7715/S5672 which the Council should sign and urge Albany to adopt. The "Good Samaritan Act" only applies to design professionals like architects and engineers. It leaves out contractors (general contractors, plumbers, electricians, etc) and offers then no protection from liability when services are provided at the scene of natural disasters or catastrophes. The "Emergency Responder Act" covers all parties involved and we urge the Council to support this legislation over the "Good Samaritan Act."

The Foundation has many other technical recommendations, some minor and some major that we will gladly discuss with the Council to ensure the devastation that occurred during and post Super Storm Sandy will not take place again in New York City.



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**Testimony of Ramon Gilsanz S.E., Partner, Gilsanz Murray Steficek, LLP to the Committees on Housing and Buildings, Environmental Protection, Parks and Recreation, Transportation, and Waterfronts on Rebuilding After Sandy and Improving the Resiliency of the City's Infrastructure**

**June 27, 2013**

Good morning committee members. Thank you for giving me the opportunity to testify on the various revisions to the NYC Construction Codes proposed by the Building Resiliency Task Force (BRTF). My name is Ramon Gilsanz and I am a structural engineer and partner at Gilsanz Murray Steficek (GMS). GMS is a structural engineering and building envelope consulting firm that has been involved in numerous resiliency and disaster recovery efforts including: participating in the NYC Building Resiliency Task Force, providing the NYC DOB on-call emergency assistance after Hurricane Sandy, participating in the post-Sandy investigation team of ASCE 24 (a task force for flood resistant design and construction), assisting the Geotechnical Extreme Events Reconnaissance (GEER) Association in their post-Sandy investigation, and serving on post-earthquake reconnaissance teams dispatched by the Applied Technology Council (ATC) and by the American Society of Civil Engineers (ASCE) to Chile in February 2010 and by the Earthquake Engineering Research Institute (EERI) to Virginia in August 2011. GMS also played a role in the World Trade Center cleanup effort and contributed to the FEMA and NIST studies of the World Trade Center. I am the lead author of the recently released American Institute of Steel Construction (AISC) Steel Design Guide for Blast Resistant Structures, which has recommendations for making buildings more resilient against collapse. I recently testified before the City on Tuesday on the subject of Intro 1056 and assume some of the committee members are already familiar with my personal background hence I will not repeat that information.

As Chair of the Structural Technical Committee for the DOB revision of the New York City Building Code and participant of the Buildings Resiliency Task Force, my testimony today is in support of the work product of the Building Resiliency Task Force, which aims to improve the City's buildings standards to address emergency situations, and in support of Intro 1056, a comprehensive revision of the New York City Construction Codes which was presented to the City Council earlier this week. Together these recommendations help to improve the City's resiliency by filling in the gaps of the City's existing building codes. They are not mutually exclusive and when combined will put New York City at the forefront of innovation, resiliency, and safety in construction.

I would like to highlight some key recommendations of Building Resiliency Task Force that are important to me, some of these items are bills presently in front of you and some recommended actions by the Green Building Council that I would like you to support:

- Clarifying construction requirements in flood zones to make it easier for design professionals and contractors to determine the code requirements for structures located in coastal high hazard areas.
- Preventing wind damage to existing buildings by requiring equipment and structures added to existing buildings to meet the same wind standards in effect for new buildings.
- Analyzing wind risks on existing buildings and those with particular wind vulnerability. While standards to protect buildings against high winds have been in place since 1968, older buildings and buildings under construction are not as well protected. Once the analysis is completed, new standards and practices to protect against wind risks can be put into place.
- Adopt an existing building code. Currently existing building renovations are governed by a complicated mix of new and old codes which discourages upgrades to improve resiliency. Putting an existing building code in place will help provide clarity to owners, designers, and contractors about the requirements of an existing building renovation and encourage owners to improve resiliency.
- Adding specific provisions to the proposed existing building code which would address the needs of post-disaster reconstruction with the aim to remove barriers to improving buildings during time-sensitive recovery periods.
- Promoting emergency planning to apartment residents and homeowners.
- Support Emergency Responder legislation which would encourage architects and engineers to get involved during emergency recovery efforts by reducing liability concerns. This legislation would go beyond Good Samaritan legislation by providing liability protection not only to short-term volunteers, but also to architects and engineers that enter into long-term contracts with the City. The legal challenges of architects and engineers involved in the World Trade Center clean up effort after 9/11 illustrates the risks that the A/E community currently faces. Following the clean up, GMS along with 20 other engineering firms faced lawsuits from over 19,000 plaintiffs regarding health problems arising from air quality at the site. The lawsuits sprung from an area outside of our control and expertise and took 10 years to resolve. Emergency Responder legislation would protect against similar unforeseen conditions that could occur in future disasters.

Because the recommendations above are important steps in improving New York City's safety and resiliency during emergency situations, we urge the committee and council to support and quickly pass the proposals presented before you today.

I have been honored to participate for the past five months in this building resiliency effort and as a structural engineer I look forward to seeing the benefits these recommendations will yield.

I urge your support and quick approval of today's proposals.





Testimony presented to the New York City Council Committee on Housing and Buildings jointly  
with the Committee on Environmental Protection the Committee on Parks and Recreation the  
Committee on Transportation and the Committee on Waterfronts

*Oversight: Rebuilding After Sandy and Improving the Resiliency of the City's Infrastructure*

June 27, 2013

On behalf of the New York Chapter of the American Institute of Architects and its nearly 5,000 architects and affiliate members based in Manhattan. It is our pleasure to appear here today to offer feedback and comment on the oversight topic on efforts around rebuilding more resilient post-Sandy and the legislation which has been put forth by the administration and the City Council toward the greater resiliency of our built environment. First, we commend the New York City Council and the Mayor's office for their efforts leading up to the storm and their ongoing efforts on behalf of those affected by the storm.

After reviewing the reports delivered by the **Special Initiative for Rebuilding & Resiliency (SIRR)** and the Urban Green Council led **Building Resiliency Task Force (BRTF)** we offer support for and express admiration for the efforts taken toward the assembly of these two benchmark documents. The intent and unquestionable dedication of the administration and the teams of professionals in organizing quickly and focusing their expertise to create these documents should be applauded. In so supporting the effort and intent of the documents we want to offer comments and suggestions to further these efforts.

We recognize that many of these recommendations, on the table today, involve individual buildings and resiliency of services where these buildings interface with current city infrastructure. By adopting these initiatives you will empower building owners and place them on the path to more resilient buildings citywide. With these changes tenants and owners can potentially rely on continued operation after future events such as Sandy. These reports confirm our own recommendations included in our Post-Sandy Initiative Report released in May as to how to build back better and smarter through recognizing and adapting to climate change and the risks it presents to the City of New York and the surrounding region.

#### Feedback

Identifying a framework for recovery, rebuilding and resilience is a necessity. We applaud and agree with the assessment that changing sea level and global warming weather patterns will require adjusting our response and building practices in the future. We see the need, an outline, for an effective feedback loop as we implement the policies and plans offered in the reports.

#### Scalability

We recommend that scalable solutions be incorporated into the phasing implementation outlined in the SIRR report.

#### Regional Coordination

We recommend a regional recovery conference and the sharing of all regional resilience recommendations as course of business to better coordinate resiliency efforts. A comprehensive regional plan with respect to the hydrocycle will be increasingly critical as resources become less predictable.

#### Insurance and Urbanity

We support and recommend the many proposals that broaden access to insurance for those less able to afford it while researching ways in which risk and reconstruction can be adjusted to ensure equity as we move forward. We advocate for clarity on insurance, land use and new design flood regulations. We recognize that many of the areas that suffered disastrous effects of inundation now face the disaster's economic effects of higher insurance and costs of meeting new regulations. These areas are low to moderate income neighborhoods with old housing stock that are far from current building code practices and safety measures.

### Good Samaritan Act

Furthermore we support and advocate for the passage of the Good Samaritan Act in the state legislature and ask for your support for passage of Resolution 1771 sponsored by Minority Leader James Oddo and included on today's agenda. Passage of such legislation would offer protection from liability to professional engineers, architects, landscape architects and land surveyors who render voluntary services at the scene of a natural disaster.

### Awareness and Education

We believe in education of the public to take resilient measures and embed awareness of public safety measures into the context of daily life in New York. This is most important in general and should start at the level of primary school education.

### Communication

We recommend that all steps be taken to insure workable and broad communications during catastrophic events. The delay in getting good information to many effected during hurricane Sandy led to extreme deficiencies in basic services and provisions in these areas.

### Energy

We believe that continuing the push to make our buildings more energy efficient is one of the most important first steps to effect great change in our City and benefit future generations. The Energy Conservation Code is further enhanced by requiring the use of specified energy efficient materials even where alterations to existing buildings are minor involving, for example, only the replacement of glazing, roofing, lighting or doors. Increased insulation reduces required energy infrastructure, reduces carbon emissions and makes buildings more resilient when there are power outages.

### Water

We agree with, support, and recommend all points in reference to water availability, purity, and discharge be carefully and completely thought through. Additionally, information about these preparations must be readily available at times and places where it is needed.

### Leadership and Continuity

We recommend that throughout the many changes, physical rebuilding and policy making underway that the City Council considers resilience through Institutional memory to ensure continuity in the implementation of these long term efforts.

We have also provided you with copies of the Post Sandy Initiate Report, assembled by 300+ volunteers and design professionals and refer you to the FEMA 361 guidelines as an additional resource.

In closing, we applaud the City Council for putting forth these pieces of legislation and the administration, and the members of the SIRR committees, and members of the Building Resiliency Task Force who have assembled these reports and we urge passage of the relevant legislation that supports our collective goals.

Sincerely,

Jill Lerner, AIA, 2013 President

Lance Jay Brown, FAIA, Vice President, President Elect,  
Co-Chair, Design for Risk and Reconstruction

Illya Azaroff, AIA, Co-Chair, Design for Risk and Reconstruction  
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Good afternoon Chair Members and Members of the Committees on Housing and Buildings, Environmental Protection, Parks and Recreation, Transportation and Waterfronts. My name is Dorothy Harris. I am the Vice President of State & Local Government Relations and your liaison to the International Code Council. The International Code Council (ICC), a member-focused association dedicated to helping the building safety community and the construction industry provide safe and sustainable construction through the development of codes and standards used in the design, build and compliance process. Most U.S. communities and many global markets choose the International Codes and since the 2008 adoption of the new building and fire codes, NYC also uses the International Codes as the basis for the City Construction Codes. The mission of the ICC is to provide the highest quality codes, standards, products, and services for all concerned with the safety and performance of the built environment.

I am honored to be here today to discuss rebuilding after Sandy and the opportunities for improving the resiliency of the City's infrastructure. Earlier this week, I appeared before Housing and Buildings Committee in support of Int. No. 1056, which will amend the Administrative Code of the City of New York, the New York City Building, Mechanical, Plumbing and Fuel Gas Codes by updating these NYC Codes with the 2009 editions of the model International Building, Mechanical, Fuel Gas and Plumbing Codes, along with NYC specific modifications. The passage of Int. No. 1056 is critical to any rebuilding following Sandy, because it will ensure up to date building construction standards including the latest FEMA requirements are in place to ensure the safety and resiliency of all new construction.

The International Codes are currently adopted at the state or local level in all 50 States, the District of Columbia, Guam Puerto Rico, the US Virgin Islands and the Northern Marianas Islands. The International Codes are revised and updated every three years by a national consensus process that strikes a balance between the latest technology and new building products, economics and cost while providing for most recent advances in public and first responder safety and installation techniques. The updated model International Codes (I-Codes) thereby ensure safety, energy efficiency, sustainability and long-term resiliency of the built environment. The I-Codes are correlated to work together without conflicts so as to eliminate confusion in building design or inconsistent code enforcement among different jurisdictions. The ICC Code Development Process is an open, inclusive process that encourages input from all individuals and groups and allows those governmental members, including representatives from federal, state and local government, including NYC, to determine the final code provisions.

New York City is one of many jurisdictions that values public and first responder safety and the protection of our built environment by updating building, fire, plumbing and energy codes every three years. By regularly updating your building construction and fire safety codes every three years, the City provides the safest, most technically advanced and economically balanced climate for its citizens since these updated codes allow the use of new construction standards, methods or materials while ensuring safety, sustainability and resilience to natural disasters like Sandy. Keeping current with the most up to date model codes and standards is essential to the mitigation of the many risks posed by natural or man-made disasters. In fact, benefits of building to regularly updated codes can include improved safety,

reduced construction and maintenance costs, energy savings and lower insurance premiums. For instance, every dollar invested on constructing safer and stronger buildings on average reduces losses from high wind damage, floods, earthquakes and other disasters by \$4 according to a report issued by the Multi-Hazard Mitigation Council of the National Institute of Building Science.

As evidenced by the various organizations that participate in the ICC Code Development Process, many of the code change proposals each code updated cycle deal with hazard mitigation and lessons learned from various natural disasters. For example, FEMA and the American Society of Civil Engineers collaborate at the code development hearings, to propose and gain adoption of numerous disaster-resistant provisions for earthquake, wind, and flood hazards. Representatives participate in various code and standards committees to lend insight to code-related studies. As a result, several improvements have been made over the last few code cycle updates such as updated flood maps and requirements for flood enclosures (vents) and improved roof drainage requirements, updated wind maps and wind load requirements (based on the 2010 ASCE/SE 17 Standard for Minimum Design Loads for Buildings and Other Structures), design standards for storm shelters and reference to ICC 500 (ICC/NSSA Standard for the Design and Construction of Storm Shelters). Other requirements help mitigate wind damage by prohibiting loose roofing material finishes and provisions for securing building Exterior Insulation and Finish Systems (EIFS) to prevent wind damage that would expose the building to weather elements or create flying debris that could damage other structures. Seismic requirements have also been updated over the last two update cycles of the model IBC.

I was privileged to participate in the activities of the Building Resiliency Task Force (BRTF). The Members of the various Committees took their roles seriously and I would like to commend the Mayor, the Speaker, the City Council and the Urban Green Council who led the BRTF for its outstanding work to ensure the safety, health and well being of its citizens. You have several bills before you today that were specific recommendations of the BRTF. While I am in support of these bills, I would only caution the Committees to be sure to coordinate these bills with Int. 1056 as outlined above so that proper administration and enforcement of the new NYC Construction Codes can occur without any unintended consequences.

Additionally, one of the recommendations outlined in the Building Resiliency Task Force Report is for the City to next adopt an Existing Building Code based on the International Existing Building Code (IEBC) that addresses alterations, additions and changes of use in already existing structures. Therefore, the ICC and all of our technical resources stand ready to assist the City as it moves forward with the review, adoption and implementation of these additional construction codes in the near future. Thank you for the opportunity to present testimony to you today. I am happy to answer any questions you may have or provide additional documentation.



**Metropolitan Waterfront Alliance**

Testimony of Roland Lewis, President and CEO

**Before the Committees on Waterfronts, Housing and Buildings, Environmental Protection,  
Parks and Recreation and Transportation**

June 27, 2013

Good afternoon, and thank you for the opportunity to submit this testimony. I am Roland Lewis, President and CEO of the Metropolitan Waterfront Alliance (MWA). The MWA is a coalition of over 730 businesses, community and recreational groups, educational institutions, and other stakeholders committed to transforming the New York and New Jersey Harbor and its waterways to make them cleaner and more accessible, a vibrant place to play, learn, and work with great parks, great jobs, and great transportation for all.

Superstorm Sandy sounded a wakeup call across the five boroughs: natural disasters beget a whole host of problems for coastal cities. I applaud Speaker Quinn and the City Council for their aggressive approach to preparing New York for the hazards of climate change and extreme weather. In particular, I am pleased to see that the Council recognizes the critical need to improve our infrastructure, from wastewater treatment to transportation. The effects of Sandy demonstrated once again that New York's surface and rail transportation infrastructure is highly vulnerable to disasters. Therefore, in addition to elevating buildings and protecting utilities, New York City should retrofit the waterfront for ferry service to facilitate waterborne evacuation and transit recovery.



As extreme weather events continue to grow in frequency and severity, it is essential that New York adapt its transit network so it is sufficiently prepared to respond to, and recover from, emergency events. As waterborne vessels, ferries are relatively immune to power outages, obstructed roads, and impassable bridges or tunnels. That is why ferries were the first mode of transport to resume service after Sandy, while the MTA worked for months to restore damaged subway tracks and tunnels. Time and again, in natural and man-made disasters, ferries have proven to be the most resilient mode of transportation, central to all contingency transportation plans. However, in order to maximize the utility of ferries in disasters and ensure that we are adequately prepared for the future, the City must make targeted investments in coastal infrastructure and water mass transit throughout the five boroughs.

At present, New York City suffers from a dearth of coastal infrastructure for ferryboat tie-up. Legal regulations require that all airplanes, public buildings, and subway cars be equipped with unobstructed emergency exits to allow for quick and safe evacuations. Though fringed with a 520-mile coastline, New York City lacks analogous requirements for waterborne evacuation points. The vast majority of New York City's marine edge either precludes public access entirely or is designed for passive use, while opportunities for active maritime use and water access are extremely limited.

Design guidelines should call for the retrofitting of the City's coastline with landings, gangways, cleats, and bollards at strategic points to ensure ample tie-up opportunities. Waterfront neighborhoods with a particular dearth in both public transportation and landing facilities should be prioritized for new infrastructure, while existing infrastructure—regardless of present use or

future development plans—should be preserved in order to ensure that ferries and other emergency vessels can safely receive and transport passengers during evacuations. To help achieve these goals, the City should seek a commitment from permitting agencies to support new coastal infrastructure that is large enough to accommodate an adequate number of appropriately sized vessels.

Beyond a shortage of tie-up space and access points, New York City lacks capacity for large-scale waterborne evacuation, which may become increasingly necessary in the future, as global climate change results in increased frequency and severity of extreme weather events. Even with proper coordination, mass waterborne evacuations may be hampered by a shortage of berthing space and inconsistently configured landings. For example, the East 35th Street ferry landing, the primary point of waterborne egress on the East Side of Manhattan, can accommodate up to four vessels at a time, while the Hunters Point ferry terminal, located directly across the river from East 35<sup>th</sup> Street, has berthing space for just one boat. During an emergency, this can result in prolonged queuing and overcrowding. Moreover, while high capacity vessels are highly effective during emergency evacuations, many ferry landings, particularly those on the East River, are too small to accommodate them. For instance, Seastreak's fleet boasts four 505-passenger ferries, among the highest-capacity passenger vessels in the New York Harbor. However, New York's waterways lack sufficient landing sites large enough for these essential boats to dock.

By creating symmetrical capacity at ferry landings, the City can ensure that all boats departing from one side of the river will be able to quickly and effectively transport evacuees to safety and, if necessary, turn back and pick up additional passengers. Moreover, coordinating landing and

ferry capacities will enable more seamless, efficient evacuations in which all involved vessels can safely transport New Yorkers to the greatest number of points along the coast.

During emergency events that results in power outages and transit shutdowns, New Yorkers instinctively flock to piers and landings, waiting in long lines to board ferries and rescue boats. Time and again, this phenomenon leads to overcrowding, delays, and inefficiencies as available vessels are overwhelmed by passenger demand. Transit experts have consistently recommended adding more inter-borough ferry routes in order to mitigate congestion on both the water and the land. This is crucial because ferries' ability to provide redundancy in contingencies is greatly affected by the availability of vessels and landings in New York's waterways. Given the rapid population growth projected in coming decades—with nearly a million new New Yorkers expected by 2030—the best way to achieve these investments is to expand citywide ferry service. Growing water mass transit will strengthen the City's capacity for waterborne evacuation and the effectiveness of its emergency response.

Thank you for the opportunity to deliver this testimony.



## **New York City Environmental Justice Alliance**

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**New York City Environmental Justice Alliance testimony to the New York City Council Committees on Housing and Buildings, Environmental Protection, Parks and Recreation, Transportation, and Waterfronts:**

### **“Oversight – Rebuilding After Sandy and Improving the Resiliency of the City’s Infrastructure”**

June 27<sup>th</sup>, 2013

Founded in 1991, the New York City Environmental Justice Alliance (NYC-EJA) is a non-profit city-wide membership network linking grassroots organizations from low-income neighborhoods and communities of color in their struggle for environmental justice. NYC-EJA empowers its member organizations to advocate for improved environmental conditions and against inequitable environmental burdens. Through our efforts, member organizations coalesce around specific common issues that threaten the ability of low-income communities of color to thrive and coordinate campaigns designed to affect City and State policies. The impact of climate change and mitigation measures is central to NYC-EJA’s agenda, and therefore, we would hereby like to testify in support of the bills that have been put forth by the City Council. We appreciate the opportunity to advocate for an equitable recovery process that integrates regional rebuilding efforts with local resiliency priorities, strengthens vulnerable communities & addresses public health impacts, expanding community-based climate change planning, preparedness & response.

#### **NYC-EJA’s Waterfront Justice Project**

In 2010, NYC-EJA launched the Waterfront Justice Project, New York City’s first citywide community resiliency campaign. When the City of New York initiated its overhaul of the Comprehensive Waterfront Plan (Vision 2020) in 2010, NYC-EJA began an advocacy campaign to convince the Bloomberg Administration to reform waterfront zones designated as the Significant Maritime and Industrial Areas (SMIAs.) These are zones designed to encourage the clustering and concentration of heavy industrial and polluting infrastructure uses. There are only six SMIAs in the City – all are located in classic “environmental justice” communities (the South Bronx, Sunset Park, Red Hook, Newtown Creek, Brooklyn Navy Yard & the North Shore of Staten Island) and predominantly low-income communities of color. Development applications in SMIAs are treated differently – and to a lower review standard – than other waterfront areas, thereby easing the siting and clustering of polluting infrastructure.

As part of these efforts, NYC-EJA discovered that the six SMIAs are all in hurricane storm surge zones, and that the City of New York had not analyzed the cumulative contamination exposure risks associated with clusters of heavy industrial use in such vulnerable locations. In collaboration with Pratt Institute, NYC-EJA began a research project to assess facilities that use, transport, or store hazardous or toxic substances in order to identify community vulnerability for those working and living in and around SMIAs in the event of severe weather. Preliminary results of this research were presented as part of NYC-EJA’s testimony to the New York City Council Committee on Environmental Protection at the

Hearing on Climate Change Impacts and Mitigation Measures in New York City that took place on December 16, 2011, and to the Committee on Public Safety at the hearing on Hurricane Sandy After Action Report And Recommendations that took place on June 20th, 2013.

### **The Sandy Regional Assembly**

Following the aftermath of Superstorm Sandy, NYC-EJA co-convened the Sandy Regional Assembly, an association of environmental justice organizations, community-based groups, labor unions and our allies from Superstorm Sandy-impacted and storm surge-vulnerable areas in New York City, New Jersey and Long Island. Nearly 200 participants representing over 40 organizations participated in a January 2013 meeting to assess the aftermath of Sandy and the role of local communities in the Sandy Recovery process. Together, we are advocating for a grassroots-led recovery that includes priorities of low-income people, communities of color, immigrants, and workers. Participants of this meeting discussed goals and recommendations that structured a Recovery Agenda, available at [www.nyc-eja.org](http://www.nyc-eja.org). The Agenda was released on April 1<sup>st</sup> 2013, and emailed to the City Council after that. In addition, this agenda was handed that month to representatives of the Mayor's Special Initiative for Rebuilding and Resiliency (SIRR) for their incorporation in the City's recovery plan.

The following recommendations are submitted to the City Council based on the research that NYC-EJA has developed as part of the Waterfront Justice Project, and the goals articulated in the Sandy Regional Assembly Recovery Agenda.

- 1. As part of the City Council's efforts to address building safety and the potential exposure of hazardous substances and toxic chemicals, we urge you to consider the following recommendations:**

*(BRTF 3 Protect Building Systems; BRTF 4 Allow Elevation of Building Systems; BRTF 7 Safeguard Toxic Materials; BRTF 8 Prevent Sewage Backflow; BRTF 10 Flood Construction Manual; BRTF 11 Prevent Wind Damage; BRTF 12 Analyze Wind Risk; and BRT 28 Create Emergency Plans.)*

- a. Require a detailed investigation of the impacts of Superstorm Sandy, particularly as they relate to potential cumulative hazardous exposure risks in industrial waterfront neighborhoods:**
  - Require a full report and detailed documentation of DEP's post-Sandy inspection of facilities in compliance with Local Law 26 of 1988 (the "NYC Right-to-Know Law") that reported spills of hazardous substances following Sandy. This should include the location, type of substances and volume, for the reported spills. *See the City's Special Initiative for Rebuilding and Resilience (SIRR) report "A Stronger, More Resilient New York" (June 2013), at p. 201.*
  - Assess environmental health impacts of potential cumulative hazardous exposures by conducting a Community Health Investigation to determine health impacts of post-Sandy contamination and health hazards, including an analysis of the impacts on community first responders, recovery workers, and clean-up volunteers.
- b. Require that emergency response plans and trainings, as well as accident investigations and risk assessments, required by the New York City Community Right-To-Know Law, should involve neighboring communities:**
  - Require that emergency response plans and trainings should be public and accessible to neighboring communities living or working in/around industrial waterfront neighborhoods.



- Require that accident investigations and risk assessments should be developed in consultation with neighboring communities living or working in/around industrial waterfront neighborhoods.
  - Prevent environmental hazards after disasters, by training recovery workers and first responders on protocols for hazardous materials and contaminants, including neighboring communities who may volunteer for these activities during/after future severe weather events.
- c. Address potential public health impacts of climate change on vulnerable industrial waterfront neighborhoods, addressing the special requirements of industrial buildings and open industrial sites:**
- Identify industrial waterfront threats by funding a participatory investigation of public health risks associated with potential exposures to industrial clusters of hazardous substances and toxic chemicals handled, manufactured and transferred -- not just stored - - in industrial facilities and sites vulnerable to climate changes impacts, such as storm surge, high winds, and sea-level-rise -- not just flooding.
  - Identify the opportunities to mitigate potential hazardous exposures through a collaborative effort between community, industry and government -- where all of these stakeholders can participate in identifying the needs of local industrial operators, and identify existing and required technical and financial resources for implementation. This should result in an incentive-based process to support building adaptation and pollution prevention, not just in stronger regulation.
- 2. As part of the City Council's efforts to create energy security, we urge you to consider the following recommendations:**

*(BRTF 6 Backup Fire Safety Communication; BRTF 14 Cool Roof Surfaces; BRTF 17 Voluntary Emergency Power Systems and Natural Gas; BRTF 20 External Electrical Hookups; and BRTF 21 Backup Residential Lighting.)*

- a. Reduce vulnerabilities by requiring redundant, distributed, sustainable systems, and providing technical and financial resources for implementation:**
- Require back-up power systems in vulnerable areas that will maintain critical building systems (elevators, heat, hallway lights, and water) in the event of power outages.
  - Require solar-powered wireless and cell phone charging stations in vulnerable areas prior to severe weather events.
  - Identify strategies to decentralize energy infrastructure and create distributed networks of sustainable energy sources.
  - Reduce dependency on fossil fuels (e.g., encourage expansion of alternative fuel vehicular fleets, expedite conversions/switches of cleaner heating fuel for large buildings, support repowerings for dirty electricity-generating "peaker" units, etc.)
  - Support solar energy projects that will generate power when the electrical grids go out in storm surge vulnerable areas. (One example is the North Brooklyn Community Solar Initiative to generate back-up power for First Spanish Presbyterian Church in Williamsburg: This can serve as a model for solar back- up power in critical facilities such as schools, nonprofits, churches, etc., near vulnerable waterfront areas.)

**3. Finally, as part of the City Council's general efforts to strengthen the rebuilding process and build community resiliency, we urge you to consider the following recommendations:**

**a. Address the specific needs of vulnerable populations:**

- Support disaster plans and building adaptation measures focused on the most vulnerable population, including people with disabilities, residents in long-term care facilities, immigrant communities, seniors, youth, people with limited English proficiency, people with language access plans or disability plans, and residents of industrial waterfront communities vulnerable to storm surge.
- Include vulnerable populations in planning and outreach activities and create multilingual outreach materials.

**b. Support local climate resilience and community-based planning initiatives:**

- Encourage technical assistance grants for policy and planning networks and community-based organizations with histories of effective advocacy partnerships promoting environmental justice, resiliency and sustainability with the most vulnerable communities: Sandy funding to support planning should not be dedicated exclusively to local or municipal planning agencies. Funding should also support community-based initiatives to reduce vulnerability through research, training, and emergency preparedness.
- Support Comprehensive Community Disaster Preparedness Plans built around community driven planning and local priorities. Utilize community plans that already provide adaptation/resiliency strategies, such as Sunset Park's & Williamsburg's 197-a plans and the Hunts Point Vision Plan.
- Create Interagency Climate Adaptation Teams for each Community Board. All agencies (City, State, Federal) that work in those communities must participate.

**c. Create community oversight and inclusive decision-making:**

- Guarantee that City recovery efforts authentically include local/neighborhood/grassroots involvement beyond "invitation-only" style meetings.
  - Require that NYC's Special Initiative for Rebuilding and Resilience (SIRR) related and successor plans/processes be more participatory.
  - Require that government and task force decision-making be transparent, including any amendments to the recovery plans.
- Ensure community oversight of CDBG and other funding decisions:
  - Obligate local officials to keep track of federal funding expenditures.

We commend the Committees on Housing and Buildings, Environmental Protection, Parks and Recreation, Transportation, and Waterfronts for holding this hearing, allowing everyone an opportunity for public comment to offer insight into the recovery process. The City Council plays a critical role in ensuring that New York City fully recovers from Superstorm Sandy, and builds the resiliency required to face the challenges posed by future climate change impacts.



**TESTIMONY OF PAUL GALLAY, PRESIDENT OF RIVERKEEPER, INC. TO THE NEW YORK CITY COUNCIL COMMITTEE ON WATERFRONTS, ET AL REGARDING POST-SANDY RESILIENCY PLANNING AND LEGISLATION**

Riverkeeper greatly appreciates the opportunity to provide our perspective on the City Council's proposed local laws addressing the current and future resiliency of New York City's infrastructure in the wake of Superstorm Sandy. We strongly support Mayor Bloomberg and the City Council's efforts to take concrete steps to better prepare the city and its residents for future severe storms and sea level rise. Riverkeeper has provided input directly to the city on the preparation of the Special Initiative for Rebuilding and Resiliency (SIRR) report, as well as the ongoing Open Industrial Uses Study (OIUS), and is committed to participating as the recommendations of these studies are implemented in the future. We would like to thank Mayor Bloomberg for soliciting Riverkeeper's involvement in these critical initiatives.

The economic vitality of New York City and the ecological health of the shared waterways surrounding it both depend on future planning that embraces a sustainable approach to strengthening the city's built and natural infrastructure to reduce the impacts of future storms and sea level rise. In this context, sustainability means maximizing the use of natural systems such as tidal wetlands, oyster reefs, dunes and soft shorelines to absorb rising waters while ensuring that the protection of life and property are given the highest priority. The specific comments on the SIRR report and the proposed NYC local laws reflect this principle.

**Comments on SIRR Report**

Riverkeeper commends Mayor Bloomberg and his staff for the work done on the SIRR report. The report provides a wealth of information on the impacts and responses to Sandy, as well as valuable analysis of a range of actions to increase the city's climate resiliency. Consistent with our mission to protect and restore the Hudson River Estuary, Riverkeeper is primarily focused on recommendations in the report that would impact the Hudson River and Upper New York Harbor directly, such as the construction of storm barriers and expansion and restoration of tidal wetlands and oyster reefs. As noted previously, Riverkeeper fully supports the report's recommendations to restore wetlands, natural shorelines and reefs to better absorb the volume and strength of storm surges and inundation events. We encourage the city to look for additional opportunities, beyond those highlighted in the report, to utilize our natural infrastructure to best effect.

While Riverkeeper appreciates the breadth and depth of analysis in the SIRR report, we do have concerns about some of the report's proposals. Riverkeeper supports in principle the need to prevent or reduce flooding in certain vulnerable areas of the city with the use of storm barriers, but it is critical that such projects undergo the most rigorous environmental review possible before moving forward. The SIRR report's recommendation to build storm barriers at Newtown

Creek, the Gowanus Canal and Rockaway Inlet are clearly intended to reduce flooding, and we support that goal. However, we have concerns about the impacts that such permanent in-water structures could have on water quality in the Estuary, and the possibility of unintended consequences that may flow from using storm barriers on waterways that are plagued with high volumes of combined sewer overflow pollution. Any plan for building storm barriers in these areas should fully assess the potential risk of flooding behind such a barrier when it's closed, as well as the risk of overflowing sewer discharges increasing water contamination and localized flooding during storm and heavy rain events. The city should also carefully consider the impact that storm barriers could have on the use of these waterways for waterborne recreation and commercial marine traffic. Riverkeeper has a long history of avidly protecting and expanding public access to our shared waters, and we are confident that recreational and commercial use of Newtown Creek and the other waterways can be maintained and even expanded without restricting the city's ability to reduce storm risk in these areas.

Riverkeeper is also very concerned about Mayor Bloomberg's proposal to build "Seaport City" on landfill on the Lower East Side of Manhattan. Expanding the city's physical footprint by filling a portion of the East River is both unwise and impractical, and would result in unacceptable, permanent impacts to the marine environment in New York Harbor. Riverkeeper opposes any proposal to fill areas of the Harbor or Hudson River, particularly when the primary purpose is to provide opportunities for private development. Rather than seeking to use the SIRR process as an avenue to expanding commercial development in waterfront areas of New York City, the city should focus its efforts on making Manhattan as resilient and sustainable as possible, without expanding Manhattan's land area at the expense of the Harbor. Any future development in low-lying and flood-zone areas must be carefully considered and dictated by science and the facts about what the natural environment can endure.

### **Comments on NYC Council Proposed Local Laws**

Riverkeeper respectfully offers the following comments on the proposed bills.

First, we strongly support *Int1094-2013* and *Int1086-2013*, which will ensure New York City residents have access to drinking water and working sanitary facilities in the event of a black out.

Riverkeeper supports *T2013-6556*, which would vest the Office of Long Term Planning and Sustainability with a lead role in ensuring that sustainable city planning include initiatives on coastal protection and critical infrastructure resiliency.

We also support *Int1088-2013*, which will advance permeable pavement. Riverkeeper has long advocated for the use of green infrastructure as an essential element of city planning to reduce stormwater pollution and improve the livability of New York City. We support the overall goals of the city's Green Infrastructure Plan, currently being implemented by the Department of Environmental Protection (DEP), and recommend that reports produced pursuant to this law be submitted to DEP and fully integrated into the Plan to avoid redundancy and improve overall implementation of Green Infrastructure projects citywide.

Riverkeeper supports *Int1098-2013*, which would prevent backflow of sewage through building drains and storm drains in the special flood hazard areas.

In regards to *Int1093-2013*, which enables the use of temporary stairs, ramps, and removable dry flood proofing for buildings in the special flood hazard area, we recommend that these allowances be extended to buildings in the moderate flood hazard area as well. *Int1096-2013* and *Int1089-2013* would enable all flood prone areas (including the moderate flood hazard areas) to prepare for flooding. This is a good practice that should be included in *Int1093-2013*.

Finally, Riverkeeper has serious concerns about the storage of toxic materials and hazardous waste in waterfront areas of the city vulnerable to flooding. Hurricane Sandy's storm surge and inundation flooding resulted in a slurry of hazardous and toxic substances being released into the environment, including petroleum that contaminated our waterways and raised public concern about potential health effects to people working and living in flooded areas. While we support the requirement laid out in *Int1102-2013* that extremely hazardous and regulated toxic substances located in the special flood hazard area be dry flood proofed or raised above the design flood elevation, we strongly encourage that these requirements be extended to facilities in the moderate flood hazard areas. We believe taking a conservative approach to securing hazardous materials against future storms and sea level rise would be prudent, given the public health and environmental hazards associated with these substances.



The North Shore Waterfront Conservancy of Staten Island, Inc.  
P.O. Box 140502  
Staten Island, New York 10314

June 24, 2013

On behalf of the North Shore Waterfront Conservancy of Staten Island, Inc., and the Environmental Justice (EJ) and Waterfront Communities that we advocate on behalf of we would like to thank you for allowing us to testify at this hearing today.

Currently there are approximately 9 development projects taking place in Staten Island's North Shore E J and Waterfront Communities. All of these projects will have to undergo a government permitting process. And receive the approval of our officials and City Council and the City Planning Commission. Yet in 8 of the 9 of these projects' Environmental Assessment and/or Environmental Impact Statements the writers have declared No Negative Impacts, No Significant Impacts and therefore No Mitigation is required. Having Mitigation as a requirement would have been the most obvious way of correcting the environmental injustices that have long plague these communities and destroyed their quality of life. Yet Mitigations were not required not even to Shore Up the communities holistically from Climate Change. Why would any governing body whose purpose is to protect and better the lives of its people pass on this opportunity?

Staten Island's E J communities need open spaces at our waterfront in our communities that are large enough in size to accommodate our people population. Currently 48% of our residential communities are a quarter mile to the nearest park. Whereas in New York City as a whole 91% of the residents live within a quarter mile of a park. Having public active recreational spaces at the waterfront that serve dual purposes of not only being there for exercise, but also to protect our waterfront communities from the effects of Climate Change is critical.

Then perhaps at long last we can have oyster and mussel gardens along our waterfront to act as filters and buffers in remedying the pollution of the Kill Van Kull, Lower Newark Bay and the Arthur Kill rivers. That are in violation of the Clean Water Act.

NSWC has been fighting diligently to educate our people of the importance of the tidal and fresh water wetlands in the EJ communities. And the necessity of maintaining our harbor estuaries like Arlington Marsh and Cove. So that it won't be so easy for people to come in and tell us untruths such as that these wetlands are insignificant. And attempt to take away this vital resource.



What we are sure about is that the contradictions in how the Climate Change Resiliency and Adaptation agenda is being administered and governed must be reconciled especially in the EJ communities.

The events of Katrina and Sandy have proven that we can not fight nature, but we can be a better ally. We can also do a much better job at protecting all of our people in this time of uncertainty in terms of the policies, procedures, laws, regulations and guidelines especially in how they are administered and enforced.

Climate Change necessitates that NYC Parks' role must change and as Parks responsibilities increase so must its budget. NYC Parks must be given a budget that will allow it to be properly staffed and the resources to maintain its properties. In turn Parks' budget cannot be used as a default bank account for when some other area of the City cannot make its debt.

New York City is going to have to become EJ resident friendly and not look for opportunities of dodging its duties to its people. While being the first to hold its residents accountable to pay for the misuse of revenue with higher taxes, fees, surcharges and cost of living expenses while providing very little in tangible results that reflect in benefits to our EJ communities. It brings us little comfort that you have known about our vulnerability to Climate Change for 35 years and have failed to do anything about it.

Our City government is going to have to take responsibility and stop looking for other states and/or the Federal Government to bail us out because of its poor decisions - that are repeatedly made. At this point the people who are being most effected daily are looking for real, practical solutions that are sustainable... to deal with our very real environmental problems.

In Staten Island's case we only have 4 bridges and a ferry that runs every 30 minutes if we are lucky, 5 emergency shelters and approximately 400,000 plus people. And there just comes a time when we have to say - just because we can do certain things doesn't always mean that we should. Especially if you don't have the infrastructure to support it.

Thank you for your time and consideration.

Sincerely,

Beryl Thurman, Executive Director/President  
North Shore Waterfront Conservancy of Staten Island, Inc.

# New York Environmental Law and Justice Project

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## Public Hearing

Council Chambers - City Hall

Thursday June 27, 2013

***Re: The introduction of Local Law no. 1088 to amend the administrative code of the city of New York, in relation to water retentive sidewalks and a study on absorptive street and sidewalk materials and alternative street angulation.***

### Testimony before the Committee on Transportation

Good morning. My name is Celia Tutunjian and I am an intern at New York Environmental Law and Justice Project. Thank you for having this hearing. I am here today to make several recommendations regarding local law no.1088:

- 1- Besides addressing the anticipated costs of absorptive materials and the projected durability of such materials, the proposed study should include a cost benefit analysis which highlights the potential estimated cost savings from avoided runoff. These include avoided infrastructure and building damage, avoided thermal and chemical pollution, avoided sedimentation, and avoided biotic decline. In fact, reducing the flow of runoff can decrease the thermal shock to aquatic life in the waterways into which runoff drains. The study should assess the potential of absorptive materials to provide this benefit.
- 2- The study should also evaluate methods of rehabilitation to restore the porosity of water retentive materials, and provide an estimate of those costs<sup>1</sup>.
- 3- The proposed law no.1088 does not address the need of a thorough site evaluation before the implementation of the pilot program in three different locations in three different boroughs. To reduce the chances of failure of adopting absorptive materials, the study should incorporate site evaluation criteria set by the EPA, as well as a survey of sub-soils, groundwater conditions, and drainage characteristics<sup>2,3</sup>. The three proposed sites for the installation of absorptive materials should look into factors such as infiltration, geotechnical, and hotspot conditions, as well as topographic evaluations<sup>4</sup>. The areas selected for the installation of absorptive pavements and streets should not be areas of moderate to high traffic and significant truck traffic<sup>5</sup>.

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<sup>1</sup> Storm Water Technology Fact Sheet, Porous Pavement. EPA 832-F-99-023. September 1999.

<sup>2</sup> Storm Water Technology Fact Sheet, Porous Pavement. EPA 832-F-99-023. September 1999.

<sup>3</sup> Stormwater Management Design Manual. Center for Watershed Protection. August 2010.

<sup>4</sup> Stormwater Management Design Manual. Center for Watershed Protection. August 2010.

<sup>5</sup> Storm Water Technology Fact Sheet, Porous Pavement. EPA 832-F-99-023. September 1999.

- 4- The study should address the problem of potential fuel leaking from vehicles, as well as the leaching of toxic chemicals from asphalt and/or binder surfaces<sup>6</sup>. Because the voids of water retentive paving risk to be clogged, the site selection of permeable paving should adhere to manufacturer's specifications and maintenance<sup>7</sup>.
- 5- The law could look into the possibility of adopting cool pavements in order to counteract the Urban Heat Island Effect. Roads and pavements with higher albedo reflective materials can store less solar heat and emit less heat, which can reduce daytime and overnight temperatures<sup>8</sup>. Adopting cool pavements could decrease summertime peak energy demand and air conditioning costs<sup>9</sup>. This would reduce the emission of air pollutants and greenhouse gas emissions from power plants, and the formation of ground-level ozone<sup>10</sup>. Cool pavements can control the temperature of storm water released into streams and rivers, and reduce the likelihood of rapid temperature changes which can cause stress to aquatic ecosystems<sup>11</sup>. Depending on the technology adopted, cool pavements can also provide other benefits such as improved water quality, increased pavement life, reduced noise and enhanced nighttime illumination<sup>12,13</sup>.
- 6- The law could also incorporate bioretention systems to reduce runoff and improve water quality. Trees and other types of vegetation can reduce the volumes and velocities of storm water through intercepting rainfall and evapotranspiration.<sup>14</sup> Trees can filter and treats rainwater, and can store elements such as nitrogen, phosphorous and fine particulate matter<sup>15</sup>. The shade of trees can slow the deterioration of street pavement, thereby reducing pavement maintenance needs and associated costs<sup>16</sup>. And finally, the selection of trees and plants should promote diversity and native non-invasive species<sup>17</sup>.

Thank you for allowing me this opportunity to testify.

Celia Tutunjian

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<sup>6</sup> Storm Water Technology Fact Sheet, Porous Pavement. EPA 832-F-99-023. September 1999.

<sup>7</sup> Storm Water Technology Fact Sheet, Porous Pavement. EPA 832-F-99-023. September 1999.

<sup>8</sup> Brochure on the Use of Cool Pavements to Reduce the Urban Heat Island Effect, prepared by the Town of Gilbert, Arizona. <http://www.gilbertaz.gov/planning/urbanheatisland.cfm>

<sup>9</sup> Heat Island Effect. State and Local Climate and Energy Program. EPA. <http://www.epa.gov/heatisland/>

<sup>10</sup> Heat Island Effect. State and Local Climate and Energy Program. EPA. <http://www.epa.gov/heatisland/>

<sup>11</sup> Heat Island Effect. State and Local Climate and Energy Program. EPA. <http://www.epa.gov/heatisland/>

<sup>12</sup> Urban Heat Island Mitigation. EPA. <http://www.epa.gov/heatisland/mitigation/index.htm>

<sup>13</sup> Trees and Vegetation. EPA. <http://www.epa.gov/heatisland/mitigation/trees.htm>

<sup>14</sup> Stormwater Management Design Manual. Center for Watershed Protection. August 2010.

<sup>15</sup> Trees and Vegetation. EPA. <http://www.epa.gov/heatisland/mitigation/trees.htm>

<sup>16</sup> Trees and Vegetation. EPA. <http://www.epa.gov/heatisland/mitigation/trees.htm>

<sup>17</sup> Storm Water Technology Fact Sheet, Porous Pavement. EPA 832-F-99-023. September 1999.



**Council of New York Cooperatives & Condominiums**  
**INFORMATION, EDUCATION AND ADVOCACY**

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**FOR THE RECORD**

**TESTIMONY ON LEGISLATIVE PROPOSALS  
TO IMPROVE THE RESILIENCY  
OF NEW YORK CITY INFRASTRUCTURE**

Presented by Mary Ann Rothman, Executive Director  
June 27, 2013

My name is Mary Ann Rothman. I am the executive director of the Council of New York Cooperatives & Condominiums, a membership organization for housing cooperatives and condominiums located throughout the five boroughs of New York City and beyond. More than 170,000 New York families make their homes in our member buildings, which span the full economic spectrum from very modest housing to some very upscale dwellings. I speak also for the Federation of New York Housing Cooperatives and Condominiums, a sister organization with a similar membership base.

We have read with interest the many proposals currently under consideration, designed to strengthen the buildings and other infrastructure of our City and make them better able to sustain, and recover from, disasters. We support and applaud these efforts, but we are left with many questions.

We hope that more detailed explanations will soon be forthcoming, to help us understand the revised flood zones and what area each one encompasses. This will be an important first step toward determining which of our members are to be affected, how much time they will have to plan for compliance, and what the financial impact will be on them.

Thank you.

## **Oversight: Rebuilding After Sandy and Improving the Resiliency of the City's Infrastructure**

Joint NYC Hearing of the Committee on Housing and Buildings, Committee on Environmental Protection, Committee on Parks and Recreation, the Committee on Transportation, and the Committee on Waterfronts  
June 27<sup>th</sup>, 2013

*Sanjoy Banerjee, Distinguished Prof Chemical Engineering and Director of the CUNY Energy Institute at the City College of New York*  
*banerjee@che.ccny.cuny.edu*

First let me thank the distinguished members of the committees for holding joint hearings on this important topic and for the opportunity to speak. My name is Sanjoy Banerjee. I'm the Director of the CUNY Energy Institute located in the beautiful and historical City College of New York in Harlem.

When emergency strikes the city needs to be ready to provide shelter to citizens. As Sandy showed, storms can hit in patches seemingly randomly. The city needs to be able to adapt available facilities for shelter with only hour's notice and shelters need energy, sometimes for 3, 4 days. Diesel generators can last two days before the diesel runs out and the fuel supply chain may break as we experienced during the aftermath of Sandy. There is a need for a different type of energy. One that is compact and safe and can be stored and transported when and where needed quickly and easily. The CUNY Energy Institute has developed safe rechargeable Zn-Mn backup batteries that are, basically, rechargeable Duracell and will stay charged 10+ years. The batteries can be reused several hundred times and they are very compact – in fact they hold more energy per unit volume than the batteries in our phones. For example a 1MWh system – enough to run emergency systems of a large building for one day – will take 3,000 liters or 100 cubic ft. for the batteries and auxiliary systems. The whole system can be assembled in a transportable pod that is only 6 ft x 6 ft x 3 ft and weights less than two cars. One such pod will cost no more

than \$500,000, requires no maintenance, and can be easily transported where needed using the existing fleet of tow tracks. The batteries are plug and play and can be used (a) as the only source of energy, (b) to extend the life of diesel generators, (c) or to continue to harness the power of solar energy: charged during the day and used at night. One or more of such batteries, connected to the solar system of a building, can provide around-the-clock energy virtually making the building a microgrid. Such systems are not years away but are already being used by the military and the oil industry.

We encourage the members of the committees to come and see our facilities at City College and to continue to explore these alternative solutions to the extraordinary problems that NYC faces today. Thank you again for your attention and the opportunity to speak. I'm available to answer any question the members of the committees may have.



**STATEMENT OF THE NATURAL RESOURCES DEFENSE COUNCIL  
AT THE JOINT HEARING OF THE COMMITTEE ON HOUSING AND BUILDINGS,  
THE COMMITTEE ON ENVIRONMENTAL PROTECTION, THE COMMITTEE ON  
PARKS AND RECREATION, THE COMMITTEE ON TRANSPORTATION, AND THE  
COMMITTEE ON WATERFRONTS**

**“OVERSIGHT – REBUILDING AFTER SANDY AND IMPROVING THE RESILIENCE  
OF THE CITY’S INFRASTRUCTURE”**

**June 27, 2013**

Good morning, Councilmembers and City Council staff. My name is Johanna Dyer and I am an attorney with the Natural Resources Defense Council (NRDC), which, as you know, has been actively involved with New York City environmental issues for more than 40 years.

My colleagues, Eric Goldstein and Donna DeCostanzo, and I have reviewed the proposed legislation and we appreciate the opportunity to comment on the proposed package of bills, which are intended to help the city to prepare for and respond to future storms. Hurricane Sandy has demonstrated New York City’s vulnerability to destructive storms and other extreme weather events, which will only become increasingly frequent and severe, due to our changing climate. As the City formulates its response to this event, it is critical that we identify ways to strengthen and protect our buildings and other infrastructure, maximize the use of natural barriers and green infrastructure to enhance our resiliency, and take aggressive action to cut greenhouse gas emissions.

New York City has been leading the way on addressing climate change, implementing a number of groundbreaking policies and initiatives, particularly in the area of increasing energy efficiency in existing buildings. Of course, we strongly support the City’s continued efforts in this area, as well as the City’s work to strengthen and reduce unnecessary damage to our building stock and improve the resiliency of our infrastructure. And it is critical that we do everything necessary to maximize the use of natural infrastructure to absorb stormwater, and that critical building systems are strategically located to avoid problems resulting from potential flooding – goals that

are addressed by a number of the proposals before you today.

With such considerations in mind, we strongly support the legislation related to water-retentive streets and sidewalks, which would require the Department of Environmental Protection and the Department of Buildings to conduct a study of, followed by a pilot program for, the use of absorptive materials on streets. Importantly, the bill would also set a uniform standard for water retention in New York City sidewalks. The use of natural infrastructure and permeable surfaces to serve as natural sponges and absorb excess stormwater is critical to relieving the city's overburdened sewer system, and depending on the materials used, may have other environmental and climate-change benefits as well.

We would also like to highlight five other bills that NRDC believes warrant special attention.

We support legislation to reduce the urban heat island effect by expanding the City's cool roof requirements; the installation of cool roofs reduces energy use, air pollution and carbon emissions, while increasing comfort for residents and helping to prevent other heat-related impacts.

We also support the safe storage of hazardous materials in Special Flood Hazard Areas as outlined in the measure before you today, which would help to prevent water contamination and other public health and environmental threats in the event of flooding.

And we support the legislation requiring prevention of sewage backflow into homes in Special Flood Hazard Areas. For obvious reasons, preventing such backflow is an important measure to protect public health and quality of life in vulnerable communities.

In addition, we endorse the legislation designed to ensure emergency residential drinking water as a way to safeguard New York's drinking water access and supply.

Finally, we are pleased to support the addition of additional resiliency staff and advisors to the Office of Long-Term Planning and Sustainability and the sustainability advisory board.

In sum, we appreciate the continuing efforts of the Bloomberg Administration and the City Council to prepare for and respond to future storms, particularly where these measures encourage natural and environmentally beneficial measures to minimize potential harms. And we stand ready to work together with you on these and other post-Sandy matters in the months to come.

Thank you.

Portland Cement Association Testimony to the Joint Hearing of the Committee on Housing and Buildings, the Committee on Environmental Protection, the Committee on Parks and Recreation, the Committee on Transportation and the Committee on Waterfronts

June 27, 2013

"Oversight – Rebuilding after Sandy and Improving the Resiliency of the City's Infrastructure,"

Good morning/afternoon ladies and gentlemen of the Committees on Housing and Buildings, Environmental Protection, Parks and Recreation, Transportation and Waterfronts. My name is Ken Justice. I am here today on behalf of the Portland Cement Association whose Members manufacture and supply portland, masonry and blended cements, which are the key ingredients for ready mixed concrete, precast and prestressed concrete, concrete masonry units, masonry mortar, cast stone and all other cement based materials used by the NYC Construction Industry. I have a Bachelor's Degree in Civil Engineering from Villanova University and a Master of Civil Engineering Degree from North Carolina State University. I am a registered Professional Engineer in seven states including New York, New Jersey, Delaware and Pennsylvania. I am a LEED Accredited Professional. I would like to thank you for the opportunity to provide testimony on two proposed bills:

- NYC Council Intro 1087 Using Cool Roof Surfaces to Reduce Summer Heat.
- NYC Council Intro 1088 in relation to Water Retentive Sidewalks and a Study on Absorptive Street and Sidewalk Materials and Alternative Street Angulation

The PCA has been an industry leader in promoting more sustainable and disaster resistant communities. We applaud the leadership of Mayor Bloomberg and Speaker Quinn in calling for the formation of The NYC Building Resiliency Task Force and recognize the thousands of hours and months of time and talent invested by the more than 200 members of the Task Force. We commend the City Council for taking the next step toward translating a number of Task Force recommendations into local laws.

With respect to NYC Council Intro 1087 Using Cool Roof Surfaces to Reduce Summer Heat:

- Remediating the negative impacts of the Urban Heat Island Effect by amending the NYC Building Code to require the use of cool roof surfaces is a very prudent approach which we strongly support.
- PlaNYC, the NYC DOT Street Design Manual and the NYC DDC High Performance Infrastructure Guidelines all recognize the Urban Heat Island Effect. To quote Climate Change Initiative 10 of PlaNYC, "In densely built cities such as New York City, pavement and the surfaces of buildings produce what is known as the Urban Heat Island Effect. Both (pavements and building surfaces) store and radiate the sun's heat energy, leading to conditions in which air temperatures are often several degrees warmer in cities than in the surrounding suburbs. In some instances, New York City's air temperatures can be more than seven degrees Fahrenheit warmer than in neighboring counties."
- Negative impacts of the Urban Heat Island Effect include increased energy consumption, elevated emissions of pollutants and greenhouse gases, compromised human health and comfort (such as respiratory difficulties and heat stroke) and reduced water quality (rapid storm water runoff temperature change can inflict stress on or be fatal to aquatic life).
- We believe the City can do much more to remediate UHI. A broadly implemented Cool Pavement initiative for the City's streets and parking lots can further reduce air temperatures, energy demand and the related emissions and smog formation and help offset CO2. According to researchers at the Lawrence Berkeley National Laboratory (LBNL),

pavements account for about 30 to 50 percent of urban surface area and about half of that is comprised of city streets with about 40 percent parking lots. This is a significant amount of surface area that is not actively being addressed by the City. A more comprehensive and balanced approach is needed.

- Specifically, we would propose either amending Intro 1087 – or creating a new, stand-alone bill – utilizing the structure of Intro 1088 (on pervious pavement) to require a study of cool pavements and develop a pilot program on their use in New York City. Further, we would urge the Council to consider that such a proposed study also address how the private sector might be incentivized to incorporate the beneficial use of cool pavements for parking lots on private property.
- We are available to work with the City Council to make the streets and parking lots of NYC part of the solution to remediating the Urban Heat Island Effect instead of being part of the problem.

With respect to NYC Council Intro 1088 to amend the administrative code of the city of New York, in relation to water retentive sidewalks and a study on absorptive street and sidewalk materials and alternative street angulation:

- Using absorptive street and sidewalk materials to help remediate the serious stormwater problem facing NYC is a good approach which we also strongly support.
- According to Riverkeeper®, "More than 27 billion gallons of raw sewage and polluted stormwater discharge out of 460 combined sewage overflows ("CSOs") into New York Harbor alone each year. As little as one twentieth of an inch of rain can overload the system. The main culprit is outmoded sewer systems, which combine sewage from buildings with dirty stormwater from streets. This extraordinary degree of pollution imposes steep environmental, human health, and economic costs. CSO discharges, in addition to preventing safe recreation, impair navigation and damage fish habitat".
- Again, there is something the City can do to realize more significant reductions in stormwater runoff. We encourage the Council to expand the proposed Intro 1088 to include a study of pervious pavements for parking lots as well as streets and sidewalks. Parking lots, both public and private are typically impermeable surfaces that make a major contribution to the stormwater runoff problem.
- In addition, we encourage the Council to consider that the proposed study also address how the private sector might be incentivized to incorporate the widespread and more beneficial use of pervious pavements for parking lots on their properties. For example, in NJ we have worked with developers to reduce or eliminate costly stormwater retention systems that waste valuable land space with pervious pavements. Some jurisdictions offer grants to developers and/or streamline the project permitting process for developers who employ approved stormwater control approaches.
- We are available to work with the City Council on appropriate language to expand Intro 1088 to make the parking lots of NYC part of the solution to remediating the stormwater runoff problem. We are also available to provide technical and engineering assistance to the Council and to any City Department to support the proposed study and pilot projects.

Thank you all again for giving the Portland Cement Association the opportunity to provide input on these two important proposed bills which can improve the air and water quality of NYC.



**Testimony for Russell Unger**

**New York City Council Committee on Housing and Buildings**

*Jointly with the Committee on Environmental Protection, the Committee on Parks and Recreation, the Committee on Transportation, and the Committee on Waterfronts*

June 27, 2013

Good morning Chair Dilan, Chair Gennaro, Chair Mark-Viverito, Chair Koo and Committee Members. My name is Russell Unger and I am the Executive Director of Urban Green Council and chair of the Building Resiliency Task Force. With me today is Cecil Scheib, Advocacy Director of Urban Green Council and Managing Director of the Task Force. We are here to testify in support of the bills being heard today, most of which would implement recommendations of the Task Force.

In the 20 years leading up to Superstorm Sandy, New York City experienced nine coastal storms and six heat waves. And we are no strangers to blackouts, with widespread power failures in 1965, 1977, 2003, and 2012. These events have caused hundreds of deaths and billions of dollars of damage. We know that in the near future, heat waves will last longer and bring higher temperatures more often, heavy rains and stormsurges will cause flooding more frequently, and there will continue to be power failures affecting large swaths of the city. New York needs resilient buildings that resist damage, protect occupants, and allow residents who must evacuate to quickly return to their homes.

In response to this challenge, City Council Speaker Quinn and Mayor Bloomberg asked Urban Green to convene the Building Resiliency Task Force to recommend how buildings can be better prepared for future emergencies. We were also asked to identify any policies that simultaneously advance resiliency and climate change mitigation.

We brought together over 200 of the city's top building experts – city officials, real estate owners, building operators, architects, engineers, hospitals, NYCHA, building trades, housing experts...the full breadth of the industry. The Task Force met from January through May, holding 45 meetings. The members donated 5,000 hours of their time, worth about \$1.1 million.





The Task Force considered extreme events including coastal storms and hurricanes, extreme temperatures, precipitation based floods, windstorms, winter storms, as well as resulting infrastructure failures such as blackouts. Our report, which was released on June 13<sup>th</sup>, contains 33 recommendations. These include code changes that remove barriers to resiliency, codes changes that would apply to new construction and substantial renovations, a few codes that would apply retroactively to existing buildings. The Task Force also proposed a few items that require further action, whether best practice recommendations for building owners or a study by the city.

Proposals fall into four chapters: "Stronger Buildings", which will prepare our building stock not only for past storms but for future events, and to mitigate such events when possible; "Backup Power", preparing buildings for blackouts; "Essential Safety", ensuring building residents are safe in the face of extreme events even when the power grid and backup power fail; and "Better Planning", steps that are often low-cost and that can help save lives and property during emergencies, if building owners, their staff, and tenants prepare ahead of time and are adequately trained.

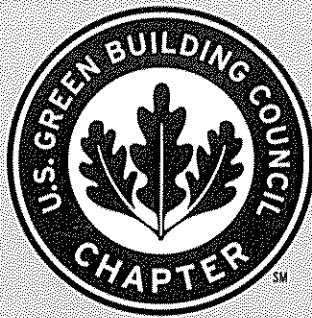
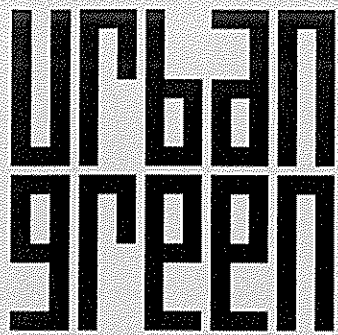
The Task Force considered how its recommendations would affect and apply to different sectors. For commercial buildings, the level of preparation is fundamentally a business decision for their owners. Multifamily residences, dorms, hotels, and adult care facilities must provide for essential needs such as safety, drinking water, habitable temperatures, and functioning stairs and elevators. One- to three-family homes must have protection against storm damage and adequate emergency planning, as water can be supplied without pumps and vertical transportation is not an issue.

In all cases, the Task Force carefully considered both the magnitude of a threat and the cost required to guard against it when making a recommendation and proposing it is as required vs best practice. Existing buildings will improve naturally over time when they undergo renovations that trigger higher code standards, allowing upgrades to be made when they are most cost-effective. For this reason, most code changes recommended by the Task Force would affect only new buildings and existing buildings when they are renovated. In a few

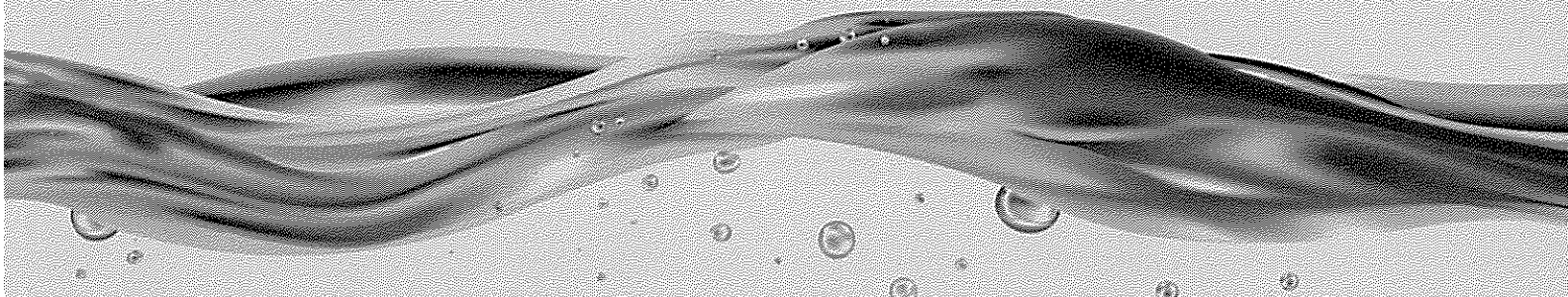


crucial cases, such as providing for basic water supply and lighting in residential buildings during blackouts, buildings may need to undergo retrofits to supplement their current resiliency features.

I would like to reiterate my gratitude to all the members of the Task Force, some of which are here today. I would also like to thank the Speaker and Mayor for the honor of assisting the city in this effort and the Council for moving so quickly on bringing this legislation to a hearing. We look forward to answering any questions you may have.



REPORT TO  
MAYOR MICHAEL  
R. BLOOMBERG  
& SPEAKER  
CHRISTINE C. QUINN



# BUILDING RESILIENCY TASK FORCE

JUNE 2013

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## Support

We thank the following foundations for their generous support of the *Building Resiliency Task Force*:



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## Printing

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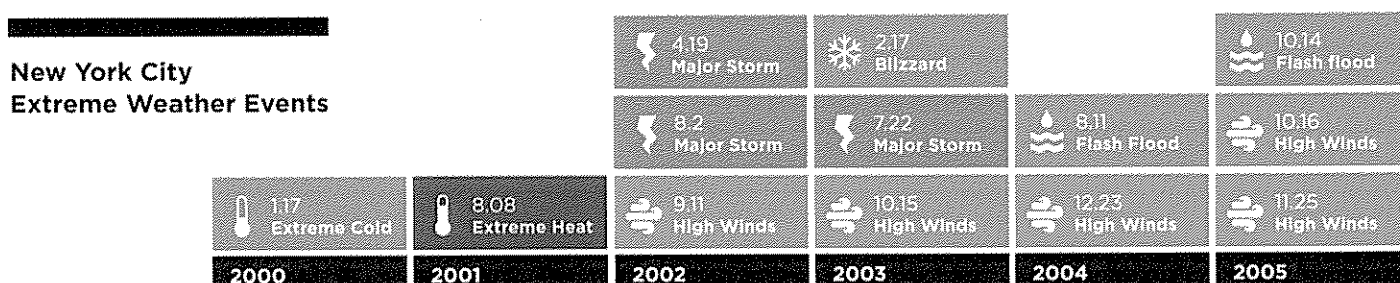
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# INTRODUCTION

In the 20 years leading up to Superstorm Sandy, New York City experienced nine coastal storms and six heat waves. And we are no strangers to blackouts, with widespread power failures in 1965, 1977, 2003, and 2012. These events have caused hundreds of deaths and billions of dollars of damage to buildings, infrastructure, and the city economy. We know that in the near future, heat waves will last longer and bring higher temperatures more often, heavy rains and storm surges will cause flooding more frequently, and there will continue to be power failures affecting large swaths of the city. New York needs resilient buildings that resist damage, protect occupants, and allow residents who must evacuate to quickly return to their homes.

New York City enjoys some natural resiliency advantages. Gravity gives the city water supply enough pressure to rise five stories without electric pumps in many neighborhoods, and the natural gas supply has remained largely uninterrupted. City construction codes already contain emergency egress requirements, and go a long way toward addressing basic resiliency against flooding and

high winds. Improving resiliency means filling gaps in what we already have. Yet we don't know exactly what New York City's next weather or power emergency will be, or whether it will happen next year or next decade. Because of this uncertainty, the Building Resiliency Task Force was reluctant to recommend many specific (and potentially expensive) retrofits to existing





buildings. Instead, its proposals focus on removing the many barriers to resiliency improvements, sharing information, and giving owners options.

Existing buildings will improve naturally over time when they undergo renovations that trigger higher code standards, allowing upgrades to be made when they are most cost-effective. For this reason, most code changes recommended by the Task Force would affect only new buildings and existing buildings when they are renovated. In a few crucial cases, such as providing for basic water supply and lighting in residential buildings during blackouts, buildings may need to undergo retrofits to supplement their current resiliency features.

Not every building sector will improve its resiliency in the same way. For commercial buildings, market forces and decisions made between tenants and owners will determine the extent to which many of these recommendations are implemented. Hospitals and nursing homes are already extensively regulated. As a result, much of the focus of this report is on residential buildings (multifamily, adult care facilities, and homes), which must be habitable as soon as possible after natural disasters.

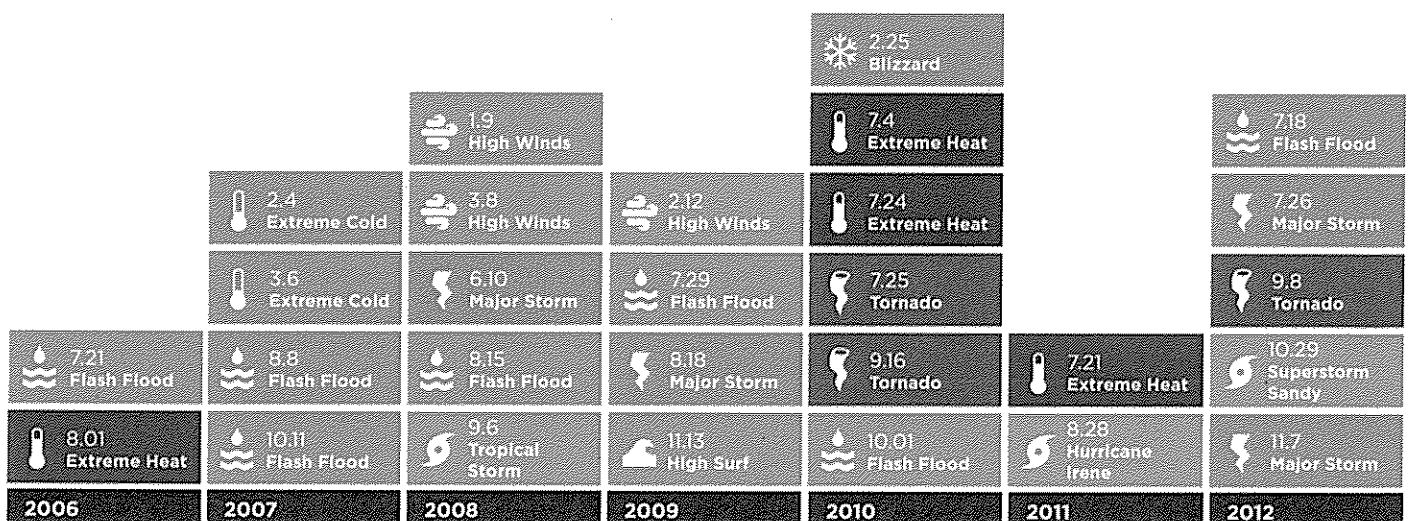
Codes set a legal minimum standard for construction, but for increased resiliency many owners will choose to do more. This report recommends a range of voluntary practices for buildings to adopt beyond basic code requirements, including simple, low-cost measures. Furthermore, constructing buildings for resiliency will be most effective when

paired with emergency planning and training of building staff, tenants and homeowners.

Measures that protect individual buildings may have both benefits and costs to society. For instance, elevating buildings can protect against floodwaters, but negatively impact streetscapes. Diesel generators provide buildings with power but cause pollution. On the other hand, a cogeneration system can provide power while also improving energy efficiency. Improving building insulation and air sealing will help ensure habitable temperatures during power outages and mitigate climate change.

Ultimately, any resiliency measures that depend on complex systems or a continuous supply of power are vulnerable to failure. In many large, modern buildings, the common systems we rely on can become hurdles to resiliency when the power fails. For example, dead electric pumps may prevent water from reaching faucets, windows may be sealed shut on the assumption that mechanical ventilation is always available, and automatic toilets may not flush without power. And most New York City homes and residential buildings are not sufficiently insulated to maintain habitable temperatures without power.

The report represents the consensus of more than 200 Task Force members on how to strike the right balance between resiliency, cost, and other issues that are important to New York City. We believe that with the right planning, New Yorkers can be prepared for whatever comes our way.



Source: National Oceanic and Atmospheric Administration & NYC Office of Emergency Management

# ABOUT THE TASK FORCE

This report is the result of the time and effort of more than 200 dedicated volunteers who are leading experts in their fields. Task Force members include real estate owners, property managers, architects, engineers, contractors, utility representatives, subject matter specialists, city officials, code consultants, cost estimators and attorneys, who devoted nearly 5,000 hours over five months to discuss and develop these proposals.

Urban Green Council convened the NYC Building Resiliency Task Force on December 19, 2012 at the request of Mayor Michael R. Bloomberg and City Council Speaker Christine C. Quinn. The city tapped Urban Green, veterans from managing NYC's 2008–2010 Green Codes Task Force, for its in-house technical expertise and deep connections within the building industry. Urban Green was well-qualified to lead the effort, given the Task Force mandate to include measures that simultaneously advance resiliency and mitigate climate change.

The Task Force coordinated with the NYC Special Initiative for Rebuilding and Resiliency, which studied how to improve citywide infrastructure and building resiliency, as well as how to help communities become more resilient. While focused on New York City and its specific environment and building codes, this report may also be useful to other cities that wish to improve their resiliency.

Task Force members were selected by Urban Green in consultation with the Speaker's Office and Mayor's Office and divided into three Working

Groups and four Committees, each led by two co-chairs. Working Groups determined what *could* be done to improve building resiliency, while Committees considered what *should* be done in each building type.

Technical experts were organized by building system into three Working Groups: *Structure, Façade, & Interiors*; *Electrical & IT*; and *HVACR, Plumbing, & Fire Protection*. Industry stakeholders represented building sectors on four Committees: *Commercial Buildings*, multifamily *Residential Buildings*, *Critical Buildings* (including hospitals, nursing homes, and adult care facilities), as well as a special Committee on *1–3 Family Homes*. The Task Force Steering Committee consisted of the chairs of the Working Groups and Committees, as well as representatives of the Mayor, the Speaker, and Urban Green.

Over the course of 45 meetings, close to 100 proposals were examined by Working Groups and Committees. Throughout the process, Urban Green worked closely with Task Force members and chairs to refine proposals to include thorough

explanations of the issues, template code language where appropriate, and practical information about implementation. Although details were often left to subgroups, all Task Force members weighed in on broad concepts. After much deliberation, 33 proposals were officially confirmed. Urban Green edited the proposals for style and completeness of content, with editing and legal review by Fried, Frank, Harris, Shriver & Jacobson and costing analysis by Turner Construction Company.

We would like to thank the Working Group and Committee members who generously volunteered their time and expertise to the Task Force. We are grateful for the experience, wisdom and dedication of everyone on the Task Force who made this report possible.

Note: This Executive Summary contains brief summaries of the 33 proposals. The full report is available at [urbangreencouncil.org/BuildingResiliency](http://urbangreencouncil.org/BuildingResiliency).

## Reading This Report: Proposal Implementation

The 33 proposals in this report address resiliency in a wide range of buildings, including commercial buildings, multifamily residences, hospitals, and 1-3 family homes. The illustrations on pages 6-11 show Committee recommendations for different building types. There are five ways a proposal may be implemented:

### **required upgrade**

In a few crucial cases, such as providing basic water supply in residential buildings during black-outs, the Task Force has recommended retroactive requirements for existing buildings. "Required Upgrade" proposals would apply to all new construction and renovations, and would also require existing buildings to comply by a specified future deadline. Buildings that are not required to perform these upgrades should still consider these proposals "Recommended."

### **new code**

"New Code" proposals would be applicable at the time of new construction or renovation, but would not retroactively apply to all existing buildings. Building types not affected by the new code should still consider these proposals "Recommended."

### **remove barrier**

Many Task Force proposals focus on improving resiliency by removing obstacles and giving owners more options. "Remove Barrier" proposals are not required for any building sector, but the changes recommended will make it easier for buildings to become more resilient.

### **recommended**

Codes set a legal minimum standard for construction, but for increased resiliency many owners will choose to do more. "Recommended" proposals cover a wide range of voluntary practices, though not every proposal will apply to every building. Taken together, the many best practices in this report represent the advice of the city's experts on resiliency and should be seriously considered.

### **further action**

Continued effort is needed to develop complete code recommendations in some areas. "Further Action" proposals will receive additional consideration, either by the city or by the Task Force under an extended mandate.

# COMMERCIAL

The level of preparation for commercial buildings, both large and small, is fundamentally a business decision for their owners. Task Force recommendations are intended to minimize interruptions to building functionality while allowing the market to dictate the need to implement resiliency measures. Still, the city has an overall interest in maintaining a viable economy by reducing large-scale business disruption.

## required upgrade

Safeguard Toxic Materials Stored in Flood Zones (#7)  
Keep Gas Stations Open During Blackouts (#22)

## new code

Relocate & Protect Building Systems (#3)  
Add Backup Fire Safety Communication (#6)  
Prevent Sewage Backflow (#8)  
Plant Wind & Flood Resistant Trees (#9)  
Prevent Wind Damage to Existing Buildings (#11)  
Keep Gas Stations Open During Blackouts (#22)  
Ensure Toilets & Sinks Work Without Power (#24)

## remove barrier

Remove Barriers to Elevating Buildings  
& Building Systems (#4)  
Remove Barriers to Sidewalk Flood Protection (#5)  
Remove Barriers to Backup & Natural  
Gas Generators (#17)  
Remove Barriers to Cogeneration (#18)  
Remove Barriers to Solar Energy (#19)

## recommended

Capture Stormwater to Prevent Flooding (#13)  
Choose Reliable Backup Power & Prioritize  
Needs (#15)  
Use Cogeneration & Solar During Blackouts (#16)  
Add Hookups for Temporary Generators  
& Boilers (#20)  
Enhance Building Water Reserves (#25)  
Create Emergency Plans (#28)  
Prenegotiate Emergency Recovery  
Agreements (#33)

## further action

Clarify Construction Requirements in Flood  
Zones (#10)  
Maintain Habitable Temperatures Without  
Power (#26)

### Reliable Sanitation

With a manual override or long-lasting batteries, automatic toilets will still flush during blackouts.



### Rooftop Pavers

Unlike small gravel, heavy pavers will not become airborne during high winds.



### Natural Gas Generators

Provides cleaner power that can be used for lighting, fire safety, elevators, and other building systems.



### Elevated Equipment

Raising building equipment to a higher floor ensures it will not be damaged by floodwaters.



### Sloped Sidewalks & Tree Pits

Sidewalks sloped into tree pits absorb rain, reducing flooding from rainstorms.



### Quick Connects

Exterior hookups allow easy connection to portable generators.



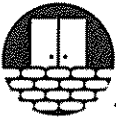
### Flood Barriers

Temporary sidewalk barriers can protect against floods.



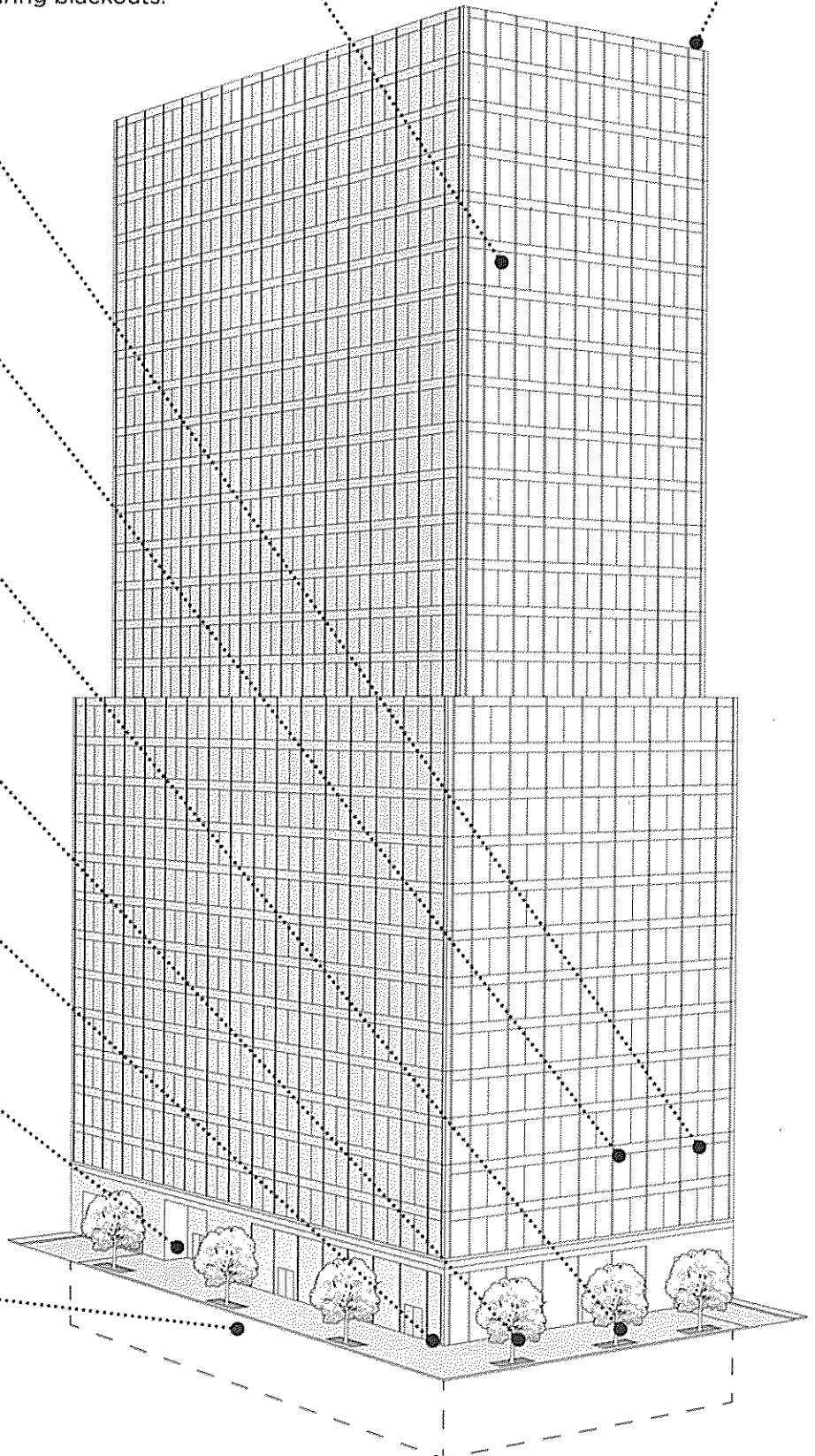
### Sandbags

Part of a building's emergency preparedness plan, sandbags are an inexpensive way to protect against flooding.



### Sewage Valves

Valves prevent sewage backflow into basements during rainstorms and floods.



# MULTIFAMILY RESIDENTIAL

Multifamily residences, dorms, hotels, and adult care facilities must provide for essential needs such as safety, drinking water, habitable temperatures, and functioning stairs and elevators. The Task Force intent was to add few financial burdens, and only in the most critical areas, given the limited financial resources available for upgrades.\*

## required upgrade

Safeguard Toxic Materials Stored in Flood Zones (#7)  
Supply Drinking Water Without Power (#23)  
Create Emergency Plans (#28)

## new code

Relocate & Protect Building Systems (#3)  
Add Backup Fire Safety Communication (#6)  
Prevent Sewage Backflow (#8)  
Plant Wind & Flood Resistant Trees (#9)  
Prevent Wind Damage to Existing Buildings (#11)  
Use Cool Surfaces to Reduce Summer Heat (#14)  
Keep Residential Stairwells & Hallways Lit  
During Blackouts (#21)  
Ensure Toilets & Sinks Work Without Power (#24)

## remove barrier

Remove Barriers to Elevating Buildings  
& Building Systems (#4)  
Remove Barriers to Sidewalk Flood Protection (#5)  
Remove Barriers to Backup & Natural  
Gas Generators (#17)  
Remove Barriers to Cogeneration (#18)  
Remove Barriers to Solar Energy (#19)

## recommended

Capture Stormwater to Prevent Flooding (#13)  
Choose Reliable Backup Power & Prioritize  
Needs (#15)  
Use Cogeneration & Solar During Blackouts (#16)  
Add Hookups for Temporary Generators  
& Boilers (#20)  
Prenegotiate Emergency Recovery Agreements (#33)

## further action

Clarify Construction Requirements in  
Flood Zones (#10)  
Maintain Habitable Temperatures Without Power (#26)  
Ensure Operable Windows in Residential  
Buildings (#27)

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\*The list of proposals above also applies to Critical Buildings (hospitals and nursing homes), excluding #'s 15, 16, 21, 23 and 28.

### Common Area Faucets ↑

Natural pressure in the city's water mains provides water to a common area faucet, even if a blackout disables the water pump.



### Rooftop Pavers ↑

Unlike small gravel, heavy pavers will not become airborne during high winds.



### Secure Loose Outdoor Items ⚙

Tie down furniture and plants or move them indoors to prevent windblown damage.



### Operable Windows +

Open windows help buildings remain habitable during summer power outages.



### Cogeneration System ⚙

Provides cost-effective hot water and electricity, and backup power for fire alarms, lighting, and water pumps.



### Elevated Equipment ↑

Raising building equipment to a higher floor ensures it will not be damaged by floodwaters.



### Insulated Walls +

Walls, windows, and roofs that are sealed and insulated keep heat in during winter and out during summer — especially important during blackouts.



### Sloped Sidewalks & Tree Pits ↑

Sidewalks sloped into tree pits absorb rain, reducing flooding from rainstorms.



### Salt-Tolerant Trees ↑

Trees planted in flood zones should be salt tolerant and pruned regularly.



### Sewage Valves ↑

Valves prevent sewage back-flow into basements during rainstorms and floods.



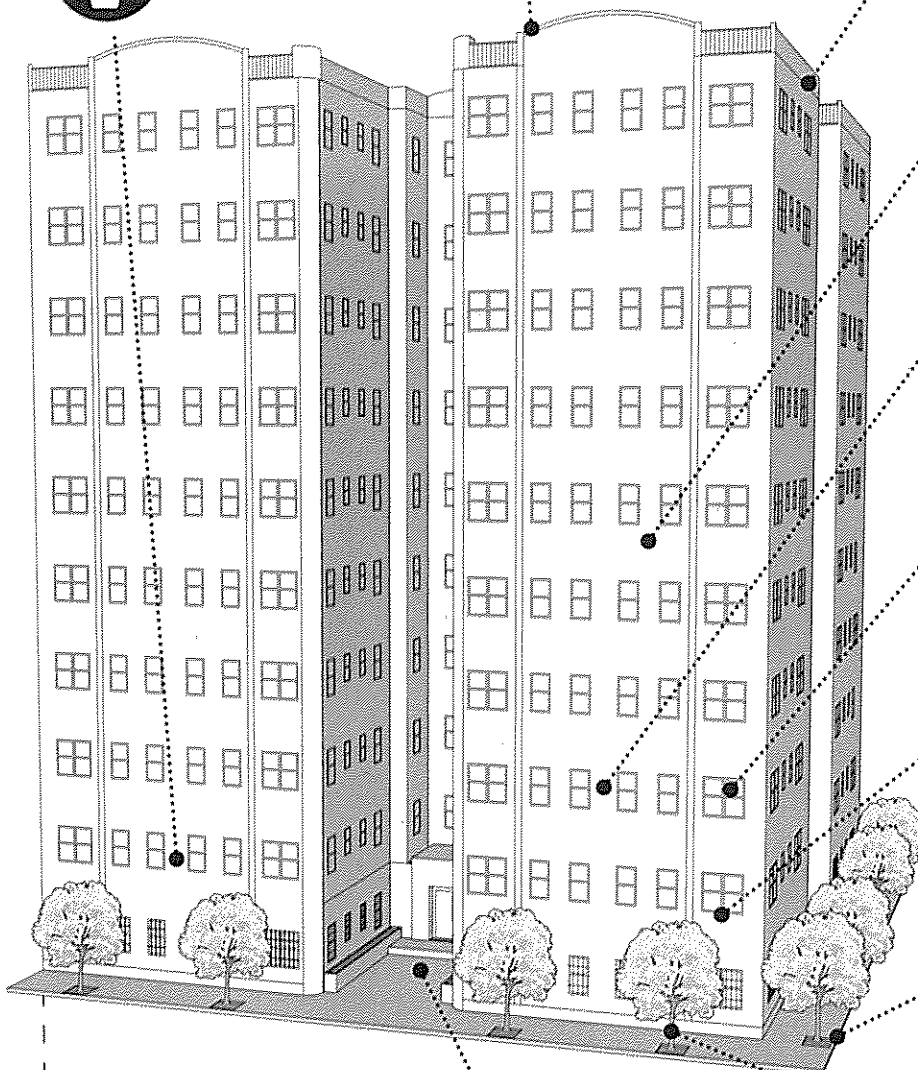
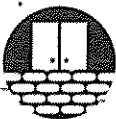
### Move Cars From Flood Zones ⚙

Park vehicles elsewhere to prevent damage and costly cleanup from leaked gas and oil.



### Sandbags ⚙

Part of a building's emergency preparedness plan, sandbags are an inexpensive way to protect against flooding.





# HOMES

One- to three-family homes must have protection against storm damage and adequate emergency planning, as water can be supplied without pumps and vertical transportation is not an issue. Since many homeowners have limited financial resources for upgrades, the Task Force avoided adding significant financial burdens.

## new code

- Prevent Storm Damage to Homes (#1)
- Relocate & Protect Building Systems (#3)
- Prevent Sewage Backflow (#8)
- Plant Wind & Flood Resistant Trees (#9)
- Prevent Wind Damage to Existing Buildings (#11)
- Use Cool Surfaces to Reduce Summer Heat (#14)
- Ensure Toilets & Sinks Work Without Power (#24)

## remove barrier

- Remove Barriers to Elevating Buildings & Building Systems (#4)

## recommended

- Launch Design Competition for Raised Homes (#2)
- Capture Stormwater to Prevent Flooding (#13)
- Use Cogeneration & Solar During Blackouts (#16)
- Create Emergency Plans (#28)

## further action

- Clarify Construction Requirements in Flood Zones (#10)
- Maintain Habitable Temperatures Without Power (#26)



### **Rooftop Pavers**

Unlike small gravel, heavy pavers will not become airborne during high winds.



### **Elevated Equipment**

Raising building equipment to a higher floor ensures it will not be damaged by floodwaters.



### **Sewage Valves**

Valves prevent sewage backflow into basements during rainstorms and floods.

### Insulated Walls +

Walls, windows, and roofs that are sealed and insulated keep heat in during winter and out during summers — especially important during blackouts.



### Cool Roofs ⚡

Reflective shingles that come in a full range of colors help reduce indoor and outdoor temperatures. Cooler roofs reduce the risk of heatstroke during a blackout.



### Secure Loose Outdoor Items ⚡

Tie down furniture and plants or move them indoors to prevent windblown damage.



### Salt-Tolerant Trees ⚡

Trees planted in flood zones should be salt tolerant and pruned regularly.



### Framing Anchors ⚡

Anchoring a home's framing to its foundation stops it from floating or blowing away during storms.



### Sandbags ⚡

Part of a building's emergency preparedness plan, sandbags are an inexpensive way to protect against flooding.



### Sloped Sidewalks & Tree Pits ⚡

Sidewalks sloped into tree pits absorb rain, reducing flooding from rainstorms.



# STRONGER BUILDINGS







# STRONGER BUILDINGS

During Superstorm Sandy, nearly 20,000 buildings were damaged by flooding and high winds. We need to be prepared for both the next storm and other natural hazards, including heat waves and flooding from heavy rains. While there is much to learn from other, storm-prone parts of the country, our high-density city — which contains 11 percent of the nation's multifamily building residents<sup>1</sup> — will need to find its own way.

Our buildings must become stronger. New York City's current building code ensures that new buildings will be hardy enough to stand up to the weather of the past. But the code needs to prepare for the weather of the future, which will be more extreme due to climate change. We must also carefully consider how to improve the resiliency of our existing buildings. This chapter is the largest in the Task Force report, with proposals that fall into three groups: managing flooding, resisting wind, and preventing emergencies.

Flooding can kill people, destroy property, and cause mass evacuations, leaving thousands of refugees in need of shelter. To prevent the worst damage, houses need to be securely attached to their foundations, and physically protected or raised. Doing so, however, may change the streetscape and neighborhood character. The city should launch a design competition to create attractive, flood-resistant designs for 1–3 family homes. In larger buildings, mechanical equipment at risk from floods must either be relocated to a higher floor, or waterproofed, and the building code must be revised to remove barriers to doing

so. To prevent floodwaters from becoming a toxic soup, hazardous materials need to be protected and sewage prevented from flowing back up into buildings. Outside the building, allowances must be made for flood barriers, and coastal trees should be chosen for salt-resistance and pruned regularly.

Winds can occur anywhere in the city and may cause local or widespread damage. Rooftops should have heavy pavers instead of loose pea gravel that can become airborne missiles, and hospitals in high wind zones should install impact-resistant windows. The city should study how high winds will affect existing buildings, partially completed buildings, and temporary structures, and assess how climate change may influence future wind events.

While we cannot stop extreme weather, we can reduce the likelihood that extreme weather will escalate into emergency conditions. We should capture stormwater to reduce surface flooding during heavy rains, and build cool roofs to reduce indoor temperatures during heat waves.



*An award-winning design of an elevated home in New Orleans.*

## 1 Prevent Storm Damage to Homes

**Issue:** Flooding, precipitation, high winds, storm surge, wave action and wind-/water-borne debris can damage homes. Much of this damage can be prevented with targeted design and construction measures.

**Recommendation:** Require new and replacement windows and doors to be wind resistant. Recommend anchoring framing to foundations and strengthening foundations and basements in existing homes. Develop custom requirements for attached homes that present unique challenges.

 new code

 recommended

## 2 Launch a Design Competition for Raised Homes

**Issue:** New York City has 71,000 buildings located in the new 100-year flood zone. New buildings in these areas will have to build above the flood line, and other homeowners may decide to voluntarily raise their homes. This will impact the city's architecture, streetscapes, and accessibility.

**Recommendation:** Launch a competition to design a streetscape of attractive raised homes that fit the character and aesthetic of existing neighborhoods and remain accessible to people with disabilities. The competition should address both detached and attached homes.

 recommended



### 3 Relocate & Protect Building Systems

**Issue:** The first and lower floors of many existing buildings are at risk because they are below flood level, and essential building equipment is often located on these lower floors.

**Recommendation:** Building owners should consider relocating equipment above the flood level and follow best practices when floodproofing. Require fire protection equipment to be raised in new construction, and enhance standards for hospitals.

 new code

 recommended

### 4 Remove Barriers to Elevating Buildings & Building Systems

**Issue:** Building owners may wish to elevate buildings or building systems, but are restricted by regulations and zoning height limitations.

**Recommendation:** Allow building owners to raise telecommunications rooms and to store more fuel above the flood line. Consider allowing zoning relief for buildings elevating to the 500-year flood line.

 remove barrier

### 5 Remove Barriers to Sidewalk Flood Protection

**Issue:** Building owners may wish to install flood barriers on sidewalks, but are deterred by codes that limit sidewalk use and that assume buildings are fully occupied during floods.

**Recommendation:** Allow underground sidewalk attachments for temporary flood barriers. After evacuation, allow nonresidential buildings to maintain a single entrance/exit for emergency personnel so that flood barriers can be installed.

 remove barrier



### 6 Add Backup Fire Safety Communication

**Issue:** Loss of power to telecommunications systems and flooding that damages underground phone and data lines can cut off communication between buildings and the Fire Department.

**Recommendation:** All large buildings in flood zones should consider having a backup wireless fire communication system, and new large critical buildings must have backup phone and data connections. Mandate the use of storage batteries with a life of at least eight hours to serve buildings' fire and life safety communication systems.

 new code

 recommended





*Unprotected hazardous chemicals can turn floodwaters into a toxic soup.*

## 7 Safeguard Toxic Materials Stored in Flood Zones

**Issue:** The NYC Department of Environmental Protection requires facilities that store hazardous chemicals to file a risk management plan, but it does not require special protection for chemicals stored in flood zones.

**Recommendation:** Require toxic materials in flood zones to be stored in a floodproof area.

⬆ required upgrade

## 8 Prevent Sewage Backflow

**Issue:** During floods, sewage can flow back into buildings.

**Recommendation:** Require valves on building sewage lines to prevent sewage from entering the building.

⬆ new code



*A tree damaged this Staten Island home during Superstorm Sandy.*

## 9 Plant Wind & Flood Resistant Trees

**Issue:** People, property, buildings, and utility lines can be at risk from trees damaged by high winds and flooding.

**Recommendation:** In waterfront areas accessible to the public, require wind- and salt-tolerant trees and regular tree pruning. Encourage private owners to follow the same practices.

🔧 new code

## 10 Clarify Construction Requirements in Flood Zones

**Issue:** City regulations for new construction and substantial renovations provide for resiliency in flood zones. However, the requirements are not always clear to design professionals and contractors.

**Recommendation:** Clarify flood zone construction requirements in code and through a Department of Buildings Bulletin. Allow more flexibility in requirements for enclosures below the flood line.

✚ further action

## 11 Prevent Wind Damage to Existing Buildings

**Issue:** High winds can cause walls, windows, doors, and building equipment to come loose. Loose stones on rooftops can become small missiles. While new buildings must meet strong wind standards, renovations to existing buildings do not.

**Recommendation:** Require that equipment and structures added to existing buildings meet the same wind standards in effect for installations on new buildings. Require heavy pavers on rooftops, and impact-resistant windows in high wind zones.

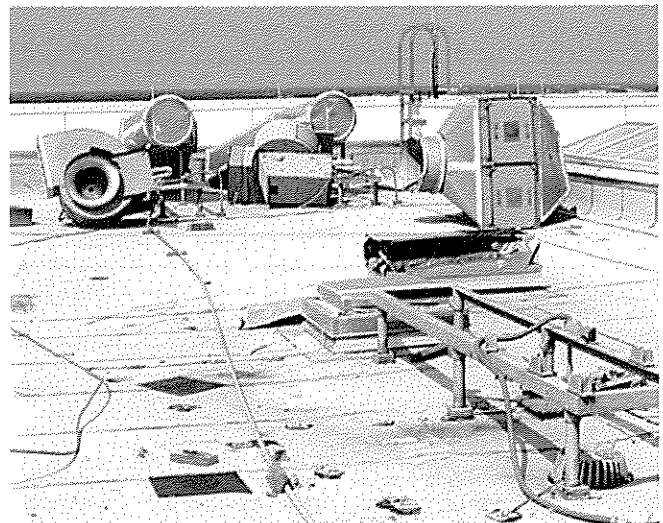
🔧 new code

## 12 Analyze Wind Risks

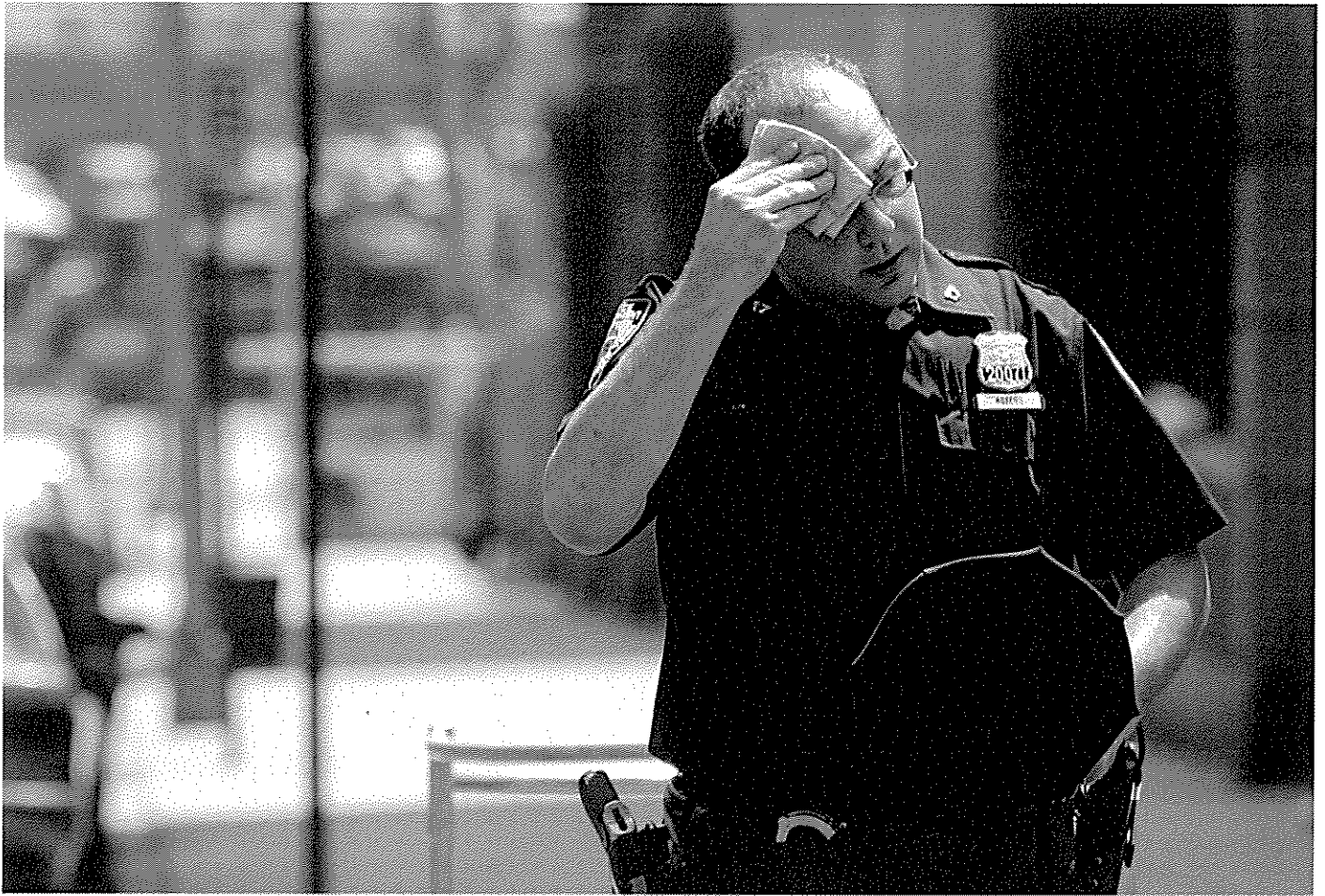
**Issue:** Standards for protection against high winds have been in place since 1968. However, older buildings and buildings under construction are not as well protected.

**Recommendation:** Study wind effects on existing buildings and those with particular wind vulnerability. Propose new standards and practices to protect against identified wind risks, considering the influence of climate change on future wind speeds.

✚ further action



*High winds can damage unsecured equipment.*



*A police officer bakes in the summer heat.*

### 13 Capture Stormwater to Prevent Flooding

**Issue:** Storms can cause localized flash flooding of buildings and streets. The city applies rigorous stormwater standards to buildings that add new sewer connections, but stormwater from existing buildings must still be addressed.

**Recommendation:** Design sidewalks to capture stormwater and continue supporting the NYC Green Infrastructure Plan.

 recommended

### 14 Use Cool Surfaces to Reduce Summer Heat

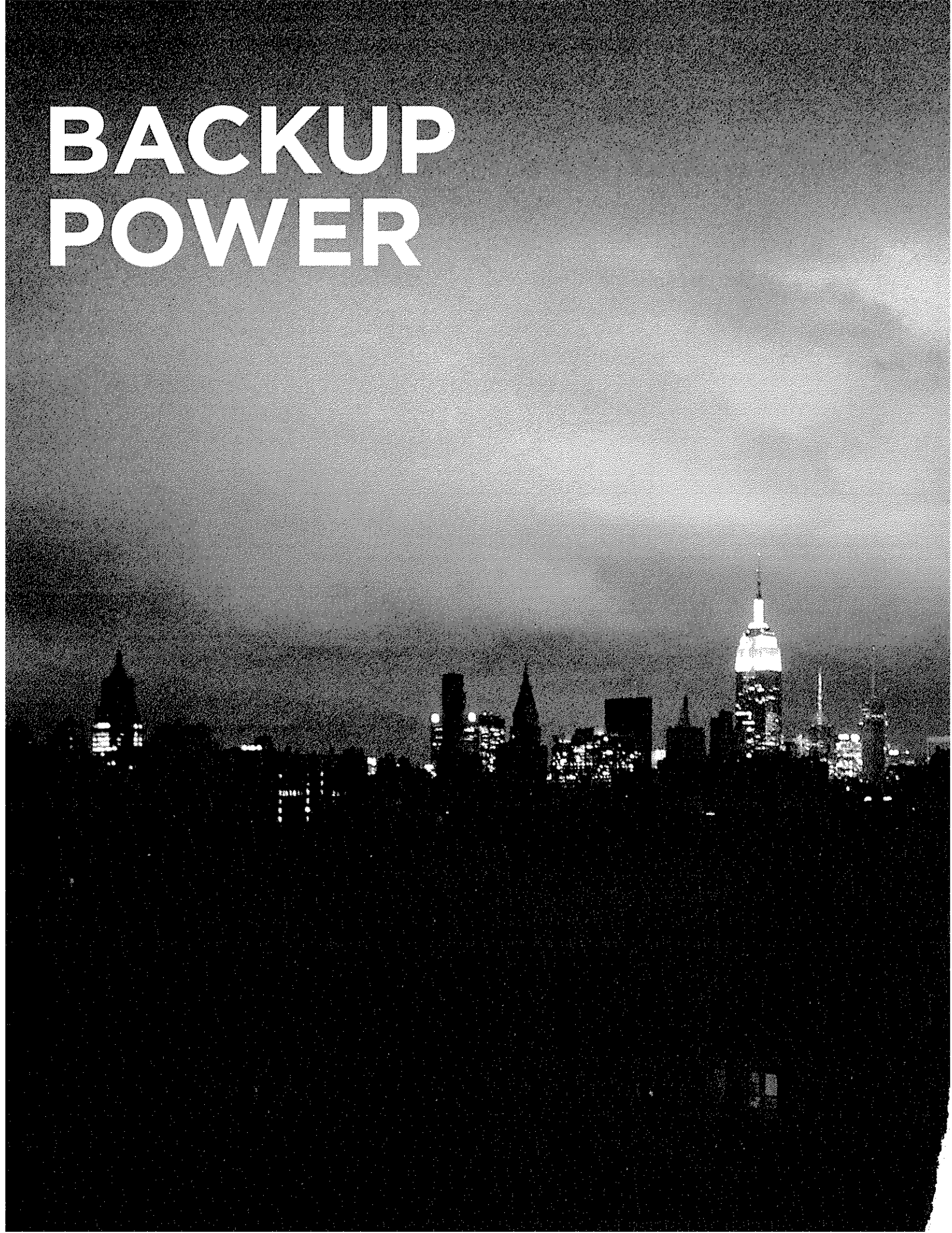
**Issue:** Light-colored roofs and surfaces reflect light and heat back into the atmosphere, cooling buildings and cities. City regulations mandate light-colored roof coatings, but only for flat roofs. These coatings also tend to darken over time, losing their effectiveness. Dark, noncompliant coatings are still sold in NYC, increasing unintentional violation of code.

**Recommendation:** Expand existing cool roof requirements to include pitched roofs. Prohibit the sale of dark roofing materials and dark “crumb” rubber in synthetic playing fields. Encourage owners to use self-cleaning cool roof coatings and study the longevity of various cool roof options.

 new code



# BACKUP POWER





# BACKUP POWER

Modern buildings need power to operate, but power sometimes fails: New York City has had two widespread blackouts in the past 10 years. Lack of electricity after Superstorm Sandy was a bigger problem for many people than the storm itself, affecting 20 percent of New Yorkers.<sup>1</sup>

Backup power should be a part of any resiliency plan. The proposals in this chapter fall into three groups. The first group consists of installation recommendations for building owners who voluntarily add backup power. The second group consists of proposed changes to laws and incentives to allow owners to choose the right backup power source for their building. The third group addresses power for two essential needs during blackouts: egress lighting in buildings and pumps at gas stations.

Providing enough backup power for full operation during a blackout can be expensive, so owners will need to prioritize their backup power uses so that basic safety and sanitation needs are addressed first. When installed, onsite power should be designed to be available during blackouts.

Choosing the right backup power source for reliability and cost-effectiveness means considering power sources that run continuously, such as cogeneration\* units or solar, increasing the chances power will work when the grid fails. To avoid reliance on potentially unreliable fuel deliveries during an emergency — and to reduce cost and air pollution — natural gas may be a better choice than diesel fuel. Emergency generators are currently required to power heavy loads and to start up with

almost no delay; smaller, less-expensive models and more options will be available if this is relaxed. For some buildings, it may be easier to install accessible connections for portable electric generators, as well as for backup heating and cooling.

To ensure that people can get in and out of buildings that are otherwise habitable, residential buildings should provide long-lasting lighting in stairwells and corridors. If the state does not act to ensure that gas stations stay operational during blackouts by requiring generators or emergency hookups, the city should do so.

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**\*Cogeneration:** When buildings use cogeneration (sometimes called “cogen,” “combined heat and power,” or just “CHP”), they make both their own heat and electricity on-site. It’s more efficient than having a separate boiler and electrical connection, since the waste heat from making electricity is used for warmth and hot water in the building rather than going up the flue. Cogeneration can also increase resiliency, since natural gas-fueled cogeneration can operate as long as gas pipelines are working, even during electricity blackouts.





*NYU's cogeneration plant kept the lights on during Superstorm Sandy.*

## 15 Choose Reliable Backup Power & Prioritize Needs

**Issue:** Few backup power systems are large enough to serve a whole building, forcing most buildings to make difficult choices about what equipment to back up.

**Recommendation:** Prioritize which electrical equipment will run on backup power so buildings can remain habitable during extended blackouts. Because cogeneration and solar power systems are always in use, they are more reliable than generators that are only turned on during emergencies.

 recommended

## 16 Use Cogeneration & Solar During Blackouts

**Issue:** Many cogeneration and solar power systems are not set up to run during a blackout. Because of this, they cannot provide heat and power to buildings during these emergencies.

**Recommendation:** Cogeneration and solar power systems should be designed to run during blackouts.

 recommended

## 17 Remove Barriers to Backup & Natural Gas Generators

**Issue:** For buildings that voluntarily provide backup power, existing regulations require that the standby generator powers at least one elevator in addition to the other loads the building has chosen to support. This increases generator size and cost, making backup generators too expensive for some buildings. Other regulations discourage natural gas generators, which are clean burning and can power buildings for extended periods without fuel deliveries.

**Recommendation:** Require only buildings higher than 75 feet to power an elevator with the standby generator, and reduce the minimum requirements for generator size. For emergency generators, increase the allowed start-up delay from 10 to 60 seconds, making more options available for generators operated by natural gas.

 remove barrier

## 18 Remove Barriers to Cogeneration

**Issue:** On-site cogeneration can be an efficient and cost effective source of heat and power to large buildings, but technical and regulatory barriers inhibit its use.

**Recommendation:** Con Edison should help facilitate the installation of larger systems by preparing guidelines similar to those for smaller systems, and implement a plan for significant expansion of cogeneration. Cogeneration should be properly sized to maximize economic benefit and energy efficiency.

 remove barrier



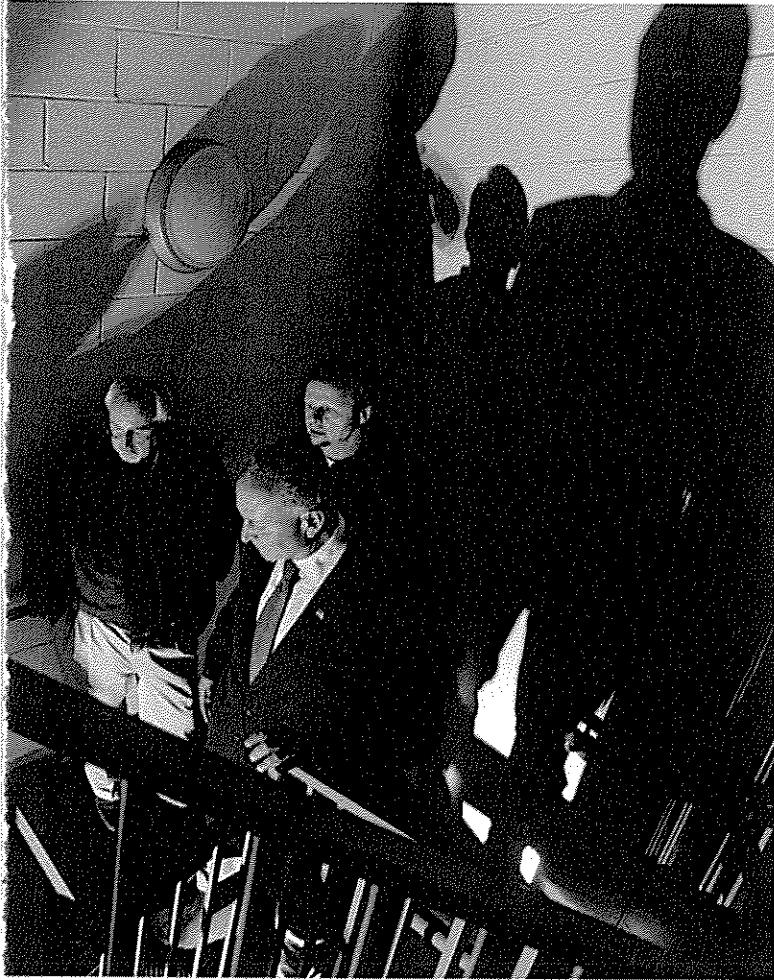
*Stairwell lighting is essential during extended blackouts.*

## 19 Remove Barriers to Solar Energy

**Issue:** On-site solar power can keep buildings habitable during blackouts, but technical, regulatory, and economic barriers inhibit its use.

**Recommendation:** Con Edison, NYSEDA, and other government agencies should continue working together to streamline permitting processes, reduce barriers in project schedules, and increase the allowable roof area for solar power.

 remove barrier



## 20 Add Hookups for Temporary Generators & Boilers

**Issue:** Buildings with extended service disruptions can use electricity and heat from temporary emergency generators and boilers. It is much easier to connect this equipment if convenient hookup points are installed in advance.

**Recommendation:** Require some existing health care facilities to install external electrical hookups. Recommend these installations as best practice for other buildings, and recommend external hookups for heating and cooling as well.

↑ required upgrade

Ⓡ recommended

## 21 Keep Residential Stairwells & Hallways Lit During Blackouts

**Issue:** All buildings are required to have 90 minutes of emergency lighting so they can be safely evacuated. However, during a prolonged blackout, residents in multifamily buildings need lighting in hallways and stairwells throughout the duration of the event.

**Recommendation:** Require most new multifamily buildings to provide lighting in hallways and stairwells during extended blackouts; require the same of existing multifamily buildings within two years.

⚡ new code

+ further action

## 22 Keep Gas Stations Open During Blackouts

**Issue:** During blackouts, most service stations are unable to sell gas because the pumps rely on electricity. In the days following Superstorm Sandy, about half of NYC's service stations were not operational, delaying recovery efforts and disrupting work and life for hundreds of thousands of residents and businesses.

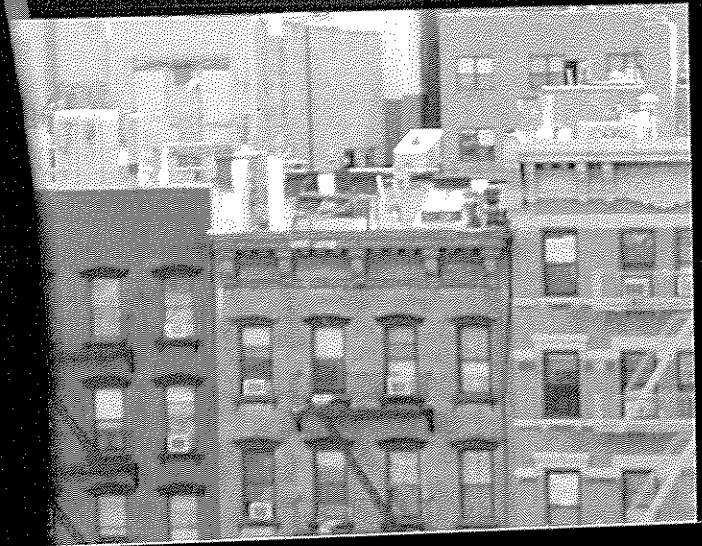
**Recommendation:** Unless New York State passes an equivalent law, NYC should require all fuel stations to either have a backup generator or be "generator ready."

↑ required upgrade



*Drivers waited for hours to fill up after Superstorm Sandy.*

# ESSENTIAL SAFETY







# ESSENTIAL SAFETY

Buildings must be capable of safely harboring residents under a wide range of circumstances, because evacuating or sheltering large portions of the city simply isn't possible. Unfortunately, modern buildings can quickly become uninhabitable without power. Since backup power is neither a universal nor a completely reliable safeguard against power failures, buildings must be able to provide essential safety without any power at all.

Proposals in this chapter focus on protecting lives by ensuring drinking water, sanitation, and habitable interior temperatures. These recommendations are generally directed toward residential buildings since most other buildings can be left vacant after extreme weather events.

Homes and other low buildings usually have a power-free water supply from the city's water system. In taller buildings, lack of access to water for drinking and sanitation during power outages will eventually force people out of their apartments. All apartment buildings should provide common area water taps that don't require water pumps so that residents have access to drinking water during power failures. Addressing this crucial need is one of the few Task Force proposals that would require upgrades to existing buildings. In addition, owners should consider installing or retaining rooftop water tanks to enhance building water reserves, and toilets and sinks should be able to flush without electricity.

Heat waves killed 152 New Yorkers between 1997 and 2010, more than any other natural disaster.<sup>1</sup> A power outage during a cold snap could be similarly deadly. The Task Force recommends extending its mandate to create a five-year plan to address this issue for residential buildings by improving insulation and air sealing. City regulations should be clarified to allow windows to safely open enough to help cool buildings during blackouts.





*This Manhattan family carried water upstairs after Superstorm Sandy left their building without power.*

## 23 Supply Drinking Water Without Power

**Issue:** During a power failure, residential buildings using electric pumps lose their supply of potable water. Water may be present below the sixth floor, but in some cases remains unavailable if a non-operating pump blocks the water supply.

**Recommendation:** Require residential buildings to provide drinking water to a common area, supplied directly through pressure in the public water main.

↑ required upgrade

## 24 Ensure Toilets & Sinks Work Without Power

**Issue:** Some toilets and faucets need electricity to function. This presents a sanitation risk during an extended power outage.

**Recommendation:** Require that toilets and faucets be capable of operating without grid power.

✦ new code



*Which of these buildings is not like the other? The dark blue super-insulated Brooklyn rowhouse in this thermal image shows just how drafty its neighbors are.*

## 25 Enhance Building Water Reserves

**Issue:** Water towers can provide potable water during power losses. City regulations no longer require water towers for new construction, and they allow towers to be removed from existing buildings.

**Recommendation:** Encourage building owners to maintain existing water towers and consider using water towers in new construction.

 recommended

## 26 Ensure Operable Windows In Residential Buildings

**Issue:** Operable windows permit cooling without power, which allows buildings to remain habitable during power outages and saves energy. New windows are often installed with stops that prevent them from opening more than 4.5 inches, reducing their cooling potential.

**Recommendation:** Extend the mandate of the Task Force through Fall 2013 to recommend options for regulating windows that address both child safety and overheating during blackouts.

 further action



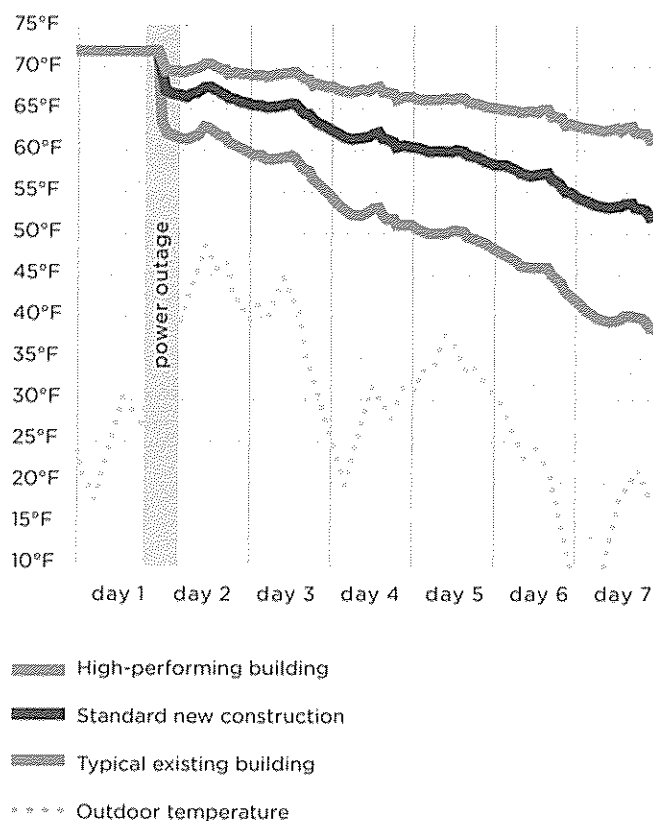
## 27 Maintain Habitable Temperatures Without Power

**Issue:** Utility failures often disable heating and cooling systems, leaving interior building temperatures dependent on whatever protection is provided by the insulation and air sealing of a building's walls, windows, and roof.

**Recommendation:** Extend the mandate of the Task Force through Fall 2013 to develop a multiyear strategy for ensuring that new and substantially altered buildings maintain habitable temperatures during utility failures. Clarify requirements for tightly sealing new windows and doors and upgrading roof insulation during roof replacement.

✚ further action

**Indoor Temperatures in a Masonry Building After a Winter Blackout**

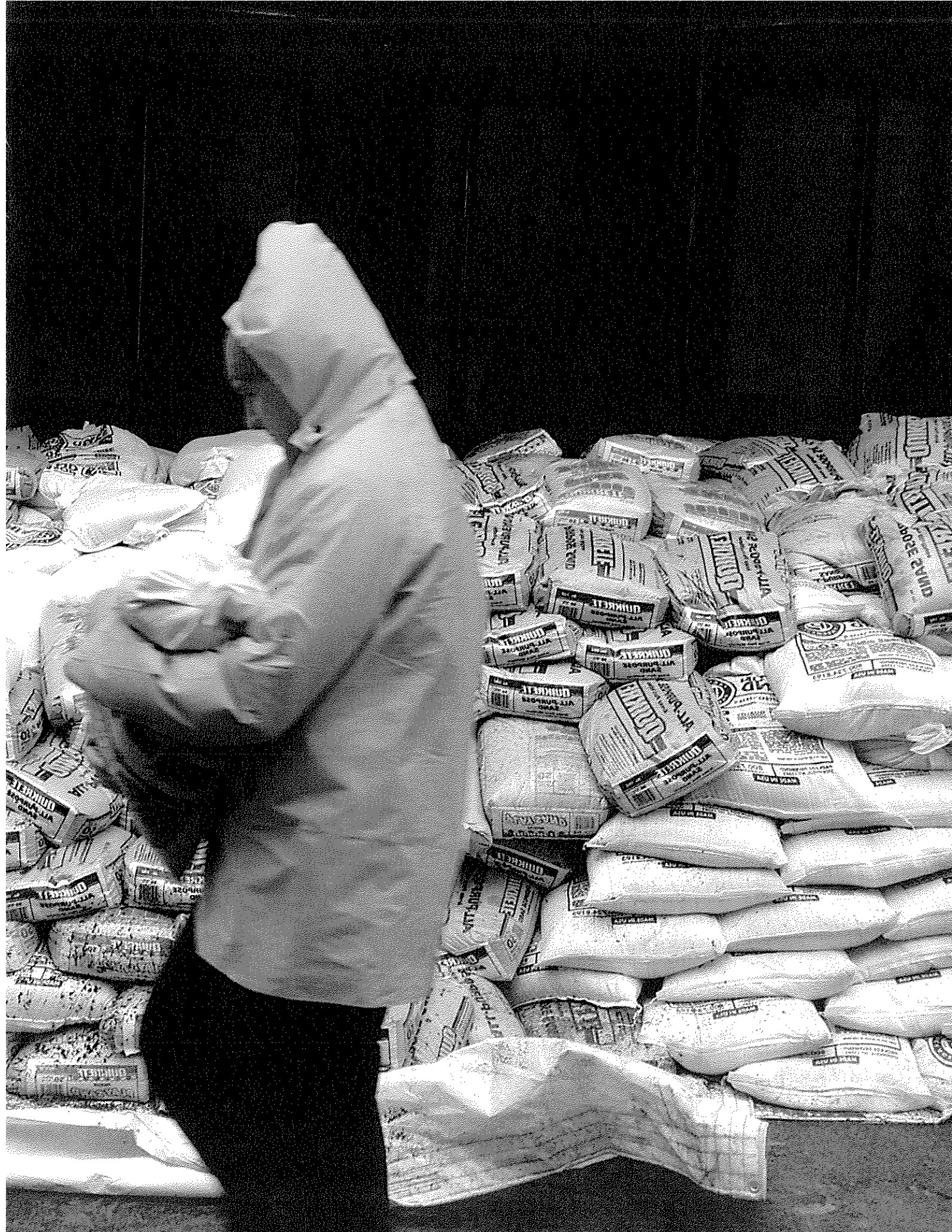


Source: Atelier Ten & Urban Green Council

# BETTER PLANNING







# BETTER PLANNING

Many low-cost steps can help save lives and property during emergencies, but only if building owners, their staff, and tenants prepare ahead of time and are adequately trained. Emergency planning can begin at any time without incurring large costs. City government should take a central role in educating building owners and residents, and owners will also need to share information with their tenants.

The proposals in this chapter fall into three groups: emergency planning, removing barriers to assisting those in need of help after disasters, and speeding up recovery.

Good planning is essential to reducing the impact of emergencies. The city should work with industry experts to develop emergency preparedness information and instructions for apartment residents and homeowners, as well as a building contact directory and emergency operation plans. Operation plans may include inexpensive measures that can prevent significant damage, such as using sandbags. And to facilitate disaster recovery, the Department of Buildings should continue its current effort to adopt an Existing Building Code, including special provisions for recovery and reconstruction.

We should also make sure that people can help each other during an emergency. Events such as Superstorm Sandy can bring out the best in people, but fear of liability or unintentional law-breaking can be barriers to helping out. This includes building owners and staff who might put

makeshift lights in stairwells and carry water and food to those in need, as well as professionals such as architects and engineers who inspect buildings during recovery. Both of these groups should be protected from liability while providing assistance after emergencies. Also, the city should inform building owners and tenants of official suspensions or relaxations of laws that may be temporarily in effect.

Recovery will go faster if officials and contractors are in a position to spring into action. The city should pre-approve more emergency inspectors. And, building owners should consider pre-negotiating agreements with their suppliers so that contract issues do not hold them up during desperate times.





*Building facades may be at risk of failure from heavy rain and high winds.*

## 28 Create Emergency Plans

**Issue:** The multiday loss of power and flooding from Superstorm Sandy exceeded most planning scenarios. As a result, few buildings or residents had plans to manage such emergencies.

**Recommendation:** The city should work with industry experts to develop emergency preparedness information and instructions for apartment residents and homeowners, including model emergency operating procedures and a building contact directory.

↑ **required upgrade**

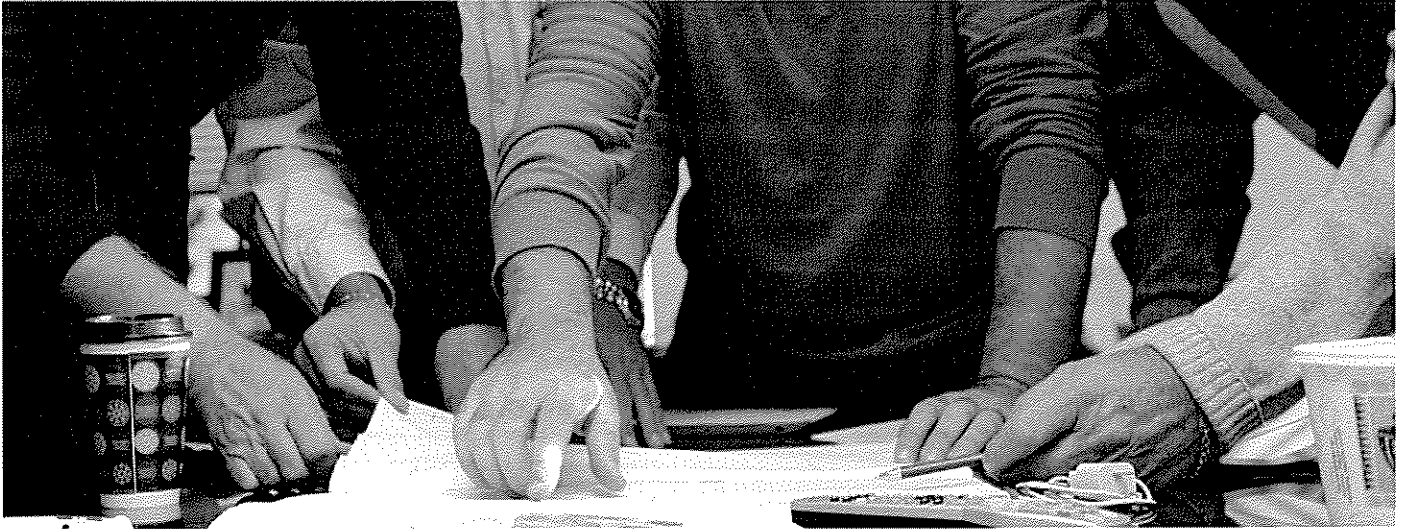
Ⓡ **recommended**

## 29 Adopt Existing Building Code

**Issue:** Existing building renovations are governed by a complex mix of new and old codes. This complexity discourages upgrades that would improve resiliency, particularly during time-sensitive recovery periods.

**Recommendation:** The Task Force supports the Department of Buildings plans to adopt an Existing Building Code, which will simplify regulation of building upgrades and streamline permitting for resiliency improvements. The new code or other regulations should include specific provisions for post-disaster reconstruction.

⊕ **further action**



*Planning ahead is essential for resiliency.*

### 30 Don't Discourage Buildings from Operating During Emergencies

**Issue:** Buildings need to remain open during many emergencies, but makeshift services that don't meet code standards during normal operations can be a liability risk. Buildings also need clarity about enforcement of various regulations during an emergency, such as those governing heat and stairwell lighting.

**Recommendation:** New York State should adopt legislation that limits the liability of building owners and their staff during emergency conditions. The city should inform owners and tenants how enforcement of regulations may be relaxed during emergencies.

+ further action

### 31 Support Good Samaritan Legislation

**Issue:** Architects and engineers often hesitate to volunteer with emergency recovery efforts due to liability concerns.

**Recommendation:** Enact New York State "Good Samaritan" legislation protecting architects and engineers from liability for emergency volunteer work.

+ further action

### 32 Preapprove Emergency Inspectors

**Issue:** The Department of Buildings has procedures to mobilize large numbers of public and private sector inspectors trained for post-disaster building assessments. There are opportunities to speed implementation and enhance capabilities by formalizing this program.

**Recommendation:** The Department of Buildings should formalize its practices by creating a Preapproved Emergency Inspector Program through its "special inspector" program to assist the city during emergencies.

+ further action

### 33 Prenegotiate Emergency Recovery Agreements

**Issue:** Finding service providers and negotiating agreements can delay recovery for damaged buildings.

**Recommendation:** As part of emergency planning, building owners and managers should identify service providers and prenegotiate emergency recovery agreements, reducing the economic and human impact of an emergency.

Ⓜ recommended

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Certain Task Force members were recognized by their peers for going above and beyond their duties. **Special designation** is given on the inside covers of this report.

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## Endnotes:

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### Chapter 2: Backup Power

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### Chapter 3: Essential Safety

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# POST-SANDY

# INITIATIVE

Building Better,  
Building Smarter:  
Opportunities  
for Design  
and Development  
*May 2013*

16'7"

Projected Year 2080 Flood Height with Sea Level Rise

14'5"

Projected Year 2050 Flood Height with Sea Level Rise

14'

Post-Sandy Advisory Base Flood Elevation  
with Residential Freeboard

13'

2012 Sandy Surge Level

12'

Post-Sandy Advisory Base Flood Elevation

8'10.8"

Pre-Sandy Base Flood Elevation

8'

Nominal Ground Level

0'

Sea level datum NAVD 88

**16'7" Projected Year 2080 Flood Height  
with Sea Level Rise**

**14'5" Projected Year 2050 Flood Height  
with Sea Level Rise**

"Climate Change Adaptation in New York City:  
Building a Risk Management Response:  
New York City Panel on Climate Change 2010,"  
*Annals of the New York Academy of Sciences*  
Volume 1196, 41-62. New York, May 2010.

**14' Post-Sandy Advisory Base Flood  
Elevation with Residential Freeboard**

Mayor Bloomberg Announces New Measures  
to Allow Home and Property Owners Rebuild-  
ing after Hurricane Sandy to Meet Updated  
Flood Standards, January 31 2013  
[http://www.nyc.gov/portal/site/nycgov/  
menuitem.c0935b9a57bb4ef3daf2f1c-  
701c789a0/index.jsp?pageID=mayor\\_press  
release&catID=1194&doc\\_name=  
http%3A%2F%2Fwww.nyc.gov%2Fhtml%  
2Fom%2Fhtml%2F2013a%2Fpr044-13.html  
&cc=unused1978&rc=1194&ndi=1](http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2013a%2Fpr044-13.html&cc=unused1978&rc=1194&ndi=1)

**13' 2012 Sandy Surge Level**

"NYC Storm Surge Map," Center for the  
Advanced Research of Spatial Information,  
Hunter College, City University of New  
York, 2012. <http://www.carsilab.org/sandy>

**12' Post-Sandy Advisory Base Flood Elevation**

(see source for 14')

**8'10.8" Pre-Sandy Base Flood Elevation**

Federal Emergency Management Agency.  
"Advisory Base Flood Elevation Information,  
Region 2 Coastal Analysis and Mapping."  
2013. [http://www.region2coastal.com/sandy/  
table](http://www.region2coastal.com/sandy/table)

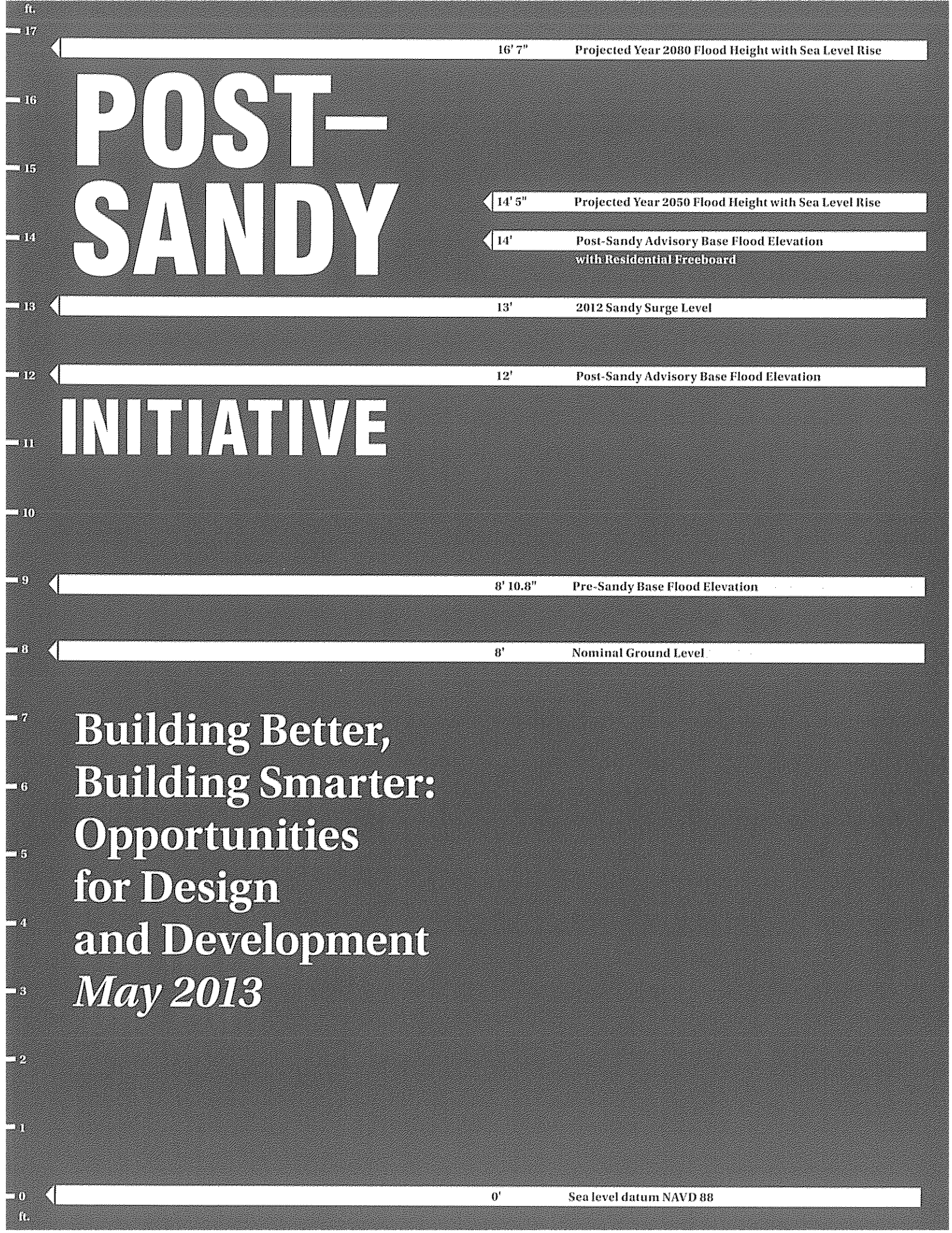
**8' Nominal Ground Level**

Federal Emergency Management Agency.  
Ground level at example site (111 Beach 222nd  
Street, Breezy Point, Queens). "Advisory Base  
Flood Elevation Information, Region 2 Coastal  
Analysis and Mapping." 2013.  
<http://www.region2coastal.com/sandy/table>

**0' Sea level datum NAVD 88**

Wikipedia. "North American Vertical Datum  
of 1988," last modified April 10, 2013.  
[http://en.wikipedia.org/wiki/North\\_Ameri-  
can\\_Vertical\\_Datum\\_of\\_1988](http://en.wikipedia.org/wiki/North_American_Vertical_Datum_of_1988)





# POST-SANDY

## INITIATIVE

Building Better,  
Building Smarter:  
Opportunities  
for Design  
and Development  
*May 2013*



# Preface

In response to Superstorm Sandy, the American Institute of Architects New York (AIA NY) has spearheaded a collaborative initiative investigating issues and outlining options and opportunities to address the short-, intermediate-, and long-term impacts of the storm and the escalating effects of climate change on New York City. The impetus for this work grew in part from an informal partnership that had developed between the AIA NY Design for Risk and Reconstruction Committee (DfRR) and the NYC Department of City Planning (DCP). Starting well in advance of Hurricane Sandy, these two groups had collaborated on multidisciplinary design explorations related to climate change. In addition, the DfRR Committee and AIA NY undertook a number of other pre- and post-Sandy initiatives, including training and organization of FEMA neighborhood assessment programs and coordination of initiatives with the NYC Office of Emergency Management (OEM), the Dean's Roundtable, related area design schools, and relevant AIA National programs. After the devastation of the storm, this relationship expanded to include a larger set of collaborators, the Post-Sandy Initiative, which prepared this summary.

This Initiative includes relevant committee members from AIA NY and volunteer representatives from other AIA chapters and sister organizations who share the commitment to recovery and belief that planning and design are a crucial component of rational decision-making. Numerous other agencies, panels, and organizations have been working in parallel with this Initiative, including those convened by the Mayor's Office, the City Council, the Governor's Office, the Municipal Art Society, the Regional Plan Association, Pratt Institute, and many others. We intend our work to complement and support these efforts, especially those with ties to the most affected populations.

## **The Initiative has four overarching objectives:**

**First**, to prepare a multifaceted report illuminating options and opportunities based on the best information available in a short amount of time. The report is intended to provide policymakers with additional tools as we forge ahead in response to Sandy.

**Second**, to mount an exhibition of this open-ended information so that it can be shared, discussed, and debated by design professionals, stakeholders, and recovery leaders.

**Third**, to initiate public symposia and ongoing programs in the four areas covered in the report, providing a framework for continued focus on Sandy recovery.

**Fourth**, to undertake continuing advocacy with relevant public, private, and institutional stakeholders, expanding the response to Sandy into efforts for a more resilient future.

In the wake of Sandy, it is evident that we need to learn from other cities and regions that have suffered similar weather events. These precedents serve as best practices on which we can rely as we begin to build back better and smarter. We support research into resilient measures of building, which can secure our regional future and become, in turn, best practices that can be helpful to other areas at risk.

As delineated in the following pages, participants have defined a variety of short-, medium-, and long-term responses in four key areas—Transportation & Infrastructure, Housing, Critical & Commercial Buildings, and Waterfront—that will feed into these larger public, private, and institutional efforts. Following the release of this report, we will continue these fruitful collaborations and advocate for ensuring the health, safety, wellbeing, and quality of life of our magnificent city and region. Building Better. Building Smarter.

## **Collaborating Organizations:**

American Council of Engineering Companies (ACEC New York)

American Society of Landscape Architects New York Chapter (ASLA-NY)

Citizens Housing & Planning Council (CHPC)

New York State Association for Affordable Housing (NYSAAFH)

American Planning Association New York Metro Chapter (APA-NYM)

Regional Plan Association (RPA)

Structural Engineers Association of New York (SEAoNY)

For more information on AIA NY's Design for Risk and Reconstruction Committee (DfRR) please refer to <http://designforrisk.com/>

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# Executive Summary

Superstorm Sandy revealed that we have created a defenseless built environment:

1. Land-use patterns encourage fragile dwelling units and critical facilities in the most vulnerable locations.
2. Transportation and utility systems fail in the face of extreme weather events.
3. Stormwater management and development policies now in effect actually increase the impact of runoff.
4. Existing buildings are barriers to sustainability, squandering power and producing greenhouse gases.

The overarching long-term objective is **resilience**, which can best be achieved by modifying buildings, transportation and infrastructure networks, and land-use patterns.

- This will require consensus on standards and where they apply—what constitutes “harm’s way,” based on updated predictions of flood zones, storm surges, and sea-level rise, and how these assumptions may shift or increase in coming years.
- It will also take careful analysis of many possible strategies—examining relative costs and benefits in the context of likely useful lifespans.
- There is no universal solution. Design approaches should be site-specific and respond to local programmatic needs.

A great deal of work has been published and is underway on responding immediately after disasters. As architects, planners, and designers, our focus has been, instead, in an area where we can make the most meaningful contribution: design approaches to new construction and rehabilitation to help limit the effects of future storms on our built environment, and processes to help us coordinate our efforts to provide critical services, including regional transportation, immediately after a major storm.

Building back better and smarter—moderating past mistakes through careful planning, becoming more energy independent, and requiring sustainable design and construction practices—will help reverse the vulnerability we have inherited from centuries of misguided development.

## TRANSPORTATION & INFRASTRUCTURE

Regional coordination and planning for redundancy can ensure that our transportation and infrastructure networks will operate before, during, and after severe weather events.

These aging systems were not built to withstand today’s rising sea levels and severe storms. Identifying their vulnerabilities and planning for their reinforcement is an urgent priority, demanding interagency collaboration, public education and commitment, and solutions that contribute to the design quality of the City and region.

### Key concepts and findings

**Planning for Redundancy:** Transportation and infrastructure networks are interdependent. Multiple and alternative power sources can keep them functioning during severe weather events. Robust, multiple-system communication plans can alert the public to evolving conditions.

**Planning for Resiliency:** Reinforcing vulnerable structures and repositioning critical equipment can protect vital infrastructure systems. Sensitively-designed elements can also serve as urban amenities. Replacement of those systems that were heavily damaged by Superstorm Sandy should maximize long-term sustainability.

**Planning Smart:** We have identified case studies that reveal three distinct strategic approaches—defensive, adaptive, and passive. **Defensive** infrastructure can demand burdensome long-term funding and management; for each particular situation, scenario-planning exercises and other research are needed to suggest whether hard infrastructure (with a constructed resiliency) or simpler, softer solutions will best protect the community. **Adaptive** efforts reduce disruption of natural ecosystems, and focus on green infrastructure approaches. **Passive** solutions accept that protecting investments is impractical in a particular situation, and focus on moving or providing alternative systems. For all strategies, solutions must contribute to the amelioration of service gaps and improved design quality of the public realm.

### Opportunities and next steps

- Assess the infrastructure and transportation systems at greatest risk, and identify strategies for their redundancy and resiliency.
- Educate the public about challenges ahead to ensure realistic expectations and support for required expenditures.
- Improve interagency and interstate communications for holistic planning

before the fact and regional coordination during extreme events, including emergency wayfinding strategies to inform residents about alternative backup plans for transportation, power, fuel, and locations for assistance.

- Recognize that infrastructure failures in New York City can have catastrophic international impacts. The funding required to strengthen our infrastructure should be leveraged through all parties that benefit from preventing expanding economic disorder.

## HOUSING

Multi-family buildings fared much better than one- and two-family dwellings. Yet local and national regulations related to housing in flood zones do not address the conditions of a dense urban place like New York City.

Superstorm Sandy revealed the need for new strategies to address evacuating residents who will be displaced in future disasters, and their security and comfort if sheltering in place is necessary. The existing housing stock must be retrofitted to become more resilient. Standards for new housing must ensure that it can be safe, accessible, and attractive.

### Key concepts and findings

Housing displaced people in extreme events requires knowledge of available units, a centralized intake process, and a set of tools including appropriate waivers, qualifying processes, model lease agreements, and allocation of subsidies.

Non-profit housing providers need support with post-disaster training to address residents’ needs, especially in flood-prone neighborhoods.

Gaps in current floodproofing guidelines and regulations—at both local and federal levels—must take into account the character of dense urban environments.

Multi-unit housing stock in flood zones, even where damaged, remains largely sound. With strategic modifications, the useful life of most of these buildings can be extended well into the future.

Broader planning implications should be addressed, such as whether exceptions to allow multi-family housing in downzoned coastal areas could increase community resiliency.

### Opportunities and next steps

FEMA and National Flood Insurance Program literature is largely focused on one- and two-family housing. It is our conclusion that a FEMA multi-family design guide is very much needed.



Zoning regulations should be adjusted, in light of predicted higher flood levels, to recognize the amount of space needed by required ramps, elevators, and lifts in multi-family buildings, and to provide for the relaxation of height restrictions in order to accommodate higher-elevation ground floors.

In low-income rental buildings and supportive and senior housing, where residents may not be able to individually evacuate, safe rooms and expanded programs should be provided to allow congregation, roll call, and rescue during emergency conditions.

Multi-family housing should be engineered with building systems that protect against HVAC shutdowns, provide for alternative power during outages, and ensure a quick return to normal.

### CRITICAL & COMMERCIAL BUILDINGS

The challenges of adapting the vast inventory of existing critical buildings to withstand the effects of extreme climate events are distinct from the relatively easier task of designing new structures for resiliency.

Critical facilities like hospitals, police stations, and data centers must be able to withstand the effects of a disaster and remain in operation without evacuation. Other buildings in vulnerable locations may be evacuated, but should be designed to survive without structural failure. Building owners have a responsibility to protect occupants, protect structures and contents from damage, and ensure that buildings can operate during and after the event.

#### Key concepts and findings

Owners of all commercial and institutional buildings—existing, in construction, or planned—should begin now to:

- ▶ Conduct vulnerability assessments of their buildings in anticipation of the likely effects of extreme climate events.
- ▶ Identify technical standards and technologies that will allow their buildings to successfully withstand these events.
- ▶ Update plans to keep buildings operational during disasters and to quickly recover functionality afterwards.
- ▶ Create implementation plans to put in place remedial actions indicated by the three preceding steps.

#### Opportunities and next steps

Disaster-resistant building design strategies, technologies, and materials that already exist or are being developed elsewhere should be examined and adapted here.

We should move toward replacing existing critical buildings in harm's way that cannot be hardened, with exceptions for buildings of historic or cultural significance.

We need regional protective systems that can enhance, or eliminate the need for, individual building responses.

The challenges that hurricane conditions and floods pose for buildings, in particular those in densely populated areas, should be brought to the attention of the many scientific, governmental, and professional organizations currently exploring the potential impacts of climate change. Dialogue will lead to better simulation models of water and wind behavior on built structures, a new national reference code for building construction, and zoning and planning approaches that bring patterns of development into line with present and emerging knowledge about disaster-prone areas.

### WATERFRONT

The future of New York as a waterfront city depends on respecting our changing environment and building on the unifying strength of our dynamic harbor and waterways in creative ways.

Superstorm Sandy has given us a new perspective on New York City's diverse waterfront and watershed—comprising ocean, riverine, and estuarine systems within a broader context of interactive water flow. Floods and storm surges are part of natural cycles, although their frequency, intensity, and impact on our city are increasing. Within this ecological context, an array of opportunities exists that can integrate diverse land-uses—public access, parks, housing, commercial districts, and working waterfronts—and accommodate the climatic events we must now anticipate.

#### Key concepts and findings

More scientific research will help us to understand the interactions between urban waterfront and human ecologies. We need a dynamic and innovative approach to waterfront projects, allowing for experimentation and novel resiliency strategies.

Interdisciplinary collaborations, organizational structures, and funding mechanisms could promote robust collaborations among pure and applied disciplines—linking the design community, the scientific research community, and the regulatory community.

There is always more than one solution. New York City has 520 miles of shoreline, with varying geomorphology, hydrology, land-uses, and habitat types. Planning and design of waterfronts should embrace unique, site-specific attributes.

For instance, we need to set priorities for current and future funding for the alternatives being identified and discussed by the City's post-Sandy task force, the Special Initiative for Rebuilding and Resiliency (SIRR).

There is always more than one solution. New York City has 520 miles of shoreline, with varying geomorphology, hydrology, land-uses, and habitat types. Planning and design of waterfronts should embrace unique, site-specific attributes. For instance, we need to set priorities for current and future funding for the alternatives being identified and discussed by the City's post-Sandy task force, the Special Initiative for Rebuilding and Resiliency (SIRR), the Department of City Planning's year-long Urban Waterfront Adaptive Strategies Study, and NYS 2100 Commission. These include nourishing beaches and expanding dunes, reinserting wetlands, raising bulkheads, adding tide gates and revetments, building breakwaters, installing passive and deployable floodwalls, constructing seawalls and surge barriers, and conceiving of dual-use or multi-purpose levees.

Redundancy and modularity should be built into flood protection and stormwater management systems in densely-populated areas.

All members of waterfront communities should be included in the planning and implementation processes via community outreach and communication.

#### Opportunities and next steps

We need a ground-up, incremental approach to waterfront resiliency, partnering with local communities to generate sensitively formulated solutions, and arming property owners with a menu of strategies. From government we need agility and flexibility in regulations, and funding that affects the planning and design of waterfront solutions in the context of a collaborative, problem-solving approach.

We propose Waterfront Labs to investigate strategies that could mitigate storm surge, prevent erosion, and soften the impact of rising tides. Experiments would focus on both predictable and unpredictable events, and take into account the different natural typologies found in the New York City region. The Waterfront Lab will make an important contribution by bringing New York City to the forefront of innovative waterfront resiliency planning and design.

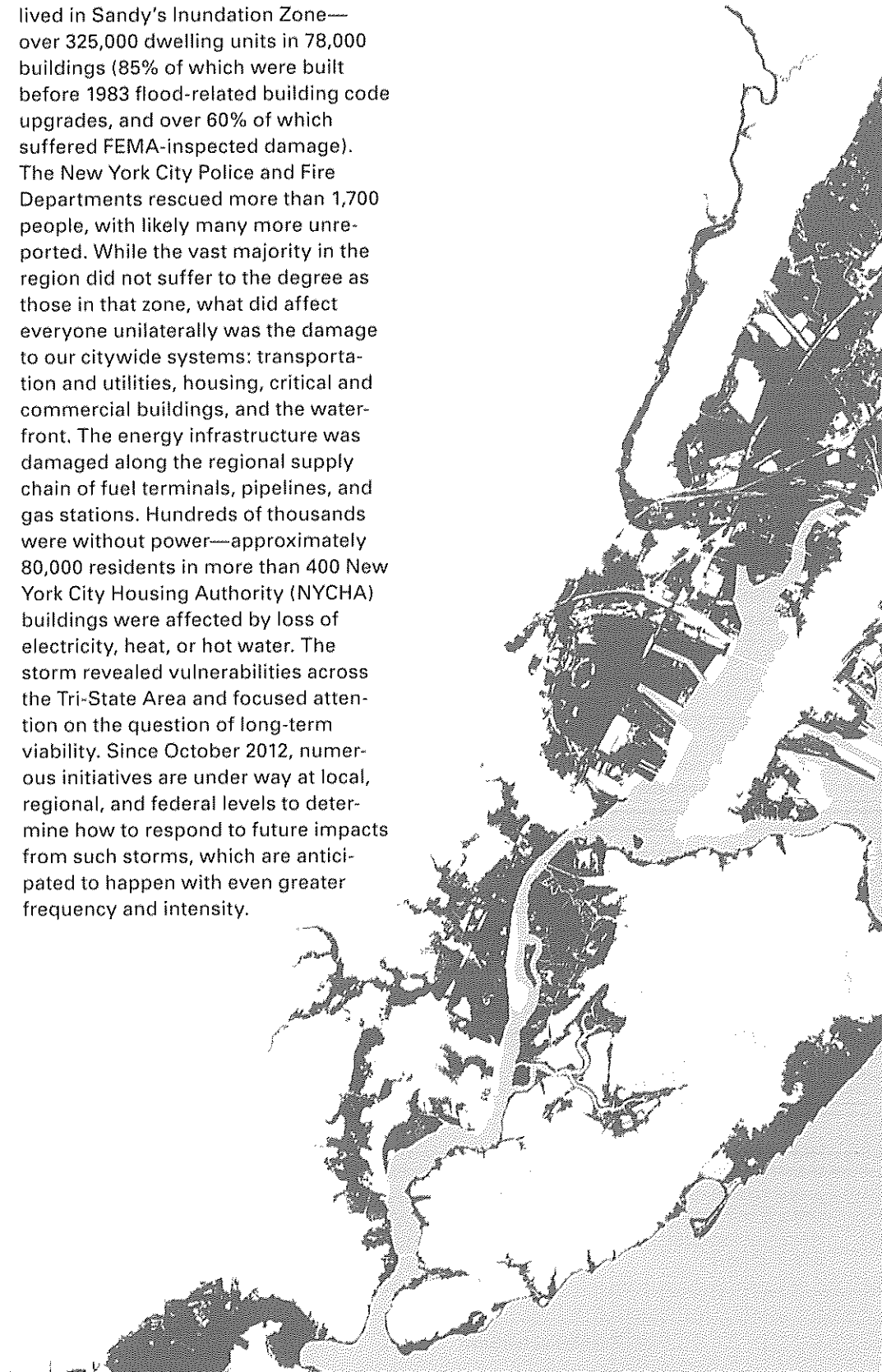
# INTRODUCTION

The cover of this report graphically quantifies Sandy's impact—and future potential implications—in terms of comparative feet and inches. Sandy's regional inundation levels are shown in the adjacent map.

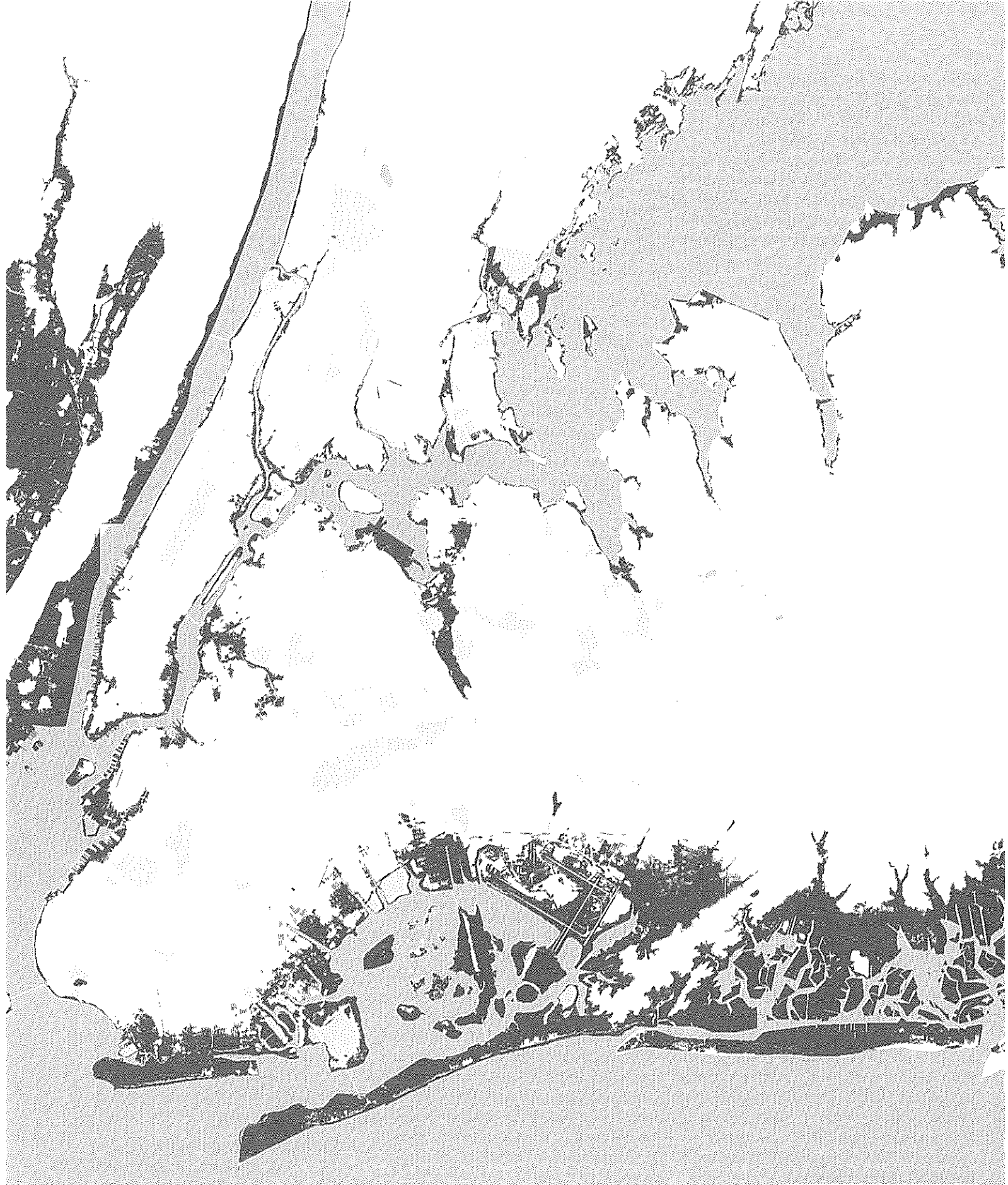
As we now understand, many of the most acute impacts of Superstorm Sandy resulted from the confluence of several unique circumstances: an off-shore hurricane that entered the New Jersey / New York City / Long Island region at full bore; a fast-rising storm surge that came and went quickly; one of the highest tides of the year combined with a full moon; a Nor'Easter, and a disturbance in the jet stream that caused the storm's turn west into New Jersey. We need to learn from Sandy in order to address other different but equally threatening factors that may emerge from the next storms. For example, Hurricane Irene in 2011 caused flooding resulting from intense rainfall, rather than the storm-surge-driven flooding seen during Sandy. Wind damage from Sandy was limited to the area of first landfall, although tree damage and resulting power outages were major issues in adjacent inland areas. Obviously it is difficult to predict the factors and results associated with any storm.

Superstorm Sandy resulted in large numbers of people losing their homes, livelihoods, and in some instances, their

lives. More than 10% of the City's population (almost 850,000 people) lived in Sandy's Inundation Zone—over 325,000 dwelling units in 78,000 buildings (85% of which were built before 1983 flood-related building code upgrades, and over 60% of which suffered FEMA-inspected damage). The New York City Police and Fire Departments rescued more than 1,700 people, with likely many more unreported. While the vast majority in the region did not suffer to the degree as those in that zone, what did affect everyone unilaterally was the damage to our citywide systems: transportation and utilities, housing, critical and commercial buildings, and the waterfront. The energy infrastructure was damaged along the regional supply chain of fuel terminals, pipelines, and gas stations. Hundreds of thousands were without power—approximately 80,000 residents in more than 400 New York City Housing Authority (NYCHA) buildings were affected by loss of electricity, heat, or hot water. The storm revealed vulnerabilities across the Tri-State Area and focused attention on the question of long-term viability. Since October 2012, numerous initiatives are under way at local, regional, and federal levels to determine how to respond to future impacts from such storms, which are anticipated to happen with even greater frequency and intensity.







Source: MQTF Inundation Model. Date: April 3, 2013  
© 2013 ESRI, DeLorme, NAVTEO

**Superstorm Sandy  
Surge Infiltration Map**

Sandy's unexpected power and breadth created a need for realistic standards to protect communities in the way of future storms—which may be even more powerful in terms of wind, rain, and potential damage. This unprecedented challenge, complicated by estimates of rising sea levels and increasing frequency of events, will define how we plan and regenerate the inundated areas and the regional context.

Even as people and buildings suffered terrible direct impacts, the City and region as a whole suffered massive indirect impacts of the storm. Adverse effects to economic vitality, communications infrastructure, and connectivity networks were widespread.

The initial step in any disaster is **response**, preserving life and critical property in the midst and immediate aftermath of the event (ideally preceded by effective pre-planning for evacuation and staging of needed resources). This is followed by **recovery**, returning to as much normalcy as possible, in turn followed by organized and deliberate rebuilding. The overarching long-term objective is **resilience**—modifying buildings and land-use patterns over time, and infrastructure where significant investment prevents physical relocation, and waterfront edges that transition between the shore and upland areas—hardening and/or softening as relevant to mitigate the impact of future events.

In order to deal with these challenges, Mayor Michael Bloomberg's Special Initiative for Rebuilding and Resiliency (SIRR) program is engaged in preparing an integrated strategy to address how we rebuild New York City to be more resilient in the wake of Hurricane Sandy, but with a long-term focus. The City will use its first allocation of federal Community Development Block Grant (CDBG) funds to support recovery from Sandy and to build in resilience to the challenges of climate change, including programs to build and support housing, businesses, infrastructure, and other city services. This process, undertaken through the coordination of numerous governmental agencies and multidisciplinary advisors, relies heavily on community outreach to define issues and priorities. As planning

and design professionals, our intent is to support that process through our parallel volunteer efforts.

But as we step back from the immediate shock and imperative response to emergency conditions, we must recognize that much of the problem lies in our own culpability as a client society—the way we have helped over the years to create a susceptible built environment:

- Land-use patterns that encourage fragile dwelling units and critical facilities in the most vulnerable locations;
- Transportation and utility systems that fail more and more frequently in the face of natural events;
- Stormwater management and development policies that increase rather than decrease the impact of runoff;
- Existing buildings that are barriers to sustainability—and that, in NYC, use 94% of electrical production and produce 75% of greenhouse gas emissions.

Overall, sea levels are rising and extreme storm events are becoming more frequent, both because of natural cycles and the worsening impact of human-induced climate change. By building back better and smarter—moderating our past poor decisions through careful planning, becoming more energy-independent, and setting in motion new, sustainable design and construction practices—we can begin to mitigate or reverse the effects of centuries of misguided development policies.

#### The Post-Sandy Initiative

The Post-Sandy Initiative, the collaboration that produced this summary report, is structured as the planning and design community's response to this challenge. Initiated by the American Institute of Architects New York (AIANY) in the weeks that followed the storm and in collaboration with a wide range of other professional organizations and concerned individuals, it has been supported by the participation of a variety of local, regional, state, and national public agency participants. At publication time, still only months after Sandy swept through our region, this report is a slice

in time of our efforts as of April 2013—a definition of issues, an analysis of options and opportunities, and the establishment of a framework for next steps. As our community continues to explore these issues and develop ideas for building better and building smarter, progress reports will be issued online at [www.postsandyinitiative.org](http://www.postsandyinitiative.org).

Unlike many of the areas devastated by comparable American storms, New York City is a major urban region whose vitality and resiliency depends on a complex web of interconnected systems. With more than 8 million residents, 6 million commuters each day, and 50 million annual visitors, New York City is the largest regional economy in the United States, and the second largest city economy in the world after Tokyo. New York is a cultural capital and home to hundreds of museums, performing arts venues, and historic sites; and more than 600,000 students are enrolled at the City's 110 higher education institutions, a larger number than the entire population of Boston.

Through the Post-Sandy Initiative's working groups, it quickly became clear that "one size does not fit all"—the imposition of national or other standards, often based on rural, suburban, or small-city situations, may not always be applicable to our high-density environment, and falls short in addressing our complex, interconnected social and economic culture. A series of complementary initiatives, many based on experience from outside the United States, is required to affect meaningful change.

As part of this Initiative, many professionals have given their time to explore important issues about Sandy and the response to date, both in terms of shorter-term recovery efforts and longer-term resiliency considerations. It is clear that we can, and need to, do better in the face of future extreme weather events. Key areas for further discussion include:

#### During a major storm event:

- Dealing with governmental/OEM and FEMA evacuation mandates in the face of concerns such as public housing con-

straints, property owner reluctance, and public safety considerations;

- ▶ Ensure that evacuees have places to go out of harm's way, and reliable means to get there;
- ▶ Reinforce and protecting building systems, infrastructure function, and ability to provide police and fire protection.

#### **Short-term recovery:**

- ▶ Assess the damage to property and community;
- ▶ Provide equitable public support in the face of varying insurance coverage;
- ▶ Justify and balance rapid-recovery efforts and costs with follow-up repairs;
- ▶ Define the standards for remediation, and resulting costs, in terms of medium-and long-term benefits;
- ▶ Understand the implications of insurance rates based on those standards, and their impact on property owners of various incomes.

#### **Medium-term remediation:**

- ▶ Define workable standards for both relatively easier new construction and significantly more difficult existing repair and reconstruction;
- ▶ Develop approaches for rebuilding based on sustainability and resource conservation;
- ▶ Establish clear standards from amongst differing expectations on the rate of climate change and sea-level rise predictions;
- ▶ Deal with social inequity, community, and economic issues of long-term settlement in areas that are now in harm's way;
- ▶ Create equitable (and appropriately funded) programs for purchase of destroyed or damaged homes and transference into open space.

#### **Long-term resilience:**

- ▶ Analyze long-term infrastructure and waterfront investments despite a lack of definitive new scientific standards for flood zones and sea-level rise;

- ▶ Evaluate how to finance premiums for design and construction based on short-term cost but long-term benefit without affecting immediate alternative needs or choices;
- ▶ Advocate planning and design solutions that reduce carbon emissions and our reliance on fossil fuels, as well as work with anticipated future water levels.

#### **There are two major determining factors in defining resilience:**

- ▶ Achieve consensus among the responsible parties (FEMA, the states, the City, and other municipalities, insurance companies) as to standards—what constitutes “harm's way.” This definition will necessarily be based on predictions of sea-level rise, possible storm surges, and recommended allowances for “freeboard” above those flood levels—and how they are predicted to increase over a series of benchmarks throughout the coming century and beyond.

**The overarching long-term objective is resilience—modifying buildings and land-use patterns over time, infrastructure where significant investment prevents physical relocation, and waterfront edges that transition between the shore and upland areas—hardening and/or softening as relevant to mitigate the impact of future events.**

- ▶ Careful cost-benefit analyses that take into account funding cycles and the benefits of funds at the users' end, present value, and alternative uses of funds.

As the planning and design community, we are one voice in these critical issues. But our expertise and perspective are invaluable components of the solution. Architects, landscape architects, planners, and engineers must be at the table as policies and standards are developed to mitigate or reduce the risk of catastrophic damage from the next storm. We must apply our experience to those issues that speak to the physical, social, and environmental implications of possible decisions. More value and emphasis must be placed on long-range comprehensive planning under the initiative of elected leaders. Systems and resources must be organized so that short-term decisions are aligned with long-term health, safety, and sound investment.

We framed this Post-Sandy Initiative in terms of design implications and applied design thinking. A set of working groups examined key aspects of the built environment in detail, through collaboration, research, workshops, and design charrettes. We have examined these topics in terms of short-, medium-, and long-term time frames, and at a range of scales, from individual buildings to neighborhood contexts, the surrounding city, and the region as a whole.

The following chapters summarize issues, options, and opportunities identified by four of these working groups—Transportation & Infrastructure, Housing, Critical & Commercial Buildings, and Waterfront. The valuable work of a fifth working group—Zoning & Codes—has been incorporated throughout the text. Each of these reports is supplemented online by additional material delving into specific areas of concern and concepts for building better and building smarter at [www.postsandyinitiative.org](http://www.postsandyinitiative.org)





# TRANSPORTATION & INFRASTRUCTURE

Regional coordination and planning for redundancy can ensure that our transportation and infrastructure networks will operate before, during, and after severe weather events.

Public transportation entities such as the Metropolitan Transportation Authority (MTA), NJ TRANSIT, the Port Authority of New York & New Jersey (PANYNJ), and Amtrak are all re-examining Sandy's impacts and developing short- and long-term responses to climate change within the context of restricted budgets and smaller workforces.

City agencies responsible for infrastructure—sewer, water, and stormwater drainage—are examining failures and planning for future needs. Power utility providers such as ConEdison, LIPA, and PSE&G are developing new strategies. Advocacy groups such as the Municipal Art Society (MAS), the Regional Plan Association (RPA), and the Rudin Center for Transportation have served in multiple roles, from educating the public through public dialogues and white papers, to lobbying for funding and improved communication among infrastructure and transportation providers. It is critical to understand all of these ongoing efforts while working across disciplines that cross municipal and state lines.

Interagency collaboration and a well-developed communications plan established jointly by various transportation and infrastructure agencies that serve the City and region can strengthen the framework for future multi-modal redundancy and resiliency.

## KEY CONCEPTS AND FINDINGS

As noted in Governor Andrew Cuomo's NYS 2100 Commission report, "Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure" (November 2012), New York State's recent ClimAID projections show that higher temperatures and sea-level rise are extremely likely for New York State through the end of the century, and that by 2100, experts project sea levels to rise in New York City and Long Island by as much as six feet under certain scenarios. Given our aging transportation and infrastructure, those statistics make identifying the weaknesses in our systems of utmost urgency. The following strategies are our recommendations for responding to the new anticipated norm.

### Planning for Redundancy

Planned redundancy provides a more flexible infrastructure. As many of our transportation and infrastructure networks are interdependent, losing one often causes the loss of others. Working towards providing appropriate backup power systems along with alternative power sources, such as solar, wind, or geothermal, will make grid dependency less critical. Policies that encourage redundancy would promote these actions.



Once in operation, New York City's CitiBike program will provide alternative transportation for some residents. Photo credit: CitiBike / NYC Bikeshare

Developing a robust communications network and plan will allow transportation agencies to alert the public about station closings and alternate transportation routes, prior to and immediately after severe storm events.

### Planning for Resiliency

There are currently available physical solutions that can protect our transportation and infrastructure networks against flooding. Sensitive designed, these barriers can also serve as urban amenities. By reinforcing vulnerable structures, we can fortify them to

withstand these "new normal" events. These actions should be supported by policies that address strengthening existing structures with ongoing repair programs, as detailed in Section 3 on critical and commercial buildings. Placing new electrical equipment above anticipated flood levels and replacing damaged equipment with new equipment designed to work in a harsh salt-water environment are examples of strategies that could be implemented as part of an overall plan.

As we move from short-term recovery to long-term planning for redundancy and resiliency, we need to plan smart so we can build smart.

### Planning Smart

Smart planning in the new ecosystem involves looking at transportation and infrastructure systems in new ways. It begins with an intermodal interagency process of regional cooperation, communication, and coordination for standard operations, regular outages, and extreme weather situations.



Temporary flood barriers were constructed prior to the storm at vulnerable entrances. Photo credit: Flickr / MTA Photos Photostream



It includes recognizing the efficiency of having tunnels act as drains for our cities, and considering the different ways that systems can function during severe storms, and how that differs from how they perform during a non-event.

Providing uninterrupted services at vital facilities such as hospitals, firehouses, and shelters should be prioritized as part of an overall infrastructure network. Planning smart means examining existing and new infrastructure comprehensively with a clear understanding of specific risks that vary based on location. Building better will mean coordinating systems between agencies serving the same region, and acknowledging that often a replacement in-kind is not an adequate solution.

To plan smart, we need to enhance our guidelines and standards for resiliency and redundancy by integrating the following best practices:

#### **New Infrastructure**

The Inner Harbor Navigation Canal Surge Barrier in New Orleans (the only

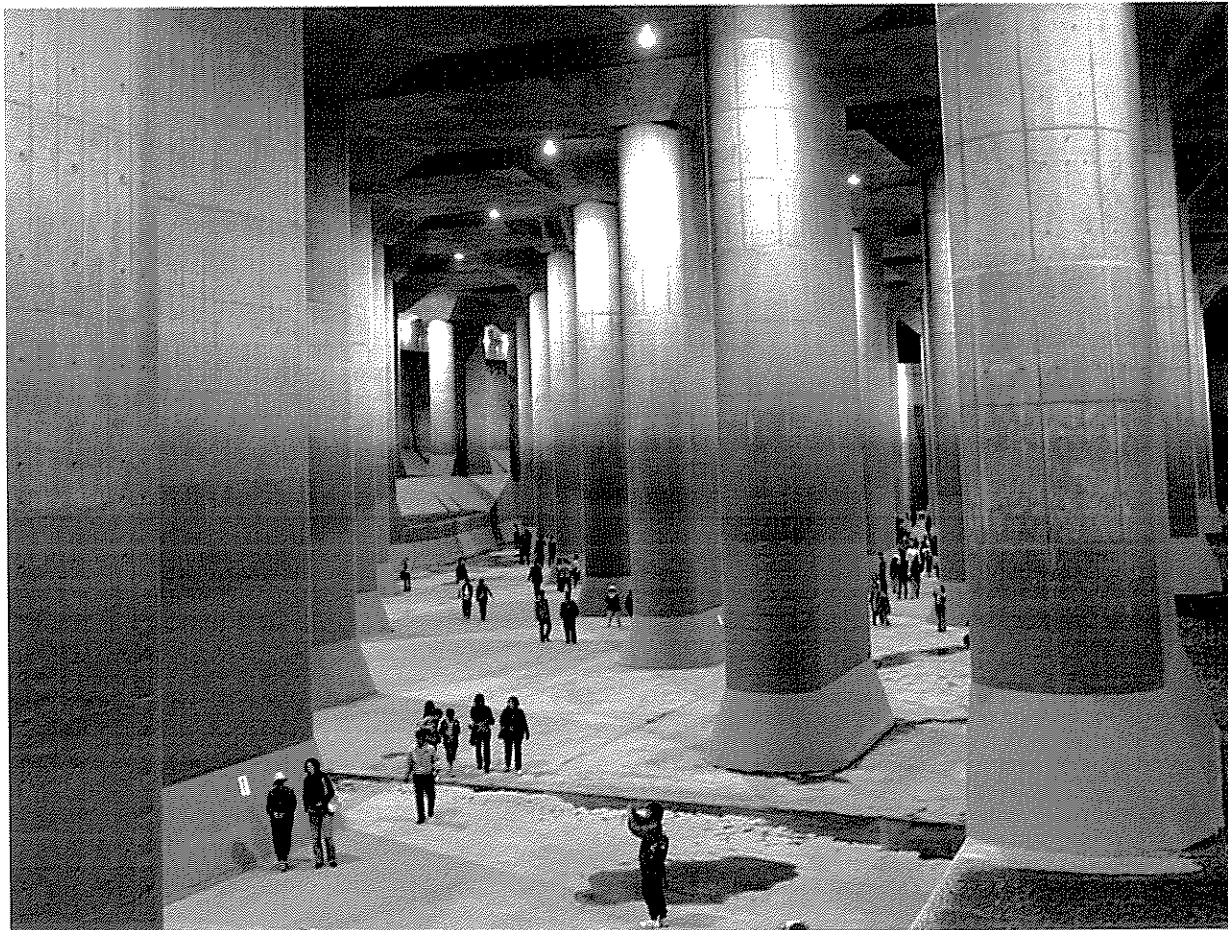
one like it to date in the United States), London's Thames Barrier, and the Delta Works in the Netherlands are examples of climate change-responsive infrastructure solutions that are less than 30 years old. These structures typically need to be funded from design through construction and maintenance. As an example, sewage treatment failures in extreme storm events may require long-term funding of a hardened system to mitigate such problems in future storms. We recognize that in our region, these new types of infrastructure will need to be developed and maintained by a new public institution, or added to the responsibilities of an existing one.

Scenario-planning exercises in different communities, similar to what is being demonstrated as part of Mayor Bloomberg's citywide Special Initiative for Rebuilding and Resiliency (SIRR), can further inform how soft solutions or hard infrastructure can protect communities from severe storms like Sandy, and how they may either detract from or enhance those communities' quality of life.

#### **Reduce Impact to the Ecosystems**

New York City already has one of the lowest carbon footprints per capita in the country. As we develop these recommendations, we must continue to reduce this footprint and reinforce our city's approach to sustainability, ensuring that our redundancy recommendations reduce negative environmental impacts as well. The use of permeable paving materials and water retention systems that reduce the demands on sewer systems are two such viable possibilities. Another is to encourage less energy-dependent transportation modes, such as bicycle and pedestrian networks and technologies, as part of the overall regional transportation system.

It will also be important to look at areas and communities that may have been underserved in terms of a broader adoption of green infrastructure measures, and how that, in fact, may minimize flooding in the future.



G-Cans Project,  
Tokyo, Japan

One of the world's largest underground flood-water diversion facilities was designed to protect Tokyo from flooding during typhoon season and heavy rains.

### Urban Design Quality

Part of building for a resilient future is protecting our communities from problems resulting from climate change, and doing so in a way that uses natural as well as engineered measures to improve both redundancy and resiliency. Neither measure should, however, exclude maintaining the quality of the built and natural environment. Therefore, it is critical to solve these technical challenges in a way that does not lose sight of the human condition. Solutions must generate positive interventions from architectural and urban design perspectives. We must not forgo the vitality of our built environment, and in cases where communities may have been underserved aesthetically, address infrastructure and transportation needs as an opportunity for both urban and economic enhancement.

### Responses Prior to Catastrophic Events

Having plans in place for catastrophic events, and communicating them to the public, is a low-cost initiative that pays dividends. Procedures to close transportation systems in order to safeguard transportation and infrastructure networks (including relocating mobile equipment to higher ground, installing temporary flood barriers, etc.), and requiring mandatory evacuations of vulnerable areas must be developed. This would increase safety and security during a storm. The MTA and the City of New York taught this lesson to millions. A regional process for communicating station, road, and line closures to the public prior to severe weather events—and providing clear information about alternative routes—should be developed and employed, as mentioned above.

### Responses to Catastrophic Events After the Fact

The recovery after Superstorm Sandy was uneven, and for many residents, not knowing when essential services would

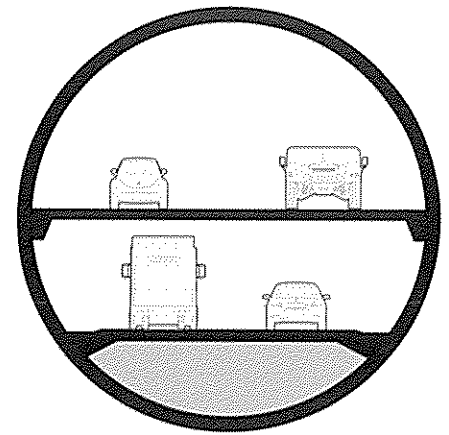
be restored was more difficult to accept than the event itself. Implementation of the strategies summarized previously, in particular the redundant and resilient systems, will help to mitigate future similar challenges.

Additionally, local outreach facilitators should be trained to educate communities about their various transportation options. Key information points can be established in advance so that in the event of a broad-based Internet shutdown, data on current and planned operations are accessible throughout the City. Details on alternative transportation systems, including bike routes and ferries, should be well distributed. Workforce development programs can help to lessen post-catastrophic isolation.

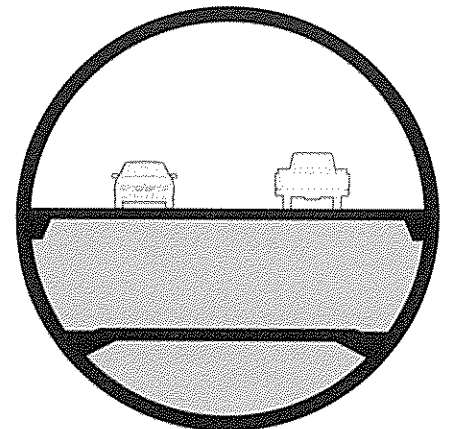
There remains much that can be done. Our institutions need to treat the “catastrophic” as “expected” and prepare accordingly. Doing so may change the “catastrophic” to merely “inconvenient.”

## POLICY CONSIDERATIONS AND REGULATORY IMPLICATIONS

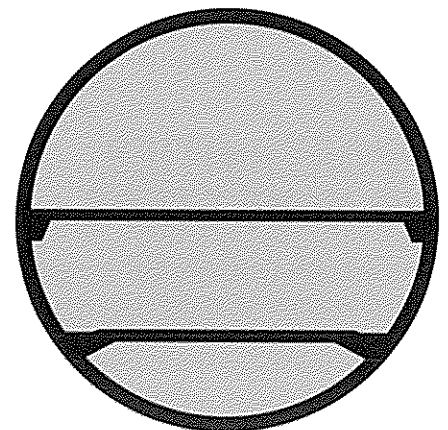
Transportation and infrastructure, when compared to other aspects of the built environment, are far more developed, controlled, and managed by public agencies. Responsive programs will necessarily be filtered through government programs and regulatory modifications. This includes agencies such as the Federal Emergency Management Agency (FEMA), the Federal Transportation Administration (FTA), the Federal Aviation Administration (FAA), the Environmental Protection Agency (EPA),



**MODE 1**  
Normal Conditions  
2 Roadways Open



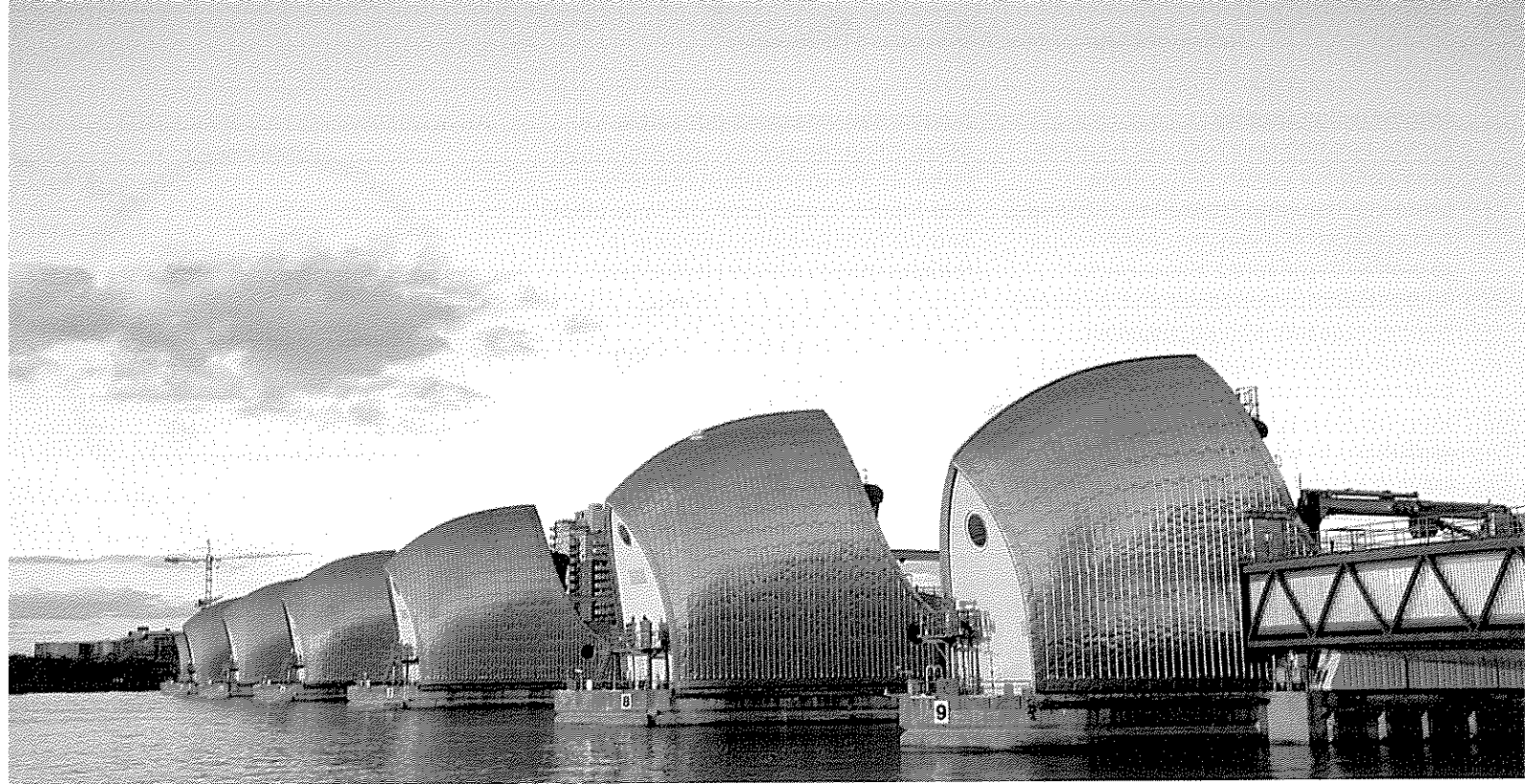
**MODE 2**  
Moderate Storms  
1 Roadway Open



**MODE 3**  
Heavy Storms  
0 Roadways Open

SMART Tunnel, Kuala Lumpur, Malaysia

The SMART tunnel is six miles long and consists of two tubes, each carrying two traffic lanes, situated one above the other. The tunnel is used to manage severe flooding during monsoon season. Its mechanical and electrical equipment can handle submersion to a depth of 65 feet during flooding.



Thames Barrier, Thames River, London, UK

Designed by Rendel, Palmer and Tritton to prevent flooding from high tides and North Sea storm surges, the Thames Barrier is located downstream from central London. It needs to be raised (closed) only during high tide; at ebb tide it can be lowered to release the water that backs up behind it. Photo credit: Bikeworldtravel / Shutterstock.com

the Federal Highway Administration (FHWA), and the Federal Railroad Administration (FRA).

To fund the responses to climate change, sea-level rise, and potentially catastrophic natural events, we must demand a new paradigm of investment. With federal support in place for a considerable amount of repair work, how can we refocus the discussion on longer-term capital needs? And where will the money come from?

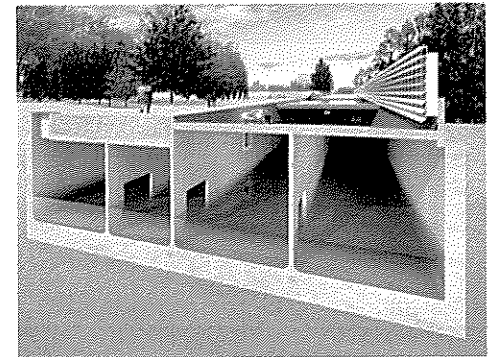
## OPPORTUNITIES AND NEXT STEPS

We must maintain a sense of immediacy. Keeping awareness of these issues front and center needs to continue and be brought to the transportation and infrastructure conversation if we are going to evolve these ideas into tangible next steps.

When it comes to transportation and infrastructure, the responses will come from the public, with advocacy groups

helping to inform decision makers. This starts with education. The public must be educated about the challenges ahead so that their expectations are realistically maintained within the context of this new reality. Cooperative efforts need to continue on a regional level. This begins with shared knowledge, including lessons learned, followed by the development of coordinated common standards and guidelines. Therefore, we need to improve interagency and interstate communications so that we are planning holistically and not in geographic vacuums. We must advocate for methods of sharing information, we must advocate for methods of sharing information, especially during a crisis. This should include emergency way-finding strategies to inform residents about alternative backup plans for transportation, power, fuel and locations for assistance.

Ultimately it is about risk management. How do we (stakeholders, the public, decision makers, government, and advocacy groups) navigate through this



MuseumPark, Rotterdam, The Netherlands

Underground parking garage designed by Paul de Ruiter Architects accommodates 1,150 cars and a 10-million-liter water reservoir, when necessary. Photo credit: Pieter Kers



historical moment in the Northeast? If we are to continue living and working here, we need to recognize all these issues, and then manage the associated risks. Superstorm Sandy forced us to recognize the fragility of our position, with millions of people from New Jersey to New England affected. Now we have to manage it. We need to begin to assess the transportation and infrastructure systems that are at greatest risk, and then identify and prioritize strategies for redundancy and resiliency in the near and long term.

It is clear that we need to expend the resources that can manage these risks. The challenge will be for the public to accept these expenditures as part of a new standard, and for the agencies that are their guardians to strengthen interagency communications during severe climatic events.

New York City, as a global city, is linked inextricably with the rest of the world. That global interdependency means that minimizing the health and responsive-

ness of our transportation and infrastructure networks can result in catastrophic impacts throughout the world. The funding necessary to manage risks and sustain the continued strength of the region should be leveraged through all parties that benefit from this truly vital region.

## STRATEGIC APPROACHES

Case studies from around the country and the world reveal three distinct strategic approaches: Defensive, Adaptive, and Passive.

A **defensive** approach implies that the subject is being attacked and must be protected. A boundary is employed like a fortress to resist the elements. These defensive approaches offer varying degrees of effectiveness, resiliency, and environmental impact, and require ongoing operations and maintenance programs.

An **adaptive** approach implies a balance between the need to protect and the acceptance of the overwhelming forces of nature. We adapt by altering the subject to live in symbiosis with the threat. If we embrace adaptive as co-existence, then solutions will become more apparent in adapting to the new normal.

A **passive** approach implies recognition that the forces of climate change have or will have such a great impact that they have won. We accept their overwhelming power completely, and the solution is to live with and embrace the threat.



Sidewalk Gratings, Queens, NY, USA

MTA commissioned raised sidewalk gratings to mitigate local flood-waters at existing subway ventilation structures. Rogers Marvel's adaptive approach serves as a bench, adding a streetscape amenity. Photo credit: David Sundberg/Esto

# HOUSING

Local and national regulations related to housing in flood zones do not address the conditions of a dense urban place like New York City.

The Post-Sandy Housing Working Group's focus was to learn what happened during Sandy and why, and to use these lessons to:

- ▶ Encourage the development of new strategies to address the evacuation and temporary rehousing of those displaced by future disasters;
- ▶ Make existing housing stock more resilient;
- ▶ Ensure that future housing is built in a way that is safe, resilient, and beautiful.

An analysis by NYU's Furman Center for Real Estate and Urban Policy and the NYC Department of City Planning revealed a few clear patterns about what worked and what did not work in residential construction.

Buildings built to modern floodproofing standards fared much better structurally than older buildings. 84% of the buildings in the flood zones were built before 1983, when New York City incorporated floodproofing requirements into the Building Code. 94% of the red-tagged buildings (i.e., those requiring repair before occupants can re-enter) were built before this date. 98% of the destroyed buildings were built before this date. Retrofitting existing housing stock and rebuilding new housing to higher, more stringent standards will require changes to the multilayered regulatory climate currently governing floodproofing issues. Also needed are creative approaches to ensuring that these changes result in safer, more resilient, and beautiful buildings and communities.

Multi-family buildings fared much better than one- and two-family buildings. 90% of the red-tagged buildings were one- and two-family buildings, even though they made up less than 30% of the floor area of all red-tagged buildings. Local and national regulations related to the design and construction of housing in flood zones have yet to take into account issues related to floodproofing in the country's densest urban environments. As building owners have moved on from immediate post-disaster recovery efforts and take the next steps to make their buildings more resilient in a post-Sandy world, the need for more attention to the future floodproofing needs of multifamily buildings has become clear.

The work by CHPC, NYSAFAH, and AIANY after Sandy revealed several issues related to displacement and rebuilding. These include: the need for organizational structures for non-profit housing providers to work together after such disasters; the potential for alternate solutions to the trailers and other temporary housing deployed after Sandy; and the need for protections that allow design professionals to play a constructive role in addressing emergency situations (the Good Samaritan Law). CHPC has recently employed a full-time Fellow who has established Zone A New York, Inc., a non-profit organization working on the ground building capacity and charged with addressing many of the key priority items outlined by the Housing Working Group.



The Post-Sandy Housing Working Group is a partnership of six professional organizations:

American Institute of Architects  
New York (AIANY)

American Society of Landscape  
Architects New York Chapter (ASLA-NY)

American Planning Association  
New York Metro Chapter (APA-NYM)

The New York City Bar Association,  
Committee on Land-use and Zoning

Structural Engineers Association  
of New York (SEAoNY)

American Council of Engineering Companies  
of New York (ACEC New York)

These organizations were joined by four  
housing policy organizations:

Citizens Housing and Planning Council (CHPC)

New York University (NYU), Furman Center  
for Real Estate and Urban Policy

New York State Association for Affordable  
Housing (NYSFAFH)

Regional Plan Association (RPA)

The Working Group also benefited from the participation and support of a number of public agencies including the New York City Department of City Planning (DCP), the New York City Department of Buildings (DOB), the Mayor's Office of Housing Recovery Operations, the Mayor's Office of Emergency Management (OEM), the New York City Housing Authority (NYCHA), and observers from the Federal Emergency Management Agency (FEMA).

## KEY CONCEPTS AND FINDINGS

Five months after Sandy, the short term has already come and gone. The Housing Working Group accordingly focused on mid- and long-term recommendations, particularly the most important needs and priorities. We identified six priority areas for the design community's attention.

**Post-disaster measures to house people displaced from their homes**  
NYSFAFH's experience coordinating the use of vacant apartments for temporary housing for people displaced by Sandy showed that there are alternatives to mobile homes or other temporary housing. However, the currently low vacancy rate and issues of supply vs. demand complicated this. Learning from Sandy, they recommended the following ideas to prepare for future disasters:

- ▶ Develop an outreach strategy to communicate with building owners on available vacant units;
- ▶ Develop a centralized intake process for applications and referrals for displaced households;
- ▶ Identify waivers necessary for the rehousing process;

- ▶ Identify and craft a model third-party lease agreement for households seeking temporary housing;
- ▶ Adopt an expedited qualifying process for displaced households applying for permanent affordable housing;
- ▶ Advocate for allocation of disaster-related Section 8 vouchers for households below 30% AMI.

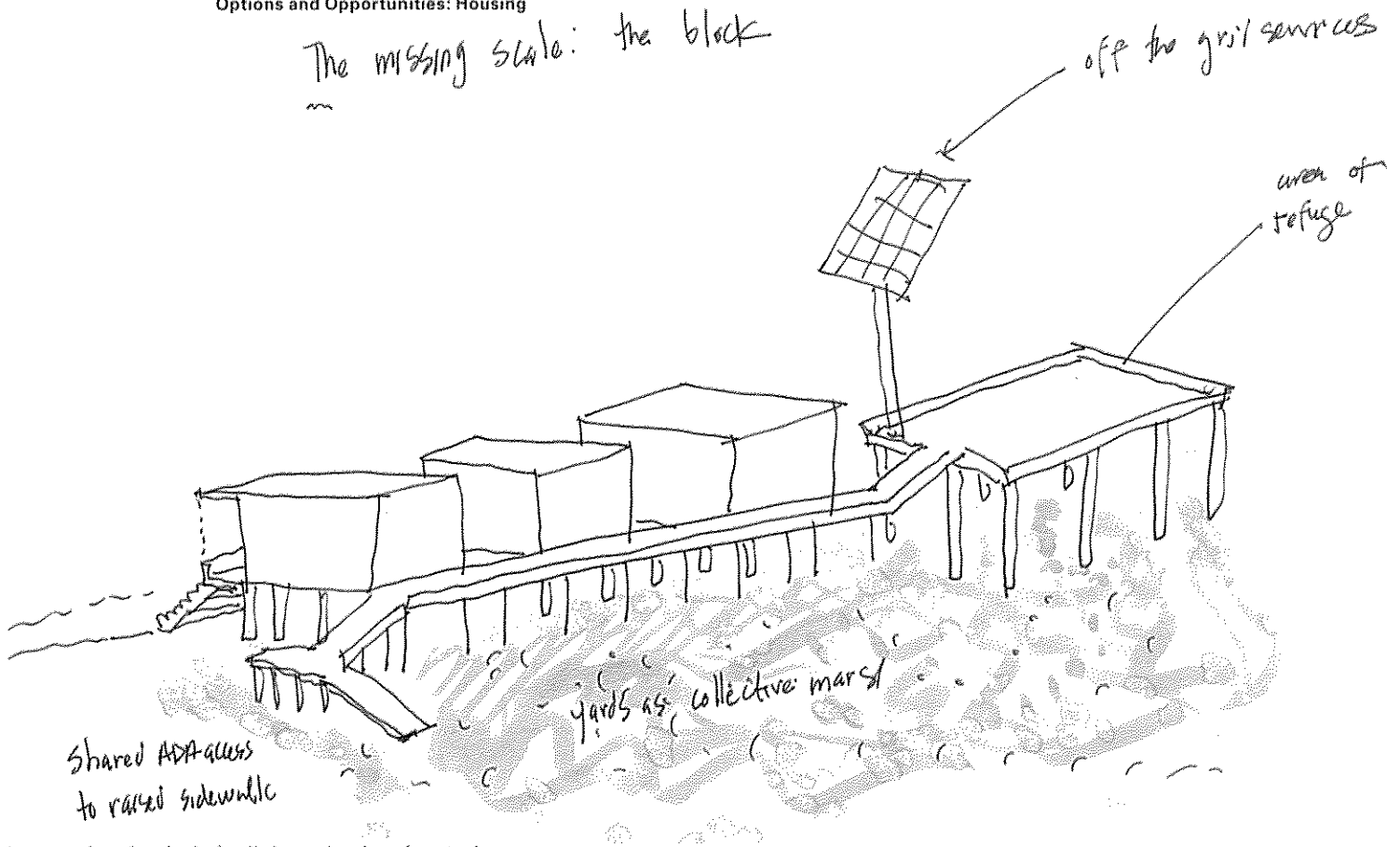
As for the regulatory requirements for design and construction of buildings, many of these are affected by overlapping regulations that make sense in normal times, but are not set up to deal with issues of housing after disasters such as Sandy.

### Capacity building

The period after Sandy revealed an absence of organizational structures to support the efforts of non-profit housing providers trying to work together. Two key priority areas were identified:

- ▶ Establishing programs in post-disaster training for non-profit leadership;
- ▶ Establishing a new citywide non-profit organization charged with addressing the needs of residents living in Zones A and V neighborhoods.

The missing scale: the block



Interventions for single-family bungalow housing stock were explored through charrettes.

### Changes to the existing patchwork quilt of floodproofing regulations

The NYC Zoning Resolution, NYC Building Code, FEMA design standards, and federal accessibility guidelines all address floodproofing issues to some extent. However, as may be expected, these regulations are not fully coordinated. Through a multidisciplinary Post-Sandy Housing Charrette, the Working Group generated a series of recommendations for addressing gaps both within and between each of the set regulations pertaining to floodproofing.

### Retrofitting existing multi-unit housing stock

New York is a growing city with limited land. In most cases, multi-family buildings in the flood zone were heavily damaged, but by and large remain structurally sound. These buildings, particularly those owned by the New York City Housing Authority (NYCHA), represent a significant portion of the City's low-income housing inventory and would be exceedingly costly to replace. With strategic modifications, the useful life of most of this stock can be extended well into the future.

### Create a body of literature to guide the future floodproofing needs of multi-family buildings, available in various languages

Local and national regulations related to the design and construction of housing in flood zones have not fully taken into account what is required for floodproofing in dense urban environments.

### Study the broader planning implications

The specific focus of the Housing Working Group was the scale of the individual residential building. During the course of our work, however, many questions regarding larger planning and policy decisions were raised:

Given the likelihood of rising sea levels, for instance, should building codes require that buildings in the City's coastal zones be designed for higher flood levels than currently projected?

Should recent downzonings in coastal areas be reexamined to understand whether allowing exceptions for multi-family housing could increase the resiliency of these communities?

How can other equally threatening factors that may emerge from the next storm, including flooding resulting from intense rainfall and wind, be addressed?

It is the hope of the Housing Working Group that its work and recommendations will be considered and used by the responsible agencies. It should be stressed that the conclusions and recommendations in this report do not represent the policies or recommendations of any one of these individual groups or agencies.

# POLICY CONSIDERATIONS AND REGULATORY IMPLICATIONS

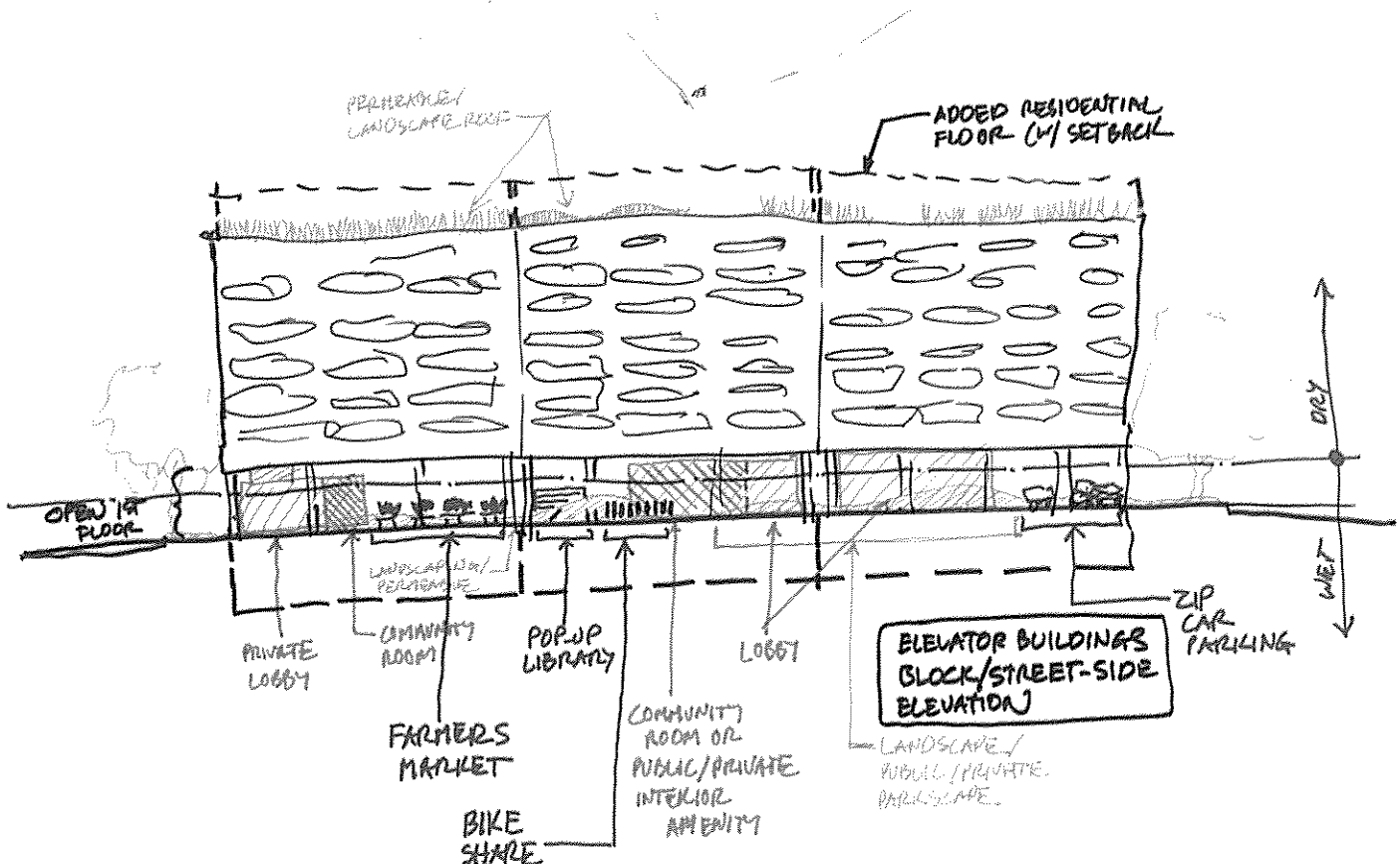
Local and national regulations governing the design and construction of housing in flood zones have not fully taken into account what is required for floodproofing in the densest urban environment in the country. The New York City Zoning Resolution, the New York City Building Code, FEMA design standards, and federal ADA guidelines all address flooding issues to some degree. However, these regulations are not fully coordinated, so a requirement stated in one may be in conflict with another. As a result of the multidisciplinary charrette held in February 2013, the Working Group generated several recommendations, which will need to be verified and modified based on specific neighborhood characters, building types, and site conditions.

## NYC Building Code

- ▶ Permit handicapped lifts in flood zones;
- ▶ Wet floodproofed buildings should have an emergency exit at the first floor above flood elevation;
- ▶ As an alternative to floodproofing individual buildings, allow block-wide or neighborhood-wide floodproofing.

## NYC Zoning Resolution

- ▶ Once a Design Flood Elevation of three feet is reached in a residential building, its first residential floor should be allowed to be raised to ten feet, without maximum building height penalty, so as to create a full-height floor at grade. This would allow a full-height lobby and elevator, providing an accessible common entrance at grade for all residents, and use for storage or parking or community space.
- ▶ In an existing building, if the ground floor cannot be used, expansion should be permitted horizontally or vertically, where possible, to make up for lost habitable space.
- ▶ Make alignment provisions in contextual districts more flexible. In some cases they currently prevent setting a building far enough from the property line to have a ramp composed of a flood-dampening landscape or permeable paving in front of the building.
- ▶ Where a building may have to be set back from the street line to accommodate flood zone-related steps and ramps, rear yard requirements should be reduced.
- ▶ Study of more flexible zoning envelopes should be undertaken so that moving more of the mechanical spaces above the flood zone is encouraged.
- ▶ Allow electric rooms to be floor-area deductible.
- ▶ Permit mechanical equipment in rear yards above flood elevation.
- ▶ Rezoning should allow for greater density in return for greater landscape buffer zones in the flood zone.



Once raised, ground floor planes can be activated by retail and community facilities.

- Stairs with natural light should be deductible, as is already encouraged in quality housing zoning for corridors in buildings in contextual districts.

#### FEMA

- Dry floodproofing of lobbies, currently permitted for mixed-use residential only, should be allowed for all multi-family buildings.
- Evacuation in place—FEMA's objective is to evacuate flood areas before floods occur, and to minimize the risks, especially to first responders. This may not always be possible in a dense urban environment such as New York. It is important in a flood event that those who do not follow government orders, for whatever reason, have a way to get out of their buildings and to safety during a flood.

#### Accessibility Regulations

- Entrances and ramps that lead to the interior of the primary lobby should be permitted.

#### Changes in National Flood Insurance Policies

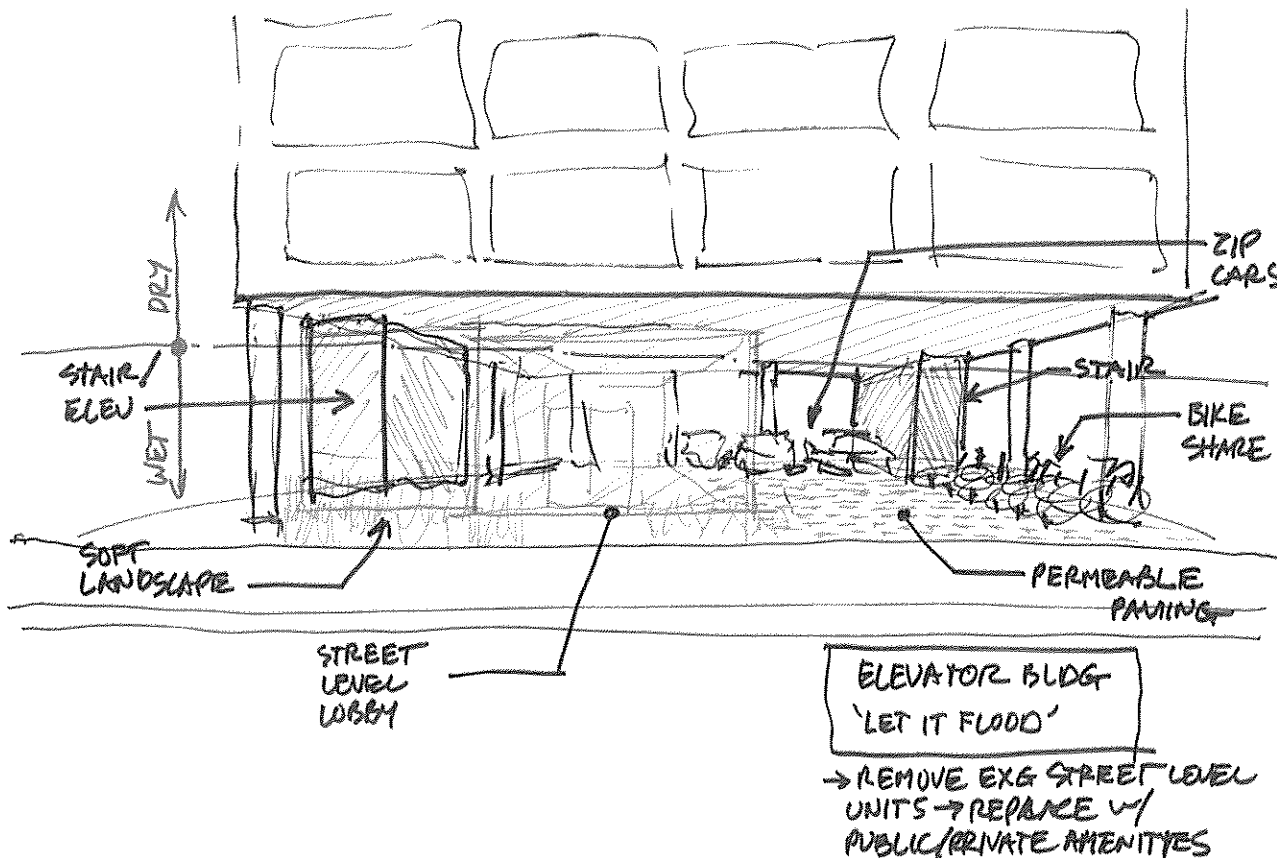
The National Flood Insurance Program (NFIP) was recently changed so that rates for buildings that meet floodproofing requirements will be significantly lower than rates for buildings that do not. This will mean that many building owners who cannot afford to meet the requirements will not be able to afford flood insurance. This is particularly true of one- and two-family and attached row houses within the flood zones, where modifying the buildings may be as costly as building new. Therefore, many buildings will not get insurance and cannot be upgraded to current floodproofing standards. This creates potential risks and costs for the City and other levels of government when the next catastrophic storm hits.

For existing buildings in the new or expanded flood zones, particularly one- and two-family detached and attached homes, renewing insurance will require much more robust flood-

proofing measures. These measures are likely to be costly. Efforts should be made to develop more affordable floodproofing options such as active barrier installations. Techniques to collectively fund and maintain such systems, which would decrease costs to individual homeowners, are used successfully in places like Prague in the Czech Republic and should be studied.

#### Other Issues

- Illegal basement apartments in buildings in the flood zone. While there is no definitive count of how many exist, there are vast numbers of such units that cannot be re-inhabited. This will be a hardship for displaced renters and owners who are dependent on this income.
- Dealing with the regulatory impediments to short-term rental of vacant housing units (see Appendix posted on [www.postsandyinitiative.org](http://www.postsandyinitiative.org)).
- A Good Samaritan law for design professionals.

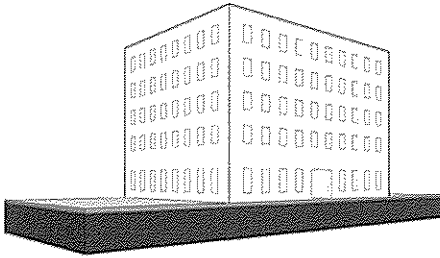


Options are being explored that combine wet-proofing and dry-proofing.

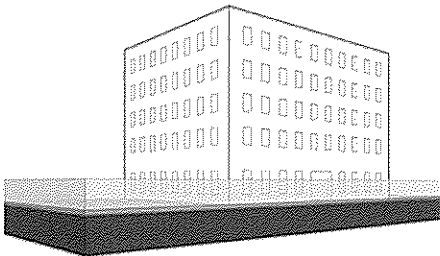
## Rising Ground Floors

Credit: Curtis+Ginsberg Architects

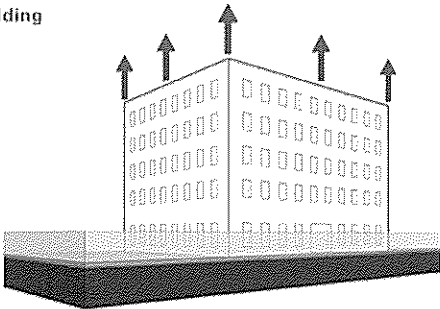
### 1. The Building



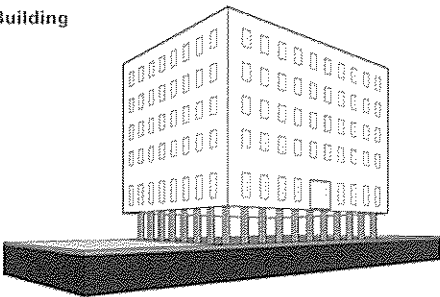
### 2. The Problem



### 3. Raise the Building

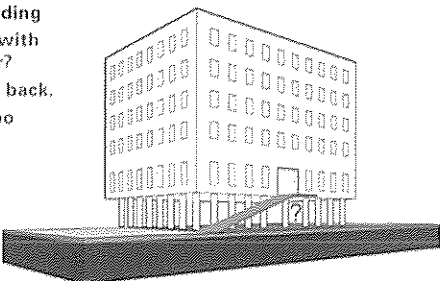


### 4. Support the Building

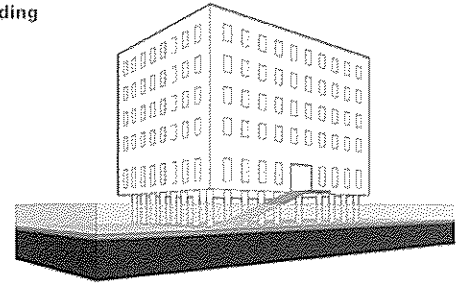


### 5. Enter the Building

What do we do with the ground floor?  
Pushes building back.  
Ramp may be too long to fit.

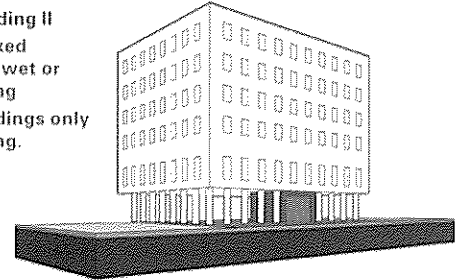


### 6. Enter the Building

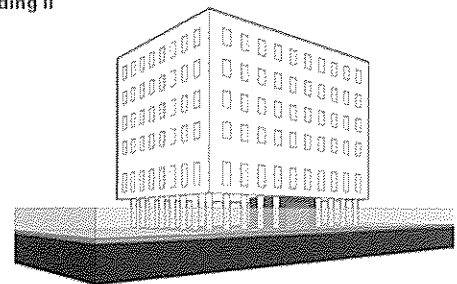


### 7. Enter the Building II

Permitted in mixed buildings either wet or dry flood proofing  
Residential buildings only wet floodproofing.

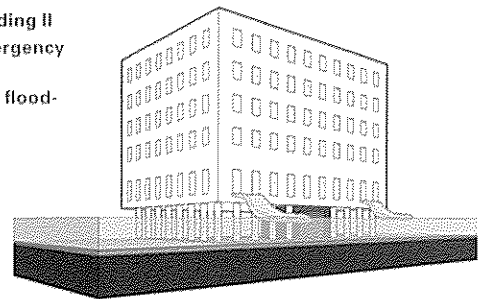


### 8. Enter the Building II



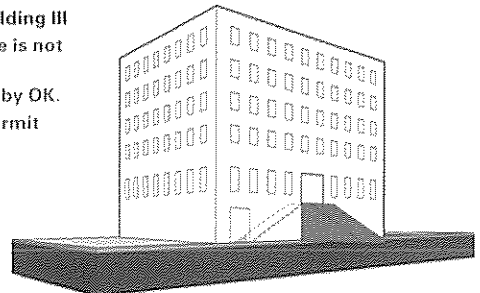
### 9. Enter the Building II

Do we need emergency exit for floods?  
Required for dry flood-proofing.



### 10. Enter the Building III

Primary entrance is not accessible.  
If Ramp is in Lobby OK.  
NYC does not permit lifts.





### The Broader Context

Although the charge of the Working Group was to focus on individual residential buildings, many questions regarding larger planning and policy decisions were raised. Should the building code require that buildings in the City's coastal zones be designed for higher flood levels than currently projected? Or, if possible, should we find ways to return vacant or irrevocably damaged sites to soft-edge conditions (a program initiated by New York State on Staten Island)? Newly published projections on sea-level rise should be closely studied in conjunction with the now updated FEMA flood maps. Regulations could, for instance, permit or encourage floodproofing in the 500-year flood zone.

Over the last twenty years, many low-density areas of the City have been downzoned. For a variety of reasons described elsewhere in this chapter, multifamily buildings are more resilient and easier to retrofit to incorporate floodproof features. In addition, efficiencies of scale allow emergency systems that facilitate faster reoccupations of multifamily buildings in flood areas. In coastal areas, these downzoned areas should be reexamined.

## OPPORTUNITIES AND NEXT STEPS

### FEMA Multifamily Manual

Existing FEMA literature had tremendous value in getting the Working Group up to speed. However, regarding residential construction, the current FEMA and National Flood Insurance Program (NFIP) literature are largely focused on one- and two-family housing and fail to cover many issues related to multifamily housing. The Housing Working Group has identified several areas where we believe that we can be of help to FEMA in outlining, and perhaps helping to author, a FEMA multifamily design guide.

### Design of Areas Below

#### Base Flood Elevations

Careful design of spaces below the base flood elevation (BFE) is important for all types of housing. It would be expected that only water- and mold-resistant materials be used below the BFE no matter the housing type. Multifamily housing structures, however, often differ from one- and two-family buildings. Based on height, longevity, and combustibility concerns, multifamily housing typically incorporates robust materials such as masonry and concrete. During Sandy, it became clear that these structures performed better than the wood framing typical of one- and two-family homes.

When flood elevations rise, minimum required elevations for residential spaces rise, and with these increased elevations come the vertical conveyances needed to get people to those elevations. In one- and two-family housing, where accessibility rules do not apply or are often less stringent, stairs can be used for elevations too high for ramps. Because of a multitude of accessibility regulations, multifamily housing typically must incorporate ramps, elevators, and lifts. Zoning regulations should be adjusted to recognize the amount of space these features occupy. For instance, as BFEs exceed three feet above grade, we recommend that first-floor residential be permitted to be raised to ten feet without maximum building height penalty, so that a full-height lobby can be accessed at grade and dry- or wet-floodproofed as required for common access to an elevator.

#### On-Site Evacuation and Areas of Refuge

When it comes to occupants' life safety at the time of an impending storm, evacuation is the best policy, regardless of housing type. Yet several external factors combine to make evacuation from multifamily housing more difficult, placing rapid post-storm re-occupation of homes more critical. Multifamily housing often occurs in dense, urban communities that are transit-dependent, like New York City. But as Sandy has shown, mass transportation may be

affected by or limited during an emergency, and mass evacuations can lead to congestion and a reduction in mobility.

Two types of specialized multifamily housing present particular challenges to evacuation, and underscore the need to address the issue of those who may not be able to leave their homes. First, low-income rental buildings, where residents may not possess cars, or the resources to move to temporary housing. Secondly, supportive and senior housing where residents may be attached to their permanent homes because of medical or disability concerns and cannot easily transport themselves elsewhere. To address these situations, the Working Group recommends identifying a safe room (most likely, a community room) that can be used for congregating, roll call, and rescue during emergency conditions.

### Building Systems

Multifamily housing should be engineered with building systems that protect against building shutdowns during emergencies and ensure a quick return to normal or standby functions post-event. One example is reliance in municipal utility-provided electricity. One- and two-family home operators may opt to partially power their homes with oil-fueled generators. This is not an option for multifamily housing.

Mid-rise multifamily housing is, however, a good candidate for the use of emergency generators wired to a transfer switch with emergency power circuits. In high-rise construction, in fact, the Building Code requires this. In New York City, more and more buildings are installing city-piped natural gas-fueled generators; this trend may have broader policy implications given the fact that the City gas supply has not been interrupted during major storms.

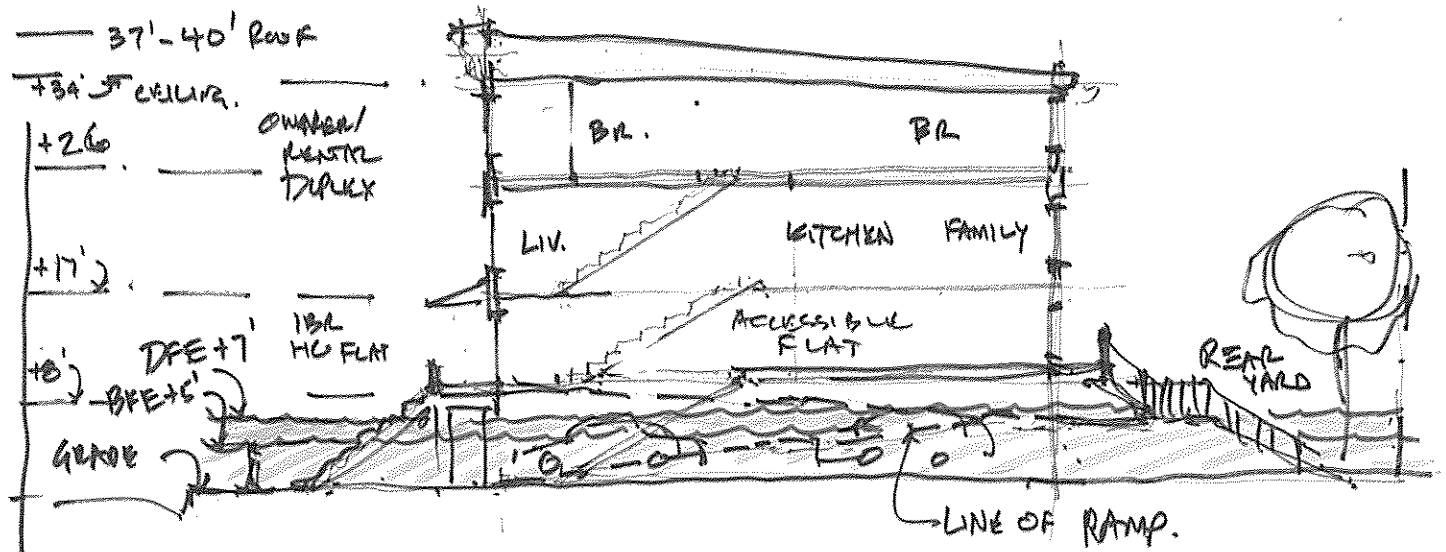
We believe there are additional opportunities for emergency generators to be used for cogeneration. Cogeneration, in which heat entropy generated in the process of creating electric power is captured for heating and domestic hot water, is most efficient in multifamily housing, particularly in projects of 100 or more units. With cogeneration's

transfer switch and emergency circuitry also comes the opportunity to wire renewable power sources, such as photovoltaic panels and wind turbines, into the building for safe use during power outages. This would allow fire pumps, elevators, emergency lighting, refrigerators, and even a convenience outlet in each apartment to remain operational. It would also provide for heat and hot water to remain available via cogeneration. Finally, high-performance building envelopes, which are increasingly required and more likely to be financed for multifamily housing projects, could contribute to the efficiency of backup systems.

### Best Practices

The Housing Working Group contacted AIA, ASLA, and APA chapters around the country, asking for best practices in floodproof design. We developed a form to collect information in an organized and comparative format listing project location, housing type, flood elevation data, design strategies, flood-based regulatory actions, lessons learned/recommendations, and project graphics. All of these documents are catalogued and appear in the online appendix. These materials include methods for installing removable dry-flood barriers to existing buildings as used in Coney Island, and the Pontilly Neighborhoods Association's work in New Orleans, where landscape architects used flood mitigation techniques to absorb and re-channel floodwaters. Future research will collect examples from overseas as well as other cities in the United States.

When flood elevations rise, minimum required elevations for residential spaces rise and with these increased elevations come the vertical conveyances needed to get people to those elevations.



SECTION THRU 2-FAMILY

Section through two-family house illustrating adaptation for ramped accessibility and the addition of a new top floor.

# CRITICAL & COMMERCIAL BUILDINGS

A man in a dark shirt is standing in a meeting room, pointing his right hand towards a presentation board. The room is dimly lit, with a small table and chairs visible in the foreground. The background shows a large window or screen.

The challenges of adapting the vast inventory of existing critical buildings to withstand the effects of extreme climate events are distinct from the relatively easier task of designing new structures for resiliency.

With substantial parts of the New York City metro area's power grid down and with Superstorm Sandy's floodwaters disabling emergency power, at least 4 major NYC hospitals (Bellevue, Coney Island, Manhattan VA, and NYU Langone) were forced to evacuate all patients and to completely shut down. Coler at the north end of Roosevelt Island transferred some patients to its sister Goldwater at the south. The same level of vulnerability took down four major data centers supporting the telecommunications networks in Lower Manhattan. A police station was abandoned when it flooded and a wall collapsed. In Brooklyn and Queens, 29 nursing homes were severely damaged; despite receiving instructions to shelter their populations in place, they were unprepared to endure the storm and its desolating aftermath. Individual buildings, as well as city- and region-wide systems, were also unready. They still are.

Building owners have a four-fold responsibility when climate-driven disasters strike:

- ▶ Protecting occupants and users from death, injury, and suffering;
- ▶ Avoiding the evacuation of occupants if possible;
- ▶ Protecting buildings and their contents from damage;
- ▶ Ensuring that buildings can operate during and after the event.

Current building technologies offer the ability to construct new buildings and retrofit existing ones to better withstand the anticipated impacts of climate change. However, the challenges of adapting the vast inventory of existing buildings to those standards are distinct from the relatively easier task of designing new structures for resiliency. There exists a vast body of technical standards that can be put in place, or adapted for the local situation as it is coming to be understood. But a sobering aspect of the new paradigm is the rapid increase in dangerous conditions, such as rising sea levels and more powerful storms, as well as the ever-deepening science of the likely effects of climate change. Building standards and disaster planning will need to be revisited and updated frequently.





New York City during the lower Manhattan blackout, after Superstorm Sandy.  
Photo credit: Vanni Archive

The Critical & Commercial Buildings Working Group consisted of 18 professionals, representing the main disciplines of the design profession including architects, planners, mechanical engineers, structural engineers, and hospital administrators. The group conducted six evening workshops over the course of two months. The Working Group incorporated five sub-groups: Vulnerability Assessment, Structural/Façade, Building Infrastructure, Operational Planning, and Implementation. Each sub-group produced a report on its assigned topic, which was incorporated into the final report.

## KEY CONCEPTS AND FINDINGS

Owners of all commercial and institutional buildings—existing, in construction or planned—can begin now on a four-part process to meet their responsibilities in response to climate disasters. Owners should:

- ▶ Conduct vulnerability assessments of their buildings in anticipation of the likely effects of extreme climate events;
- ▶ Identify the specific technical standards their buildings must meet, and the technologies and products available to do so;
- ▶ Update operational plans to keep their buildings working during disasters, and to quickly recover functionality afterwards;
- ▶ Create implementation plans to put in place the remedial actions indicated by the three preceding steps.

### Assessing Vulnerability

**First**, the specific impacts buildings might experience during climate-driven disasters should be determined. The potential effects on a given location can be inferred from published flood-zone and wind maps, as well as historical and modeled future weather data. As noted in the Introduction, however, the increasing severity of recent and anticipated climate events reveals much existing data to be inadequate, and highlights an urgent need to update and reach consensus on such standards.

**Second**, the critical roles of specific buildings should be established. A building, or a portion of one, should be considered a critical facility if it is required to withstand the effects of a disaster and remain in operation, whether to safeguard the activity conducted within it, or the lives and well-being of its occupants, other disaster victims, or emergency-services personnel. Critical facilities include, for example, hospitals, police and fire stations, data centers, evacuation shelters, and

## Systems Matrix

This matrix illustrates the kinds of changes that can be integrated into code, using healthcare facilities as a category of building.

Utility Services	Risk Addressed	Proposed Measure	Critical Facility	
			New	Existing
Incoming Electric Service	Flood	Locate or relocate incoming service above FEMA flood evaluation	Req.	BP
		Existing Utility Rooms to be made watertight with bulkhead or submarine doors and extensive waterproofing. Waterproof cable entries below flood plain.	N/A	Req.
		Existing Utility Rooms to be made watertight with bulkhead or submarine doors and extensive waterproofing. Waterproof cable entries below flood plain.	Req.	Req.
	Extreme Heat	Electric Utility Rooms to be provided with ventilation and/or air conditioning to maintain room temperature to stay below equipment temperature ratings. Use ASHRAE Weather Data. code mandated	Req.	BP
	Wind	Evaluate overhead distribution (where permissible) versus direct buried based on potential wind and flood events. Design overhead distribution to FEMA Wind Zone Maps.	Req.	BP
Incoming IT Services (Telephone & Data)	Flood	Locate or relocate incoming services above FEMA flood elevation using approved cables	Req.	BP
		Existing Utility Rooms to be made watertight with bulkhead or submarine doors and extensive waterproofing. Waterproof cable entries below flood plain.	N/A	Req.
	Provider Interruption	If existing Utility Rooms cannot be relocated, consider redundant wireless communication and data system.	BP	BP
Gas Service	Flood	Locate or relocate incoming gas service above FEMA flood evaluation	Req.	BP
		Existing Gas Service Rooms to be made watertight with bulkhead or submarine doors and extensive waterproofing. Waterproof pipe entry.	N/A	Req.
Domestic Water	Flood	Locate or relocate incoming water service above FEMA flood evaluation	Req.	BP
	Provider Interruption	Consider water storage tanks on site.	BP	BP
Steam Service	Flood	Locate or relocate incoming steam service above FEMA flood evaluation	Req.	BP
		Existing Steam Service Utility Rooms to be made watertight with bulkhead or submarine doors and extensive waterproofing.	N/A	Req.
Mechanical Equipment (boilers, chillers, pumps, fans, air conditioning units, storage tanks, etc.) essential for the facility to operate and fulfill its mission	Flood	Locate or relocate above FEMA flood elevations.	Req.	BP
		Existing Mechanical Rooms to be made watertight where practical with bulkhead doors and extensive waterproofing. External flood barriers should be considered.	*N/A Req.	BP
	Wind	All exterior equipment to be properly strapped down to meet FEMA Wind Maps.	Req.	Req.
		Provide barriers to protect against damage from wind-blown projectiles.	N/A	Req.
	Extreme Heat	Systems to be designed to maintain minimum code requirements for occupant and building functionality. Load shedding to be employed. Use code-mandated ASHRAE Weather Data.	Req.	BP
Fire Pump	Flood	Locate fire pumps above FEMA flood plain elevation. If not feasible due to code or inadequate street pressure, provide submersible watertight room. Review with FDNY.	Req.	BP
Emergency and Standby Power	Flood	Locate or relocate generators above FEMA flood evaluation	Req.	Req.
	Wind	Protect exterior equipment from wind-blown damage and projectiles.	Req.	Req.
	Extreme Heat	Evaluate capacity to serve life safety loads during extreme heat.	BP	BP
	Extended Widespread Outage	Evaluate and add additional loads above Code mandated to fulfill the building's functional requirements during prolonged outages. Provide additional standby generation.	BP	BP
Emergency and Standby Generator Fuel Source	Flood	Fuel oil tank's pumps and controls to be located in a submersible watertight room with bulkhead or submarine doors. Fuel pump to be submersible to pump up to transfer tank and pumps on level located above the FEMA flood plain elevations.	Req.	Req.
	Prolonged Outage of Power	Provide additional fuel capacity above code-mandated minimum for emergency and standby loads needed for building functionality, or provide dual fuel source (oil and gas) fired generators to extend existing oil storage. Technology not readily available.	BP	BP
Sump Pumps & Ejectors	Flood	Locate in watertight submersible room with bulkhead or submarine doors and put on emergency power.	Req.	BP
Enhanced Standby Power Generation and/or Co-Generation	Prolonged Outage of Power	Based on a regional plan for healthcare and critical facilities, designate those facilities that need to operate in a self-sufficient mode with no reliance on the normal electric grid.	BP	BP
Fire Alarm Command Station	Flood	Provide redundant Fire Command Station above the FEMA flood plain.	Req.	BP
Fire Alarm Devices	Flood	Locate fire alarm system devices above the FEMA flood plain.	Req.	BP
Elevators	Flood	Locate power and controls above FEMA flood plain. Cars to recall above FEMA flood plain.	Req.	BP

BP = Best Practices

Req. = Required

\*N/A for Healthcare Facility



buildings or portions of buildings that provide essential support to them. Other vulnerable buildings should be required to withstand a climate disaster without failure of structural components, including façade elements, though they need not remain functioning and are likely to be evacuated during the disaster; these should be considered protected facilities rather than critical.

**Third, survey building systems.** Essential building systems comprise the design features, technologies, and equipment necessary to support continued operations. For critical facilities, for example, these include emergency power systems, water and ventilation systems, vertical transportation systems, and food storage and preparation facilities. For critical facilities, the survey should assess the ability of essential building systems to continue functioning during a disaster. For protected facilities, the survey should evaluate the ability of the building structure and façade to survive intact.

#### Meeting Updated Technical Standards

Two building components—structure/facades and internal systems—are key to resisting climate-driven threats whether from flooding, wind, snow, or extreme temperatures. Simply put, the goal is to assure that a building's physical structure remains intact and relatively undamaged by the forces of a disaster, especially the structural system and the building envelope, including fenestration.

**Façade and structure:** Current New York City and State codes specifying design requirements for snow resistance and flood resistance do not require changes. For wind load design, however, requirements should be upgraded to ASCE/SEI 7-10; this code provides ultimate wind-speed values and introduces maps that incorporate the risk categories. For example, for Occupancy Category III and IV buildings, which include those posing a substantial hazard to human life in the event of failure, such as schools, hospitals, and critical facilities as defined above, this code requirement corresponds to wind speeds with only a 3% probability of being exceeded in 50 years.



Hospital protected from flood water by a flood wall in mid-state New York.  
Photo credit: FEMA

**Systems:** We studied a range of building system and utility issues, including the vulnerability points of electricity, IT, gas, water, and steam services as they enter a building; the location and protection of mechanical equipment; emergency equipment to provide for and back up supplies of water and power; fire alarm and firefighting systems; and elevators. We reviewed these in the context of three facility types—commercial and institutional; healthcare; and other mission-critical buildings—and for both new and existing structures. Examples of options for making these systems more resilient are shown here.

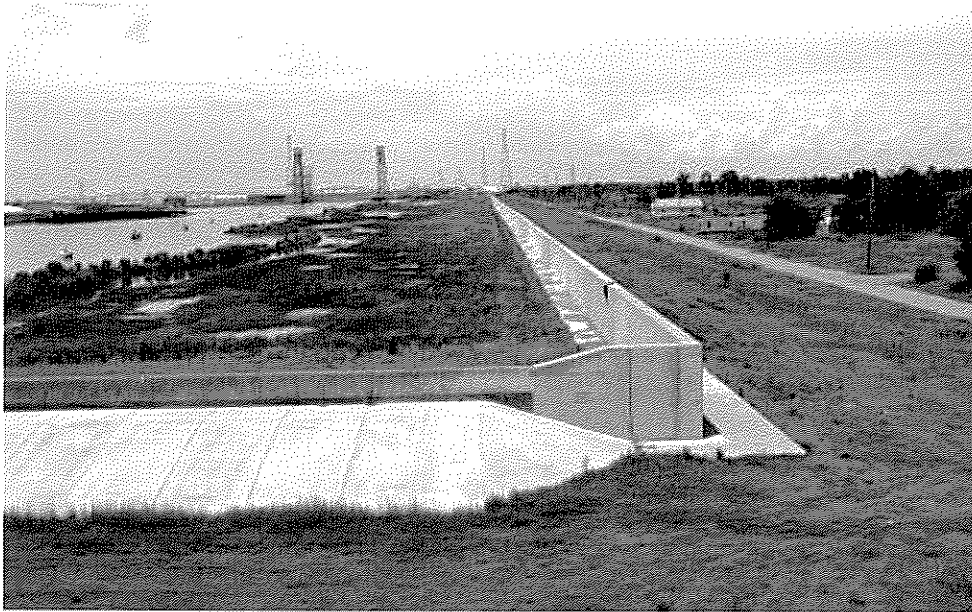
In general, a new critical building must meet higher performance standards than a commercial building, since its services are to be available before, during, and after a climate-driven event; new critical buildings should comply fully with new standards. Existing buildings demand more flexibility in determining the best corrective action. A realistic approach for an existing building is generally a best-practice standard, with some latitude in offering equivalent solutions. In some cases for existing buildings, even those deemed critical in function, evacuation may be the only feasible action to permit compliance.

#### Developing Operational Plans

While many New York City-area agencies and institutions have disaster plans in place, in general these need to be updated to reflect the increased risks our region is now understood to face. Moreover, disaster planning should always consider buildings and their particular vulnerabilities and requirements.

#### Before An Event

Not all disasters can be foreseen, but for some—in particular, weather events—there may be substantial warning and the ability to anticipate specific effects like flooding. Building owners' advance operational plans should address a range of issues, including the evacuation and relocation of occupants, building shutdowns, and the possible extended relocation of occupants afterwards. For critical facilities, emergency equipment and supplies should be accommodated, temporary relocations should be envisioned, and advance arrangements should be made with the NYC Office of Emergency Management for disaster-zone access for essential personnel.



Flood wall near New Orleans, LA, USA  
Photo credit: FEMA

### During An Event

Planning should consider the provision of security for evacuated buildings; in Class E high-rise buildings, the risk of a fire-detection system failure requires particular attention. Hospitals by definition are both especially vulnerable and uniquely essential during disasters, and disaster planning for them creates distinct obligations. For example, hospitals should plan for surge capacity for emergency and inpatient departments, the capability to house and feed stranded staff, and provisions for "passive operational survivability," such as natural ventilation during power failures and electric generation capabilities independent of the City's grid.

### After An Event

Plans for continuing or resuming operations in the wake of a disaster should consider that normal transportation and supply routes will most likely be disrupted. Therefore, back-up supplies and the on-site storage capacity for them are necessary. Emergency-supply agreements made in advance with vendors may be advisable. Portable emergency trailers housing heating or electrical generators, water or oxygen supply, and sewage or waste containment may need to be accommodated as well.

Clean-up and decontamination may require, for example, pre-negotiated

arrangements with specialized contractors or vendors for mold removal, fuel or sewage overflows, debris removal, disposal of floodwater and the like, and environmental waivers for removing contaminated water and debris to disposal points. Restoration of normal operations may require post-storm inspections of floor and façade walls; testing and remediation of mechanical, electrical, plumbing, and communications systems; drying out of flooded areas; prioritizing of repairs and/or demolition; and even a strategy for abandonment or managed retreat, if a facility is found to be damaged beyond repair.

### Implementing a Plan

#### Determining A Building's Risks, Strengths, and Weaknesses

Conducting a vulnerability assessment of a building and evaluating it against updated technical standards will indicate what must be done to make it disaster-ready. This process will also illuminate relative priorities among the risks a building faces and the available solutions, and create a sense of sequence for how to proceed.

#### Calculating Available Resources

Implementation of a plan requires evaluating both capital and human resources. Capital resources could be funds from internal sources, such as operating budgets and borrowing; or

from external sources, such as grants, tax incentives, and philanthropy. Human resources include the personnel who will be expected to follow the operational procedures developed for withstanding and recovering from an extreme event. They also include a building's stakeholders who may be potential allies or opponents in preparedness planning.

### Reconciling Needs and Resources

Arriving at a realistic plan will mean reconciling needs with resources. Typically, needs outstrip resources, so that strategic trade-offs and deferments are necessary. These can be arrived at by:

- ▶ Developing a detailed plan;
- ▶ Conducting cost-benefit analyses of its elements;
- ▶ Determining a timeframe and budget;
- ▶ Assembling a team responsible for implementation.

### Keeping On Track

- ▶ A progress-monitoring system, and honest assessments of progress, should be part of establishing a building's preparedness.
- ▶ Deviations from a plan must be corrected.
- ▶ Standards may change, our understanding of the risks may change, and available funding may change, so periodic re-examination and re-calibration will be necessary. Intervals of four and eight years are realistic to stay up to date.

## POLICY CONSIDERATIONS AND REGULATORY IMPLICATIONS

Because vulnerability assessments are the necessary first step in making buildings resilient, and because no obstacles exist to undertaking them immediately, the City Council should enact a law requiring building owners to conduct vulnerability assessments of their properties.

A great number of specific changes to current zoning and building codes will

be called for if the City and its buildings are to withstand repeated climate-driven and other disasters. In general, these include:

- ▶ An updated building code mandating a more robust disaster resistance capability for all new buildings.
- ▶ Hardening and retrofitting of existing buildings deemed vulnerable. This will be expensive, and in some cases impossible. The building code should provide a mechanism for permitting non-compliance; in such cases, an alternative strategy of evacuation should be required. Critical-function buildings in vulnerable locations must have a plan for Transfer of Service to a protected alternate facility, and these alternate facilities should be required to have the additional capacity and equipment to accommodate such a transfer.
- ▶ Zoning for land-uses should appropriately align with new and updated knowledge of flood zones and other risks, which may mean downzoning in some areas; and revisions to zoning and density limits for other areas that may in the future be required to absorb growth previously destined for flood zones and vulnerable waterfronts.

## OPPORTUNITIES AND NEXT STEPS

### Long Term

Innovation in the development of disaster-resistant building design strategies, technologies, and materials is essential. Where applicable, such innovations that already exist or are being implemented in other countries where resiliency planning is more advanced should be adopted or adapted. New York City's particular vulnerabilities call for:

- ▶ Policies that move toward elimination of non-compliant existing buildings that cannot be hardened, and their replacement—with an exception path for buildings deemed of significant historic or cultural value.
- ▶ Regional protective systems that enhance, or eliminate the need for, individual building responses. These should involve making utility, data, and security networks redundant and resilient, and finding regional strategies for maintaining essential services and supplies, such as public transport, food, and fuel, during disasters. In particular, regional networks for maintaining essential healthcare services must be established.

### Medium Term

Numerous scientific, governmental, and professional organizations and collaborators are exploring the potential impacts of climate change on natural and built environments; these include the Federal Emergency Management Agency, the National Academy of Sciences, the National Oceanic and

Atmospheric Administration, the U.S. Conference of Mayors, C40 Cities Climate Leadership Group, and many others. The specific challenges that extreme climate events pose for buildings, cities, and in particular for densely populated areas, illuminated by our experience of Sandy and explored by this and other initiatives in the storm's aftermath, must be brought to the attention of these research bodies. The goals should include:

- ▶ Better simulation models of water and wind behavior on built structures;
- ▶ New national reference code for building construction;
- ▶ Zoning and planning approaches that bring patterns of development into line with present and emerging knowledge of disaster-prone areas.

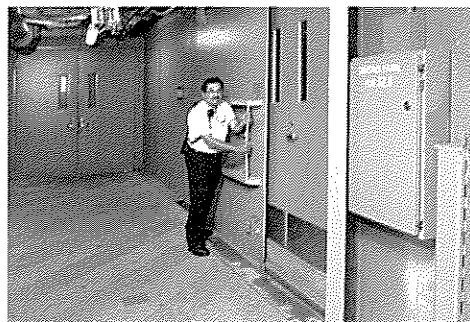
### Short Term

Advisory bodies have been established at the City and state levels, and among professional associations, to develop recommendations for changes to codes and zoning, façade and structural systems, building systems, and operational requirements. Similar groups focused on disaster-response planning will also have recommendations relevant to the design and operation of buildings. Their valuable findings will need to be aligned and reconciled. In the meantime, building owners should begin assessment programs to determine their risks; undertake voluntary upgrades to their properties; and update operational plans for disaster events.

A collaborative, integrated design approach to assessing and upgrading critical and commercial buildings will enable these important facilities to remain in operation when we most need them.



Watertight submarine door for creation of a protected infrastructure space. Photo credit: FEMA



Watertight submarine door for protection of critical equipment within an unprotected passageway. Photo credit: FEMA



# WATERFRONT

The future of New York as a waterfront city depends on respecting our changing environment and building on the unifying strength of our dynamic harbor and waterways in creative ways.

## The Waterfront is Not Alone

"The waterfront" in New York City and the region is actually a placeholder term for an astoundingly diverse range of conditions, comprising ocean, riverine, and estuarine systems within a broader context of water flow. The Urban Waterfront Adaptive Strategies study that is currently being drafted by the New York City Department of City Planning will elucidate and classify the array of different shoreline and land-use conditions that make up "the waterfront."

The waterfront zone is, literally, a transitory edge. Our culture has been changing in recent years to counter attempts to harden waterfront edges and transform them into permanent habitable places. If we are to continue to adapt to changing conditions in the future, we will need to be even more versatile in the ways we design our coastal built environments. Flood events and storm surges are not anomalies; rather, they are parts of historic natural cycles, although their frequency and intensity are dramatically increasing because of continuing global warming. They only become tragic events if we deny their existence and fail to plan for them.

Every waterfront edge is an integral part of an interconnected regional watershed, and the dynamics of that watershed provide the context for any individual waterfront plan or design.

Within this ecological context, and with appropriate planning and design, there is a wide array of opportunities to integrate diverse land-uses including natural habitats, public access, parks, housing, commercial districts, and working waterfronts at appropriate locations.

The challenges of climate change lead us to reexamine traditional approaches to coastal management, and to seek new, creative solutions to supplement the range of available adaptation strategies. ...It will be important to establish partnerships among practitioners of many disciplines—including planning, engineering, design, marine biology, and ecology—to develop and test new coastal interventions that have the potential to promote a safe city and sound ecology within a changing environment. Studies that provide information on the benefits and drawbacks of emerging strategies will be helpful as part of this effort. Pilot projects that gather empirical data on the effectiveness and ecological value of alternative strategies will also be valuable.

*Vision 2020: New York City Comprehensive Waterfront Plan, The City of New York, Department of City Planning, March 2011, page 111.*

## KEY CONCEPTS AND FINDINGS

The principles described here emphasize the overall context and commitments needed to support successful, innovative adaptations to changing waterfront conditions.

**Innovation, Experimentation, Research**  
More scientific research is needed to understand the interactions between urban waterfronts and human ecologies, especially in terms of communication with regulators and designers about the impacts of design decisions.

Our challenges over the next decades and centuries will be genuinely unprecedented, considering the number of people living in waterfront environments and the uniqueness of the variables facing the New York metropolitan region. We must create new opportunities for a dynamic and innovative approach to waterfront projects—one that allows for experimentation through multiple scales and flexible policies, and provides for short- and long-term innovations with novel strategies for resiliency.

Superstorm Sandy emphasized the many planning and design issues on the waterfront affecting New York City and the region. The Waterfront Working Group is a task force of architects, planners, landscape architects, engineers, ecologists, environmental consultants, and maritime experts. Professionals on the team hail from a number of organizations allied with the American Institute of Architects New York (AIANY), including the American Planning Association New York Metro Chapter (APA-NYM), and the American Society of Landscape Architects NY Chapter (ASLA-NY), as well as the Metropolitan Waterfront Alliance (MWA), and engineering associations including the Structural Engineering Association of New York (SEAO NY) and the American Consulting Engineers Council (ACEC New York).

This collaborative effort builds on the work of other interdisciplinary working groups that have addressed waterfront issues in previous years. This new model of collaboration among professional designers, scientific researchers, and policy makers may begin to address the enormous challenges that climate change holds for the future of the region.

### Interdisciplinary Collaborations

Organizational structures and funding mechanisms must be created to allow for more robust collaboration among pure and applied disciplines linking the design, scientific research, and regulatory communities.

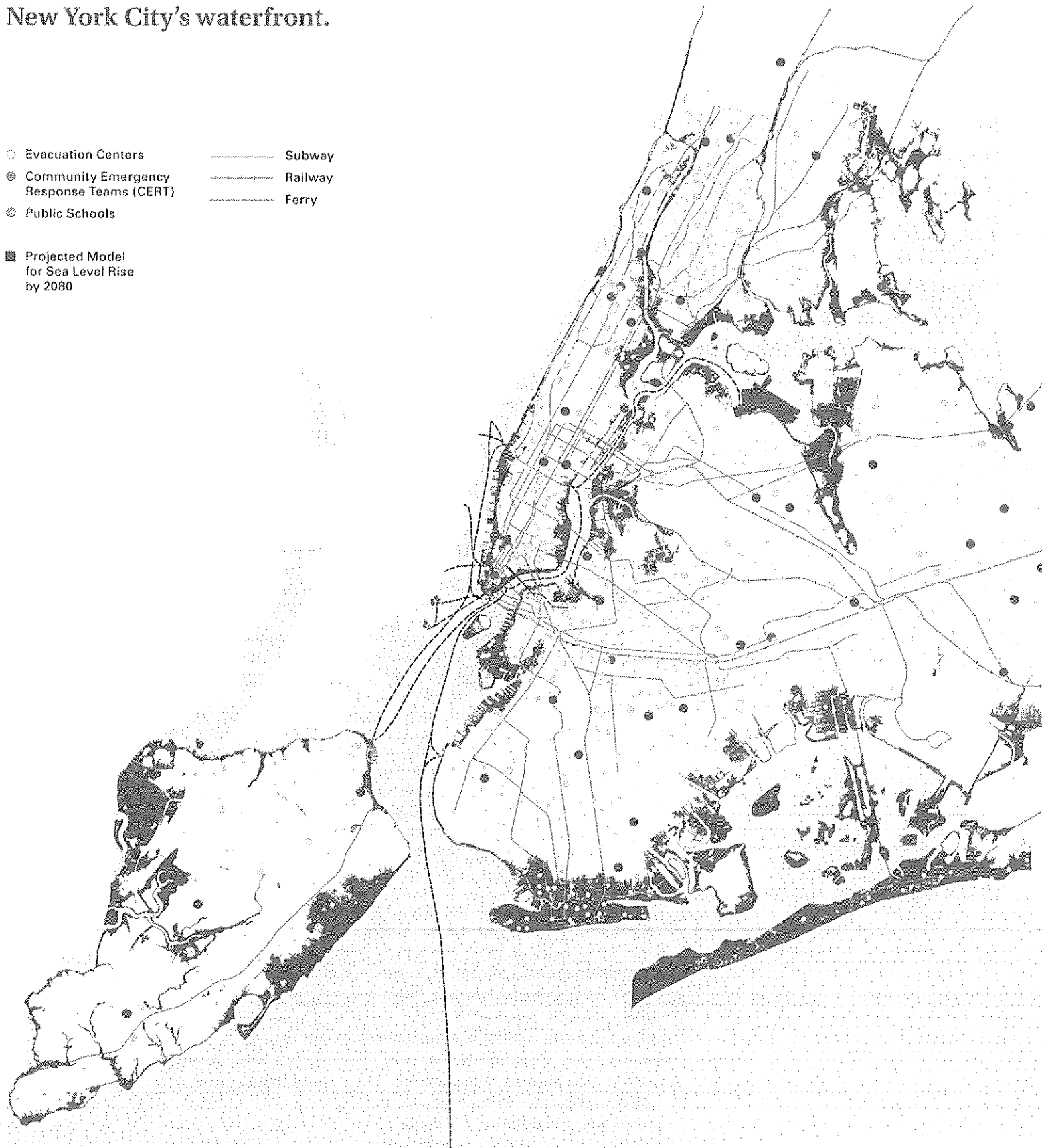
Teams of architects, landscape architects, engineers, planners, and permitting specialists, working closely with scientists (ecologists, biologists, and climate scientists), environmental regulatory staff, and local communities, have the capacity to identify innovative options and opportunities and to create smart, novel, and feasible solutions.

Current project and research funding structures enforce occupational and disciplinary silos that often preclude innovation. Waterfront regulatory restrictions need to evolve with more interdisciplinary research, more opportunities for experimental projects in selected locations, and more feedback from these projects.



By 2080, sea level rise is projected to flood many areas along New York City's waterfront.

- Evacuation Centers
- Community Emergency Response Teams (CERT)
- Public Schools
- Projected Model for Sea Level Rise by 2080
- Subway
- - - Railway
- Ferry



Map credit: Composite map by Richard Gonzalez, Architect with data from New York City Mayor's Office, Office of Emergency Management (OEM), Department of City Planning (DCP), NYC Police Department (NYPD), Federal Emergency Management Agency (FEMA), and Intergovernmental Panel on Climate Change (IPCC), LandScan™ GIST.

### **Complexity and Site-Specificity**

With 520 miles of shoreline in the City alone, and an enormous set of variables in geomorphology, hydrology, land-uses, and habitat types, there is an equally broad range of types and combinations of solutions.

Even within a specific area there is more than one solution. Rather, it is important to increase alternatives. There are short-, medium-, and long-term possibilities for a range of flexible scenarios that allow for success and provide safeguards in the event of failure. Planning and design of waterfront areas should embrace their unique, authentic, site-specific attributes and capture the essence and identity of each one.

We need to set priorities for use of current and future funding for the alternatives being discussed at the City's Special Initiative for Rebuilding and Resiliency (SIRR), the Department of City Planning's year-long Urban Waterfront Adaptive Strategies Study, and NYS 2100 Commission. These include nourishing beaches and expanding dunes; reinserting wetlands; raising

bulkheads; adding tide gates and revetments; building breakwaters; installing passive and deployable floodwalls; constructing seawalls and surge barriers; and conceiving of dual-use or multi-purpose levees.

### **Ecological Sensitivity**

Rich waterfront habitats are among the most productive ecosystems on the planet, and shoreline designs in the coming years need to be based on a healthy respect for the water and natural systems.

We must learn to "go with the flow," both a more controlled flow from the watershed to the sea, balanced with a mitigated flow from the sea onto land. The notion that the human-built realm should be considered first and foremost, often to the exclusion of other life processes, needs to be rethought. With current extreme declines in fish, bird, and pollinator populations (to name a few), better waterfront management practices can protect the ecosystems of which we are a part, and provide a better scientific understanding of how they function.

### **Redundancy and Modularity**

Flood protection and stormwater management should duplicate critical functions and be self-sufficient in densely-populated areas.

Such approaches are similar to those employed to ensure the stability of essential infrastructure systems and services (power, transportation, and waste).

### **Inclusivity**

Involving all members of waterfront communities in ongoing planning and implementation requires making community outreach and communication priorities.

Engaging and supporting well-developed social networks and information dissemination will promote trust and local leadership among and within communities, and foster both inter-agency communication and collaboration among government, professionals, and local citizens.

**The Waterfront Lab is a place to test ideas, produce data, and monitor results. In a rapidly changing environment, well-planned "experiments" can help create a safer, more resilient city.**

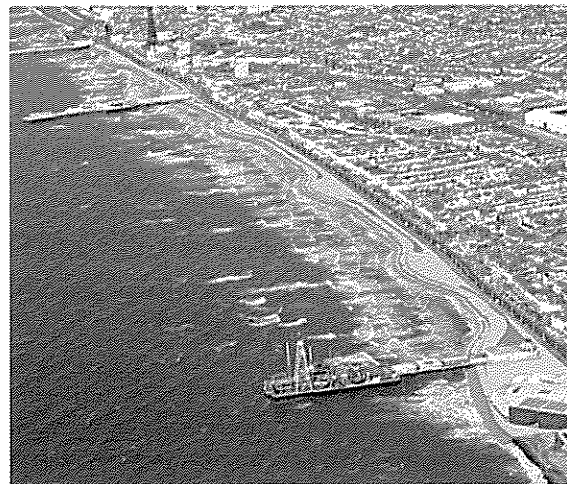


Photo credit: Bonnie A. Harken, AIA, APA, Nautilus International Development Consulting, Inc., 2010

## POLICY CONSIDERATIONS AND REGULATORY IMPLICATIONS

There are strategies that can enhance and enable the ability of planning and design professionals to act on opportunities:

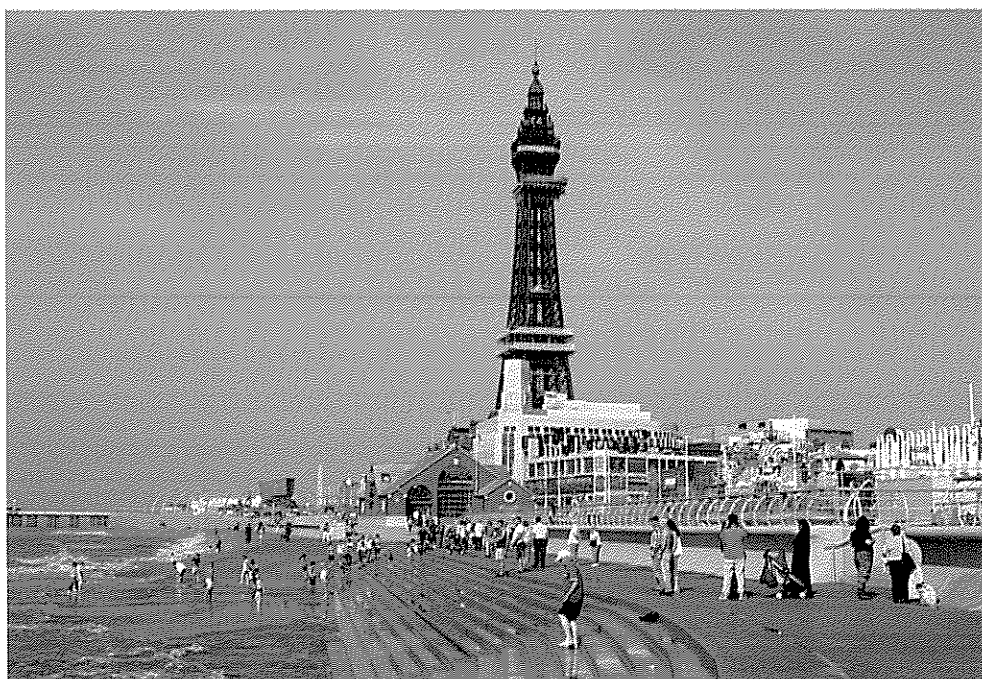
- ▶ Break out of occupational silos. Foster meaningful, longer-term collaborations among designers, ecologists, biologists, and climate scientists.
  - ▶ Recognize naturally occurring districts - bioregions, watersheds, and smaller ecosystems. Although jurisdictional rather than natural divisions structure our political geography, there are other precedents such as watershed management entities worthy of emulation.
  - ▶ Seek out environmental regulators willing to be involved with experimental approaches and problem solving. Current regulations and regulators are sometimes change-averse, even when projects might have the potential to improve environmental conditions.
  - ▶ Advocate for appropriate funding levels to adequately maintain and operate public urban environments.
- ▶ Put in place mechanisms and funding for long-term monitoring and evaluation of waterfront design solutions.
  - ▶ Educate stakeholders on the value of “green” solutions and stewardship of urban open spaces. These elements are sometimes misguidedly value-engineered out of projects because of funding constraints and a lack of understanding and commitment.
  - ▶ Widely implement green infrastructure approaches to stormwater management throughout watersheds and “sewer sheds”—water harvesting, capturing, treating, and management at all scales, from building and site to metropolitan and regional.
  - ▶ Give consideration to other issues such as inland flooding and wind damage in addition to our major focus on coastal flooding from sea-level rise and storm surges.



Victorian Seawall in 2007. Design and Photo credit: AECOM



Design Concept in 2008. Design and Photo credit: AECOM



Design and Photo credit: AECOM

New seawall defenses protected more than 600 businesses and created new places for people to enjoy the popular seaside resort of Blackpool, UK, along a 3.2 km reach.

## OPPORTUNITIES AND NEXT STEPS

### The Waterfront Lab: Design and Planning for Resiliency

The tremendous amount of uncertainty about the future—from the effects of climate change and rising sea levels to the frequency with which we will be experiencing major environmental events—provides an opportunity to explore and test the effectiveness of innovative ideas to expand the range of current waterfront strategies.

Numerous governmental, academic, professional, and advocacy groups are already collecting and analyzing data and making recommendations. Rather than duplicate those efforts, the Waterfront Lab focuses on complementary explorations of new and innovative waterfront planning and design strategies.

The starting point was to ask, “What went right?” and draw lessons from what weathered Superstorm Sandy successfully. That investigation raised the additional questions of “What could be explored further?” and “What needs to open up for that to happen?” The answer was to create a Waterfront Lab for testing ideas, producing data, and monitoring results, especially after substantial environmental events. The Lab is a place to investigate strategies with the potential to mitigate storm surge, prevent erosion along the urban edge, and soften the impact of rising tides. Such experiments would focus on testing ideas for both predictable and unpredictable events within a framework that does not threaten the life and property of surrounding areas. Experiments also take into account the different typologies found in the New York City region—the ocean, estuaries, and rivers—and the widely different scales of projects, from individual sites and neighborhoods, to larger areas and the region as a whole.

The work of the Waterfront Lab could be an important contribution to how the City assesses new proposals that have never been put in place here—efforts that could advance flexible and sustainable waterfront planning and design for

the future—based on best practices around the country and world.

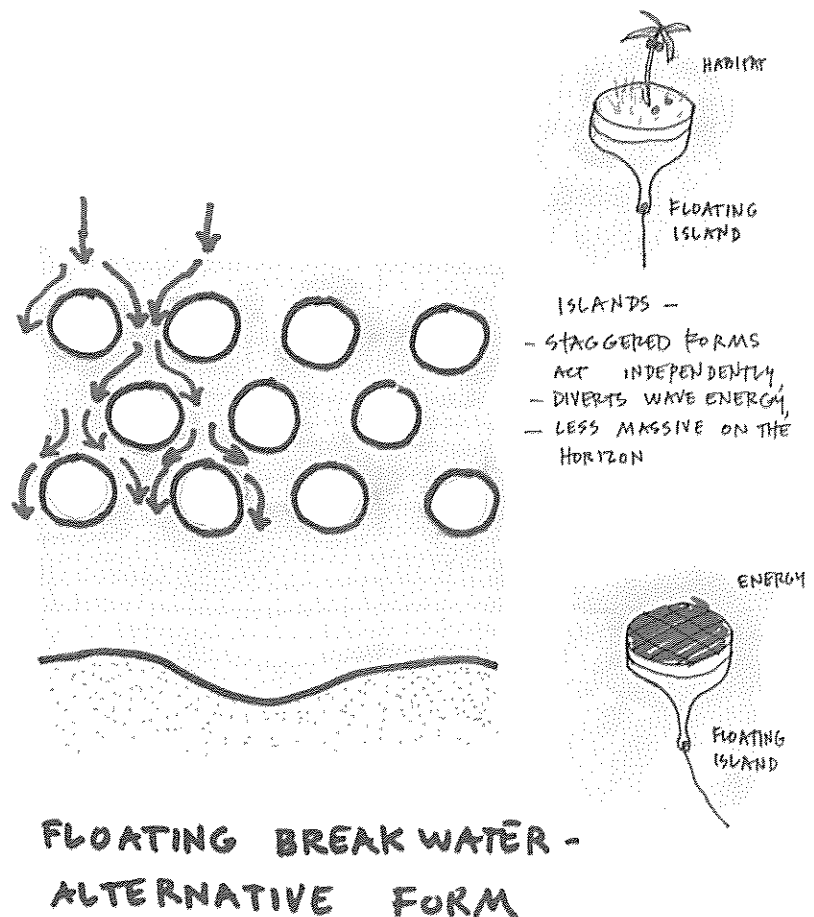
As the number of major events on the waterfront is projected to increase by designating areas for experiments along the water’s edge, promising strategies can be implemented and their performance examined. Those that prove successful may then be expanded upon and put into practice in other locations throughout the region.

Looking holistically at potential strategies, there are both short- and long-term experiments that could be employed. Instead of merely replacing outdated structures or landscapes in kind, more resilient and climate-neutral alternatives could be put in place and evaluated. Waterfront planning and design must continually adapt to maximize response to rapidly changing ecosystems.

## CONCLUSIONS

The challenges facing New York City and the region as we adapt to new realities brought on by climate change over the coming decades are enormous. Cross-disciplinary collaboration within a broad structure that allows for innovative strategies to be applied and tested can address public safety issues and protection of the built environment, and can also integrate innovative solutions for managing stormwater, enhancing biodiversity, incorporating renewable energy, and creating myriad combinations of new strategic approaches.

By connecting local communities with teams of professionals—from architects, landscape architects, planners and engineers, to environmental consultants, maritime experts, ecologists,



Drawing by Caleb Crawford,  
Coggan + Crawford Architecture + Design

## SCALES

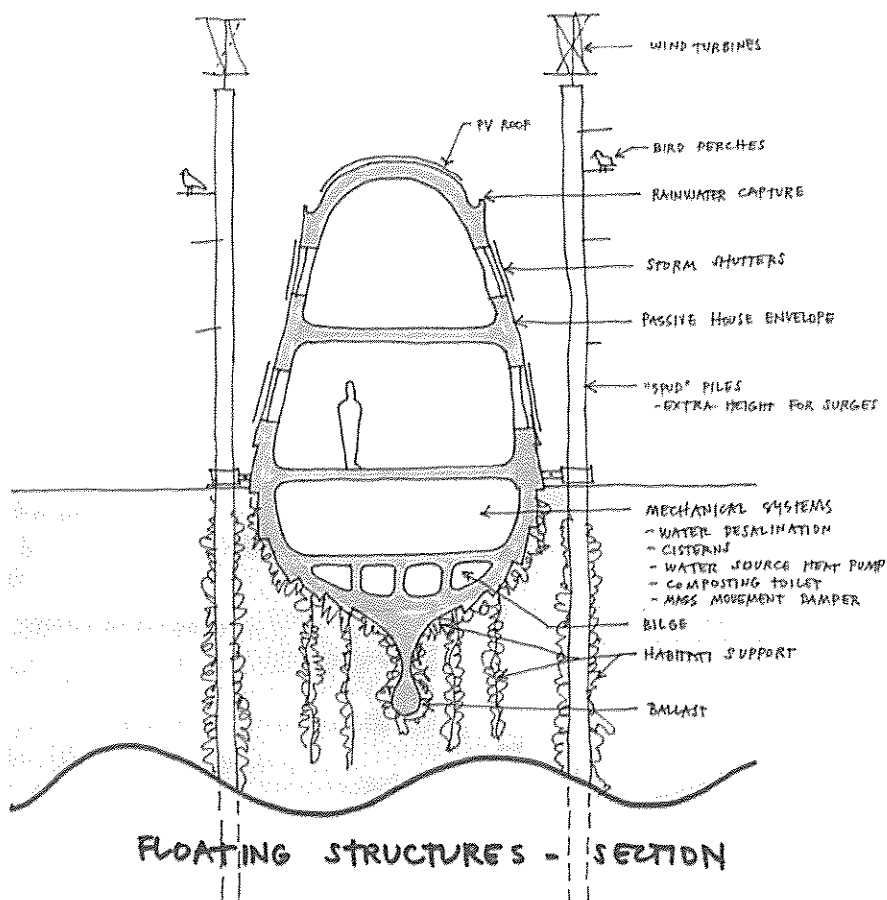
## SHORELINE TYPES



and biologists—a case can be made for obtaining funding for meaningful projects. The design and scientific communities can, together, contribute to solving urgent issues confronting the City. What is needed is a ground-up, incremental approach—not just a few high-cost, high-profile projects. Partnering with local communities we can develop sensitively formulated, localized solutions, arming property owners with a menu of resilient strategies, and lending our voice to the important discussion about what uses are put on the waterfront.

From the government side, we look for agility and flexibility in the planning and design of waterfront solutions in the context of a collaborative, problem-solving approach. This need for agility applies to all scales—from new regional models for watershed management to site-specific experimental projects to test the performance of materials. We must evaluate zoning and land-use along our shores, where hard and soft edges are best suited, and how to integrate buildings and open space in response to rising water levels.

Funding for Waterfront Lab projects (research, capital, maintenance and operations, and monitoring) could come through planing and financial structures that allow for deeper, longer-term collaborations among many disciplines and stakeholders. The Waterfront Lab could be a continuing means of testing innovative ideas, bringing New York City to the forefront of innovative waterfront resiliency planning and design.



Drawing by Caleb Crawford,  
Coggan + Crawford Architecture + Design

#### EXAMPLES OF POTENTIAL WATERFRONT LAB EXPERIMENTS

**An array of potential Waterfront Lab experiments can be applied to ocean, estuarine, and riverine systems at different scales:**

Networks and rhizome systems of floodable open spaces and infrastructure (such as day-lighted streams, water plazas or piazzas, streets, canals, or multipurpose bioretention projects);

High-ground safe areas in neighborhoods with solar-powered cell phone charge stations and other essential post-emergency services;

Defensive strategies, such as naturalized edges, berms/dunes, large capacity bioswales, or native, salt-resistant plantings;

Renewable energy (i.e., wind- and hydro-powered turbines) integrated into waterfront structures and infrastructure;

Creative concepts for seawalls/wave walls that dissipate storm surges and provide ecological edges;

Natural and armored dunes using various types of materials;

Biodiversity integrated into infrastructure, e.g., bulkheads as habitat or floating breakwaters;

Combined sewer outfalls (CSOs) with lightweight fiber which then attracts suspension feeders for water filtration;

Habitat for fish, oysters, and other mollusks or beneficial organisms;

Permeable waterfront parks in floodplains;

Floating habitat, wetlands, recreation, breakwaters, evacuation routes, and housing.

Wind-resistant streets and resilient evacuation routes; and

Model waterfront districts with distributed infrastructure (energy, waste, sewer, water).

# ADAPTATION, ADVOCACY & NEXT STEPS

## Adaptive Response

Based on our initial examinations of options and opportunities by the various working groups—Transportation & Infrastructure, Housing, Critical & Commercial Buildings, and Waterfront issues—some general conclusions can be drawn for how to define and implement resilient planning and development strategies in this new post-Sandy world.

Can we prevent Sandy-like occurrences in the future? No one pretends we can, even with the most aggressive carbon-reduction programs. Although compounded by man-made situations, such events are punctuations in a timeless

and continuing cycle of natural change—a cycle that appears to be increasing in intensity and frequency, and which will bring us extreme events that are an evolving reality with which we need to contend.

Can we mitigate the impact of these extreme occurrences and protect ourselves against their effects? The answer is a qualified “yes”—if we take a deliberate and measured risk-management approach based on adaptive responses. Such an approach must carefully balance the benefits of various interventions and their costs, bearing in mind that, as always, we are dealing with scarce economic resources. We

must balance expenditures for other pressing public and private needs with disaster recovery and protection (in which a dollar spent today will save multiple dollars tomorrow).

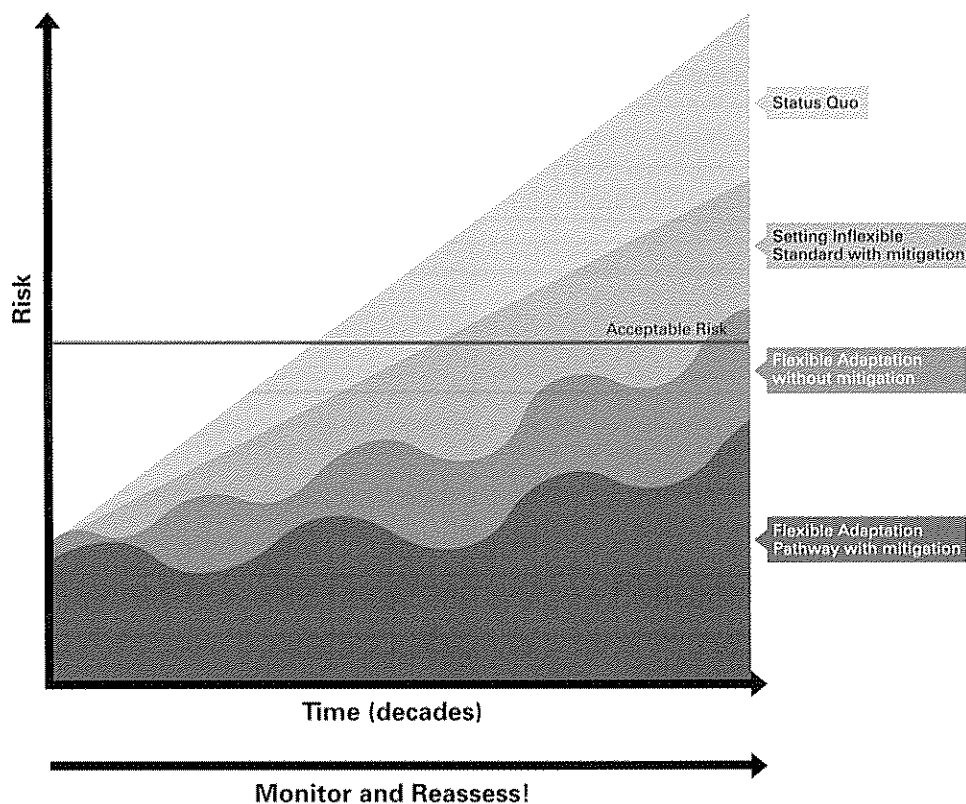
One of the conclusions emerging from the investigations undertaken as part of this Post-Sandy Initiative is that different types of investments may require different adaptation strategies.

This conceptual graph, presented at “Futureproofing Our Cities,” a symposium held in March 2013 at the Newman Real Estate Institute of Baruch College/CUNY, describes the relative costs and benefits of potential adaptive responses:

The Status Quo represents the most rapid accumulation of risk over time.

An inflexible adaptation strategy can retard the rate of risk but through high-cost front-end investment, leaving the problem of not realizing all benefits until the long-term future.

By contrast, a Flexible adaptation approach, described by the wavy lines at the bottom of the graph, makes lower-cost, medium-term investments for medium-term benefits, reinvesting over time with new science and technology whenever conditions threaten to surpass acceptable risk levels.



Graphic adapted from: Lowe, J., T. Reeder, K. Horsburgh, and V. Bell. "Using the new TE2100 science scenarios." UK Environment Agency, as cited by NYC Panel on Climate Change (NPCC), 2010.

For instance, long-term investments should be those with the longest useful lives—the 100-year-plus life span for many types of new large transportation and utility infrastructure (whose failure can be truly catastrophic), or the similar time frame for extensive rebuilding of waterfront areas (where protection is critical to nearby social and economic stability). These should be designed with the long view, even at a premium cost, to deal with maximum potential risk. This strategy commits the government to protect its public investments, guarding its citizens against the threat of failure.

On the other hand, buildings and redevelopment in threatened areas present shorter-term opportunities and needs. New and renovated housing and critical/commercial structures—and remediation, as opposed to reconstruction of infrastructure or waterfronts—should involve lower but more affordable costs and risk levels. The caveat is that they may be required to upgrade to a higher level of risk protection as conditions change over time—accepting the potential of failure, coupled with a commitment to learn from experience. This strategy can bring private investments, insurance funding, and relevant public subsidies more in line with realistic capabilities—an issue that today threatens individual capacities.

### Advocacy

In the immediate term, the planning and design community will undertake a program of advocacy for both shorter-term tactics to deal with critical issues at hand, and longer-term strategies growing out of these larger-concept approaches:

- ▶ Giving input into the various task forces now under way to develop consensus on next steps for public investment and private response—including challenges to be examined as part of the upcoming mayoral election.
- ▶ Contributing to considerations at the City level (Mayor Bloomberg's SIRR initiative and other agency responses and approaches), at the regional level (partnering with other planning and design professionals in adjacent municipalities and states in areas of

common interest), at the New York State level (both short-term recovery responses and longer-term policy proposals), and at the national level (for instance, lobbying for possible refinements to FEMA standards and regulations).

- ▶ Reinforcing analysis through relationships developed with various city agencies both prior to and during our interactive post-Sandy events.
- ▶ Building upon the collaboration among organizations represented by this Post-Sandy Initiative, developing common positions, sharing research and proposals, and propounding advocacy initiatives—with the understanding that speaking with one voice is more powerful than many uncoordinated efforts.
- ▶ Apprising other organizations that are not part of the collaboration of this work, undertaking parallel efforts to generate conclusions, and engaging in dialogue to learn from other initiatives.
- ▶ Expanding outreach and educational efforts through contacts with education groups, institutions, student groups, and others.
- ▶ Advocating for refinements to laws that facilitate planning and design assistance in disaster recovery (such as the proposed Good Samaritan Law exemption to indemnify professionals for pro bono responses in times of emergency).

In many ways, the most important advocacy point going forward is to ensure that architects, planners, landscape architects, and engineers—those who understand the physical implications of the various policy and strategic options under consideration—are part of the discussions at the outset.

### Next steps

Taking into consideration these proposed adaptive strategies, the areas studied by the working groups should be further analyzed and more detailed implementation steps proposed. This report presents a framework for this continuing, broad, and multi-disciplinary evaluation of options and opportunities. The issues are varied, and many are

beyond the scope of our volunteers. For the most part, responsibility resides with various levels of government and institutional advisors currently examining these critical issues. Together we can develop implementation steps for:

- ▶ Waterfront and infrastructure: make an in-depth comparison of regional options and opportunities for protection of natural and man-made features. The objective should be to make the hard decisions, based on what we know now, as to what long-term expenditures are necessary for long-term benefits. The scenario approach spearheaded by the Regional Plan Association (RPA) is a valuable framework for this effort.
- ▶ Buildings: examine the tactics of regulation—zoning, codes, and other standards—in terms of what is feasible relative to medium-term benefits. The objective should be to mitigate the economically unsustainable pinch faced by home and property owners, between one-size-fits-all standards and government/private insurance premiums. A detailed comparative analysis of the range of assumptions that underlie potential standards, and the implications of their implementation, will be an important part of this effort.
- ▶ Continue to advance our knowledge. We know as design professionals that it is critical to expand the proportion of funding allocated to research and development of resilient, sustainable systems for buildings and the public realm—super insulation, better glass, fuel cells, storage batteries, innovative transit, and stormwater technologies. Our future could be that our buildings produce as well as consume energy, that we minimize the need for fossil fuels, and that we handle all by-products, including waste, in a sustainable manner.
- ▶ Finally, the imperative of sustainability must underlie the need for resiliency. We must ensure that new development not only adapts to extreme weather conditions, but also defines how to mitigate long-term climate change concerns. In a recent white paper, the AIANY Committee on the Environment (COTE) put forward a summary

description of potential strategies to achieve this goal—from suggestions for urban policy and legislation, to district systems and strategies, and individual building scale.\*

The decision-making process needed to refine such recommendations can be undertaken in the framework of proposed labs—multidisciplinary investigations, rigorously defined to posit, test, and evaluate potential solutions so that the best possible choices can be made.

This report is the first step, a summary of where we are in our response as planning and design professionals to these unprecedented challenges in trying to understand the big-picture options ahead of us even as we grapple with the minutiae of pressing details. As we document more specific information from work already undertaken, and as we investigate the implications of these assumptions further (through workshops, charrettes, labs, and scenarios), we will present material on our new website, [www.postsandyinitiative.org](http://www.postsandyinitiative.org). The site—currently a repository for appendices and background material generated at various working group events—will be a flexible and open-ended vehicle for next steps, updated regularly to reflect ongoing research, ideas, and recommendations.

Our working groups are readying their next-phase efforts beyond this report's initial definition of options and opportunities. They will continue this work using the website as a platform:

- ▶ Transportation & Infrastructure will continue advocacy efforts for best practices, both through collaborative programs and through interaction with regional agency and institutional initiatives.

- ▶ Housing will expand its work to: propose changes to FEMA multi-family standards; design options for spaces below the base flood elevation; explore alternatives to evacuation where infeasible or impossible; building system emergency responses, and further analyze best practices in the United States and worldwide.
- ▶ Critical & Commercial Buildings will prepare guidelines for implementation of recommendations for building owners and regulatory agencies, both locally and, to the extent relevant, nationwide.
- ▶ Waterfronts will press forward with its Waterfront Lab approach to defining and evaluating experimental solutions for testing ideas, producing data, and monitoring results, especially after substantial environmental events.

In addition, the AIANY Design for Risk and Reconstruction Committee (DfRR) will continue its multi-pronged focus on education, training, preparedness, and advocacy, based on its partnerships with various city agencies and institutions. The other consortium members will continue their own independent efforts (for example, APA Far Rockaway consultations, CHPC zoning proposals, SEAO NY damage analysis coordination, etc.).

#### Join Us

Through this consortium and its member organizations, we will continue our pro bono efforts to analyze alternatives, assimilate potential responses, and advocate for relevant public policies and private approaches for the preservation and growth of New York City and the region in this new and challenging environment of unpredictable change. Please join us in advocating for the options and opportunities defined in this summary, and by responding to our evolving work posted on the website at [www.postsandyinitiative.org](http://www.postsandyinitiative.org).

\* "Where Mitigation Meets Adaptation: An Integrated Approach to Addressing Climate Change in New York City" AIANY Committee on the Environment, March 2013 (posted on [www.postsandyinitiative.org](http://www.postsandyinitiative.org))



We would like to express appreciation to the many volunteers who gave their time and knowledge to the Post-Sandy Initiative.

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Special thanks to Jay Bond, Policy  
Director, and Eliza McLellan, Policy  
Assistant, AIANY, for their patience  
and dedication to the Post-Sandy  
Initiative and for their involvement  
with all the Working Groups.

**Additional AIANY Staff Support:**  
Juliana Barton, Eve Dilworth Rosen,  
Daniel Fox, and Berit Hoff

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# Glossary

An abbreviated glossary  
of important terms\*

## Adaptation

Adaptation is the set of adjustments that society or ecosystems make to limit negative effects of climate change. It can also include taking advantage of opportunities that a changing climate provides.

<http://www.epa.gov/climatechange/impacts-adaptation/adapt-overview.html>

## Disaster

A serious disruption of the functioning of a community or a society involving widespread human, material, economic, or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

<http://www.wcpt.org/node/36996>

## Mitigation

Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters. Mitigation is taking action now—before the next disaster—to reduce human and financial consequences later (analyzing risk, reducing risk, insuring against risk). Effective mitigation requires that we all understand local risks, address the hard choices, and invest in long-term community wellbeing. Without mitigation actions, we jeopardize our safety, financial security, and self-reliance.

## Preparedness

Preparedness is achieved and maintained through a continuous cycle of planning, organizing, training, equipping, exercising, evaluating, and taking corrective action. Ongoing preparedness efforts among all those involved in emergency management and incident response activities ensure coordination during times of crisis. Moreover, preparedness facilitates efficient and effective emergency management and incident response activities.

## Prevention

Encompasses activities designed to provide permanent protection from disasters. This includes engineering and other physical protective measures, as well as legislative measures controlling land-use and urban planning.

<http://www.wcpt.org/node/36996>

## Recovery

A focus on how best to restore the capacity of the government and communities to rebuild and recover from crisis, and to prevent relapses into conflict. In so doing, recovery seeks not only to catalyze sustainable development activities, but also to build upon earlier humanitarian programs to ensure that their inputs become assets for development.

<http://www.wcpt.org/node/36996>

## Regenerative Design

Regenerative design (sometimes referred to as cradle-to-cradle design) is a process-oriented systems theory based approach to design. The term “regenerative” describes processes that restore, renew, or revitalize their own sources of energy and materials, creating sustainable systems that integrate the needs of society with the integrity of nature. (Wiki)

## Resilience

Ability of systems, infrastructures, government, business, communities, and individuals to resist, tolerate, absorb, recover from, prepare for, or adapt to an adverse occurrence that causes harm, destruction, or loss.

## Response

Activities to address the immediate and short-term effects of an emergency or disaster. Response includes immediate actions to save lives, protect property, and meet basic human needs. Based on the requirements of the situation, response assistance will be provided to an affected state under the National Response Plan (NRP) using a partial activation of selected Emergency Support Functions (ESFs) or the full activation of all ESFs to meet the needs of the situation.

## Risk

Risk is Hazard + Vulnerability. Risk is potential impact to people, environment, and economy of a community (FEMA 2004). Vulnerability is measured by identifying exposure, sensitivity, and ability to cope. Hazard is a natural process with the potential to harm people or property (FEMA 2001).

## Risk Assessment

Methods used to quantify risks to human health and the environment.

## Sustainable Design / Development

Involves activities that meet the needs of the present without compromising the ability of future generations to meet their own needs.

<http://www.wcpt.org/node/36996>

## SWOT Analysis

A process used to identify Strengths, Weaknesses, Opportunities, and Threats in business organizations, public agencies, and other entities. Can be useful as applied to determining building resilience.

\*All are FEMA definitions  
unless noted otherwise.

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Address: 241 Water Street, 3rd Fl NY, NY 10038

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I represent: Mayor's office

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THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. BRTF Res. No. \_\_\_\_\_

☒ in favor ☐ in opposition

Date: 27 June 2012

(PLEASE PRINT)

Name: Ramon Gilson

Address: 129 West 27 St NY NY 10011

I represent: Chair of the Street Committee of DOB

Address: \_\_\_\_\_

**THE COUNCIL  
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. \_\_\_\_\_ Res. No. \_\_\_\_\_

☒ in favor ☐ in opposition

Date: 6/27/2013  
June 27, 2013

(PLEASE PRINT)

Name: RUSSELL UNGER / CECIL SCHEIB

Address: 20 BROAD ST #709 NY NY 10004

I represent: BUILDING FREQUENCY TASK FORCE / URBAN GREEN COUNCIL

Address: same as above 10 NY City

**THE COUNCIL  
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. \_\_\_\_\_ Res. No. \_\_\_\_\_

☒ in favor ☐ in opposition

Date: 6/27/2013

(PLEASE PRINT)

Name: Lance Jay Brown + Margaret Castillo

Address: \_\_\_\_\_

I represent: AIA-NY

Address: 536 Laguardia Place NY NY

Please complete this card and return to the Sergeant-at-Arms

**THE COUNCIL  
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. \_\_\_\_\_ Res. No. \_\_\_\_\_

☒ in favor ☐ in opposition

Date: 6/27/13

(PLEASE PRINT)

Name: Dotie Harris

Address: 48 Dublin Drive Hickory

I represent: International Code Council

Address: Dame

**THE COUNCIL  
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. \_\_\_\_\_ Res. No. \_\_\_\_\_

☒ in favor ☐ in opposition

Date: 6/27/13

(PLEASE PRINT)

Name: SANJOY BANERJEE

Address: \_\_\_\_\_

I represent: City University Energy Institute

Address: 160 Convent Ave NYC, NY

**THE COUNCIL  
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. \_\_\_\_\_ Res. No. \_\_\_\_\_

☒ in favor ☐ in opposition

Date: June 27, 2013

(PLEASE PRINT)

Name: Mary Ann Rothman

Address: \_\_\_\_\_

I represent: Council of NY Cooperatives + Condominiums

Address: \_\_\_\_\_

Please complete this card and return to the Sergeant-at-Arms



**THE COUNCIL  
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. \_\_\_\_\_ Res. No. \_\_\_\_\_

☐ in favor ☐ in opposition

Date: 6/27/13

(PLEASE PRINT)

Name: PAUL GALLAY

Address: 20 Secor Road, Ossining

I represent: Riverkeeper

Address: same

Please complete this card and return to the Sergeant-at-Arms

**THE COUNCIL  
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. 1088-2013 Res. No. \_\_\_\_\_

☒ in favor ☐ in opposition 72013-6556

Date: 6/27/2013

(PLEASE PRINT)

Name: BERYL Thurman

Address: P.O. Box 140502, SE. NY. 10304

I represent: North Shore Waterfront Conservancy of

Address: Staton Island Inc.

Please complete this card and return to the Sergeant-at-Arms

**THE COUNCIL  
THE CITY OF NEW YORK**

**Appearance Card**

I intend to appear and speak on Int. No. 1088 Res. No. \_\_\_\_\_

☐ in favor ☒ in opposition

Date: 27/06/2013

(PLEASE PRINT)

Name: Delia Tutunjian

Address: 44 W 62<sup>nd</sup> St, #238

I represent: New York Environmental Law & Justice Project

Address: 351 Broadway, 3<sup>rd</sup> Floor

◆ Please complete this card and return to the Sergeant-at-Arms ◆

**THE COUNCIL  
THE CITY OF NEW YORK**

**Appearance Card**

I intend to appear and speak on Int. No. 1087 Res. No. 1088

☒ in favor ☐ in opposition

Date: 6-27-13

(PLEASE PRINT)

Name: KENNETH JUSTICE

Address: 1036 WOODS LANE, AMBLER PA

I represent: PORTLAND CEMENT ASSOCIATION

Address: CASTLETON, NY & WASHINGTON D.C.

◆ Please complete this card and return to the Sergeant-at-Arms ◆