



**A STRONGER,
MORE RESILIENT
NEW YORK**

Resiliency Briefing: NOAA

February 26, 2014



The City of New York

Agenda

- Sandy and the Risks of Climate Change
- PlaNYC: A Stronger, More Resilient New York
- NOAA Datasets, Tools, and Resources

Recovery, Rebuilding, and Resiliency

In the aftermath of Sandy, the City set up the Special Initiative for Rebuilding and Resiliency (SIRR)...



The goals of SIRR were to identify ways to

1. Rebuild neighborhoods not just as they were, but better; and
2. Strengthen critical infrastructure systems

by answering three key questions.

Question 1

What happened during Sandy and why?

Question 2

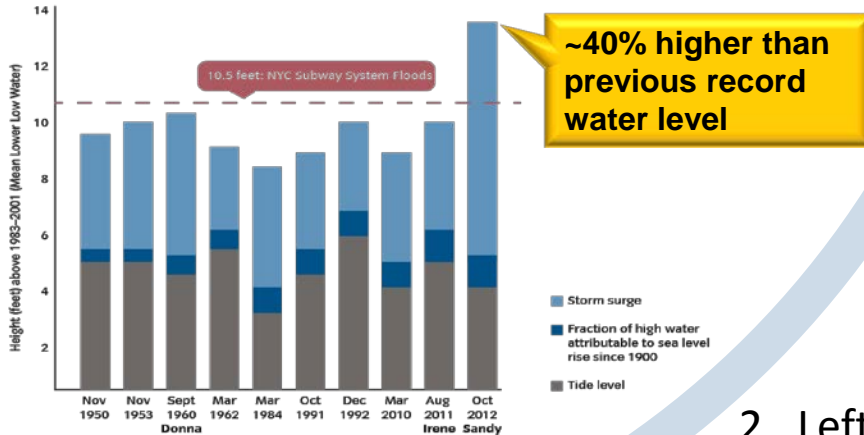
What could happen in the future?

Question 3

How do we rebuild post-Sandy and prepare for a future with climate change?

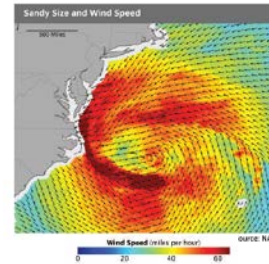
Sandy

An idiosyncratic surge event for NYC...



Why?

1. Wind Field



- 1,000 mile wind field pushed water into the NY Bight and caused record 32' waves off Rockaway coastline
- Wave action caused severe structural damage to buildings

2. Left Hook



- A rare "westward hook" put the city in the path of its onshore winds
- 3rd hurricane since 1878 to hit NJ

3. Tide



- Sandy's storm surge largely coincided with a rising tide in the Upper Harbor
- Spring tide added to the peak water levels

Result:

- 44 lives lost
- \$19 billion in damages
- Countless lives upended
- Major infrastructure disruptions

The Risks of Climate Change

At the City's request, the NYC Panel on Climate Change (NPCC) updated its 2009 analysis of how climate change might impact New York for chronic hazards.

CHRONIC HAZARDS	Baseline (1971-2000)	2020s		2050s	
		Middle Range (25 th -75 th percentile)	High End (90 th percentile)	Middle Range (25 th -75 th percentile)	High End (90 th percentile)
Average Temperature	54°F	+2.0°F to 2.8°F	+3.2°F	+4.1°F to 5.7°F	+6.6°F
Precipitation	50.1 in.	+1% to +8%	+10%	+4% to +11%	+13%
Sea Level Rise ¹	0	+4 to 8 in.	+11 in.	+11 to 24 in.	+31 in.

Source: NPCC; for more details, see *Climate Risk Information 2013*

¹ Baseline period for sea level rise projections is 2000-2004.

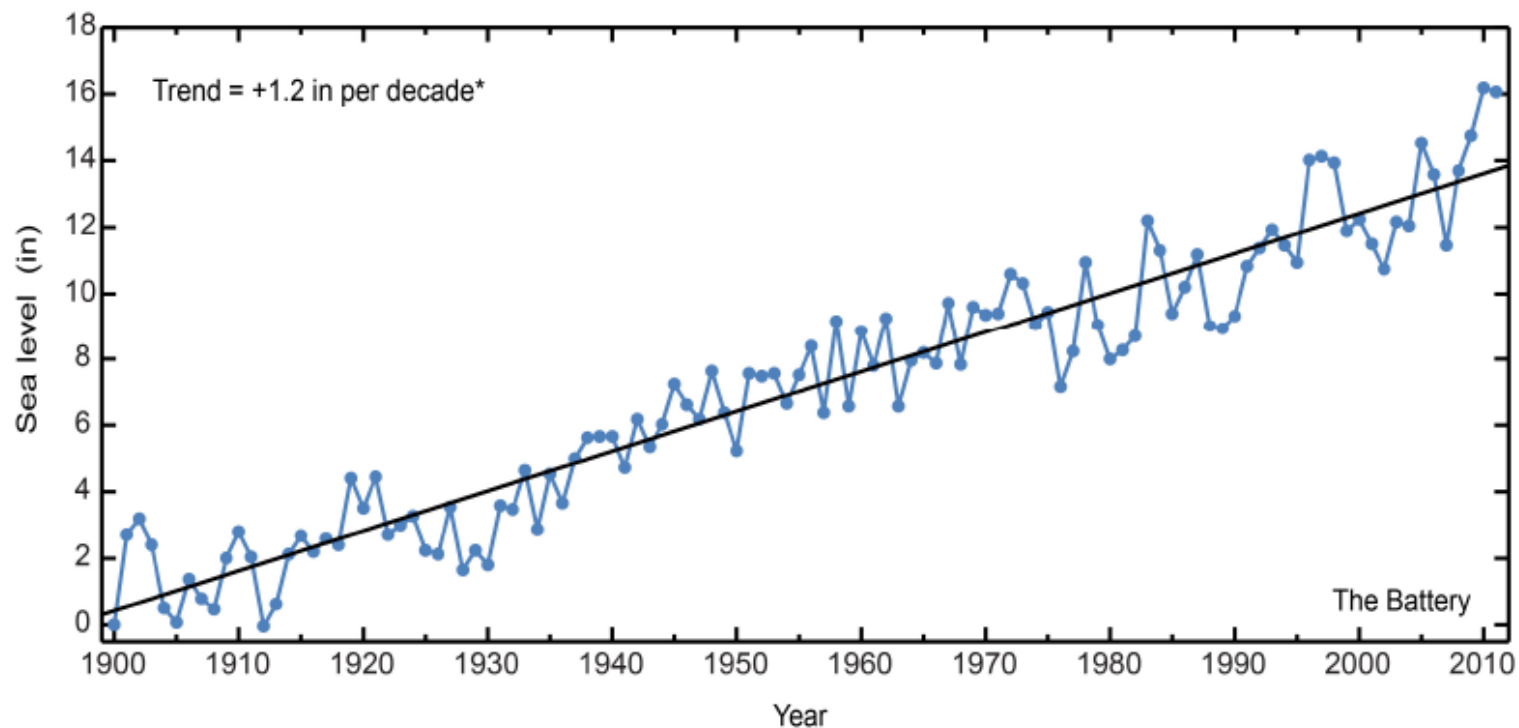
Sea levels are likely to rise 1-2 ft. and could rise more than 2 ½ ft.

Coordination with NOAA's Sea Level Rise Planning Tool was crucial for stakeholder buy-in.

The Risks of Climate Change

These sea level rise projections are in addition to the 1 ft. of sea level rise seen in NYC since 1900...

Historic Battery Tide Chart

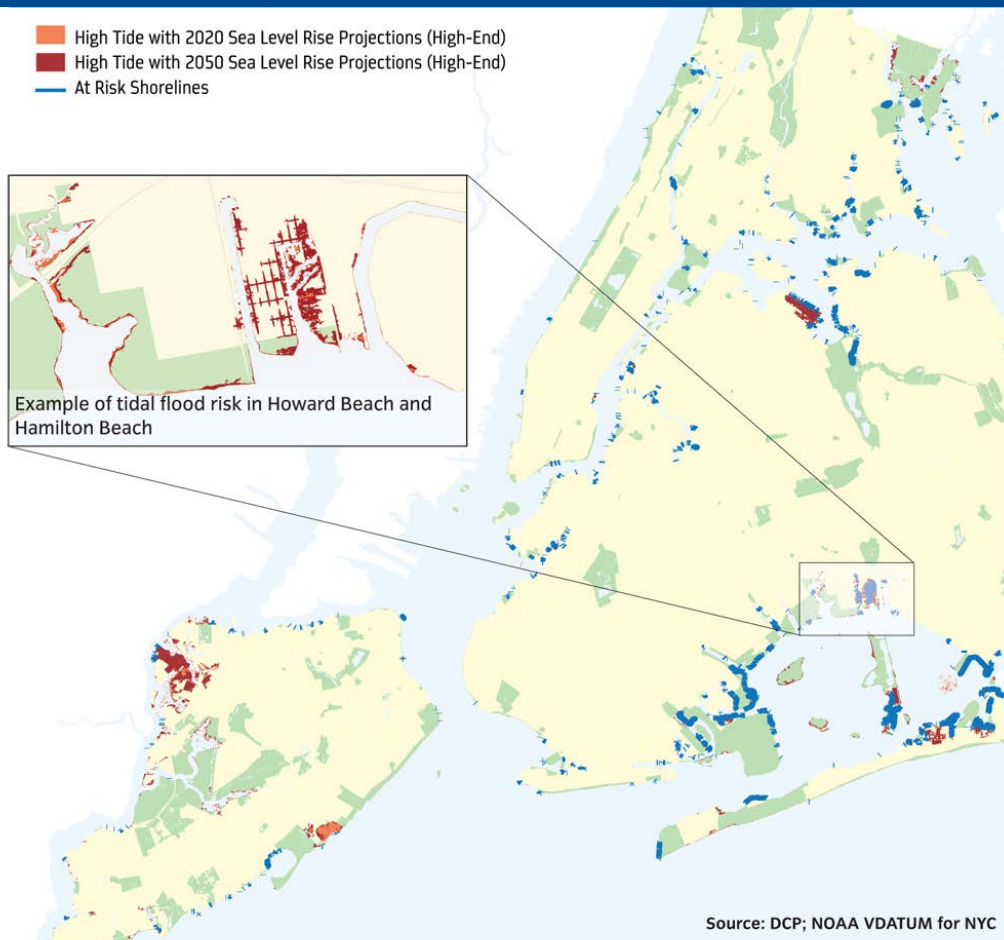


Source: Data are from the Permanent Service for Mean Sea Level (PSMSL)

The Risks of Climate Change

And will subject 8% of New York's coast to regular tidal flooding by the 2050s, even without storms.

Areas Experiencing Regular Tidal Flooding by 2050s



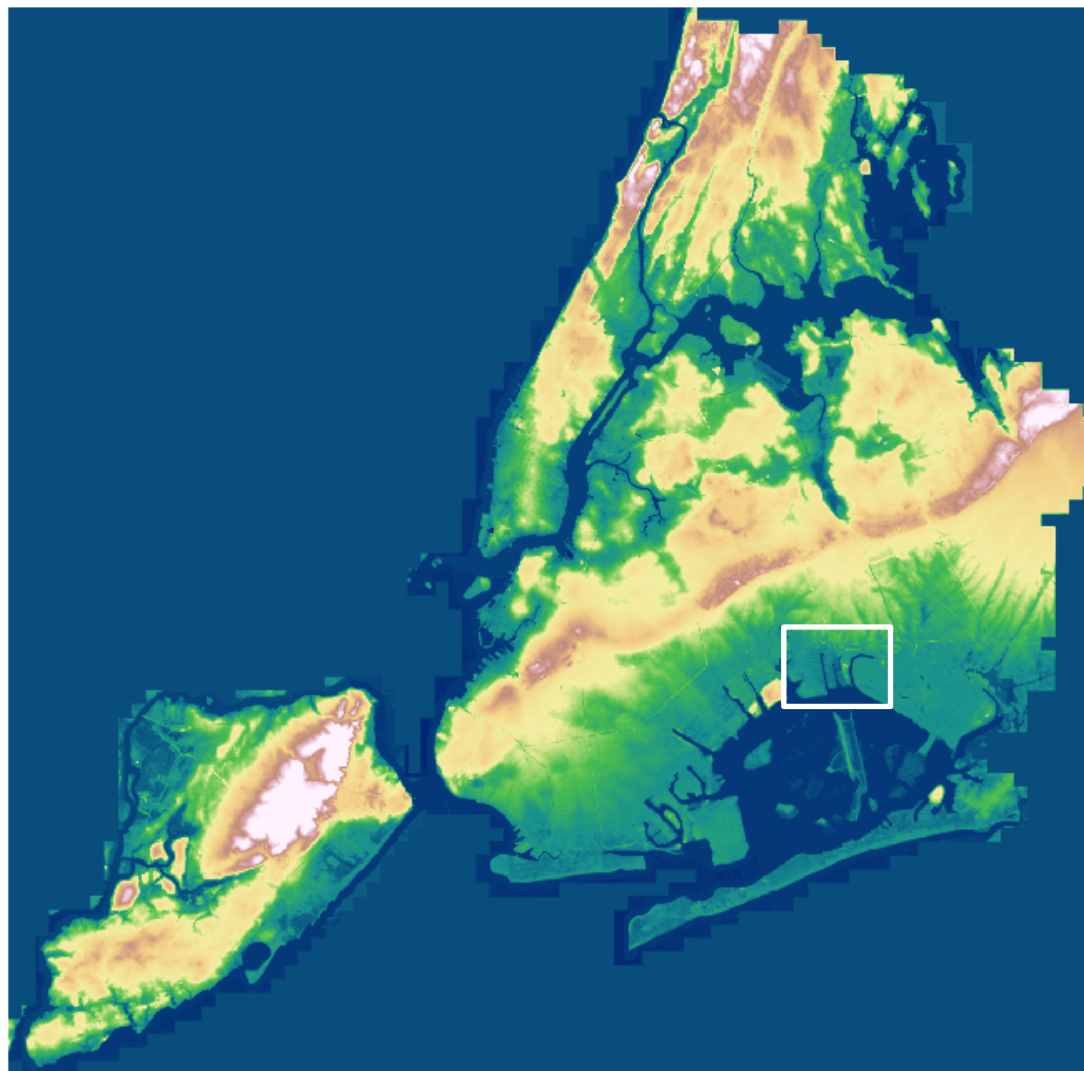
POTENTIAL SEA LEVEL RISE IMPACTS

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%
Total	520	43	8%

The Risks of Climate Change

Regular tidal flooding analysis was done with NOAA's assistance.

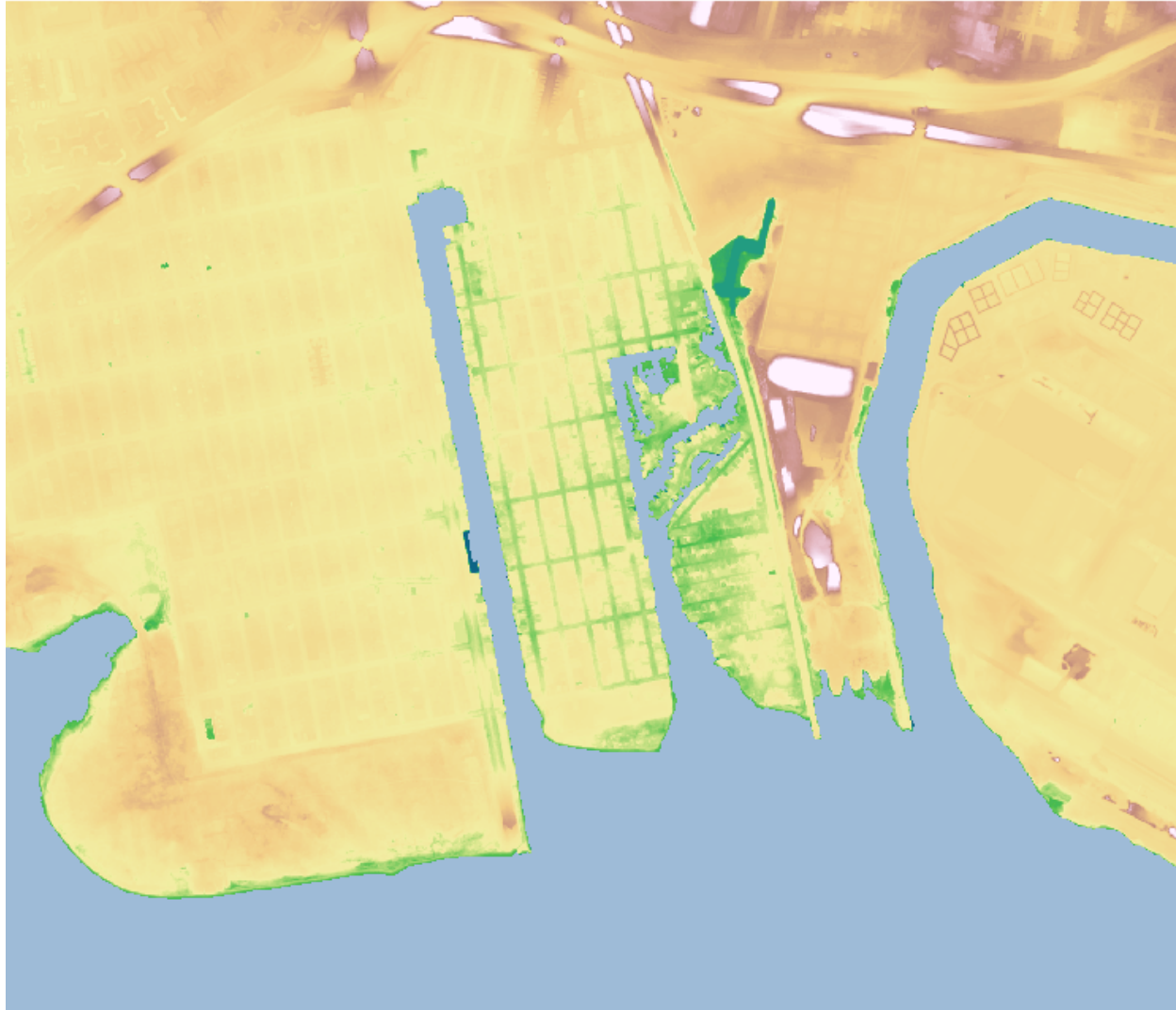
*Digital
Elevation
Model*



The Risks of Climate Change

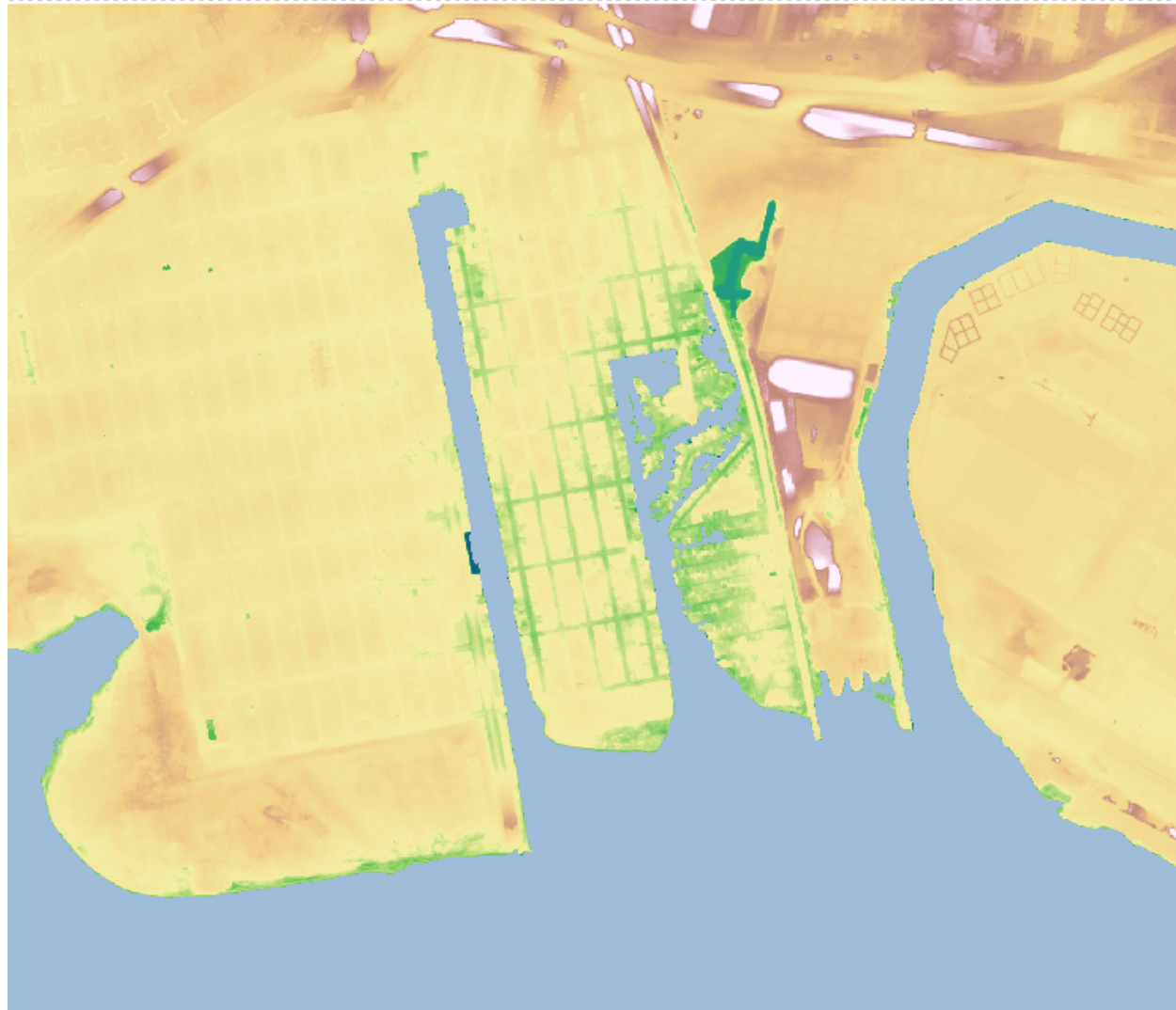
Regular tidal flooding analysis was done with NOAA's assistance.

***Digital
Elevation
Model
Mean Higher
High Water
(aka High Tide)***



The Risks of Climate Change

Regular tidal flooding analysis was done with NOAA's assistance.



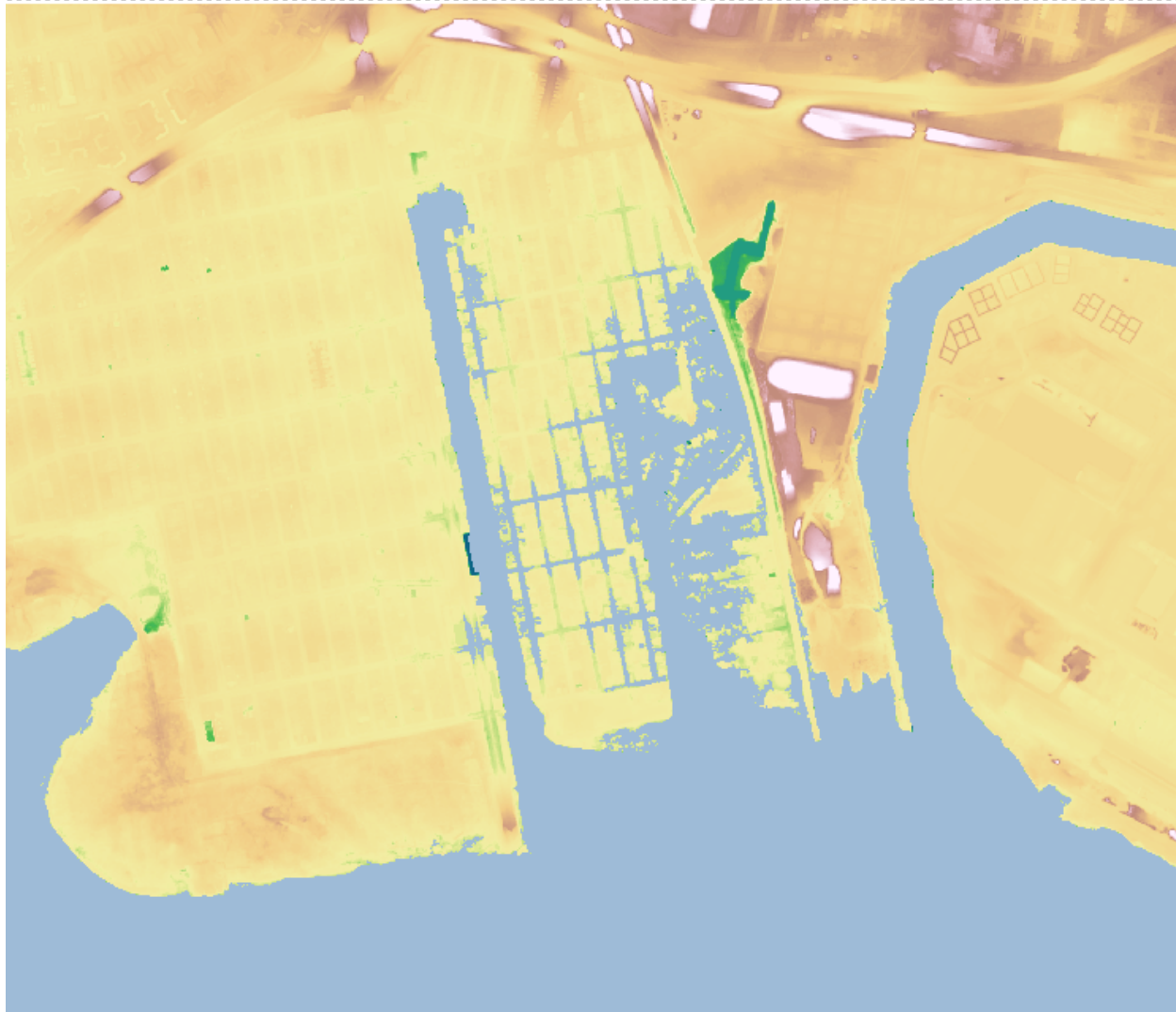
**Digital
Elevation
Model**

**Mean Higher
High Water
(aka High Tide)**

**+ 11" of SLR
(2020's high end
projection)**

The Risks of Climate Change

Regular tidal flooding analysis was done with NOAA's assistance.



*Digital
Elevation
Model*

*Mean Higher
High Water
(aka High Tide)*

*+ 31" of SLR
(2050's high end
projection)*

The Risks of Climate Change

The NPCC also updated its 2009 analysis for extreme events.

EXTREME EVENTS		Baseline (1971-2000)	2050s		2080s	
			Middle Range (25 th -75 th percentile)	High End (90 th percentile)	Middle Range (25 th -75 th percentile)	High End (90 th percentile)
Heat Waves and Cold Events	Days per year $\geq 90^{\circ}\text{F}$	18	39 to 52	57	44 to 76	87
	Heat waves per year	2	5 to 7	7	6 to 9	9
Intense Precipitation	Days per year with rainfall > 2 in.	3	4	5	4 to 5	5
Coastal Floods at the Battery¹	Future annual frequency of today's 100-year flood	1.0%	1.7% to 2.9%	4.5%	2.4% to 7.1%	18.5%
	Flood heights from a 100-year flood (feet above NAVD88)	15.0	15.9 to 16.8	17.5	16.5 to 18.3	19.8

Source: NPCC; for more details, see *Climate Risk Information 2013*

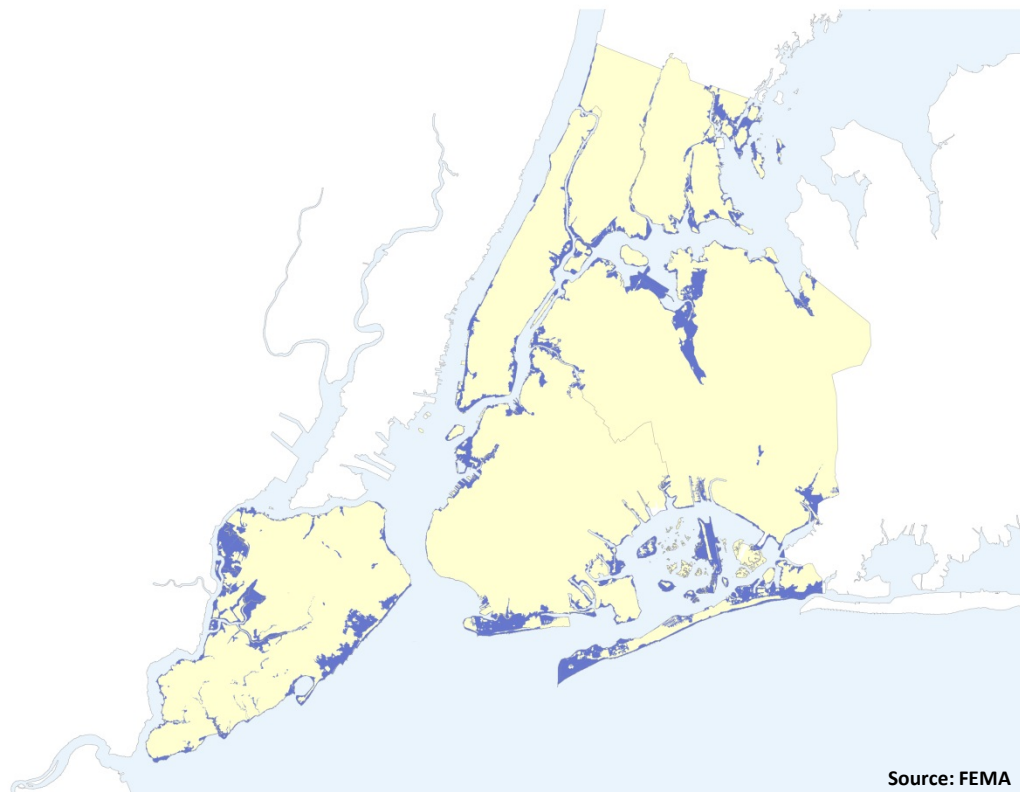
¹ Baseline period for sea level rise projections is 2000-2004.

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

The Risks of Climate Change

Prior to Sandy, the best indicator of New York's vulnerability to coastal storm surge flooding could be found in FEMA's 1983 Flood Insurance Rate Maps.

FEMA 1983 Flood Maps (FIRMs)



100-Year Floodplain (FEMA 1983 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**

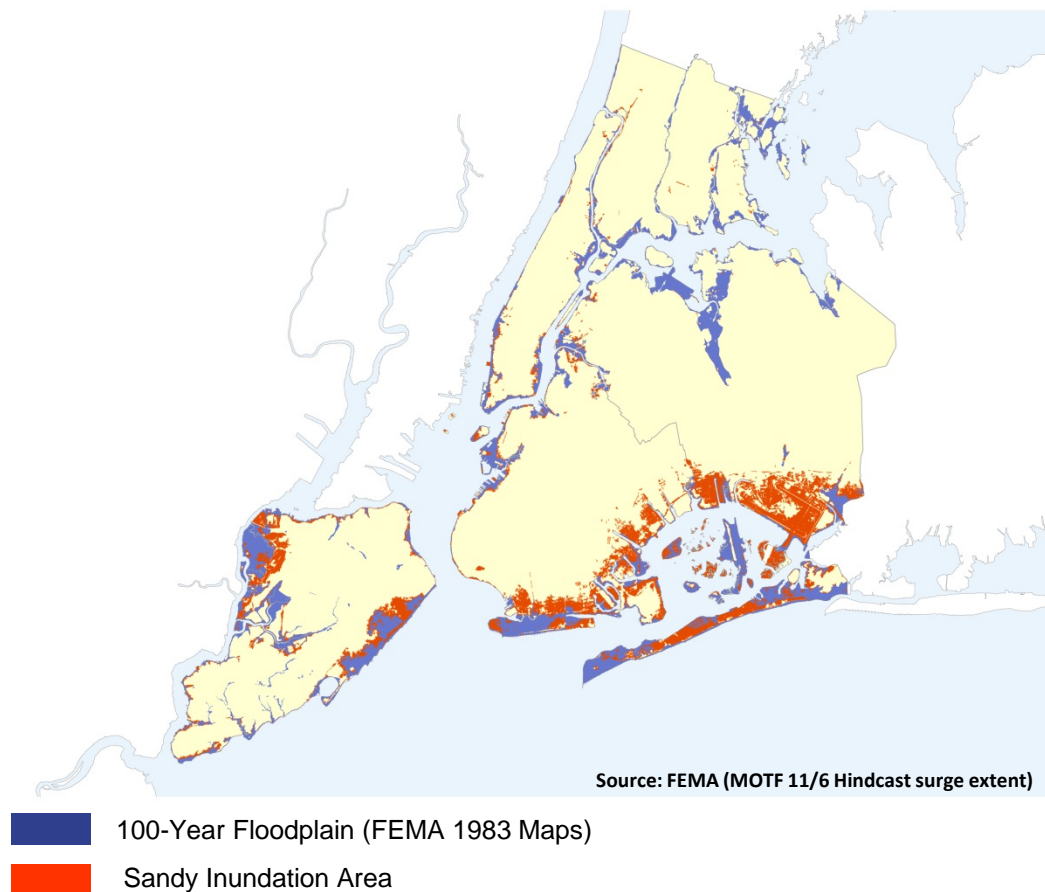
* Numbers are rounded for clarity

Source: FEMA

The Risks of Climate Change

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

FEMA 1983 Flood Maps vs. Sandy Inundation Area



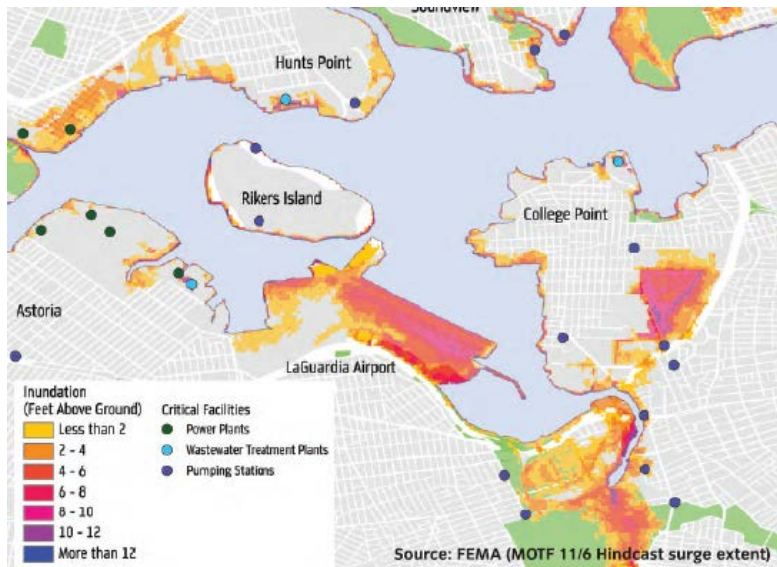
Share Outside 100-Year Floodplain

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

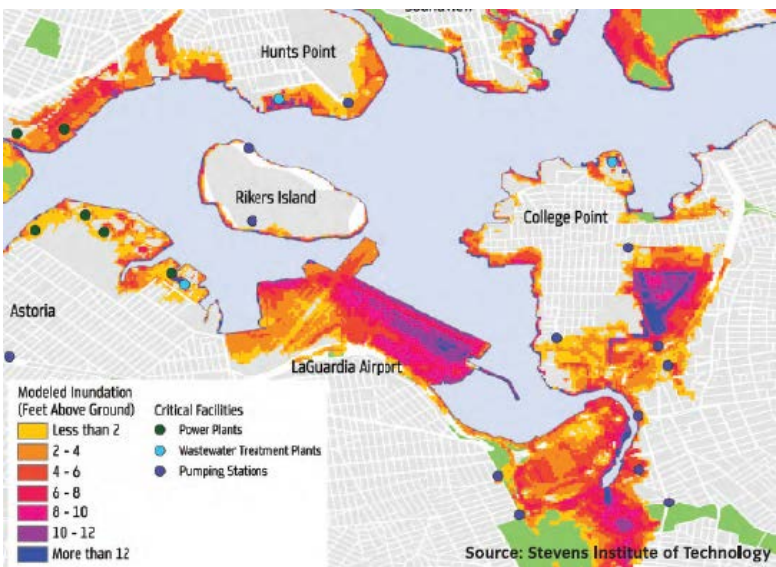
The Risks of Climate Change

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



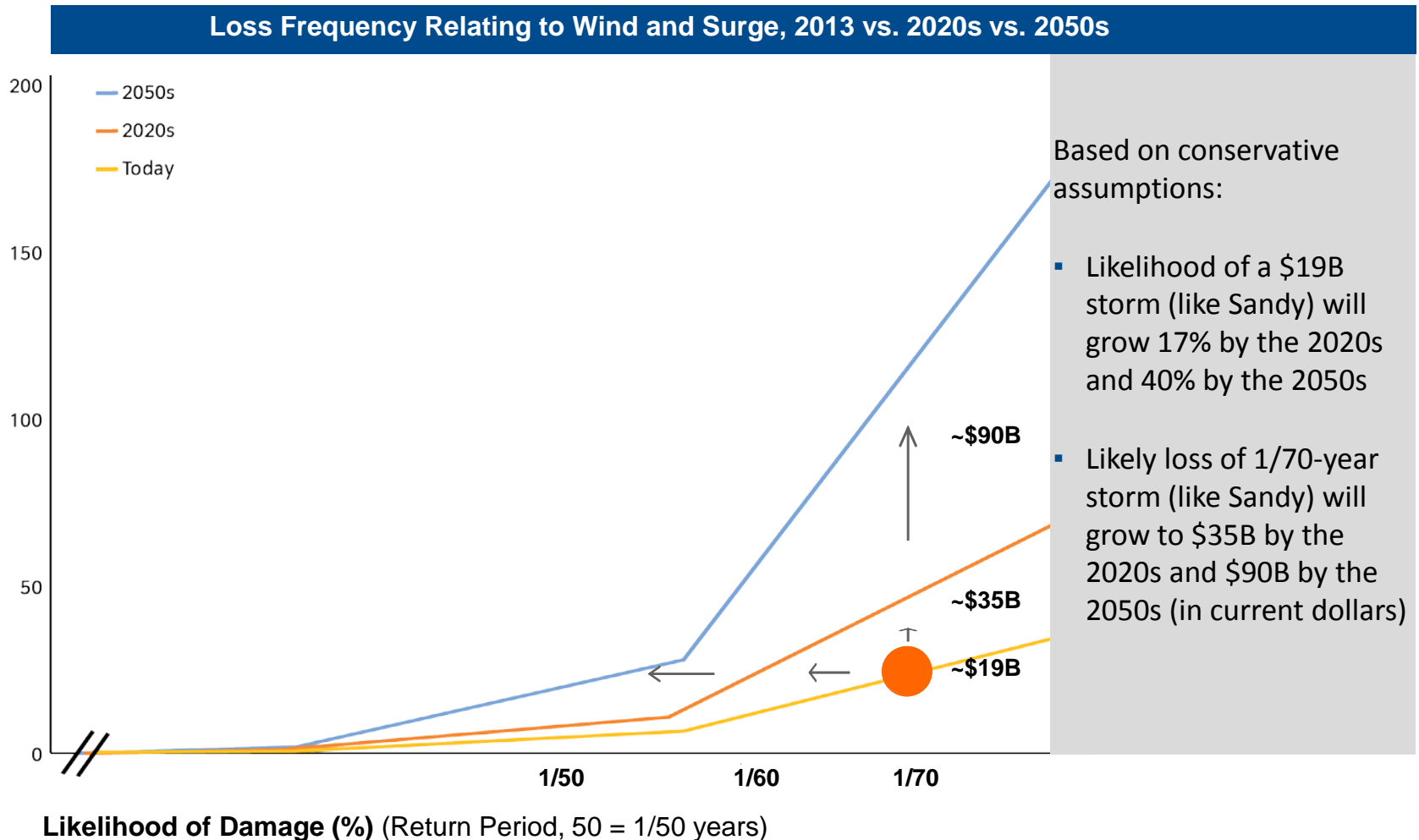
Sandy Inundation: Simulated 9 Hours Earlier



More significant impacts than were experienced during Sandy likely would have occurred at Hunts Point, LaGuardia Airport, key power generation facilities, and other locations.

Sandy and the Risks of Climate Change

Working with Swiss Re, the City quantified the potential monetary impacts resulting from an increased frequency in damaging storms as a result of climate change.



Sandy and the Risks of Climate Change

From this analysis, we learned several lessons.

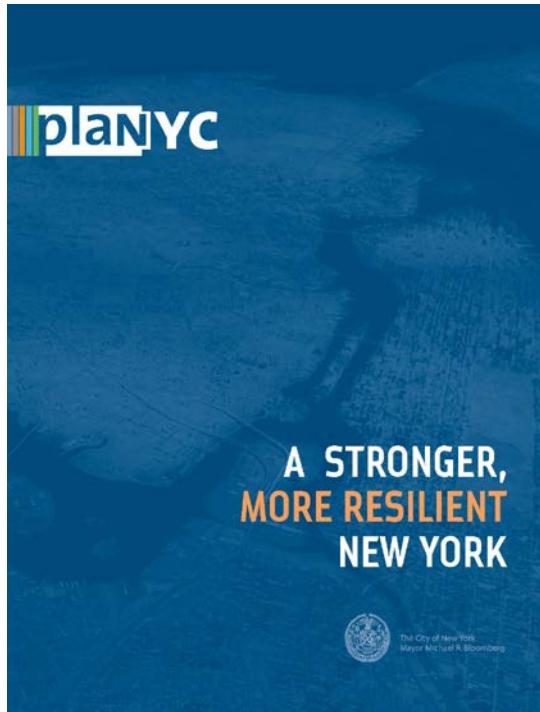
- 1 Building codes work**
 - 1-story, timber, pre-1961 were 18% of inundated buildings; 73% of heavily damaged structures
 - New development, such as Arverne-By-The-Sea, was virtually unscathed
- 2 Infrastructure systems are linked and regional**
 - When the power goes out, nearly every other system is affected
 - Supply chains outside the City need to be hardened against emergencies
- 3 Prepared communities bounce back more quickly**
 - Neighborhoods with strong ties and effective local non-profits are able to recover faster
 - Underlying challenges can hamper response, recovery, and resiliency efforts
 - The current flood insurance regime is broken
- 4 We must reject the false dichotomy of green vs. grey infrastructure**
 - The right solutions are locally-tailored and utilize hybrid solutions
 - There is no single silver bullet solution
- 5 Sandy wasn't a worst case scenario**
 - The timing of the storm, both relative to the tide and to the time of year, determined its impacts
 - Sea level rise will continue to make flooding more likely
- 6 We are vulnerable now and must act to reduce our risks**
 - The risks of extreme weather are here now
 - The Sandy supplemental funds provide a unique opportunity to invest now to reduce future costs

Agenda

- Sandy and the Risks of Climate Change
- PlaNYC: A Stronger, More Resilient New York
- NOAA Datasets, Tools, and Resources

A Stronger, More Resilient New York

The City's plan to build resiliency and make all New Yorkers safer is a multi-layered approach that is ambitious, achievable, and based on the best available science



Strengthen coastal defenses

- Complete existing USACE coastal risk reduction projects
- Expand natural protections and other innovative measures

Upgrade buildings

- Amend the building code to strengthen new construction
- Incentivize investments in existing buildings

Protect infrastructure and services

- Harden critical assets and supply chains
- Expand natural infrastructure systems

Make neighborhoods safer and more vibrant

- Advocate for flood insurance affordability
- Address underlying challenges during the rebuilding process

The City's 257 initiatives comprise a **comprehensive plan** to reduce the risk of extreme weather and climate change. This innovative plan includes funding, an implementation schedule, and **can be achieved over the next ten years.**

Physical Resiliency

Investing in new infrastructure can help reduce the risk to our neighborhoods, critical services, businesses, and vulnerable populations...



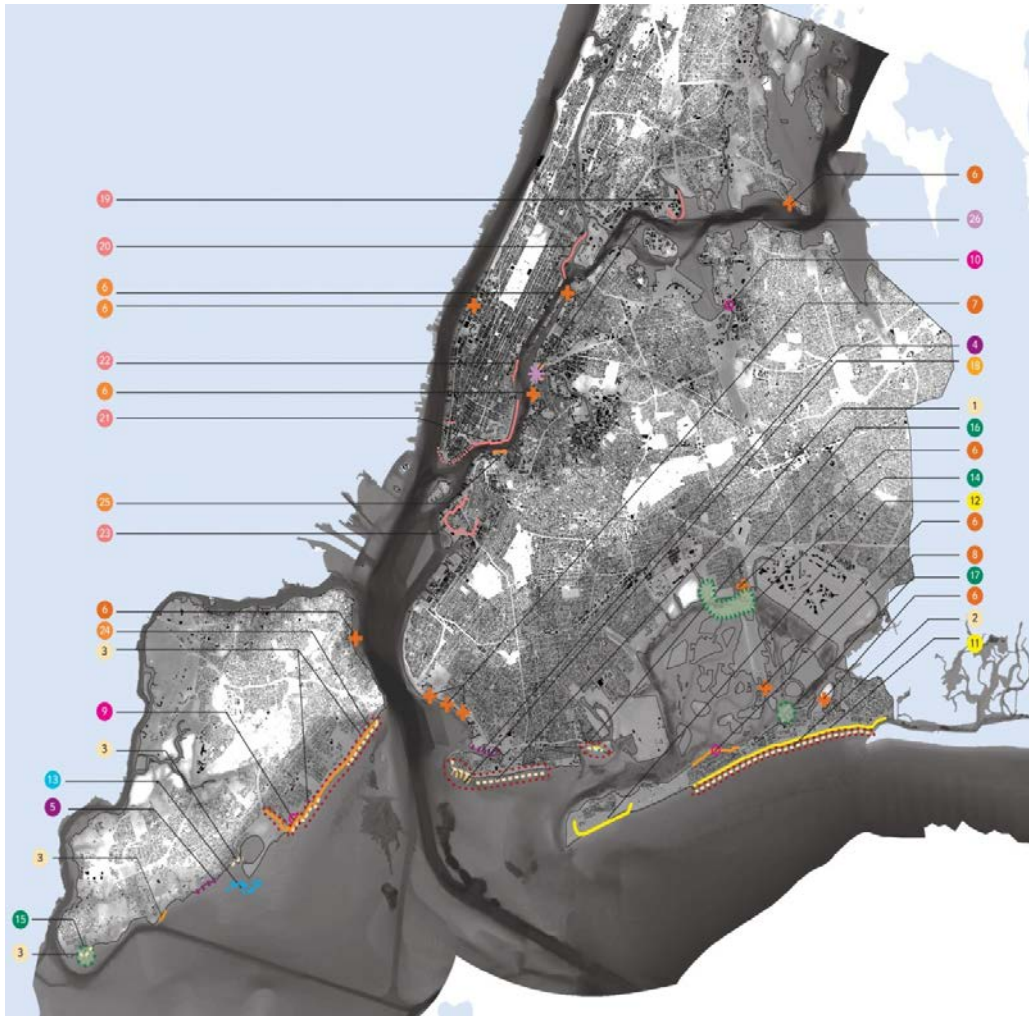
Newtown Creek Local Storm Surge Barrier

Critical Infrastructure

- Coastal Protection
- Buildings
- Insurance
- Utilities
- Liquid Fuels
- Healthcare
- Telecommunications
- Transportation
- Parks
- Water and Wastewater
- Food Supply
- Solid Waste

Physical Resiliency

The City's plan includes detailed recommendations for a first line of defense on the coastline.



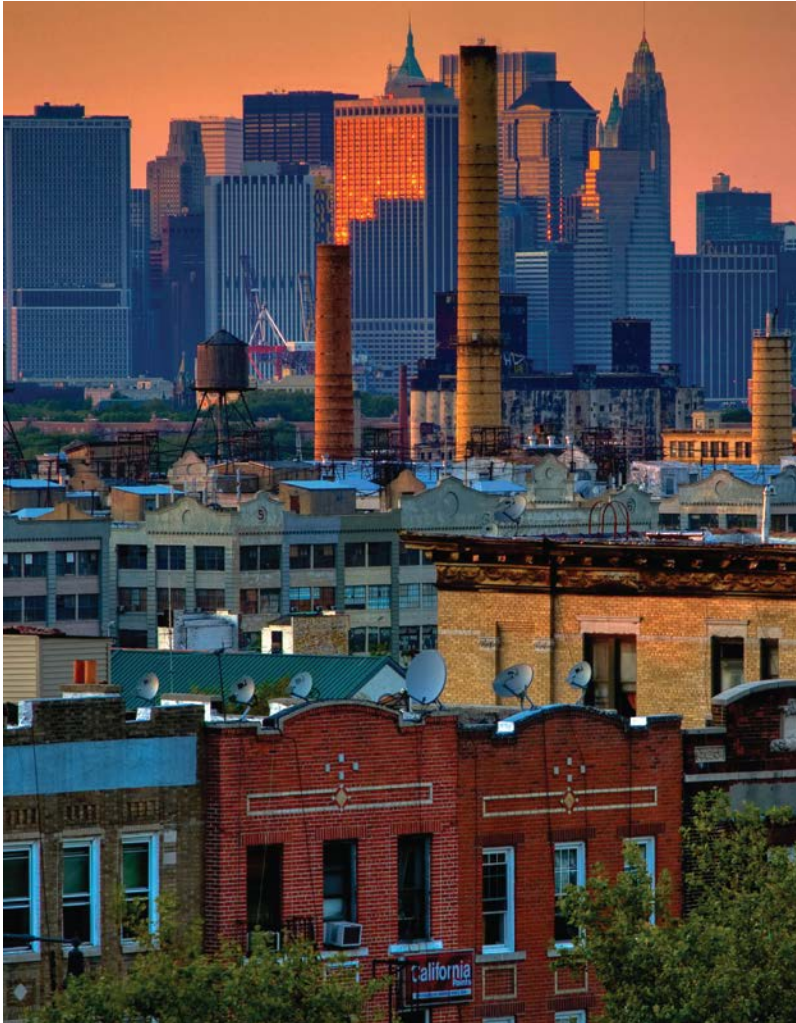
Proposals

The **1st phase** of the \$3.7 billion plan will include 37 initiatives to protect vulnerable areas from waves and inundation based on four key strategies:

1. Increase coastal edge elevations
2. Minimize upland wave zones
3. Protect against storm surge
4. Improve coastal design and governance

Physical Resiliency

The City's plan also includes detailed recommendations for protecting buildings...



Buildings

- **Strengthen City building code** to increase flood and wind resiliency **for new buildings**
- **Guidance** to building owners on compliance
- For 68,200 existing buildings in floodplain, initiate a **\$1.2B retrofit incentive for protection** of building systems and, for the most vulnerable buildings, structural integrity. **\$120 million** is already in hand for this program.
 - **Funds reserved** for small homes, industrial buildings, and affordable housing in each borough
 - **Mandate** key system protection **for largest buildings** in City by 2030
- Work with FEMA to **reform the National Flood Insurance Program** and provide for premium credits for risk reduction measures

Physical Resiliency

The City is working with utility providers to make infrastructure more resilient...



Utilities

- **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

Other Networks

- **Liquid Fuels**
- **Healthcare**
- **Telecommunications**
- **Transportation**

Physical Resiliency

...and to green elements of infrastructure that can reduce extreme weather impacts.



Green Infrastructure

- **Improve and expand drainage infrastructure** (e.g., build sewers in areas with limited drainage in Queens, install high-level sewers Citywide, expand green infrastructure, accelerate Bluebelt investment)
- Promote **redundancy** in and **flexibility** of **water supply network**
- **Rethink parks and open spaces** to serve as buffers for adjacent neighborhoods
- **Expand tree networks** across the entire city

Other Networks

- **Parks**
- **Wastewater**
- **Solid Waste**

Social and Economic Resiliency

...While land use changes, economic development, community engagement, insurance reform, and capacity-building can also promote quicker and more sustained recovery...



Focus Areas

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

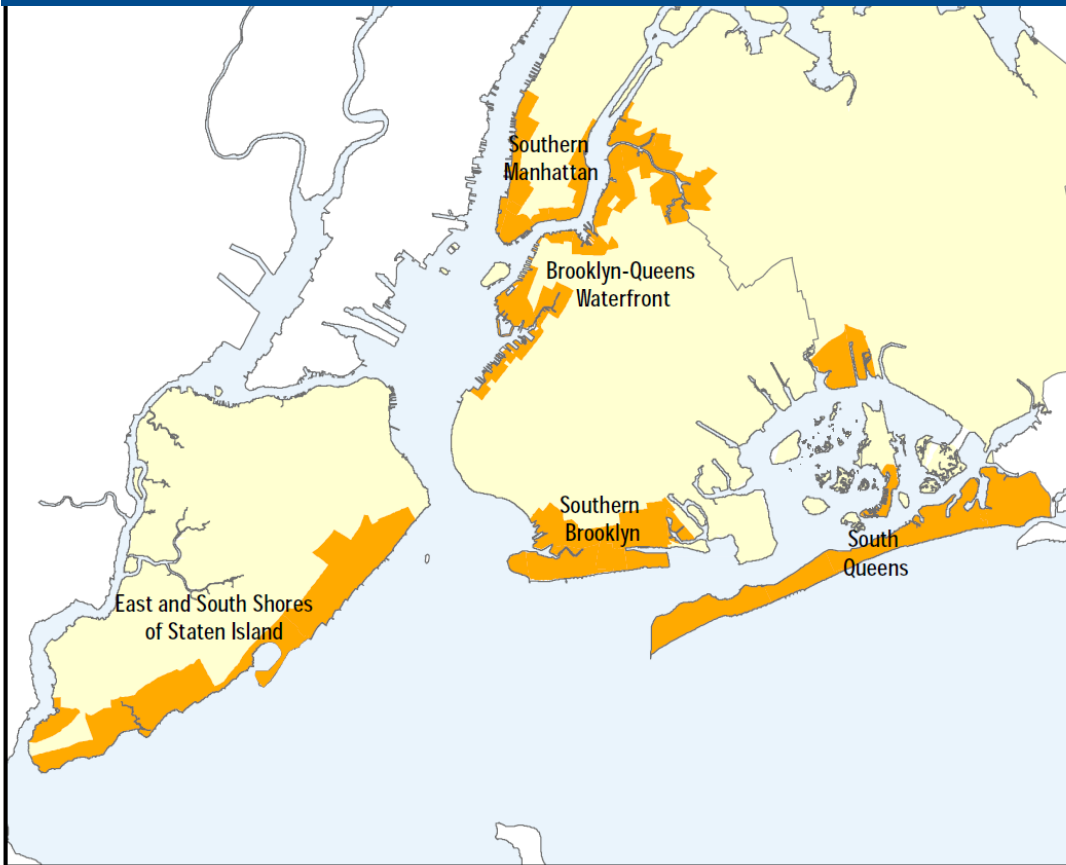
Other Areas Citywide

B. 116th Retail Corridor Enhancements

Social and Economic Resiliency

While focusing on citywide systems and infrastructure, the City developed plans to help Sandy-impacted areas rebuild safer and stronger....

Sandy-Impacted Communities



- Focus on areas where physical damage has lingered
- Incorporate citywide resiliency initiatives (rebuilding programs for homes, businesses, and infrastructure)
- Prioritize rebuilding, but seek to address underlying challenges
- Identify locally-preferred initiatives, like the “Neighborhood Game Changer Competition”
- Cooperate with NY Rising Community Reconstruction Program and HUD’s Rebuild by Design
- Investigate potential land use changes

A Resilient Transformation

...And bold thinking about resiliency can transform neighborhoods and provide for enhanced safety, economic development, and stronger communities.



Coney Island Creek Tidal Barrier

Implementation

And, while this is necessarily a long-term plan, the City has already taken steps, with many partners, to advance many of its key initiatives, including these highlights:

1

Strengthening Coastal Defenses



- Placed 1.2m cy of sand on City beaches
- Secured \$50 million of State HMGP for Howard Beach
- Launched feasibility study of Seaport City

2

Upgrading Buildings



- Signed 17 of 22 local laws to improve building resiliency
- Launching building resiliency incentive program

3

Protecting Critical Infrastructure and Services



- Supported ConEd's \$1 billion in resiliency investments
- Secured \$7.5 million USDA grant for bluebelts
- Launching telecom resiliency office

4

Making Neighborhoods Safer and More Vibrant



- Launched Game Changer competition
- Advocated for affordability measures in NFIP
- Released Staten Island beach concession RFEI

Agenda

- Sandy and the Risks of Climate Change
- PlaNYC: A Stronger, More Resilient New York
- NOAA Datasets, Tools, and Resources

NOAA Datasets, Tools, and Resources

The Federal government plays a critical role in helping us make risk-based decisions that are fundamental to our response.

Tide Gauge Stations

- Important for understanding historic trends, monitoring emergency situations, operations
- Need for additional gauges for more localized information

Tide and Surge Interpretation Tools

- PSURGE important for real time emergency planning and critical asset protection
- Visualization is critical
- VDATUM needed for operations and resiliency planning
- Difficult to use, potential for refinement

Staff Time and Resources

- Critical for information transmittal, tool translation, and trouble shooting

Coordinated Messaging

- Acknowledgement of local initiatives such as climate projections is important
- More work to be done on coordinating communication tools and visualization

Continued collaboration and coordination with NOAA is critical for resiliency planning.

These Risks Demand Leadership

New York City is uniquely positioned to lead the way in adapting to the risks of extreme weather and a changing climate.



- Though New York has always been **vulnerable to coastal flooding**, Sandy and FEMA's maps show this **vulnerability** to be **greater than previously understood**.
- The City'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**.
- An economic analysis shows a **real cost of inaction**
- According to FEMA, **every \$1 invested now saves \$4 later** through reduced damage



**We must take immediate steps to address these climate challenges;
New York City will not ignore these risks.**



Website: www.nyc.gov/resiliency

Email: NYCresiliency@cityhall.nyc.gov

Twitter: @PlaNYC

**A STRONGER,
MORE RESILIENT
NEW YORK**



The City of New York