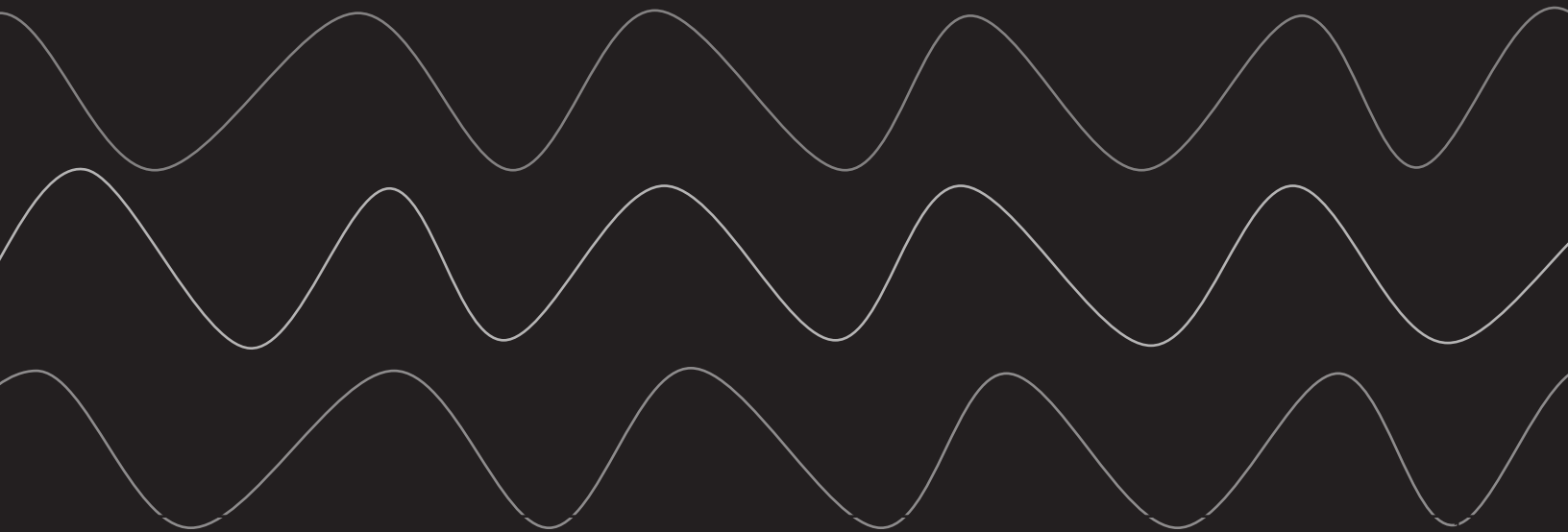


AN ANTHOLOGY OF IDEAS
after Hurricane Ida

20
EXPERTS
DISCUSS

Our future with flashfloods...
and what we can do about it.



DEAR FRIENDS,

On August 29th, Hurricane Ida made landfall in Louisiana, wiping out power grids and leaving residents vulnerable to high winds and extreme heat. Three days later, the storm made its way up to New York, dumping record-breaking rainfall on unsuspecting residents. Over 43 lives in the New York area were claimed by Hurricane Ida.

Hurricane Ida left a path of destruction and a collective head scratching – wondering what could have been done to prepare, what can be done to help those most affected, and what should be done to prevent a similar event from happening again.

However, we already have the answers. Experts in water management, data, transportation, parks and open space, regional planning, and emergency planning – locally, nationally, and internationally – have long been talking about the bold action we need to both prepare and respond to increasing severe climate events. We hope that the death and destruction we saw this month will never be repeated again.

Rebuild by Design asked 20 experts to offer “Concrete ideas of policies and projects that protect our communities from the flash flooding and loss of life which we experienced from Hurricane Ida.” We know this will not comprise all the solutions, but we hope it is the start of an understanding of what we know we need to do – collaborate across government silos, sectors, and communities to enact it.

These essays will demonstrate that if we invest in green infrastructure on a large scale, changing the ways our government invests in projects, substantially increasing resources for the creation and maintenance of our green spaces, investing in data and more precise emergency alert systems, which can be life-saving, building housing that is both safe and affordable, and doing with communities – from the start, we can thrive in the face of climate change while also creating jobs, increasing physical and mental health outcomes, restoring ecology, improving neighborhoods, and building and rebuilding a city even greater than the city we live in today.

We hope you will work alongside us on this journey.

Sincerely,



Amy Chester
Managing Director
Rebuild by Design
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**Rebuild by Design extends a deep thank you to all of the contributors to this anthology, as well as
Geethanjali M R and Johanna Lawton for their hard work on this report.**

Please reference as: Amy Chester, Ibrahim Abdul-Matin, Cynthia Barton, Kate Boicourt, Matthijs Bouw, Sarah Charlop-Powers, Joyce Coffee, Danielle Feld-Spiegel, Adam Ganser, Daniel Goedbloed, Teresa Gonzalez, Klaus Jacob, Lot Locher, Timon McPhearson, Deborah Morris, Gita Nandan, Thad Pawlowski, Betsy Plum, Julie Pullen, Caleb Stratton, Carter Strickland, Joseph Sutkowi, Jason Volk. "An Anthology of Ideas After Hurricane Ida," Rebuild by Design, New York. September 21, 2021.

#IDEAS4IDA

- 1 This is a solvable problem.
- 2 **Plan comprehensively.** Develop a mission-driven comprehensive planning and infrastructure framework through which all land use decisions would meet citywide targets for equity, housing, and resiliency.
- 3 **Update our disaster notification system.** Local authorities have the capability to use geo-targeting to deliver life-saving information to people who need it most, yet NYC does not maximize this technology.
- 4 **Prioritize resilience in all government decision-making.** Institute cost-benefit analysis that requires a triple bottom line encompassing social, environmental, and financial pillars and prioritize investments in infrastructure with multiple benefits.
- 5 **Fund and empower local community-based organizations.** They can work directly with local residents to bring plans to reality, which is a critical key to realizing true community resilience.
- 6 **New standards will save lives.** All City-funded capital infrastructure needs to be built to withstand climate threats and meet a resiliency score.
- 7 **A network strategy is key.** Invest in large-scale integrated networks, with nature based solutions to absorb, store, and direct water flows away from homes and businesses.
- 8 **Natural solutions are a win-win.** Make a commitment to choose Green before Gray every time.
- 9 **Sanitation is a resilience issue.** Walls of trash stacked on sidewalks before garbage collection can become clogged sewer drains which will worsen subway flooding during heavy rains.
- 10 **Parks can be the front line in adaptation.** But not without full funding.
- 11 **Build safe housing.** Legalizing basement dwellings provides nothing to fundamentally increase the supply of available housing while also increasing tolerance for a form of housing that is inadequate and fundamentally unsafe.

- 12 **Retrofit existing buildings.** A city-wide climate resilience retrofit incentive program can facilitate meaningful change at-scale.
- 13 **Invest in data.** Build a common integrated building-resolving modeling and data assimilation system that can span this timescale continuum.
- 14 **Stop Sprawl.** New York City has to grow vertically from existing built areas, not sprawl outward into our natural buffers, which are protected from storm surge
- 15 **Protect our subway network.** Instal devices such as gates and barriers – some installed permanently, some that need to be inserted into place before the water shows up ensuring handicap access.
- 16 **Natural areas need long-term funding.** We cannot rely on nature to be self-sustaining resilience protection, they require investment and maintenance too.
- 17 **Invest in emergency housing before an emergency.** A supply of code-compliant, permanent-quality, eco-friendly housing could go up in a few days in a variety of locations: parking lots, along highways and boulevards, or on land reserved for future development.
- 18 **Start with the population who needs it the most.** Low-income, immigrant and communities of color – and the advocates and organizations that fight for them – must be prioritized in comprehensive community outreach and engagement within the planning process to ensure that all perspectives, lives and voices are being considered
- 19 **Other Cities are leading the way.** We can learn from those who have already had successes such as Hoboken and Amsterdam Rainproof who are adding green infrastructure and multiple acres of parkland to create natural solutions turning a global challenge into benefits for communities, even on dry days.
- 20 **Adaptation is expensive.** But not as expensive as being unprepared.

COMBATING EMERGENCY ALERT FATIGUE WITH PRECISION



Jason Volk [@alertustech](#)
CEO - Alertus Technologies

The shocking and tragic flash floods that swept New York City underscore what's at stake in the absence of an effective emergency notification system. The severity of the emergency wasn't communicated in a timely enough manner — certainly not in advance, and not urgently enough even while the flash floods were underway. Most New Yorkers, programmed to dismiss “typical” flood and heavy rain notifications, didn't realize the gravity of the situation until they saw the footage of flooding on the news or worse — were caught in it themselves.

Alert fatigue is real, but it's not because citizens don't care about their own safety. They've been desensitized by frequent, broad, and sweeping warnings thanks to outdated processes, an inefficient approach to deploying alert systems, and a lack of policies and governance that has led to over notification for incidents that don't rise to the level of “emergency.”

The challenge isn't unique to New York — alert and warning fatigue and effectiveness is an important issue for all municipalities to address. To protect lives and mitigate harm, cities of all sizes must have targeted and impactful alert systems and messaging in place, especially as they are confronted with the reality of new and worsening climate-driven natural disasters affecting their streets and citizens.

You might wonder what exactly is behind the alerts you receive, and what would make them better? Developed in 2006 in the wake of Hurricane Katrina, the Integrated Public Alert & Warning System (IPAWS) is FEMA's national system for state and local alerting that provides authenticated emergency and life-saving information to the public through mobile phones using Wireless Emergency Alerts (WEA), and to radio and television via the Emergency Alert System, among other channels.

When cell broadcast capability was first introduced through IPAWS, local governments using the system found themselves in conflict with the technology available from wireless carriers, which at the time was not location-based enough. Naturally, local authorities worked within the constraints and built processes reliant on centralized authority and authentication to broadly distribute limited emergency information.

Today, however, wireless technology has improved to a remarkable degree, offering us the ability to target WEA recipients (basically, anyone with a mobile phone) down to areas within no more than 1/10th of a mile or 528 feet. Local authorities have the capability to use geo-targeting to get potentially life-saving information only to people who need it most, and rapidly communicate emergency severity levels and safety instructions without relying

on people to opt-in to and check subscription notification services like NotifyNYC. When citizens come to expect reliable, critical alerts that are hyper-relevant to them, they will be more likely to take proper precautions.

“OFFICIALS IN STATES ACROSS THE COUNTRY MUST BEGIN REMOVING HISTORICAL, PROCEDURAL RED TAPE AND EMPOWER LOCAL AUTHORITIES TO USE ALERT SYSTEMS TO THEIR FULL POTENTIAL”

Officials in states across the country must begin removing historical, procedural red tape and empower local authorities to use alert systems to their full potential. The utility and effectiveness of cell broadcast technology as a life saving tool must be accompanied by an expansion of authorized, local alerting operators. State officials should instill clearer processes for granting timely origination authorities to local jurisdictions. Federal officials should look to modify the criteria to allow institutional users, including places like private universities and amusement parks, to become alerting authorities.

In the days following the flash floods across the Northeast, New York City announced it will start targeting special phone alerts to neighborhoods, particularly in Queens where there are heavy concentrations of basement apartments prone to flood dangers. This is an important step in the right direction, but it shouldn't end with flood warnings or be limited by neighborhood boundaries and zip codes. The more targeted and specific local authorities can become with emergency alerting, the more trust they will build among citizens and the more lives they will inevitably save. The technology is there, and it's time to use it.

EMERGENCY HOUSING FOR NEW YORK CITY



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The era of sudden flash flooding means more New Yorkers are finding themselves suddenly without a home. In a city of acute housing scarcity, there are no easy answers, but there is more we could do. After Ida two weeks ago, the Red Cross sheltered 350 displaced people in congregant and non-congregant facilities, and the need will grow as mold begins to spread in inundated homes. After Hurricane Sandy in New York City in 2012, there was a mad dash for housing. The City sheltered over 3,000 people in hotel rooms, ultimately spending more than \$70 million over the course of the next year. It also worked with FEMA to set up a Rapid Repairs program that allowed thousands of households to “shelter-in-place” by turning back on the heat, electricity, and hot water. Rapid Repairs set the groundwork, so to speak, for the \$3.4 Billion Build it Back program, which elevated many of the same houses above the post-Sandy floodplain, leaving behind a lot of questions about the inherent inequities of post disaster recovery programs. It’s reasonable to expect that each new disaster will tighten the housing squeeze on working New Yorkers, especially those without intergenerational wealth: Black households, recent immigrants, and all people struggling for opportunity.

Fifteen years ago, after witnessing

Hurricane Katrina displace half the (mostly minority) population of New Orleans, the NYC Office of Emergency Management hosted a prescient design competition for post-disaster provisional housing. The competition asked where people would live if their neighborhoods were suddenly and completely destroyed. The ideas competition yielded one clear but challenging result: the City should work with the FEMA to build a supply chain for rapidly deployable emergency housing at scale. It can be done. There is a prototype between OEM HQ and the entrance to the Brooklyn Bridge that was meant to be relocated to a FEMA site in Maryland to show that this type of housing could not only be deployed quickly, but redeployed. It is still there, used as office space.

As with most post-disaster housing, what is intended to be temporary is so often permanent. A supply of code-compliant, permanent-quality, eco-friendly housing could go up in a few days in a variety of locations: parking lots, along highways and boulevards, or on land reserved for future development. The housing would need to sit lightly on the ground, with solar panels and batteries for more frequent blackouts. They should keep people close to home, to their social networks and neighborhood services, they should be

designed with care for both common and private space. In theory, having a safe supply of temporary housing would allow time and space for rebuilding the neighborhood, not just how it was, but better for everyone inclusively.



Is it expensive? Relatively no, the prototype cost roughly the same to build as other affordable housing in the City, about \$1 M for a three-story building with two two-bedroom units and a one-bedroom unit on top, a lot of that in site preparation. The benefits could be much greater over time, and every single dollar would be used toward increasing long-term housing supply instead of tightening the housing squeeze. Would it be so nice that people might just stay there? Maybe, there would have to be a public discussion about that, but it's not crazy to imagine these modular buildings weaving into the fabric of the city like the "quake shacks" around San Francisco that were given out to survivors after the 1906 earthquake.

"EITHER WE LEARN FROM OUR MISTAKES, OR WE KEEP ALLOWING EACH SUCCESSIVE DISASTER TO ACCELERATE THE DIVIDE BETWEEN THOSE WHO HAVE ACCESS TO A SAFE, SECURE, AND HEALTHY PLACE TO LIVE AND THOSE WHOSE OPTIONS ARE GETTING SMALLER AND SMALLER"

Disaster housing programs are designed to make homeowners "whole," but shouldn't we demand our public money be used for making our communities whole? Either we learn from our mistakes, or we keep allowing each successive disaster to accelerate the divide between those who have access to a safe, secure, and healthy place to live and those whose options are getting smaller and smaller.



Drawings of temporary housing and a resilient recovery for Prospect Shore by Jeff Shumaker

COMMUNITIES FIRST IN RESILIENCE PLANNING



Teresa Gonzalez [@TGingLady](#)
Founding Board Member – Resilience PAC

While Hurricane Ida ravished much of New York City with record winds and flooding, it quickly became clear in the images presented in the press and on many social media platforms that, yet again, the brunt of the devastation would be felt by the city's most vulnerable communities. This is nothing new, as we watched our fellow Americans in Louisiana face yet another destructive storm a mere 16 years after Hurricane Katrina. So how has resilience planning and investments in green infrastructure not been prioritized by legislators who claim to care about the city's most vulnerable? And how are these communities being informed and considered as plans and policies develop behind closed doors?

Environmental justice advocates and grassroots organizations in these communities have been beating this drum for decades, and it is high time for their voices to be acknowledged as essential to the conversation. More than that, low-income, immigrant, and communities of color – and the advocates and organizations that fight for them – must be prioritized in comprehensive community outreach and engagement within the planning process to ensure that all perspectives, lives, and voices are being considered. It is not enough to share words of condolences as we watch fellow New Yorkers lose everything, including their lives, in the face of climate change.

We must create opportunities for ALL to participate in resilience planning. This includes providing more funding and resources to environmental justice organizations to support their work, creating climate change community councils, requiring resilience and climate change education in public schools, prioritizing language and varying abilities' access in all resilience and environmental issues outreach, and ensuring that environmental impacts and considerations are publicly discussed and shared in all city infrastructure planning. Though these are certainly not foolproof solutions, the ideas these proposals present share a common thread: they center the voices of those who suffer the most because of climate change. We can no longer wait for the next catastrophic event to act. Planning with and alongside communities that reflect the diversity of the city is real comprehensive resilience planning.

**“PLANNING WITH AND
ALONGSIDE COMMUNITIES
THAT REFLECT THE
DIVERSITY OF THE CITY
IS REAL COMPREHENSIVE
RESILIENCE PLANNING”**

EVERY DROP COUNTS IN MAKING NEW YORK RAINPROOF



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From the relative safety of Amsterdam, we watched in shock the devastation caused by Ida to properties and infrastructure, listened to the personal suffering, and were horrified by the number of deaths. While it is critical to have immediate action and funding to recover, such storms also underline the need for long-term planning. Cynically as it may sound, it is important to leverage this crisis into the funding necessary for “rainproofing” New York. Watching these events repeat again and again, not only in the US but all over the world, we feel that forward planning will bring justice to impacted communities and to the climate crisis we are in. With funding critical, we hope that by learning from each other we will also manage to use funds efficiently. This is necessary if we want to meet the scale of the challenge ahead. Rather than waiting for the cloud to burst over your city and pay for the damage, it is better to proactively make sure that all investment decisions in infrastructure and real-estate are made Rainproof. That is what we have experienced in Amsterdam.

Amsterdam Rainproof

Amsterdam learned from the cloudburst in Copenhagen in 2011 and recognized its own vulnerability to flash foods. The public water-cycle company, Waternet, launched “Amsterdam Rainproof,” a semi-independent program for making the capital

of The Netherlands “cloudburst resilient” by reducing damage from heavy rainfall while creating a healthier, greener city by investing in infrastructure that capture, detain, infiltrate, or transport stormwater, as well as projects that “harvest” rain for reuse or waterproof basement and metro entrances. Eight years later, successes can be seen on multiple scales in rainproof projects on public and private land. Rainproof enabled many policy changes and created an awareness that reached far beyond the more than 120 organizations participating in the still growing Rainproof network.

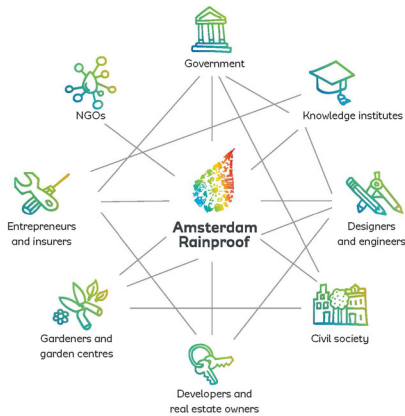
There are three important components that can be translated to New York: a network strategy is key, clear communication is essential, and capacity building in the public sector is required.

**“THE MOTTO ‘EVERY DROP
COUNTS,’ HELPS TO MAKE
THE PEOPLE AWARE THAT
THEY ARE CO-OWNERS OF
BOTH THE PROBLEM AND ITS
SOLUTIONS”**

A network strategy is key

The most important lesson learned from Amsterdam Rainproof is that dealing with

cloudburst events demands a collaborative, comprehensive approach that can't be done by one agency alone. Rain falls everywhere. Therefore, the whole city – its streets, parks, private gardens and roofs – should act as a sponge. From the start, Rainproof was tasked with involving all stakeholders in rainproofing Amsterdam: this includes the municipality and water authority along with businesses, property owners, residents, consultants, and education institutions. Rainproof started as a network strategy to connect and activate all parties that can contribute. It incentivized private parties such as insurers, garden retail centers, and housing corporations structurally to act as middlemen for reaching larger groups, particularly home-owners. Additionally, it collaborated with existing government and non-government initiatives where the interests aligned to work together, broadening our reach.



Clear communication is essential

The motto “Every drop counts,” helps to make the people aware that they are co-owners of both the problem and its solutions. Rainproof developed a tone that is accessible and inviting, utilizing drawn images so people want to take part. All communication demonstrates the variety of situations that are reflected in an online platform and folders with tips and tricks for the user’s garden, street, or neighborhood and how they (as citizens, as investors, or as civil servants) can take actions to make it more rainproof over time.

Capacity building in the public sector is required

To be successful we need all departments and organizations of the public sector to be involved. We must ensure that they understand

how Rainproof influences their own work, their policies, and their investment decisions within and across departments. Even though the sewer system plays a key role, cloudburst resilience can't be solved in technical pipes and pumps alone. Therefore, Amsterdam Rainproof has mainstreamed Rainproof into public policies and technical guidelines regarding streets, parks, procurement, and others. It has played a part in connecting different departments and has been training civil servants in all sectors involved so that when they do what they do, they do it Rainproof.

Every investment Rainproof

Whilst Amsterdam is different from New York, we can take a Rainproof approach. We can make New York rainproof by making sure that climate change is taken into account in every investment decision, by any actor made (from how to plant your garden to how to organize and maintain your street to how to build a new building), and that all these measures, taken over a period of time, taken during their natural investment cycles, will make communities rainproof. Every action counts, every step counts, every drop counts.

Make your neighbourhood rainproof.

How? Use these tips!

1 Green / blue roof
A green roof is a roof that is covered with vegetation. It can be used to reduce the amount of rainwater that runs off the roof and into the sewer system. It can also help to improve the insulation of the roof and reduce the energy costs of heating and cooling the building.

2 Small front garden
A small front garden can help to absorb rainwater and reduce the amount of rainwater that runs off the road and into the sewer system. It can also help to improve the appearance of the street and provide a place for people to sit and relax.

3 Open gutter
An open gutter can help to collect rainwater and direct it to a water square or other rainwater management measure. It can also help to prevent rainwater from overflowing the gutter and causing damage to the building.

4 Urban infiltration strips
Urban infiltration strips can help to absorb rainwater and reduce the amount of rainwater that runs off the road and into the sewer system. They can also help to improve the appearance of the street and provide a place for people to sit and relax.

5 Infiltration zones
Infiltration zones can help to absorb rainwater and reduce the amount of rainwater that runs off the road and into the sewer system. They can also help to improve the appearance of the street and provide a place for people to sit and relax.

6 Green between the rain rolls
Green between the rain rolls can help to absorb rainwater and reduce the amount of rainwater that runs off the road and into the sewer system. They can also help to improve the appearance of the street and provide a place for people to sit and relax.

7 Water-permeable paving
Water-permeable paving can help to absorb rainwater and reduce the amount of rainwater that runs off the road and into the sewer system. It can also help to improve the appearance of the street and provide a place for people to sit and relax.

8 Speed bumps
Speed bumps can help to reduce the speed of vehicles and reduce the amount of rainwater that runs off the road and into the sewer system. They can also help to improve the appearance of the street and provide a place for people to sit and relax.

9 Grass concrete blocks
Grass concrete blocks can help to absorb rainwater and reduce the amount of rainwater that runs off the road and into the sewer system. They can also help to improve the appearance of the street and provide a place for people to sit and relax.

10 Water square
A water square can help to absorb rainwater and reduce the amount of rainwater that runs off the road and into the sewer system. It can also help to improve the appearance of the street and provide a place for people to sit and relax.

11 Infiltration
Infiltration can help to absorb rainwater and reduce the amount of rainwater that runs off the road and into the sewer system. It can also help to improve the appearance of the street and provide a place for people to sit and relax.

12 Rainwater
Rainwater can help to absorb rainwater and reduce the amount of rainwater that runs off the road and into the sewer system. It can also help to improve the appearance of the street and provide a place for people to sit and relax.

13 Rainproof roof
A rainproof roof can help to absorb rainwater and reduce the amount of rainwater that runs off the road and into the sewer system. It can also help to improve the appearance of the street and provide a place for people to sit and relax.

14 Detached
A detached building can help to absorb rainwater and reduce the amount of rainwater that runs off the road and into the sewer system. It can also help to improve the appearance of the street and provide a place for people to sit and relax.

15 Greenhouse
A greenhouse can help to absorb rainwater and reduce the amount of rainwater that runs off the road and into the sewer system. It can also help to improve the appearance of the street and provide a place for people to sit and relax.

CLIMATE RESILIENT INVESTMENTS WILL IMPROVE OUR QUALITY OF LIFE



Carter Strickland [@tpl_org](#)
VP, Mid-Atlantic Region and New York State
Director - The Trust for Public Land

Climate resilient infrastructure can make our city safer while improving quality of life. Let me explain.

Hurricane Ida's record rainfall on New York City was immediately concentrated by streets, rooftops, and other impervious surfaces into deadly flash floods, overwhelming our storm sewers. But our wetlands, parks, and other natural lands absorbed the rainfall, and even when saturated, shed the excess water more slowly, giving our sewers time to work. The day after the deluge, while many cars were still stranded on highways, kids were able to play on our community playgrounds like the ones The Trust for Public Land built at PS 140 in Jamaica, Queens or at MS 354 in Crown Heights, Brooklyn – both of which are in the extreme flood zones mapped by the city. That is because those parks are built with green infrastructure elements like turf fields, rows of shade trees and rain gardens over layers of gravel; all basketball courts, play areas, and recreational features are tilted into those natural infiltration basins.

How can the city encourage more of these natural climate solutions?

First, we need to protect the open spaces we have. That includes safeguarding all wetlands in the city from development.

For instance, develop of a big-box retail store and parking lot on Graniteville Swamp in Staten Island will only worsen flooding for the surrounding residences and businesses in the next big storm. New York City has to grow vertically from existing built areas, not sprawl outward into our natural buffers.

**“ WE CANNOT AFFORD
TO IGNORE THAT FLOODS
POSE AN IMMEDIATE
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DOES AFFECT DRINKING
AND SWIMMING WATER
QUALITY ”**

Second, in addition to generating more sewer capacity, our strategies must include effectively “de-building” through retrofits. In just the first ten years of the NYC Green Infrastructure Plan, New York City has created 11,000 green infrastructure basins. But more needs to be done to balance four centuries of road construction and real estate

The Trust for Public Land has proposed the ambitious Park Equity Plan to add more parks to accommodate our growing city; currently, the areas most lacking in park infrastructure are too often the areas that suffer the worst flooding. A program to build new parks can increase social and climate resilience, without the opposition that can stall other projects. Parks are “Yes In My Backyard” projects.

Third, funding needs to be focused on the critical issue of climate resilience. Our new State leadership could immediately redirect hundreds of millions of dollars in existing water-quality funding to low-tech flood protection, land conservation, and green infrastructure measures rather than expensive, high-tech “end-of-pipe” treatments. Up until now, flood mitigation has not been prioritized for funding because it is considered a discretionary action not important to meet regulatory standards. But we cannot afford to ignore that floods pose an immediate threat to life and that muddy water from intense cloudbursts does affect drinking and swimming water quality. Better yet, our State could get funding out faster by streamlining the cumbersome grant programs and valuing small projects (like green infrastructure playgrounds) that can be built quickly. For example, we have completed two green infrastructure playgrounds funded by Housing and Urban Development disaster recovery grants, while similarly-funded large floodwall projects are still in the project initiation or design phase, ten years after Hurricane Sandy.

We can, and have to, build back better.

HOBOKEN: ADAPTING TO CLIMATE CHANGE IN ONE SQUARE MILE



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Hoboken ranks in the top 100 of National Flood Insurance Policy (NFIP) communities – all within one square mile. The federal government underwrites 9,832 insurance policies covering \$2.3 billion in assets for 60,000 people. This is approximately one of every three households. Multiple times every year, Hoboken experiences flash flooding that results in flooded streets and properties. Flood risk from both storm surge and flash flooding within Hoboken is so severe that following Hurricane Irene in 2011 and Superstorm Sandy in 2012 the community (along with utility and federal partners) invested \$700 million on flood risk reduction and climate adaptation infrastructure.



The most significant endeavor, Resist, Delay, Store, Discharge – shorthand for a \$380 million four-part water management strategy, was developed and partially funded through the Rebuild by Design Competition sponsored

by The Department of Housing and Urban Development. The strategy is inspired by the Dutch in a series of flood risk interventions that address rainfall and coastal flood risk. The strategies resist storm surge impacts (seawalls, levees, gates), delay stormwater entry into the sewer system (green roofs, downspout disconnects, rain gardens), create more storage space in the sewer system (cisterns under parks), and keep pumps running to discharge stormwater during heavy rain events against high tide (two pump stations built).

On the western side of the City, a series of parks work like sponges with green infrastructure on the surface absorbing water from rainfall events, and holding heavy rainfall in cisterns under the parks. With every new capital road project stormwater gardens are built at intersections to hold and filter rainwater (22 rain gardens constructed to date). Rebuild by Design identified 61 locations in public right-of-way for porous pavement to filter stormwater into underground cisterns. Hoboken constructed four of these locations in conjunction with the first phase of its \$33 million drinking water infrastructure improvements program. By combining stormwater infrastructure with drinking water upgrades and complete streets improvements, Hoboken employed a “one water” approach to leverage capital investment for multiple benefits. Beyond stormwater,

these green infrastructure projects benefit water quality, pedestrian safety, air quality, and public health.



The City began construction of Phase I of these investments prioritizing flooding related to rainfall. The wet weather pump stations built since 2011 have the capacity to pump over 90 million gallons of stormwater during the heaviest rainfall events. Our third wet weather pumping station is in construction now, with construction finished by the end of 2022. The pumps are complemented by our “Parks as Defense” strategy, with two resiliency parks in operation and one under construction, collectively storing up to 2.7 million gallons of water in green infrastructure or holding tanks, and removing hundreds of thousands of gallons of rainwater from flooding our city streets. While mitigating rainfall flooding, these projects also provide more than 10.5 acres of parkland in western Hoboken, ensuring every Hoboken resident lives within a 5-minute walk to a park for active and passive recreation. We are currently under design to expand one of our existing resiliency parks, and two more are planned.



Phase II includes storm sewer modifications separating rainfall and sanitary flow, as well as implementation of an urban coastal levee. Seawalls and levees were designed to function for up to a .02% storm event, but are embedded in urban amenities that contextualize the feature to the location. These include material, lighting, signage, landscape, color, texture, and functions to integrate the flood risk reduction measure into the dense urban fabric. Construction of the entire system is expected to be complete by 2025.



During this same period of time, PSE&G invested over \$320M to floodproof the natural gas system, as well as consolidate and elevate three substations in the floodplain to two; both are no longer vulnerable to flooding.

The North Hudson Sewerage Authority estimates that Hurricane Ida dumped approximately 150 million gallons of rainwater in our mile square city over an 8 hour period. With pumps and parks operating at peak efficiency, it took us 48 hours to dewater our flooded streets.



Absent our flood risk reduction investments and substation elevations, we would have experienced rolling power outages for days due to flooded electrical substations, coupled with weeks long flooding like Hurricanes Irene and Sandy. By elevating the substations, it reduced their risk to grade level flooding, allowing us to sustain power. We were spared the worst of the storm, recording no storm-related injuries or deaths, no building failures, no substantially damaged properties. And to be fair to our impacted residents, much more is needed to address these recurrent flood events and the impacts of sea level rise on our city systems. Henri and Ida registered the two most intense and heaviest rainfalls in our recorded history, 10 days apart. The City must brace for a more relentless and intolerant climate.

Hoboken has more flood risk per capita than the City of Houston (which is 1st in NFIP policies). If insured assets are used as a proxy for risk we would have either 6x more risk per person, or 34 times more by area. What NYC might have experienced two or three times in the last few decades we experience annually. NYC is approaching adaptation with an investment of over \$20Billion – huge numbers. These two

points illustrate that our density of risk forces dramatic investments in risk management, and that these investments are keeping pace with leaders in the adaptation space.


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Even through all this investment, we have learned that we still will not ensure that our streets never flood. Policy and education have to be tools we pick up to deploy as quickly as shovels and excavators as we learn to live with the water.

To further education, we are posting permanent signs with solar lighting that simply state “this area floods” ensuring that residents and business owners understand their risk. In advance of a thunderstorm, cloudburst or tropical depression, we are looking at mobilizing semi-permanent road closed barricades to keep residents and vehicles safe. We beta tested a crowd sourced flood map so residents could report flooding in real time, giving our emergency services..... We will also issue more severe and blunt warnings. We’ll keep innovating, if the public is willing to keep listening, learning, and adapting alongside our team.

CREATIVE, INNOVATIVE, & TRANSFORMATIVE: FUNDING FRONTLINE COMMUNITIES



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Adjunct Associate Professor – Pratt Institute
Co-founder and Principal – Thread Collective
Board Chair – RETI Center

Every storm behaves a bit differently and every storm reveals repeated patterns of vulnerabilities that continue to put New Yorkers at risk. Hurricane Ida's record rainfall was unique, but not unexpected. In fact, such a cloudburst has been predicted for many years by experts across multiple fields. Upon the anniversary of Superstorm Sandy, nine years later, we are at a standstill on large-scale impactful resilient installations and code transformations to ensure that we can survive the growing saturation levels expected by increased hurricanes and weather events. Rain events like Hurricane Ida, can only be vastly mitigated by storm water management implemented as large-scale integrated networks, with nature based solutions to absorb, store, and direct water flows. But the urgency for such ecological transformations of our hardened built environment cannot short circuit or circumnavigate the need for true community leadership and a grass roots approach. We must prioritize the empowerment of local organizations to steer the future of their communities and be stewards who will nurture their success.

A growing number of New York City residents live within the 100-year floodplain, predicted to go from 1.3 million today to 2.2 million by 2100, (Rebuild by Design,

2019) with the majority of those living in such climate vulnerable areas being low-income New Yorkers. New York City's focus must be on environmental justice communities who have disproportionately borne the burden of a variety of environmental impacts and live on the frontline of climate change.

Funding and empowering local community-based organizations who are working directly with local residents to bring plans to reality is a critical key to realizing true community resilience. Local community members have deep local knowledge that can more accurately guide the best design directions for social, ecological, and economic

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transformations. RISE and Rockaway residents have created the Greater Rockaway Waterfront Vision 2020, UPROSE and the Sunset Park community have created the GRID, Hunt's Point South Bronx and Bronx residents have created the Community Resiliency Agenda, Red Hook and its residents have created a vision for an integrated flood protection system and the 197A-plan, and yet these action oriented proposals are not driving the implementation of actual resilience. There is no need to start from zero, there is a high level of advanced deeply integrated planning and design created by community members that can positively reimagine these low-income low-lying communities.

A key to the success of realizing such community based planning efforts is funding. New York State's Mother Nature Bond Act has been put back on the ballot for the November 2022 general election for approval, where \$3 billion could provide critical dedicated dollars for such nature based network solutions needed for the implementation of blue-green infrastructure. This is an important funding stream that must be enacted and will be the first of its kind for the State and nation. The move towards softer, plant-based absorptive water storage can drastically support our urban spaces with a wide variety of multiple benefits, from heat island mitigation to mental health. But the funding must support our residents in greatest need and should lift into action these viable visions that are creative, innovative, and transformative. Guaranteeing the resilient futures of these communities assures the resilience of New York and is at the heart of how NYC must adapt for climate change.

PAST IS PROLOGUE



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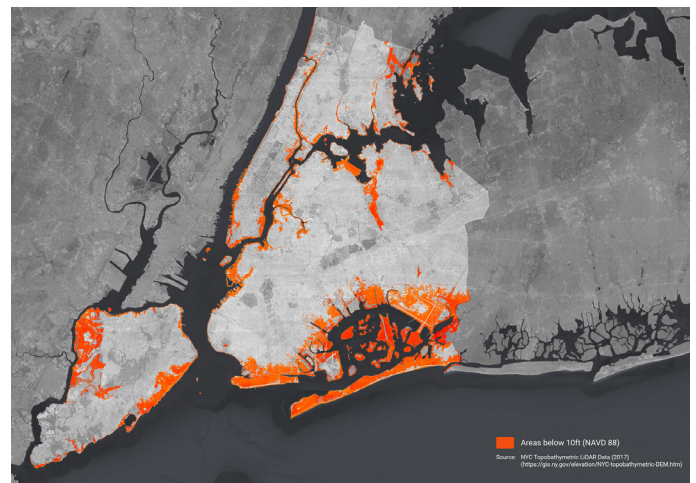
Hurricane Ida has demonstrated how, when considering the impacts of the climate crisis on our cities, the past is prologue. The flooded basement apartments in Flushing, located in the floodplain of the buried Kissena Creek, are a vivid example of how the land use choices that were made, and the urban systems constructed, have not taken our natural systems into account. The hubris of fossil-fuel driven development and use of concrete has come to roost in the climate emergency, where tempests spurred by the same hubris overwhelm our cities. We need to undo and repair at a massive scale to mitigate these impacts, at a speed much greater than with which our cities were built.

What has me worried is that, while Ida was bad, future climate conditions will be much worse, and will start to compound one another. Undoing and repairing needs to be combined with preparation for that future. This all needs to start now: city making (and changing) takes time, especially when one wants to optimize the transformation with ongoing investment cycles.

Two issues demand extra attention. The first is that, with sea-level rise, large areas of New York City will effectively become a polder, as the Dutch call it, meaning an area surrounded

by dikes and kept dry by pumps.

In New York City, for example, 120 square miles of land lie less than 6 feet above the high tide line. This land is home to nearly half a million New Yorkers, as well as \$101 billion in property value, more than 1,500 miles of road, and 100 public schools. These numbers nearly double at 9 feet above the high tide line – Sandy’s peak flood elevation as measured at the Battery in New York City.¹ For urban communities in this situation to remain livable towards the end of the century, it is necessary to protect against repeat or permanent coastal flooding and drastically alter the stormwater management infrastructure such that water can be retained during heavy precipitation events.



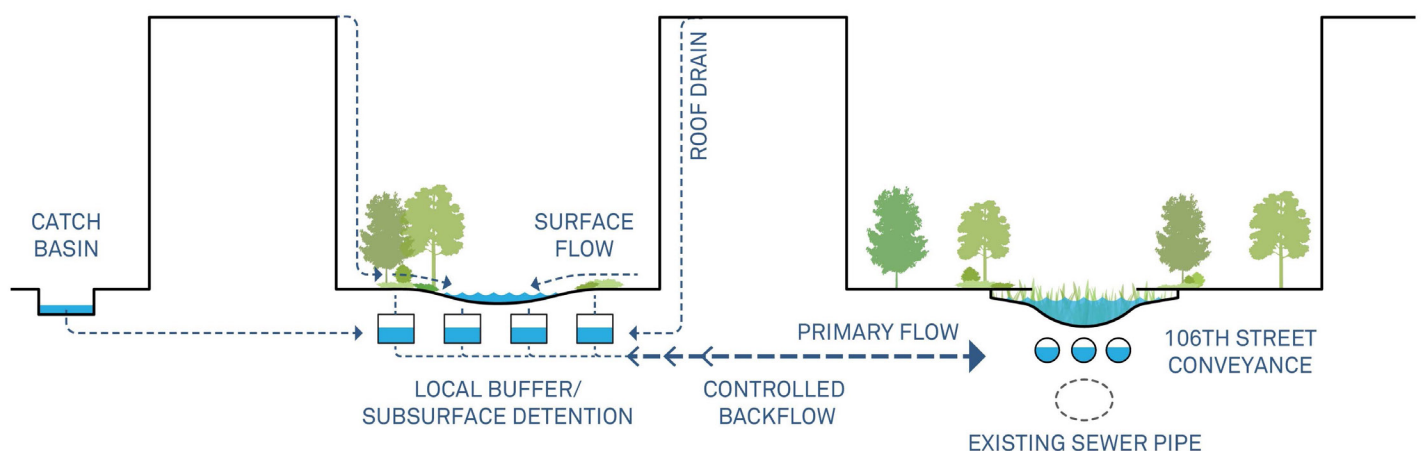
¹ Climate Central New York and the Surging Sea April, 2014

Stormwater management infrastructure ideally encompasses all scales of intervention, from measures for individual buildings, such as rainwater barrels or “blue” roofs, places for stormwater in parks and open spaces, temporary water detention above ground or through detention crates below, to measures using public infrastructure such as roads and sewer systems. In densely built-up cities, in particular, there is very little space available for stormwater management, so every possible measure counts.

In a study for New York City’s East Harlem neighborhood, commissioned by New York City’s Department of Parks and Recreation and the Mayor’s Office of Resilience, ONE Architecture & Urbanism, working with the landscape architecture firm Starr Whitehouse, explored the relationships between coastal protection, stormwater management, and open space. East Harlem is a low-lying part of Manhattan, and drains a large area. In old maps, such as the well-known Viele map from 1865, creeks flow from what is now Amsterdam Avenue, on the west side of the island, to the East River. On the map, the coastal area is swampy and marshy. The flood maps that were made for the study showed that exactly those areas, the former creeks and swamps (particularly between 96th and 120th street) would flood all the way to Central Park during a big rainstorm event or a coastal flooding event. Further analysis showed that a future coastal protection system would increase the flooding from a cloudburst unless additional measures, either using retention or pumps, were taken.

The team proposed an approach aimed at reducing pumping as much as possible and instead invest in green solutions that enhance the neighborhood. Stormwater pumps are designed for average rainfall – not extremes – use a lot of energy, have a chance of failure, and have none of the benefits that green retention infrastructure would have, such as streetscape improvements and cooling effects. The approach calls for decentralized retention infrastructure at all scales, connected into a system that would optimize the storage capacity and be able to convey the water to the shore where it can, at least in the coming decades, drain at low tides. In this study, E. 106th street was proposed to become what is essentially a new, partly nature-based, partly piped creek that holds and conveys water. A newly imagined street with its creek in the middle can double as a piece of social infrastructure, with a pedestrian promenade and a bikeway, and places to hang out or play in the shade of the new vegetation. As such, the development of public green stormwater infrastructure can undo some of the historical inequities, including lack of tree canopies, that plague the formerly redlined neighborhood.

The second issue is adapting to climate change and population increases. With the increased rainbombs that will come with a changing climate, it is important to create much more space for water retention and conveyance. At the same time, the city is densifying, as it should be. But the City’s guidelines and norms for new projects are



based on near term climate projections rather than on the climate reality affecting these developments during their lifespan. An analysis by my firm for the Resilience by Design Amsterdam Metropolitan Region program showed that even recent area developments will have to be adapted to accommodate a changing climate after 2050, and that the increased density of development results in a lack of space to adapt by using cost-efficient and multi-benefit green/blue infrastructure solutions. This will result in significant additional costs for expensive solutions in future years, such as blue roofs, crates under pavements, and tanks in basements. These costs could have been avoided by taking future climate change into account now, with early investments in open space reservations and blue/green infrastructure.

“WE NEED TO UNDO AND REPAIR AT A MASSIVE SCALE TO MITIGATE THESE IMPACTS, AT A SPEED MUCH GREATER THAN WITH WHICH OUR CITIES WERE BUILT”

It also makes financial sense. Economic analysis shows that by accounting for the multiple benefits such solutions bring (including higher real estate revenue because of the increased attractiveness of the environment), the total return on investment will be higher. However, making long-term investments in climate-robust solutions early is often difficult for real estate developers – or first-time buyers – who have a much shorter time horizon. The result, however, might be a combination of distressed real estate in the future, or much higher adaptation costs, which just might fall in the public domain.

Taking future climate change into account now should guide the way our city is made, including a recalibration of the balance

between built-up area and an increased amount of open area providing a host of ecosystem services to mitigate flooding and urban heat, retain fresh water, increase biodiversity, and provide recreational amenities. By keeping generous open areas in the public domain, access to these green spaces can be given to all, and public authorities can ascertain that this new public infrastructure performs optimally on a systems level.

The ultimate consequence of the East Harlem work demonstrates that in order to adapt to climate change, we must reimagine the role of parks, streets, and public spaces as infrastructure for water management, and invest in the associated budgets for construction and maintenance. This work could be stewarded by its communities and the people employed by a new “Climate Corps,” further enhancing connections to neighbors. If the “now” is the past of the future, let us not make the same mistakes in their prologue.

INVEST IN DATA TO IMPROVE STORMWATER RESILIENCY



Timon McPhearson [@timonmcphearson](#) [@usl_nyc](#)
Director and Professor, Urban Systems Lab,
The New School

The human losses and infrastructure damage from the Ida cloudburst were clearly terrible, but to some extent also expected. Though the City has put major effort into addressing stormwater driven flooding, including 10,000 green infrastructure installations designed to increase stormwater absorption capacity, these efforts have mainly focused on decreasing the volume of stormwater entering sewer systems where stormwater and sewage water are combined. Investing at the scale needed to reduce surface flooding during extreme rainfall events such as Ida requires investment on another scale entirely. A dramatic transformation in our flood resilience will likely cost hundreds of billions of dollars and take years to decades to implement. But there is much we can do now, and it requires data.

First, we need better information on where flooding occurs. The city has limited information from 311 calls, but many communities do not report flooding through 311 and when they do it often lacks critical information such as flood depth, flow rates, how long water is standing or pooling in an area, when flooding began and when water receded. Better flood data is key to more fully understanding the flood problem so we can ensure that solutions we invest in are designed for the local neighborhood context. It is exactly

this kind of data that can be gathered by installing real-time, cloud-based flood sensors in areas we know are likely to flood or where the recent NYC Stormwater Resiliency Plan flood scenario maps have suggested are areas most likely to be exposed to flooding, including from extreme rainfall or even extreme rainfall combined with coastal storm surges and affected by sea level rise. Investing in small, powerful, real-time, cloud-based IoT sensing can do many things for improving our knowledge of when and where flooding occurs, and provide the nuanced information needed to design solutions to fit. In some cases, we may need to raise roads or curb heights, in others we may need to install temporary storage bases, in others we may need hybrid grey and green infrastructure to improve temporary stormwater storage and absorption. Ultimately, what will work best depends on improving our flood knowledge system with better flood event data.

We can also do a better job of asking and listening to New Yorkers who are on the front lines of flood exposure in their neighborhoods. Many people take photos, post them on social media, or otherwise share critical time-stamped information about where flooding occurs, approximate depths, and what human and infrastructure impacts are occurring, often in real-time. We need to better coordinate and mine this information from social media

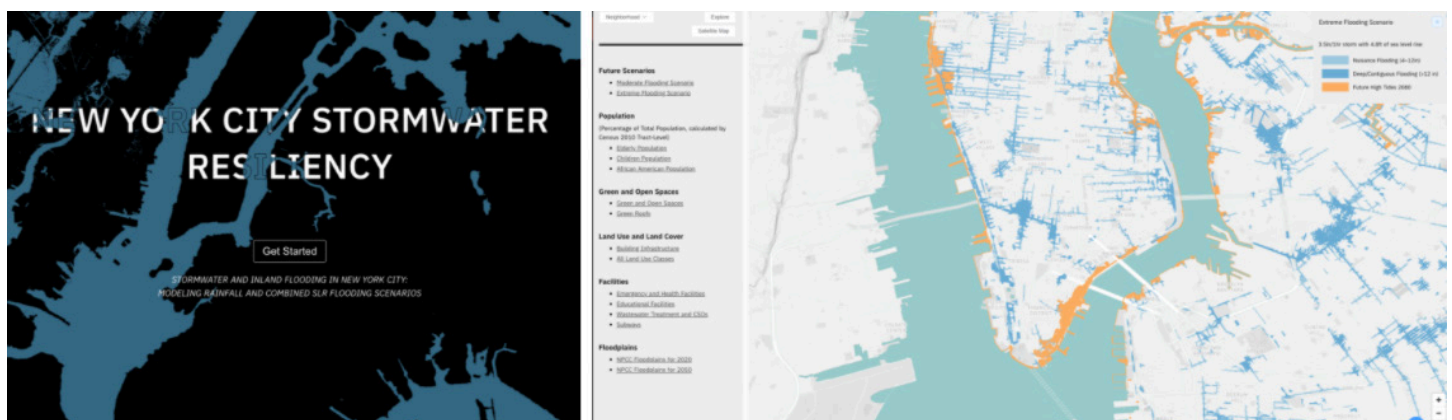
sources including Twitter, Instagram, and other places where people are already providing key information that can improve our knowledge.

“MODEL PROJECTION INFORMATION IS KEY TO MAKING SMART, LOCAL, AND CONTEXT SPECIFIC INVESTMENTS TO DECREASE IMPACTS OF MULTIPLE FORMS OF STORMWATER FLOODING IN THE CITY, BUT WE MUST IMPROVE OUR KNOWLEDGE ABOUT FLOODING WHEN IT HAPPENS”

Investing in data is not only important for assessing damage. Improving real-time data flow on flood extent, depth, and damage can improve emergency response and help prioritize where critical services need to be restored. These data can also help us better predict where flooding is likely to occur from different kinds of storms. Most of our information about where flooding may occur in the city comes from hydrological models such as those used in the NYC Stormwater Resiliency Plan (2021) flood scenarios, which you can see and interact with at [stormwater](#). However, flood projection models, no matter how sophisticated, are only

as good as the data that we feed them. And any model projection needs to be validated for accuracy. Flood sensor, camera, and social media data are all critical information for model validation, which essentially allows us to see where models are accurate, and where they make mistakes. The more accurate and precise our models the better information we'll have for designing resiliency solutions for the multiple drivers of flooding from cloudbursts, moderate rain events, rainfall that is combined with high tides, or extreme rain combined with coastal storms that may have high, medium or low storm surge.

The future of flooding in NYC is certain. We will have more floods. But what combination of sea level rise, tidal action, storm surge, and rainfall we may face in any future event is all unknown. However, we have the capability to improve our understanding of where different types of events will flood, how much flooding may occur with different scenarios, and even the ability to project potential damages, especially if we invest in improving knowledge and data gathering. Model projection information is key to making smart, local, and context specific investments to decrease impacts of multiple forms of stormwater flooding in the city, but we must improve our knowledge about flooding when it happens. This means investing in the sensors, social media data mining, and analysis of camera feeds in real time to improve the emergency response and to make sure that we are learning from every storm, no matter how small or large, to build preparedness and resiliency over time into every at-risk neighborhood in the city.



SIMULATING WATER FLOWS FOR PREPARING AND PLANNING



Dr. Julie Pullen [@DrOceanJulie](#)
Director of Product – Jupiter Intelligence

Rainfall-induced flooding is on the rise in our region. Our local extreme precipitation is increasing in magnitude, frequency, and duration according to the most recent National Climate Assessment that I helped peer-review for the National Academy of Sciences. The solutions must reflect the complexity of our built environment and meet the needs of the lives and livelihoods that thrive therein. Vitally, the data and technology solutions need to represent the non-linear feedbacks inherent in complex systems like ours where the sea and sky meet the urban landscape and patterns of life pulse across many time scales, from the daily commute to the seasonal shifts that make rain turn to snow. This necessitates anticipating the impacts across a continuum of timescales, from hours/days-long forecasts to months/years projections.

I believe we need a common integrated building-resolving modeling and data assimilation system that can span this timescale continuum. This system should encompass a high-fidelity representation of the water flows and their interaction with the buildings and storm drains. It should feature the way the ocean and rivers come together and interact in our crossroads of water currents that defines our region. It should include the ebb and flow of people and cars and bikes in our transportation corridors that creates the vitality of our cities. And it should show us how “green” interventions

like permeable surfaces and waterfront edge design can blunt the worst impacts of storms.

Crucially, the system should account for variable uncertainty – allowing for smaller uncertainty bounds as storm events approach, and increasing uncertainty as the time horizon lengthens to years and decades. Such an integrated system would allow us to collectively be responsive to individual rainfall events (preparedness), while expecting that each storm event we experience will not be the last or the worst (planning).

**“THE SOLUTIONS MUST
REFLECT THE COMPLEXITY
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THAT THRIVE THEREIN”**

These are among the elements of true resilience in the face of our climate crisis. And because such an integrated resilience project is a collective responsibility, it makes sense to collaborate across the public, academic and private sectors to build a dedicated flood forecasting system. This is an investment in our present and future. Let’s get there together.

UNNATURAL DISASTERS AND POLICIES FOR PREVENTION



Kate Boicourt [@kateboicourt](#) @EDF
**Director, NY-NJ Climate Resilient Coasts and
Watersheds - Environmental Defense Fund**

Worsened by climate change, stormwater has challenged New York City for decades, regularly combining with sewage, overflowing into streams and streets and snarling transit.¹ While standing on a subway platform-turned-waterfall, in one of the most wealthy and innovative cities in the nation, I often wonder – can’t we do better? Yes, we can.

We must start with funding the repairs, programs, and monitoring we need to update our infrastructure. Improving stormwater infrastructure is expensive, but Ida made it plain – the costs of inaction are comparatively steep. At the state level, a mixture of funds, such as the three billion proposed by the 2022 environmental Bond Act ballot measure, millions authorized by the federal STORM Act, and an ongoing revenue generator could be paired in a single statewide climate resilience fund. At the City level, a long overdue overhaul of our water rate structure could increase equity, green infrastructure, and expand the resources needed to tackle the problem. Ratepayers are currently charged for water use, with lower income families paying more than their fair share. This could be made into a much more equitable policy that generates greater revenues in which larger contributors pay more and basic needs are met for low income families

at little or no cost. Current financial barriers to installing green infrastructure on private lands could also be reduced through incentives such as rate discounts or up-front funds paid back later through rate fees.

Besides increased investment, the City should also reduce climate risks through every land use, building, and infrastructure decision. Two recent policy opportunities could facilitate this. First, in the spring of 2021, a bill was passed (Intro 2092) that requires all City-funded capital infrastructure to be built to withstand climate threats and meet a resiliency score. If executed successfully by the next administration, this requirement could be expanded to the private sector. Combined with recent mitigation legislation, this could establish a future in which all New York City buildings and infrastructure are rated both for their impact on and resilience to climate change. Second, a bill introduced by Council Speaker Johnson (Intro 2186) proposes a mission-driven comprehensive planning and infrastructure framework through which all land use decisions would meet citywide targets for equity, housing, and resiliency. Through such a policy, all City agencies would have to work together and consider these targets and community priorities for how they are met

¹According to the Fourth National Climate Assessment, the heaviest rains in the Northeast now produce 55% more rain compared to the 1950s and could increase another 40% by 2100.

in the capital budgeting process. Regardless of the vehicle, the Council and Mayor must work together to address climate change comprehensively, informed by science and in partnership with communities.

“WE NEED TO COLLECTIVELY DARE TO DREAM AND DEMAND THE FUTURE WE WANT”

Finally, we need to collectively dare to dream and demand the future that we want. In 2015, as I read about the mayor of Paris opening up the City’s canals to swimming, I felt envious. I feel the same when I see case studies of Portland’s beautiful public spaces and greener, cooler streets that are actually part of a multifunctional stormwater system. For New York City and all of its residents to thrive, we need to roll up our sleeves and align our policies and investments in a way that demonstrates that we value public wellbeing and the infrastructure required to support it. After the devastation of Ida, it is easy to feel anger and despair. But for the next Mayor and Council, it is important to also hold on to envy, to dream of the kind of future New York we’d like to live in, and work toward that.

CREATING ACCESS TO RESILIENCE

RESILIENCE RETROFITTING PROTECTS COMMUNITIES AT AN ACCESSIBLE SCALE



Joseph Sutkowi [@OurWaterfront](#)
Waterfront Design Associate Director,
Waterfront Alliance

Hurricane Sandy exposed New York City's coastal vulnerability as catastrophic flooding flowed deep into waterfront neighborhoods in all five boroughs. Hurricanes Ida and Henri were different. Their destructive power came not from the sea but from torrential, devastating, unprecedented rainfall. That rainfall went beyond submerging homes, streets, and vehicles, it overwhelmed our 20th century stormwater infrastructure sending water and sewage shooting out through drains and fixtures. These storms, particularly Ida, demonstrated the importance of resilience across the boroughs. While large-scale government-led infrastructure upgrades are in dire need, the city also requires a network of smaller-scale solutions at the building and neighborhood-level.

New York City has options for small-scale interventions to retrofit buildings and properties for higher resiliency. At an individual building level, critical mechanical and electrical systems can be moved to higher floors and potential penetration points for water like utility hook ups can be sealed. Investments in green infrastructure at the building scale can reduce the burden on the stormwater system. Green roofs, holding tanks, porous surfaces and landscaping, and filtration systems can reduce or eliminate runoff that would otherwise flow into traditional stormwater infrastructure.

Much more can be done at the building-level scale. Programs to upgrade the existing building stock have largely focused on carbon emissions, an important but fundamentally different goal.

There is substantial value in a city-wide climate resilience retrofit incentive program to facilitate meaningful change at-scale. The City and State's climate responses must include incentives, grants, and loans that support resilience retrofitting by property owners. This would enable individual building owners to enact changes that benefit not only their property, but their neighborhood more broadly. This adaptation policy would also provide new green construction jobs and workforce opportunities, along with critical flood protection.

The incentive program has precedent. With the recent enacting of Local Law 97, the City created loan programs and technical assistance to incentive property owners to install solar panels and other energy efficient adaptations. NYSEDA's Commercial Property Assessed Clean Energy (PACE) program provides financing for renewable energy upgrades for commercial properties and the NYC Accelerator provides guidance to building owners for compliance with Local Law 97. Expanding programs like these to include flood resilience and residential properties creates

a toolkit that will increase tactical uptake of resilience projects. Addressing environmental injustices and past disinvestment should be central to the program's funding structure to ensure protection in the most vulnerable communities.

The Waterfront Edge Design Guidelines (WEDG) developed by the Waterfront Alliance are a powerful tool for communities and landowners alike to build resilience into projects. While designed for the waterfront, WEDG's strategies for reducing stormwater quantity, improving stormwater discharge quality, establishing preparedness plans, and reducing the risks brought on by climate change are applicable across the city. Credits in WEDG reward designs that use green infrastructure to manage the additional stormwater runoff expected with increased and more intense episodes of precipitation. For example, high on-site precipitation capture in the form of backflow prevention devices or retention basins for stormwater capture and infiltration or re-use. WEDG offers best practice design solutions that go beyond municipal code to protect neighborhoods. The guidelines offer a blueprint for resilience solutions that can apply across a broad swath of the city.

“ THE CHALLENGE IS NOT ABOUT TECHNOLOGY, BUT ABOUT POLICY AND PRIORITIES”

Recent storms brought the city's vulnerabilities to the forefront. The technical solutions, whether they are capacity upgrades to the City's stormwater system or resilience retrofits for buildings, exist. The challenge is not about technology, but about policy and priorities. Creating a climate resilience retrofit incentive program is a critical means by which we can equip individual property owners to strengthen their communities.

COMMIT TO MAKING THIS THE RESILIENCE DECADE



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Founder and President – Climate Resilience Consulting
Affiliate Global Futures Scholar – Global Futures
Laboratory

As we approach the 9th anniversary of Sandy, it's easy to see how swiftly a decade can pass without building enough resilience for this climate-changed era. Now our New York City metropolitan leaders have the chance to fix those wrongs and make the next ten the "Resilience Decade."

Hurricane Ida's sudden and frightening destruction in the New York City metropolitan area underscores the obligation of public and private sector leaders to partner and accelerate plans for solving the uppermost challenge of our time: climate change.

If they fail to create resilience to climate risks, they will jeopardize the region's immense strength as a center of world commerce. (Similarly, the leaders of nations at the upcoming U.N. climate talks – COP26 – must do the same and agree on climate resilience actions beyond just setting goals and deadlines for reducing greenhouse gas emissions.)

The time for hand-wringing is over. No sane leader thinks these disastrous climate change events and pandemics will decline in frequency any time soon. They also know that countless families, businesses, government services and the overall economy face devastating consequences if climate amelioration initiatives aren't taken – and fast.

**"NO SANE LEADER THINKS
THESE DISASTROUS
CLIMATE CHANGE EVENTS
AND PANDEMICS WILL
DECLINE IN FREQUENCY
ANY TIME SOON"**

In the New York Metro Region, it's not that private and public sector leaders don't have strong examples of promising climate adaptation elsewhere to consider. Miami Beach serves as a prime illustration as it deals with an estimated one-inch-a-year rise in sea level. It's using the best available technology and science to prepare its physical infrastructure for climate events. It's elevating roads, upgrading its stormwater system and, smartly, including power redundancy in its pumping stations. The public and private sectors are collaborating there to further climate resilience efforts.

There is no dearth of actions Metro New York and regional leaders can take. They can more quickly assess the vulnerability and exposures to climate change to its assets and neighborhoods. Address the risks through preparedness, mitigation, and disaster risk

financing. Assess hazards and establish strategic priorities for dealing with them. And shape resilience plans for the region's workforce and neighborhoods.

Even more important, New York municipal leaders must institute a cost-benefit analysis, or CBA that prioritizes resilience in decision-making. The so-called triple bottom line accounting framework encompasses social, environmental, and financial pillars is well-suited to the resilience decade's demands. Very simply, CBA excludes the social and environmental benefits that accrue over time, even decades after a project's completion. So, the intangibles that make a city livable and enhance residents' ability to thrive aren't communicated within the bottom line. This creates social inequities that must be considered as New York leaders adopt climate change-driven actions.

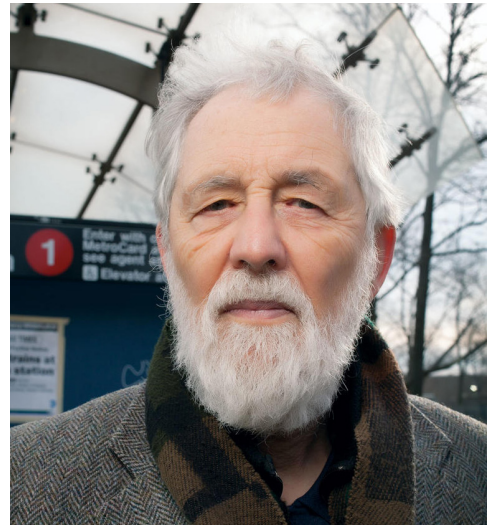
Strong, decisive, and effective initiatives are available to deal with climate change. They must be taken so we can make this the Resilience Decade. So, here's the call to action for public and private sector leaders: Grasp that mitigation and adaptation are complementary strategies for creating climate resilience and managing climate risk. Work together as partners to quickly determine the best way to make the region climate resilient.

Otherwise, the consequences of another Hurricane Ida could turn this into the Disaster Decade.

SUBWAY FLOODING, IDA, CLIMATE CHANGE, AND 'ELEVATION COUNTS'

This interview has been edited for length from *The Conversation* in collaboration with Klaus Jacob.

Image taken from "Sandy's Wake" by Paul Hond in Columbia Magazine.



Dr. Klaus Hans Jacob
Geophysicist and Emeritus Research Professor -
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In New York over the last few weeks (August/September 2021), we have had three subway floods – first due to a heavy downpour, then from Tropical Storm Henri, and now Hurricane Ida. Meanwhile, we have seen similar floods in cities across America and the world. The message should be pretty clear by now: Climate change isn't a matter of the future; its effects are happening right now. Warmer oceans mean more moisture in the atmosphere, and as that moisture encounters cold air, it all comes down on the cities like the proverbial cats and dogs.

It is not necessarily a problem just for coastal cities. Ida, for example, left havoc across the entire interior of the eastern United States. But, of course, many major metros – from London to Amsterdam to Marseilles to New York and New Orleans – have been built next to major rivers or on the coast. This makes them vulnerable to excess water through either rising tides, or heavy rains, or both. In the most recent case in New York, it was from above, but the flooding from Sandy came from coastal surge.

How does the age of some of these subway systems affect flood risk?

When the subway was initially built in New York, opening in 1904, no one was thinking of

sea level rise or torrential rains. And therefore, the fundamental design of this underground system did not take those phenomena into account.

Now we know better. For the past 20 years, it has been clear that more severe storms are an inevitable outcome of human-made climate change.

But despite having a couple of decades to do something about it, we are still in a reactive mode rather than being proactive. Essentially, City and MTA officials are cleaning up the mess after the storm, rather than taking more fundamental, corrective measures, like relocating infrastructure or even just protecting it.

So, what can cities do to better protect aging subway systems?

Odd as it may seem, water by itself is not the problem. Rather, it is a mismatch of the amount of rainfall we are seeing and where the openings are in our subway systems – not just where people go in and out, but also the ventilation grates where air goes in and out and where the electric cables enter the system. All these openings allow for water to run off the streets and into the subway tunnels.

These are long-known engineering problems that can be fixed. In New York, the Metropolitan Transportation Authority fixed a large proportion of the problems caused by coastal storm surges, like Sandy in 2012; they did this by installing devices such as gates and barriers – some installed permanently, some that need to be inserted into place before the water shows up. These prevent water getting into the subway system. When working as designed, they can result in a 98% reduction in coastal flood potential, according to calculations I did jointly with some Columbia grad students.

But these measures work for coastal flooding. The problem we saw on Sept. 1, 2021, was the result of heavy rain runoff from the streets that gets into the system. With coastal storm surges, the water comes into the subway system only at low elevations – perhaps at entrances just a few feet above sea level. With the heavy rains, even at higher elevations in New York City, subways can flood.

How do you address this runoff street water problem?

You have to approach it in two ways: (i) Avoid street-flooding in the first place and (ii) Protect entrances to subways.

Avoiding street flooding can be achieved through increasing the capacity of street gutters, of storm drains, and of the combined sewer system to take up the runoff water from streets. This can be done by widening or adding new gutters or storm drains, but also by having larger-diameter sewer pipes in the roads; and adding more capacity at the City's wastewater processing plants.

And then you can make the ground more absorbent by planting more trees on streets and putting in permeable surfaces. For example, rather than concrete parking lots, put in gravel or other permeable surfaces that allow the ground to absorb water.

Individual property owners can, if they have flat or near-flat roofs, put gardens on

their roofs rather than have just gutters. Green roofs can absorb the water coming down from the sky; and catch basins – devices that collect stormwater – and then release that water slowly over days, for each building; they can help to ensure sewer systems don't get overwhelmed. NY City is starting to mandate such retarding features for new buildings above a certain size. Trash on the streets can amplify the problem by clogging up drainage, but it isn't the systemic issue. It just makes a bad situation worse.

When it comes to protecting existing subway entrances, you can build berms – mini levees or raised banks – of several feet at every entrance. That does make it more difficult for people with disabilities, so you also have to modify elevators to take people down.

All it needs is good engineering – there is no mystery. Well, it is engineering, and political will and money.

You mentioned political will and money...

It isn't cheap. To effectively protect a city's subway system from flooding costs tens of billions of dollars. But it is cheaper to fix the problem before extreme events than having to fix the problem after the damage is done.

Unfortunately, the current trillion-dollar infrastructure bill going through Congress has a totally insufficient amount for subways – far more of it, around \$110 billion goes to bridges and roads than public transportation modes, which are set to receive around \$39 billion.

How long have we known that we have flooding issues with our NYC transportation infrastructure?

Oh at least 2 decades. After some earlier research, some Columbia colleagues and I wrote a 2008 climate change adaptation plan for the MTA, and then subsequently, in 2011 – three years later, but still one year before Sandy, we wrote a report as part of a state-funded project called ClimAID in which we assessed generically a hundred-year storm and what the

impact would be on the transportation system in New York City. We focused on the subway but looked at other transportation systems as well.

What are the most pressing concerns about the New York City subway system with regards to climate change?

What we figured out in the 2008 report, and was repeated in the 2011 report, and what manifested itself during Sandy, and then again with the events like the extreme rainfalls in July of this year (2021), was that very specific locations of the system were highly vulnerable to flooding. That is not surprising for coastal storm surges, because, after all, much of the subway system is subterranean, many station entrances are below or close to sea level. So those entrances at and below sea level are susceptible to having coastal storm water just pour in. In some cases, in less than 40 minutes the system is completely flooded.

After Sandy, the MTA started a billion-dollar program to fix the most obvious entrances to the subway system. They fixed not only the pedestrian steps down into the subway, which are the obvious openings, but many other openings such as the sidewalk ventilation shafts, electrical manholes and cable entryways for the subway. The MTA has many other divisions such as Bridges and Tunnels, and they installed heavy steel doors on the entrances to the Brooklyn-Battery Tunnel. And many of these protective systems seem to be effective. Fortunately, since Sandy we haven't had any major new coastal storm surges to test many of the improvements that were made.

But in 2017 we did a (unpublished) study that was testing theoretically, many of those newly installed barriers and manhole covers, and so on. And for the most part, if they perform as designed, they work well for coastal storm tides.

But there are other weather events over which the MTA does not have sufficient

control yet. As we saw in this summer of 2012 during multiple heavy rainfall events, the runoff from the street caused flash floods on City streets. When the sewer system, which is under the control of the City, not the MTA, was overwhelmed because of its limited capacity, the subway system became the default sewer system. Water runs from the streets into places that have not yet been either modified by the MTA, by permanent protective devices, or in some instances, would require that the MTA, in preparation of forecast heavy rainfall, would insert certain devices that require manpower to be put in place. In short, for heavy rain events, the MTA does not seem to have yet a well-functioning operational protocol.

To solve the street runoff problem requires cooperation between the City and the MTA. When and where City streets flood, the MTA would need to act in advance. This interagency cooperation seems operationally and administratively an unsolved problem. Because of climate change we must expect more frequent extreme rainfalls; therefore, such operational action plans need to be developed, tested and implemented with urgency, until a more permanent engineered solution can be put into place. Permanent engineered solutions are needed, to avoid street flooding in the first place, and at locations where street flooding seems unavoidable, we must protect the tunnel entrances by permanent, engineered measures.

Are there other gaps you feel should be prioritized either operationally or in terms of the actual physical infrastructure?

I was recently in the subway and while it was not one of the hottest days, it was very hot down there. Some of the subway stations are a real burden for vulnerable people, especially elderly people. Also, the MTA needs to pay attention during very hot days, to ensure that all subway cars have operating air conditioning.

More than once did I find myself trapped in a car that had no air conditioning. It is bad enough that subway stations have virtually no

cooling options.

On a much larger scale, way beyond just transportation issues: we need to think much harder about land use, urban planning, zoning, and especially about managed retreat from low-lying coastal areas. The future of NYC, and many other cities, does not lie at current waterfronts that are still considered valuable real estate. The future lies at safe, high elevations. Elevation counts!

“SOME OF MTA’S POST-SANDY MEASURES WERE EFFECTIVE FOR THE TIME BEING. BUT WE NEED A LONG-TERM COMPREHENSIVE PLAN TO REDUCE – IF NOT ELIMINATE – OUR INFRASTRUCTURE’S LONG-TERM VULNERABILITY TO CLIMATE CHANGE”

Would you say the money dedicated to safeguarding the transportation system after Sandy enhanced our long-term resilience to climate change?

Some of MTA’s post-Sandy measures were effective for the time being. But we need a long-term comprehensive plan to reduce – if not eliminate – our infrastructure’s long-term vulnerability to climate change. To date there has been little support on the governance side – from the New York State governor on down. If there are insufficient funds set aside to create sustainable resilience, any plans are just a piece of paper. And that’s exactly what happened before Sandy. And even then, it took another one or two years beyond Sandy to act. I think the MTA finally put its climate change adaptation task force together in 2014. There was at least a five-year delay in just forming the task force from the time we had suggested it,

not to speak of coming up with financing and implementing such a plan.

True, developing a vision has been hampered by financial constraints. Engineers and planners feel: what’s the point of long-term planning if there is no foreseeable financing for implementing the plan? And that’s the chicken and egg problem. That’s not just a problem for the MTA. That is a general problem in the United States. Infrastructure funding is very limited. Right now, we have this infrastructure bill before Congress. It has not yet passed. It has potentially billions of dollars for infrastructure adaptation to climate change. But even that would be only a first step. It is a much broader, national infrastructure problem, not just an MTA, or subway problem.

It sounds overwhelming.

We need visionary plans. And not just technical plans, but also detailed capital plans. Often budgets last only an election cycle. We do have entities in this city, like the NYC Department of Environmental Protection. They have a long tradition of making at least midterm (decadal) capital plans. For instance, when the NYC DEP built the third water tunnel, that was a multi-billion dollar project and they had to fund it. How did they do it? They issued municipal bonds, and the costs of those bonds, which we pay for by our water bills, covered at least some of the expenses.

Is that something that you think we will see more of?

Municipal or State bonds are a typical financing instrument, but there has to be a political will and financial planning. And it cannot be just top-down, many of these planning issues require a consensus from communities. It’s a very slow, elaborate and demanding process, and we need to work hard towards a consensus, combined with a sense of urgency. I gather that political will and a sense of urgency are both finally emerging. We have no choice!

WHAT SUBWAY RIDERS NEED FROM CITY LEADERS AFTER IDA



Betsy Plum [@betsyplum](#)
Executive Director, Riders Alliance

As Stacey Abrams says, “We have to start thinking about transportation as a critical part of emergency management, in a way that we don’t as a nation right now.”

Storm Ida stopped New York’s subway in its tracks, flooding stations and stranding riders across the city. Extreme rainfall now outpaces Sandy-like tidal surges as the biggest weather-related threat to public transit.

City leaders must better leverage public space, particularly streets, to protect the subway from floods. Streets are our largest shared asset, 27% of the City’s land area. Today streets are largely given over to drivers to congest, pollute, and emit carbon.

Instead of slouching toward a future mired in gridlock, we need to make three key improvements: rapidly redesign our streets as sponges for stormwater, secure containers on streets for trash, and allow streets to function as arteries for a fast, reliable bus network to complement and supplement subway service.

First, the City must accelerate installation of green infrastructure to complement sewer drains. Tree pits, bioswales, and other permeable surfaces are no longer just about improved water quality; they’re essential to transit reliability. The more water that streets

soak up, the less water descends into the subway. In neighborhoods where runoff floods tunnels, DOT should turn asphalt streets into green sponges.

Siting and maintenance of green infrastructure have proven challenging to the City’s Department of Environmental Protection. But aided by lanes of asphalt and space at intersections and expert maintenance teams from the Parks Department, there’s no reason that public space cannot quickly become much more permeable and absorbent during storms.

Properly constructed and stewarded, green infrastructure affords enormous additional benefits. It cools neighborhoods, lessening the deadly, inequitable urban heat island effect. Bioswale soil and plantings both filter pollutants from air and water and beautify communities starved of green space. Scaling up the Green Streets program will ensure adequate public investment in green infrastructure projects, alleviating burdens on local communities.

Second, the City needs to implement policies that let all of us clean up our act. Walls of trash stacked on sidewalks before garbage collection all too easily become clogged sewer drains and worsen subway flooding during heavy rains. Businesses are required to contain

their waste. Residential buildings should do the same. Both should use containers in the street, leaving sidewalks clear, safe, elevated corridors for every neighborhood.

“SECURING TRASH AGAINST INFILTRATION BY RODENTS, RACCOONS, AND RAIN WILL MAKE OUR TRANSIT SYSTEM MORE RESILIENT IN THE FACE OF EXTREME WEATHER”

Securing trash against infiltration by rodents, raccoons, and rain will make our transit system more resilient in the face of extreme weather. It will also improve the liveability of our neighborhoods, cut down on litter, and help homeowners avoid sanitation tickets. All it requires is a portion of our scarce street space, which doesn't necessarily mean less parking; we can often narrow or eliminate travel lanes instead.

Third, as the MTA upgrades infrastructure like the power backup that failed three days before Ida and weather-proof more of its stations and tracks, the City should also accelerate its initiatives to improve bus service. The more redundancy the bus system can provide during subway outages and maintenance, the more reliably transit riders will be able to get home and reach other essential destinations no matter the weather. When our entire subway system went out of service during Ida, 90% of buses kept running.

Bettering buses means dedicating lanes and implementing signal priority at intersections so riders can spend less time in slow traffic and at red lights. The Streets Master Plan, now in development at the Department of Transportation, should prioritize new busways and bus lanes on heavy ridership routes and lines that help alleviate pressure on the subway

system.

Our bus network will increasingly need to do double duty, providing connectivity to a subway that doesn't serve every neighborhood while also tracing many of the same central arteries where subways usually run. With more priority on streets, better buses will help get New Yorkers out of cars and also improve transit service for the millions already reliant on it.

The transit system that the majority of us depend on faces serious external threats and needs support from City officials. The answers, which would be both commute- and life-saving, are right there on our streets.

BASEMENTS ARE FOR STORAGE, NOT PEOPLE



Deborah Helaine Morris [@dhmorris](#)
Design Critic - Harvard Graduate School of Design

No one should live in a basement. Basement and ground floor dwellings will always be susceptible to aquatic intrusion while also being dark, damp, spaces that are more difficult to ventilate than their counterparts that are fully above grade. There are some challenges we can design and engineer our way out of, but basement flooding is not among them. Legalizing basement dwellings may bring some light and formality to the realm of illegal dwellings, but legalization does nothing to fundamentally increase the supply of available housing while also increasing tolerance for a form of housing that is inadequate and fundamentally unsafe.

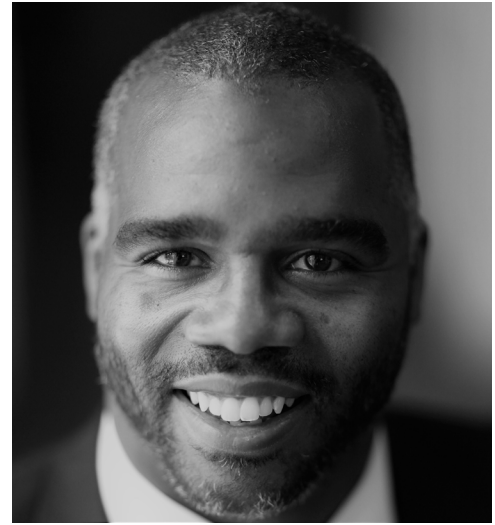
The tragic deaths from the flooding of basement dwellings during Hurricane Ida should be seen as a flashing sign that New York desperately needs more new housing, not as justification to lower thresholds in public health and safety. As the region sits at the crossroads of housing and climate crises, flash flooding demonstrates the limitations of New York City's infrastructure, including its housing, today. For more than 100 years, New York City has not been able to affordably or safely house the entirety of its population. Despite having a combination of one of the most rigorous building codes and strongest tenant legal protections in the country, New York City's buildings are ill prepared for the hazards of climatic extremes and rental tenants are as

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vulnerable to displacement and unsafe housing as they have ever been. The need for housing is so desperate, but the tolerance for change so weak, that we've all collectively looked the other way as grew significant portions of the region in environments inappropriate for development and without the infrastructure sufficient to support the existing population, let alone future growth.

New York City must recognize that certain structures are simply not designed to protect inhabitants from weather hazards and that investment in critical stormwater and flood management infrastructure must be accompanied by investment in the creation of new affordable housing. A combination of buyout programs and shared equity community land trusts can help homeowners in vulnerable structures or in vulnerable geographies make decisions about how and where to live in physical and financial safety. For rental tenants to have financial and physical stability, the City must focus on creating permanent housing stability through greater supply and the development of more nimble rental assistance programs. Responding to climate risk will take decades of course correction and billions of dollars. There is no one single path, instead we need to generate options so that the most vulnerable can have stable, safe, and affordable housing.

GREEN BEFORE GRAY



Ibrahim Abdul-Matin [@ibrahimSalih](#)
Author - "Green Deen: What Islam Teaches About
Protecting the Planet"
Co-founder - Green Squash Consulting

New York City spends billions a year on managing water.

Not just the water that you drink and the water you flush down the toilet and kitchen sink, but also water that falls from the sky.

Right now, the reality of water falling from the sky is crystal clear. Hurricane Ida dumped 3.28 inches of rain in one hour. The storm caused the deaths of at least 13 people in New York City, at least 11 of whom were found in flooded basement apartments. The trend lines suggest that we will be dealing with hotter, wetter, more volatile weather - like the onslaught of Ida - more regularly.

So, what are we going to do about it?

Take a moment and imagine that if you were to design a solution to this problem of managing increasing amounts of rain (and in increasing intensities) how would you go about it?

First you must know how we solve the problem now.

At the end of your block in many parts of the city are drains - called catch-basins. Water and debris that collects from a rain

event arrives in these catch basins and gets sent, using the power of gravity in most cases, to one of our 14 wastewater resource recovery facilities dotted around the edges of our coastline. Our combined sewer system gets overwhelmed sometimes and sewage (from our homes) and storm water mix and get in the waterways around us - making swimming after a severe rainfall a public health concern.

A combined system was state of the art at one time. London and San Francisco both have similar systems. A separate system is better because they are separating water that falls from the sky and the sewage that comes from our homes - this leads to less pollutants and therefore cleaner water around us. Federal policy, through the Clean Water Act, gives municipalities guidance on how to do this in a traditional way. This guidance is critical because in many places the management of stormwater is one of the biggest capital items in the budget. Many of these control efforts involve large containment or retention tanks made of concrete, to hold excess flow until it's safe to let it travel through the combined system. These systems are referred to as grey infrastructure. It is usually effective but those can reach capacity and be overwhelmed - especially as these storms increase in intensity - as we saw with Hurricane Ida, sending millions

of gallons of rainwater into our neighborhoods. There are better ways to manage the increased rainfall we will see more often because of climate change – ones with multiple benefits – that is known as “green” infrastructure.

By now you’ve likely heard your local newly minted elected official make a call for “green infrastructure,” which uses natural solutions to soak up rainfall. That’s the right call. Why do we allow stormwater to push pollution into our waterways or overwhelm us where we sleep? In the past we built up and pressed landfill, garbage, steel, concrete and asphalt everywhere. Do we need more of that?

Today, 72% of the city is impervious. Green infrastructure is finding the right ways to incorporate porous surfaces. These, often green spaces, soak up the rain and keep it out of our sewer system. We can engineer spaces that allow water to absorb – to go back into the ground. We should prioritize building and maintaining controlled rain gardens and other designed spaces that clean the air and provide space for pollinators. We should be thinking about all our roadbeds as water retention underneath by choosing porous surfaces when we redesign major infrastructure such as the BQE and our 8,000 miles of city streets.

Green Infrastructure on NYCHA projects and how we can train and employ NYCHA residents to install and maintain green infrastructure. Every city agency should do the same. The City’s Department of Environmental Protection (DEP) which manages all things related to water and the City’s Parks Department which maintains natural areas all over the city know the correct levels of staffing needed to build out and maintain a robust green infrastructure network but the City simply has not invested in hiring and staffing at the right levels or paying these folks competitively to keep them.

We are overdue to make these decisions. Remember, we are talking about the problem of what to do with water falling from the sky – it is not something to think small about. Bottom line, every agency which touches our physical environment needs the staffing levels they need to plan comprehensively to address the level of water which Hurricane Ida has shown will be coming more regularly.

“CITY GOVERNMENT NEEDS TO MAKE A COMMITMENT TO GREEN INFRASTRUCTURE FIRST. IT SHOULD BE GREEN OVER GREY EVERY TIME”

City government needs to make a commitment to green infrastructure first. It should be Green over Grey every time. We are making a commitment to green over grey at NYCHA. The City’s Housing Authority, home to more than 175,000 units, has made that commitment. They are asking how we can build

PROTECTION AND CARE OF OUR EXISTING NATURAL AREAS OFFER A RESILIENT SOLUTION



Sarah Charlop-Powers

[@scharloppowers](#) [@naturalareasnyc](#)

Executive Director - Natural Areas Conservancy

Many people - even long-time New Yorkers - are surprised to learn that 10% of New York City is natural areas. These large forests and wetlands are frequently located on parkland in the outer boroughs. In addition to providing New Yorkers with the opportunity to explore the stunning natural beauty of our City, understanding and investing in our natural areas should be an important part of our response to climate change, including flash flooding.

While they do not offer a complete solution, natural areas are often the unsung heroes of extreme weather events. During SuperStorm Sandy, neighborhoods that were buffered by coastal wetlands and salt marshes experienced less damage and devastation. Last week, SuperStorm Ida reminded us that our freshwater natural areas, like rivers, streams, and ponds, are just as important. There is real urgency to investing in natural areas. NYC's forests and wetlands provide huge benefits to New York City, including regional cooling, carbon capture, coastal flood mitigation, and absorbing stormwater. While we often think of nature as self sustaining, these areas require investment to ensure that they continue to serve our city.

Targeted solutions for protecting New York City's natural resources already exist — they just need to be adopted and prioritized.

Since 2012, the Natural Areas Conservancy has partnered with NYC Parks to release two robust plans — the Wetlands Management Framework for New York City and the Forest Management Framework for New York City — that would significantly increase resources and funding to forests and wetlands, and reinvigorate the city's commitment to caring for natural areas. Building on more than thirty years of restoration and management, the frameworks use extensive data to make recommendations to manage New York City's hydrological infrastructure for the future. These plans call for the protection and care of our existing natural areas, acquisition of properties of high conservation value, and watershed management to increase the capture of stormwater at its source to decrease the volume and frequency of contaminated water flowing into our city's waterways.

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As we continue to experience more and more extreme weather events like SuperStorm Ida, it's time for the City to utilize existing solutions, like these natural area frameworks, in their planning and current mitigation efforts. With 520 miles of shoreline and retaining over 100 miles of streams, our city is a city of water. The Wetlands Management Framework for New York City comes at just the right time — and the Natural Areas Conservancy and its parks partners will continue to advocate for its adoption and funding at the City level.

INVEST IN PARKS: AN UNDERUSED TOOL TO COMBAT CLIMATE CHANGE



Adam Ganser [@NY4P](#)
Executive Director – New Yorkers for Parks

Hurricane Ida was only the most recent reminder of New York City’s vulnerability to climate change.

As NYC grapples with adaptation to severe weather events and sea level rise, our parks system remains an underused tool in our city’s fight for greater climate resilience and sustainability.

Resilience is one of the most urgently compelling arguments for more investment in New York’s green spaces, along with the array of benefits we know well-funded parks bring to our city -- including healthier communities, equity in the public realm, and economic development.

NYC’s parks are integral to our city’s landscape, occupying 30,000 acres of land and more than 161 linear miles of its coast. While our parks system could be part of the front line in the long-term resilience of NYC, the parks department is historically neglected by our elected officials. The parks operations budget is chronically underfunded, our parks are riddled with crumbling infrastructure, and our leaders have shown little appetite to build the next generation of great multi-function New York City parks.

The devastation of Ida, coming as we navigate COVID 19 and its variants, should serve as a call to action for New York City’s incoming elected leaders that there has never been a more poignant moment to invest in the future vision of this city.

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New Yorkers for Parks' Five Point Plan for Park Equity offer these incoming leaders some pointed suggestions:

1. Commit to a big vision for NYC's parks and open spaces and our public realm, with a focus on open space equity and climate change. Currently many of NYC's open spaces are managed and maintained by a variety of agencies using different standards with no unified vision for the challenges NYC faces.
2. Increase the parks budget to 1% of the city budget and ensure that our city's trees, natural areas and coastlines are safe and well maintained, and our parks remain a resource for all New Yorkers. New York City's parks budget has hovered at just .5% of the overall city budget for decades and our parks have suffered as a result. Most other US cities commit 2-4%.
3. Invest in bold new park ideas to make our coasts more protected, provide more shade, better air, and cooler temperatures...and ensure that all New Yorkers have equitable access to parks and open spaces. NYC has shied away from investing in large parks over the last 8 years, to the detriment of our health and the viability of the city.
4. Commit to tackling the \$6 Billion of deferred parks infrastructure maintenance AND commit to fixing the city's broken capital project system in the process. These steps would help to solve the city's massive drainage problem and turn our parks into stormwater absorbers.
5. Support local open space advocates. No other sector in NYC has more volunteers and dedicated not-for-profit stewards, many of which represent the very neighborhoods that are most threatened by climate change. The city currently makes it difficult for these advocates to dedicate their time and resources to our city's parks.

BOLD INCENTIVES FOR STORMWATER COLLECTION



Danielle Feld-Spiegel [@NYUGuarini](#)
**Executive Director - Guarini Center on
Environmental, Energy & Land Use Law, NYU**

The catastrophic flooding that New York City experienced on September 1st underscored a longstanding deficiency in the City's approach to resilience – it has never adequately incentivized property owners to capture stormwater.

The overwhelming majority of New York City is covered with impervious surfaces – concrete sidewalks, asphalt streets, slate roofs. When rain water falls on these surfaces, it rushes towards the City's antiquated sewer-system, which gets quickly overwhelmed. Even relatively routine rainfall events of a fraction of an inch can cause the sewers to overflow, discharging raw sewage into our rivers.

Green infrastructure can do much to mitigate these problems. By replacing some of the impervious surfaces with vegetation, green infrastructure stores rainwater where it falls, slowing its flow into our streets and sewers. It is a tested, relatively low-cost solution to improving resiliency and New York City has long touted its benefits. In fact, in 2012, the City pledged to cover 10% of its area with green infrastructure by 2030 and set interim targets to meet along the way.

Unfortunately, the City has routinely fallen behind its targets. It has made some notable progress deploying green infrastructure

on public property, but its efforts to incentivize green infrastructure on private property – which accounts for a majority of the land area that the City has targeted for green infrastructure development¹ – have been lackluster at best.

**“THE PROGRAM OFFERED
ONLY MINIMAL TAX RELIEF
AND REQUIRED PROPERTY
OWNERS TO COMPLY
WITH CUMBERSOME
PROCEDURAL
REQUIREMENTS. IT WAS A
TOXIC COMBINATION ”**

The saga behind the City's green roof tax abatement offers a case in point. In 2009, the City authorized a tax abatement for property owners who install green roofs. But the program offered only minimal tax relief and required property owners to comply with cumbersome procedural requirements. It was a toxic combination; eight years into the program, only seven property owners had received the abatement. Seemingly aware of the failure, legislation authorizing a new and improved tax

abatement was passed in the summer of 2019. But the City set a \$1 million annual funding cap for the program and took nearly two years to adopt the implementing regulations needed to make the program actionable.

There's so much more the City could be doing to encourage property owners to help capture the water that flows across their properties. For starters, the funding cap for the tax abatement should be raised to far more than \$1 million in total expenditure. Given the urgency of the problem, lawmakers should consider expanding the abatement to cover more types of blue and green infrastructure as well, such as porous pavement and subsurface storage. And lawmakers should look at whether it is feasible to adopt a stormwater fee, as many other jurisdictions have done. As with the green roof tax abatement, local officials may need to coordinate with the State to adopt a stormwater fee. But given the urgency of the problem, no solution should be taken off the table.

Earlier this summer, New York City announced that it would establish a new \$53 million program to fund green infrastructure projects on large properties that the City and its contractor identifies. This is a critical step in the right direction. However, there is still much more that can, and should, be done. With so much ground to cover, the City needs a multi-pronged incentive strategy that animates the private sector to adopt a wide-range of solutions for a wide variety of property types. Let's hope the incoming administration picks up where this government left off.

¹NYU Stern & Natural Resources Defense Council, Catalyzing Green Infrastructure on Private Property (2017)