Stormwater Resiliency in New York City

October 19, 2021

NYC Environmental Protection

About the NYC Department of Environmental Protection (DEP)

DEP is the largest combined water and wastewater utility in the United States, with 6,000 employees and an annual budget of more than $1 billion.

WATER SUPPLY

- Deliver almost 1 BGD of water to nine million New Yorkers every day and maintain 7,000 miles of water mains
- Protect approximately 2,000 square miles of watershed, including 19 reservoirs and three controlled lakes

WASTEWATER TREATMENT

- Treat almost 1.3 BGD of wastewater each day
- Operate and maintain 14 plants, 96 pumping stations, and over 7,500 miles of sewers

AIR, NOISE, AND HAZARDOUS WASTE

- Enforce the NYC Air Pollution Control Code to reduce local emissions, enforce the NYC Noise Code, and regulate hazardous waste

NYC must prepare for the full range of climate threats

COASTAL STORMS

+50% increase in intense hurricanes by 2100

MORE FREQUENT, MORE DESTRUCTIVE HURRICANES

SEA LEVEL RISE

Up to **30 in** SLR by 2050s

INCREASED TIDAL FLOODING + GROUNDWATER TABLE RISE

PRECIPITATION

Up to **1.5x** rain days > 1" by 2080s

FLOODING IN NON-COASTAL AREAS

TEMPERATURE

# of days above 90°F **TRIPLE** by 2050s

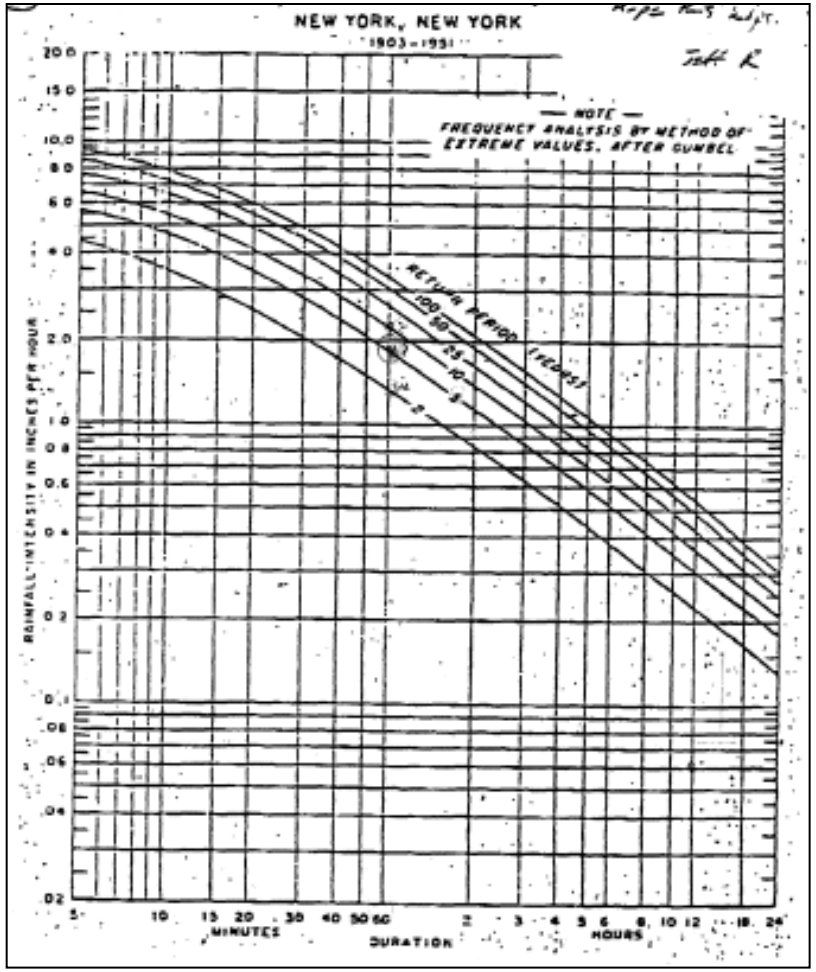
LONGER, MORE DANGEROUS HEAT WAVES

Sewer design is based on historical observations

- IDF curves used in engineering and planning applications:
  - Sewer design/construction
  - Sizing of onsite detention systems

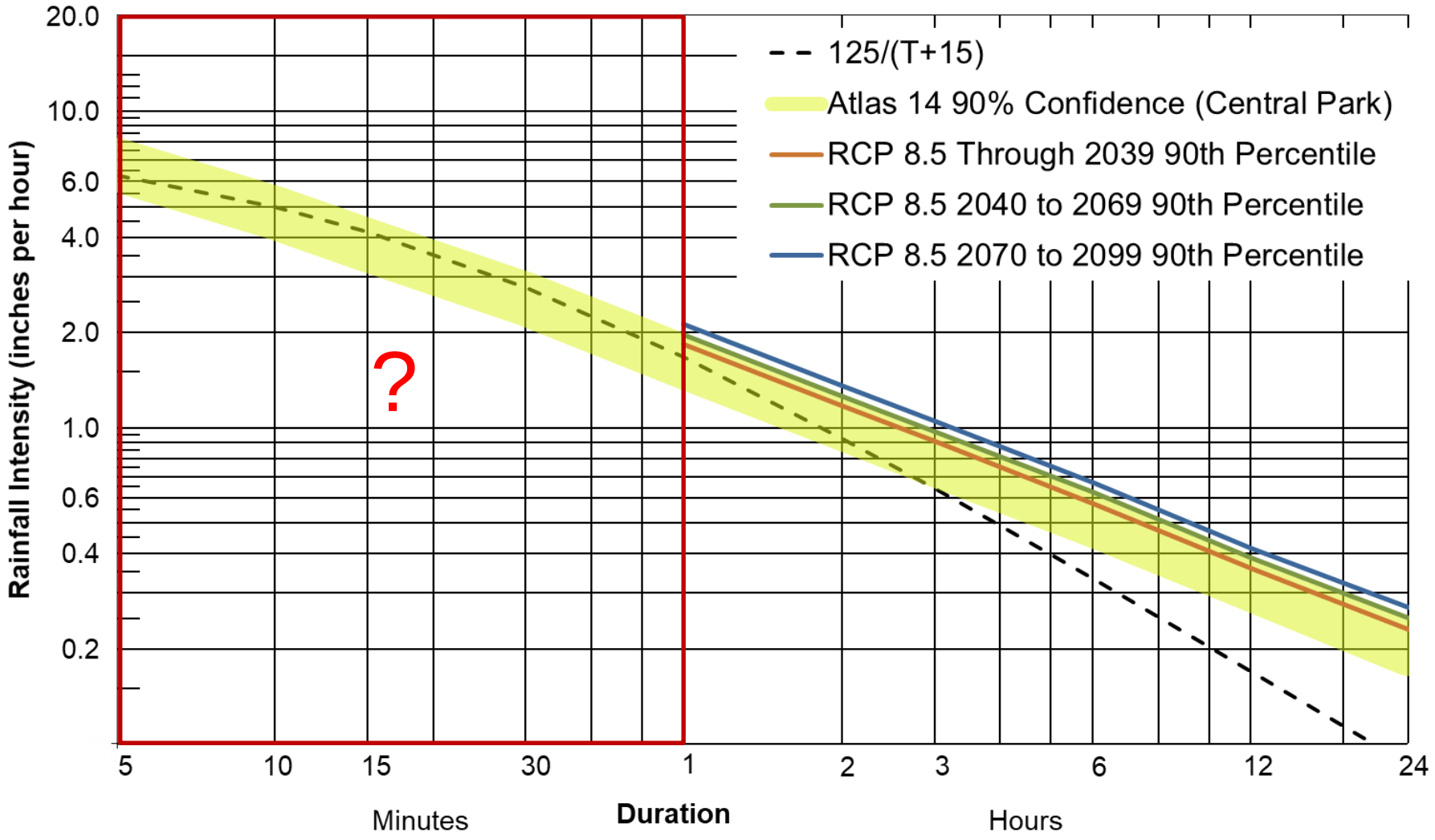
- A single curve is applied citywide; historically based on observed rainfall data from 1903 to 1951.

- Application focused on short duration, high frequency events (5-10 year return periods).



Updating precipitation data using climate models

Historical observations (Atlas 14) and sewer design curve (125/T+15) compared with downscaled, high-emissions climate scenario (Representative Concentration Pathway 8.5)

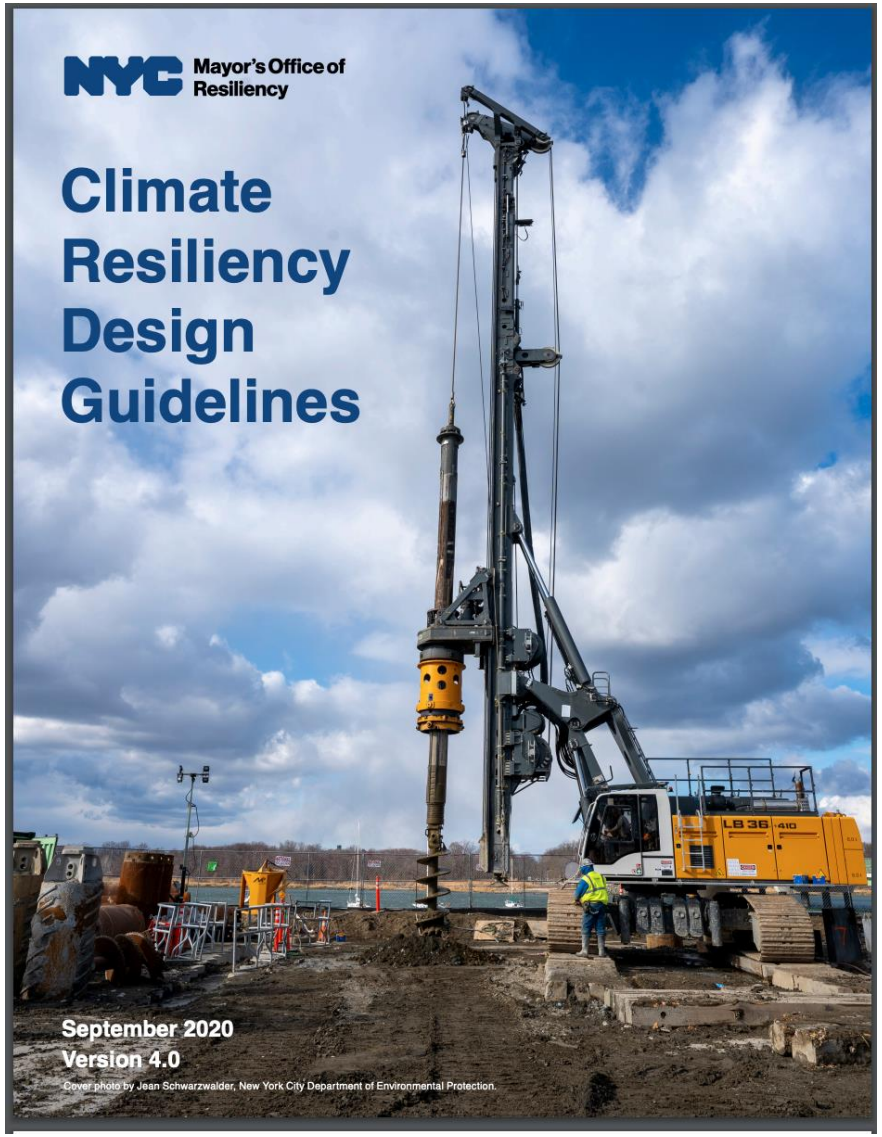


Incorporating climate data into design

Goal: establish consistent approach for using climate change data across the City capital plan

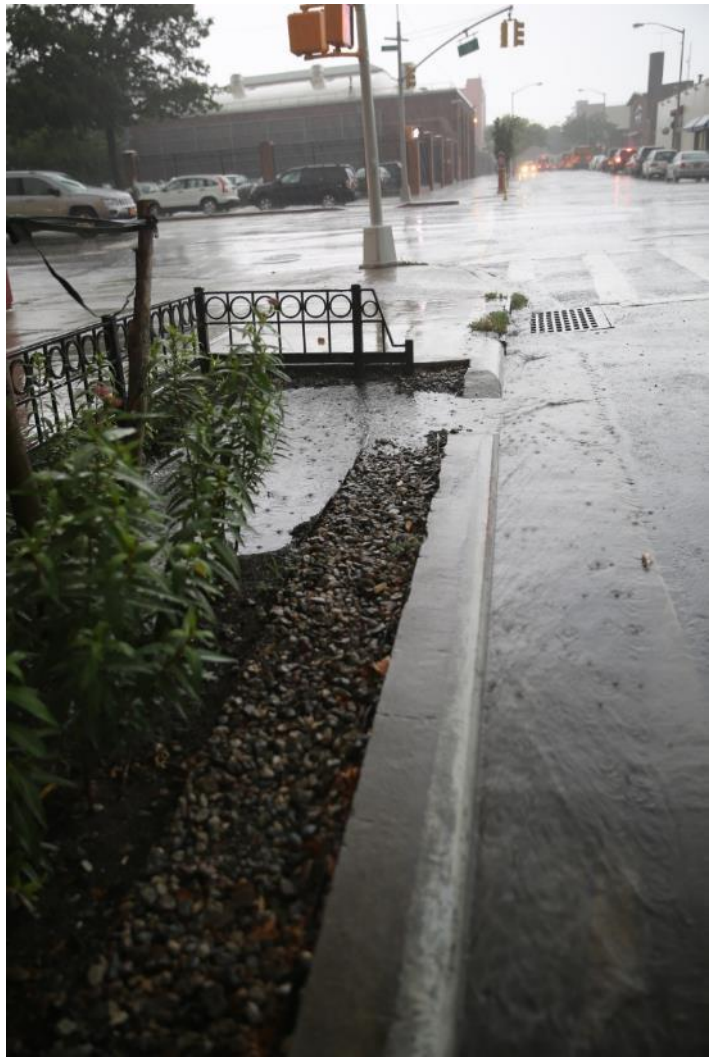
- For use by NYC agencies, engineers, architects, landscape architects and planners
- For new capital construction and major rehabilitations
- Buildings, infrastructure, and landscapes
- Not applicable to coastal protection projects and private development

New resilient design standards for:
1) extreme heat; 2) extreme rainfall; 3) tidal inundation with sea level rise; and 4) coastal storms



Incorporating precipitation data into design

Precipitation design adjustment for on-site stormwater systems



"Choose the right combination of interventions after considering the project type, site location, operational requirements, cost, benefits, and useful life of the intervention."

- Utilize strategies that infiltrate, evaporate, or reuse rainwater
- Install stormwater infiltration, detention, and storage
- Protect areas below grade from flooding
- Develop plan to keep catch basin grates clear

NYC is maximizing infiltration where feasible

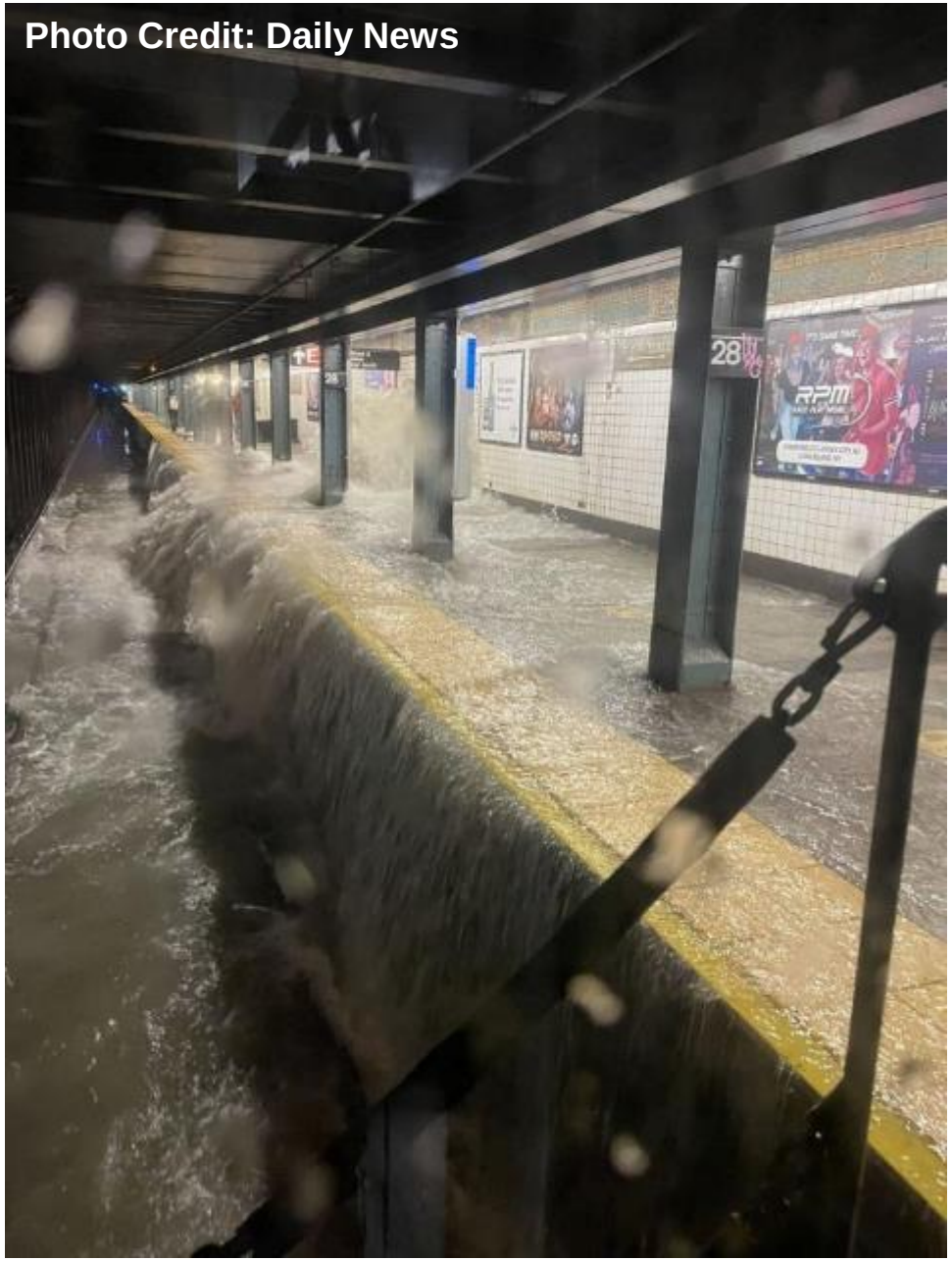
City Sidewalks


City Streets


Grant Program for Private Property Owners


Public Property Retrofits

Record-Breaking Rainfall in 2021



Tropical Storm Elsa: July 8-9

- Max 1-hr rainfall rate: 2.75 to 3 in/hr

Tropical Storm Henri: August 21-23

- Central Park reported 4.45 inches of rain on Aug. 21 alone, with 1.94 inches falling between 10 to 11pm.

Tropical Depression Ida: September 2

- The Central Park rain gauge set a new record for 1-hour rainfall with 3.15 inches (previously 1.94 in. from Tropical Storm Henri)

Green infrastructure can alleviate flooding

September 2015: Cloudburst event in Copenhagen, Denmark

Public spaces can also be used for flooding

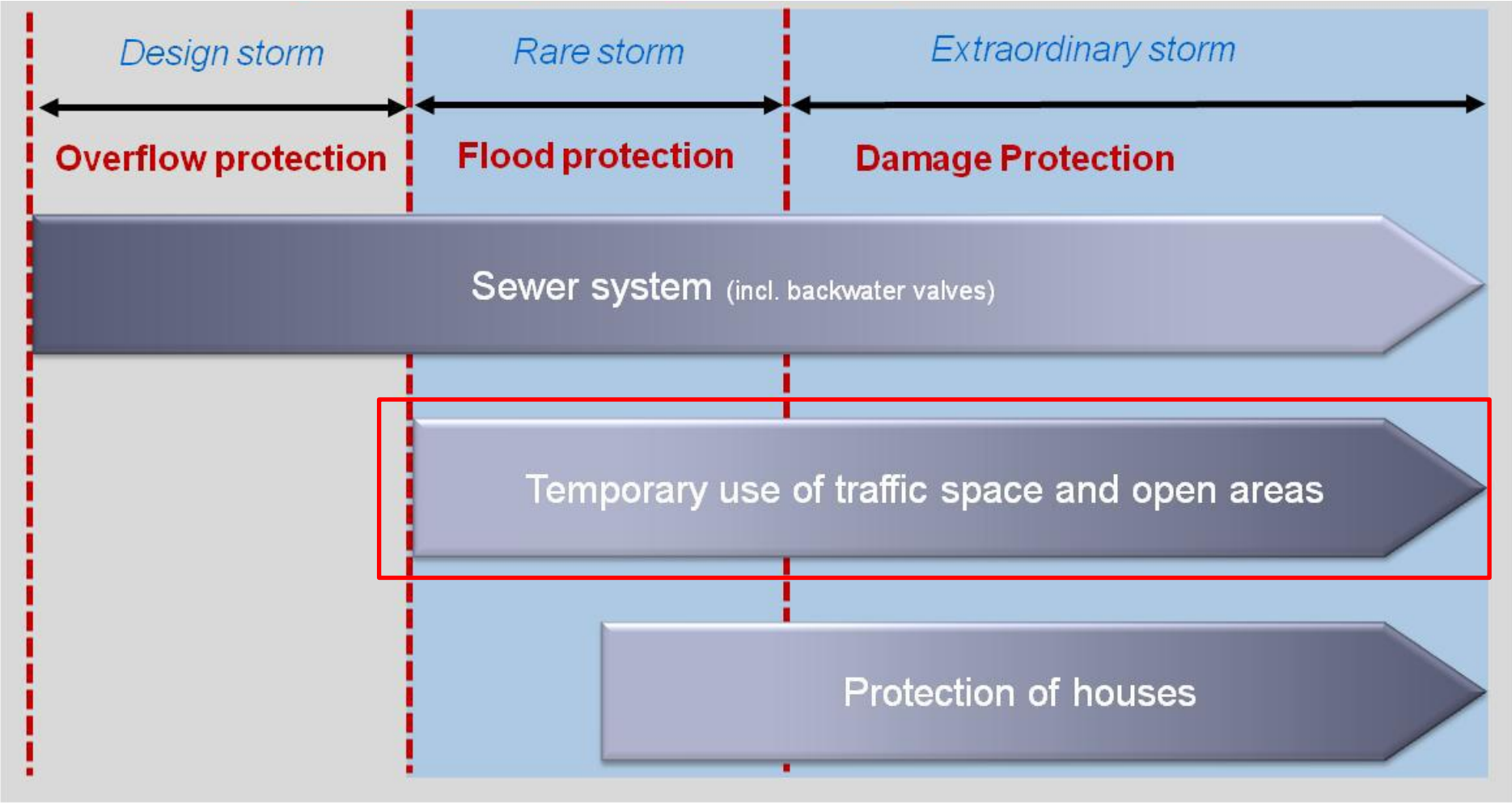
Rotterdam's "Water Square"

Cloudburst Resiliency Planning Study

Objectives

- Manage stormwater for both everyday and extreme rain events
- Incorporate stormwater management with well-designed outdoor space and infrastructure
- Use stormwater features to enhance connectivity

What is our objective?



Elements of flood protection of municipal drainage systems (Reference: DWA, 2008)

Applying climate projections to design

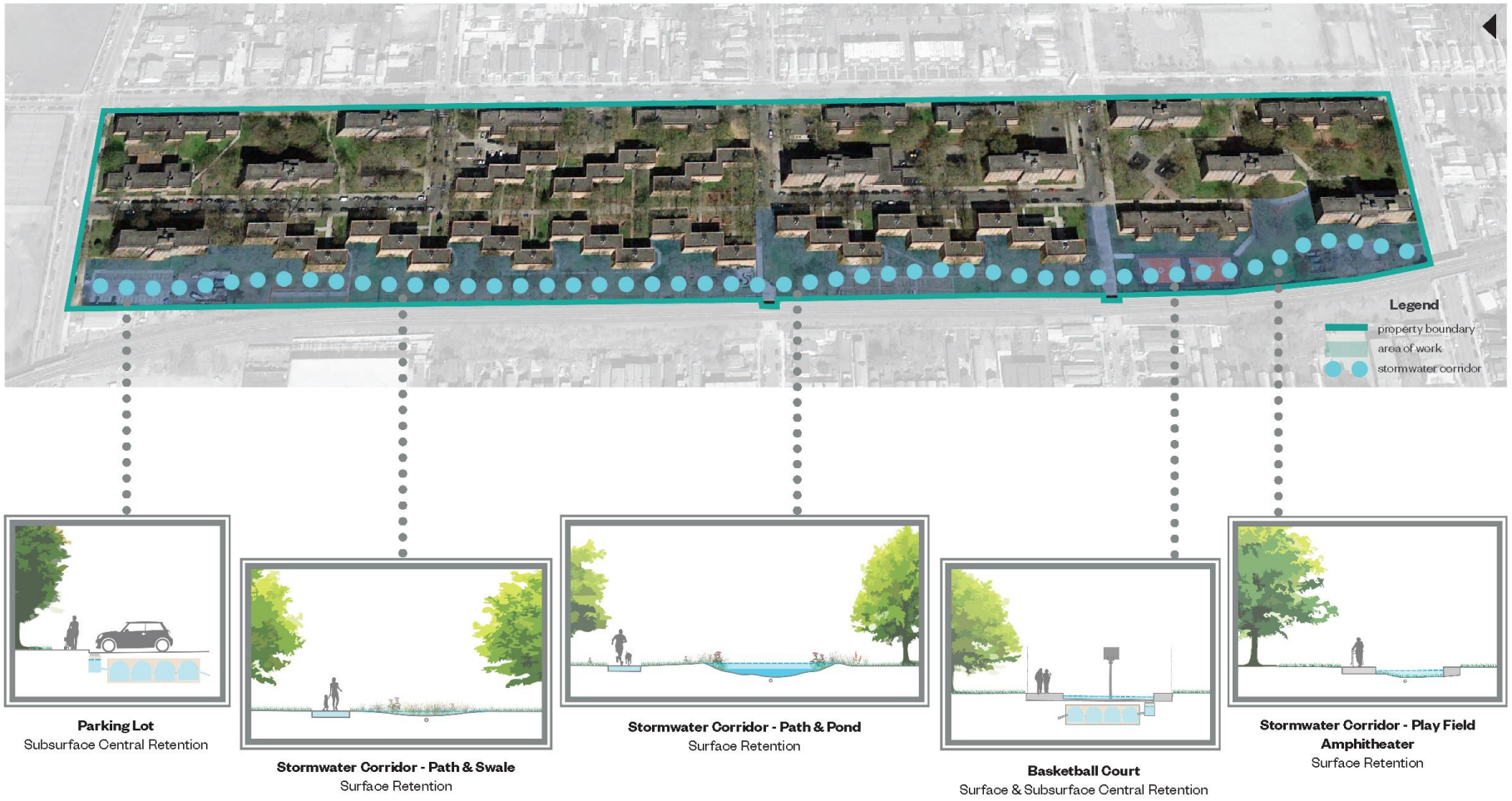
1-hour duration rainfall depths			
End of useful life	5-year design storm (in)	50-year design storm (in)	100-year design storm (in)
Baseline	1.61	2.57	2.87
Through to 2039	1.83	3.02	3.41
2040-2069	1.97	3.33	3.93
2070-2099	2.12	3.74	4.34

10-year
2.30

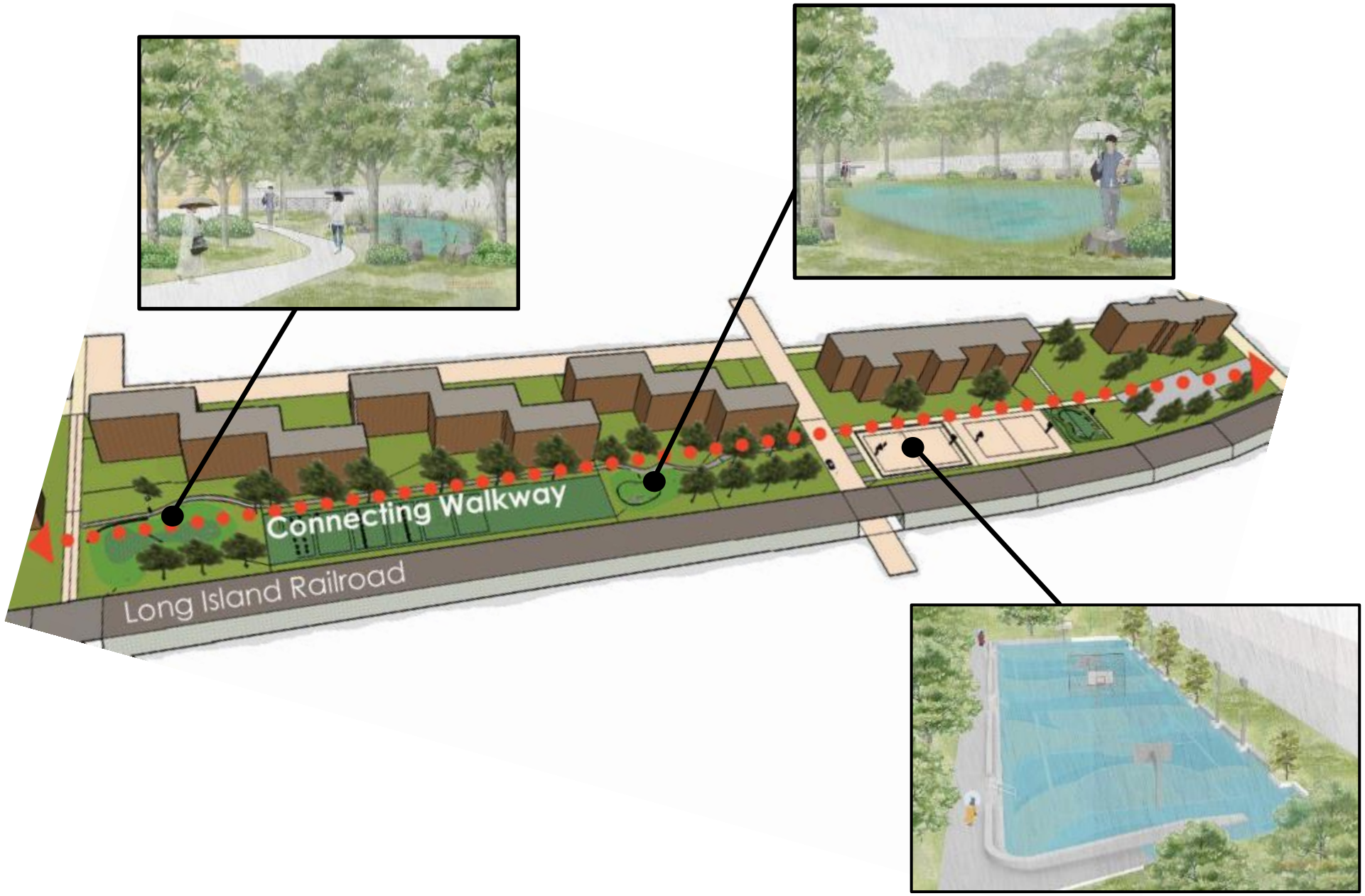
24-hour duration rainfall depths			
End of useful life	5-year design storm (in)	50-year design storm (in)	100-year design storm (in)
Baseline	4.70	7.83	8.79
Through to 2039	5.41	9.21	10.55
2040-2069	5.88	10.13	12.31
2070-2099	6.35	11.28	13.40

South Jamaica Houses Pilot Project

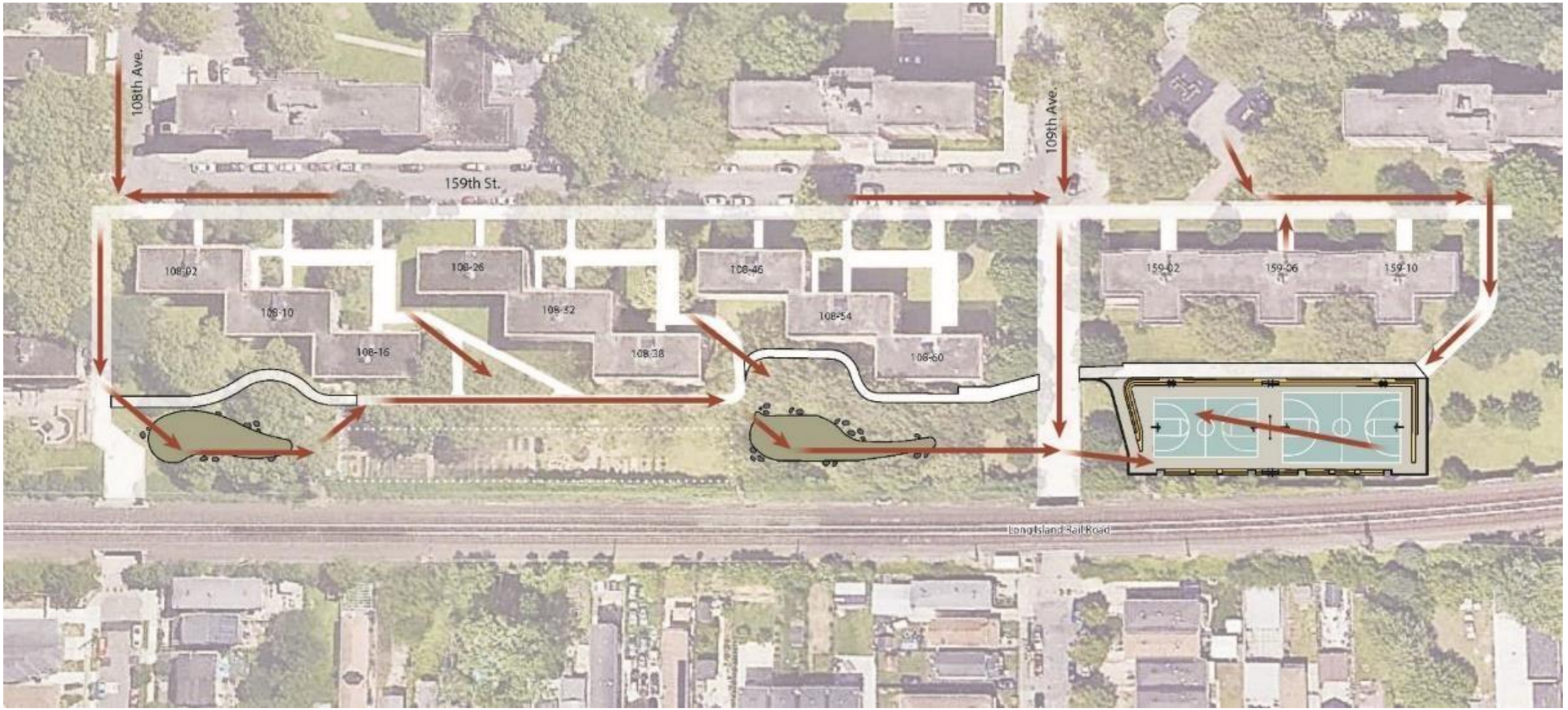
- **Goal**: Manage stormwater for a moderate event (~10-yr storm), creating a "Stormwater Corridor" through the property



Stormwater systems designed for future 10-year storm



Drainage pipes will be diverted from the sewer



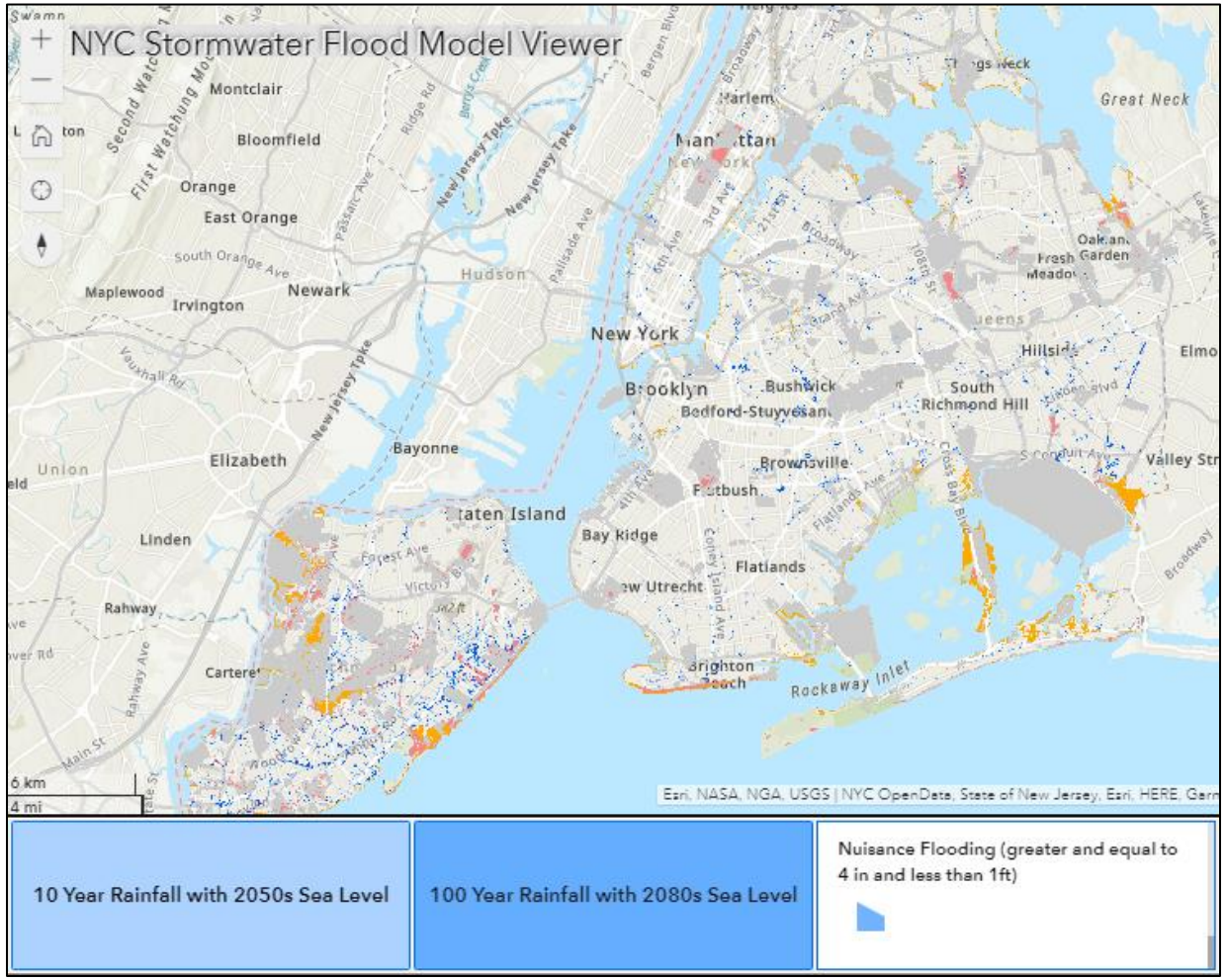
Extreme Rainfall – Evaluating the Impacts

The Stormwater Resiliency Plan reflects critical science that says:

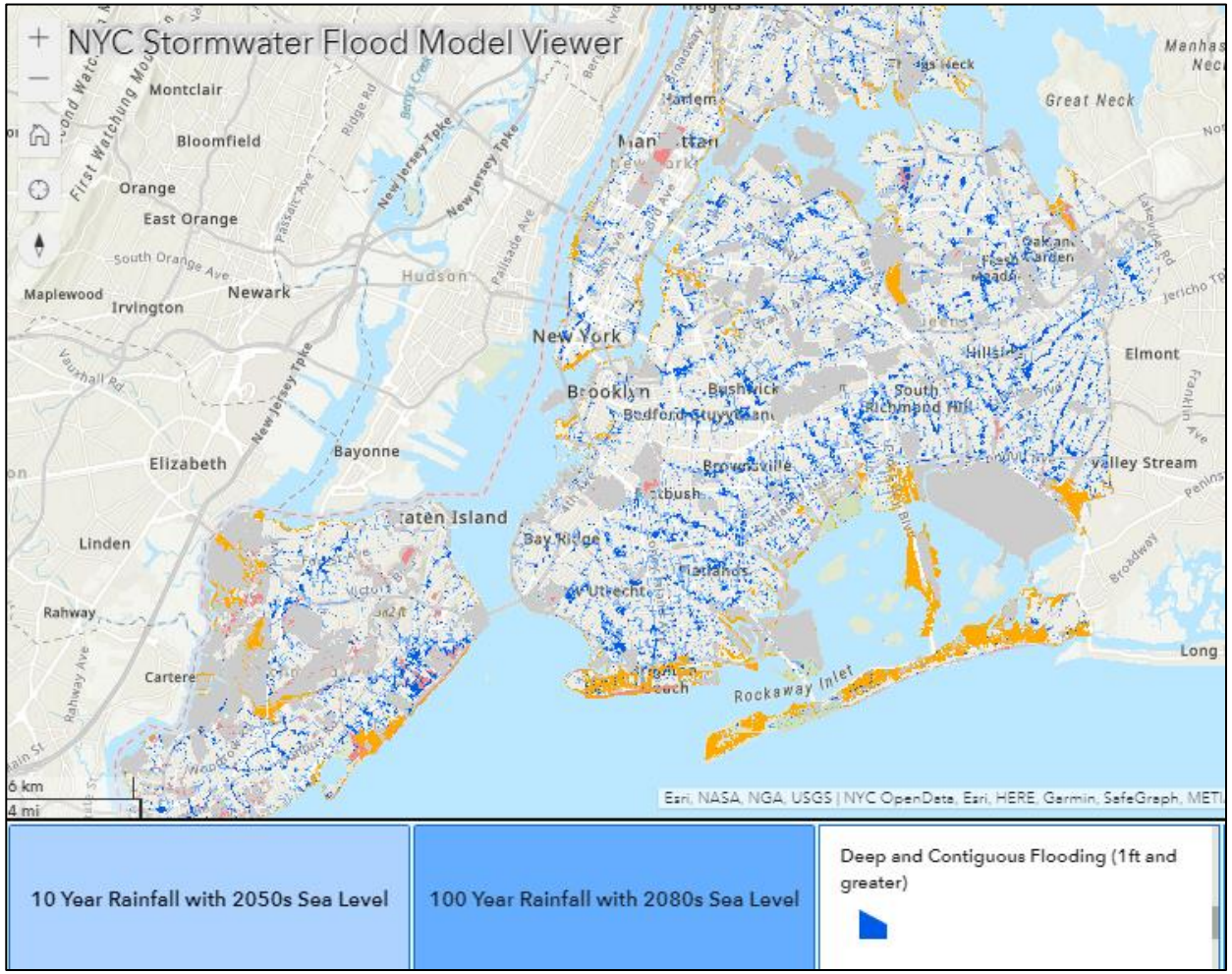
- **Precipitation events are intensifying.**
- Extreme rain events **can cause flooding in neighborhoods that are inland**, away from the coast.
- Extreme rain is **hard to predict and can occur suddenly**.

In **May 2021** the City released its first **Stormwater Resiliency Plan** to communicate the impact of extreme rainfall, and share plans to strengthen the City's sewer infrastructure and pilot innovative long-term strategies like cloudburst management

NYC Citywide Stormwater Flood Maps



Moderate Stormwater Flood
(10-yr + SLR)



Extreme Stormwater Flood
100-yr + SLR

The New Normal: A Deeper Dive into the Commitments

SCIENCE

- Expanding **the flood sensor network** citywide
- Integrating flood maps and **improve citywide models of combined flood risk**
- Improving **future projections of extreme precipitation**

Links and Contact Information

- NYC Stormwater Resiliency Plan and NYC Stormwater Flood Maps: www.nyc.gov/resiliency
- NYC DEP Climate Resiliency: www.nyc.gov/dep/climatechange
- Contact: alanc@dep.nyc.gov