# Reducing Flood Risk to Key Wastewater Infrastructure in NYC

*Climate Risk Assessment and Adaptation Study*

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# Climate Change Planning

***Since 2007, DEP has been proactively investigating the impacts of climate change on its infrastructure…***

# City-wide Climate Framework

## 1) Climate Analysis:

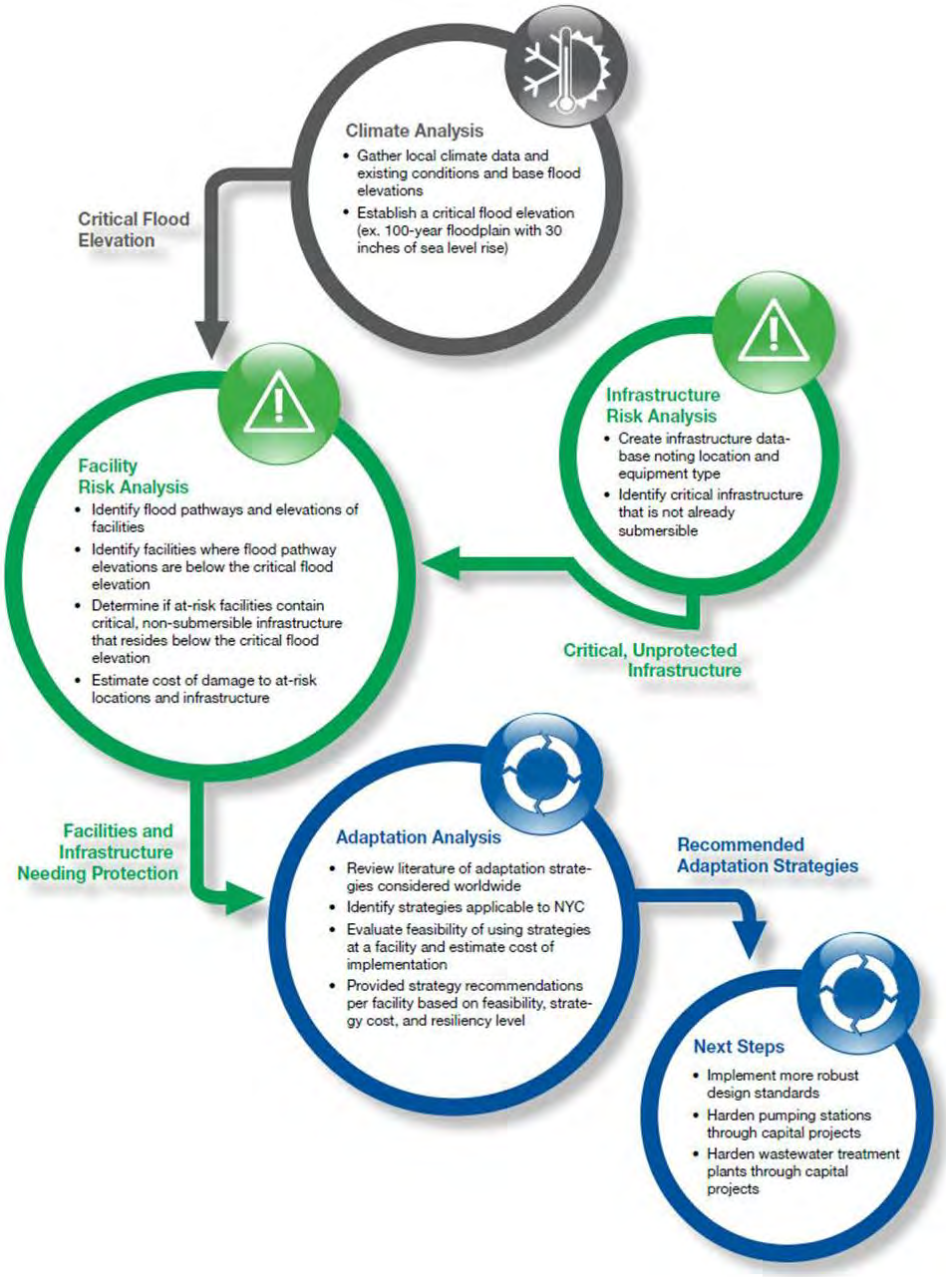
- What future climate and storm surge conditions should NYC prepare for?

## 2) Risk Analysis:

- What are the critical flood pathways ?
- What buildings and assets are at risk?
- What is the value of assets at risk?

## 3) Adaptation Analysis:

- What protective measures should be implemented to reduce risk while balancing resiliency and cost?



# Building-Level Vulnerability Assessment

- Performed site visits and analyzed each facility for flood pathways and threshold elevations.
- Locations identified as at-risk if threshold elevations are below the assigned flood elevation *(100-yr ABFE + 30-inches SLR).*

## *Common Flood Pathways:*


Rollup Doors


Doorways & Windows


Areaways


Tunnels


Grates


Electrical Conduits and Manholes

# Asset-Level Vulnerability Assessment

- Target Assets include:
  - Equipment associated with primary treatment
  - Electrical equipment
  - Pumps and motors

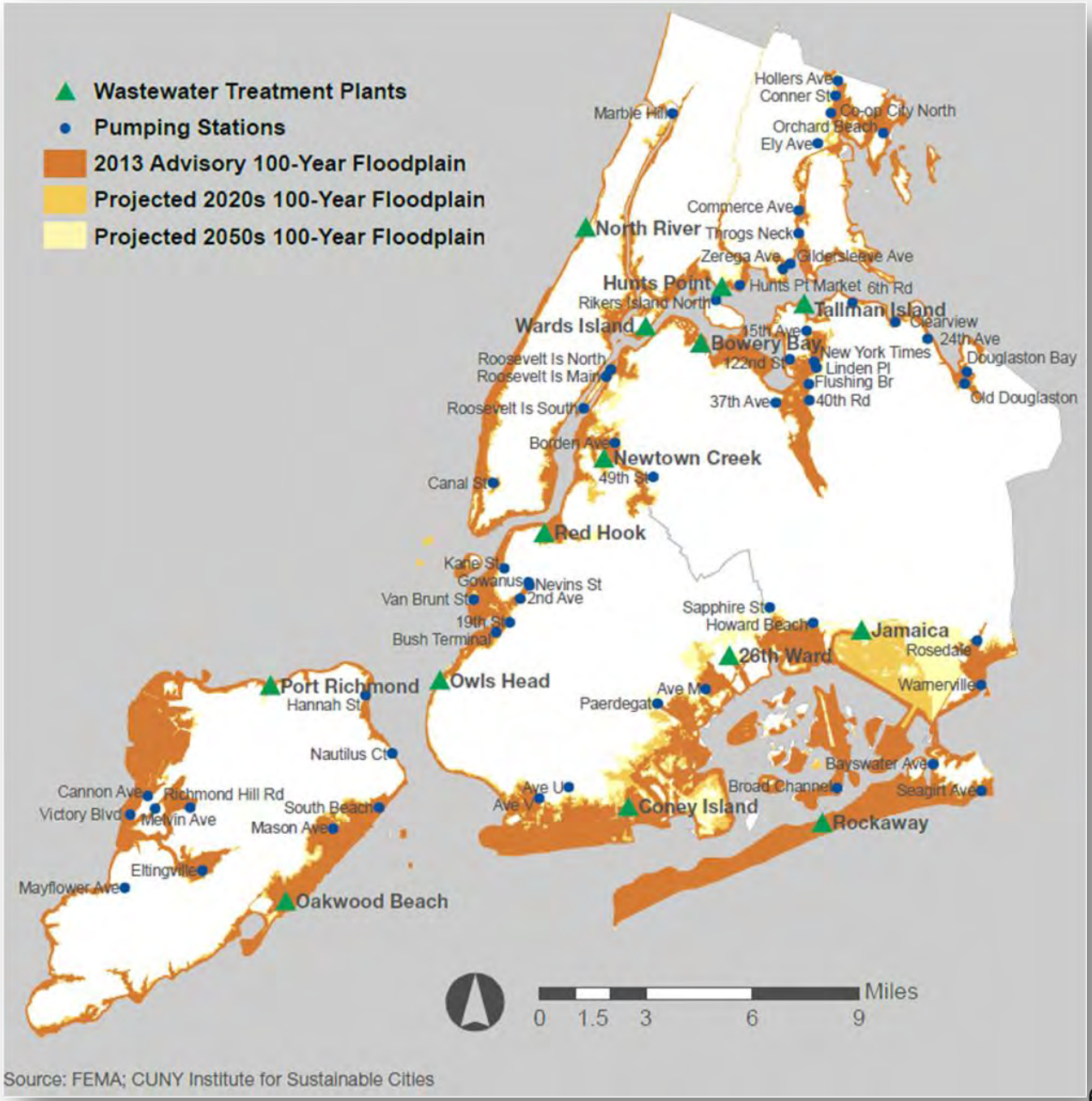
- Target asset identified as at-risk- situated below the assigned flood elevation *(100-yr ABFE + 30 inches SLR),* and are not submersible.

*Electrical assets located underground in the RAS Gallery at 26th Ward WWTP are at risk of flood damage.*

# Facilities At-Risk of Storm Surge Inundation

Based on 100-year floodplain plus 30 inches of SLR:

- All 14 treatment plants and 60% of pumping stations are at risk.
- Over $1.1 billion of assets are at risk if no protective measures are implemented



# Prioritization Approach

Prioritization considered against seven metrics:

1. Historical Frequency of Flooding
2. Historical Loss of Power
3. PS Tied in with Other PS (Daisy Chained or Grouped)

**Operational Metrics**

4. Tributary Area Population Impacted
5. Number of Critical Facilities Impacted
6. Beaches Impacted

**Vulnerability Metrics**

7. Included in DEP's 10 year Capital Plan

**Other Metrics**

# Adaptation Strategies / Protective Measures

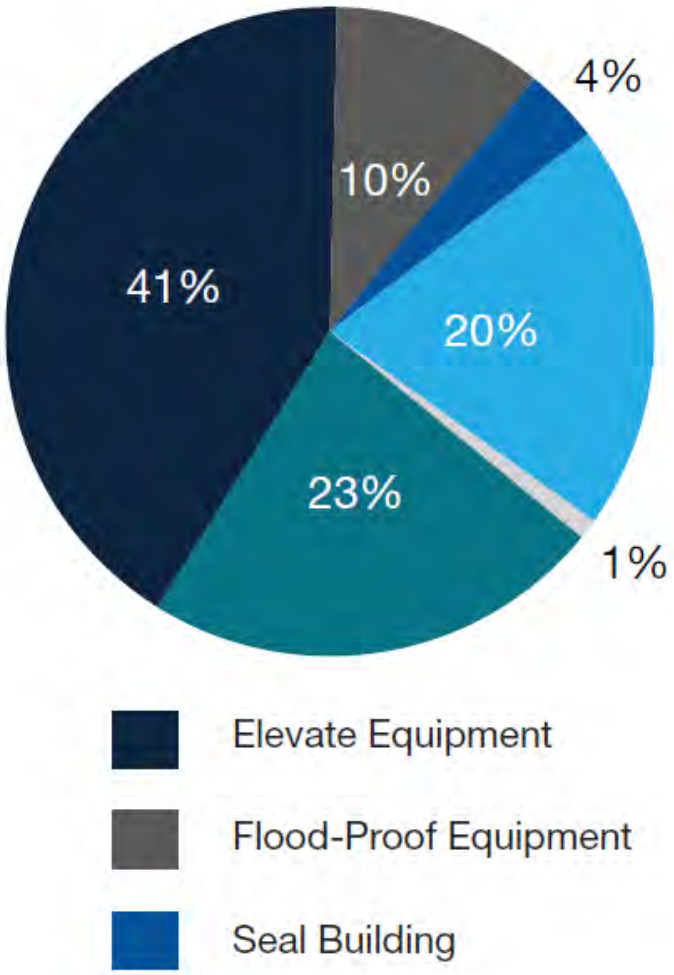
- Identified site-specific protective measures to minimize prolonged service interruption and flood risk, while balancing *feasibility*, *resiliency*, and *cost*.

- Established robust design guidelines for future wastewater infrastructure upgrades/designs that assist in mitigating flood risk.

| Adaptation Strategy | | Resiliency/Effectiveness | Cost |
|---|---|---|---|
|  | **Elevate Equipment** on pads or platforms, to a higher floor, to the roof, or to a new elevated building. |   | $$$$ |
|  | **Flood-Proof Equipment** by replacing pumps with submersible pumps and installing watertight boxes around electrical equipment. |   | $$$ |
|  | **Install Static Barrier** across critical flood pathways or around critical areas. |   | $$$ |
|  | **Seal Building** with water-tight doors and windows, elevating vents and secondary entrances for access during a flood event. |   | $$ |
|  | **Sandbag Temporarily** around doorways, vents, and windows before a surge event. |   | $ |
|  | **Install Backup Power** via generators nearby or a plug for a portable generator. | *Does not protect equipment but facilitates rapid service recovery.* | $$$ |

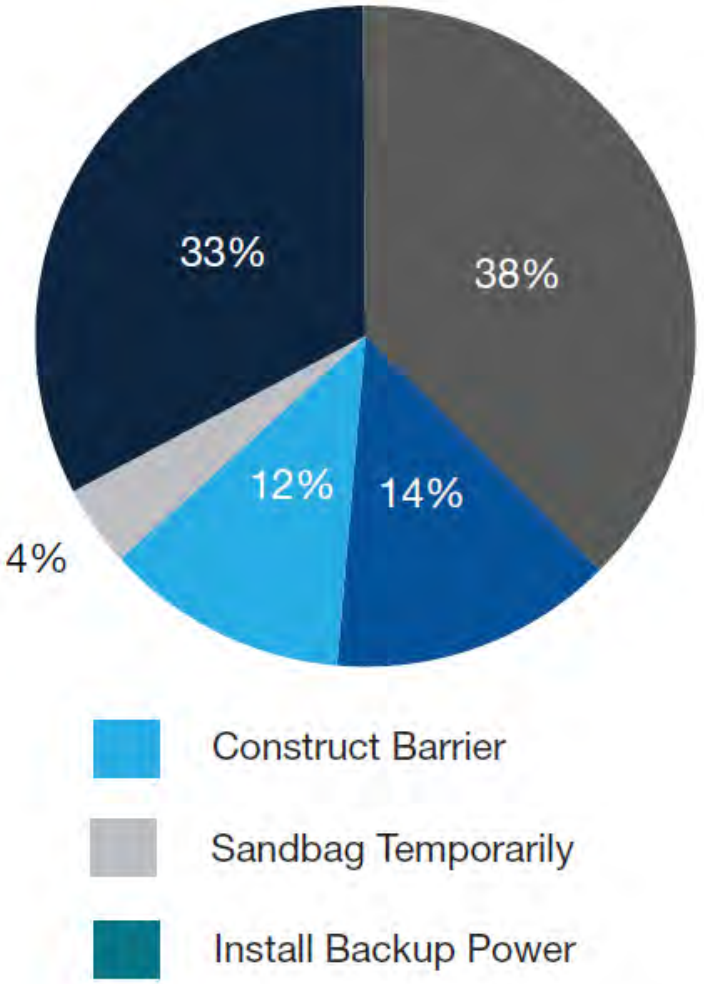
# Recommended Adaptation Strategy Allocations

## Pumping Stations

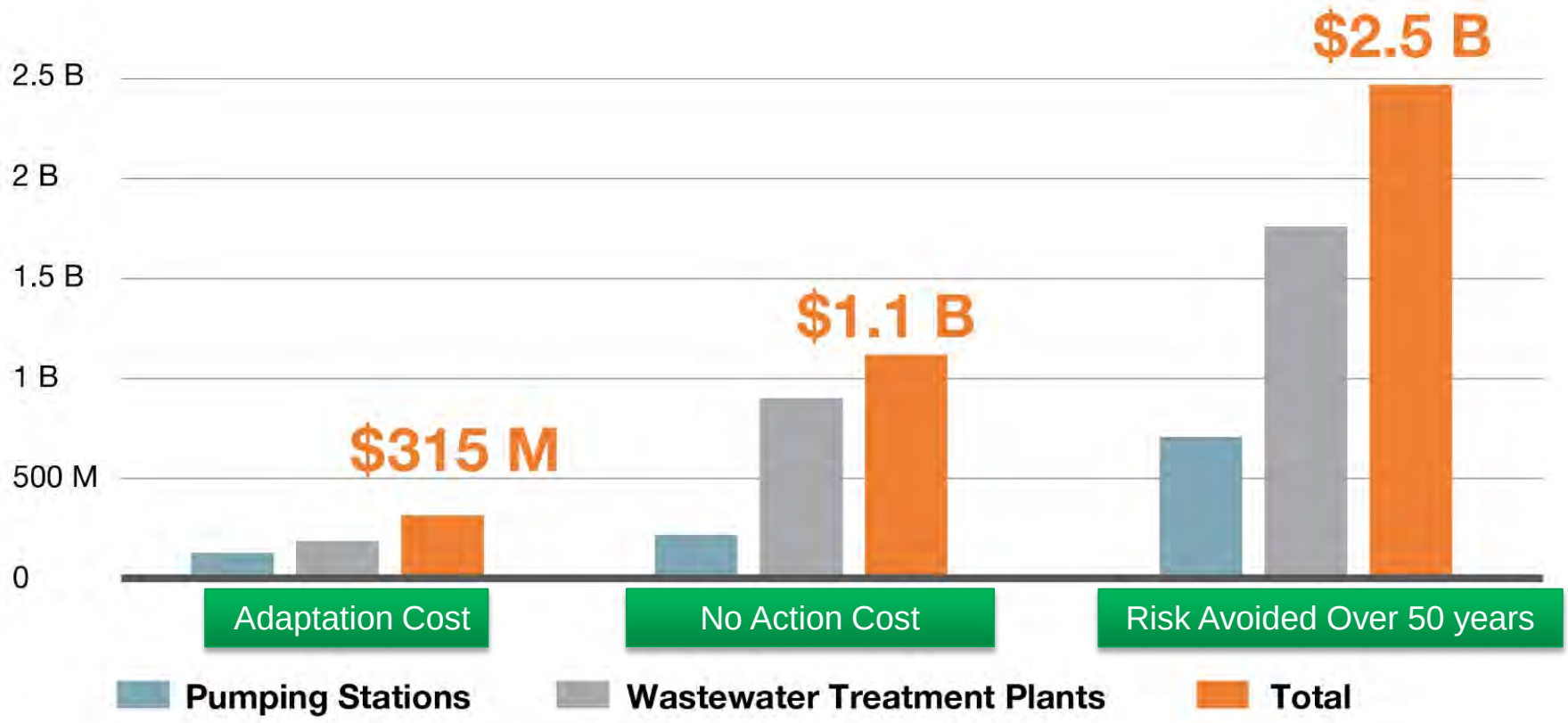



## Wastewater Treatment Plants

Note: All facilities are already equipped with backup power generators



# Summary of Costs




Investing **$315 Million** in strategic fortification can safeguard **$1.1 Billion** of vital infrastructure and save the city **$2.5 Billion** in emergency response costs over the next 50 years.

*All estimates are based on AACE Level 5 Cost Estimate guidelines as noted in the NYCDEP BEDC Cost Estimating Manual*

# Green Infrastructure for Resiliency


Green streets

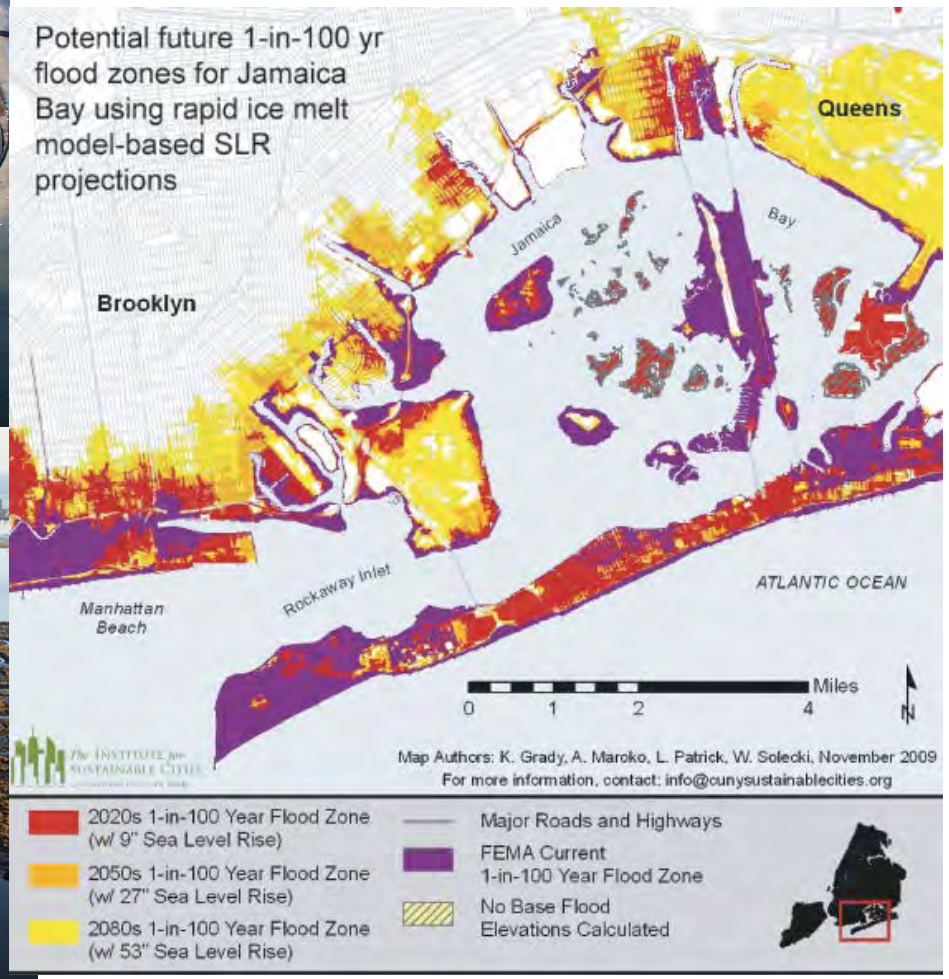
Blue Roofs

Porous Pavements

Staten Island Bluebelt

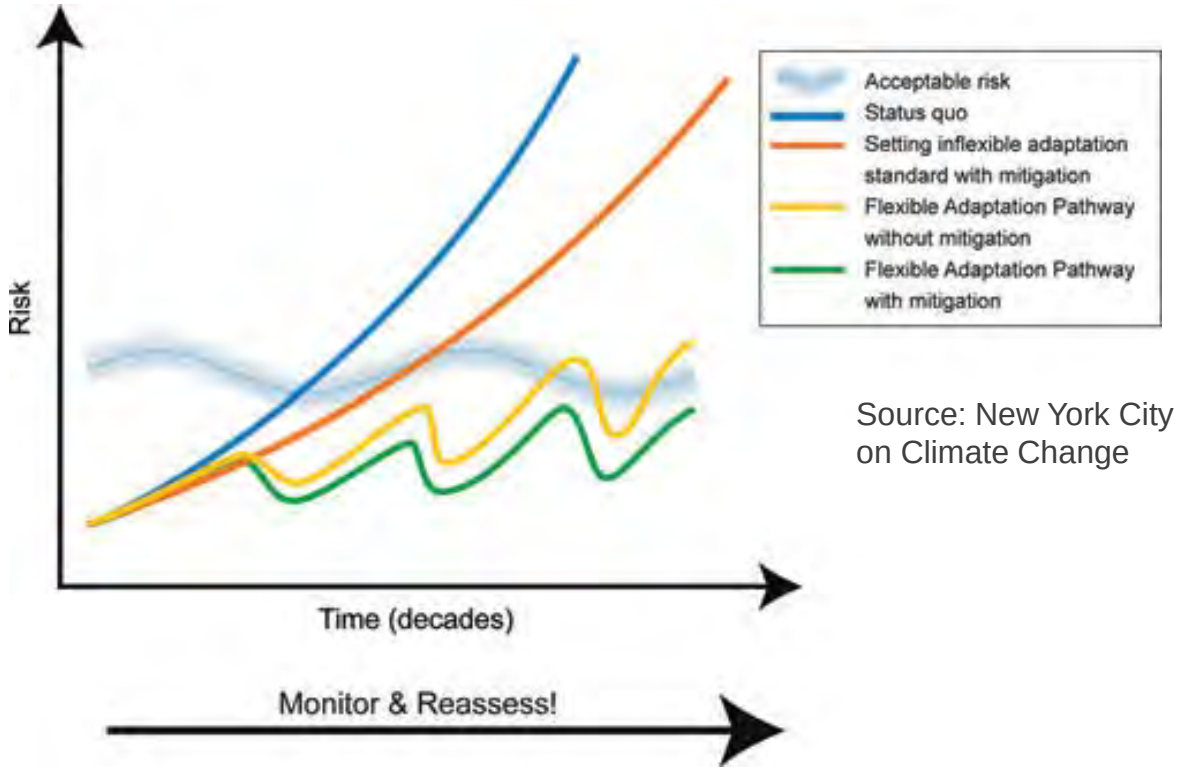
Bioswales

# Restoring New York Harbor



# Climate Resilience Summary

- Adaptation can come in many forms:
  - adjustments in **operations and management**
  - **capital investments** in infrastructure
  - policies that **promote flexibility**
  - recalibrating **design standards**
  - leveraging **co-benefits** and pursuing **no-regrets** strategies




Source: New York City Panel on Climate Change

Environmental Protection

# Precipitation, Watershed, and Tide Gate Analysis

# Watershed Planning & Analysis

***Conducted in Three Phases:***

## Phase 1: Precipitation Analysis

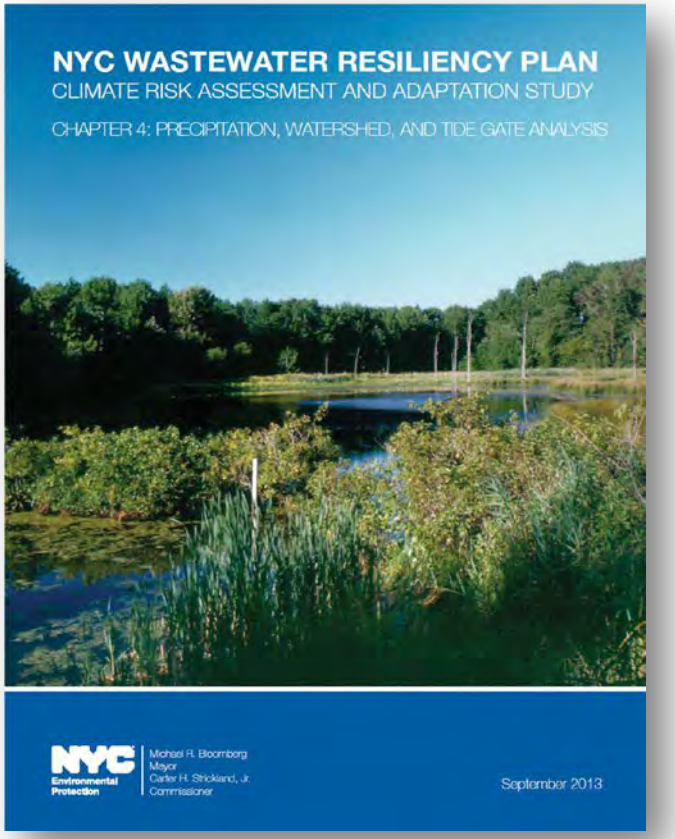
- Assess whether sewer design data and CSO LTCP modeling need updating
  - Intensity-Duration Frequency (IDF) Curves
  - "Typical Rainfall Year" Basis

## Phase 2: Watershed Analysis

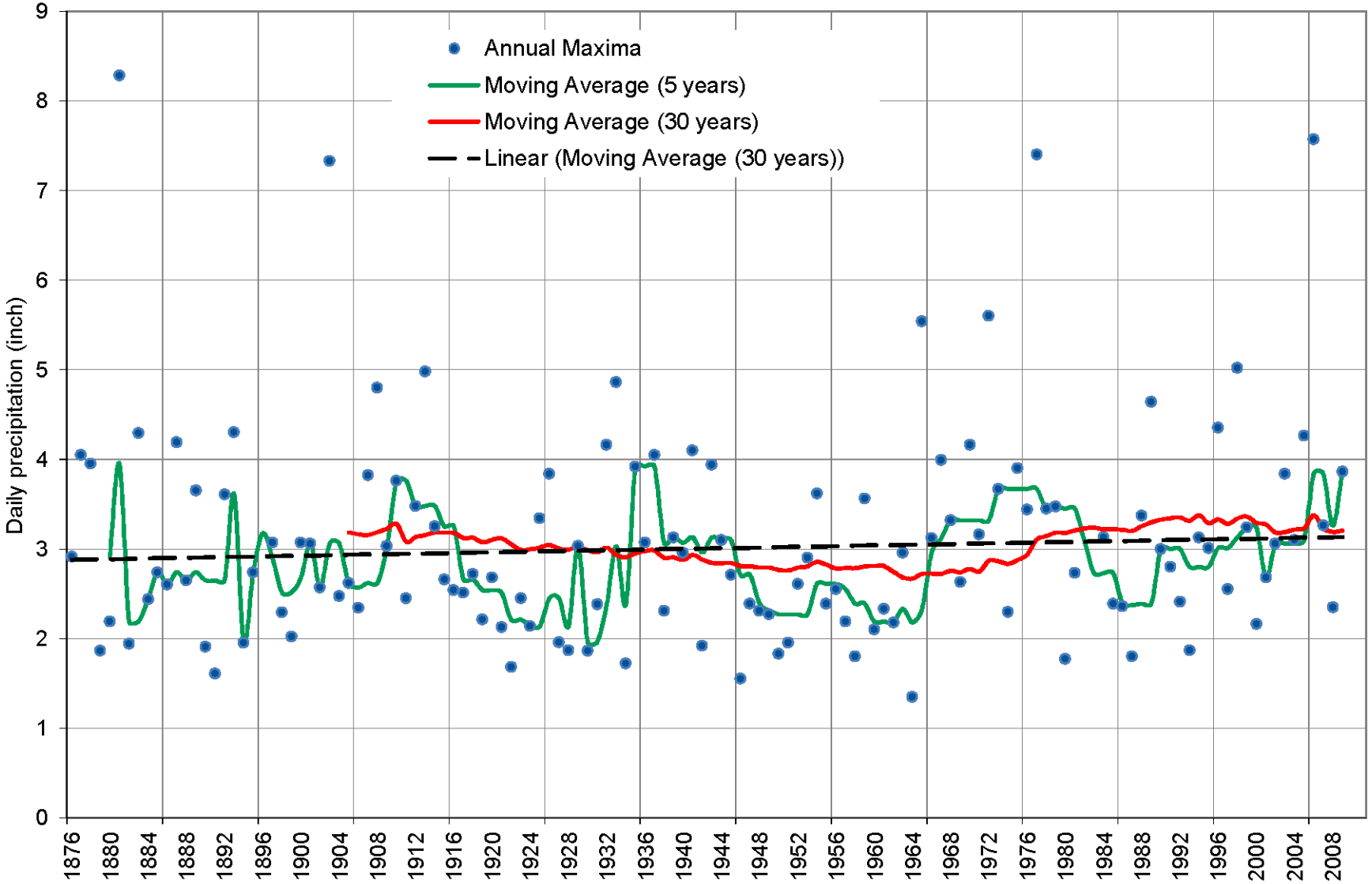
- Assess impact of changes in sea level and precipitation on drainage system performance
  - CSO Frequency and Street Flooding

## Phase 3: Tide Gate Analysis

- Assess effectiveness, cost, and benefits of installing tide gates at stormwater outfalls to prevent storm surge inundation in adjacent communities



# Rainfall Trend Analysis

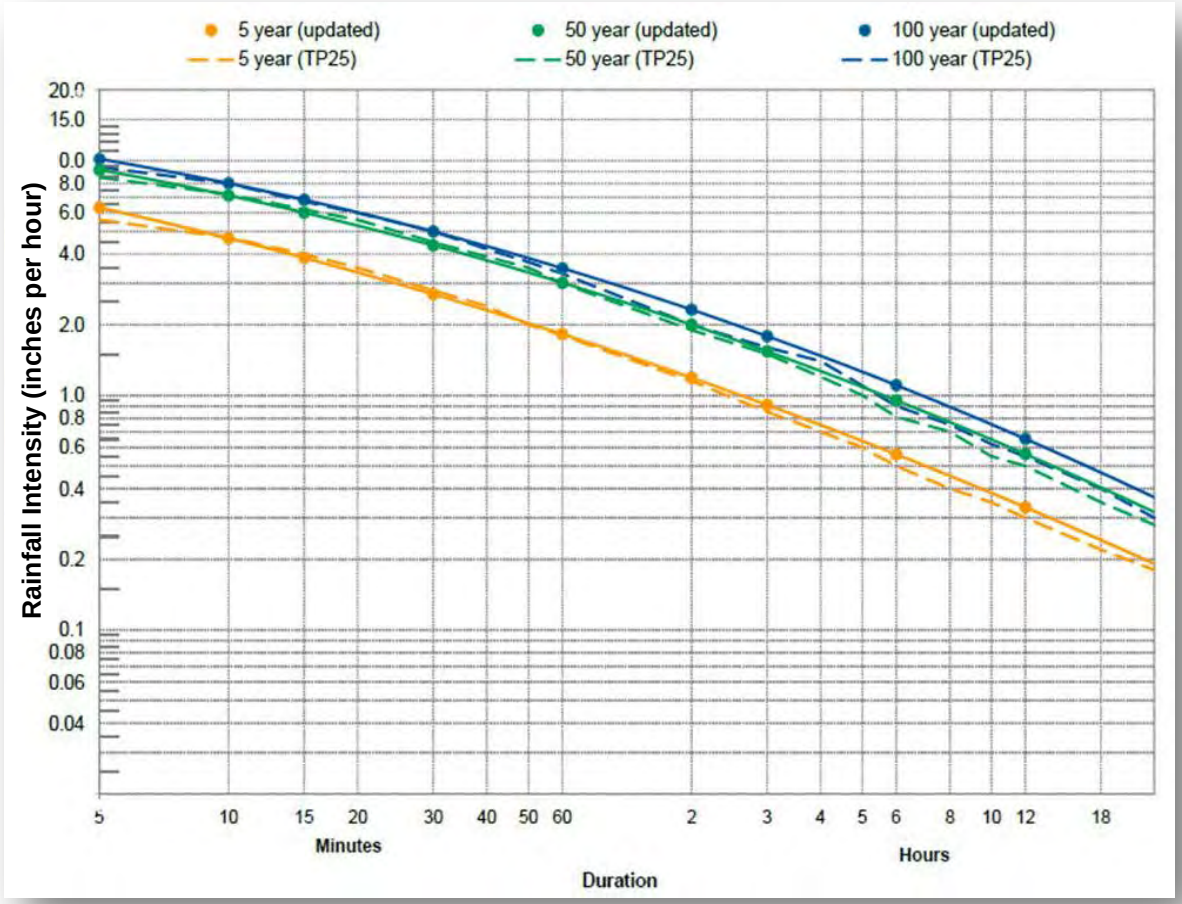


# Phase 1: Precipitation Analysis

## *Summary of Findings:*

- Assessed an additional 50-yrs of regional precipitation data
- Expanded historical record show no statically significant trend towards more intense rainfall events
- Confirmed that current drainage planning tools (IDF curves) remain suitable for design
- JFK Airport in 2008 identified as the new "typical rainfall year" for LTCP modeling

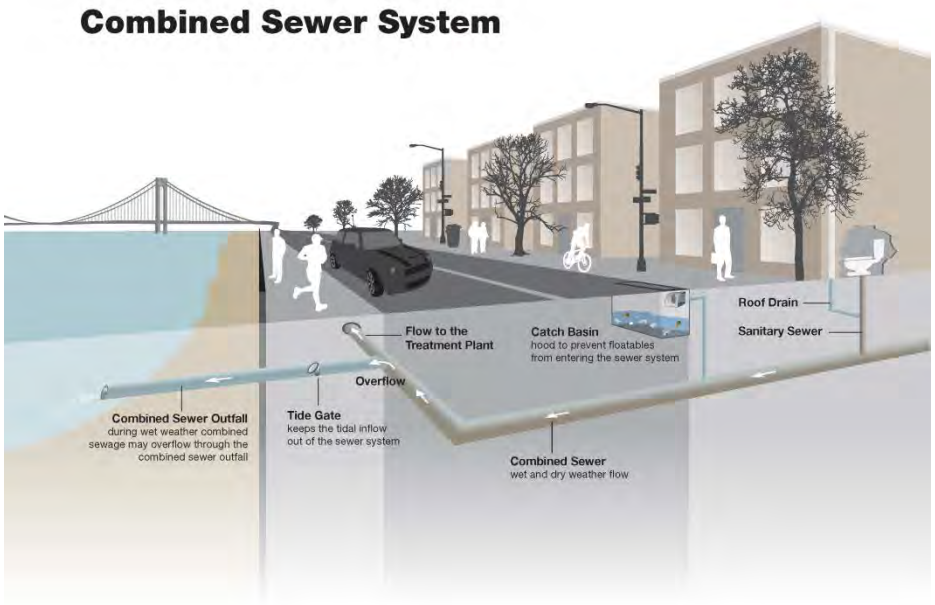
**Comparison of Existing and Proposed Intensity-Duration-Frequency (IDF) Curves**



# Phase 2: Watershed Analysis

## *Summary of Findings:*

- Flushing Bay selected as the representative watershed for analysis
- Analysis indicate that CSO discharges and local flooding would likely increase under future climate conditions due to projected increased precipitation volume
- A combination of green and grey infrastructure will provide the greatest benefit to counter potential increased CSO discharges





Right-of-Way Bioswale in Brooklyn

# Phase 3: Tide Gate Analysis

## *Summary of Findings:*

- Preliminary *static* analysis conducted for 211 DEP owned stormwater outfalls
  - 152 outfalls have no benefit from tide gate installation
  - 59 outfalls require further analysis with dynamic modeling
- Installation of a seawall or other flood barrier is critical to the ability of a tide gate to benefit the community
- Tide gate feasibility and benefits must be assessed on a case-by-case basis

**Stormwater Outfalls Assessed for Tide Gates**

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|---|---|
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**Development Team:**

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