Green Infrastructure & Water Quality

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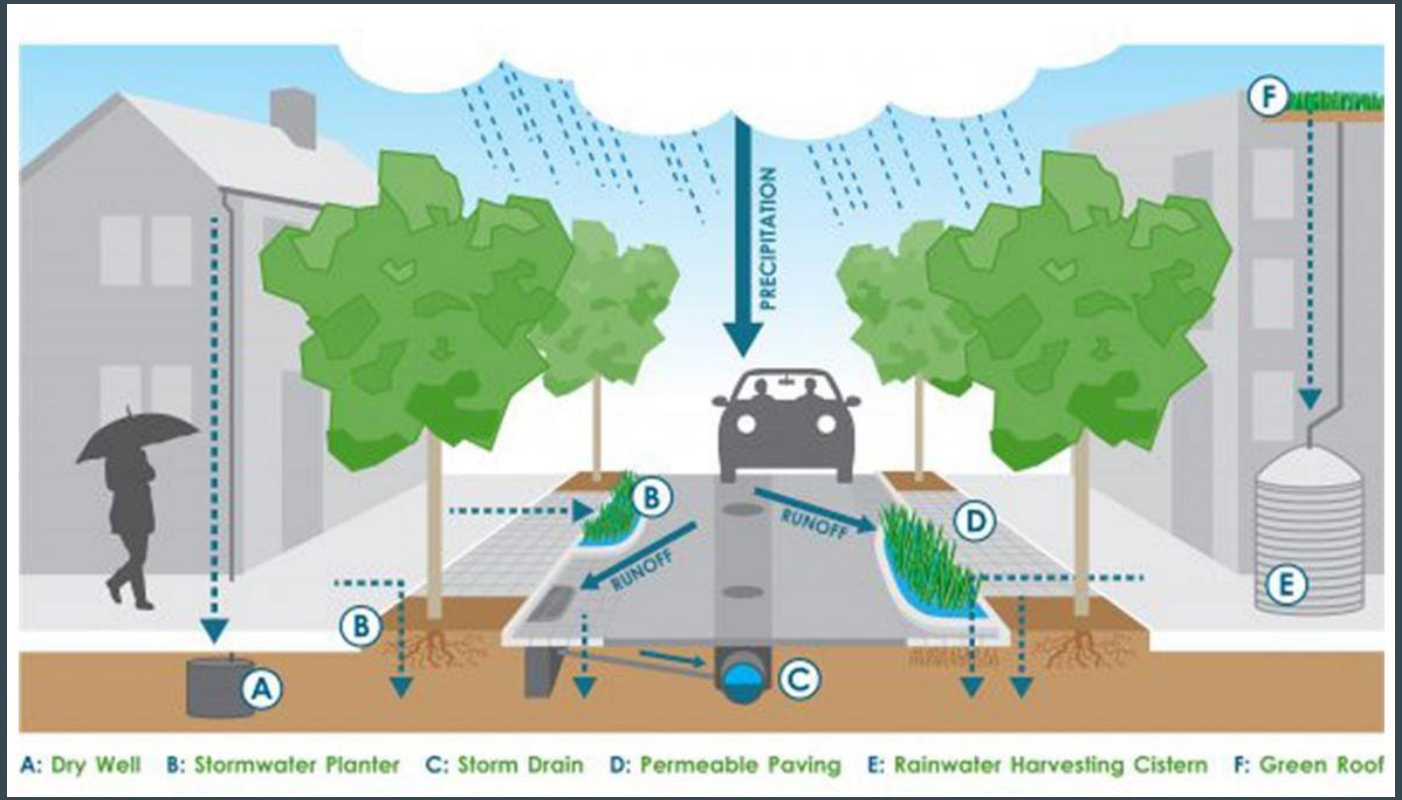
What is Green Infrastructure?

- Definitions:
  - A network of parks, green spaces, and natural open space
  - Engineered spaces designed to trap/redirect stormwater

Green infrastructure manages water by:

RETAINING **REDIRECTING** **REUSING**

What is Green Infrastructure?



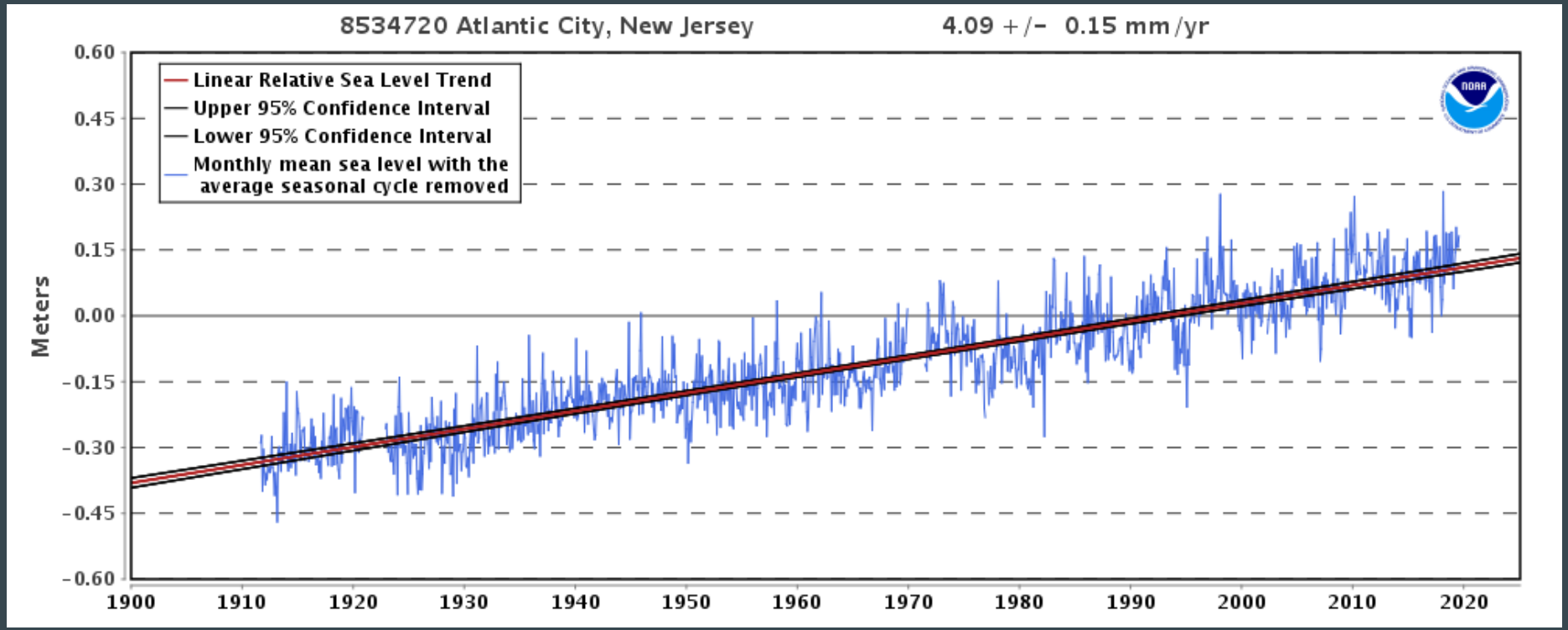
Examples of Green Infrastructure

Perth Amboy is a waterfront city; we want to take advantage of the benefits of the city's waterfront while combating the threats.

Green infrastructure can help Perth Amboy become more resilient to climate threats.

Climate Threats to Perth Amboy

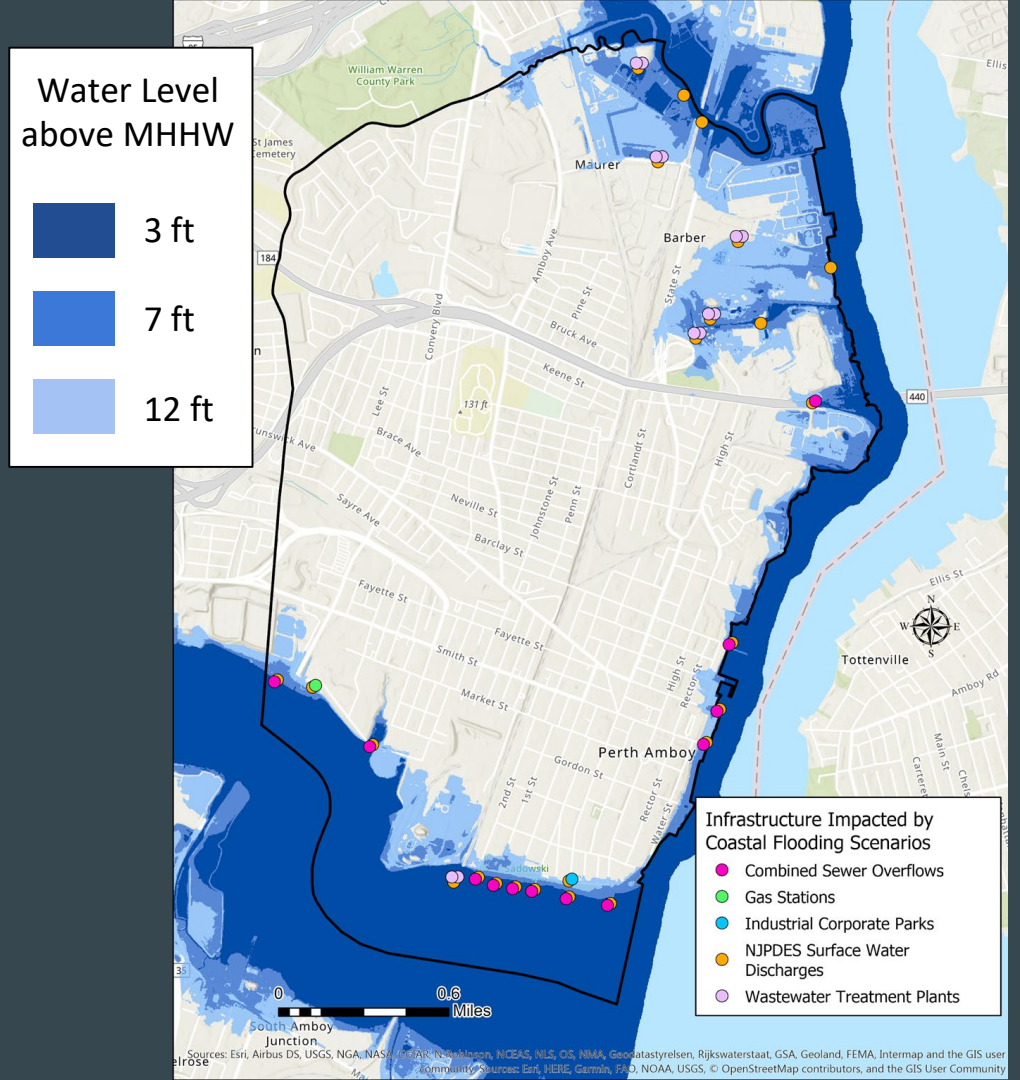
Climate Threats - Sea Level Rise



NOAA

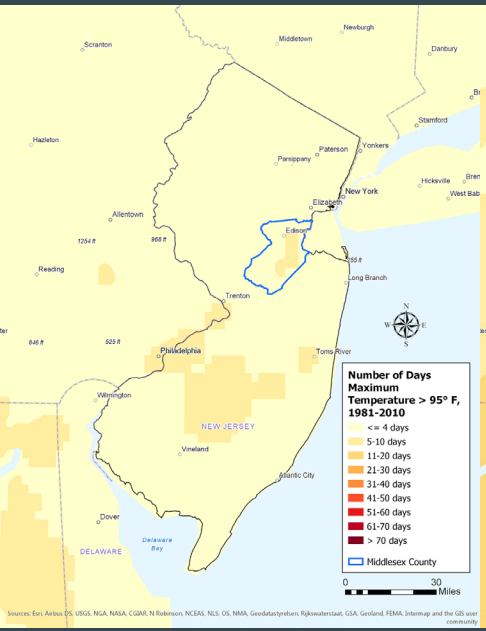
Sea Level Rise and Infrastructure

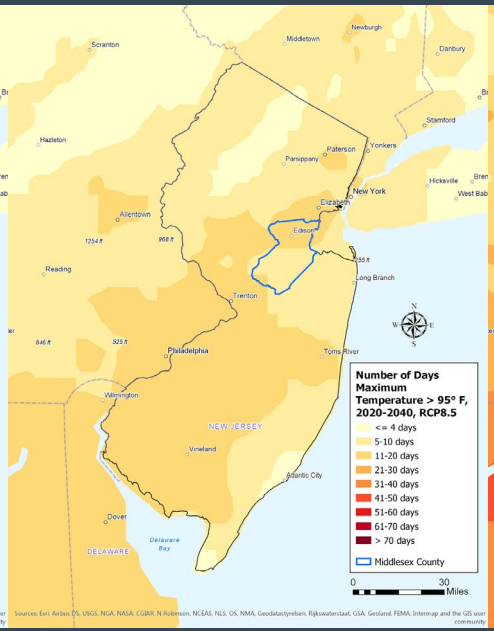
- Wastewater treatment facilities, CSOs, and surface water discharges impacted
- Green infrastructure can redirect floodwaters from essential facilities

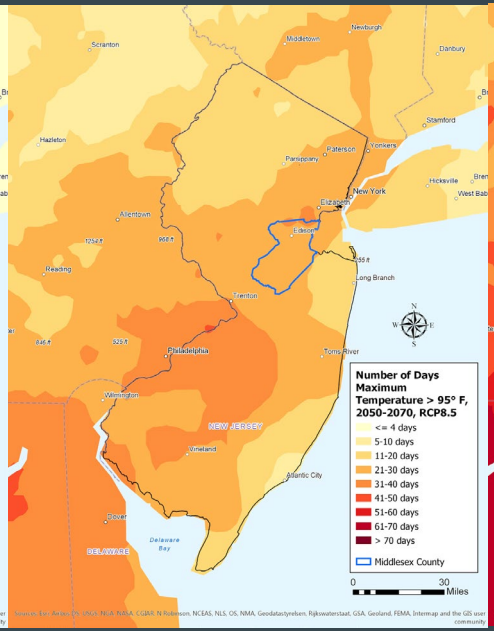


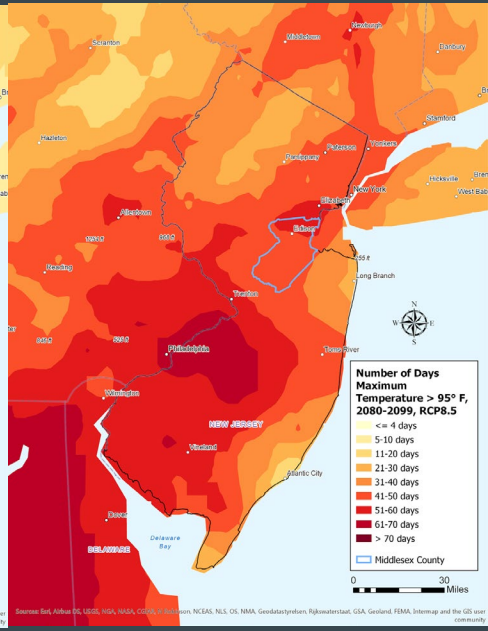
Rutgers, NJDEP

Climate Threats - Heat









Data Source: Rutgers, NJAdapt

Climate Threats - Precipitation

- Extreme precipitation events are increasing in number

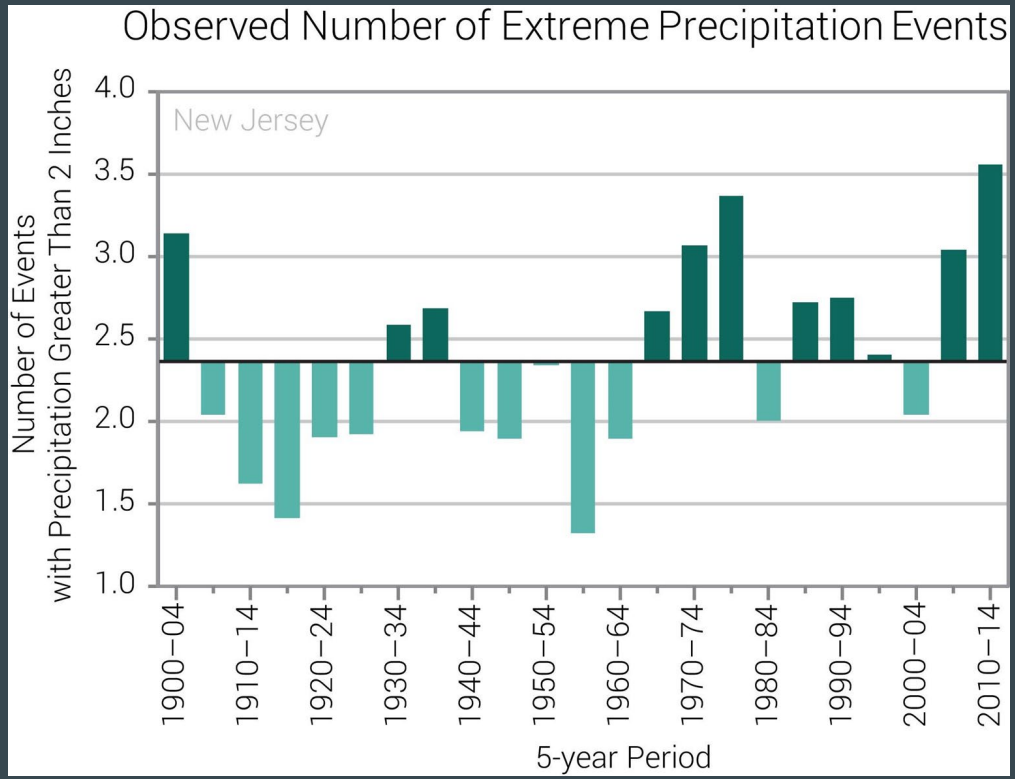


Figure Source: CICS-NC and NOAA NCEI
https://statesummaries.ncics.org/chapter/nj/

Climate Threats - Precipitation

- Perth Amboy is extremely vulnerable to flood events
- Aging infrastructure exacerbates the problem

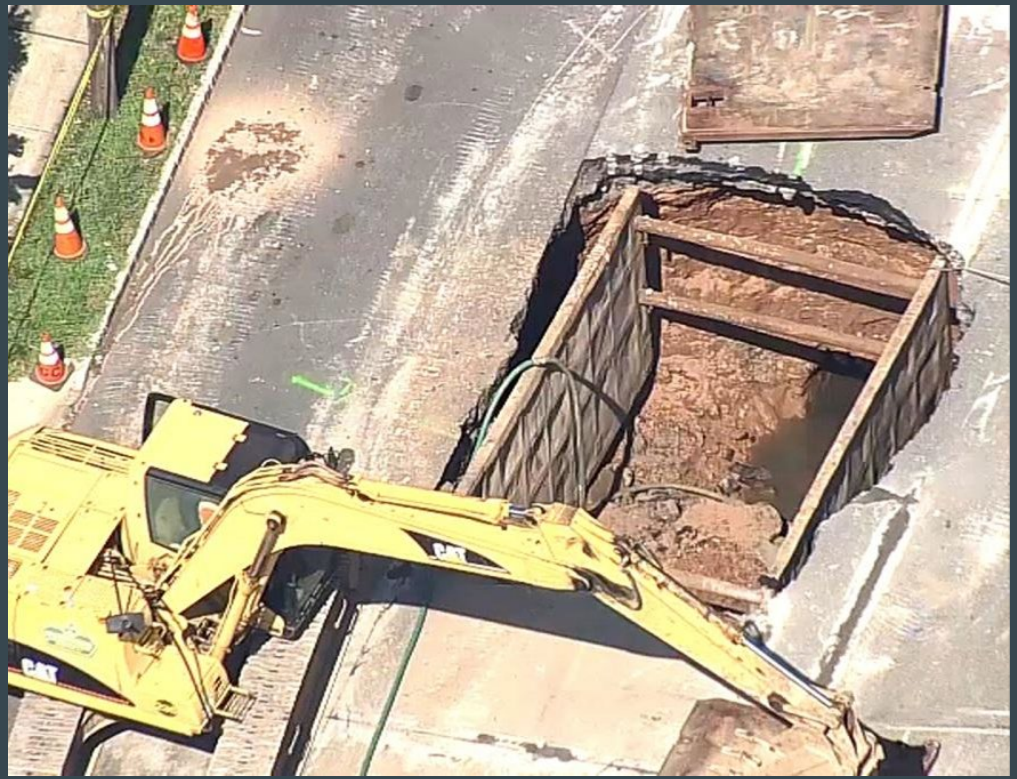
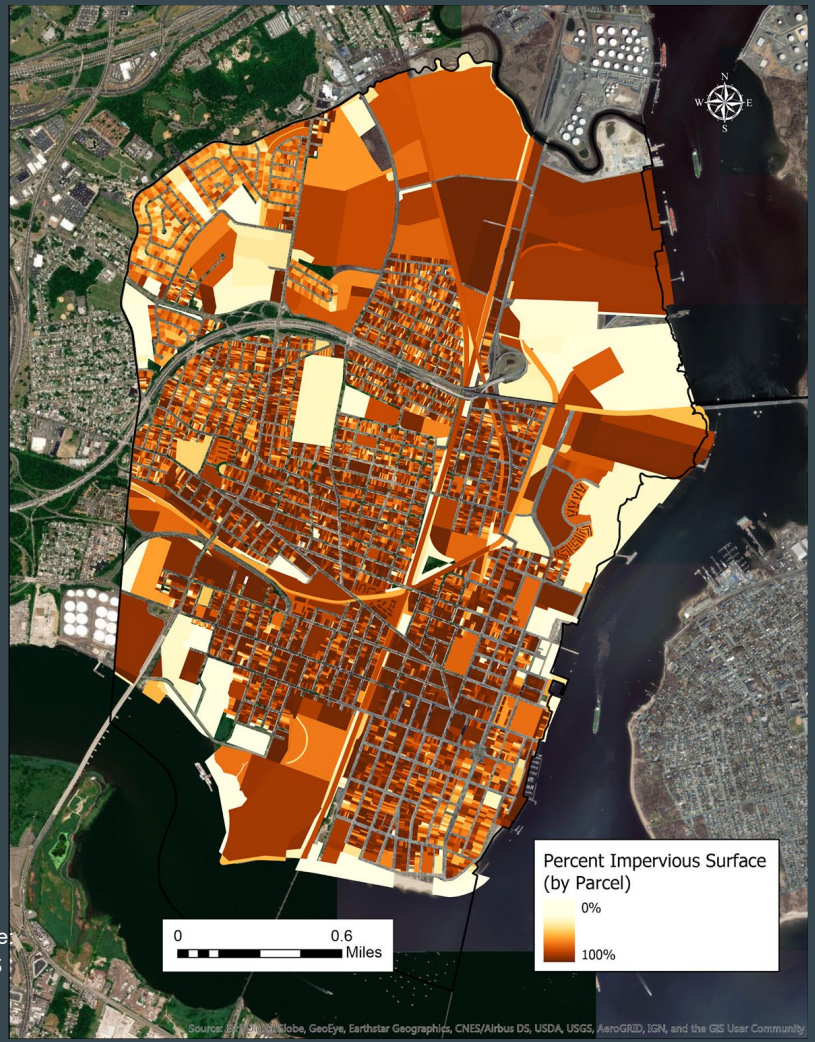


Figure Source: Channel 4 NBC New York
https://www.nbcnewyork.com/news/local/Massive-Sinkhole-New-Jersey-Street-Perth-Amboy-513199411.html

Impervious Cover



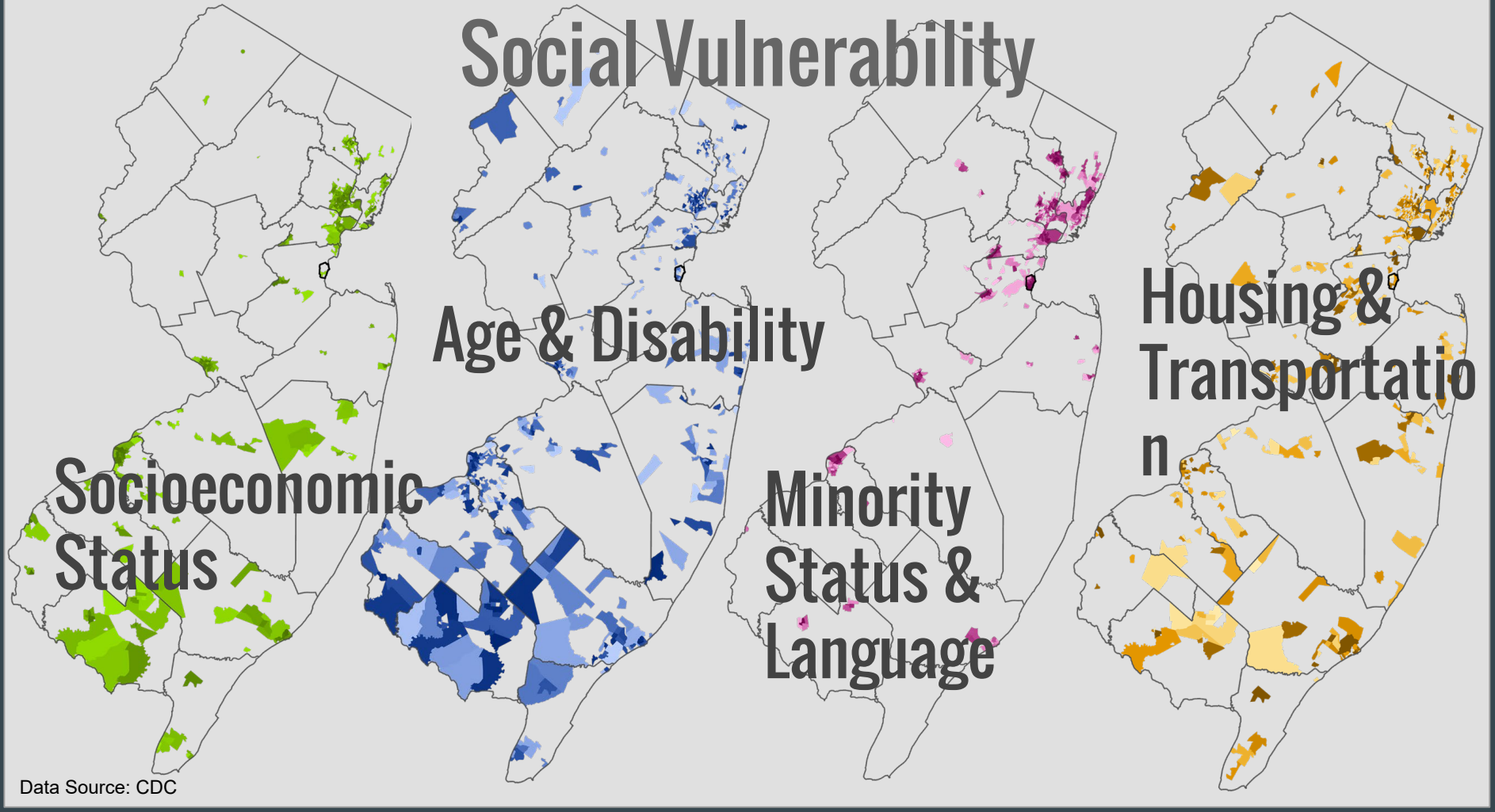
Data Source:
NJDEP 2015

- Exacerbates flooding from precipitation or sea level rise
- Generates heat island effect
- Impacts water quality
- Green Infrastructure can mitigate these effects

Perth Amboy: Relevant Demographics

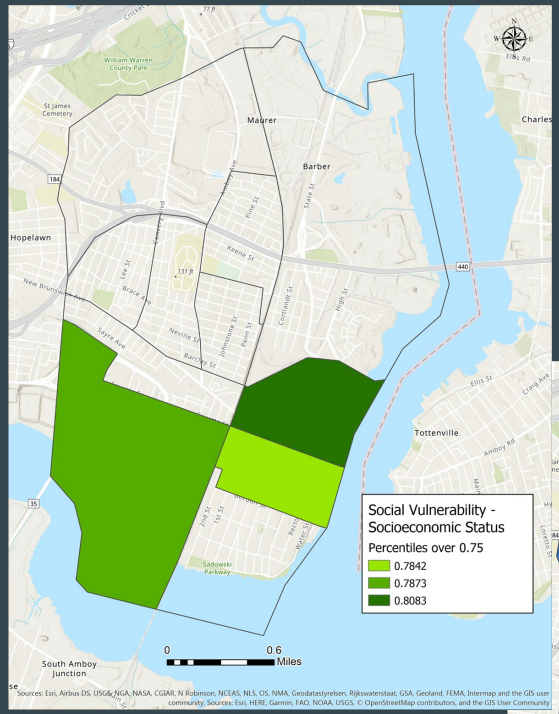
Street Use

- 21% of households do not have access to a vehicle (ACS 2017)
  - 8% for Middlesex County
  - This means that allocating street space to green infrastructure and pedestrian safety designs may be accomplished with less pushback for on-street parking that exists in other communities in the county and state.

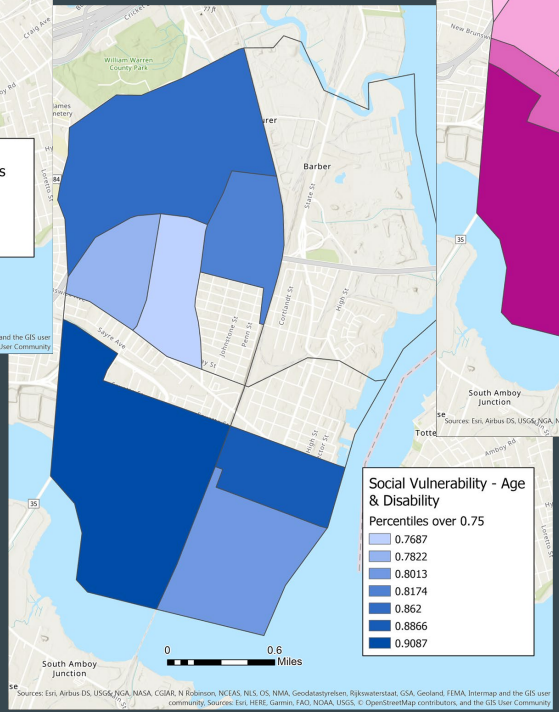

Social Vulnerability
Socioeconomic Status
Age & Disability
Minority Status & Language
Housing & Transportation
Data Source: CDC

Social Vulnerability

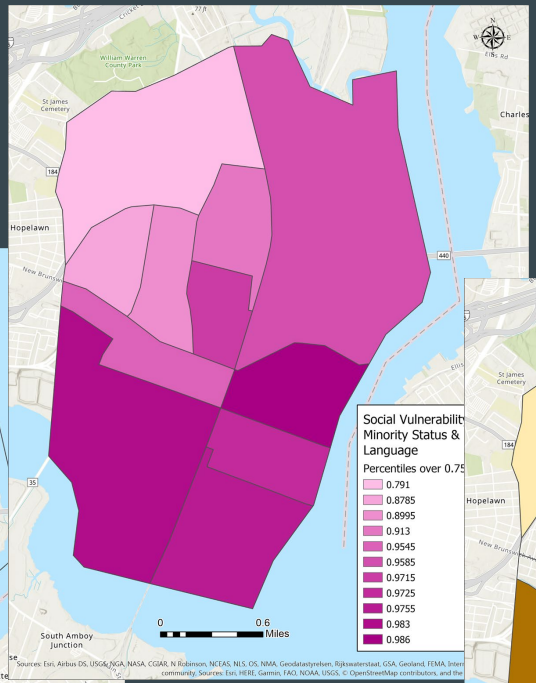
Socioeconomic Status



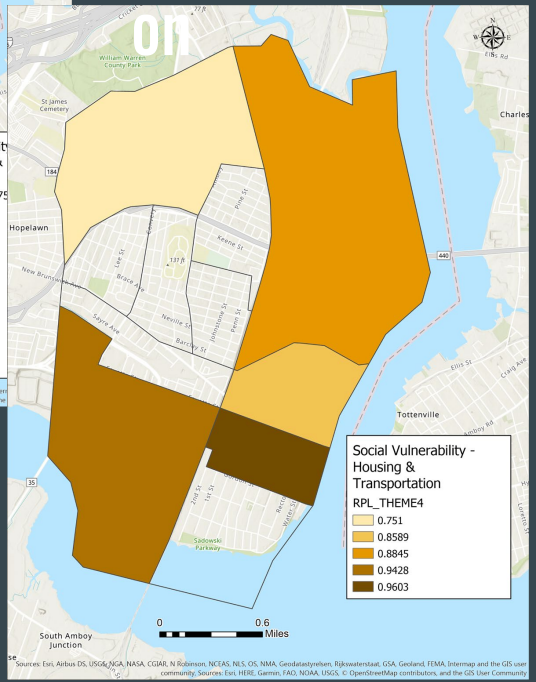
Age & Disability



Minority Status & Language



Housing & Transportation



Data Source: CDC

Team Vision Statement:

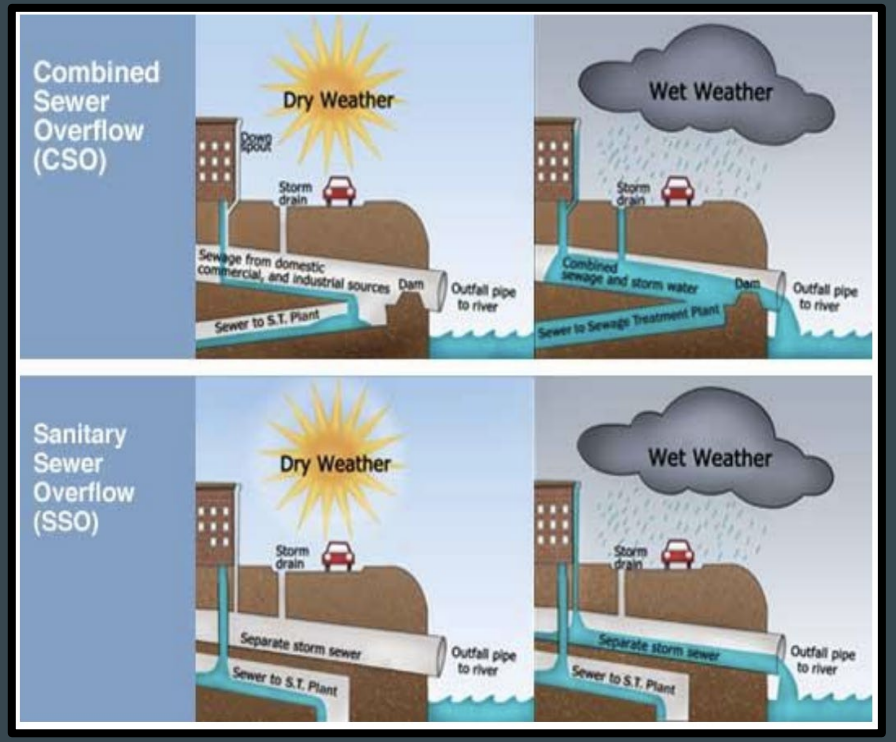
To promote climate resilience and a healthy environment for the residents of Perth Amboy while establishing natural habitat and enhancing public enjoyment of the city's waterfront.

We can accomplish this through 1) improvement of the city's wastewater management systems, 2) landscape-based stormwater management planning, and 3) adding vegetated features to the city's streets and open spaces.

Water Quality: Background & Recommendations

Key Terms

- **Combined sewage system:** A wastewater collection system designed to carry sanitary sewage and stormwater in a single pipe to a treatment facility.
- **Combined sewage overflow:** Events when combined sewage and surface runoff flows exceed the capacity of the treatment plant or CSS.



EPA, 2012

Water Quality in Perth Amboy

- Water quality structural/organizational challenges:
  - Intrusions of receiving waters into CSS
  - No current operation and maintenance program
  - Not all annual CSO inspections completed
  - No CSO pollution prevention plan or implementation
  - Failure to certify annually permit compliance

NJDEP, 2012

Water Quality Recommendations

- Update underground sewage system and CSOs
- Reduce pollution
- Protect natural landscapes providing important hydrologic functions
- Implement Green Infrastructure

RETAIN

REDIRECT

REUSE

Update CSS and CSOs

- Updated survey of CSS system
- Install new storm sewers
  - ➢ PVC, ductile iron, and concrete
- Introduce pump stations
- New flow meters for each CSO
- Install more regulator structures

Implementation

- NJDEP
- BPU
- Jersey Water Works
- New Jersey Future
- New Jersey Climate Adaptation Alliance
- New Jersey Water Bank (formally NJEIFP)-CSO Updates
    - 30 year interest-free financing
    - Up to $3 million in principal forgiveness loans
    - Money available for loan repayments

Reduce Pollution

- Reduce/eliminate fertilizers, pesticides, and herbicides
- Incentivize regular inspection of septic systems
- Set up initiatives for proper disposal pollutants
- Bio-based dioxane breakdown
- Green Infrastructure

Green Infrastructure: Site Selection and Recommendations

General

RETAIN

- Green roofs, blue roofs
- Vegetated detention basins
- Bioswales & detention planters

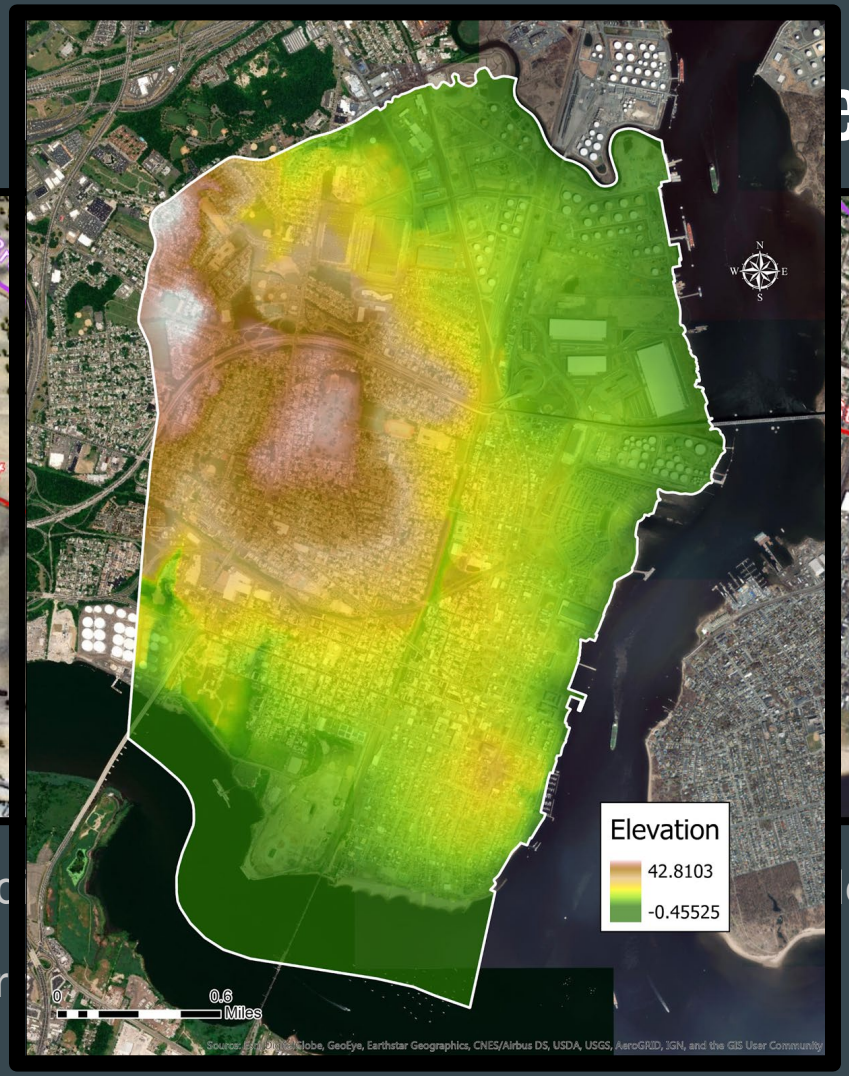
REDIRECT

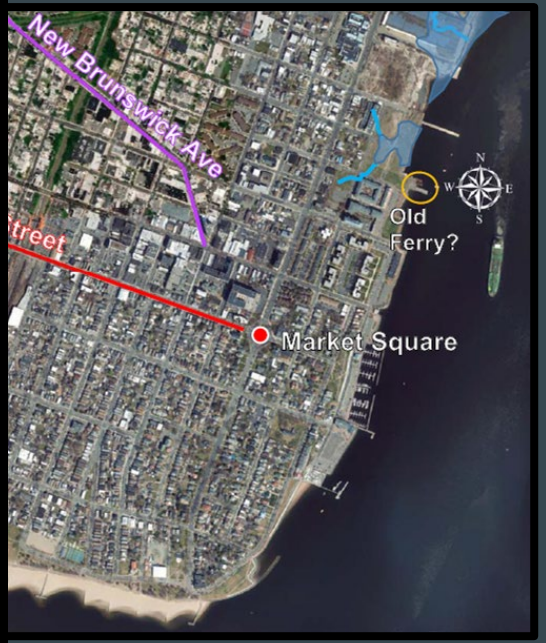
- Infiltration planters
- Permeable pavements
- Salt marsh restoration
- CSS Separation

REUSE

- Rain barrels
- Rain gardens

Site Selection: eams



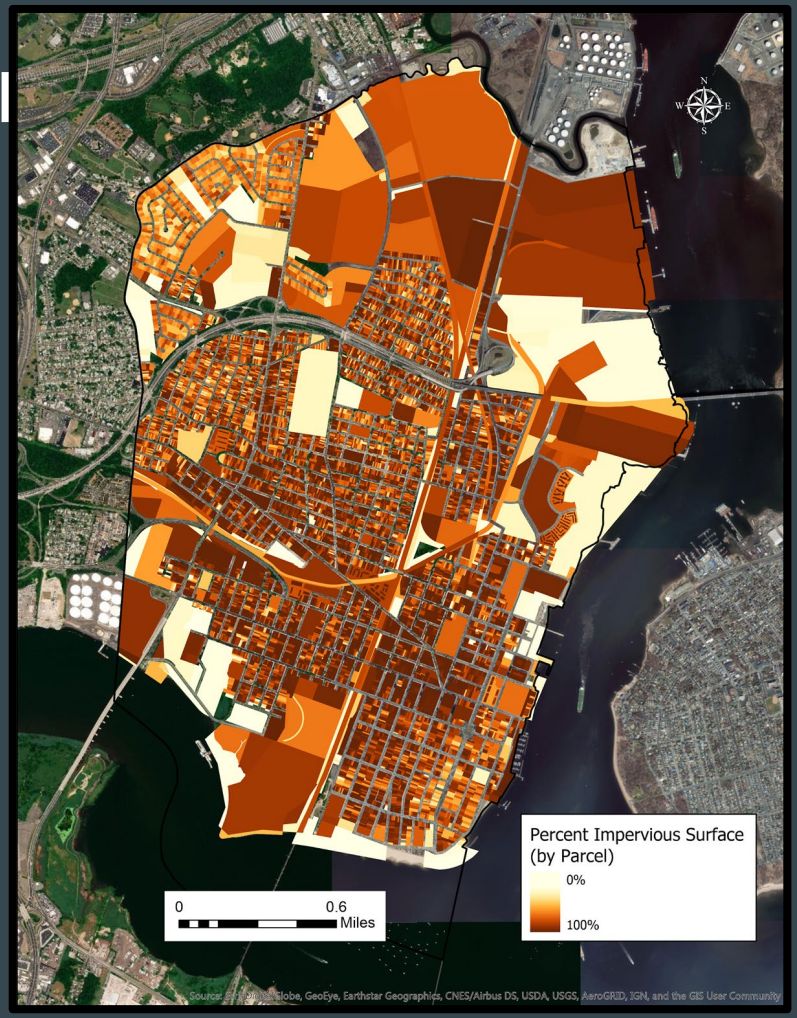


- Ideal elevation grad eal for development
- Good candidates for

Library of Congress, Rutgers

Site Selection: Impervious Cover

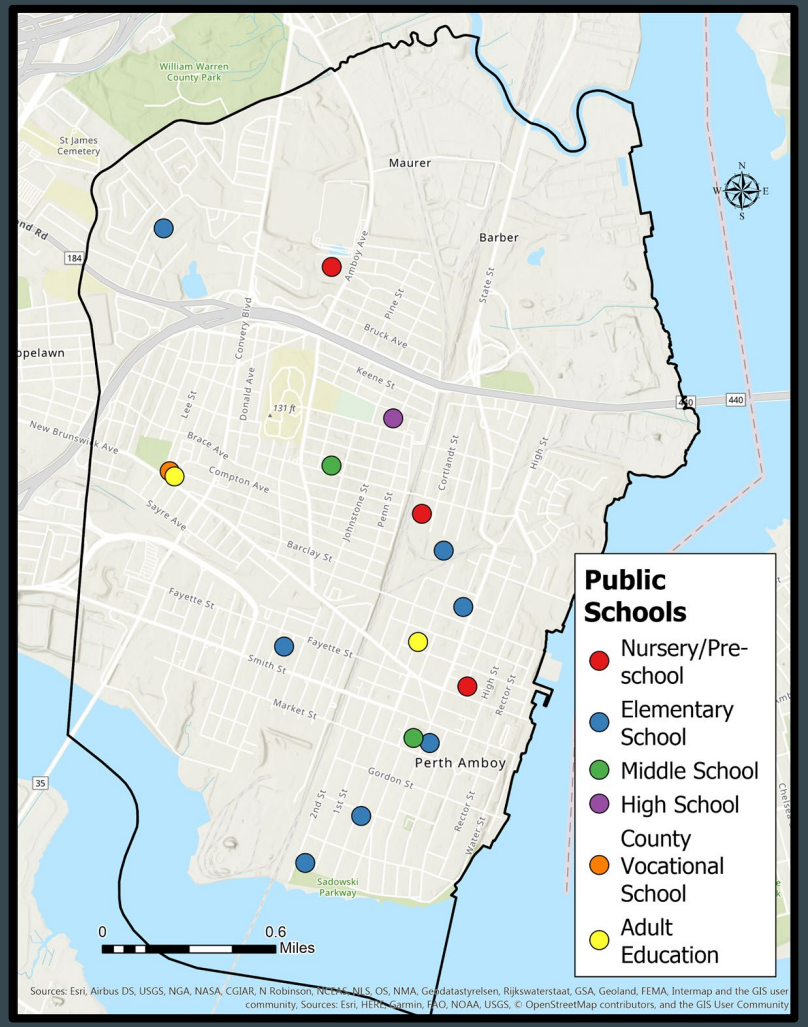
- Add green infrastructure in high impervious cover areas (more susceptible to flooding)
- Slows the movement of floodwaters
- Allows for rainwater collection/recharge into soils
- Can direct floodwaters in a favorable direction (i.e. toward storm drains and waterbodies)



NJDEP

Site Selection: Schools

- 16 public schools throughout the city
- Schools are ideal green infrastructure sites:
  - Public control of property
  - Eligible for design and construction through Rutgers Cooperative Extension Water Resources
  - Provide learning tools for teaching students about stormwater, plants, and construction
  - Maintenance through school and possible training through Rutgers Water Resources



Rutgers, NJ Flood Mapper

Green Infrastructure: Social Considerations

- Need to avoid climate gentrification in creation of green infrastructure
  - Avoid physical and cultural displacement of people in creation of green infrastructure
  - Equitable distribution of green infrastructure benefits
- Residents' specific interests
  - More resting places downtown
  - Reduction in urban heat
  - Increase in overall greenery
  - Community gardens not well-utilized
- Consider socially vulnerable areas when choosing sites for green infrastructure

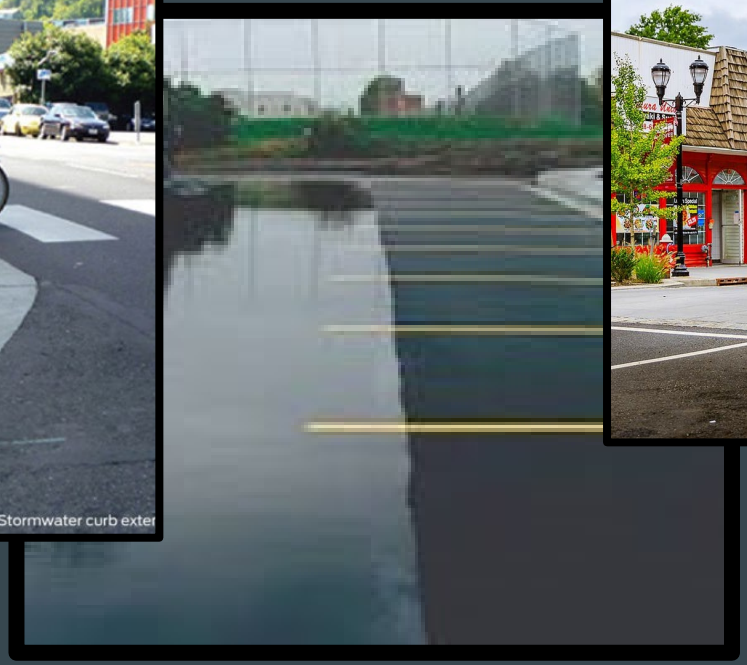
Maximo Vazquez, personal communication

Green Infrastructure: Example Strategies

Public & Commercial Spaces: Swales, Planters, Green Roofs & Trees

RETAIN

REDIRECT



https://bbandm.wordpress.com/2012/02/15/a-nyc-street-in-detroit/

NACTO; Arterial LLC

Implementation: Public & Commercial Spac

RETAIN

REDIRECT

- NJDOT
  - Incorporate GI into any street resurfacing or other construction or maintenance funding
- NJDEP Grants
  - Green Acres (if recreational component included)
  - Clean Water State Revolving Fund
  - Nonpoint Source Program (319(h))
  - "Water Bank" - low-cost financing (not grants)
- EPA Office of Sustainable Communities Greening America's Communities
- EPA Environmental Justice Small Grants program
- Private sources:
  - Encourage developers to incorporate - through site plan approval process, zoning, or incentives

Public Space: Marsh Restoration

REDIRECT

- Social and ecological benefits:
  - Carbon sequestration
  - Water filtration/flood mitigation/storm buffering
  - Aesthetics/recreation
  - Habitat creation/enhancement

Photos: VASWCD, USDA

Implementation: Marsh Restoration

REDIRECT

- Consult with NJDEP Office of Natural Resource Restoration
- NJDEP Grants
  - Green Acres (if recreational component included)
  - “Water Bank” - low-cost financing (not grants)
  - Water Quality Restoration Grant Program
- EPA Office of Sustainable Communities Greening America’s Communities
- Regional Greenhouse Gas Initiative (RGGI)

Residential Spaces: Rain Barrels, Gardens

REUSE

- Rain barrels capture stormwater from downspouts
  - Newark has free rain barrel program
- Rain gardens can be subsidized
  - Rutgers Cooperative Extension - Water Resources designs rain gardens for residents

Save the Source, South Jersey Landscape Makeover Program; City of Newark

Implementation: Residential Spaces

REUSE

- Free training and technical support from Rutgers Water Resources
  - Workshops on design, maintenance, funding, etc
  - Free design and construction assistance
- Private sources
  - For instance, Newark's rain barrel program is funded through the Cities of Service and the Walmart Foundation

Green Infrastructure & Water Quality in Perth Amboy

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RETAIN

REDIRECT

REUSE