



◦ Aspen Global Change Institute

# **Real-World Wicked Problems:**

*Resiliency Planning and Progress in Baltimore City*

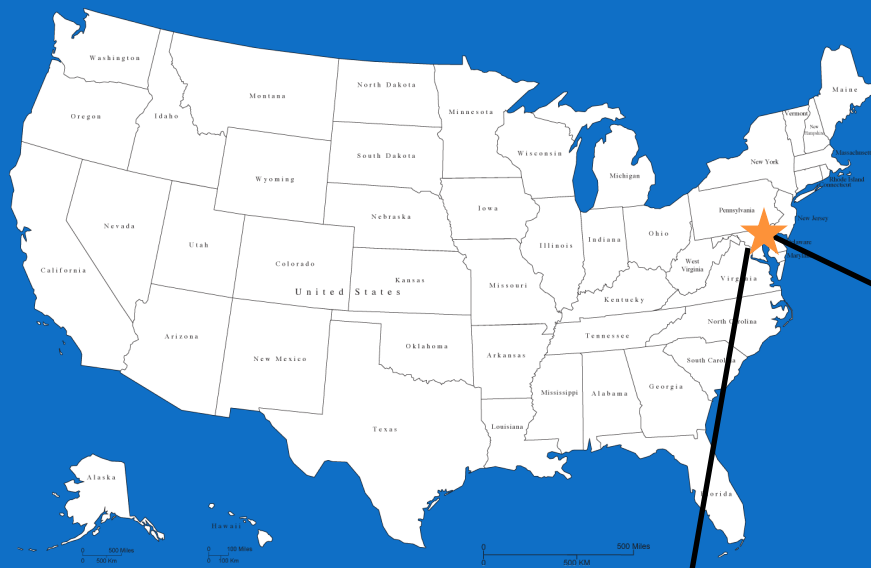


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City of Baltimore, Office of Sustainability

# Overview

- Background
- Planning
- Implementation
- Ongoing projects
- Partnerships







# Watersheds and Reservoirs





# Shocks



# Natural Hazards



**Coastal Storms**

**more severe**

**Floods**

**more extensive**

**Severe Thunderstorms**

**more severe**

**Wind**

**increase intensity**

**Winter Storms**

**less snow, more flooding**

**Extreme Heat/Drought**

**more severe and intense**

**Sea Level Rise**

**increased threat**

**Air Quality**

**lower quality and increase risk**





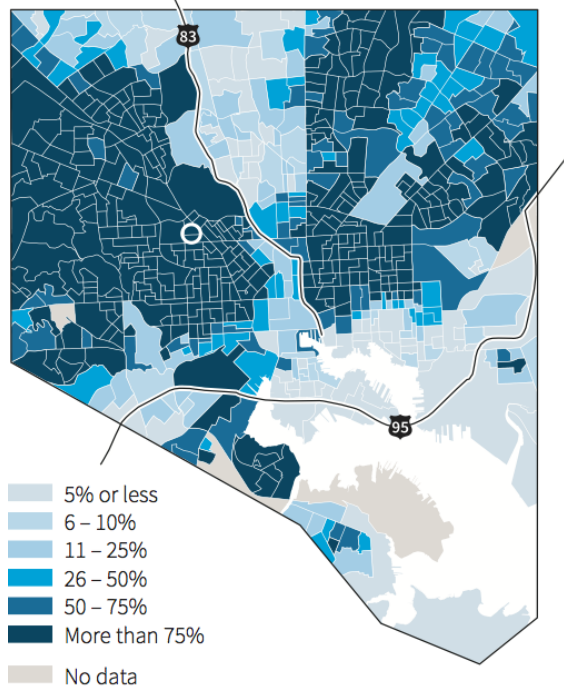
## Socioeconomics in Baltimore

Following the funeral of Freddie Gray, a 25-year-old black man who died after he was injured in police custody, disturbances broke out a few blocks from the site of the service. Demonstrations turned violent and spread through parts of Baltimore on Monday.

○ New Shiloh Baptist Church (location of Gray's funeral)

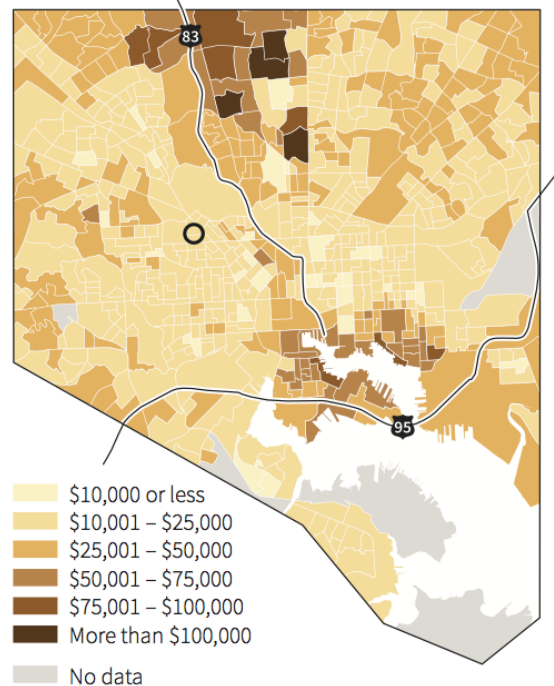
### BLACK/AFRICAN AMERICAN POPULATION

As a percentage of total population



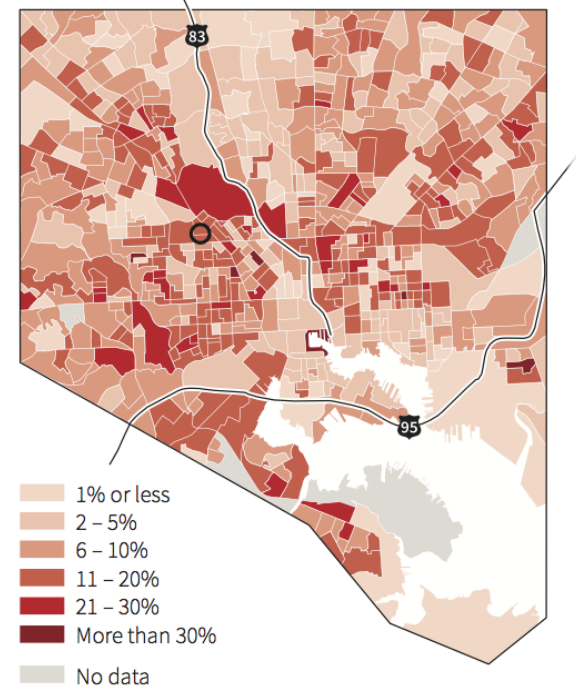
### INCOME PER CAPITA IN THE PAST 12 MONTHS

In 2013 inflation-adjusted dollars



### UNEMPLOYMENT

Unemployed population\* as a percentage of total



Sources: 2013 American Community Survey estimates, U.S. Census Bureau; Open Baltimore, City of Baltimore; Reuters

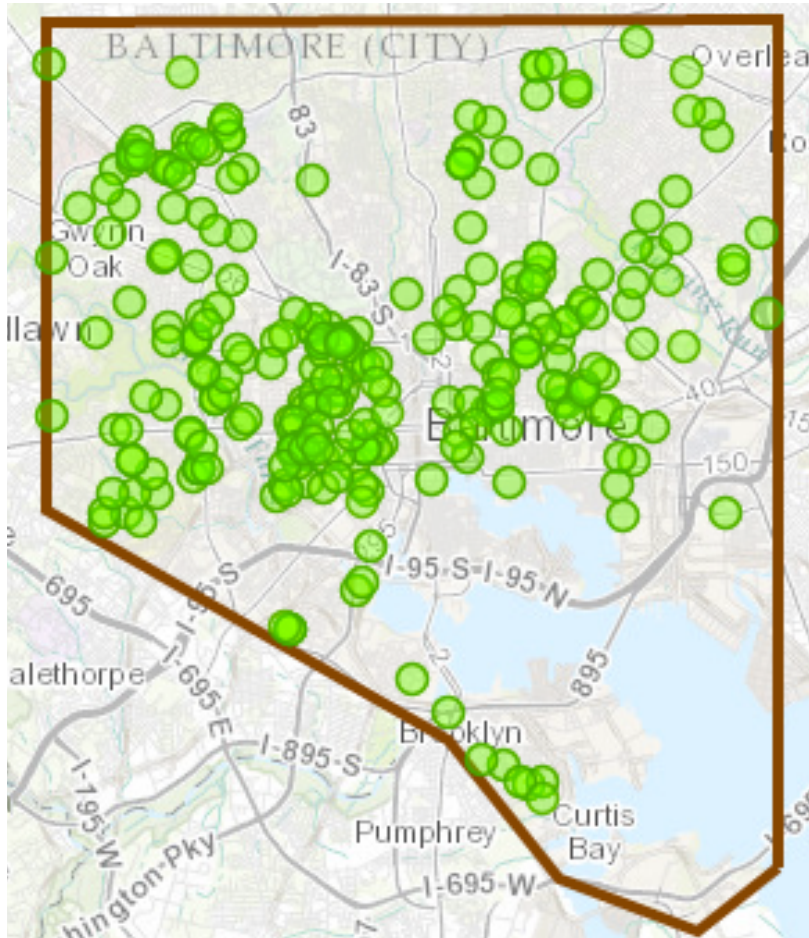
\*In civilian labor force, population aged 16 years and above



# Stresses



Map of 2015 Baltimore City Homicides,





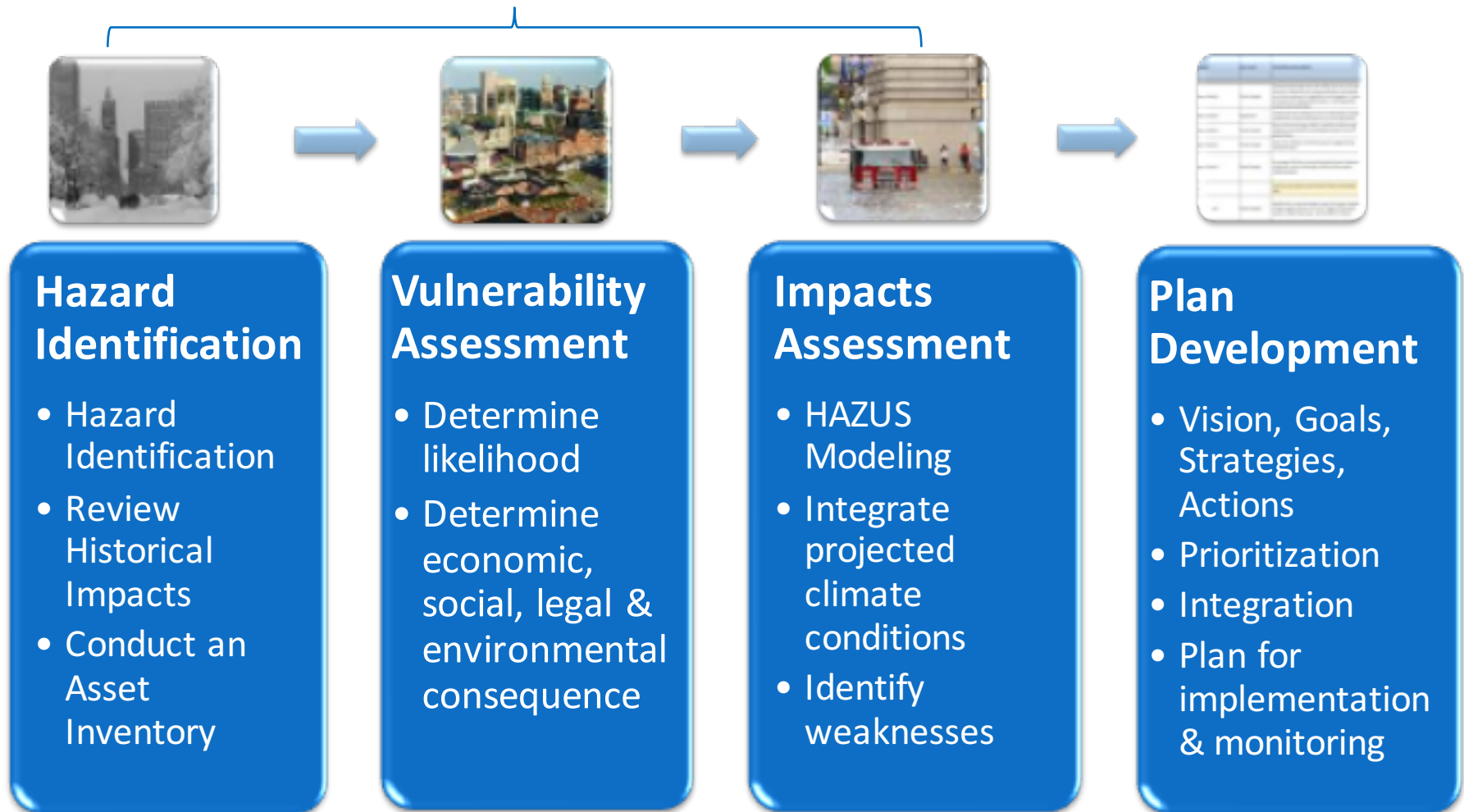
# Planning



# Process



## Risk Assessment





# Structure



## Infrastructure

Energy

Liquid Gas

Communication

Transportation

Waterfront

Wastewater

Stormwater

Solid Waste

Policy

## Buildings

City Codes

Structural

Non-Structural

## Natural Systems

Urban Parks &  
Forests

Water Supply  
and  
Management

## Public Services

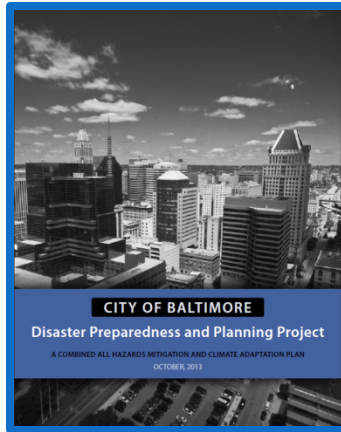
Emergency  
Preparedness  
& Response

Health

Education &  
Outreach

Food System

# Disaster Preparedness Plan



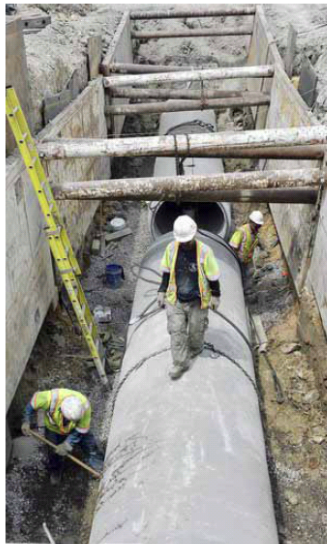
**CITY OF BALTIMORE**  
Disaster Preparedness and Planning Project  
A COMBINED ALL HAZARD MITIGATION AND CLIMATE ADAPTATION PLAN  
OCTOBER 6, 2013

## Combined All Hazard Mitigation and Climate Adaptation Plan

KNOWLEDGE AND PLANNING PROJECT

ment that evaluates and improves all pipes' ability to withstand cold

System is dated and in need of upgrades. It is important to build extreme weather resilience and disaster prevention into water and wastewater systems by using both adaptation and mitigation actions. Additionally, structural and infrastructural upgrades must be made to reduce loss of water supply from the distribution system.



Baltimore Water Pipe

Source: BaltimoreSun

1. Replace old and malfunctioning pipes with new pipes or retrofit existing pipes with new lining

Pipes that have already begun experiencing problems, or older pipes which are more vulnerable to the impacts of hazards, should be upgraded using the best available technology.

2. Evaluate and utilize new technology that allows for greater flexibility in pipes as they are replaced

It is essential to prepare for future changes in hazard events and proactively upgrade pipe systems to prevent cracking and bursting.

### IMPLEMENTATION GUIDELINES

Lead Agency	DPW
Stakeholders	DOT, DPW, Water and Wastewater Utilities
Alignment with Goals	Goal 3
Connection with Existing Efforts	CAP, CRS; MD DNR; ESF-3; ESF-4
Timeframe	



## STORMWATER

### IN-16 Enhance and expand stormwater infrastructure and systems

Future changes in precipitation frequency and intensity may require reconsideration of the design of existing stormwater infrastructure systems.

Increase resiliency and disaster prevention measures related to stormwater systems by enhancing drainage systems in stream corridors and improving and repairing stormwater conveyance pipes and outfalls.

1. Implement the requirements of Baltimore's MS4 (separate stormwater and sewer system) permit (S)
5. Review and revise storm drain design on a continuous basis, to accommodate projected changes in intense rainfall (O)

The City of Baltimore operates under a Municipal Separate Stormwater and Sewer System (MS4) permit, which protects water-quality and requires that Baltimore prevents pollution as much as possible. It is critical that the requirements of these permits are fully met.

2. Prioritize storm drain upgrades and replacement in areas with reoccurring flooding (S)

While proximity to a floodplain or floodway can increase vulnerability to flooding, certain measures can reduce this vulnerability. Inadequate or older pipes, which cannot accommodate the excessive amounts of stormwater, should be upgraded so as to handle extreme rainfall and storm surge events.

3. Install backflow-prevention devices or other appropriate technology along waterfront to reduce flood risk (M-L)

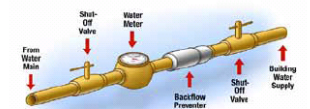
Backflow-prevention devices are used to ensure that water does not flow back through drainage infrastructure. Through the installation of backflow-prevention devices, the City can improve the performance of the drainage network and prevent risk of flooding impact along the waterfront.

4. Preserve and protect natural drainage corridors (S)

It is important to utilize natural drainage corridors and green infrastructure to capture more stormwater runoff and enhance the ability of the existing infrastructure to cope with environmental changes.

### IMPLEMENTATION GUIDELINES

Lead Agency	DPW
Stakeholders	Community Groups, DOT, DPW, MOEM, MDNR, NGOs, Private Developers, Stormwater Utility
Alignment with Goals	Goals 1, 3, and 6
Connection with Existing Efforts	CRS; MD DNR
Timeframe	

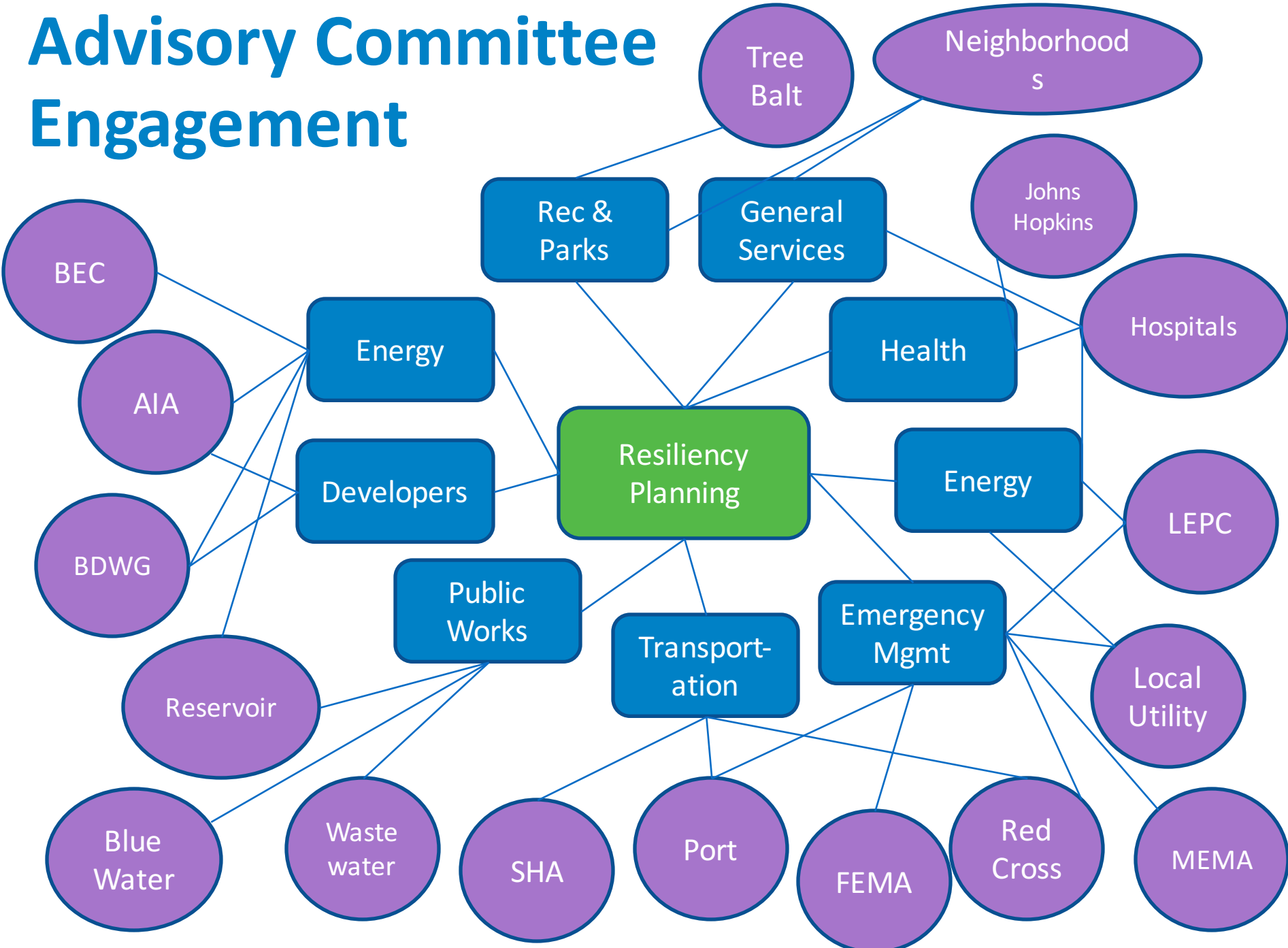


Backflow Preventer

Source: Demar Plumbing NYC

STRATEGIES AND ACTIONS 191

# Advisory Committee Engagement





# Community Engagement



## Small Staff Trainings and Community Meetings



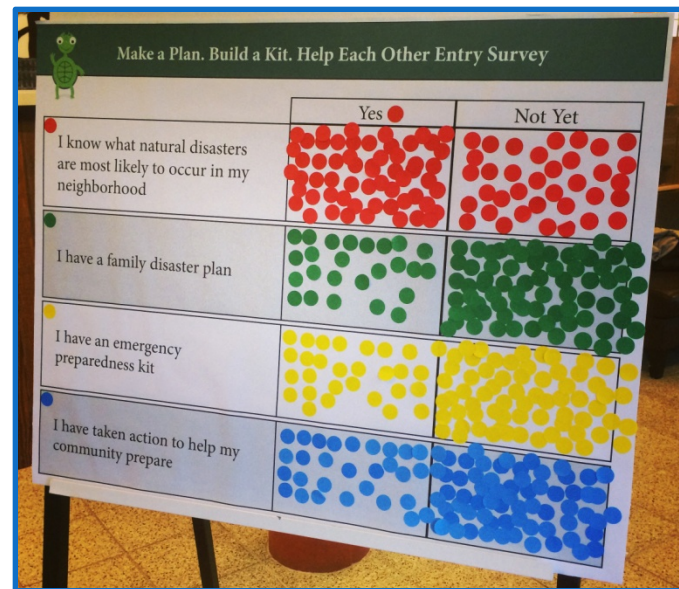
## Large Town Halls and Interactive Community Meetings



# Community Engagement



- Busing provided to residents in low income areas without access to transportation
- Entirely hands-on and interactive meeting. No presentations
- Free food, free kits, free trees, and information
- Trusted space- community building utilized daily by residents





# Equity as a Lens



- Prioritize neighborhoods with highest vulnerability and historic disinvestment
- Provide job training and green job opportunities as part of most initiatives
- Build trust and relationships
- Highlight economic and health benefits such as lower electricity costs













Implementation



- Identify overlaps with existing planning efforts
- Prioritize Strategies and Actions with lead stakeholders

[illegible]

# Identify Connections

IMPLEMENTATION GUIDELINES	
Lead Agency	DPW
Stakeholders	DOT, DPW, Water and Wastewater Utilities
Alignment with Goals	Goal 3
Connection with Existing Efforts	   CAP; CRS; MD DNR; ESF-3; ESF-4
Timeframe	  

## Emergency Support Functions

Governmental and certain private sector capabilities that provide support, resources, and services needed to save lives, protect property and environment, restore essential services and critical infrastructure and help communities.

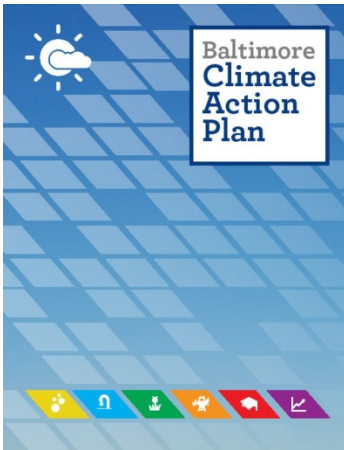
## Climate Action Plan

Increasing resiliency of the electricity system and increasing energy conservation efforts

# Prioritization



## MITIGATION



Energy Savings and Supply

Land Use and Transportation

Growing a Green City

## Co-Benefits

Drinking water  
Renewable Energy  
Trees  
Building Codes  
Energy Grid  
Energy Efficiency  
Transportation Inf.

## ADAPTATION + HAZARD MITIGATION



Infrastructure

Buildings

Natural Systems

Public Services



# Whole Block Approach

## Energy

- Cool Roofs
- Weatherization
- Energy Education

## Additional

- Trees and Greening
- Renewable Energy
- Stormwater
- Heat sensors

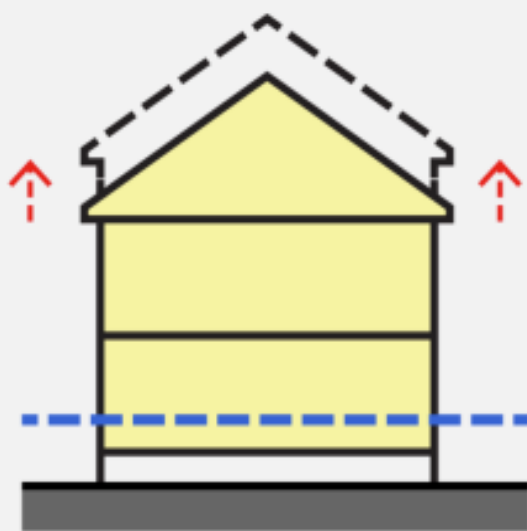


- ## Height



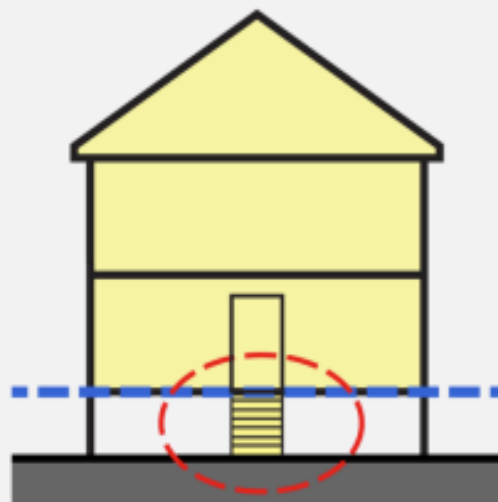
100 →





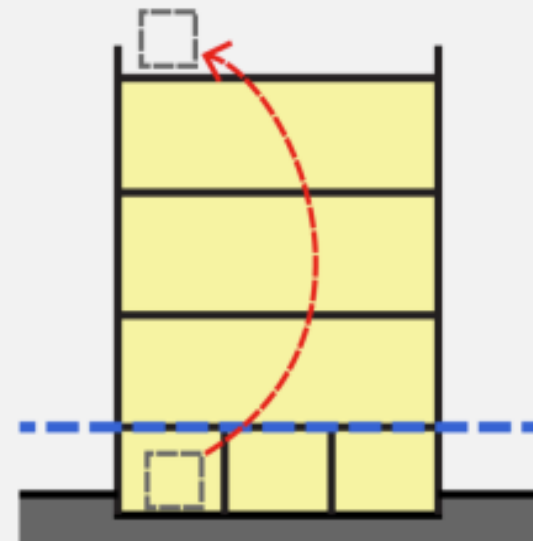
### HEIGHT

*must recognize elevation requirements in flood zones*



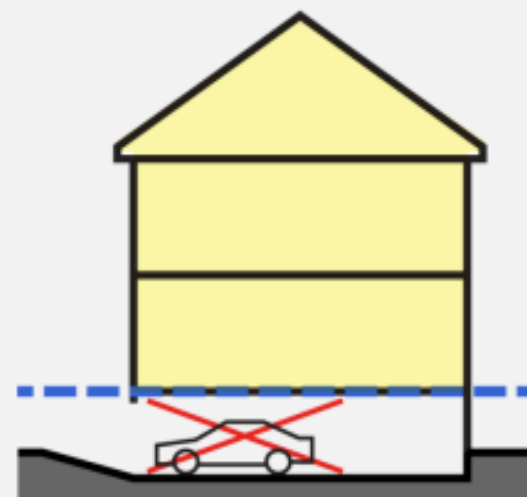
### ACCESS

*need for stairs or ramps requires imaginative solutions*



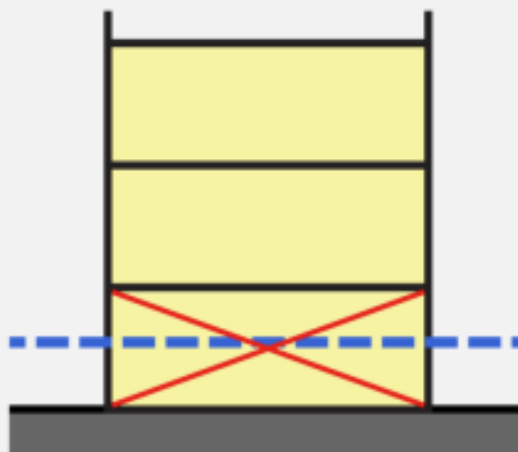
### MECHANICAL SYSTEMS

*must allow relocation out of flood-prone areas*



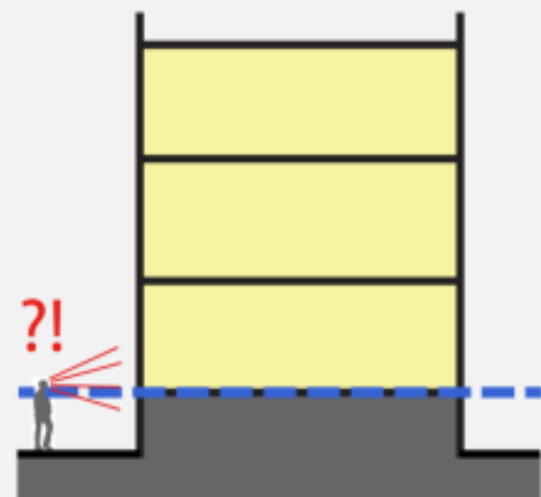
### PARKING

*may not be possible below ground*



### GROUND FLOOR USE

*buildings may be allowed only limited use of ground floors*



### STREETSCAPE

*limit negative effect of blank walls on streetscape*



# Codes: IGCC



In November, 2014 we adopted the International Green Construction Code 2012 as an overlay to the City's building, fire and related codes

For Sustainability: At least 50% of the total building materials used" in a building of 25,000 square feet or greater, must be recycled, recyclable, bio-based or indigenous (within 500 miles)

For Resiliency: Buildings are now mandated to have renewable energy systems and are encouraged to consider battery backup



# Energy



**Residential:** Focus in low-income areas. Weatherization, cool roof installation and solar panel installation (low to no cost)



**Private Partners:** Promote energy efficiency upgrades through free audits and connection to renewable options



**Critical Facilities:** Installation at wastewater treatment plant. 4200 panels on 5 acres.

# Resiliency Hubs



Building upon our energy and preparedness work, develop a pilot project to integrate solar with battery backup systems at trusted facilities in lower income areas

Focus on creating “Resilience Hubs” in neighborhoods

Not City-owned buildings-  
utilizes existing facilities that  
are trusted in the community





# Make a Plan, Build a Kit, Help Each Other





# Overlapping City Initiatives

## Using Green Infrastructure as part of a comprehensive strategy for rebuilding Baltimore

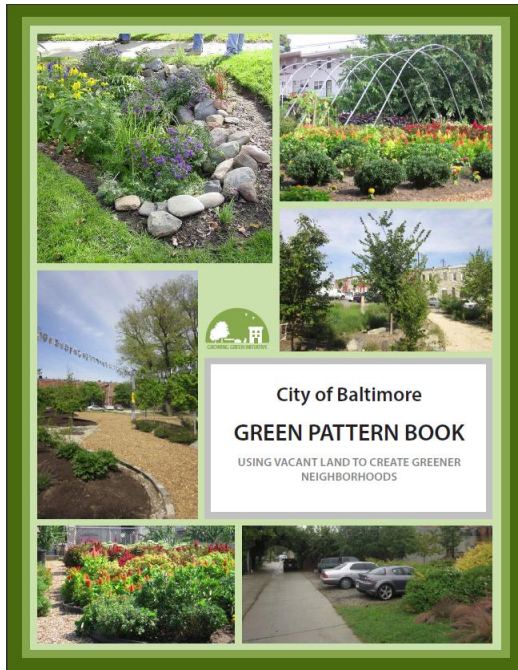
- Provides economic, environmental, and social benefits
- Capacity to support the missions and goals of multiple agencies by addressing issues including stormwater management, health issues, and economic development.



# Growing Green



Effort focused on re-using vacant land to green neighborhoods, reduce stormwater runoff, grow food, and create community spaces that mitigate the negative impacts of vacant properties





# Tree Species Database



## Database of Trees

- Predicted climate conditions
- Species that thrive
- Maintenance and soil requirements
- Planting specifications

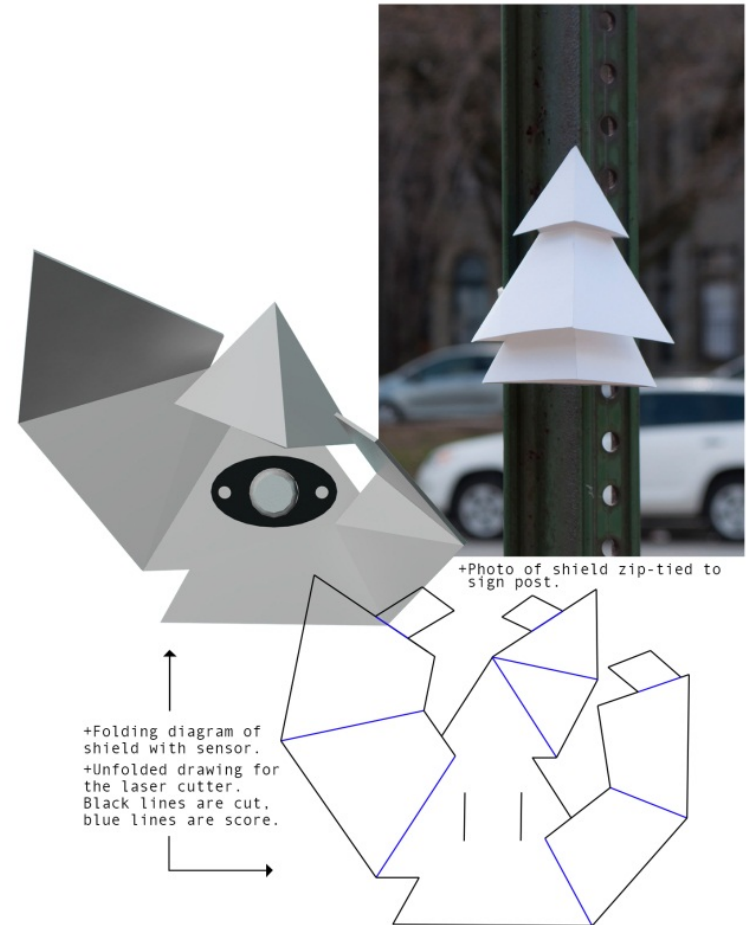
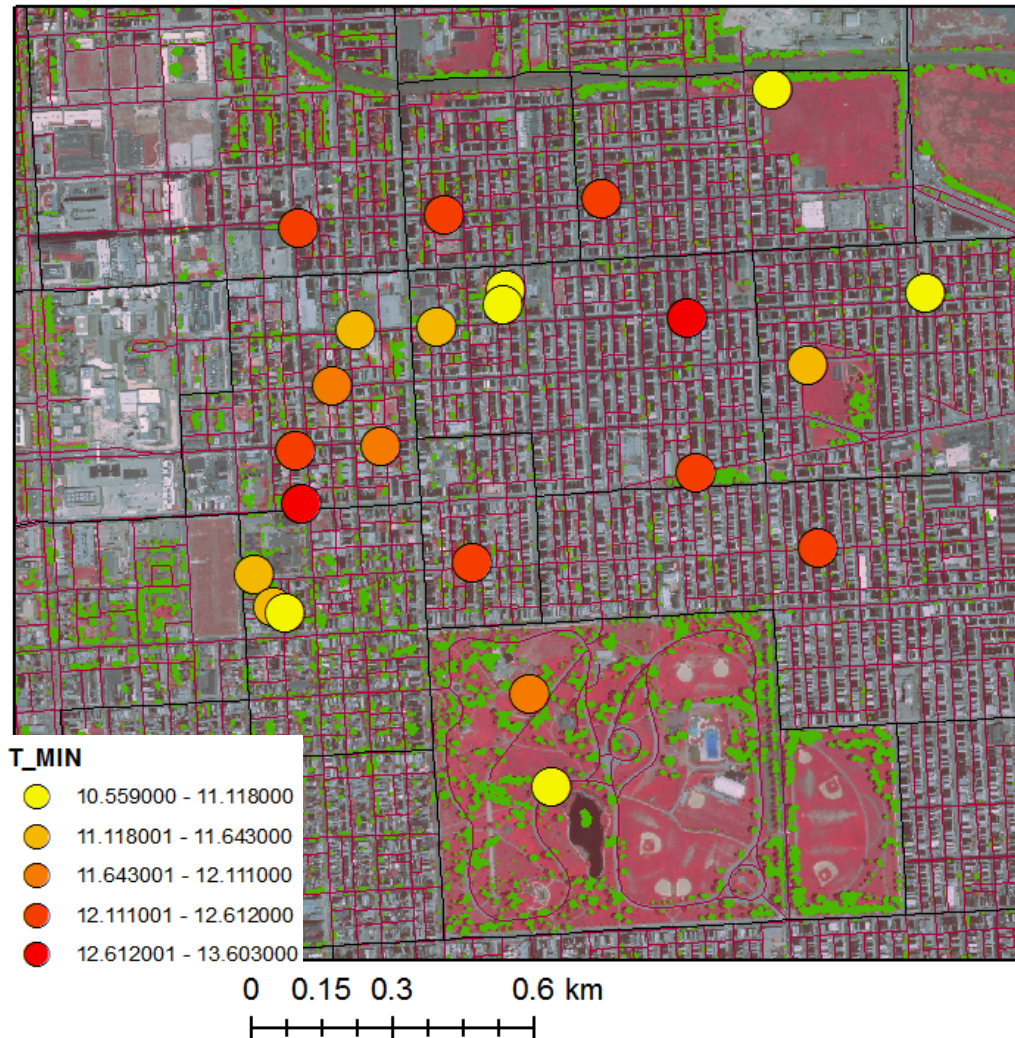
## Spatial Analysis Tool

- Overlay areas at risk
- Overlay soils, demographic information, water/salt water info
- Develop list of trees best for those conditions

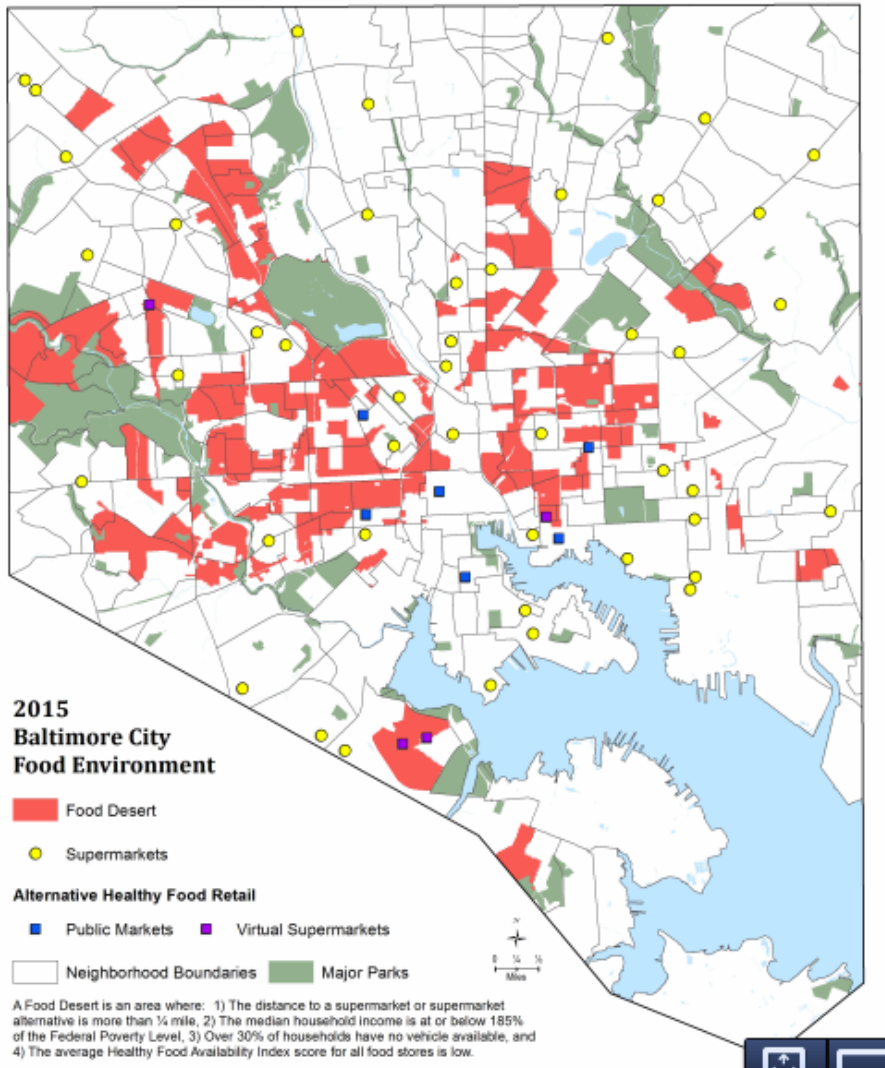
# Heat Islands and Sensors



Minimum Temperature ( $^{\circ}\text{C}$ )



# Food Deserts/Access



## Food Desert Definition:

- ¼ mile from supermarket
- Low vehicle availability
- Low Healthy Food Availability Score

## Impact:

- 25% residents (158,000 people)
- 30% School aged children
- 25% Seniors
- Black residents 4x more likely to live in a food desert than White residents



# Food Access Initiatives



## **Virtual Supermarket:**

- The Health Department coordinates online grocery ordering at 5 senior, disabled and public housing sites.

## **Healthy Stores Program:**

- 4 healthy Corner Stores (with plans to add 14 more over the next 2 years)
- 20 middle school students trained as Youth Neighborhood Food Advocates

## **Healthy Carryouts:**

- Developed a Healthy Carryout Strategy with 36 vendors in Public Markets

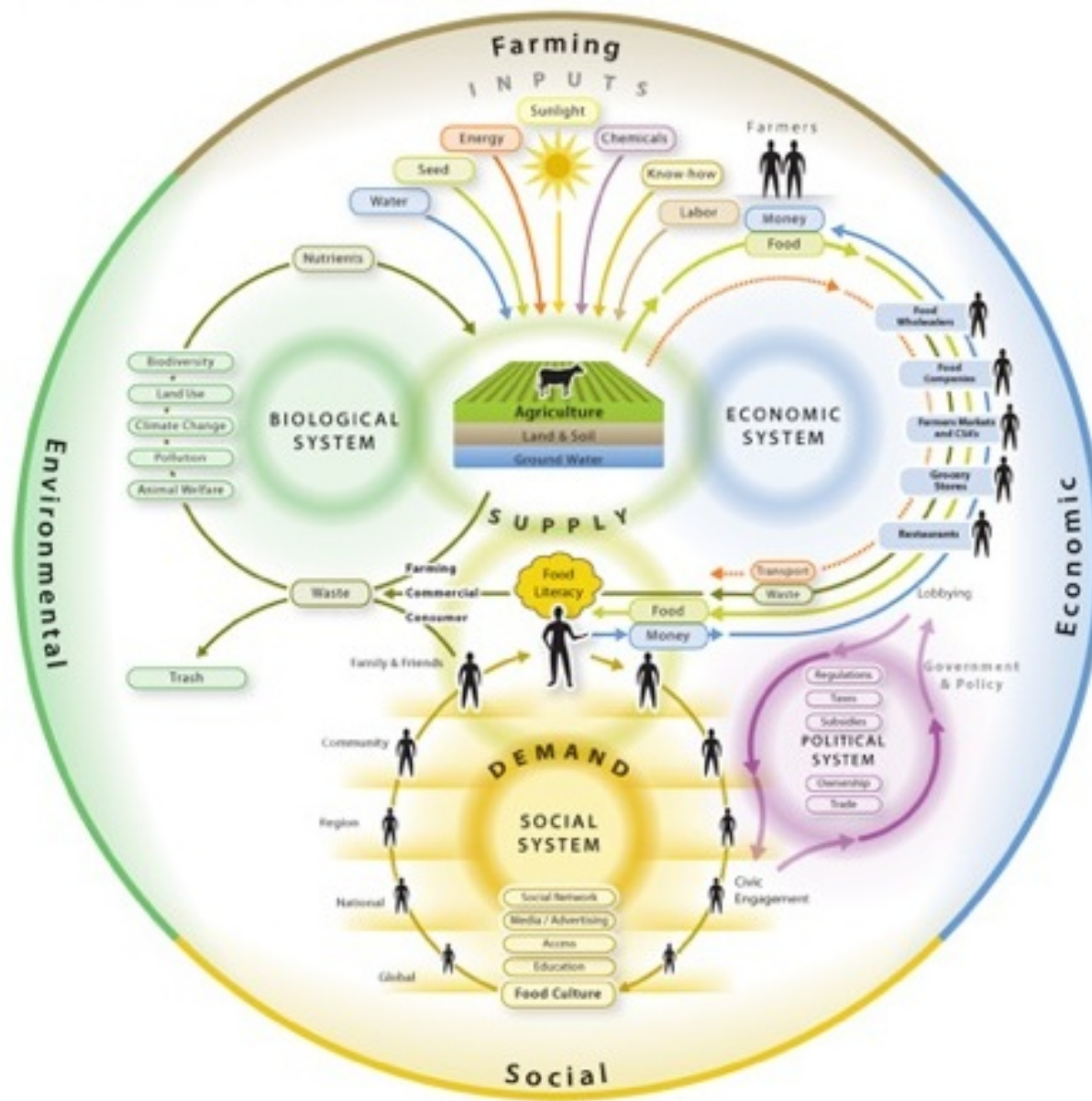


# Urban Agriculture



- Turning vacant lots into farms
- **Updated the City's Animal Code** to liberalize standards for the keeping of bees, chickens, rabbits, and dwarf, miniature, and pygmy goats
- **Created a Soil Safety Policy** - using funds for soil testing to support new farm sites
- **Passed an Urban Agriculture Tax Credit**-reduce tax burden on urban farms

# Food Resiliency Plan and Task Force





# Critical Facilities



Conducted an engineering study on critical infrastructure in riverine and coastal areas



Main focus is to integrate solar with battery backup into critical facilities around the City and lessen disruptions



*City of McKinney, Texas*

# Response and Recovery



- Integration of resiliency planning into After Action Reporting
- Build upon the CERT program
- Coordination with OEM on Public Safety Initiatives
- Communications coordination with Health, Emergency, Public Works, and Sustainability



# Green Schools

Goal: Turn Every  
School in Baltimore  
into a Green School

Currently 26  
Baltimore City Public  
Schools certified as  
Maryland Green  
Schools

Technical assistance,  
grants, workshops





# Capital Improvement



- Department of Planning manages process
- Developed a Resiliency Checklist for projects
- Identify how each project will help reduce risk and improve the City's ability to adapt and respond to natural hazards
- **Projects must take into account anticipated impacts from climate change**
- Include extreme weather events, adaptation, SLR, floodplain considerations, and mitigation



- **Trainings:** We are developing trainings for city agency directors, project managers, and staff as well as stakeholders. Will have basic intro and then sector-specific phases.
- **Ambassadors:** Connecting all our ambassador programs and unifying under resiliency and sustainability messaging and outreach
- **Historic Properties:** Developing Floodplain Design Manual for urban areas with entire section focused on retrofitting historic structures
- **Curriculum development** for universities/schools

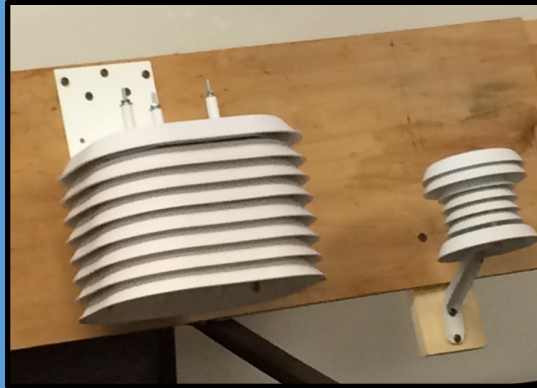
# Local Partners



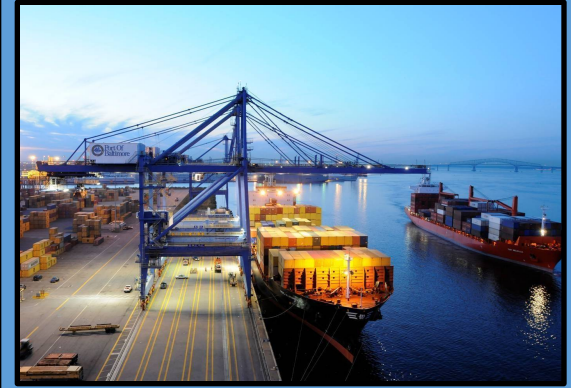
## Non-Profits



## Universities



## Business & Industrial

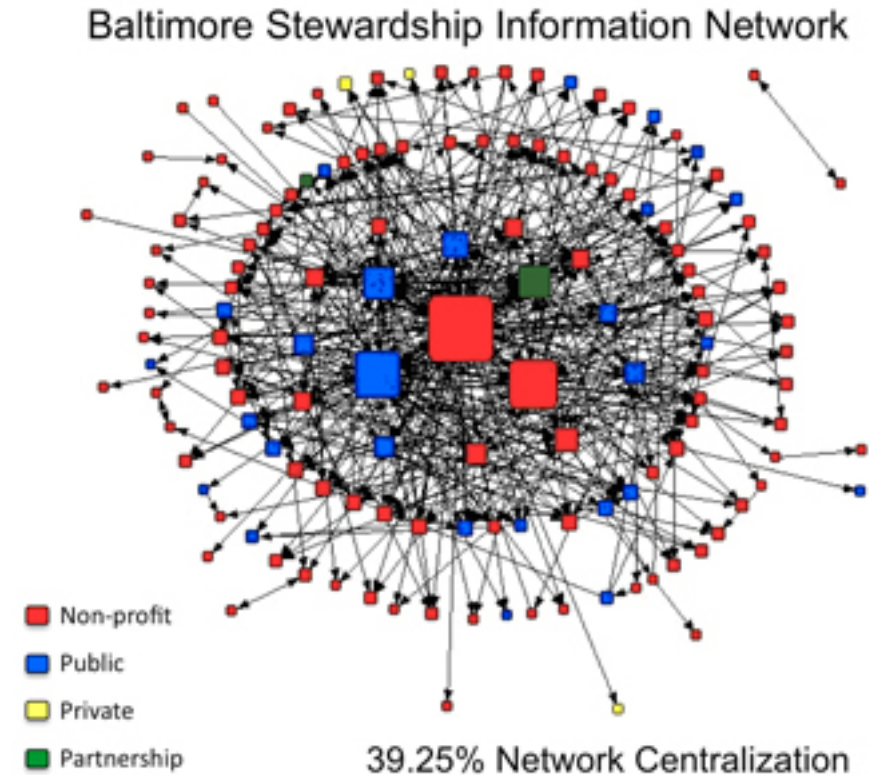




# Regional and National



- Climate Consortium of Maryland
- American Society of Adaptation Planners
- Urban Sustainability Directors Network
- Association of State Floodplain Managers
- STAR Community Rating System



# Thank you!



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