

City of Baltimore

Climate Adaptation Planning & Implementation



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City of Baltimore, Office of Sustainability

Overview

- Plan Development
- Implementation
- Communication
- Integration



Context- Chesapeake Bay



Context- Watersheds and Reservoirs

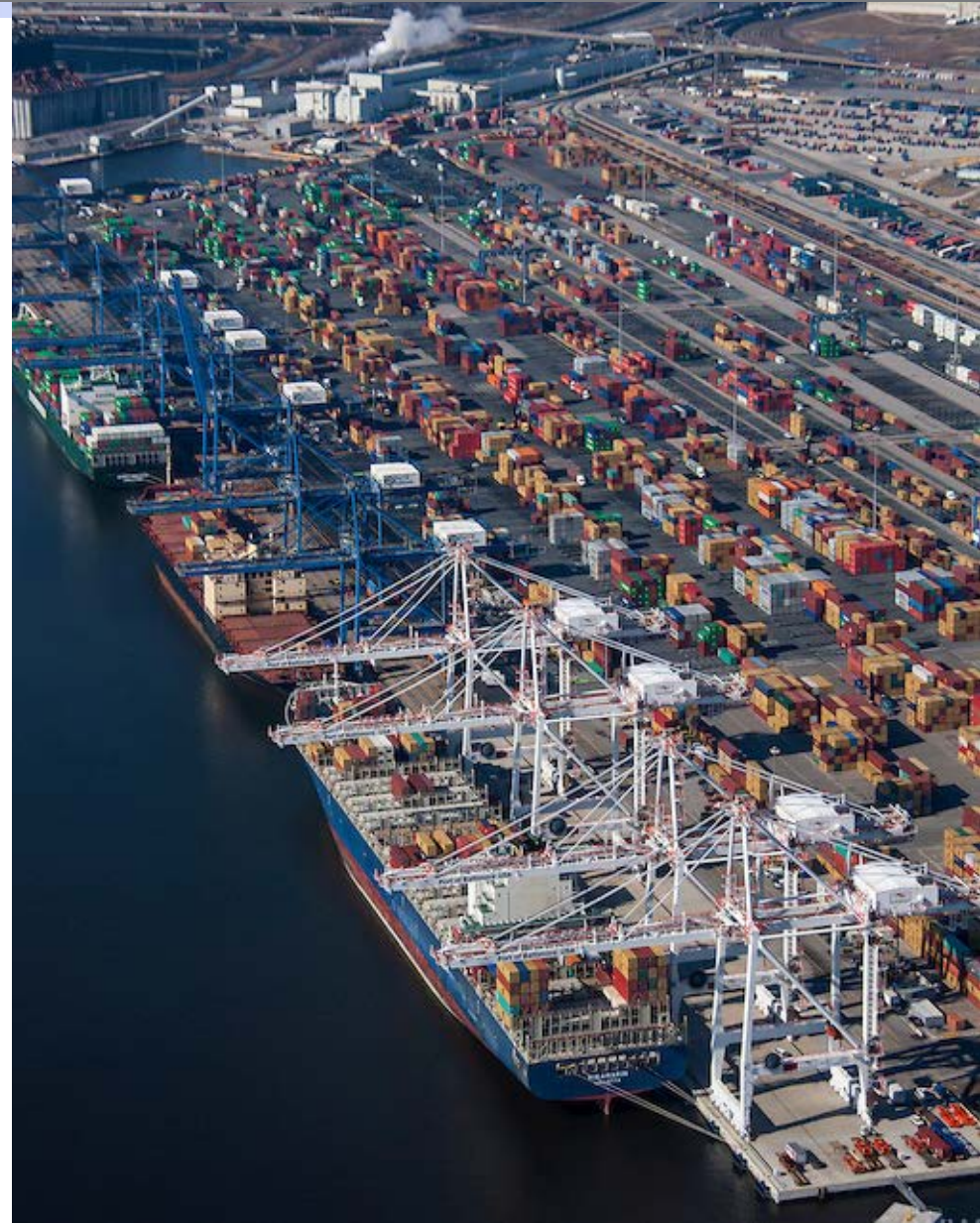


DMA 2000 and AHMP



Hazard Mitigation is action taken to reduce or eliminate long-term risks to people and their property from hazards.

FEMA requires All Hazard Mitigation Plans in order to be eligible for pre-disaster mitigation funds.



Baltimore's Unique Approach



All Hazard Mitigation Plan

(Current and Historical Hazards)

+

=

Resilience

Climate Adaptation Plan

(Adapt to new and predicted climate conditions)



Resilience



The ability of our community to anticipate, accommodate, and positively adapt to or thrive amidst changing climate conditions or hazard events and enhance quality of life, reliable systems, economic vitality, and conservation of resources for present and future generations.





Current Impacts

Shocks and Stresses



Shocks

Shocks are typically considered single event disasters, such as fires, earthquakes, and floods.

Stresses

Stresses are factors that pressure Baltimore on a daily or reoccurring basis, such as endemic violence or high unemployment.

Focus on both shocks and stresses to enhance community adaptive capacity and resilience, especially in more vulnerable areas

Future Impacts/Shocks



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

Stresses



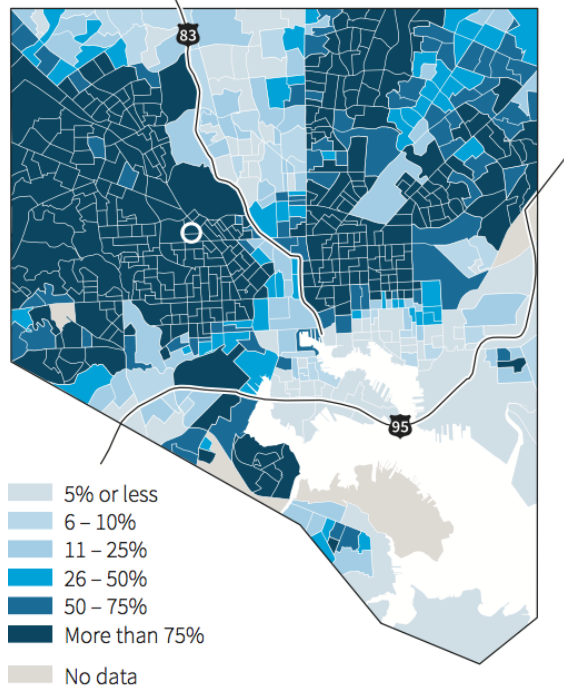
Socioeconomics in Baltimore

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)

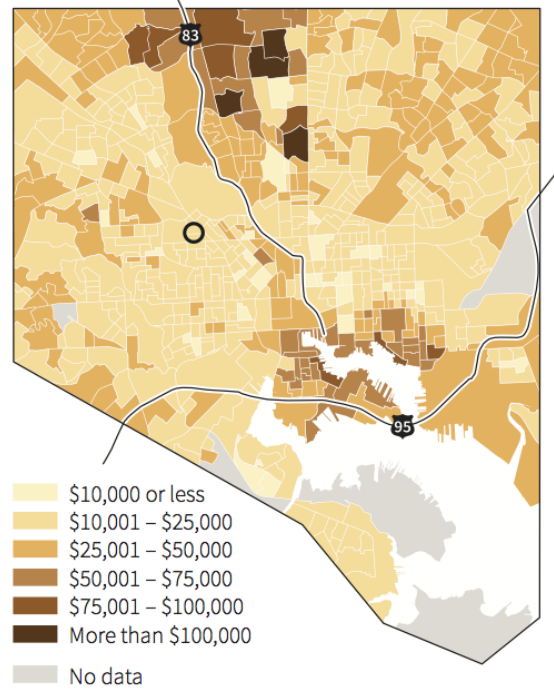
BLACK/AFRICAN AMERICAN POPULATION

As a percentage of total population



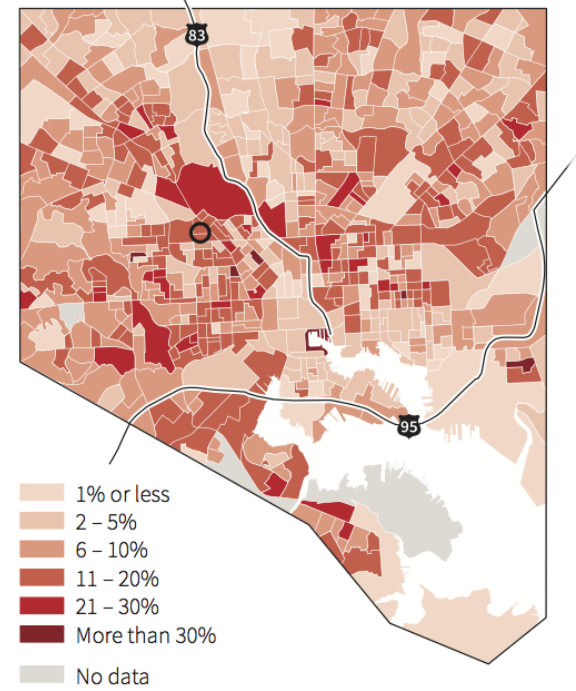
INCOME PER CAPITA IN THE PAST 12 MONTHS

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

Planning



Process



Risk Assessment



Hazard Identification

- Hazard Identification
- Review Historical Impacts
- Conduct an Asset Inventory

Vulnerability Assessment

- Determine likelihood
- Determine economic, social, legal & environmental consequence

Impacts Assessment

- HAZUS Modeling
- Integrate projected climate conditions
- Identify weaknesses

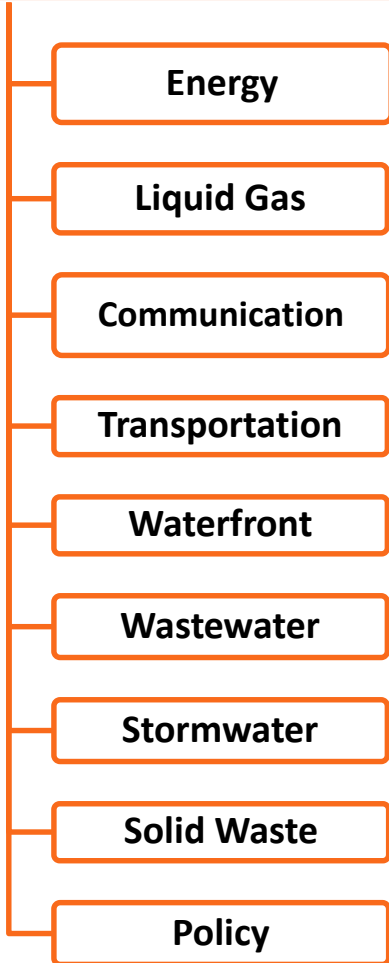
Plan Development

- Vision, Goals, Strategies, Actions
- Prioritization
- Integration
- Plan for implementation & monitoring

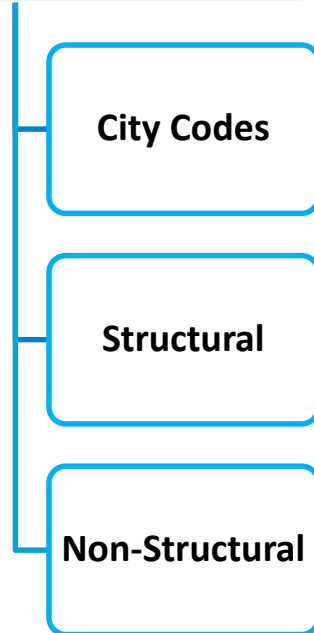
Structure



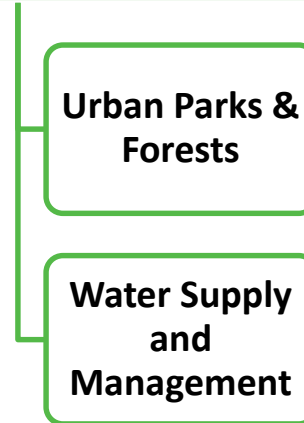
Infrastructure



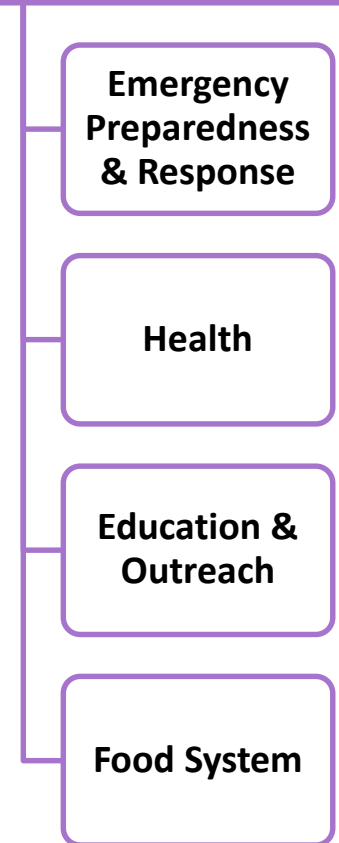
Buildings



Natural Systems



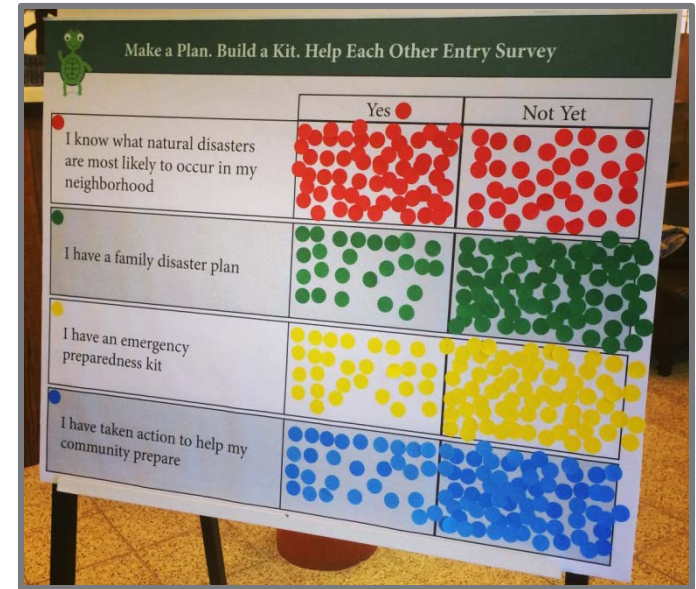
Public Services



Community Engagement



- Interactive events/meetings
- Busing provided to residents in low income areas
- Entirely hands-on. No presentations
- Free food, free materials, free trees, and information
- Trusted space- community building utilized daily by residents

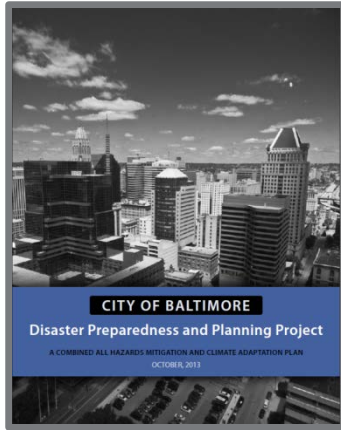


Peer-to-Peer Engagement



Disaster Preparedness Plan

Adopted unanimously in October, 2013

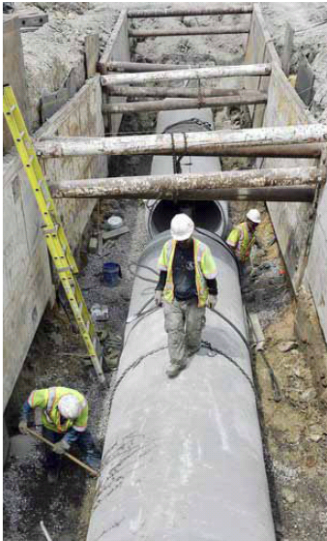


RESILIENCE AND PLANNING PROJECT

STRATEGIES AND ACTIONS 191

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.

The City's storm drains will require continual revision to incorporate new and projected changes in intense rainfall. This will ensure that the storm drains maintain adequate capacity.

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.

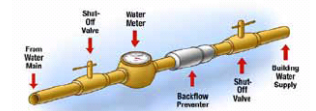
3. Install backflow-prevention devices or other appropriate technology along waterfront to reduce flood risk (M-L)

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	

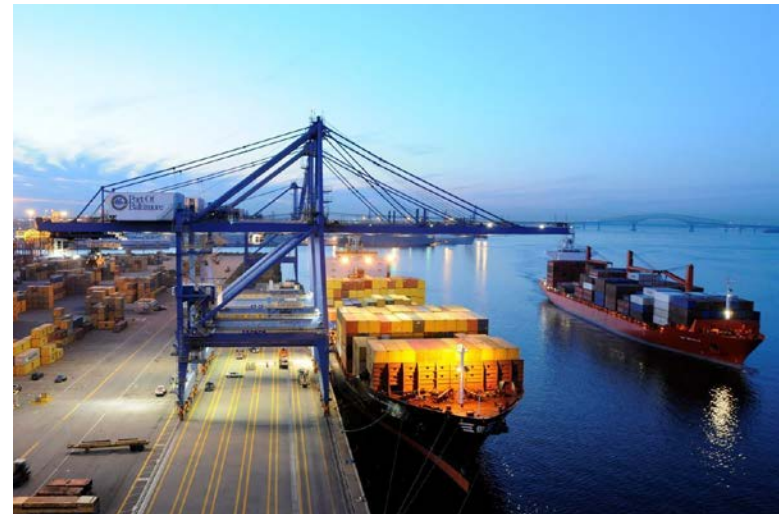


Backflow Preventer

Source: DemarPlumbing/NYC

Additional Considerations

- Historic Buildings and Areas
- Engineering Studies on Critical Facilities
- Health Impact Assessment
- Response and Recovery
- Port





Implementation



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



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.

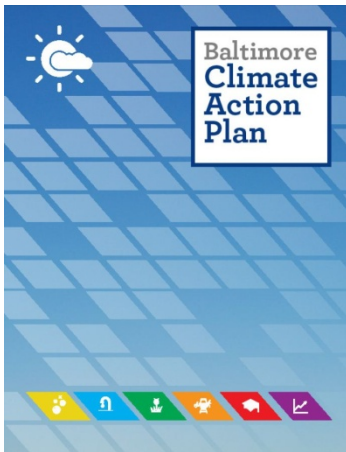
Climate Mitigation

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

RESILIENT + SUSTAINABLE

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

ADAPTATION + HAZARD MITIGATION



Infrastructure

Buildings

Natural Systems

Public Services

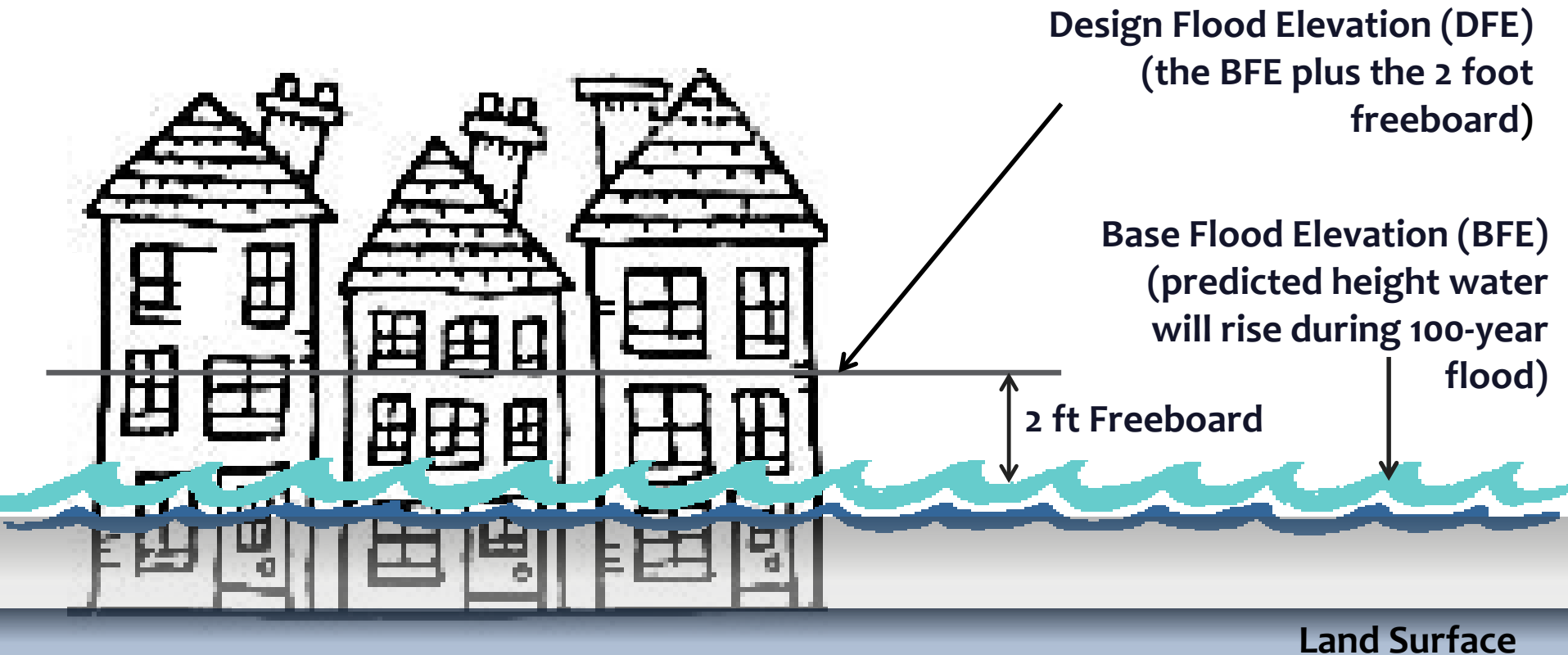


Code Example



- Baltimore adopted the International Green Construction Code (IgCC) in 2014. Energy efficiency and mitigation were reasons for this.
- Updated Floodplain Ordinance in 2014 establishing:
 - Two (2) feet of freeboard
 - Flood Resilience Area and 500-year extent
 - ASCE-24 construction standards
- Floodplain code integrated into new building code
- Higher regulatory standards

Basics- understanding BFE, DFE, FB



Floodplain Regulations



- The City of Baltimore regulates to the height and extent of the 500-year flood in tidal areas



Both
100
and
500



In non-tidal areas, the City regulates to the height of the 100-year flood and to the extent of the 500-year flood



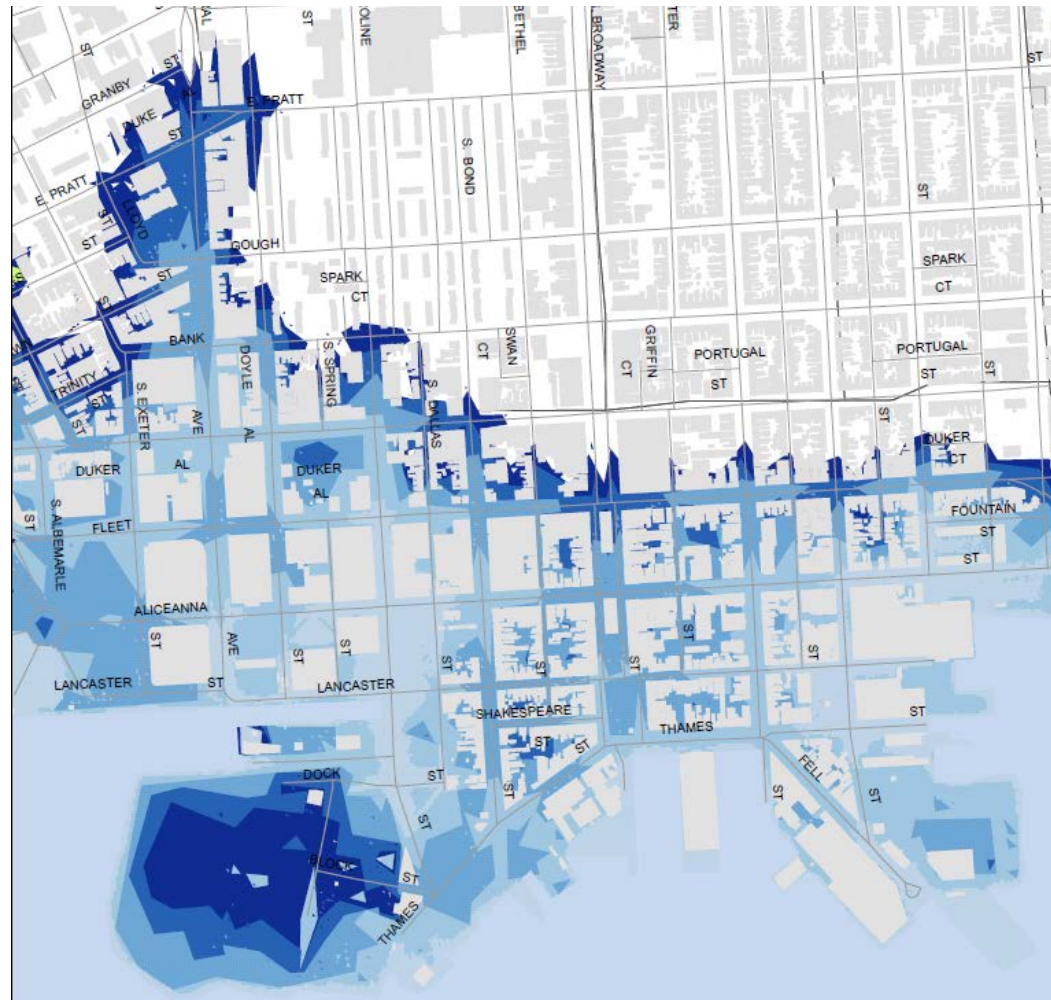
Both
100
and
500

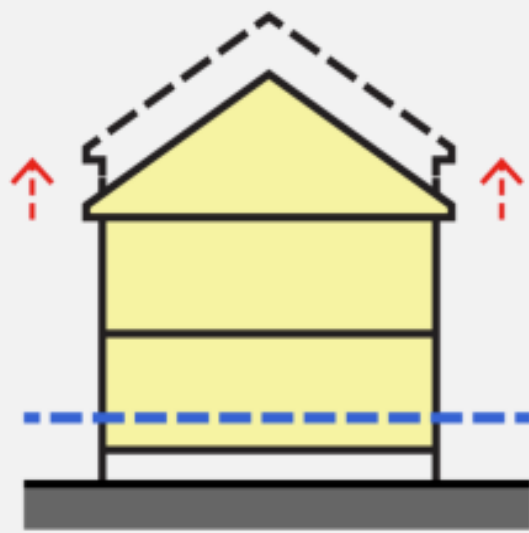


Flood Resilience Area



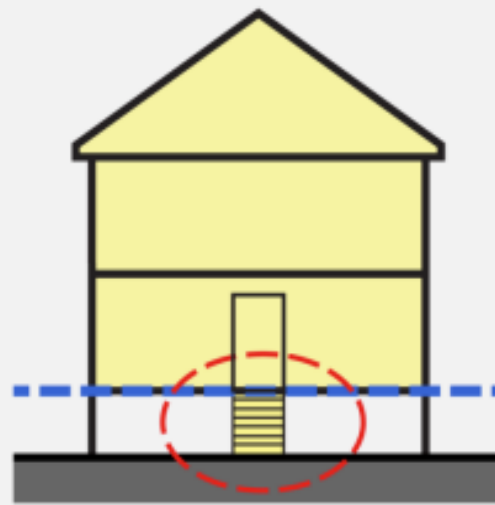
- In the Tidal Floodplain
- Regulate to the height of the 500-year flood
- Regulate to the extent of the 500-year flood
- Utilize ASCE-24 construction standards which creates higher standards based on building categories (critical facilities)





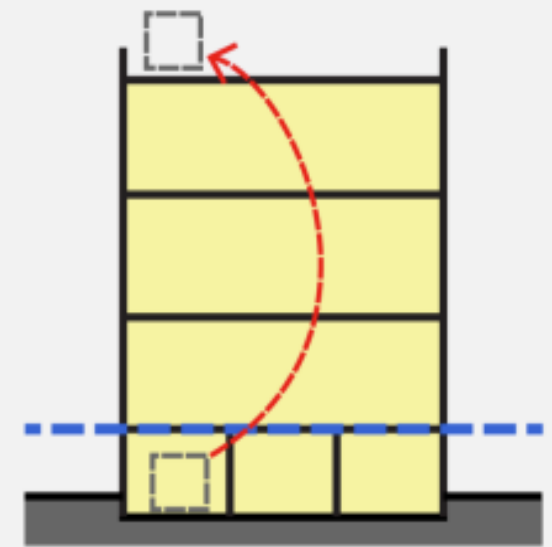
HEIGHT

must recognize elevation requirements in flood zones



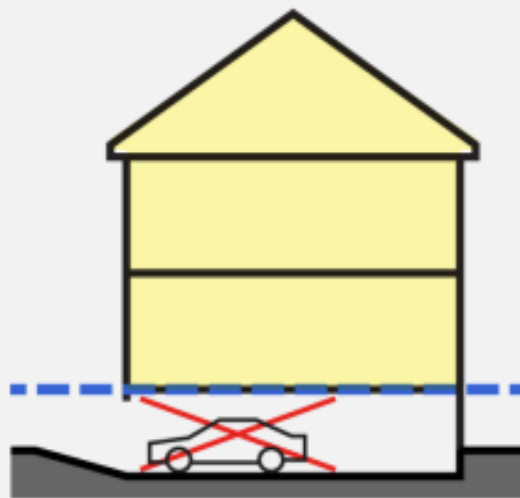
ACCESS

need for stairs or ramps requires imaginative solutions



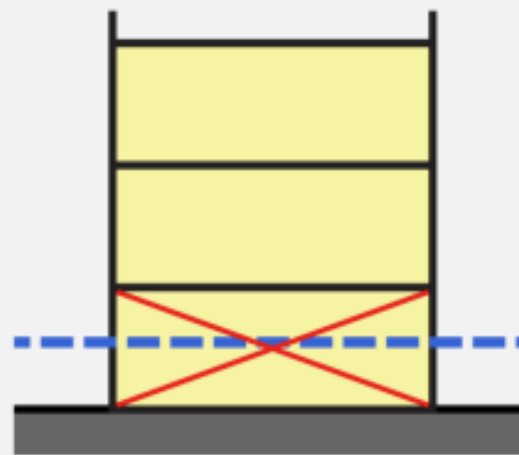
MECHANICAL SYSTEMS

must allow relocation out of flood-prone areas



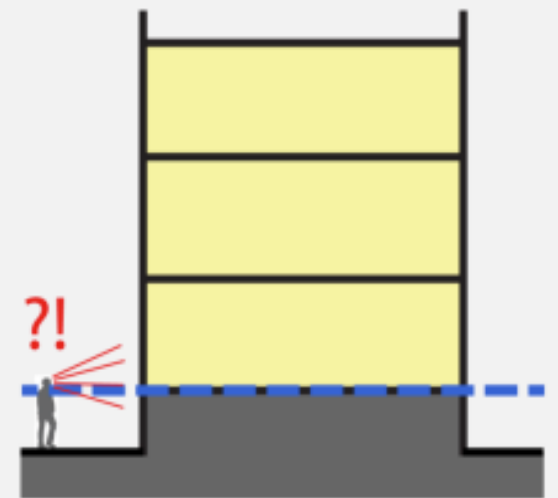
PARKING

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



Biggert-Waters Flood Insurance Reform Act of 2012

- Intended to phase in increases in flood insurance rate for homes in flood zones
- Proposed loss of subsidies and grandfathered status

Homeowner Flood Insurance Affordability Act of 2014 (HFIAA)

- Repeal and modifies Biggert-Waters
- Slows some flood insurance rate increases
- Phases out subsidies for some older buildings in high-risk areas
- Insurance rates for these buildings will rise quickly until they reach full-risk rates
- All policyholders subject to new assessments and surcharges

Increases annually

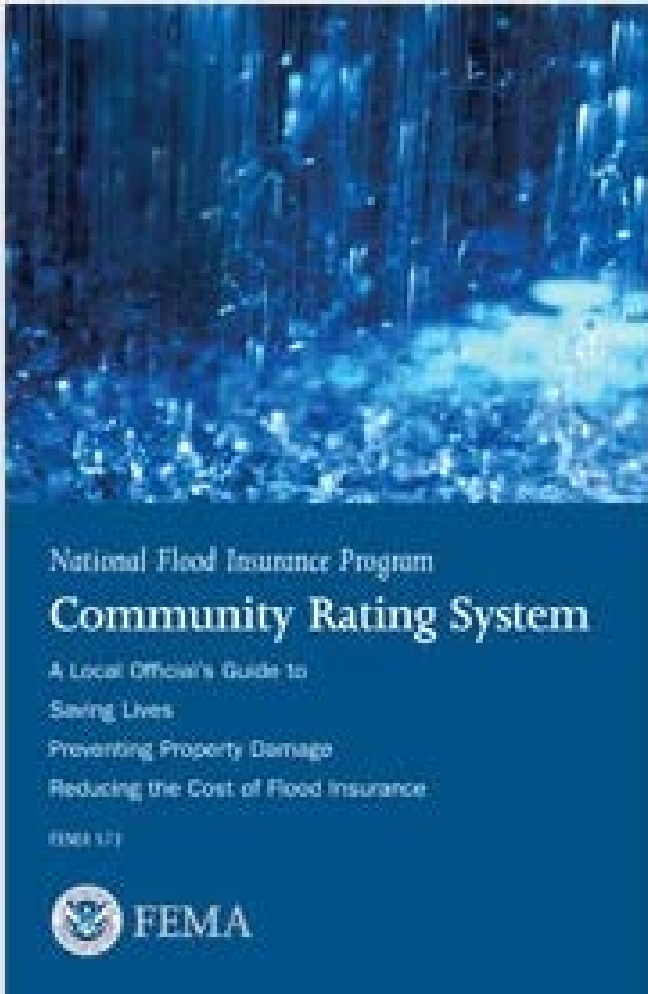


Another Round of NFIP rate changes took place on April 1, 2016

- Pre-FIRM subsidized properties (non-primary residential, business properties, severe repetitive loss properties and substantially/damaged/substantially improved properties) must be increased annually by 25% until they reach full-risk rates
- The average annual premium rate increases for all other risk classes are limited to 15% while the individual premium rate increase for any individual policy is limited to 18% and
- The average annual premium rate increase for Pre-FIRM subsidized policies must be at least 5%.
- Lapsed policies (90 days) not eligible for pre-FIRM subsidized



Community Rating System



Voluntary incentive program that recognizes and encourages floodplain management activities that exceed the minimum NFIP requirements.

Leads to reduced flood insurance rates to reflect the reduced flood risk

Reduces flood damage to insurable property and encourages a comprehensive approach to floodplain management.

Stormwater Management



Resiliency & Restoration

- Stream Restoration
- Stormwater Capture Systems
- Impervious Surface Removal
- Erosion Control
- DAMS
- Wastewater Treatment Plants
- Blue Alley Projects
- Replace and upgrade pipes





Implementing Adaptation Projects

Whole Block Approach

Energy

- Cool Roofs
- Weatherization
- Energy Education

Additional

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



Energy: Residential Pilot



- Identify neighborhoods most vulnerable to impacts from climate change
- Pilot project: solar on row houses in low income area
- Include weatherization and cool roof installation





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.





Database of Trees

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

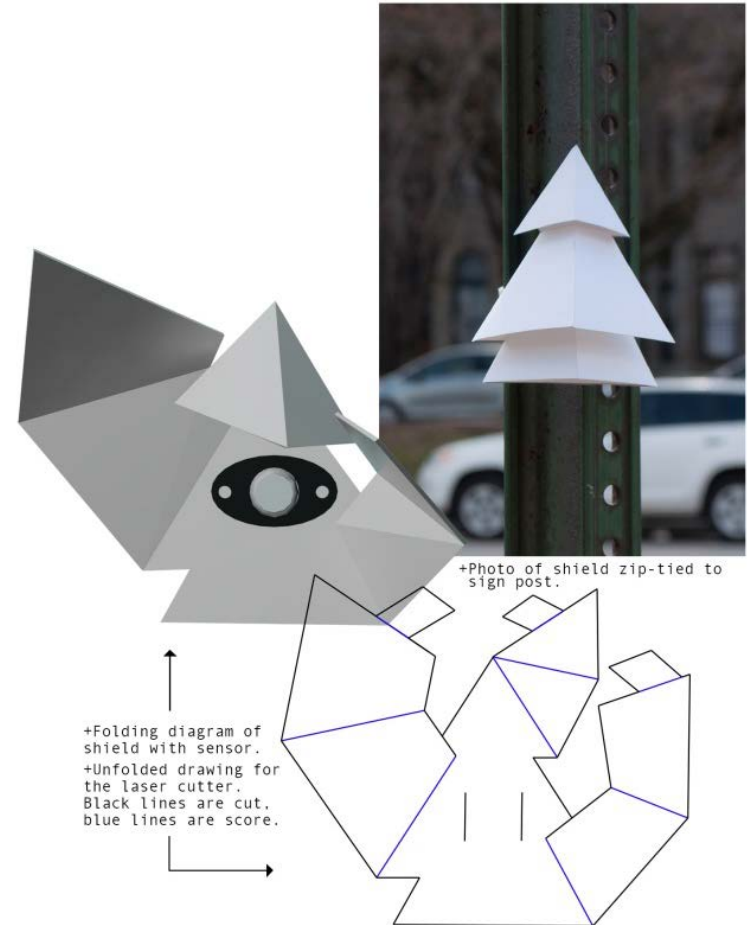
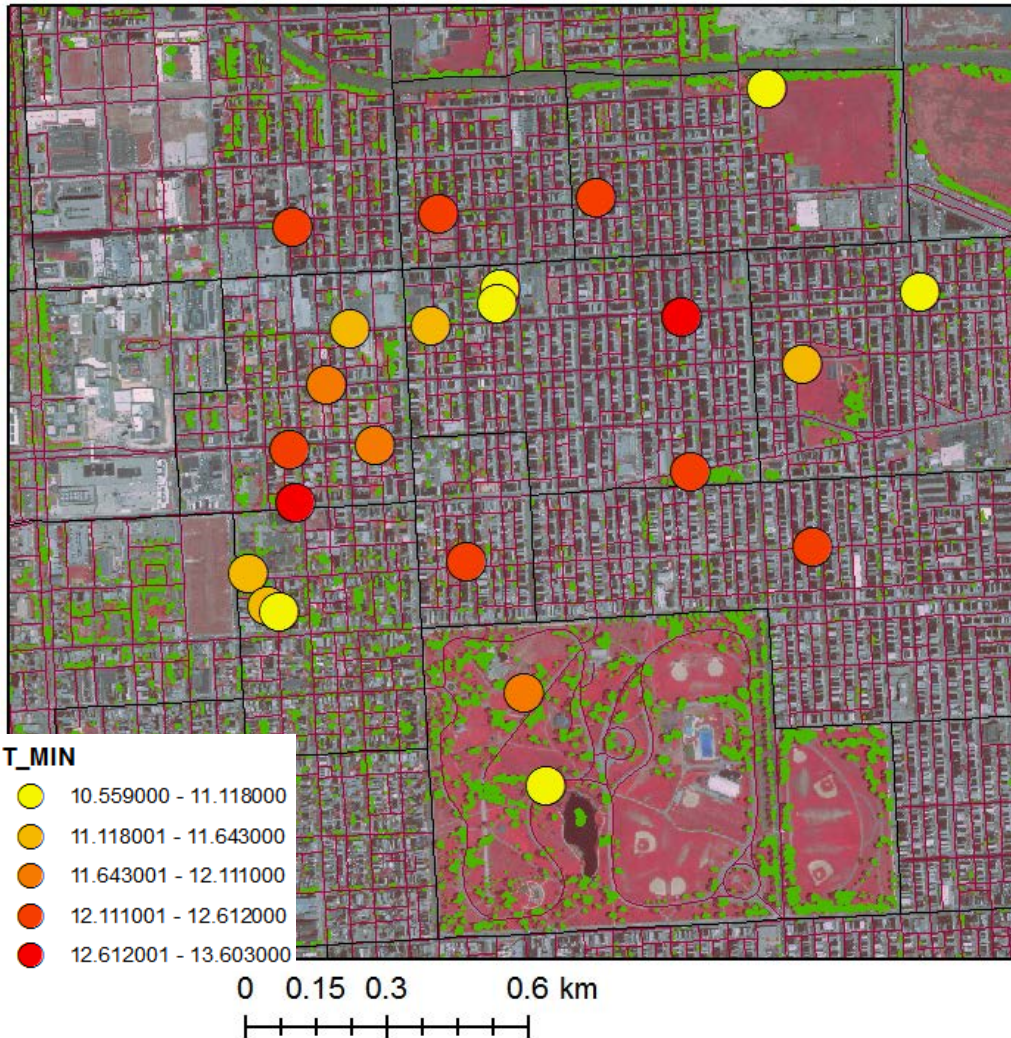
Spatial Analysis Tool

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

Heat Islands and Sensors



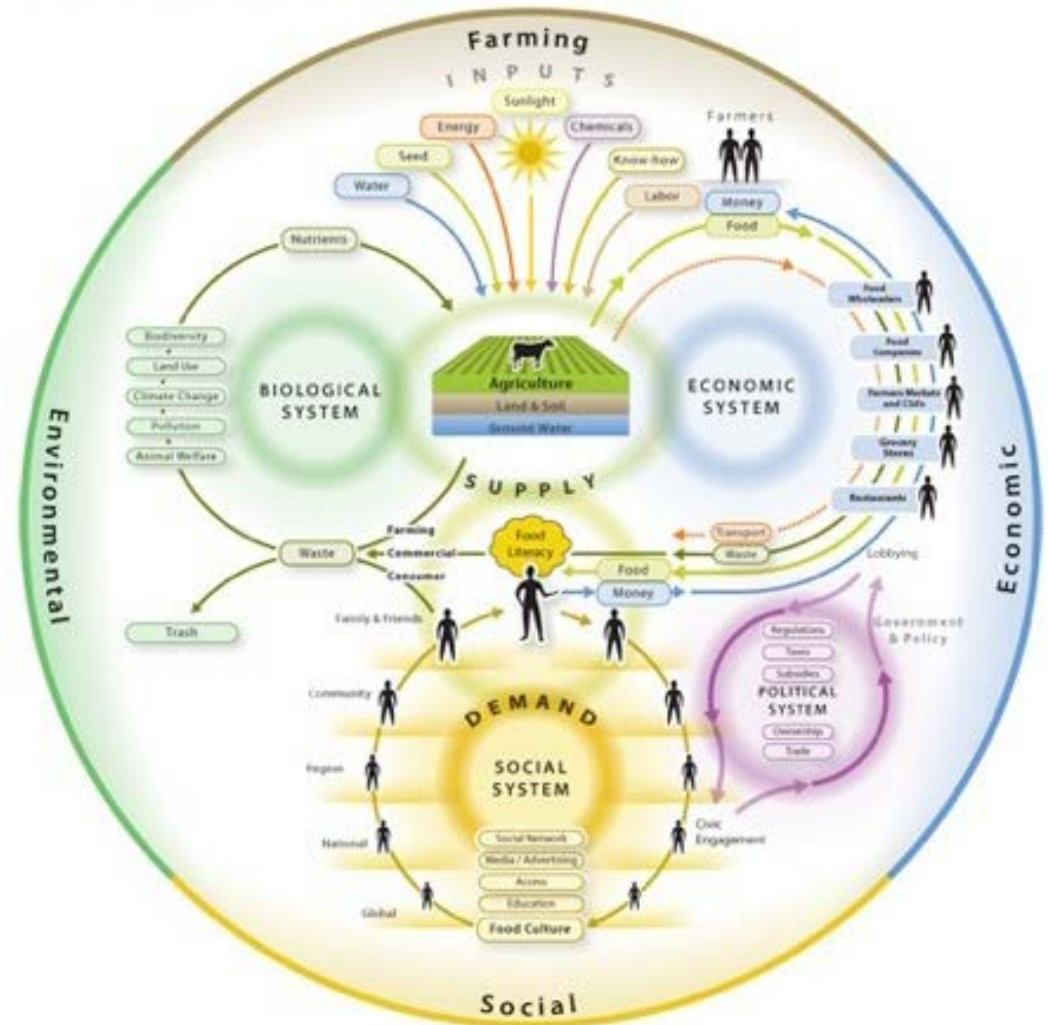
Minimum Temperature (°C)



Food Resiliency Plan



Conduct a risk assessment of our food system and determine local, regional and national factors that will impact food security both short and long term.





Community Preparedness

Make a Plan, Build a Kit, Help Each Other



Missing Piece



Held over 40 Community Preparedness Meetings. In those meetings, residents identified a need for more than kits and plans. They identified the following missing pieces:

- Safe place to go
- Access to materials and tools
- Access to heat and cooling
- Information center
- Power
- Medical care
- Food and water



Resiliency Hubs

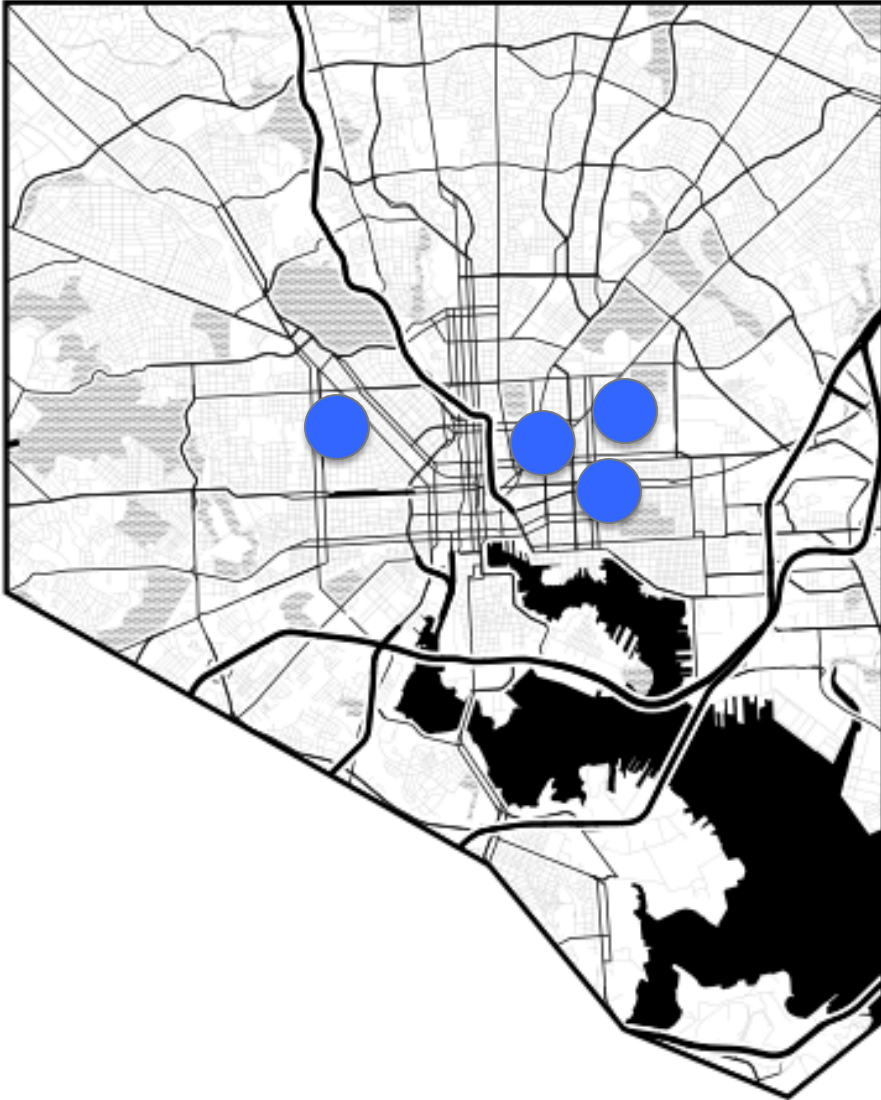


Definition: A Resiliency Hub consists of a building or set of buildings and neighboring outdoor space that will provide shelter, backup electricity, access to fresh water, and access to resources such as food, ice, charging stations, etc. in the event of an emergency.

Ideally, hubs will also include additional elements such as a place to grow fresh and local food, increased tree canopy for shade and cooling, and resources for sheltering in place or evacuation as needed.



Resiliency Hubs



Resiliency Hubs are locations that are used year-round and for other activities

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

Currently working on **four pilot hubs** in Baltimore City

Community Engagement

HELP

SAFE

Let your **neighbors** know if you need assistance by placing the appropriate side of this sign in your window.

***NOTE:** This sign is intended for **NEIGHBORHOOD ASSISTANCE ONLY!** Displaying this sign **DOES NOT** imply that Police or Fire Service will respond. For emergencies, call 9-1-1

WHAT TO DO AFTER AN EMERGENCY?

1. Stay calm.
2. Are you injured?
3. Is anyone around you injured?
4. Is your home safe?
5. Are your neighbors safe?
6. Tune into local news for information



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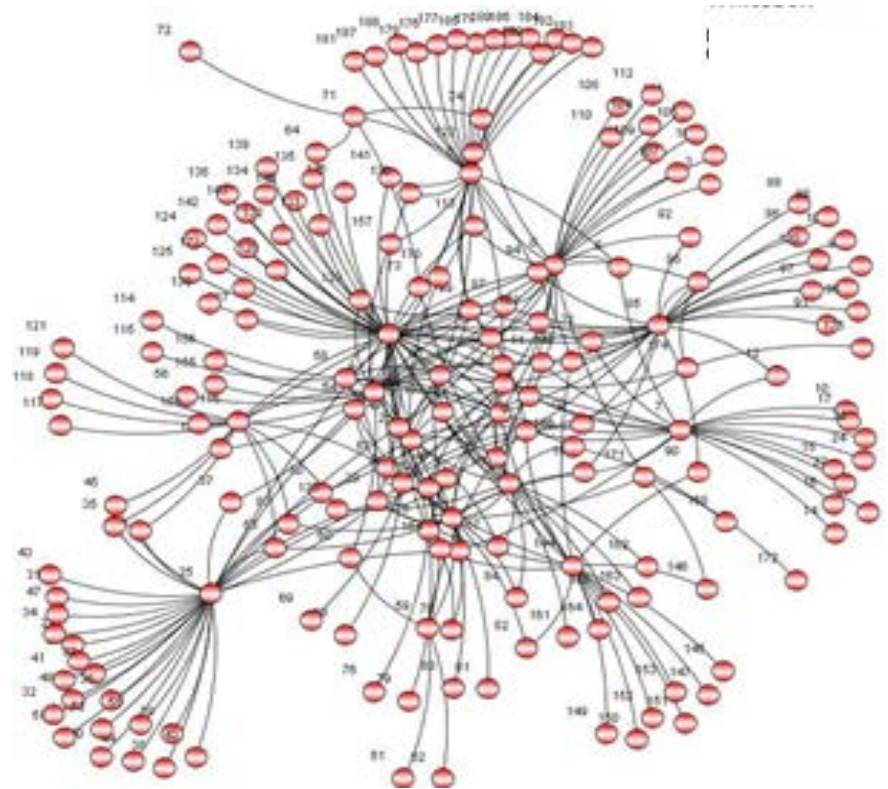




Ambassador Network



- We start recruiting Community Ambassadors by tapping into the networks of the **35 people** from the Community Supper held in late 2015.
- Ask them to recommend people who might be interested in the process
- Ongoing peer-to-peer network that grows



TRAINING TOOLKIT

• DATA AND INFORMATION

- Provide District-specific data to each Ambassador such as:
- Council Member
- Transportation options
- Vacant properties and housing
- Urban Heat Island
- Floodplain

• EXTRAS

- Stipends provided to Lead Ambassadors in each District.
- Small amount of money Lead Ambassadors work with Ambassadors to determine how and what the money will be used for.
- Solar powered cell chargers and bling
- Cameras provided to document the engagement
- Ipads provided to document feedback

• DRAFT SURVEY QUESTIONS

- What do you like about your neighborhood?
- What do you dislike?
- What would you want to see change?
- How would you like to be involved in making your neighborhood more equitable and sustainable?
- What would a healthy environment look like to you?

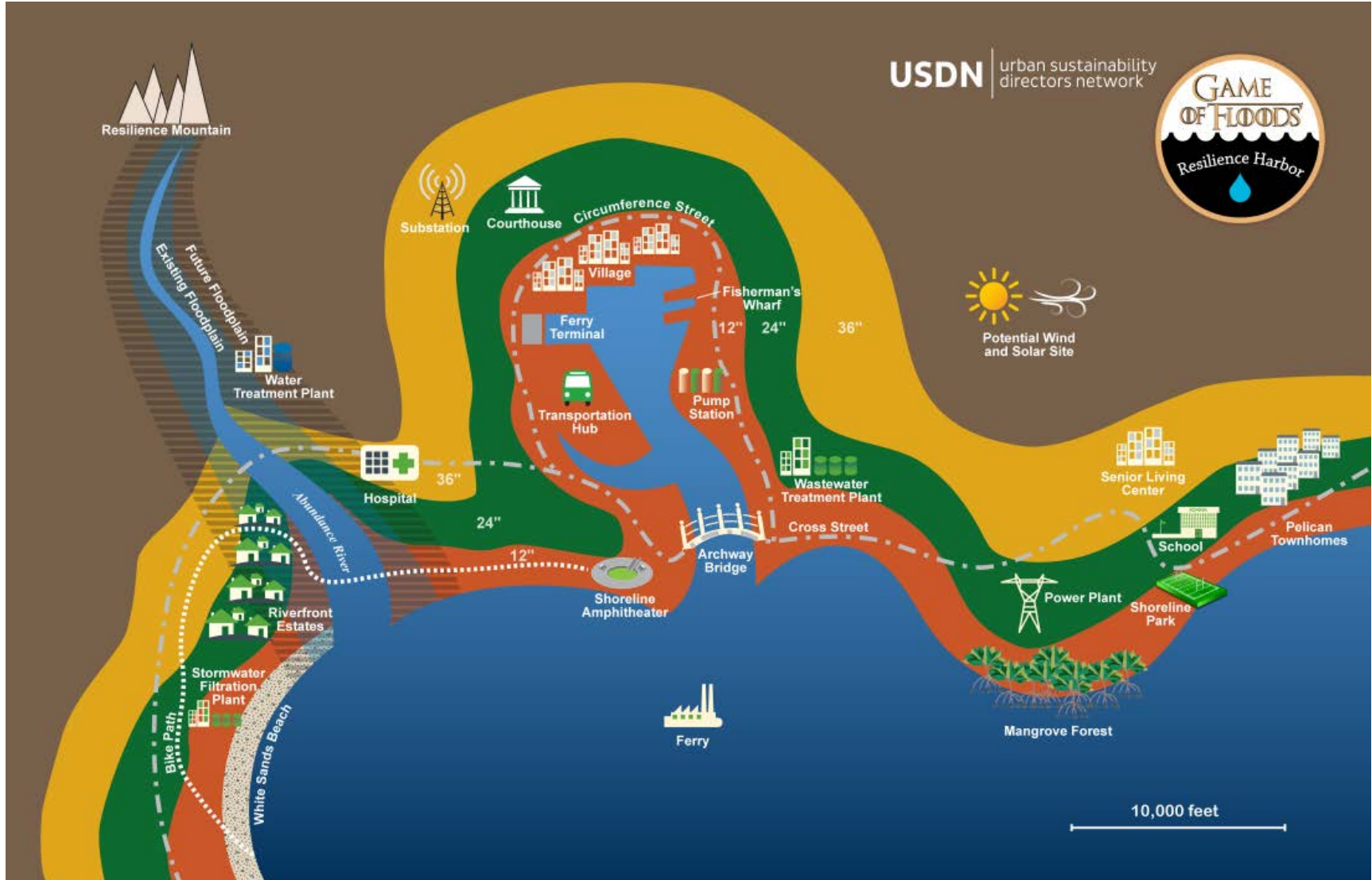
• TOOLKIT ELEMENTS

- Draft Presentations
- Suggestions for Engagement
- Surveys
- Suggestions for locations to engage with people
- Data and Information about District



- Climate Adaptation Trainings for City Departments
- Equity and Inclusion Trainings
- Focus on decision makers and middle managers
- Provide training for community ambassadors
- Collaboration with other cities throughout the U.S. to develop next level of training

Training with Games



Training with Games



Team Scenario 1



Planning Horizon: 2050
Sea Level Rise: Mid range (12" by 2050)
Precipitation: 20% increase in precipitation intensity

Town History:

Originally settled by longline fisherman in the 1890s, the area became heavily farmed in the 1930s, and transitioned to a resort community during the economic boom of the 1980s. The town's economy is now based on a mix of technology-related industry, tourism, fishing, and agriculture.

Current Resident Population = 225,000

City Planning and Sustainability



Role: City Planner and Sustainability Director

You represent the interests of the Resilience Harbor Planning Department. It is your role to ensure the recommendations and decisions made ensure a safe, healthy, and sustainable path for Resilience Harbor to continue to grow and function in the face of future climate change.

Asset Condition Cards



Historic Courthouse

The Historic Courthouse is a registered landmark beloved by the community and frequently used for weddings. Because it is a historic structure, the building cannot be elevated or



Asset Condition Cards



Riverfront Estates

Originally settled in the 1890s by fishermen, the Estates neighborhood has tripled over the last two decades and now comprises 300 homes. Housing styles range from original Craftsmen to sprawling 1950s ranch homes to new, luxury vacation estates. This neighborhood is home to many wealthy residents. The Abundance River has overflowed its banks twice in the last decade, causing millions of dollars worth of damage.



Built gradually, 1890s-present.

Integration



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

STAR Community Rating



Table of STAR Goals and Objectives

Built Environment	Climate & Energy	Economy & Jobs	Education, Arts & Community	Equity & Empowerment	Health & Safety	Natural Systems
Ambient Noise & Light	Climate Adaptation	Business Retention & Development	Arts & Culture	Civic Engagement	Active Living	Green Infrastructure
Community Water Systems	Greenhouse Gas Mitigation	Green Market Development	Community Cohesion	Civil & Human Rights	Community Health & Health System	Invasive Species
Compact & Complete Communities	Greening the Energy Supply	Local Economy	Educational Opportunity & Attainment	Environmental Justice	Emergency Prevention & Response	Natural Resource Protection
Housing Affordability	Industrial Sector Resource Efficiency	Quality Jobs & Living Wages	Historic Preservation	Equitable Services & Access	Food Access & Nutrition	Outdoor Air Quality
Infill & Redevelopment	Resource Efficient Buildings	Targeted Industry Development	Social & Cultural Diversity	Human Services	Indoor Air Quality	Water in the Environment
Public Spaces	Resource Efficient Public Infrastructure	Workforce Readiness		Poverty Prevention & Alleviation	Natural & Human Hazards	Working Lands
Transportation Choices	Waste Minimization				Safe Communities	



Integrate into Framework



Built Environment	Climate and Resiliency	Community Services	Economy and Jobs	Human Health and Well-being	Natural Systems
Water Systems	GHG Emissions	Education	Green Market Development	Active Living	Green Infrastructure
Housing	Energy	Green Schools	Local Economy	Food Access and Nutrition	Natural Resource Protection
Transportation	Natural and Human Hazards	Waste and Recycling	Quality Jobs and Wages	Human Services	Water in the Environment
Planning Communities	Preparedness	Community Cohesion	Targeted Industry Development	Indoor and Outdoor Air Quality	Biodiversity
Buildings	Emergency Prevention & Response	Arts and Culture	Training and Readiness	Safe Communities	Natural Systems
		Social and Cultural Diversity		Poverty Prevention & Alleviation	Working Lands

Build into new plans



- Continue to build resiliency into all new plans and projects
- Regional collaboration
- Reach out to new partners and identify new opportunities for relationship building



Every Story Counts



Baltimore Office of Sustainability ✓
@baltimoresustainability

- Home
- About
- Photos**
- Reviews
- Likes
- Events
- Videos

👍 Liked ▾ 💬 Message 📌 Save ⋮ More ▾

Contact Us

Every Story Counts

6 Photos · Updated 5 days ago

You don't have to be a climate scientist or city planner to create sustainability + resilience. Everyone has a story to tell about making Baltimore a stronger, fairer and safer place for all of us. Be a part of our Every Story Counts Campaign by sharing yours on Twitter or Instagram using the hashtag #EveryStoryCounts or #ItsAboutUs, or by sharing your words and pictures through our website at <http://tiny.cc/everystory>. Join the many people who've shared their stories already at <http://tiny.cc/everystory> so that the whole city can see how we're making a difference together, and so we can match you with the resources to do even more.





Thank you!

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