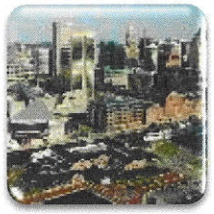

Planning

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

- Energy
- Liquid Gas
- Communication
- Transportation
- Waterfront
- Wastewater
- Stormwater
- Solid Waste
- Policy

Buildings

- City Codes
- Structural
- Non-Structural

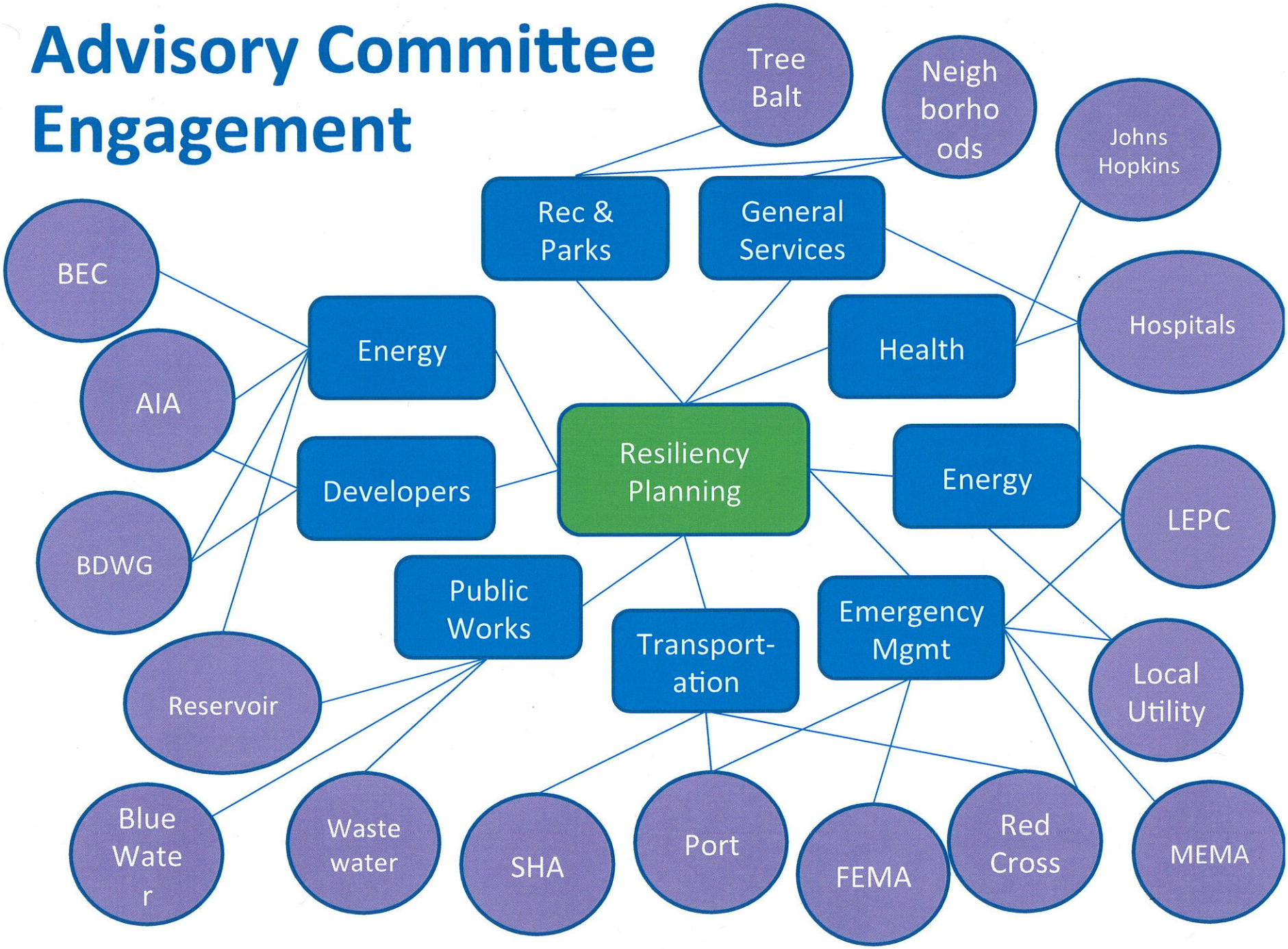
Natural Systems

- Urban Parks & Forests
- Water Supply and Management

Public Services

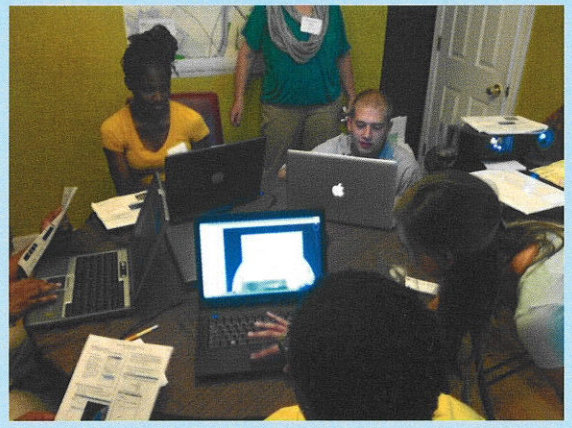
- Emergency Preparedness & Response
- Health
- Education & Outreach
- Food System

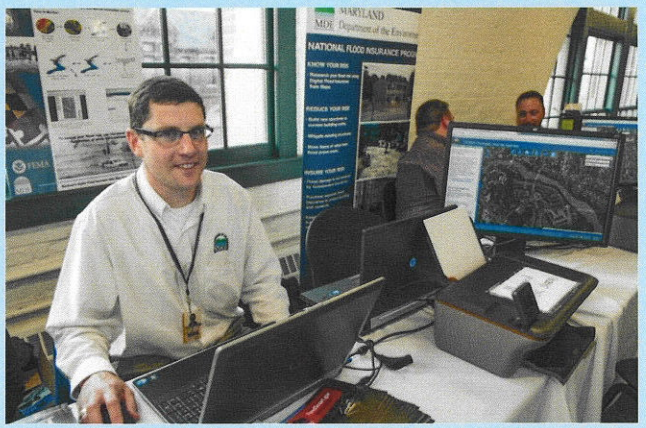
Advisory Committee Engagement



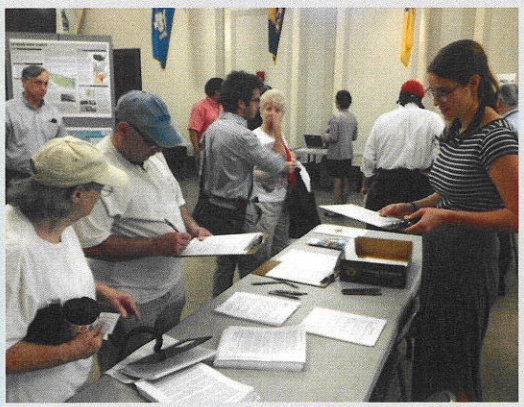
Community Engagement

Small Staff Trainings and Community Meetings

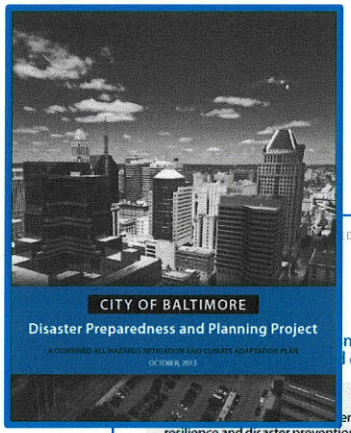




Large Town Halls and Interactive Community Meetings



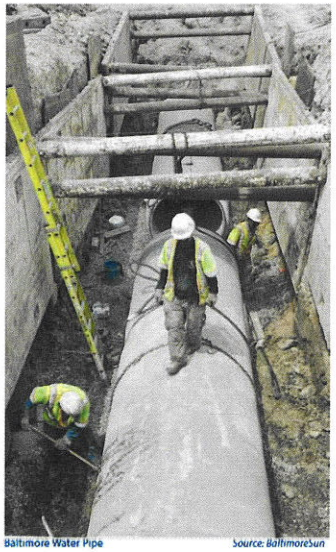
Disaster Preparedness Plan



Adopted unanimously in October, 2013

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

em 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 popes and outfalls.

1. Implement the requirements of Baltimore's MS4 (separate stormwater and sewer system) permit (S)

   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.

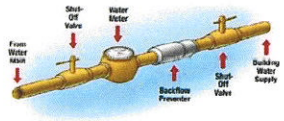
4. Preserve and protect natural drainage corridors (S)

   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.

5. Review and revise storm drain design on a continuous basis, to accommodate projected changes in intense rainfall (O)

   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.

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	



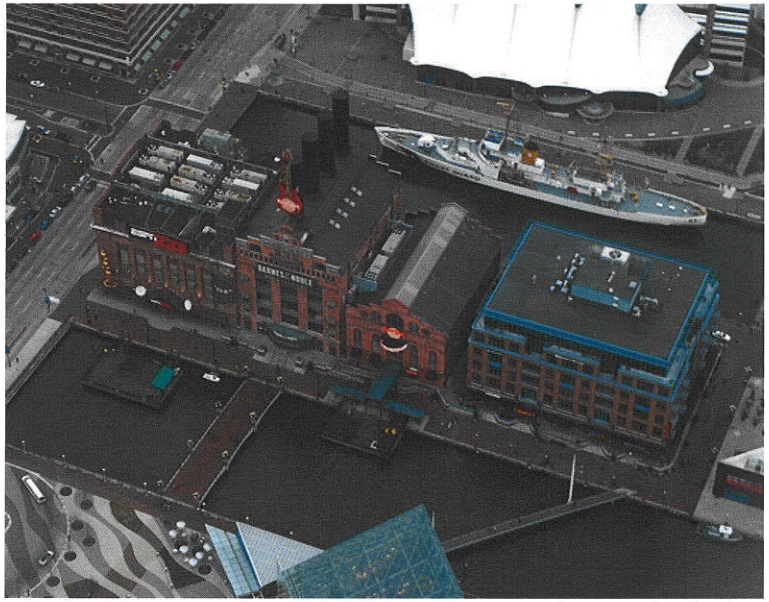
Backflow Preventer — Source: DemarPlumbingNYC

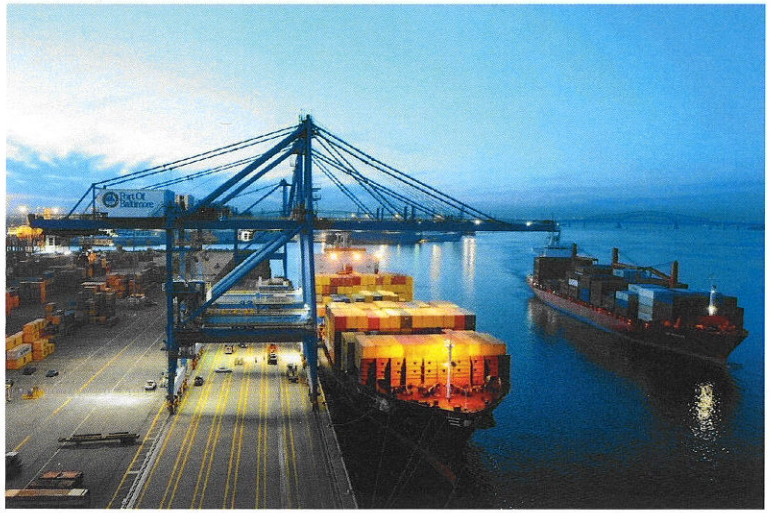
Six Goals

1. Protect the health, safety and welfare of Baltimore City residents and visitors
2. **Prevent damage to structures, infrastructure, and critical facilities**
3. Build resilience and disaster prevention and planning into all programs, policies, and infrastructure (public and private)
4. Enhance the City of Baltimore's adaptive capacity and build institutional structures that can cope with future conditions that are beyond past experience
5. Promote hazard mitigation and climate adaptation awareness and education throughout the City of Baltimore
6. Become a Community Rating System (CRS) classified community

Additional Considerations

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





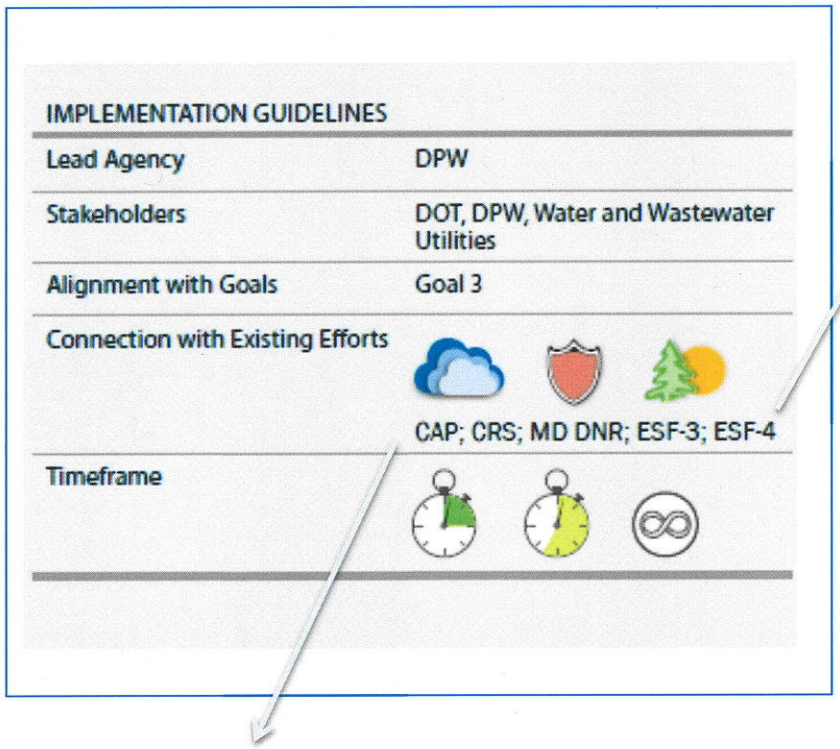
Implementation

Crosswalk

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

STRATEGY NUMBER	STRATEGY	ACTION	Water a	C1	C2	C3	PP1	PP2	PP3	PP4	PP5	RC1	RC2	RC3	RC4	G1	G2	G3	G4	T1	T2	T3	T4	T5	EA1	EA2	EA3	EA4	GE1	GE2
		Review and revise storm drain design on a continuous basis, to accommodate projected changes in intense rainfall							x				x																	
IN-17	Modify urban landscaping requirements and increase permeable surfaces to reduce stormwater runoff	Support existing stormwater requirements and continue to evaluate and improve Best Management Practices							x				x			x			x										
		Encourage urban landscaping requirements and permeable surfaces into community managed open spaces							x				x			x		x	x										
		Utilize water conservation elements such as green roofs, rain gardens, cisterns, and bioswales on residential, commercial, industrial, and City-owned properties to capture stormwater							x				x			x		x	x										
		Encourage permeable paving on low-use pathways							x				x					x	x										
IN-18	Evaluate and support DPW's stream maintenance program.	Review and improve status of standing maintenance requirements			x				x										x										
		Ensure adequate funding is in place to support stream maintenance			x				x										x										
		Identify opportunities where stream restoration efforts will off-set maintenance costs			x				x										x										
		Identify interdependencies and benefits of stream maintenance with other transportation programs			x				x										x	x	x	x	x	x						
		Clear streams on a regular basis, prioritize dredging the stream beds, and increase inspection and cleaning of culverts and storm drains to prevent flooding		x	x				x										x										
IN-19	Support and increase coordination and information sharing across jurisdictions to better enable mitigation of cross-border impacts on the regions watersheds (e.g., understanding flood conditions upstream in the County)	Partner with local counties to evaluate major tributaries in all watersheds to determine best management practices for capturing run-off and slowly releasing it (stormwater quantity management)							x				x						x										
		Encourage information sharing within the Chesapeake Bay community to assist in developing best management practices							x				x						x										
IN-20	Reevaluate and support a comprehensive debris management plan for hazard events	Investigate best practices for managing and disposing of downed trees, yard waste, building debris, as well as additional household garbage		x	x									x															
		Expand and integrate existing programs to reduce or intercept debris before it gets into the streams and harbor		x	x									x															
		Develop and promote solid waste management actions for citizens to implement before a hazard event		x	x									x															
		Incorporate consideration of hazards and climate adaptation efforts into all plans, systems,		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Identify Connections



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Timeframe	

Emergency Support Functions

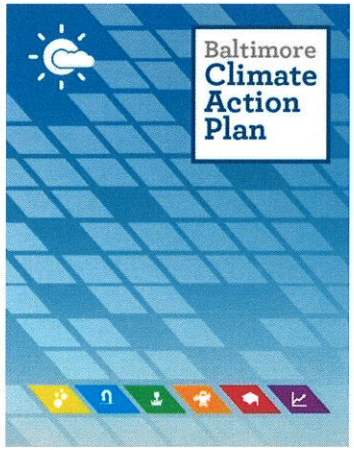
Governmental and certain private sector capabilities that provide support, resources, and services needed to save lives, protect property and environment, restore essential services and critical infrastructure and help communities.

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

RESILIENT + SUSTAINABLE

Drinking water

Renewable Energy

Trees

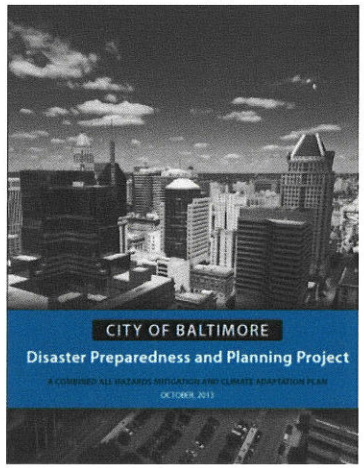
Building Codes

Energy Grid

Energy Efficiency

Transportation Inf.

ADAPTATION + HAZARD MITIGATION



Infrastructure

Buildings

Natural Systems

Public Services

Whole Block Approach

Energy

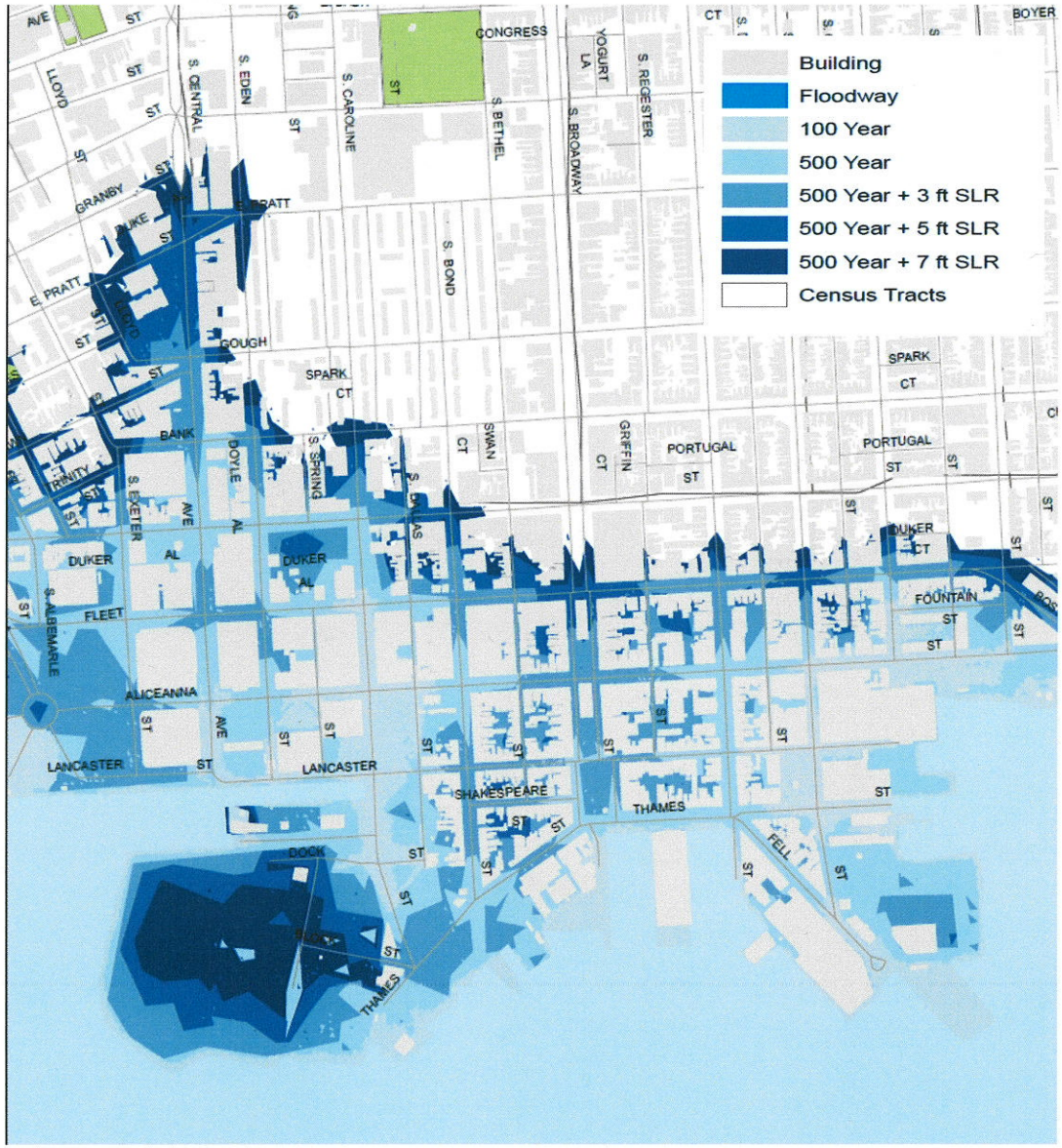
- Cool Roofs
- Weatherization
- Energy Education

Additional

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


Floodplain

Stormwater: Floodplain



Updated Ordinance in April, 2014 establishing:

- Two (2) feet of freeboard (plus <u>additional foot for critical facilities</u>)
- Flood Resilience Area and 500-year extent
- ASCE-24 construction standards

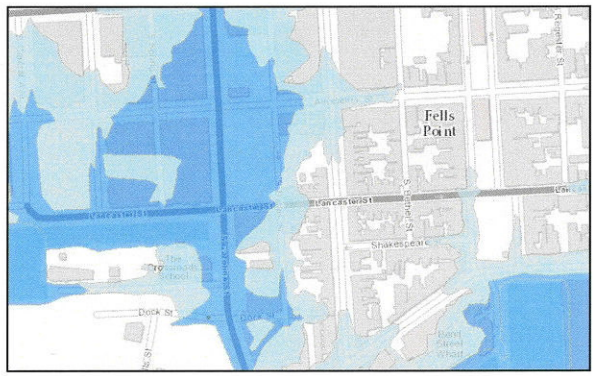
Floodplain Regulation

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

Height

500

Both 100 and 500



Extent

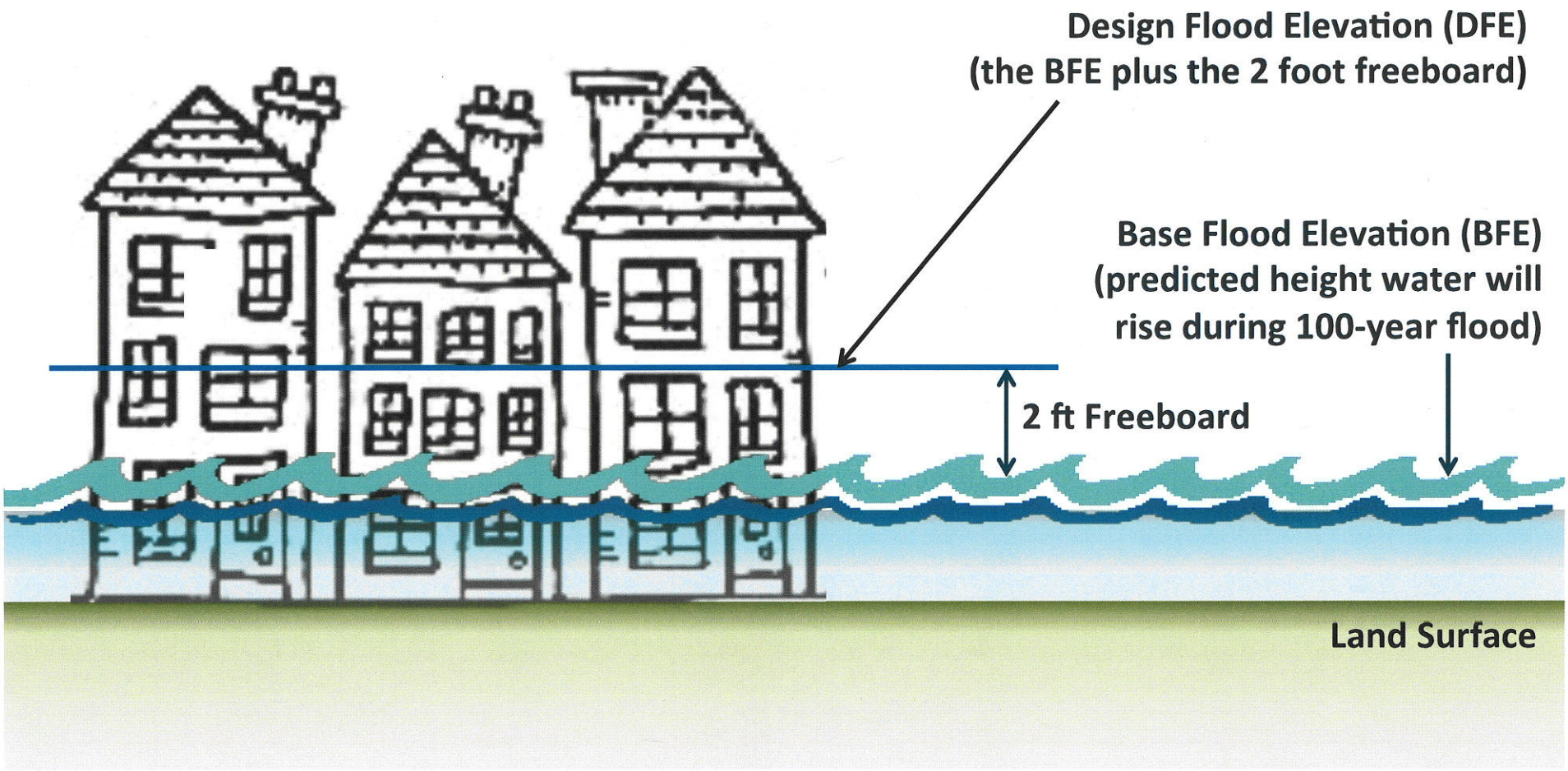
In non-tidal areas, the City regulates to the height of the 100-year flood and to the extent of the 500-year flood

100

Both 100 and 500

Floodplain Regulation

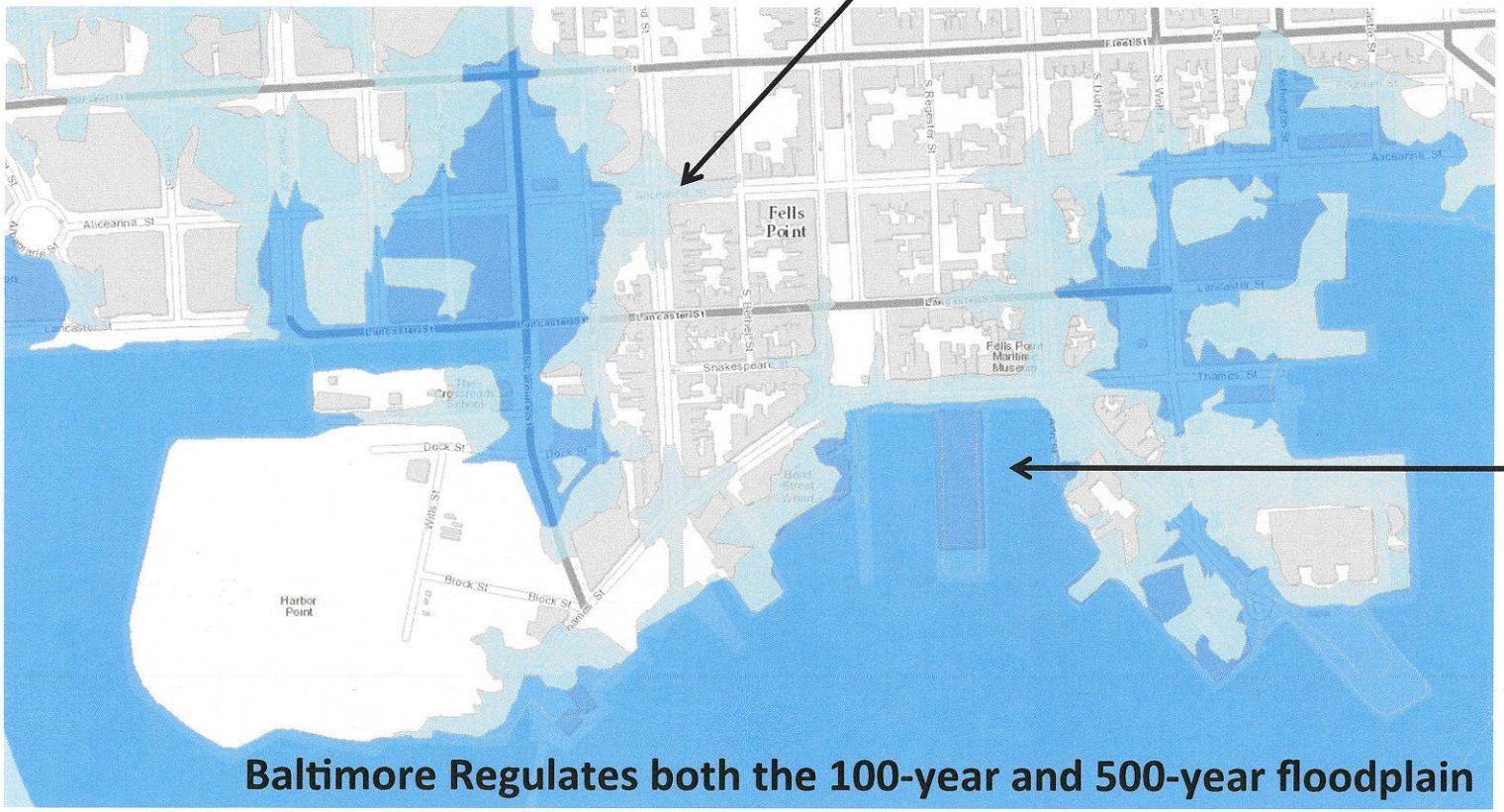
Understanding Height and Freeboard



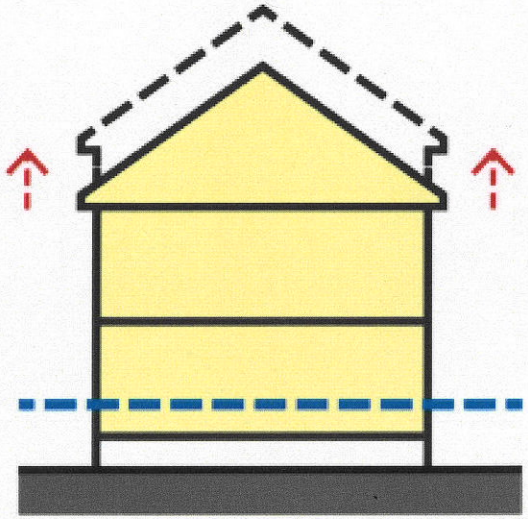
Floodplain Regulation

Understanding Extent of Regulated Floodplain

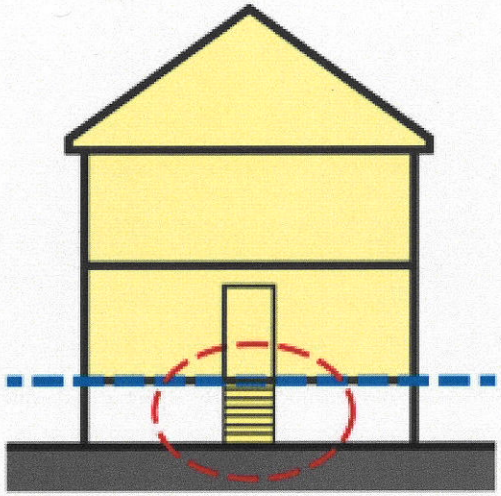
Light Blue- Flood Resilience Area (FRA)
500 year Floodplain



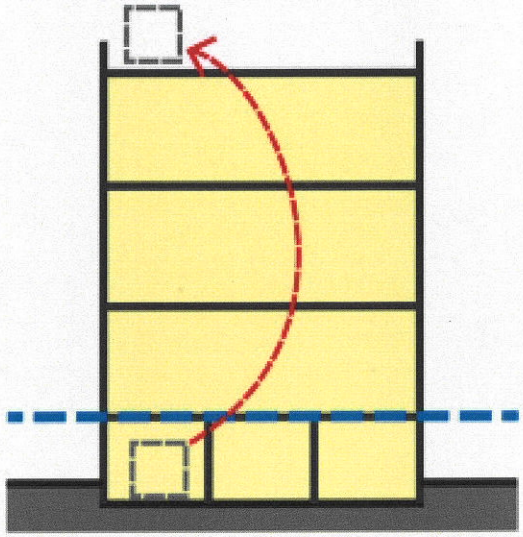
Dark Blue-
100 year
Floodplain



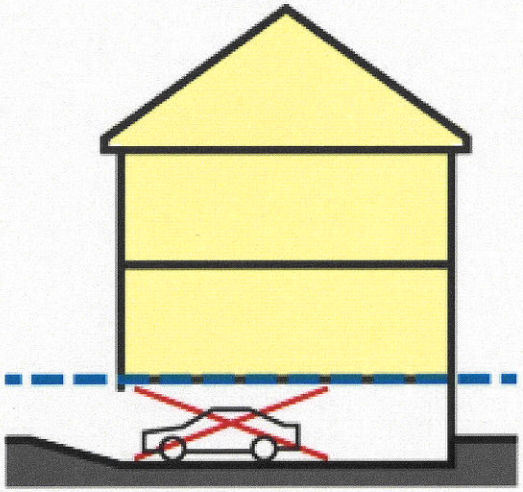
HEIGHT
must recognize elevation requirements in flood zones



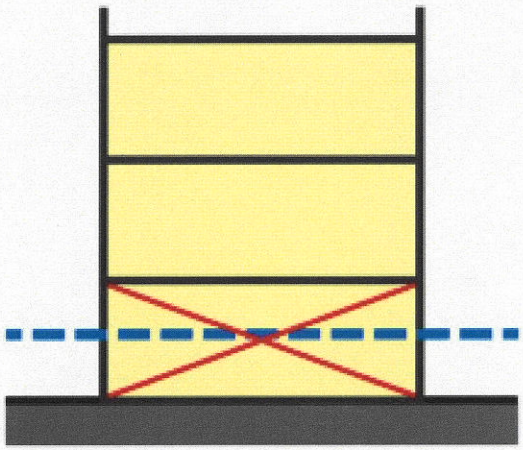
ACCESS
need for stairs or ramps requires imaginative solutions



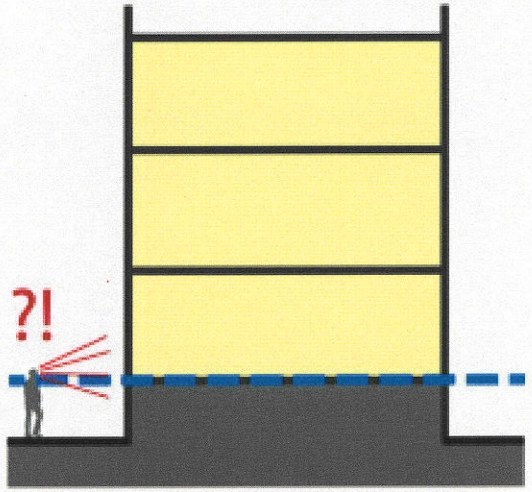
MECHANICAL SYSTEMS
must allow relocation out of flood-prone areas



PARKING
may not be possible below ground

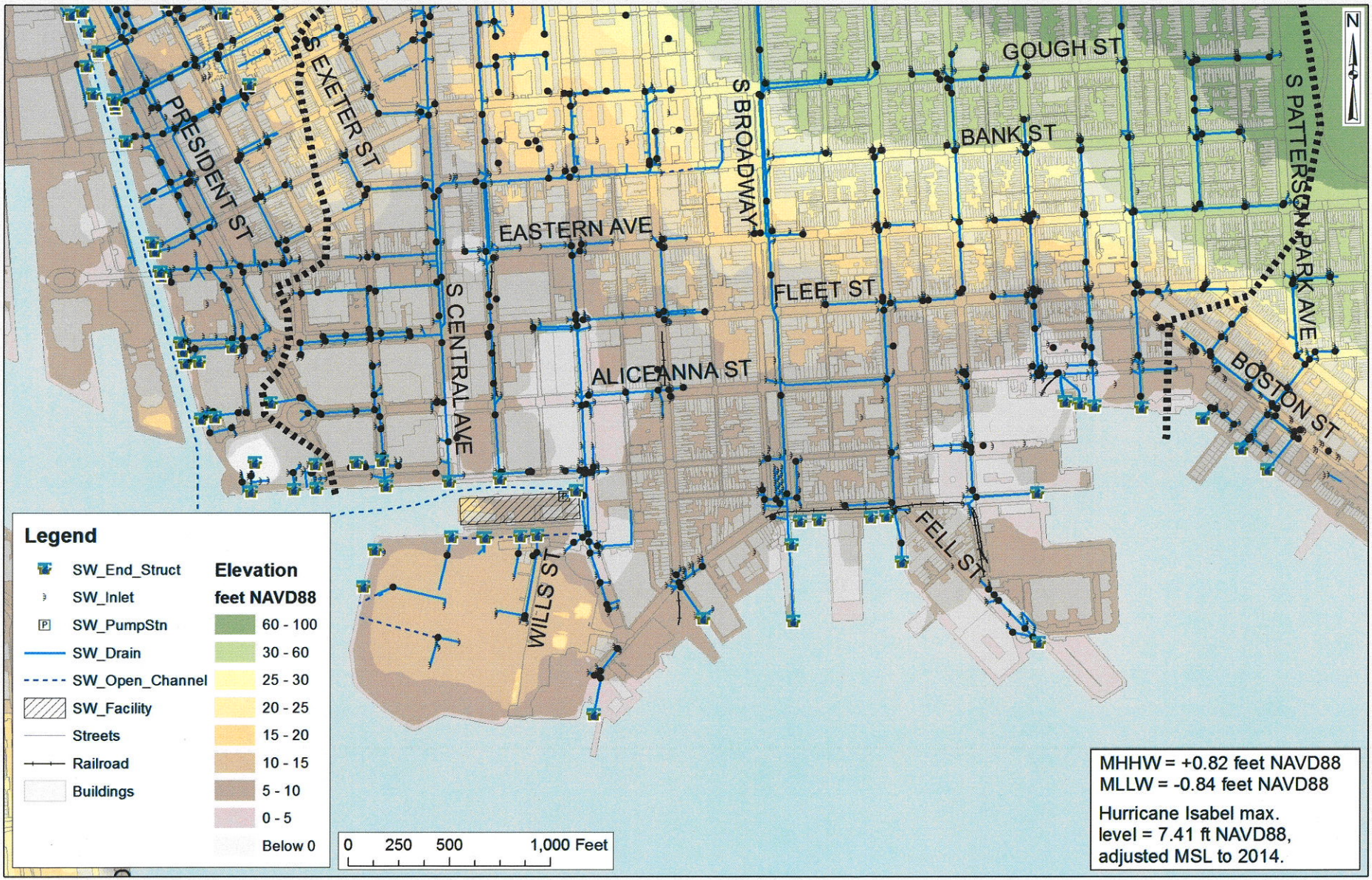


GROUND FLOOR USE
buildings may be allowed only limited use of ground floors



STREETSCAPE
limit negative effect of blank walls on streetscape

Critical Infrastructure



Outfall Backflow Prevention