New Partners for Smart Growth Conference

Better Together: Collaborative Approaches to Catalyzing Adaptation Action

Baltimore Climate Resilience:

Collaboration around an All Hazard Mitigation and Climate Adaptation Process

Baltimore Office of Sustainability
People · Planet · Prosperity

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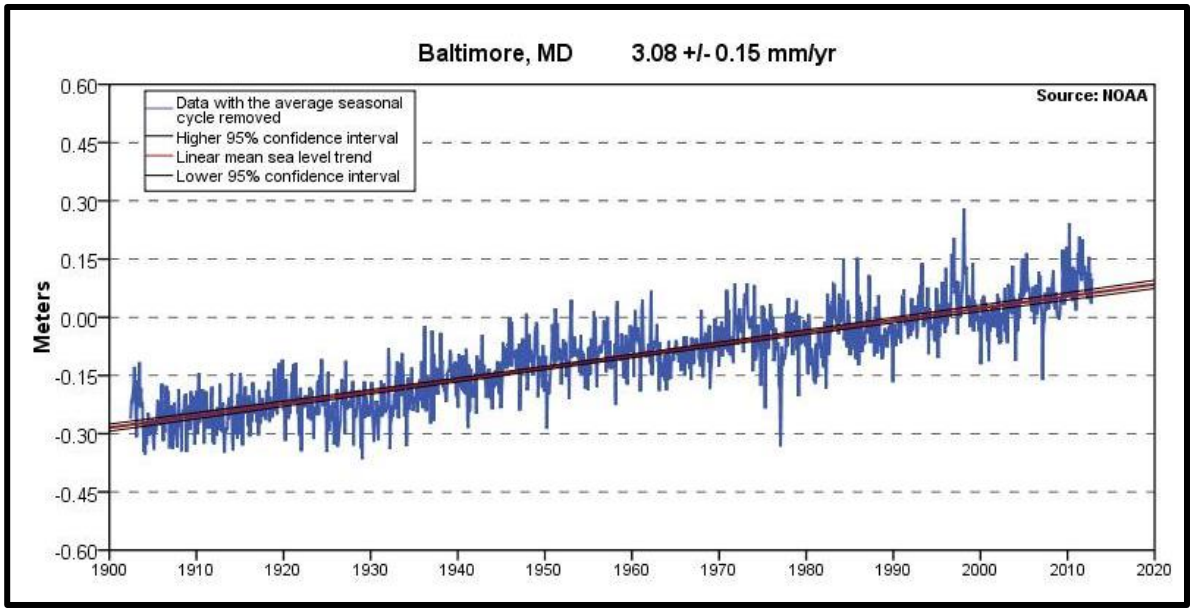
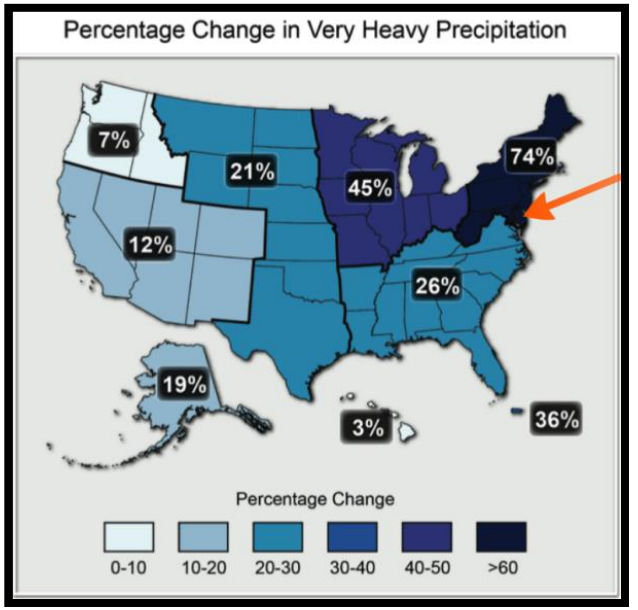
Overview

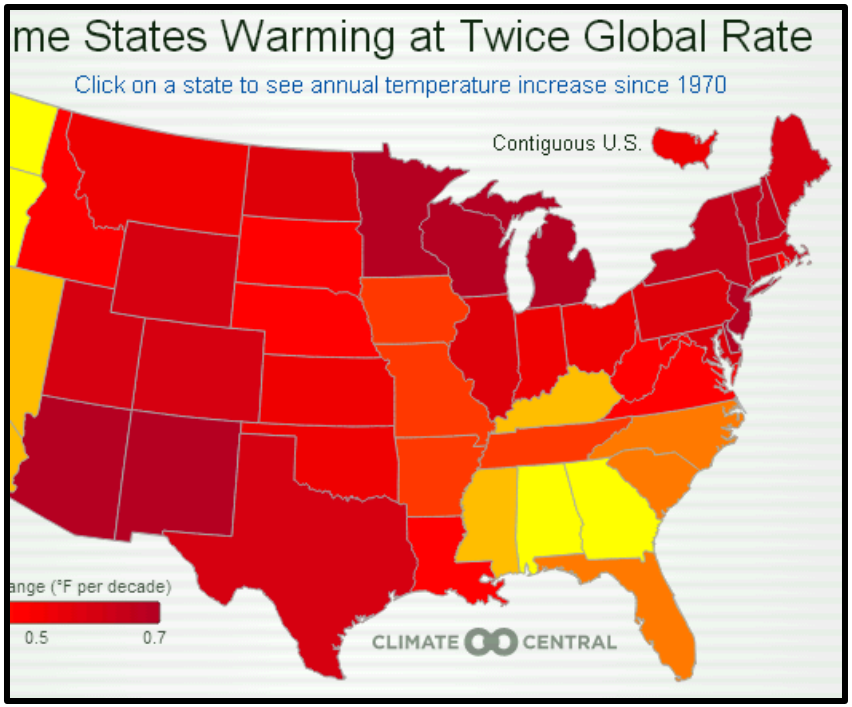
- Background
- Hazards
- Plan Development
- Collaboration
- Lessons Learned

Baltimore City Intro

- Most heavily developed area in Maryland- population 622,000
- Port and waterfront remain extremely important assets
- Home to many Universities and Health Institutions
- Known as the City of Neighborhoods
- 64% African American, 4% Hispanic or Latino, 31% White


Baltimore, MD
3.08 +/- 0.15 mm/yr
Source: NOAA
Data with the average seasonal cycle removed
Higher 95% confidence interval
Linear mean sea level trend
Lower 95% confidence interval
Meters
0.60
0.45
0.30
0.15
0.00
-0.15
-0.30
-0.45
-0.60
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020


Percentage Change in Very Heavy Precipitation
7%
21%
45%
74%
12%
26%
19%
3%
36%
Percentage Change
0-10
10-20
20-30
30-40
40-50
>60


me States Warming at Twice Global Rate
Click on a state to see annual temperature increase since 1970
Contiguous U.S.
ange (°F per decade)
0.5
0.7
CLIMATE CENTRAL

Quick Review of 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**

Baltimore's Unique Approach

All Hazard Mitigation Plan
(Current and Historical Hazards)

\+ = Resilience

Climate Adaptation Plan
(Adapt to new and predicted climate conditions)

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

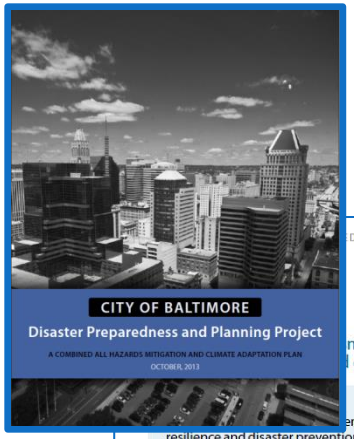
Natural Systems

- Urban Parks & Forests
- Water Supply and Management

Public Services

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

Disaster Preparedness Plan

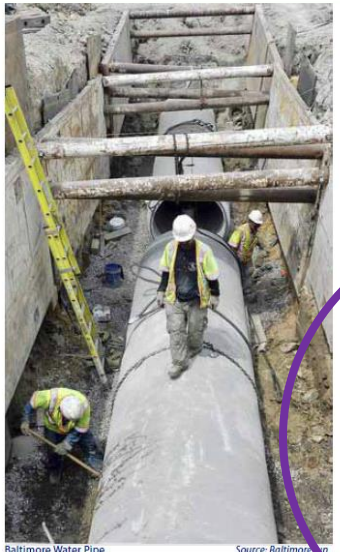


Adopted unanimously in October, 2013

DNESS AND PLANNING PROJECT

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: Baltimore...

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 prev... cracking ...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	

STRATEGIES AND ACTIONS 191

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.

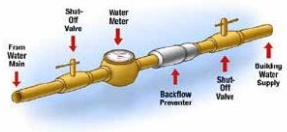
4. Preserve and protect natural drainage corridors (S)

   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


Collaboration

Collaboration

- 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

Federal and State

FEMA

US Army Corps of Engineers®

NOAA

- Floodplain
- Community Rating System (CRS)
- Modeling and HAZUS
- Engineering Studies
- DP3

A more Sustainable and Resilient Baltimore City

- Pre-Disaster Mitigation
- Floodplain
- Modeling
- Coastal Adaptation
- Community Preparedness

MDE

MARYLAND DEPARTMENT OF NATURAL RESOURCES

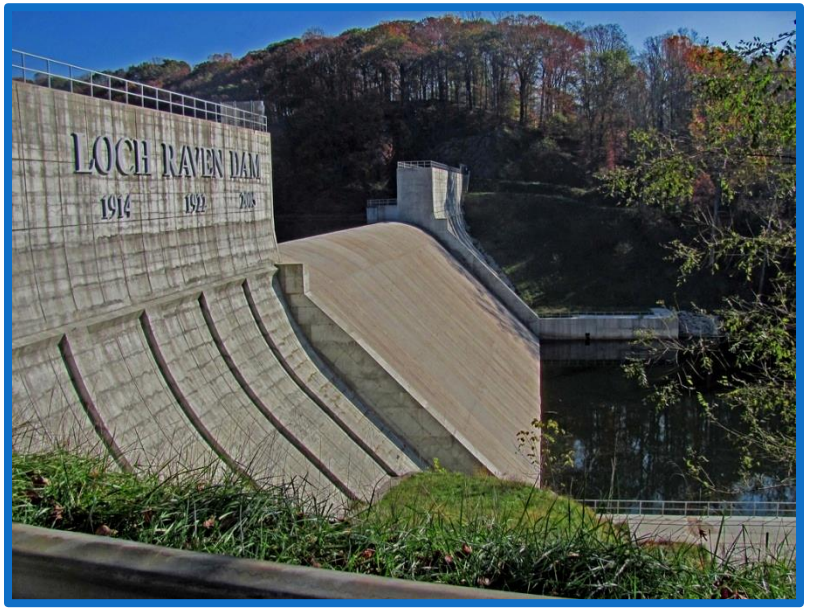
Regional Collaboration

Surrounding Counties:

- Dams
- Stormwater Management
- Emergency Management
- Critical Facilities
- Energy and Transportation

Regional Partnerships:

- Other Cities (DC, Philly, NYC)
- Baltimore Wilderness Coalition
- Baltimore Urban Waters Partnership
- USDN Preparedness Group



Inter-Agency Collaboration

Outcome Budgeting

- 10 year budget and strategy guide
- Measurable goals and outcomes
- Determine amount needed in the “rainy day fund”

Capital Improvement Process

- Resiliency checklist for projects (↓ Risk)
- Projects must take into account anticipated impacts from climate change
- Build resiliency into new projects/plans

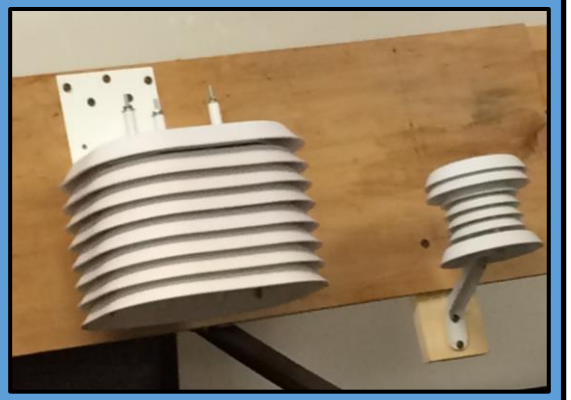
CitiStat

- Integrate climate adaptation into metrics
- Connect resiliency to other agencies work

Local Partners

Non-Profits

Universities

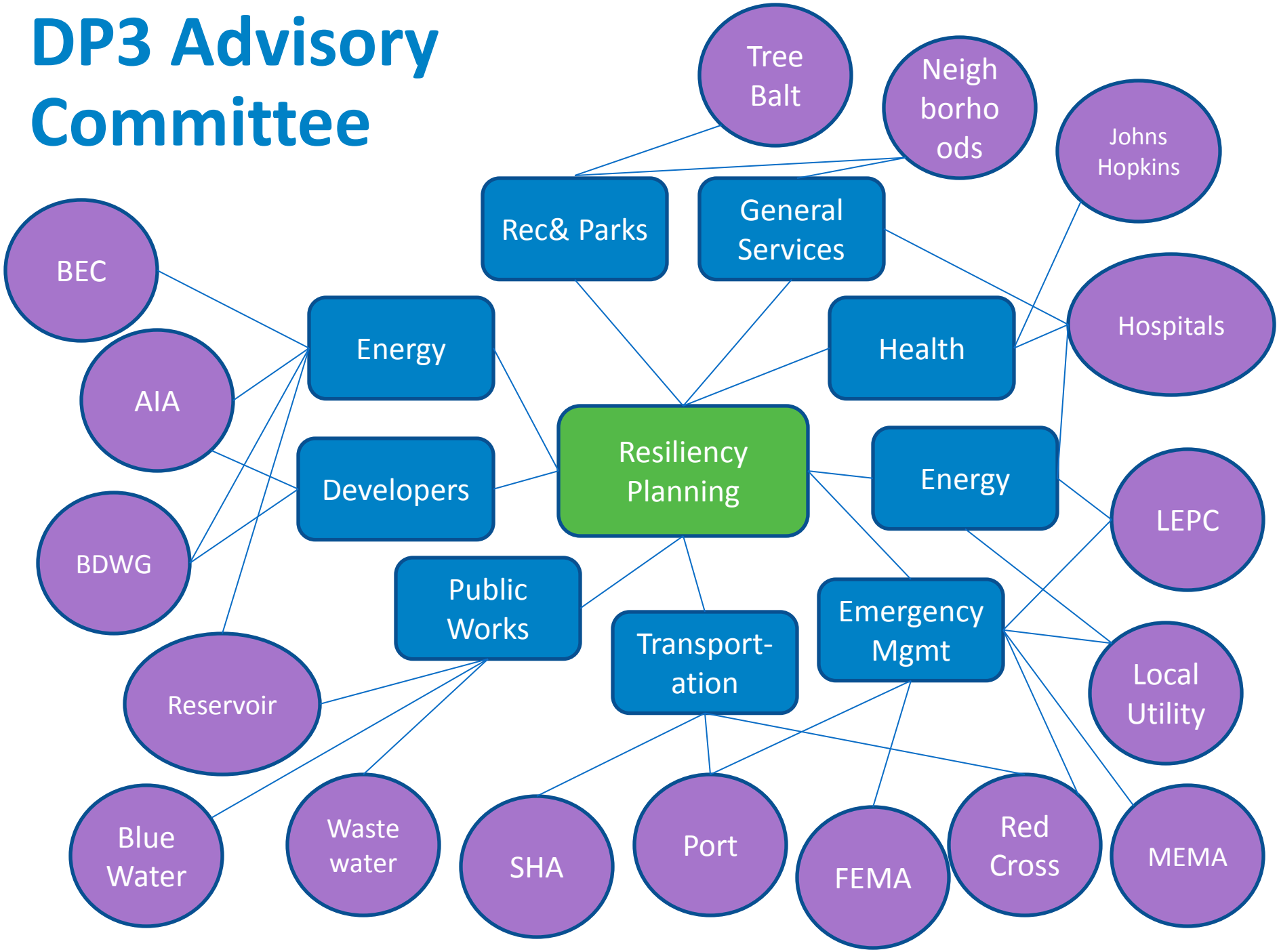


Business & Industrial

Community Collaboration

Make a Plan, Build a Kit, Help Each Other

DP3 Advisory Committee



Benefits

- Develop a comprehensive system for addressing existing and future impacts
- Capitalize on hazard mitigation requirements to gain support from agency directors for adaptation
- Model both historic and predicted hazard scenarios
- Helps ensure adaptation strategies are incorporated into budgeting and CIP processes
- Stronger implementation phase if collaborate extensively in the planning phase
- Overlaps with all stakeholders, plans, projects and partnerships identified and enhanced

Lessons Learned

- Being well organized is essential
- In-person meetings and information sessions are extremely beneficial – gain greater support
- Identifying overlaps with existing plans or projects helps with gaining support
- Identifying funding opportunities or ways to enhance existing projects also helps with gaining support
- You will have a stronger implementation phase if collaborate extensively in the planning phase

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THANK YOU!

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