Appendix

Appendix A: Adoption

Documentation of Adoption of the DP3 Plan by the Baltimore City Planning Commission

Letters of Support

AIA BALTIMORE

September 24, 2013

RE: Letter of Support for the City of Baltimore Disaster Preparedness and Planning Project (DP3) Plan: A Combined All Hazards Mitigation and Climate Adaptation Plan

To Whom it May Concern,

The American Institute of Architects (AIA) Baltimore Chapter is excited to support the City of Baltimore's Disaster Preparedness and Planning Project (DP3) Plan. As architects, we firmly believe in the sustainability and resiliency of the urban environment and how it can adapt to climate change. The efforts put forth by the city to develop their DP3 plan have been truly remarkable and the plan will become an excellent tool for the city in the years to come.

AIA Baltimore is dedicated to promoting the artistic, scientific, and best ethical standards of the architectural profession. As stewards of both the natural and built environment, we support the effort of this study to help make the Baltimore built environment more sustainable and more resilient. The plan will serve as a guideline to future designs and building codes that will help architects in the city build better, which is a very important to maintaining a built environment that will last for generations to come.

AIA Baltimore has a working relationship with the Baltimore Office of Sustainability and, as committee chair of the Disaster Assistance Committee, I am personally familiar with the high caliber of their work. For example, earlier this year, I approached the DP3 Project Manager, Kristin Baja, to provide presentations and information regarding the Baltimore's Disaster Preparedness and Planning Project (DP3). Her presentation helped inform many of our local architects about what the city is doing to respond to climate change and hazards. We were happy to be involved in the development of the plan and provide valuable expertise. Since many of the strategies and actions highlighted in the plan relate directly to buildings and long term resilience strategies, we felt it was an important experience and are happy to have been involved with the process.

I know that the Baltimore Office of Sustainability has delivered a thorough, in-depth study with their DP3 Plan. It is a high-quality product that can serve as a benchmark for Baltimore and other cities across the country. We look forward to being involved with the implementation process.

Please feel free to contact me with any questions.

Sincerely,

Martina Dobrosielski Reilly, Assoc. AIA
AIA Baltimore Chapter
Disaster Assistance Committee Chair

September 27, 2013

RE: Letter of Support for the City of Baltimore Disaster Preparedness and Planning Project (DP3) Plan: A Combined All Hazards Mitigation and Climate Adaptation Plan

To Whom It May Concern:

The Maryland Department of Natural Resources (DNR) is thrilled to support the City of Baltimore's Disaster Preparedness and Planning Project (DP3) Plan. DNR leads Maryland in securing a sustainable future for our environment, society, and economy by preserving, protecting, restoring, and enhancing the State's natural resources. The efforts put forth by the City of Baltimore to develop the DP3 Plan have been truly remarkable. The Plan aligns with DNR's climate adaptation and resiliency efforts throughout the State. It is a comprehensive forward-thinking guide that will help ensure a better future for generations to come.

DNR recognizes that the health of our society and economy are dependent on the health of our environment. DNR has an excellent working relationship with the Baltimore Office of Sustainability and has been directly involved with development of the DP3 Plan. Zoe Johnson, DNR Program Manager for Climate Policy and Planning, was a member of the DP3 Advisory Committee and also worked directly with the Project Director, Kristin Baja, on a variety of climate-related projects throughout the State. In addition to Zoe's participation, I am personally familiar with the high caliber of work completed for the DP3 Plan. I was involved in many of the community input session and city agency vulnerability assessment meetings that helped shape the strategies and actions for the Plan. Many of the strategies and actions highlighted in the plan relate directly to sustainability, environment, coastal shorelines, and long term resilience strategies, all of which are important connections to DNR's statewide efforts.

I know that the Baltimore Office of Sustainability has delivered a thorough, in-depth study with their DP3 Plan. It is a high-quality product that can serve as a benchmark for Baltimore and other cities across the country. The Maryland Department of Natural Resources supports the effort of the DP3 Plan to help make Baltimore more sustainable and more resilient. We look forward to being involved with the implementation process and continuing to work with the City on their climate and resilience efforts.

Please feel free to contact me with any questions.

Sincerely,

Kate Skaggs

Kate Skaggs
CoastSmart Communities Planner
Chesapeake & Coastal Service

Tawes State Office Building – 580 Taylor Avenue – Annapolis, Maryland 21401
410-260-8DNR or toll free in Maryland 877-620-8DNR – www.dnr.maryland.gov – TTY Users Call via the Maryland Relay

Letters of Support, Continued

NATIONAL AQUARIUM

[illegible]

September 30, 2013

To Whom It May Concern,

Re: Letter of Support for the City of Baltimore Disaster Preparedness and Planning Project (DP3) Plan: A Combined All Hazards Mitigation and Climate Adaptation Plan.

As the Safety/Risk Manager at the National Aquarium, it is with great enthusiasm that I support the final Disaster Preparedness and Planning Project Plan.

National Aquarium is home to 17,000 animals and welcomes more than 1.4 million guests each year. But its iconic location in the middle of Baltimore's Inner Harbor makes it vulnerable to high winds and storm surges. When Tropical Storm [illegible] swept up the Chesapeake Bay in 2003, Baltimore harbor waters rose so high they turned the aquarium's buildings into islands.

National Aquarium is very aware of the risks associated with global climate change and sea-level rise. We look forward to being a long-term partner with Baltimore City to launch a long-term planning effort to assess, develop, and implement strategies for coping with sea-level rise.

National Aquarium has a working relationship with the Baltimore Office of Sustainability and I am personally familiar with the high caliber of their work being a [illegible] committee member with the buildings section of the plan. [illegible] National Aquarium.

National Aquarium is pleased to be involved in the development of the plan and provide valuable expertise throughout the process. In fact, many of the strategies and actions highlighted in the plan relate directly to increasing resiliency of the waterfront and infrastructure which is vital to the Aquarium's long term conservation success and mission.

We know that the Baltimore Office of Sustainability has delivered a high-quality product and process for the City of Baltimore. We look forward to being involved with the implementation process.

Sincerely,

[illegible]
Safety/Risk Manager

Appendix B: Glossary and Acronyms

Glossary

100-Year Floodplain- The geographical area with a 1 percent or greater chance of flooding in any given year.

500-year Floodplain- The geographical area with a 0.2 percent chance of flooding in any given year.

Adaptive Capacity- The ability of a system to adjust to changes in the environment — including climate variability and extreme shifts in weather — in order to moderate potential damages or cope with the consequences of those changes.

Asset- Any man-made or natural feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

Base Flood- A flood that has a 1% probability of being equaled or exceeded in any given year. Also known as the 100-year flood.

Base Flood Elevation (BFE) Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The Base Flood Elevation is used as the standard for the National Flood Insurance Program.

Building- A structure that is walled and roofed, principally above ground, and permanently affixed to a site.

Community Rating System (CRS)- An NFIP program that provides incentives for NFIP communities to complete activities that reduce flood hazard risk.

Climate- Describes the long-term trends of atmospheric conditions in particular regions.

Climate Adaptation- A process that intends to reduce long-term risks from hazards associated with climate variability and climate change. More specifically, adaptation refers to changes that are made to better respond to new climate conditions, thereby reducing harm and taking advantage of present opportunities.

Climate Change- Any significant change in the measures of climate lasting for an extended period of time.

Climate Normals- The latest three-decade averages of climatological variables including temperature and precipitation.

Climate Projection- Consolidates weather patterns over a period, typically 30 years, to determine expected changes in averages, called "climate normals."

Community Asset- Anything that can be used to improve the quality of community life such as a person, physical structure or space, business or community service.

Critical Facilities- Facilities that are critical to the health and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, and hospitals.

Critical Infrastructure- The assets, systems, and networks, whether physical or virtual, so vital that their incapacitation or destruction would have a debilitating effect on security, national economic security, national public health or safety, or any combination thereof.

Debris- The scattered remains of assets broken or destroyed in a hazard event. Debris caused by a wind or water hazard event can cause additional damage to other assets.

Duration- How long a hazard event lasts.

Earthquake- A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.

Erosion- The wearing away of the land surface by detachment and movement of soil and rock fragments, during a flood or storm or over a period of years through the action of wind, water, or other geologic processes.

Extent- The size of an area affected by a hazard or hazard event.

Exposure- Extent to which an asset experiences an impact

Fault- A fracture in the continuity of a rock formation caused by a shifting or dislodging of the earth's crust, in which adjacent surfaces are differentially displaced parallel to the plane of fracture.

Flash Flood- A flood event occurring with little or no warning where water levels rise at an extremely fast rate.

Flood- A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

Flood Depth- Height of the floodwater surface above the ground surface.

Flood Elevation- Elevation of the water surface above an established datum, e.g. National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or Mean Sea Level.

Flood Hazard Area- The area shown to be inundated by a flood of a given magnitude on a map.

Flood Insurance Rate Map (FIRM)- Map of a community, prepared by FEMA that shows both the special flood hazard areas and the risk premium zones applicable to the community.

Flood Zone- A geographic area shown on a Flood Insurance Rate Map (FIRM) that reflects the severity or type of flooding in the area.

Floodplain- Any land area, including watercourse, susceptible to partial or complete inundation by water from any source.

Floodway- The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the 1-percent-annual-chance flood without cumulatively increasing the water surface elevation by more than a designated height.

Frequency- A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. The reliability of this information varies depending on the kind of hazard being considered.

Fujita Scale of Tornado Intensity Rates- tornadoes with numeric values from F0 to F5 based on tornado wind speed and damage sustained. An F0 indicates light damage such as broken tree limbs or signs, while an F5 indicates incredible damage was sustained.

Geographic Information Systems (GIS)- A computer software application that relates physical features on the earth to a database to be used for mapping and analysis.

Global Warming- The recent ongoing rise in global average temperature near Earth's surface caused mostly by increasing concentrations of greenhouse gases in the atmosphere.

Hazard- A source of potential danger or adverse condition. Hazards in this plan are both natural and technological in origin and include: floods/flash floods, droughts, wind, thunderstorms/lightning, winter storms, tornadoes, hurricanes, extreme heat, landslides, earthquakes, wildfires/fires, land subsidence, mining hazards, dam failures, hazardous materials, and nuclear accidents. These events are hazards when they have the potential to harm people or property.

Hazard Event- A specific occurrence of a particular type of hazard.

Hazard Identification- The process of identifying hazards that threaten an area.

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

Hazard Profile- A description of the physical characteristics of hazards and a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

HAZUS- A GIS-based, nationally standardized hazard loss estimation tool developed by FEMA.

Hurricane- An intense tropical cyclone, formed in the atmosphere over warm ocean areas, in which wind speeds reach 74-miles-per-hour or more and blow in a large spiral around a relatively calm center or "eye." Hurricanes develop over the North Atlantic Ocean, northeast Pacific Ocean, or the South Pacific Ocean east of 160° longitude. Hurricane circulation is counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Glossary Continued...

Hydrology- The science of dealing with the waters of the earth. A flood discharge is developed by a hydrological study.

Infrastructure- Refers to the public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or internet access, vital services such as public water supplies and sewer treatment facilities, and includes an area's transportation system such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, dry-docks, piers and regional dams.

Intensity- A measure of the effects of a hazard event at a particular place.

Impact- The action of one object coming forcibly into contact with another or having a strong effect on someone or something.

Impact Assessment- Identifies the degree to which, and in what manner, hazards will impact people, places, and the economy. The impact assessment identifies what stands to be damaged due to a hazard event, and the cost of such a loss.

Landslide- Downward movement of a slope and materials under the force of gravity. Lateral Spreads Develop on gentle slopes and entail the sidelong movement of large masses of soil as an underlying layer liquefies in a seismic event.

Magnitude- A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.

Mitigation Plan- A systematic evaluation of the nature and extent of vulnerability to effects of natural hazards typically present in the state and includes a description of actions to minimize future vulnerability to hazards.

National Flood Insurance Program (NFIP)- Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations in 44 CFR §60.3.

National Weather Service (NWS)- Prepares and issues flood, severe weather, and coastal storm warnings and can provide technical assistance to federal and state entities in preparing weather and flood plans.

National Emergency Management Information System (NEMIS)- An evolving agency-wide system of hardware, software, telecommunications and applications software that provides a new technology base to FEMA and its partners to perform the emergency management mission.

No-Notice Incident- A no-notice incident is one that occurs unexpectedly or with minimal warning. Incidents with typically predictable patterns can also become no-notice incidents when their behaviors or patterns differ from what had been predicted or expected. Due to the nature of no-notice events, the ability of emergency responders to react in a timely manner may be challenged

No-regrets Actions- Actions that have negative net costs, because they generate direct or indirect benefits that are large enough to offset the costs of implementing the action.

Nor'easter- An extra-tropical cyclone producing gale-force winds and precipitation in the form of heavy snow or rain.

Planning- The act or process of making or carrying out plans; the establishment of goals, policies and procedures for a social or economic unit.

Pre-Disaster Mitigation Program (PDM)- The Pre-Disaster Mitigation (PDM) Program was authorized by §203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 USC, as amended by §102 of the Disaster Mitigation Act of 2000. Funding for the program is provided through the National Pre-Disaster Mitigation Fund to assist states and local governments (to include Indian Tribal governments) in implementing cost-effective hazard mitigation activities that complement a comprehensive mitigation program.

Probability- A statistical measure of the likelihood that a hazard event will occur.

Recurrence Interval- The time between hazard events of similar size in a given location. It is based on the probability that the given event will be equaled or exceeded in any given year.

Repetitive Loss Property- A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least $1000 each have been paid within any 10- year period since 1978.

Replacement Value- The cost of rebuilding a structure. This is usually expressed in terms of cost per square foot, and reflects the present-day cost of labor and materials to construct a building of a particular size, type and quality. In this plan, replacement values are largely based on insurance estimates.

Richter Scale- A numerical scale of earthquake magnitude devised by seismologist C.F. Richter in 1935.

Risk- The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment- identifies the nature, location, intensity and probability of a threat, and then determines vulnerabilities and exposure to those threats while considering the capacities and resources available for to address or manage threats. A risk assessment is a multi-faceted, 'stepped' process. It includes three stages: (1) Hazard identification, (2) vulnerability assessment, and (3) impacts assessment.

Riverine- Of or produced by a river.

Scale- A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the earth's surface.

Sensitivity- Degree to which an asset is impaired by an impact.

Severity- Intensity or degree of impact.

Stafford Act- The Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-107 was signed into law November 23, 1988 and amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

State Hazard Mitigation Officer (SHMO)- The representative of state government who is the primary point of contact with FEMA, other state and federal agencies, and local units of government in the planning and implementation of pre- and post- disaster mitigation activities.

Structure- Something constructed. (See also Building)

Topographic- Characterizes maps that show natural features and indicate the physical shape of the land using contour lines. These maps may also include man-made features.

Tornado- A violently rotating column of air extending ground-ward.

Tropical Cyclone- A cyclonic, low-pressure system over tropical or sub-tropical waters.

Tropical Storm- A tropical cyclone with maximum sustained winds greater than 39 mph and less than 74 mph.

Tsunami- Great sea wave produced by submarine earth movement or volcanic eruption.

Urban Heat Island- A metropolitan area that is significantly warmer than its surrounding rural areas due to human activities.

Urban Karst- Urban land with sinkholes, springs, and streams that sink into subsurface caverns. These sinkholes may develop progressively as subtle, bowl-shaped depressions, or they may collapse suddenly into steeply sided, water-filled craters.

Vulnerability- Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power – if an electric substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Often, indirect effects can be much more widespread and damaging than direct ones.

Vulnerability Assessment- A process that further develops the risk assessment by examining current exposure (measure(s) of defense), sensitivity (degree to which something is affected), and adaptive capacity (ability to recover). This assessment determines the extent of injury and damage that may result from a hazard event of given intensity in a given area.

Weather- Refers to what changes we experience on a day-to-day basis or over a short period of time. Weather may describe current temperature, humidity, precipitation, wind, or other similar conditions; and a weather forecast may predict conditions in the near future

Glossary Continued...

Acronyms

A/C	Air conditioning
BCFD	Baltimore City Fire Department
BCHD	Baltimore City Health Department
BCPD	Baltimore City Police Department
BCPSS	Baltimore City Public School System
BCRP	Baltimore City Department of Recreation and Parks
BDC	Baltimore Development Corporation
BDW	Baltimore Development Workgroup
BFE	Base Flood Elevation
BFPI	Baltimore Food Policy Initiative
BGE	Baltimore Gas and Electric
BOS	Baltimore Office of Sustainability
CAI	Community Asset Inventory
CAP	Climate Action Plan
CDBG	Community Development Block Grant
CERT	Community Emergency Response Teams
CHAP	Commission for Historic and Architectural Preservation
COOP	Continuity of Operations Plan
CoS	Commission on Sustainability
CRS	Community Rating System
CSC	NOAA's Coastal Services Center
CSX	CSX Corporation
CVAT	Community Vulnerability Assessment Tool
DES	Department of Environmental Services
DFIRM	Digital Flood Insurance Map
DGS	Baltimore City Department of General Services
DHCD	Department of Housing and Community Development
DHMH	Maryland Department of Health and Mental Hygiene
DOIT	Department of Information Technology
DOP	Baltimore City Department of Planning
DOT	Baltimore City Department of Transportation
DP3	Disaster Preparedness and Planning Project
DPH	Department of Public Health
DPW	Baltimore City Department of Public Works
EAP	Emergency Action Plan
EHR	Electronic health records
EOP	Emergency Operation Plan
ESF	Emergency Support Function
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FTA	Federal Transit Administration
GGi	Growing Green Initiative
GHG	Greenhouse Gas
GIS	Geographic Information Systems
HAZUS-MH	Hazards U.S.–Multi-Hazard, software
HVAC	Heating, ventilation, and air conditioning
ICLEI	International Council for Local Environmental Initiatives
IPCC	Intergovernmental Panel on Climate
LiDAR	Light Detection and Ranging
LiMWA	Limit of Moderate Wave Action
LPC	Landmarks Preservation Commission

MCC	Maryland Conservation Corps
MDE	Maryland Department of the Environment
MDH2E	Maryland Hospitals for a Healthy Environment
MDNR	Maryland Department of Natural Resources
MDTA	Maryland Transportation Authority
MEMA	Maryland Emergency Management Agency
MOEM	Mayor's Office of Emergency Management
MON	Mayor's Office of Neighborhoods
MOIT	Mayor's Office of Information Technology
MPA	Maryland Port Administration
MPH	Miles per hour
MTA	Maryland Transit Administration
NACCS	North Atlantic Coast Comprehensive Study
NAHB	National Association of Home Builders
NAS	National Academy of Sciences
NAVD88	North American Vertical Datum 1988
NCA	National Climate Assessment
NCDC	National Climate Data Center
NFIP	National Flood Insurance Program
NGO	Non-governmental Organization
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
PSC	Public Service Commission
RVAT	Risk and Vulnerability Assessment Tool
SHA	Maryland State Highway Administration
SLOSH	Sea, Lake, and Overland Surge from Hurricanes
SLR	Sea level rise
SNAP	Supplemental Nutrition Assistance Program
UHI	Urban Heat Island
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
UTC	Urban Tree Canopy

Appendix C: Acknowledgments

Project Management
Kristin Baja, Project Manager
Megan Griffith, Project Intern

Baltimore Office of Sustainability Staff
Beth Strommen, Director
Alice Kennedy, Sustainability Coordinator
Kristin Baja, Climate and Resilience Planner
Ken Hranicky, Floodplain Manager

GIS and HAZUS Support
Cynthia McCoy, Risk Analyst, FEMA Region III
Melissa Oguamanam, GIS Analyst
Travis Pate, GIS Analyst
Jamie Williams, GIS Analyst

Additional Advisors:
Clark Howells
Bill Merritt
David Thomas
Erik Dihle
Baltimore Sustainability Commission Climate Committee
Local Emergency Planning Committee (LEPC)
Homeland Security Planning Committee (HSPC)
Baltimore Community Groups
Georgetown Climate Center

Engineering Consultants:
Moffat and Nicol, Inc.

Grant Funding:
Federal Emergency Management Agency
Maryland Emergency Management Agency
National Oceanic and Atmospheric Administration
Maryland Department of Natural Resources

Advisory Committee Members
Tom Stosur, Co-chair
Robert Maloney, Co-chair
Oxiris Barbot
Meghan Butasek
James S. Clack
Rich Foot
Alfred H. Foxx
David Guignet
Eben Hansel
Dale Hargrave
Joy Hatchette
Gary Holland
Richard Hooper
CP Hsia
Zoe Johnson
Phil Lee
Jodie McFadden
Barbara McMahon
David McMillan
Michael McNamee
Frank Murphy
Cindy Parker
Joan Plisko
Craig Purcell
John Quinn
Inez Robb
Laurie Schwartz
Connor Scott
Art Shapiro
Steve Sharkey
Eileen Singleton
John Skinner
Joe Wade
Jerry Young
Khalil A. Zaied

Not voting Advisory Committee members:
Kristin Baja
Benjamin Brosch
Tess Grub
Ken Hranicky
Mark James
Alice Kennedy
Beth Strommen

Appendix D: Advisory Committee

Advisory Committee Members

Tom Stosur (Co-chair), Director
Baltimore City Department of Planning

Robert Maloney (Co-chair), Deputy Chief
Mayor's Office of Emergency Management

Oxiris Barbot, Health Commissioner
Baltimore City Health Department

Meghan Butasek, Director
Office of Public Health Preparedness and Response
Baltimore City Health Department

James S. Clack, Fire Chief
Baltimore City Fire Department

Rich Foot, CEO and Lead Advisor
Foots Forecast

Alfred H. Foxx, Director
Baltimore City Department of Public Works

David Guignet, State NFIP Coordinator
Maryland Department of the Environment

Eben Hansel, Attorney
Ballard Spahr LLP

Dale Hargrave, Community Leader
Greenmount West

Joy Hatchette, Associate Commissioner
Maryland Insurance Administration

Gary Holland, Chief of Staff
Department of General Services

Richard Hooper, Acting Deputy Director
Department of Transportation

CP Hsia, Preparedness Program Manager
Mayor's Office of Emergency Management

Zoe Johnson,
Maryland Department of Natural Resources

Phil Lee, Utility Engineer
Moffat & Nichol, Inc.
Jodie McFadden, Major
Baltimore City Police Department

Barbara McMahon, Manager of Risk and Safety
Port of Baltimore

David McMillan, Assistant Deputy Chief
Mayor's Office of Emergency Management

Michael McNamee, Division Chief Utility Maintenance
Department of Public Works

Frank Murphy, Acting Director
Baltimore City Department of Transportation

Cindy Parker, Assistant Professor
Johns Hopkins University School of Public Health

Joan Plisko, Technical Director
Maryland Hospitals for a Healthy Environment (MDH2E)

Craig Purcell, Director of Urban Design
BCT Architects

John Quinn, Service Manager
Baltimore Gas and Electric Co. (BGE)

Inez Robb, Community Leader
Sandtown-Winchester

Laurie Schwartz, President
Waterfront Partnership of Baltimore Inc.

Connor Scott, Emergency Planner
Mayor's Office of Emergency Management

Art Shapiro, Chief of Engineering
Baltimore City Department of Public Works

Steve Sharkey, Director
Department of General Services

Eileen Singleton, Principal Transportation Engineer
Baltimore Metropolitan Council

John Skinner, Deputy Commissioner
Baltimore City Police Department

Joe Wade, Fire Fighter
Baltimore City Fire Department

Jerry Young, Chief of Safety and Training
Department of Public Works

Khalil A. Zaied, Deputy Chief of Operations
Baltimore City Mayor's Office

Not voting Advisory Committee members:
Kristin Baja, Climate and Resilience Planner
Baltimore Office of Sustainability

Benjamin Brosch, Budget and Management Research
Bureau of Budget & Management Research

Tess Grub, Community Planner Lead
FEMA Region III

Ken Hranicky, Floodplain Manager
Baltimore City Department of Planning

Mark James,
Maryland Emergency Management Agency

Alice Kennedy, Sustainability Coordinator
Baltimore Office of Sustainability

Beth Strommen, Director
Baltimore Office of Sustainability

Additional Advisors:
Clark Howells, Watershed Section Manager
City of Baltimore Department of Public Works, Bureau of Water and Wastewater

Bill Merritt, Contract Services Specialist
Baltimore City Energy Office

David Thomas, Assistant to the Director
Baltimore County Department of Public Works

Baltimore Sustainability Commission Climate Committee

Sub-Committees

Infrastructure

Anne Draddy (a)
Alfred H. Foxx
Tess Grub
Richard Hooper
CP Hsia
Phil Lee
Barbara McMahon
David McMillan
Michael McNamee
Frank Murphy
Art Shapiro
Eileen Singleton
John Quinn
Jerry Young
Khalil A. Zaied
Kristin Baja (Lead)

Buildings

Rupert Denney (a)
David Guignet
Eben Hansel
Joy Hatchette
Gary Holland
Stephen Levitsky (a)
Connor Scott
Steve Sharkey
Gene Taylor (a)
Alice Kennedy (Lead)

Natural Systems

Erik Dihle (a)
Rich Foot
Mark James
Zoe Johnson
Craig Purcell
Laurie Schwartz
Beth Strommen (Lead)

Public Services

Oxiris Barbot
Meghan Butasek
James S. Clack
Dale Hargrave
Jodie McFadden
Cindy Parker
Joan Plisko
Inez Robb
John Skinner
Betty Bland Thomas (a)
Joe Wade
Kristin Baja (Lead)

(a)- advisory role, not a voting member of the committee

Advisory Committee, Continued

Full Advisory Committee Meeting Dates

Advisory Committee Meeting #1

Date: February 13, 2013
Location: Baltimore City Department of Planning
Attendees: 33
Materials: Agenda
Project Timeline
Definitions List
Consensus Document
Google Drive Instructions
Reporting Document
Presentation

Advisory Committee Meeting #2

Date: March 5, 2013
Location: Baltimore City Department of Planning
Attendees: 26
Materials: Agenda
Subcommittees List
Presentation

Advisory Committee Meeting #3

Date: April 9, 2013
Location: Baltimore City Department of Planning
Attendees: 24
Materials: Agenda
Draft Recommendations List
Framing Document
Vulnerability Assessment Exercise
Presentation

Advisory Committee Meeting #4

Date: June 28, 2013
Location: Baltimore City Department of Planning
Attendees: 30
Materials: Agenda
Draft Recommendations List
Vulnerability Assessment Results
Presentation

Advisory Committee Meeting #5

Date: August 9, 2013
Location: CitiStat Room, City Hall
Attendees: 26
Materials: Agenda
Draft Document
Presentation

Sub-Committee Meeting Dates

Meeting Dates:

INFRASTRUCTURE

Dates:	March 25, 2013
	March 27, 2013
Location:	Department of Planning

BUILDINGS

Dates:	February 27, 2013
	March 11, 2013
	March 27, 2013
Location:	Department of Planning

NATURAL SYSTEMS

Dates:	March 22, 2013
	March 25, 2013
Location:	Department of Planning

PUBLIC SERVICES

Dates:	March 11, 2013
	March 26, 2013
Location	Department of Planning

Internal Working Group Meeting Dates

Meeting Dates:

January 16, 2013	Project Review and Roles
February 4, 2013	Historic Hazards Research
March 1, 2013	Profiling Hazards
March 25, 2013	Final Hazards List
March 26, 2013	Critical Facilities
April 10, 2013	Critical Facilities
May 23, 2013	Review Strategies
July 12, 2013	Review Actions
July 16, 2013	HAZUS Review
July 31, 2013	HIA

Additional Presentations and Input Sessions

Baltimore City Homeland Security Planning Committee (HSPC)	Nov., 2012
Parks and People Foundation	March 7, 2013
American Institute for Architects (AIA)	April 15, 2013
	June 10, 2013
DC Climate Action Group	May 18, 2013
Northwest Public Safety Day	June 23, 2013
Baltimore City Forestry Board	July 16, 2013
Blue Water Baltimore	July 25, 2013
Baltimore City Local Emergency Planning Committee (LEPC)	July 1, 2013
Johns Hopkins Public Health	Sept. 10, 2013

Advisory Committee Meeting February 13, 2013

Agenda

City of Baltimore - Disaster Preparedness and Planning Project (DP3)

Advisory Committee Meeting

February 13, 2013

Committee Purpose:

- To bring together stakeholders from key agencies, institutions, businesses, and neighborhoods to identify actions and recommendations for the City of Baltimore's Disaster Preparedness and Planning Project.

Meeting Objective:

- Review project process
- Review existing hazards and implications of climate change and come to consensus on vision statement, hazards, and definitions of climate change and adaptation
- Present examples of actions and recommendations for sub-committee review

Materials Provided:

- List of committee members with contact information
- List of key dates and deadlines
- Draft list of example actions and recommendations for sub-committee review

Agenda:

3:00pm-3:15pm: Tom Stosur, Director, Department of Planning

- Welcome and brief introductions

3:15pm-3:30pm: Tom Stosur, Director, Department of Planning

- Why you are here and review meeting goals

3:30pm-3:40pm: Beth Strommen, Director, Office of Sustainability

- Integration of the All Hazards Mitigation Plan and the Climate Adaptation Plan
- Importance of this project

3:40pm-4:20pm: Kristin Baja, Hazard Mitigation Planner, Office of Sustainability

- Natural hazards in Baltimore City
- Overview of hazard mitigation and climate adaptation
- Review example actions and recommendations list and reporting document
- Vision statement for the project
- Project timeline
- Consensus on hazards, definitions of climate change and adaptation, and vision statement

4:20pm-4:40pm: Beth Strommen, Director, Office of Sustainability

- Subcommittee expectations
- Subcommittee assignments and reporting criteria
- Subcommittee meeting scheduling and deadlines

4:40pm-5:00pm: Tom Stosur, Director, Department of Planning

- Next steps

Project Timeline

City of Baltimore - Disaster Preparedness and Planning Project (DP3)

Project Timeline

February 5	Advisory Committee Meeting (full group)
February 5-25	Advisory Committee Sub-Committee meetings
	HAZUS analysis complete
March 5	Advisory Committee Meeting (full group)
March 5-29	Advisory Committee Sub-Committee Meetings
March 27	Town Hall Meeting I
April 9	Advisory Committee Meeting (full group)
April 9-30	Advisory Committee Sub-Committee Meetings
	Community Meeting - Fells Point (Sea Level Rise)
May	Advisory Committee Meeting (full group) – if needed
	Advisory Committee Sub-Committee Meetings– if needed
	Community Meeting – Urban Heat Islands
June 25	Town Hall Meeting II
July	Final Document (word)
August	Approval from Sustainability Commission
September	Final Document (In Design)
	Approval from Planning Commission

Definitions List

City of Baltimore - Disaster Preparedness and Planning Project (DP3)

Definitions

What is the Disaster Preparedness and Planning Project (DP3)?

The DP3 is comprised of three different elements that will all be integrated into one final plan. Every five years the Federal Emergency Management Agency (FEMA) requires local governments to update their All Hazards Mitigation Plan (AHMP). In an effort to plan for existing hazard and prepare for predicted hazards due to climate change, we propose to develop and implement an integrated AHMP, floodplain mapping, and Climate Adaptation Plan that will provide the City with a comprehensive system for addressing existing and future impacts. This project assures that adaptation recommendations are included in capital and operation budget decision making and prioritized in planning processes.

Hazards Mitigation and All Hazards Mitigation Plan

According to FEMA, hazard mitigation is sustained action taken to reduce or eliminate long-term risk to people and their property from hazards. The purpose of mitigation planning is to identify policies and actions that can be implemented over the long term to reduce risk and future losses. In 2000, the President signed into law the Disaster Mitigation Act of 2000 (DMA 2000). Part of this act requires local governments to develop and submit a hazard mitigation plan as a condition of receiving mitigation project grants. Hazard mitigation plans are required to be updated every five years. The City's AHMP will act as the foundation for Baltimore's long-term strategy to reduce disaster losses, damage, and expenses. The DP3 project will follow all requirements and procedures required for local mitigation plans by FEMA.

Climate Change

Climate Change refers to any significant change in the measures of climate lasting for an extended period of time. This includes major changes in temperature, precipitation, wind patterns, or other effects, that occur over several decades or longer. Over the past century, Maryland's average temperatures have risen by 1.8°F and are projected to continue rising. These rising temperatures have already led to changes in weather and climate including more extreme weather events, longer and more frequent heat waves, and a rise in sea level to name a few.

Climate Adaptation

Climate-related impacts are already affecting Baltimoreans. Adaptation refers to changes made to better respond to new climate conditions, thereby reducing harm and taking advantage of opportunities. Heat waves, sea level rise, and flooding due to more extreme precipitation events will all impact the City's environmental, social, and economic systems. Building adaptation into this plan will allow Baltimore City to reduce risk and increase resiliency

Why Combine the AHMP and Climate Adaptation Plan?

Integrating hazard mitigation planning which focuses on past events with climate adaptation planning and its focus on what will likely happen in the future is a win-win situation for Baltimore City. Both plans require a detailed inventory of natural hazards, a risk assessment, and a vulnerability analysis. These processes will then inform both actions to mitigate hazards and adapt to predicted climate impacts. This process provides clear guidance and a unified strategy that supports Baltimore's sustainability and resilience. Essentially, the goals for hazard mitigation and climate adaptation are the same.

Our Process:

The DP3 project will utilize the following process for plan development:

1. Identify and profile existing hazards.
2. Conduct an inventory that identifies all assets such as hospitals, schools, etc.
3. Utilize modeling to identify risk from existing hazards and predicted climate impacts.
4. Complete a vulnerability analysis of identified assets and critical facilities. Identify exposure, sensitivity and adaptive capacity.
5. Identify actions and recommendations to deal with existing hazards and predicted impacts.
6. Develop implementation plans for these actions, as well as recommendations for stakeholder involvement and funding strategies.

Vision Statement:

Baltimore will be a city whose daily activities reflect a commitment shared by government, business, and citizens to reduce or eliminate impacts from current and future natural hazards.

Consensus Document

City of Baltimore - Disaster Preparedness and Planning Project (DP3)

Topics for Consensus

It is important to gain consensus from the Advisory Committee regarding the following topics in order to move forward with this project. Please feel free to submit any changes to the DP3 Project Director.

Natural Hazards:

Coastal Storms, Drought, Earthquakes, Extreme Heat, Flooding, Hail, Hurricane, Ice Storms, Lightning, Severe Winter Storms, Tornado, Windstorm (Derechos)

Climate-Related Changes:

Flooding

- The frequency and severity of major storms is increasing leading to more intense rainfall and peak flooding events

Tropical Storms and Sea Level Rise

- Rising sea surface temperatures and sea level
- Sea level in this region is projected to rise more than the global average
- Sea level could rise between 2 to 3 feet (conservative estimates) by the end of this century
- The rate of sea level rise is faster now than at any time in the past 2000 years

Heat

- Temperatures are projected to rise an additional 2.5 to 4°F in winter and 1.5 to 3.5°F in summer
- More frequent days with temperatures above 100°F
- Heat waves are projected to become much more commonplace in the near future
- Hot summer conditions arriving earlier in the spring and lasting longer into the fall
- Vector

Extreme Storms and Precipitation

- Increased heavy precipitation events
- Less winter precipitation falling as snow and more as rain
- More irregular extreme events are predicted

Air Quality

- Hot summer days can worsen air pollution, especially in urban areas
- This region is likely to experience some of the highest number of heat-related illnesses and deaths compared with the rest of the nation

Infectious Diseases

- Higher temperatures, humidity and changes in precipitation will provide more ideal environments for reproduction, survival and longevity of insects and arachnids which carry diseases

Sub-Committees

I. Infrastructure

II. Buildings

III. Public Health and Human Services

IV. Natural Systems

Vision Statement:

Baltimore will be a city whose daily activities reflect a commitment shared by government, business, and citizens to reduce or eliminate impacts from current and future natural hazards.

Project Name:

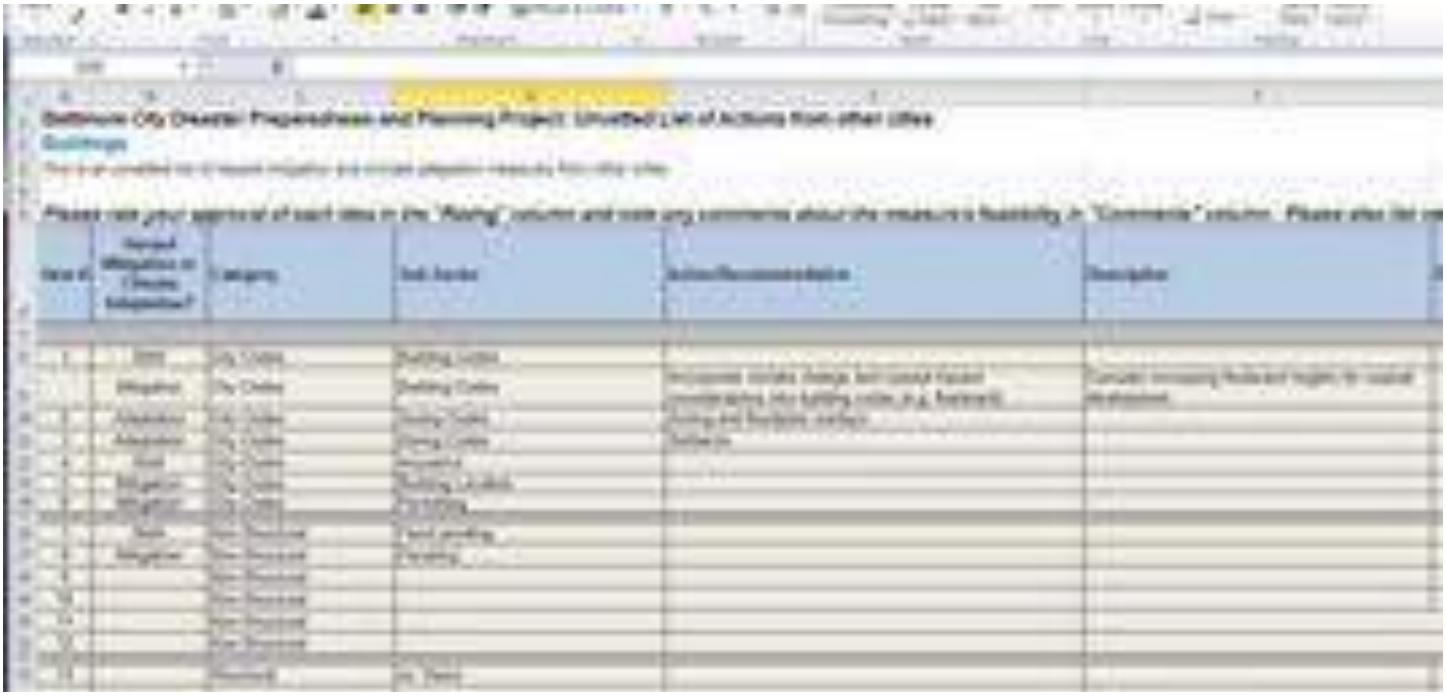
Throughout this process we have found that people have a difficult time understanding the difference between hazard mitigation, climate mitigation, and climate adaptation. For this reason we decided to rename this project for ease of understanding. The City of Baltimore Office of Sustainability appreciates your input on this decision. Do you feel Disaster Preparedness and Planning Project is a good title for this process?

Google Drive and Documents

Google drive was utilized through this project as a place to store files, research and information for the entire Advisory Committee to access. Documents were also posted on the google drive site so all committee members could make edits and communicate with each other via chat when not in a advisory committee meeting.

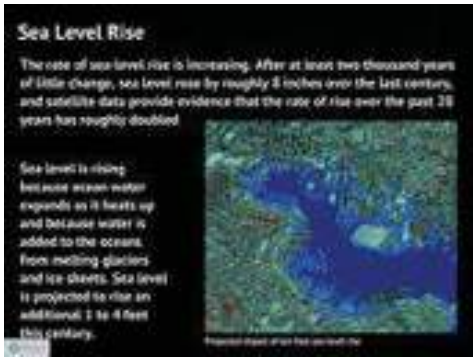
Reporting Document

Draft strategies and actions were brainstormed and collected in an online reporting document. The document was used by city staff and the sub-committees to determine timelines, stakeholders, lead agencies, benefits, and concerns related to each draft strategy and action.



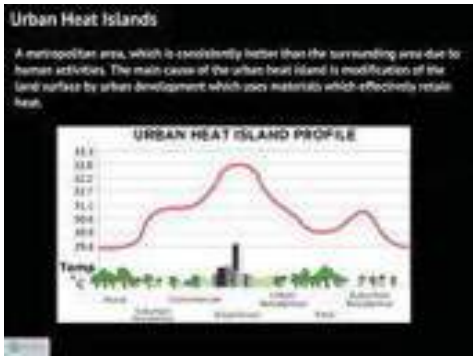
Presentation

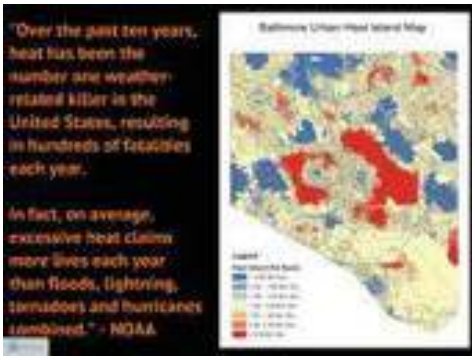

Tropical Storms
Tropical cyclones are circulating weather systems over tropical waters. They bring powerful winds, rain, flooding, and tornadoes. Types of tropical cyclones include tropical storms and hurricanes.
There has been a substantial increase in hurricane activity in the Atlantic since the 1970s.
Recent Tropical Storms/Hurricanes in Baltimore:
2011 Tropical Storm Lee
2011 Hurricane Irene
2006 Tropical Storm Ernesto
2003 Hurricane Isabel


Sea Level Rise
The rate of sea level rise is increasing. After at least two thousand years of little change, sea level rose by roughly 8 inches over the last century, and satellite data provide evidence that the rate of rise over the past 20 years has roughly doubled
Sea level is rising because ocean water expands as it heats up and because water is added to the ocean from melting glaciers and ice sheets. Sea level is projected to rise an additional 1 to 4 feet this century.


Storm Surge
Refers to the rise of water associated with the storm, plus tide, wave run-up, and freshwater flooding.


Extreme Heat


Urban Heat Islands
A metropolitan area, which is consistently hotter than the surrounding area due to human activities. The main cause of the urban heat island is modification of the land surface by urban development which uses materials which effectively retain heat.
URBAN HEAT ISLAND PROFILE
Temp

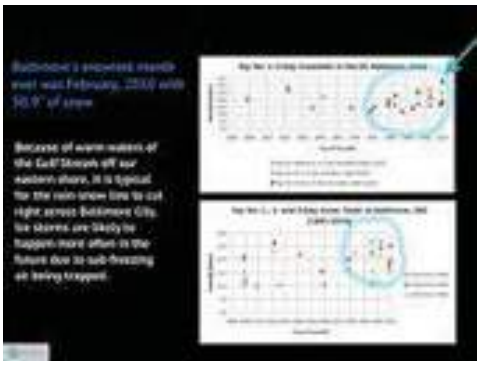

"Over the past ten years, heat has been the number one weather-related killer in the United States, resulting in hundreds of fatalities each year.
In fact, on average, excessive heat claims more lives each year than floods, lightning, tornadoes and hurricanes combined." - NOAA


Drought
Drought is not a major issue directly facing the City of Baltimore, however residents of Baltimore will be severely impacted by the drought conditions being felt throughout the rest of the country
Droughts may have economic, social or environmental impacts.
Baltimore residents are likely to see impacts in the form of increased food prices and diminished food availability.
Increased weed and pest pressure associated with longer growing seasons and warmer winters will also have human health


Extreme Storms and Precipitation


Increase Precipitation
The increase in extreme precipitation events are occurring primarily during the spring and fall.
The map shows percent increases in the amount falling in very heavy precipitation events (defined as the heaviest 1 percent of all daily events) from 1958 to 2012 for each region
Rainfall in Maryland is projected to increase by 5-12% by 2100


Winter Storms


Baltimore's snowiest month ever was February, 2010 with 32.9" of snow

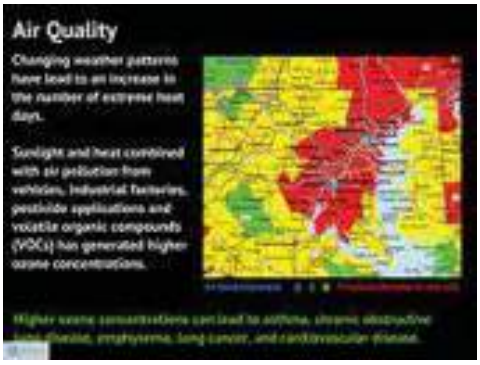

Lightning and Hail

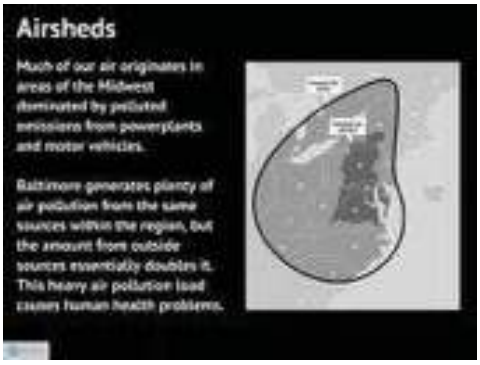

High Wind Events


Extreme Wind Storms and Derechos


Tornadoes


Other Important Hazards
Air Quality
Earthquakes
Infectious Diseases

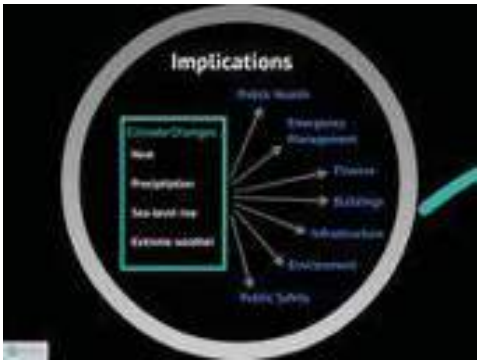

Air Quality


Airsheds


Earthquakes
Earthquakes are a sudden release of energy in the Earth's crust that creates seismic waves. On August 23, 2011 a 5.8 magnitude earthquake occurred in the Central Virginia Seismic Zone. Earthquakes in the eastern US, although less frequent, are typically felt over a much broader region.
In Baltimore, two buildings partially collapsed due to the quake blocking off the area of Highland Ave and Conkling Street.


"After the blizzard of the century and the tornado and the floods, I don't think we should be surprised."
Mayor Stephanie Rawlings-Blake referring to the 2011 earthquake


Infectious Diseases
"Vector-borne disease" is the term commonly used to describe an illness caused by an infectious microbe that is transmitted to people by blood-sucking insects or arachnids such as mosquitoes, fleas, lice, mites and ticks.
Weather affects vector disease transmission. Higher temperatures, humidity, and changes in precipitation all factor into biting behavior, survival, reproduction rates, and longevity for insects.
This can lead to formerly prevalent diseases such as malaria and dengue fever to re-emerge, or the introduction of new disease agents, such as West Nile virus.


Implications
Climate Changes
Heat
Precipitation
Sea-level rise
Extreme weather
Public Health
Emergency Management
Finance
Buildings
Infrastructure
Environment
Public Safety


The DPS Process Simplified
Identify Hazards
Assess Vulnerability
Determine Risk
Mitigation and Adaptation Recommendations


The Process in Detail
Identify Hazards
Identify Climate Impacts
Asset Inventory
Assess Vulnerability
Determine Risk
Mitigation and Adaptation Recommendations


Mitigation and Adaptation Recommendations
- Identify advantages and disadvantages
- Identify stakeholders
- Identify interdependencies with other systems
- Cost-benefit analysis
- Determine overlap
- Ranking
- Consensus


Baltimore needs to develop and apply proactive approaches to increase community resilience by planning for and adapting to emerging climate change impacts


Your Role

- Help gather and verify historical hazard data
- Provide information regarding cost and impacts of previous hazard events
- Assist with gathering more recent and relevant climate science
- Work in sub-committees to develop both mitigation and adaptation recommendations
- Assist with outreach, education and development of implementation and monitoring plan

Sub-Committees

I. Infrastructure

II. Buildings

III. Public Health and Human Services

IV. Natural Systems

Sub-Committee Tasks

1. Consider the hazards and climate impacts we discussed
2. Determine how these hazards impact your topic area
3. Work with sub-committee to draft recommendations
4. Fill in reporting document

Google Documents

- You will be sent an invitation to join
- You will need to create a User Name
- You will need to create a Password

Timeline

February 15	Advisory Committee Meeting (full group)
February 15-17	Advisory Committee Sub-Committee meetings
March 1	Advisory Committee Meeting (full group)
March 5-29	Advisory Committee Sub-Committee Meetings
March 27	Town Hall Meeting 1
April 9	Advisory Committee Meeting (full group)
April 9-30	Advisory Committee Sub-Committee Meetings Community Meeting
May	Advisory Committee Meeting (full group) - if needed Advisory Committee Sub-Committee Meetings Community Meeting
June 23	Town Hall Meeting 2
August	Approval from Sustainability Commission
September	Approval from Planning Commission

Vision Statement

Baltimore will be a city whose daily activities reflect a commitment shared by government, business, and citizens to reduce or eliminate impacts from current and future natural hazards

Consensus on the following:

- Hazards we are facing
- Climate related changes
- Vision Statement
- Sub-Committees
- Project Name

Questions?

Comments?

Advisory Committee Meeting March 5th, 2013

Agenda

City of Baltimore - Disaster Preparedness and Planning Project (DP3)

Advisory Committee Meeting

March 5, 2013

Committee Purpose:

- To bring together stakeholders from key agencies, institutions, businesses, and neighborhoods to identify actions and recommendations for the City of Baltimore's Disaster Preparedness and Planning Project.

Meeting Objectives:

- Report out on sub-committees and get everyone on the same page
- Discussion and consensus on goals and objectives for the project
- Enhance the understanding of adaptation and what we are adapting to
- Better understand how Baltimore has responded to hazards in the past

Materials Provided:

- Agenda
- List of sectors, categories, and subcategories

Agenda:

9:30am-9:35am: Tom Stosur, Director, Department of Planning

- Welcome and brief introductions

9:35am-10:00am: Kristin Baja, Hazard Mitigation Planner, Office of Sustainability

- Report out on sub-committees
- Vision, goals, objectives, actions

10:00am-10:15am: Kristin Baja, Hazard Mitigation Planner, Office of Sustainability

- Increased frequency and intensity of hazards (Rich Foot)
- Adaptation and the ICLEI process

10:15am-10:35am: CP Hsia, Office of Emergency Management

- Understanding past hazards and the City's response
- Future hazard response when considering climate change

10:35am-10:50am: Kristin Baja, Hazard Mitigation Planner, Office of Sustainability

- Subcommittee meetings and next steps
- Subcommittee deadlines

10:50am-11:00am: Gather with subcommittees

Subcommittees

City of Baltimore - Disaster Preparedness and Planning Project (DP3)

Subcommittees

March 5, 2013

Subcommittee Progress:

- Each subcommittee met at least once between February 13th and February 27th. Subcommittee members determined the categories and subcategories for structuring recommendations and actions within their sectors; they evaluated best practices from other city's all hazards plans and climate adaptation plans; and they drafted new actions based on the hazards identified in the previous meeting.

Categories by Sector:

Infrastructure:

- Energy Systems
- Transportation Systems
- Communication Systems
- Water and Wastewater Systems
- Stormwater Systems
- Solid Waste Systems

Buildings:

- City Codes
- Non-Structural
- Structural
- Design

Natural Systems:

- Land Use
- Greening
- Maintenance and Operations
- Water Supply
- Stormwater Management

Public Health and Human Services:

- Organized by Hazard instead of Category- all hazards, flooding, extreme storms, air quality, sea level rise
- Identified actions as mitigation measures, preparedness measures, response, recovery, and/or policy
- Began process of identifying education/outreach measures and communication measures associated with each action/recommendation

Advisory Committee Feedback:

- Are there any categories missing that you feel are important to incorporate into a specific sector?
- Do you feel the sectors adequately cover the main elements at risk to hazards and climate change?

Advisory Committee Meeting Presentation — March 5, 2013

City of Baltimore
Department of Planning

Disaster Preparedness and Planning Project (DP3)

Advisory Committee Meeting #2

March 5, 2013

Tom Stosur,
Director
Department of Planning

Robert Maloney,
Deputy Chief of Emergency
Management and Public Safety

Agenda

- Review Subcommittee Progress
- Vision Statement and Goals
- Rich Foot- Climate Science
- Review Adaptation and the ICLEI process
- CP Hsia- Understanding the City's response to hazards
- Next Steps

Subcommittees

- Infrastructure
- Buildings
- Natural Systems
- Public Health and Human Services

Infrastructure

- **Energy Systems**
  - Power supply, Substations
- **Transportation Systems**
  - Highways and Roads, Bridges, Tunnels, Public Transportation
- **Communication Systems**
  - Technology, Redundancy
- **Water and Wastewater Systems**
  - Drinking Water, Water Supply, Sewers, Pumping Stations
- **Stormwater Systems**
  - Flooding and Erosion, Maintenance
- **Solid Waste System**

Buildings

- **City Codes**
  - Building Codes, Zoning Codes, Insurance
- **Non-Structural**
  - Improve Efficiency
- **Structural**
  - Retrofits and Upgrades, Flood proofing, Critical Facilities
- **Design**
  - Design Guidelines

Natural Systems

- **Land Use**
  - Land Acquisition, Land Preservation
- **Greening**
  - Tree Canopy, Landscape, Policy, Vacant Lots
- **Maintenance and Operations**
  - Trees and Vegetation, Debris, Ecological Buffers
- **Water Supply**
  - Drinking Water Quality and Supply, Drought Preparedness
- **Stormwater Management**

Public Health and Human Services

- **Organized by Hazard instead of Category**
  - All Hazards, Heat, Flooding, Extreme Storms, Sea Level, Air Quality
- **Identified whether actions were Mitigation Measures, Preparedness, Response, Recovery and/or Policy**
- **Began process of identifying Education/Outreach Measures and Communication Measures associated with each action/recommendation.**

Sample of Recommended Actions

- Incorporate climate change and coastal hazard considerations into building codes by increasing freeboard requirements to two or three feet.
- Manage urban forest and vegetation to reduce susceptibility to invasive or epidemic insects, disease, and drought.
- Become a Community Rating System (CRS) certified community.
- Use elevation data and model results to determine roads at risk of flooding and prioritize infrastructure upgrades for those at risk.

Vision and Goals

Vision Statement:
Baltimore will be a city whose daily activities reflect a commitment shared by government, business, and citizens to reduce or eliminate impacts from current and future natural hazards.

Goals: A broad statement of what will be achieved within a fixed timeframe

Examples:
1. Protect life and property.
2. Support emergency services.
3. Promote public awareness.
4. Encourage the development and implementation of long-term, cost-effective and environmentally sound mitigation and adaptation projects.

Goals → Objectives → Actions

Objectives and Actions

Objectives: Specific, measurable outcomes of the project.

Examples:

1. *Increase awareness of threats from natural hazards and climate change.*
2. *Enhance the understanding of Baltimore's vulnerability to climate change and natural hazards, and identify data gaps.*
3. *Develop hazard mitigation and climate adaptation actions and utilize a prioritization system to direct implementation efforts*
4. *Design a methodology that combines hazard mitigation planning and climate change adaptation, enabling the City to engage in a combined planning effort in the future.*
5. *Create a DP3 plan that Baltimore can use to implement the chosen actions.*

Actions: Activities the City of Baltimore and the community will undertake to achieve greater resiliency, mitigate hazards and adapt to the impacts of climate change.

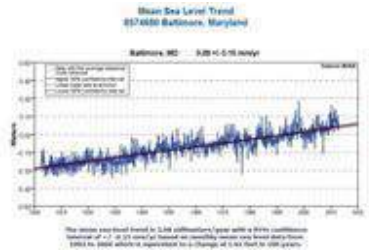
Climate Science

Rich Foot
Data and specific changes to natural hazards in Baltimore

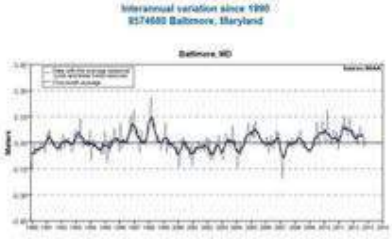
Coastal Storms	more severe
Floods	more extensive
Severe Thunderstorms	more severe
Wind	increase intensity
Winter Storms	less snow, more flooding
Extreme Heat/Drought	more severe and intense
Sea Level Rise	increased threat
Air Quality	lower quality and increase risk

Sea Levels

Mean Sea Level Trend



Inter-decadal variation since 1990

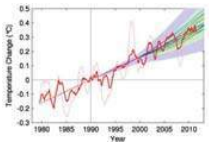


http://www.agu.org/pubs/crossref/pip/2012GL053435.shtml

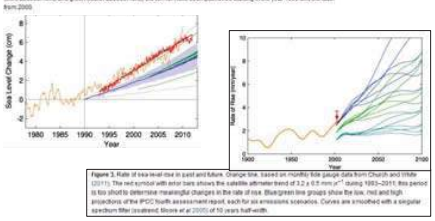
http://stateofthecoast.noaa.gov/

IPCC Guidance

The results show that global temperature continues to increase in good agreement with the best estimates of the IPCC, especially if we account for the effects of short-term variability due to the El Niño/Southern Oscillation, volcanic activity and solar variability. The rate of sea-level rise of the past few decades, on the other hand, is greater than projected by the IPCC models. This suggests that IPCC sea-level projections for the future may also be biased low.



IPCC Guidance



Adaptation

- **Why focus on adaptation?**
  - Scientific evidence indicates that even if we could halt greenhouse gas emissions today, the world would still experience a changing climate for decades to come
- **Adaptation refers to changes made to better respond to new climate conditions.**
  - Many of the impacts (changing temperature and weather patterns, drought, flooding, and sea level rise) are already being felt directly in Baltimore

ICLEI

- **International Council for Local Environmental Initiatives, ICLEI**, is an international association of local governments that have set the national standard for local climate adaptation planning
- ICLEI supports cities in their efforts to develop adaptation strategies and action plans, and to guide them through a systematic process of implementation and management.

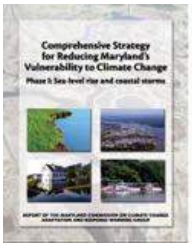
ICLEI Process

ICLEI Process: Current Phase

Identify possible adaptation responses:

1. **Develop actions**
   Activities the City of Baltimore and the community will undertake to achieve greater resiliency, mitigate hazards and adapt to the impacts of climate change
2. **Prioritize actions**
3. **Identify implementation tools**
4. **Develop measures used to track results over time**

State Adaptation Plan



- Integrate key recommendations into our plan
- Data-sharing
- Utilize State Adaptation and Hazard Mitigation information to enhance our preparedness and planning efforts

City of Baltimore
Mayor's Office of Emergency Management

MOEM and Disaster Preparedness and Planning Project (DP3)

C.P. Hsia
March 5, 2013

Stephanie Rawlings-Blake, Mayor

Robert Maloney, Deputy Chief of Emergency Management and Public Safety

MOEM Overview

- Prepare City government
- Prepare the public
- Work with partners to mitigate disasters
- Coordinate interagency response and recovery
  - Incidents
  - Events

MOEM Partners

- City Agencies
  - Not just BCFD, BPD, BCHD, DHCD, DOT, DPW…
- Other Government Partners
  - MEMA, MTA, MDOT, etc.
- Private Sector
  - BGE, CSX
- Non-profits
  - Red Cross, Salvation Army, Business Volunteers Unlimited, etc.

MOEM: Operations Programs

- 24x7 Field response
  - Dispatched when incident overwhelms single agency or is outside normal scope of operations
- EOC operations

MOEM Typical Responses

- Large fires
- Incidents affecting critical infrastructure or location of cultural importance (hospital, school, etc.)
- Weather-related, usually flooding
  - 8 flood-related MOEM responses since 2006, outside of large incidents such as Hurricane Irene and TS Lee
  - Typically involves: DPW, DOT, DHCD, BPD, MOEM, MTA, BGE

MOEM: Preparedness Programs

- Planning
- Exercises
- Training
- Equipment
- Grant programs

Continuous Improvement Cycle

- Preparedness cycle is one of constant improvement
- MOEM generates After-Action Report (AAR) for incidents
- Large incidents will also have an After-Action Conference (AAC)
- Many agencies also have an internal AAR process

Homeland Security Exercise and Evaluation Program (HSEEP)

Similar cycle for HSEEP

NEXT STEPS!

Information/Data Gathering

- Agency Directors will receive a survey regarding what your agency is already doing in response to natural hazards (keep an eye out for this email)
- Specific committee members will be asked for assistance and data related to climate and modeling
- All members should review the Reporting Spreadsheets on google drive before the subcommittee meetings and add additional information

Subcommittees

- Important Subcommittee meetings in March
- Accomplish the following tasks:
  - Finalize all actions (mitigation and adaptation)
  - Identify stakeholders and lead agencies
  - Prioritization exercise
  - Develop a timeframe for all actions
  - Assess feasibility
  - Vulnerability Assessment exercise

Subcommittee Meeting Dates

- **Infrastructure**
  Monday, March 25th 9:00am-11:00am
- **Buildings**
  Tuesday, March 12th 2:30pm-4:30pm
  Wednesday, March 27th 1:00pm-2:30pm
- **Natural Systems**
  Friday, March 22nd 2:00pm-4:00pm
  Monday, March 25th 11:30am-1:30pm
- **Public Health and Human Services**
  Monday, March 11th 3:30pm-5:30pm
  Tuesday, March 26th 11:00am-1:00pm

*Subcommittee meetings will be held at the Department of Planning Office

Reminders

- **Remaining Full Advisory Committee Meetings**
  - Tuesday, April 9th 9:30am-11:30am
  - Tuesday, May 21st 9:30am-11:30am
- **First DP3 Public Meeting**
  - Wednesday, March 27th 5:00pm-8:00pm
    War Memorial Building

Advisory Committee Meeting April 9, 2013

Agenda

City of Baltimore - Disaster Preparedness and Planning Project (DP3)

Advisory Committee Meeting

April 9, 2013

Committee Purpose:

- To bring together stakeholders from key agencies, institutions, businesses, and neighborhoods to identify actions and recommendations for the City of Baltimore's Disaster Preparedness and Planning Project.

Meeting Objectives:

- Review document framing, goals, strategies and recommendations
- Review full recommendations list and top priority recommendations
- Gain a greater understanding of new floodplain maps
- Determine perceived risk for current and future climate conditions

Materials Provided:

- Agenda
- Full list of DP3 recommendations
- Framing document
- Vulnerability assessment worksheet

Agenda:

9:30am-9:35am: Tom Stosur, Director, Department of Planning

- Welcome and brief introductions

9:35am-10:00am: Kristin Baja, Hazard Mitigation Planner, Office of Sustainability

- Progress to date
- Framing of document
- Goals, strategies and recommendations

10:00am-10:05am: Beth Strommen, Director, Office of Sustainability

- Connection of DP3 plan to Federal, State, Local and non-government plans

10:05am-10:15am: Ken Hranicky, Flood Manager, Department of Planning

- Updated FEMA maps and importance of regulating to old lines

10:15am-10:50am: Small Group Work Sessions

- City employees: with Ken Hranicky and Alice Kennedy
  - Vulnerability assessment exercise
  - Future scenarios exercise
- Non-city employees: with Kristin Baja and Beth Strommen
  - Vulnerability assessment exercise
  - Future scenarios exercise

10:50am-11:00am: Kristin Baja, Hazard Mitigation Planner, Office of Sustainability

- Town Hall meeting
- Subcommittee meetings
- Advisory Committee moving forward

Small Group Scenarios

City of Baltimore - Disaster Preparedness and Planning Project (DP3)

Small Group Session Two

April 9, 2013

Three Scenarios:

1. **One month of 95°+ days with rolling brown outs**
   - High volume of people going to the hospital or clinics for heat related illnesses
   - Pavement buckling and systems heavily impacted
   - What else?

2. **Massive hurricane with storm surge followed by a derecho thunderstorm system**
   - Considerable portion of downtown inundated with floodwaters
   - Debris scattered all over the City
   - Power Out
   - What else?

3. **One solid week of torrential rains and flooding**
   - Considerable flooding throughout the City
   - Damage to infrastructure
   - Many roads unusable
   - What else?

Considerations:

Personal

How would this scenario impact your personal life?

How would it impact your immediate family?

How would it impact the people you work with?

What impact would it have to your home?

Economic

How would this scenario impact business in your neighborhood?

How would it impact the city at large?

Environmental

How would this scenario impact your local environment?

Systems

How would this scenario impact the systems in which you work?

How would it impact the systems you rely on daily?

Framing

City of Baltimore - Disaster Preparedness and Planning Project (DP3)

Framing: Vision, Goals and Strategies

April 9, 2013

Vision: Outlines what the project wants to be

- Baltimore will be a city whose daily activities reflect a commitment shared by government, business, and citizens to reduce or eliminate impacts from current and future natural hazards.

Goals: Goals are defined as a general value statement of long-range direction which identifies desired states of affairs toward which activities andresources can be directed. Goals reflect the community's needs and values.

Draft goals

- To make Baltimore more resilient to current hazard events and predicted climate conditions
- To protect the health and safety of Baltimore City residents and visitors
- To prevent damage to infrastructure, structures, and critical facilities
- To support emergency services
- To promote public awareness
- To encourage the development and implementation of long-term, cost-effective and environmentally sound mitigation and adaptation projects

Strategies: Strategies are thoughtfully constructed plans, methods, or actions that can be employed to ultimately result in positive progress towards the achievement of a given goal. Strategies are based upon identified strengths, weaknesses, and opportunities.

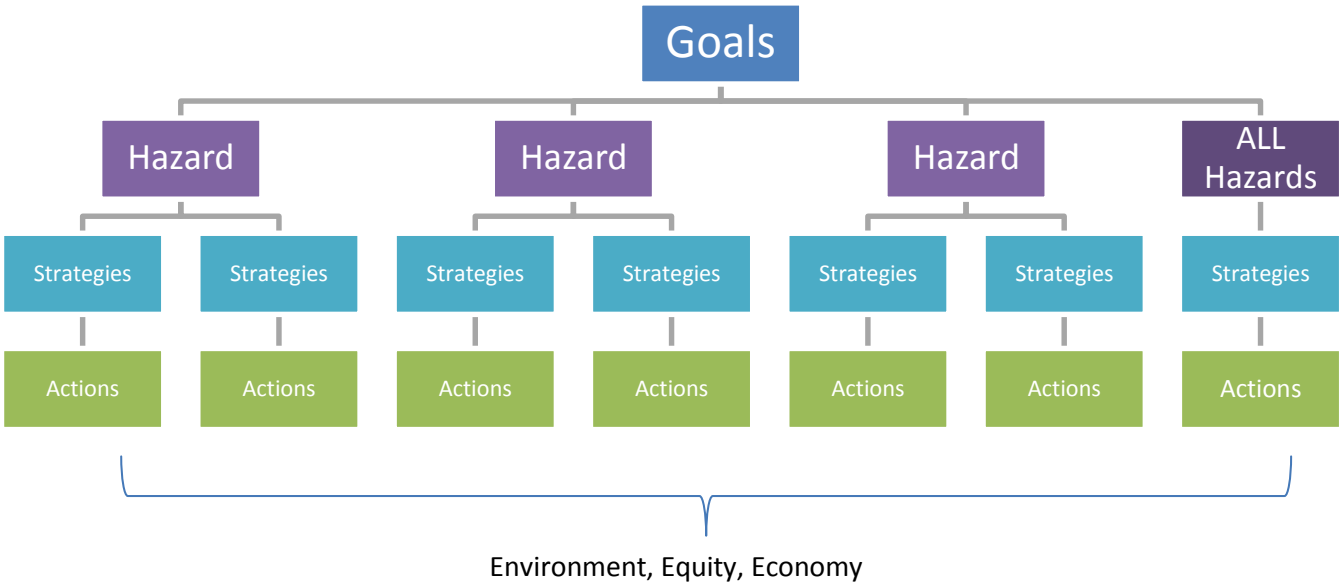
Small sample of draft strategies:

- Improve stormwater management throughout Baltimore City
- Become a Community Rating System (CRS) Community
- Increase participation in the National Flood Insurance Program (NFIP)
- Reduce vulnerability to increased heat and storm events
- Minimize damages from current and predicated extreme weather events
- Increase awareness of vulnerability to natural hazards and changes in climate through a targeted outreach and education campaign
- Incorporate climate adaptation and hazard mitigation planning and preparedness measures into all city-wide plans and planning efforts
- Continue to monitor and enhance climate data to better inform and update recommendations

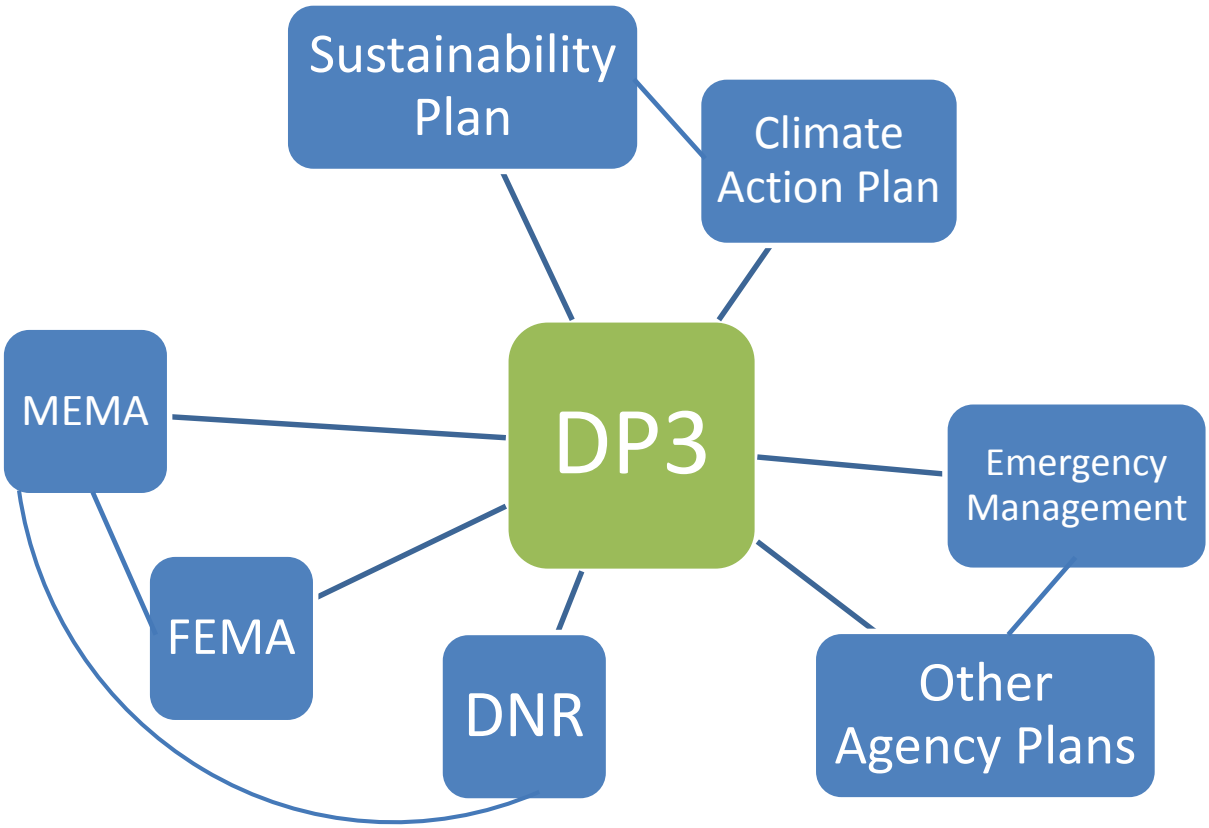
Actions: Specific actions that are endorsed to accomplish one or more strategies, and thereby make positive progress toward the achievement of goals.These are actions the City of Baltimore and the community will undertake to achieve greater resiliency, mitigate hazards and adapt to the impacts of climate change.

- See spreadsheet for a full list of draft recommendations

Framing the DP3 Plan:



Connection with other Plans:



Presentation

April 9th, 2013

DISASTER PREPAREDNESS AND PLANNING PROJECT (DP3)

Advisory Committee Meeting

Presentation Overview

1 Framing & Structure

2 FEMA Maps & strategies

3 Small Group work sessions

4 Next Steps

Progress to Date

- Completed hazard identification and assessment
- Identified 150 mitigation and adaptation actions
- Generated list of lead agencies, stakeholders and co-benefits
- Identified timeframe and initial prioritization
- Conducting HAZUS analysis to identify risk and vulnerabilities
- Set up public outreach meetings- start with floods, heat next

Now onto completing data analysis and writing the plan

1

Framing

Goals, Strategies, and Recommendations

Kristin Baja, Hazard Mitigation Planner

Methodology- integration of planning processes

FEMA Crosswalk Requirements

Conduct a Risk Assessment- Identify Hazards, Profile Hazards, Assess Vulnerability

Create a Hazard Mitigation Strategy- Goals, Actions, Implementation

Plan Maintenance- Monitoring, Evaluating, Updating the Plan & Public Involvement

ICELI Five Milestone Process

Milestone One: Conduct a Climate Resiliency Study

Milestone Two: Set Preparedness Goals

Milestone Three: Develop a Climate Preparedness Plan

Milestone Four: Publish & Implement Preparedness Plan

Milestone Five: Monitor & Reevaluate Resiliency

Structure of the DP3 Plan

Main Goals	Overarching goals for the plan
Hazards	Sections divided by hazard
Strategies	Strategies for each hazard
Recommendations	Actions divided into four sectors: Infrastructure, Buildings, Natural Systems, Public Health and Human Services

Example:

Hazard: Heat

Strategy: Reduce vulnerability to increased heat

Recommendations: Environment, Equity, Economy

- Infrastructure: Reduce damage to asphalt from changes in climate and determine a repaving strategy that incorporates better maintenance and operations.
- Buildings: Require reflective roof systems or vegetative roofs for all new commercial, industrial, multifamily, and city-owned development
- Natural Systems: Increase the urban tree canopy and target areas with urban heat island impacts
- Public Health: Ensure redundancy of energy systems at all city cooling centers

Structure of the Plan

Goals and Strategies

Based on the draft list of goals and strategies in front of you, do you feel we are **heading in the right direction?**

The goals and strategies may evolve as we connect DP3 to other plans

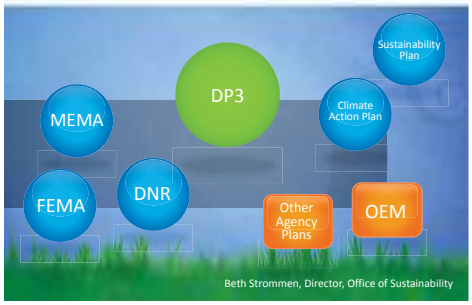
List of Recommendations

- Extensive list generated by the subcommittees- Thank you!
- DP3 Project Manager currently working to place all recommendations into the plan structure discussed
- Final list will be distributed via email for comment

Top Ten DP3 Recommendations:

1. Identify how a natural disaster event will impact important energy supply systems such as the Trigen/Violia steam system, chilled water loop , and the BRESCO facility
2. Improve backup power systems by increasing the number of backups and pulling from different grids. Ensure all water and wastewater pumping stations have reliable backup power sources
3. Ensure all water and wastewater pumping stations have reliable backup power sources. Take steps to provide some level of disinfection to raw sewage for overwhelmed wastewater pumping stations.
4. Develop stricter flood regulations for critical facilities such as hospitals, fire stations, police stations, hazardous material storage sites, etc.
5. Require property owners, when completing rental registration, to identify if their property is located in the floodplain
6. Increase the urban tree canopy and target areas with urban heat island impacts
7. Develop a comprehensive list of plant and tree species or varieties known to have a broad range of environmental tolerances.
8. Ensure consistency and integration with existing response plans within and between agencies
9. Educate and train community groups to participate in responding to hazards
10. Require, through policy, that new city capital improvement projects incorporate hazard mitigation principles (e.g., prohibit new projects in hazard-prone areas such as floodplains or the coastal high hazard area; requiring above code design requirements for critical facilities).

DP3 Plan Connections



Beth Strommen, Director, Office of Sustainability

2 FEMA Flood Map Update

Ken Hranicky, City of Baltimore Flood Manager

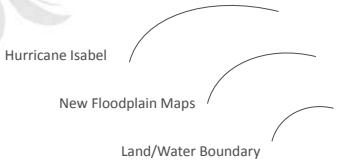
Floodplain Maps

Current Maps
- Adopted on February 2, 2012
- Tidal Floodplain Delineation was based on a 1977 Virginia Institute of Maritime Science Study of the Chesapeake Bay

New Tidal Study
- Currently under consideration
- New Study- a significant increase in computing and data

FEMA Flood Maps

Significantly lower flood heights for the 1% Storm



Flood Maps: Inner Harbor

Before After

Flood Maps: Colgate Creek

Before

After

Flood Map Recommendations

Continue to regulate,

1. To the existing boundary
2. To the storm of record- Isabel

3 Small Group Exercises

Office of Sustainability and Department of Planning Staff

Small Group Exercise One

Perceived Vulnerability and Risk

- Review spreadsheet as a group
- Fill in spreadsheet
- Return spreadsheet to city staff member

SCENARIOS

Work in your small groups on the following future climate scenarios

Small Group Exercise Two

Planning for Future Climate Changes

- One month of 95°+ days with rolling brown outs
- Massive hurricane with storm surge followed by a derecho thunderstorm system
- One solid week of torrential rains and flooding

4 Next Steps

Kristin Baja, Hazard Mitigation Planner

Town Hall Meeting

- Tuesday, April 30th at the War Memorial Building
- Invitations will be sent to all people within the floodplain
- Information gathering and feedback opportunity
- Focus on new FEMA floodmaps, DP3 project, and emergency management
- Review hazard mitigation and climate adaptation actions
- 5:00pm-9:00pm

Advisory Committee Next Steps

- **Next Advisory Committee Meeting**
  Tuesday, May 21st 9:30am-11:30am
  Focus on HAZUS outcomes and finalized actions
- **Next Subcommittee Meeting**
  Groups can meet in person or review material online
  Focus on Implementation and Monitoring
- **Document Review and Comment**
  Portions of the document will start to be available for review and comment in May. Advisory Committee members will be sent portions of the document for editing and review.
- **Final Meeting to approve plan- June, 2013**

QUESTIONS?

Advisory Committee Meeting June 28, 2013

Agenda

City of Baltimore - Disaster Preparedness and Planning Project (DP3)

Advisory Committee Meeting

June 28, 2013

Committee Purpose:

- To bring together stakeholders from key agencies, institutions, businesses, and neighborhoods to identify actions and recommendations for the City of Baltimore's Disaster Preparedness and Planning Project.

Meeting Objectives:

- Report on progress made to date
- Review and approve DP3 strategies
- Discuss DP3 actions and clarify any concerns
- Review next steps and committee members roll

Materials Provided:

- Agenda
- List of DP3 strategies
- List of DP3 strategies with draft actions

Agenda:

10:00am-10:05am: Tom Stosur, Director, Department of Planning

- Welcome and goals for the meeting

10:05am-10:20am: Kristin Baja, Hazard Mitigation Planner, Office of Sustainability

- Progress to date
- HAZUS and vulnerability assessment
- Flood and Heat meetings in communities

10:20am-10:35am: Beth Strommen, Director, Office of Sustainability & Kristin Baja

- Discussion of strategies by sector
- Approval of strategies

10:35am-11:10am: Beth Strommen & Kristin Baja

- Review and discuss actions of concern

11:10am-11:15am: Kristin Baja, Hazard Mitigation Planner

- Final document outline
- Final document timeline
- Final meeting for vote

11:15am-11:30am: Beth Strommen, Director, Office of Sustainability

- Looking beyond this plan

Presentation

City of Baltimore Disaster Preparedness and Planning Project (DP3)

Advisory Committee Meeting

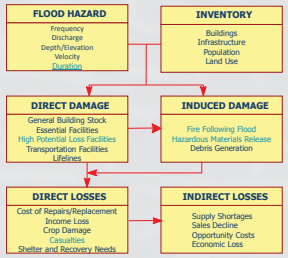
June 28th, 2013

Agenda

- Progress since our last meeting
- Review and approve strategies
- Review actions and discuss concerns
- Final document outline and progress
- Timeline
- Next steps

Progress to date

- HAZUS analysis nearly complete
- HAZUS is a planning tool that estimates damage and losses resulting from natural hazards



Progress to date

Progress to date

- Vision approved
- Goals approved
- Strategies approved today
- Actions

Community Outreach

Town Hall Event

Community Outreach

Flood and Heat meetings

- Four flood meetings in both tidal and non-tidal
  - Two in tidal flooding areas
  - Two in non-tidal flooding areas
  - Focus on current flooding, potential flooding, behavior change, and preparedness

Community Outreach

Flooding

- Work with the EPA to host a meeting focused on flooding for city employees
  - City and County representatives
  - Reservoir representatives

STRATEGIES

Review and approval

Infrastructure Strategies

ENERGY

Strategy IN-1: Protect and enhance the resiliency and redundancy of electricity system

Strategy IN-2: Increase energy conservation efforts

Strategy IN-3: Ensure backup power generation for critical facilities and identified key infrastructure during power outages

Strategy IN-4: Partner with utility to evaluate protecting power and utility lines from salt-water intrusion.

Infrastructure Strategies

LIQUID FUELS:

Strategy IN-5: Protect and manage compressed liquefied natural gas sites and (City) fueling stations before and during hazard events

Strategy IN-6: Evaluate and improve resiliency of liquid fuels infrastructure

COMMUNICATION SYSTEMS

Strategy IN-7: Evaluate and improve resiliency of communication systems that are in place for sudden extreme weather events

WATERFRONT

Strategy IN-8: Enhance the resiliency of the City's waterfront

Infrastructure Strategies

TRANSPORTATION

Strategy IN-9: Integrate climate change into transportation design, building and maintenance

Strategy IN-10: Identify additional alternative routes and modes for effective transport and evacuation efforts during emergency situations

Strategy IN-11: Alter transportation systems in flood-prone areas in order to effectively manage stormwater

Strategy IN-12: Design and implement floodgates and barriers in transportation tunnels

Strategy IN-13: Ensure structural stability of all transportation tunnels to reduce impact from seismic activity

Strategy IN-14: Explore changes to road maintenance and construction materials based on anticipated changes in climate

Infrastructure Strategies

WATER AND WASTEWATER

Strategy IN-15: Increase the resilience of all wastewater pumping stations and protect them from current and projected extreme weather events

Strategy IN-16: Integrate resiliency, redundancy, and structural stability into the City's drinking and water system to ensure safe and reliable water storage and distribution

Strategy IN-17: Conduct a assessment that evaluates and improves all pipes' ability to withstand extreme heat and cold

Infrastructure Strategies

STORMWATER

Strategy IN-18: Enhance and expand stormwater and sewer infrastructure and systems

Strategy IN-19: Modify urban landscaping requirements and increase permeable surfaces to reduce stormwater runoff

Strategy IN-20: Evaluate and support DPW's stream maintenance program

Strategy IN-21: 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)

Infrastructure Strategies

SOLID WASTE

Strategy IN-22: Reevaluate and support a comprehensive debris management plan for post hazard events

POLICY AND GOVERNMENT DECISION-MAKING

Strategy IN-23: Encourage the integration of climate change and natural hazards into private and State planning documents, systems, operations, and maintenance

Strategy IN-24: Develop City policy which requires new city government capital improvement projects incorporate hazard mitigation principles

Buildings Strategies

CITY CODES & DESIGN GUIDELINES

Strategy B-1: Create hazard protections for critical facilities including hospitals, fire stations, police stations, hazardous material storage sites, etc.

Strategy B-2: Enhance building codes that regulate building within a floodplain or near the waterfront

Strategy B-3: Strengthen city codes to integrate anticipated changes in climate

Strategy B-4: Increase floodplain awareness for rental tenants

Buildings Strategies

LAND USE

Strategy B-5: Update a list of flood prone and repetitive loss buildings to consider for acquisition

Strategy B-6: Prioritize retrofitting and increasing resiliency of public housing units in the 100-year floodplain and other high risk areas

Buildings Strategies

STRUCTURAL

Strategy B-7: Improve wind resiliency of new and existing structures

Strategy B-8: Evaluate various seismic design enhancements using prototypical Baltimore City building types

Strategy B-9: Retrofit existing buildings in the 100-yr floodplain to increase resiliency

Buildings Strategies

NON-STRUCTURAL

Strategy B-10: Improve resource conservation opportunities in all city owned buildings

Strategy B-11: Provide education about resource conservation within buildings

Strategy B-12: Determine losses generated by a coastal storm/hurricane and engineering effectiveness and cost-benefit of various coastal storm mitigation measures using HAZUS-MH computer modeling

Natural Systems

URBAN PARKS AND FOREST

Strategy NS-1: Utilize green corridors and parks to help protect surrounding communities from the impacts of hazard events

Strategy NS-2: Increase and enhance the resilience and health of Baltimore's urban forest

Strategy NS-3: Create an interconnected network of green spaces to support biodiversity and watershed based water quality management

Strategy NS-4: Expand, protect and restore riparian areas in the city

Strategy NS-5: Preserve and create new ecological buffer efforts and support creating more (e.g. wetlands) along coastal areas

Natural Systems

FOOD SYSTEM

Strategy NS-6: Increase Baltimore's Food Security

WATER SYSTEM

Strategy NS-7: Enhance and improve the resilience of Baltimore's water supply

Strategy NS-8: Require the City's drought management plan to account for changes in climate

Strategy NS-9: Integrate climate change and natural hazards planning into small watershed action plans (SWAPs)

Strategy NS-10: Ensure that local flood damage prevention regulations account for changes in sea level rise and climate

Public Health and Human Services

EMERGENCY PREPAREDNESS

Strategy PH-1: Strengthen emergency preparedness coordination between local government, NGOs, and private entities by updates to the City Emergency Operations Plan (EOP) and related Emergency Support Functions (ESF)

Strategy PH-2: Develop a Hazard Awareness Program

Strategy PH-3: Designate community leaders and organizations who can assist and provide support during hazard events

Strategy PH-4: Integrate climate change and natural hazards planning into all City and community plans

Strategy PH-5: Anticipate and address potential disease outbreaks caused by extreme weather events and change climatic conditions

Public Health and Human Services

EMERGENCY RESPONSE

Strategy PH-6: Better equip emergency workers for natural hazards

Strategy PH-7: Protect Baltimore residents from the effects of high heat events and plan for more frequent instances of high heat days

EDUCATION AND OUTREACH

Strategy PH-8: Conduct climate, resiliency, and emergency planning education and outreach

Strategy PH-9: Improve awareness and education about the importance of flood insurance and preparation

ACTIONS

Review and discuss

Infrastructure Actions

- **Strategy IN-1:** Protect and enhance the resiliency and redundancy of electricity system

  Action 2: Evaluate the City of Baltimore utility distribution system, and identify "underground utility districts" – areas of the City where performing underground utility conversion would be feasible

- **Strategy IN-7**: Evaluate and improve resiliency of communication systems that are in place for sudden extreme weather

  Action 6: Ensure continued operation of the City's various computer mainframes for email, control systems, and internet service by having stand-by batteries for each with a capacity sufficient for backup generation to operate

Infrastructure Actions

Strategy IN-24: Develop City policy which requires new city government capital improvement projects incorporate hazard mitigation principles

Action 1: Prohibit new projects in hazard-prone areas such as floodplains or the coastal high hazard area

Action 2: Require above code design requirements for critical facilities

Strategy IN-9: Integrate climate change into transportation design, building and maintenance

Action 3: Incorporate compliance with earthquake standards to withstand a magnitude eight earthquake for all new, improved and rebuilt bridges

Action 4: Design bridges expansion joints for longer periods of high heat and develop a more robust inspection and maintenance process

Buildings Actions

Strategy B-1: Create hazard protections for critical facilities including hospitals, fire stations, police stations, hazardous material storage sites, etc.

Action 1: Require all hazardous materials within the floodplain to be elevated a minimum of three feet above the freeboard

Action 2: Require new critical facilities to be designed with redundant operating systems.

Strategy B-7: Improve wind resiliency of new and existing structures

Action 1: Review local building codes to determine if revisions are needed to improve the structures ability to withstand greater wind velocities and storm impacts

Action 2: Retrofit emergency shelter windows to withstand winds associated with coastal storm events

Buildings Actions

Strategy B-9: Retrofit existing buildings in the 100-yr floodplain to increase resiliency

- Action 1: Develop a creative financing program for residential and commercial properties
- Action 2: Mandate flood resiliency retrofits for large buildings in the 100-yr floodplain
- Action 3: Study engineering alternatives where retreat and accommodation are not possible

Public Health and HS Actions

Strategy PH-1: Strengthen emergency preparedness coordination between local government, NGOs, and private entities by updates to the City Emergency Operations Plan (EOP) and related Emergency Support Functions (ESF)

- Action 8 : Encourage Baltimore Animal Rescue and Care Shelter Inc. (BARCS) to further develop their internal plan for relocating animals from the shelter if needed during an emergency
- Action 9: Assist Baltimore Animal Rescue and Care Shelter Inc. (BARCS) in obtaining funding to move their facility out of the floodplain
- Action 10 : Partner with MD H2E, two Baltimore hospitals, and other stakeholders to develop and implement a case study of hospital-based practices that foster community resilience to climate change

Public Health and HS Actions

Strategy PH-7: Protect Baltimore residents from the effects of high heat events and plan for more frequent instances of high heat days

- Action 6: Work with Regional, State and Local partners to improve air quality and reduce respiratory illnesses
- Action 7: Develop plans to give BCHD authority to temporarily close down specific, pre-identified, high-polluting entities when specific heat and weather conditions occur

DOCUMENT

Progress

Document outline

- Chapter 1: Introduction
- Chapter 2: Mitigation and Adaptation
- Chapter 3: Hazard Identification
- Chapter 4: Risk and Vulnerability Assessment
- Chapter 5: Strategies and Actions
- Chapter 6: Adaptive Capacity
- Chapter 7: Implementation Guidance

Timeline

June 28th	Committee approve Strategies
July 10th	Final list of Actions distributed
July 30th	Town Hall Meeting
July 31st	Draft document to committee
August 10th	Draft document posted online
August 20th	Document approved by committee
August 27th	Sustainability Commission approval
September	Planning Commission approval

WHAT'S NEXT?

Beth Strommen

Advisory Committee Meeting August 19, 2013

Agenda

City of Baltimore - Disaster Preparedness and Planning Project (DP3)

Advisory Committee Meeting

August 19, 2013

Committee Purpose:

- To bring together stakeholders from key agencies, institutions, businesses, and neighborhoods to identify actions and recommendations for the City of Baltimore's Disaster Preparedness and Planning Project (DP3).

Meeting Objectives:

- Discuss DP3 Plan chapters (generally)
- Review and endorse chapters of the DP3 Plan

Materials Provided:

- Agenda
- DP3 Plan outline
- Copy of Chapter 5
- List of comments and proposed changes

Agenda:

3:00pm-3:05pm: Tom Stosur, Director, Department of Planning and Bob Maloney, Deputy Chief of Emergency Management and Public Safety

- Welcome and goals for the meeting

3:05pm-3:30pm: Kristin Baja, Hazard Mitigation Planner, Office of Sustainability

- Progress to date
- Plan outline and review
- Anticipated additions

3:30pm-4:15pm: Beth Strommen, Director, Office of Sustainability & Kristin Baja

- Strategies and actions grouped/changed
- Discuss edits and concerns

4:15pm-4:30pm: Kristin Baja & Beth Strommen

- Final discussion and endorsement of DP3 Plan

4:20pm-4:30pm: Kristin Baja, Hazard Mitigation Planner, Office of Sustainability

- Final timeline
- Looking beyond this plan

Presentation

Progress to Date!

- Second DP3 Town Hall Event, July 30th
- Community Meetings
- Writing of the Plan
- HAZUS Analysis

Chapter 1!

Introduction

- Overview of Project
- Overview of the City of Baltimore
- Methodology
- Plan Contents and Scope
- Climate Change

Chapter 2!

Importance of Planning to Mitigate Natural Hazards and Adapt to Climate Change

- Hazard Mitigation
- Climate Change
- Climate Adaptation
- Connection between Hazard Mitigation and Climate Adaptation

Chapter 3!

Natural Hazards in Baltimore City

- Identification and Profile of Current Natural Hazards
- Each Hazard explained individually accompanied with historical impacts

Chapter 4!

Vulnerability Assessment

- Self-Assessment
- Impact Analysis
- Community Asset Inventory
- Inventory of Critical Facilities
- Estimated Losses

Chapter 5!

Strategies and Actions for Addressing Hazards and Climate Change

- Vision
- Goals
- Current City Initiatives
- No Regrets Actions
- Strategies and Actions listed by Sector

Chapter 6!

Implementation Guidance

Implementation, Monitoring and Evaluation

- Current City Initiatives
- Alignment with Goals
- Connection with existing plans/efforts
- Lead Agencies and stakeholders
- Timeframe
- Financing
- Metrics

Appendices!

- Glossary
- Engineering Study of Fells Point
- Health Impact Assessment (Urban Heat)
- Community Meetings (Town Hall, Heat, Flood) feedback sheets and surveys
- Self Assessment Documents
- Maps, Supporting Charts and HAZUS data
- Ranking exercise and prioritization
- Presentations and supporting documents
- References

Additions

- Executive Summary
- THIRA/COOP Integration
- Hyperlinking to plans
- Design and use of symbols
- Historical Considerations
- Any missing data
- Appendices

Document Title

Preparedness
(Hazard Mitigation)

+

Planning
(Climate Adaptation)

= **Resilience**

Baltimore Resilience Plan

Resilience allows us to integrate hazard mitigation, climate mitigation, climate adaptation and emergency preparedness under one umbrella for education, outreach and implementation

Infrastructure

IN-4
John Quinn
Action 3: Support the Maryland Public Service Commission's effort to accelerate replacement of aging natural gas infrastructure which will harden the system against flooding
Action 4: Work with BGE to ensure existing preparedness plans for Spring Gardens compressed-liquefied natural gas site incorporate vulnerability to present and predicted flooding, storm surge and sea level rise.

IN-7
Beth Strommen
Action 5: Research utilizing the Envision™ Rating System and Greenroads Rating System for all new infrastructure and road projects
We shouldn't name specific programs or companies/vendors. This implies support of one over another, which isn't legal in terms of public procurement practices. Best to just describe what is needed and how this type of program can help.

IN-11
Sara Hoverter
I obviously like the fact that you're thinking about pavement that can withstand extreme heat – I would expand that to include pavement that will reduce heat as well.

Infrastructure

IN-13
Beth Strommen
Action 4: Retrofit and harden low-laying pumping stations and treatment plants in flood hazard areas
Language needs clarification regarding stormwater infiltrating the sewerage conveyance system.

Sara Hoverter
One of the things that DC stormwater folks are worried about is that our stormwater outfalls are not always above the water line when the river runs high, which means backups. There's talk of theoretically trying to raise some of them, but I don't know how realistic that is. Does Baltimore have the same worry with sea level rise?

IN-14
Beth Strommen
Action 7 is redundant with NS-6, Action 4
Action 9 is redundant with NS-6, Action 9

Infrastructure

IN-17
Beth Strommen
Action 1: Evaluate existing stormwater requirements and increase them to incorporate Environmental Site Design (ESD) regulations *(M)*
This should be approved by DPW Surface Water Division. Seems like they are already required to do this because of existing State regulations.

Eben Hansel
Action 4:
I don't think these actions belong in the infrastructure section, and I think they are too broad to make mandatory. It's not possible for all new buildings to have vegetative roofs, which is apparently what this requires – it just isn't feasible on some types of buildings. We discussed this in the buildings committee and (if I recall correctly) wanted to say that the city would encourage "green" roofs, meaning either vegetative or reflective.
Action 6:
The same issue applies for #6 – it's just not feasible for some buildings, and shouldn't be stated as an absolute requirement for "all" new development.

IN-21
Beth Strommen
Action 2: Ensure Red Line planning incorporates adaptation strategies. *(S)*
Modify this language to be more specific. The Red Line is in design now, and must have a specific rule for this that meets current Federal and State requirements.

Infrastructure

Transportation
Karin Holland
One thing that you might want to make explicit in the report is how to make available more and safer transportation routes for bicycling and other alternative types of transportation (walking, etc.). This not only allows for communities to become healthier and more livable during normal day-to-day, but also allows for redundancy transportation systems in the event of an emergency or storm event. After Sandy, one of the best ways to get into cities was on bicycle (subways flooded, buses overloaded, etc.).

General Comments
Sara Hoverter
For evacuation-related strategies/actions (IN-8 and others), you might want to think about explicitly designating special assistance/outreach plans for your most vulnerable residents. Some of that shows up elsewhere, but you might want it more than one place so that multiple departments are thinking about it

Buildings

B-1
Beth Strommen
Action 7: Require that backup solar powered street lights and signals be integrated along evacuation routes and high traffic areas
Move this action to IN-7 (Integrate climate change into transportation design, building and maintenance)

B-2
Beth Strommen
Action 3: Continue to regulate to the existing tidal floodplain delineation *(M)*
This action is both redundant to NS-9 Action #5 (Develop policy to keep existing tidal floodplain boundaries for regulating development purposes) and the language is not clear. What is 'existing tidal floodplain delineation'. There is no reference to what this means. Also one is M, and one is S.

Buildings

B-1, B-7, B-9
Beth Strommen
The actions below are redundant

B-3
Eben Hansel
This had come up a few times in the full group and my understanding was that the plan would not aim to discourage development along the waterfront, but would focus on making sure any development was done correctly through building codes, etc.

Sara Hoverter
Yay to changing city codes for urban heat adaptation in B-3

Natural Systems

NS-2
Sara Hoverter
Yay for urban forestry, especially targeted to urban heat islands

Infrastructure Overlaps: See in Infrastructure Section
Beth Strommen
The actions are redundant

Public Services

PH-2
Sara Hoverter: Delaware is currently testing a heat health warning system that you might want to have your health department look at (hyperlink to this)

PH-6
Sara Hoverter: With the focus on vector-borne disease, etc., you might want to include an element of public health surveillance and reporting

Document Outline

- Chapter 1: Introduction
- Chapter 2: Mitigation and Adaptation
- Chapter 3: Hazard Identification
- Chapter 4: Risk and Vulnerability Assessment
- Chapter 5: Strategies and Actions
- Chapter 6: Implementation Guidance

Vulnerability Self-Assessment

The DP3 Advisory committee provided specialized and expert input through a self-assessment process that utilized two different methods. First, the Committee employed a Disaster Preparedness and Planning Project Vulnerability Assessment Tool. This exercise, which asked members to rank the probability and severity of various hazards (both natural hazards and man-made incidents were considered), revealed the percentage of relative threat (risk) for each hazard using the following formula:

Risk % = ((Probability)*3 ((Human Impact + Property Impact + Economic Impact + Preparedness)/12))* 100

The results of this assessment were discussed briefly in Chapter 4 and are displayed in the table below.

Appendix- Table –1 Advisory Committee Self Assessment

Hazard Event		Probability	Severity (Magnitude minus mitigation)				Risk
			Human Impact	Property Impact	Economic Impact	Preparedness	
		Likekihood this will occur	Possible deaths or injuries	Physical losses and damages	Interuption of services	Planning	Relative threat
	Ranking	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0-100%
Natural Hazards							
N1	Air Quality	2.00	2.18	0.94	1.47	1.24	32.35
N2	Coastal Erosion	1.00	0.82	1.35	1.12	0.88	11.60
N3	Coastal Storm	2.00	1.94	2.24	2.18	1.53	43.79
N4	Drought	1.00	1.59	1.24	1.71	1.41	16.50
N5	Earthquake	1.00	1.71	2.35	2.35	1.29	21.41
N7	Extreme Heat	3.00	2.53	1.12	1.82	2.00	62.25
N8	Flood (Stream and River)	2.00	1.59	2.24	1.65	1.82	40.52
N9	Flood (Stormwater)	3.00	1.47	2.06	1.82	1.82	59.80
N10	Flood (Storm Surge)	1.00	2.18	2.35	2.24	1.59	23.20
N11	Flood (Tidal)	1.00	2.00	2.29	2.06	1.65	22.22
N12	Fog	1.00	1.24	0.82	0.76	1.00	10.62
N13	Hail	2.00	1.24	1.53	1.12	1.06	27.45
N14	Hurricane	2.00	2.53	2.65	2.35	1.88	52.29
N15	Ice Storm	2.00	2.06	2.00	2.06	1.88	44.44
N17	Landslide/Land Slump	1.00	1.12	1.53	1.24	1.24	14.22
N18	Severe Winter Storm	2.00	2.29	2.06	2.41	2.18	49.67
N19	Tornado	1.00	2.35	2.65	2.29	1.47	24.35
N20	Windstorm/Derecho	1.00	2.12	2.53	2.29	1.47	23.37
Human-Caused Hazards							
H1	Dam Failure	1.00	1.88	2.12	2.12	1.24	20.42
H2	Fire and Explosion	1.00	2.18	2.71	2.06	2.12	25.16
H3	Transportation Accident	3.00	1.94	1.35	1.35	2.00	55.39
H4	Structural Fires	2.00	1.94	2.41	1.82	1.82	44.44
H5	Sinkholes	2.00	1.47	2.06	1.53	1.53	36.60

In a second self-assessment, the Advisory Committee was asked to interpret potential impacts from three different scenarios by providing their qualitative input regarding affects to economic, environmental, personal, and systems-related aspects of urban living. In each category, questions were focused on specific vulnerabilities. In addition to the questions listed in Chapter 4, which solicited arguably subjective responses, more systematic considerations were addressed and are described here.

Just as the DP3 Advisory Committee engaged in this exercise to determine vulnerabilities, individual agencies, departments, organizations, and other groups should also consider pursuing a similar process. The series of questions, which is meant to focus on a single scenario or hazard event (e.g. massive hurricane with a storm surge followed by a derecho thunderstorm; or a tornado, drought, etc.), could be asked either generally (here, for the City of Baltimore) or with regards to an individual system.

Responses might be in the form of multiple choice selections, or may be open-ended to allow for narrative. The discussion is divided into smaller assessments for addressing vulnerability in terms of exposure, sensitivity, and adaptive capacity.

EXPOSURE

To identify the probability and risk of impact from natural hazards.

On average, what percentage of the City of Baltimore/System would be disrupted if faced with this hazard?

1. 75-100%
2. 50-74%
3. 25-49%
4. 5-24%
5. <5%

Are there any signs suggesting key areas of weakness in the City of Baltimore/System that might be most vulnerable in this hazard event?

How would the disruption or failure of outside systems impact the City of Baltimore/System?

Considering predicted future impacts and climate change events, what is the probability that the City of Baltimore/System will be impacted by this hazard?

What impact would this event have on the regional capacity to benefit from ecosystem services?

SENSITIVITY

To determine the degree to which the City would be affected.

How many businesses would experience service disruptions if this event were to occur?

1. 75-100%
2. 50-74%
3. 25-49%
4. 5-24%
5. <5%

If this event has occurred in the past, what social impacts did the City of Baltimore/System suffer? Economic impacts? Environmental impacts?

To what extent would the City of Baltimore/System suffer social impacts if this hazard were to occur in the future? Economic impacts? Environmental Impacts?

How would community assets be impacted if the City of Baltimore/System experienced failure?

How many residents would have been impacted if the City of Baltimore/System were disrupted by this hazard in the past year? Given climate predictions, would this number be expected to increase in the future?

If this event occurred, how many Baltimore City residents would be displaced?

Vulnerability Self-Assessment, Continued

ADAPTIVE CAPACITY

System Operations and Interdependencies

In order to determine if the system adequately prepared to endure projected future scenarios.

What is the current daily demand on the City of Baltimore/System capacity?

1. 90-100%
2. 75-89%
3. 50-74%
4. 25-49%
5. 0-24%

Is the most current technology being utilized where appropriate, and to what extent? Or, to what level is technology outdated?

1. Latest Technology
2. Relevant Technology
3. Outdated Technology

How often does the City of Baltimore/System experience change (in technology, operational practices, or otherwise) that would require development of process evolution?

1. Frequently
2. Regularly
3. Infrequently

How well prepared would the City of Baltimore/System be to meet future demands? Or, are demands likely to exceed City of Baltimore/System capacity?

Is the City of Baltimore/System flexible; able to accommodate change or unexpected events?

Does the City of Baltimore/System have a management plan for technological or other upgrades?

Are City of Baltimore/System operations incorporated into planning or other documents (e.g. COOP, ESF, etc.)?

Do other agencies, sectors, groups or individuals depend upon the functionality of the City of Baltimore/System?

Constraints

In order to determine limitations to adaptive capacity.

To what extent are the City of Baltimore/System needs currently being met?

1. 75-100%
2. 50-74%
3. 25-49%
4. 0-25%

For how long could the City of Baltimore/System function if stressed by this natural hazard?

1. Month or longer
2. Weeks
3. Days
4. Hours
5. Minutes

Does the City of Baltimore/System currently face operational constraints (e.g. inadequate personnel, public/private assistance, technological access, operational power, etc.)?

Are there additional constraints (e.g. budget, politics, policy, technology, etc.) that prevent upgrading, retrofitting, or replacing key elements of the City of Baltimore/System?

What are the known thresholds of the City of Baltimore/System?

How is the City of Baltimore/System insured against risks of loss or failure? Is there a contingency plan in place? Is there redundancy?

Does the City of Baltimore/System already plan for hazard mitigation and climate adaptation?

Vulnerability Assessment Responses:

Advisory committee members brought various perspectives to the table, but some common concerns were mentioned repeatedly. Including stress placed on operating budgets, a significant disruption to vital communication and transportation systems, and a significant impact on critical assets, such as waste treatment facilties.

Appendix E: Public Process

Town Hall Meetings

April 30, 2013

Number of Attendees: 65

Public Informed:

Over 8,000 mailers were sent out. 6,500 to people who live in the floodplain. 800 to the Community Association Directory. Additionally, emails were sent to the entire city planning list and to city employees

Information Tables:

Flood Manager/ Flood Maps Table (3 tables)

Maryland Emergency Management Agency (MEMA)

Maryland Department of the Environment (MDE)

Department of Natural Resources CCI

National Flood Insurance representative (NFIP)

Disaster Planning and Preparedness Project (DP3)

Office of Emergency Management (OEM)/CERT teams

Baltimore Public Health Department (BCHD)

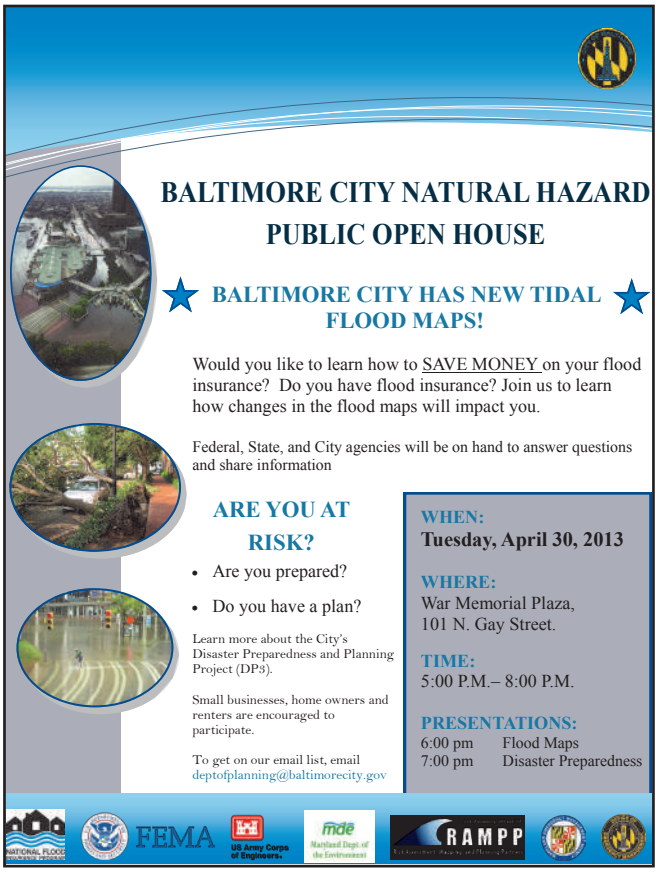
Baltimore Energy Challenge/ Climate Action Plan

Presentations:

FEMA Flood Maps in Baltimore

FEMA Flood Maps update (RAMPP)

Disaster Planning and Preparedness Project (DP3)



Press Release

MEDIA CONTACT:

Alice Kennedy
Sustainability Coordinator
Office of Sustainability
alice.kennedy@baltimorecity.gov
Mobile 410.960.9803
Office 410.396.4556

FOR IMMEDIATE RELEASE

City of Baltimore to host Disaster Preparedness and Planning Project Town Hall Meeting

Office of Sustainability will provide members of the public with an opportunity to provide feedback on the new FEMA Floodplain maps and draft list of goals, strategies and actions drafted by the Disaster Preparedness and Planning Project (DP3) Advisory Committee

Baltimore, MD (Tuesday April 30, 2013) – Today, the City of Baltimore is hosting a town hall event on at the War Memorial Building in downtown Baltimore. This meeting will provide members of the public with an opportunity to provide feedback on the draft list of goals, strategies and actions drafted by the Disaster Preparedness and Planning Project (DP3) Advisory Committee. There will also be presentations about the DP3 project, modeling of predicted worst case scenarios, and how to prepare for disaster events.

What:	Flood Map and Disaster Preparedness and Planning Project Town Hall	
Where:	War Memorial Building, 100 N. Gay Street, First Floor	
Time:	5:30pm-8:00pm	
Presentations:	Flood Map Changes	6:00pm
	Disaster Preparedness and Planning Project	7:00pm

Baltimore is highly vulnerable to many natural hazards, ranging from coastal storms and flooding to extreme heat and high winds. There is strong consensus that these types of extreme events will increase, both in frequency and intensity, over the coming years. Recognizing the City's current vulnerability to the impacts of hazard events, Baltimore has undertaken a thorough, proactive approach to the hazard mitigation planning process.

Baltimore's Disaster Preparedness and Planning Project (DP3) was created by the Department of Planning as an effort to address existing hazards while simultaneously preparing for predicted hazards due to climate change. This project develops a plan and implementation guidelines that integrate hazards mitigation planning, floodplain mapping, and climate adaptation planning.

A full draft list of DP3 goals, strategies and actions can be found at:
http://baltimorehazards.wordpress.com/disaster-preparedness/goals-strategies-and-actions/full-list-of-goals-strategies-and-actions/

For more information visit www.baltimoresustainability.org

# # #

Town Hall Meetings

July 30, 2013

Number of Attendees: 88

Public Informed:

Informational emails and invites were sent to the entire city planning list, the natural hazards list, the floodplain manager list, and to city employees. A press release was also sent out before the meeting date.

Information Tables:

Flood Manager/ Flood Maps Table (3 tables)

Maryland Emergency Management Agency (MEMA)

Maryland Department of the Environment (MDE)

Department of Natural Resources CCI

National Flood Insurance representative (NFIP)

Disaster Planning and Preparedness Project (DP3)

Office of Emergency Management (OEM)/CERT teams

Baltimore Public Health Department (BCHD)

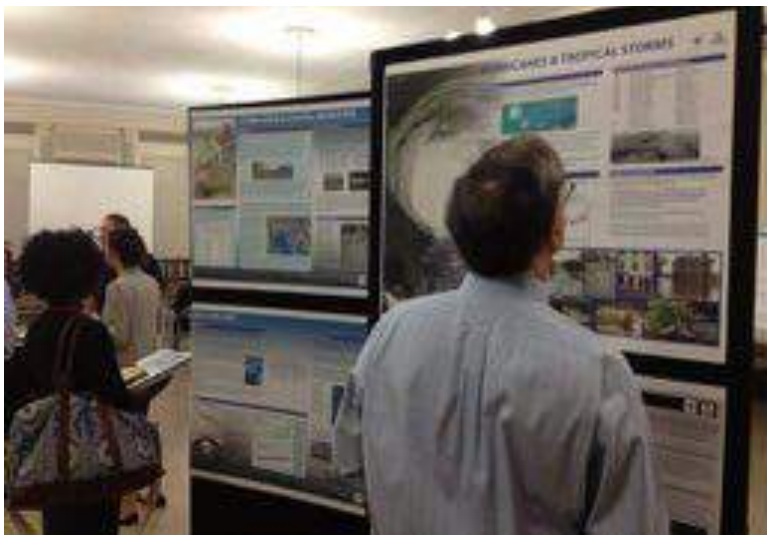
Baltimore Energy Challenge/ Climate Action Plan

Presentations:

Disaster Planning and Preparedness Project (DP3)

FEMA HAZUS Information

MOEM Emergency Preparedness



Press Release

MEDIA CONTACT:

Alice Kennedy
Sustainability Coordinator
Office of Sustainability
alice.kennedy@baltimorecity.gov
Mobile 410.960.9803
Office 410.396.4556

FOR IMMEDIATE RELEASE

City of Baltimore to host Disaster Preparedness and Planning Project Town Hall Meeting

Office of Sustainability will provide members of the public with an opportunity to provide feedback on the draft list of goals, strategies and actions drafted by the Disaster Preparedness and Planning Project (DP3) Advisory Committee

Baltimore, MD (Tuesday July 30, 2013) – Today, the City of Baltimore is hosting a town hall event on at the War Memorial Building in downtown Baltimore. This meeting will provide members of the public with an opportunity to provide feedback on the draft list of goals, strategies and actions drafted by the Disaster Preparedness and Planning Project (DP3) Advisory Committee. There will also be presentations about the DP3 project, modeling of predicted worst case scenarios, and how to prepare for disaster events.

What:	Disaster Preparedness and Planning Project Town Hall	
Where:	War Memorial Building, 100 N. Gay Street, First Floor	
Time:	6:00pm-8:00pm	
Presentations:	Disaster Preparedness and Planning Project	6:30pm
	FEMA Worst Case Scenario Mapping	6:45pm
	Mayor's Office of Emergency Management	7:15pm

Baltimore is highly vulnerable to many natural hazards, ranging from coastal storms and flooding to extreme heat and high winds. There is strong consensus that these types of extreme events will increase, both in frequency and intensity, over the coming years. Recognizing the City's current vulnerability to the impacts of hazard events, Baltimore has undertaken a thorough, proactive approach to the hazard mitigation planning process.

Baltimore's Disaster Preparedness and Planning Project (DP3) was created by the Department of Planning as an effort to address existing hazards while simultaneously preparing for predicted hazards due to climate change. This project develops a plan and implementation guidelines that integrate hazards mitigation planning, floodplain mapping, and climate adaptation planning.

A full draft list of DP3 goals, strategies and actions can be found at:
http://baltimorehazards.wordpress.com/disaster-preparedness/goals-strategies-and-actions/full-list-of-goals-strategies-and-actions/

For more information visit www.baltimoresustainability.org

# # #

Community Vulnerability Survey

Baltimore City
Disaster Preparedness and Planning Survey

1. **Over the past several years, has the weather in your local area been… (Check ONE)**

☐ Much worse than usual
☐ Somewhat worse than usual
☐ About the same
☐ Somewhat better than usual
☐ Much better than usual
☐ Don't know

2. **Have the following types of extreme weather events become more or less common in your community over the past several years, or stayed about the same?**

Please circle your response	Much less common	Somewhat less common	Stayed about the same	Somewhat more common	Much more common	Don't know
Heat waves	1	2	3	4	5	0
Heavy rains	1	2	3	4	5	0
Heavy snows/ ice storms	1	2	3	4	5	0
Tropical storms/ hurricanes	1	2	3	4	5	0
High wind events	1	2	3	4	5	0
Severe Cold	1	2	3	4	5	0
Flooding events	1	2	3	4	5	0

3. **How vulnerable (exposed to the possibility of harm or damage)- if at all- are the people living in your immediate household, including yourself, to the impacts of extreme weather events?**

☐ Not at all vulnerable
☐ Only a little vulnerable
☐ Moderately vulnerable
☐ Very vulnerable
☐ Don't know

4. **Which of the following resources in your community do you think may be harmed by climate change in the next several years?**

☐ Public water supplies
☐ Public sewer systems
☐ People's health
☐ Transportation/roads/bridges
☐ Historical sites
☐ Coastlines
☐ Wetlands
☐ Private wells/septic systems
☐ Privately owned land/buildings
☐ There are no local risks from climate change

5. **What assets do you have in your community to assist in dealing with hazard events?** (add your own)

☐ Generator
☐ _____
☐ _____
☐ Hospital
☐ _____
☐ _____
☐ Strong community group
☐ _____
☐ _____

6. **Do you live in the regulated floodplain?**

☐ Yes ☐ No ☐ Don't know

7. **If you answered yes, are you a business owner or resident?**

☐ Business Owner ☐ Homeowner ☐ Renter ☐ Don't know

Name: _____

Zip code: _____

Flooding ABC's

FLOODING TO DO's

To PREPARE for a flood, you should:

Immediate:

- Build an emergency kit (http://www.ready.gov/build-a-kit) and make a family communications plan (http://www.ready.gov/make-a-plan).

Long Term:

- Elevate the furnace, water heater and electric panel in your home if you live in an area that has a high flood risk.
- Consider installing "check valves" to prevent flood water from backing up into the drains of your home.
- If feasible, construct barriers to stop floodwater from entering the building and seal walls in basements with waterproofing compounds.

In a flood, you should:

Immediate:

- Listen to the radio or television for information.
- Be aware that flash flooding can occur. If there is any possibility of a flash flood, move immediately to higher ground. Do not wait for instructions to move.
- Be aware of stream, drainage channels, and other areas known to flood suddenly. Flash floods can occur with or without typical warnings such as rain clouds or heavy rain.

Long Term: If you must prepare to evacuate or have to leave your home, you should do the following:

- Turn off utilities at the main switches or valves if instructed to do so. Disconnect electrical appliances. Do not touch electrical equipment if you are wet or standing in water.
- Do not walk through moving water. Six inches of moving water can make you fall. If you have to walk in water, walk where the water is not moving. Use a stick to check the firmness of the ground in front of you.
- Do not drive into flooded areas. If floodwaters rise around your car, abandon the car and move to higher ground safely. You and the vehicle can be swept away quickly.
- Do not camp or park your vehicle along streams, rivers, creeks, or waterfront, particularly during threatening conditions.

After a flood:

- Avoid water that is moving quickly.
- Stay away from damaged areas unless your assistance has been specifically requested by police, fire, or relief organization.
- Play it safe. Additional flooding or flash floods can occur. Listen for local warnings and information. If your car stalls in rapidly rising waters, get out immediately and climb to higher ground.
- Stay out of any building if it is surrounded by floodwaters.

Posters Developed for Public Meetings and Education

PRECIPITATION VARIABILITY

Drought

The U.S. Army Corps of Engineers' defines **drought** as "periods of time when natural or managed water systems do not provide enough water to meet established human and environmental uses because of natural shortfalls in precipitation or stream flow". In order to monitor potential drought conditions in a uniform manner across the State, Maryland uses four indicators of water sufficiency. The indicators are based on the amount of precipitation and the effect of the precipitation (or lack of precipitation) in the hydrologic system. These indicators include:

1. Precipitation levels
2. Stream flows
3. Ground water levels
4. Reservoir storage

Indicators are evaluated by comparing current conditions to natural conditions within the period of record. In this way, it can be determined if a current deficit is within a commonly experienced range, or whether it is unusually large. Maryland DNR

Drought History

From 2001-2002 the State of Maryland experienced one of the most severe droughts in the region's history. The water levels in Baltimore's three reservoirs slipped by more than 4 billion gallons -- from 75 percent of capacity to 69 percent. The city even tested the pumps to evaluate moving Susquehanna water to Baltimore.

Baltimore experienced the driest February, amid the fourth-driest winter, since record-keeping began in 1871. The flow of water in Maryland streams fell below record lows set in the 1960s, and in some cases in the 1930s.

Reservoirs

Reservoirs are designed to provide adequate storage when demand exceeds reservoir inflow. As the streamflows are lowest during the summer period and demand is also greatest, the most critical time begins at the onset of summer. Baltimore has three reservoirs that are monitored for the purposes of evaluating drought conditions: Loch Raven Reservoir, Prettyboy Reservoir, and Liberty Reservoir.

Future Concerns

- Drought will significantly affected the Chesapeake Bay ecosystem and the plants and animals that live in and rely on the bay.
- Drought conditions often provide too little water to support food crops which increases food prices and reduces food availability.
- Drought sets the stage for wildfires that may cause injuries or deaths as well as extensive damage to property.

Heavy Rain Storms

Water droplets form from warm air. As the warm air rises in the sky it cools. Warm air holds quite a bit of water. When enough of these droplets collect together, we see them as clouds. If the clouds are big enough and have enough water droplets, the droplets bang together and form even bigger drops. When the drops get heavy, they fall because of gravity, and you see and feel rain.

Among the expected consequences of global warming is an increase in the heaviest rain and snow storms, fueled by increased evaporation and the ability of a warmer atmosphere to hold more moisture. **Extreme downpours are now happening 30 percent more often nationwide than in 1948.** Moreover, the largest annual storms now produce 10 percent more precipitation, on average.

The geographic area from Maryland to Maine has experienced the greatest precipitation change, with **intense rainstorms and snowstorms now happening 85 percent more often than in 1948**. Not only are extreme downpours more frequent, but they are also more intense.

History in Baltimore

Flooding is common in Baltimore and can occur during any part of the year. It is but is most common during late winter and early spring and during the hurricane season from midsummer to early fall. Baltimore has experienced many large flood events.

Source: Frank Raytown

Future Impacts in Baltimore City

According to the U.S. Global Change Research Program, "heavy downpours that are now 1-in-20 year occurrences are projected to occur about every 4 to 15 years by the end of this century," while producing 10 to 25 percent more precipitation per storm.

Increase in heavy downpours is "one of the clearest precipitation trends in the United States" and is linked to global warming.

Nor'Easters

A Nor'easter is a type of storm that forms from a strong low pressure system in the Eastern United States. Cold air from the North, primarily from Canada, will often clash with the warm air masses that form over the ocean and from the Gulf Stream in the coastal areas. While most people associate Nor'easter storms with winter, these storms can actually form any time of the year. Nor'easter storms are also commonly thought to be storms that move in from the Northeast. Instead, strong Northeast winds within the storm are how the storms are named.

A Nor'easter storm forms when a low pressure system meets a high pressure system. The storms often move very slowly causing heavy amounts of precipitation. In the winter, the heavy snowfall and blizzard-like conditions cause icy road conditions, power outages, and other winter weather hazards. Nor'easter storms are also dangerous in coastal areas due to the potential for large wind-driven storm-surge waves and heavy precipitation that can cause flooding.

Hail and Ice Storms

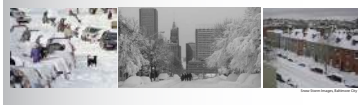
An **ice storm** is a type of winter storm caused by freezing rain. The U.S. National Weather Service defines an ice storm as a storm which results in the accumulation of at least 0.25-inch of ice on exposed surfaces. Ice storms form when a layer of warm air is between two layers of cold air. Frozen precipitation melts while falling into the warm air layer, and then proceeds to refreeze in the cold layer above the ground. This creates freezing rain or a glaze of ice. Warmer air in the winter months increases the possibility of a dangerous ice storms in Baltimore City.

Hail is created when small water droplets are caught in the updraft of a thunderstorm. These water droplets are lifted higher and higher into the sky until they freeze into ice. Once they become heavy, they will start to fall. If the smaller hailstones get caught in the updraft again, they will get more water on them and get lifted higher in the sky and get bigger. Once they get lifted again, they freeze and fall. This happens over and over again until the hailstone is too heavy and then falls to the ground. According to NOAA, hail causes $1 billion dollars in damage to crops and property each year.

Winter Storms

Winter storms derive their energy from the clash of two air masses of different temperatures and moisture levels. Winter storms usually form when an air mass of cold, dry, Canadian air moves south and interacts with a warm, moist air mass moving north from the Gulf of Mexico.

As the Earth gets warmer and more moisture gets absorbed into the atmosphere, we are steadily loading the dice in favor of more extreme storms in all seasons, capable of causing greater impacts on society. Large snowstorms that happened once every 12 months, on average, in the middle of the 20th century now happen every nine months. In fact, in each of the past two winters the northeastern United States has been hammered by three snowstorms that qualified as Category 3 storms or worse on the Northeast Snowfall Impact Scale.



Green Dome Images, Baltimore City

EXTREME WIND EVENTS

Definition

Wind is air in motion. It is produced by the uneven heating of the earth's surface by the sun. Since the earth's surface is made of various land and water formations, it absorbs the sun's radiation unevenly. Two factors are necessary to specify wind: speed and direction.

As the sun warms the Earth's surface, the atmosphere warms too. Some parts of the Earth receive direct rays from the sun all year and are always warm. Other places receive indirect rays, so the climate is colder. Warm air, which weighs less than cold air, rises. Then cool air moves in and replaces the rising warm air. This movement of air is what makes the wind blow.

History in Baltimore

Maryland is at risk for high wind events. Historically, the City has seen deaths, injuries, and property damage from extreme wind events.

Notable Wind (non-hurricane) Events in Baltimore City:

June 2012	Mid-Atlantic and Mid-west Derecho
July 2011	The Cross Country Derecho
November 2010	Northeast Baltimore Tornado (EF1)
July 1996	Central Baltimore Tornado (F0)
November 1994	East Baltimore & Cadmen Yards Tornados (F1)
October 1990	Baltimore City Tornado (F1)
April 1991	The West Virginia Derecho of 1991
November 1989	Mid-Atlantic Low Dewpoint Derecho

Types of Wind Storms

A **windstorm** is a storm with high winds or violent gusts but little or no rain. Baltimore is vulnerable to wind damage because of the large number of trees. Trees bring down power lines, disrupt traffic patterns, and damage property when they fall. Economically, a windstorm's effects are similar to those of a snowstorm. They halt most economic activity for several days. Many people cannot, or choose not, to come to work because they fear long drives or must take care of damage at home. For local governments, debris removal and power restoration can place a strain on budgets.

Tornadoes

Tornadoes are nature's most violent storms. Spawned from powerful thunderstorms, tornadoes can cause fatalities and devastate a neighborhood in seconds. A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long. Tornadoes generally occur near the trailing edge of a thunderstorm.

Scientists are unsure if tornadoes will become stronger or more frequent, but with increased temperatures changing the weather in unexpected ways, the risk is real that tornado outbreaks will become more damaging in the future. The lack of certainty in the state of the science does not equate with a lack of risk, since risk is based on possibility. The lack of scientific consensus is a risk factor itself, and we must prepare for a future that could possibly include increased tornado damage. CBS

Hurricanes

The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. When hurricane storms hit the coast, they can let loose very strong winds, as high as 180 miles per hour. Please visit the Tropical Storms and Hurricanes Poster for more information about hurricanes in Baltimore.

Derechos

A derecho is a widespread, long-lived wind storm that is associated with a band of rapidly moving showers or thunderstorms. Although a derecho can produce destruction similar to that of tornadoes, the damage typically is directed in one direction along a relatively straight swath.

By definition, if the wind damage swath extends more than 240 miles (about 400 kilometers) and includes wind gusts of at least 58 mph (93 km/h) or greater along most of its length, then the event may be classified as a derecho.

Typically, derecho-producing storm systems move at speeds of 50 mph or greater, and a few have been clocked at 70 mph. Such rapid movement means that darkening skies and other visual cues that serve to alert one to the impending danger (e.g., gust front shelf clouds --- see photo right) appear on very short notice. Advance notice given by a derecho often is not sufficient for one to take protective action

The June 2012 derecho was one of the most destructive and deadly fast-moving severe thunderstorm complexes in North American history. Capital Weather Gang

Wind Maps

Designed by data-visualization artists Fernanda Viegas and Martin Wattenberg, this U.S. wind map conveys Hurricane Sandy's East Coast wind patterns.

The first map (right) shows Sandy approaching the coast on **October 29, 2012 at 9:59AM EDT**

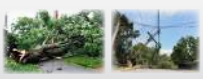
October 30, 2012 at 12:59 AM EDT

The Seaside Park anemometer and National Weather Service recorded a maximum wind gust of 97 miles per hour and sustained wind speeds of 90 miles per hour.

October 30, 2012 at 5:00 PM EDT

National Weather Service wind speeds map (right) shows maximum sustained winds at landfall were estimated at 80 mph, and the broad wind field stretching out hundreds of miles from the center brought damaging wind gust.

Future Predictions



Wind Damage, Baltimore City

- Derechos are most common in warm weather conditions, with more than 75% occurring between April and August. Maryland is expected to experience one derecho every four years (see map left).
- Future hourly/daily wind gust events are projected to increase late this century under a changing climate. Cheng, 2011
- Climate change, through rising temperatures and water vapour levels for example, is changing the odds of extreme events occurring.
- Wind speeds have risen steadily over the past twenty years and are expected to become more extreme. Geophysical Research Letters
- Severe wind events will flatten trees, damage buildings and homes, and generate flying debris.


Hurricane Isabel, 2003

HURRICANES & TROPICAL STORMS

Definitions

A tropical storm is a rotating, organized system of clouds and thunderstorms that originates over tropical or subtropical waters and has a closed low-level circulation. Tropical cyclones rotate counterclockwise in the Northern Hemipsher. They are classified as follows:

Tropical Depression: A tropical storm with maximum sustained winds of 38 mph (33 knots) or less.

Tropical Storm: A tropical cyclone with maximum sustained winds of 39 to 73 mph (34 to 63 knots).

Hurricane: A tropical cyclone with maximum sustained windes of 74 mph (64 knots) or higher.
In the North Pacific, hurricanes are called typhoons; similar storms in other parts of the world are called cyclones.

Major Hurricane: A tropical cyclone with maximum sustained winds of 111mph (96 knots) or higher, corresponding to a Category 3, 4, or 5 on the Saffir-Simpson Hurricane Wind Scale.

Hurricane History in Baltimore

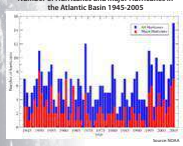
1954	Hurricane Hazel	October 15
1955	Hurricanes Connie and Diane	August 12 and 18
1972	Hurricane Agnes	June 21-23
1979	Hurricane David	September 5-6
1996	Hurricane Fran	September 5
1999	Hurricane Floyd	September 16-17
2003	Hurricane Isabel	September 18
2004	Hurricane Frances	September 8
	Hurricane Ivan	September 17
	Hurricane Jeanne	September 28
2011	Hurricane Irene	August 27-28
	Tropical Storm Lee	September 6-9


Flooding from Hurricane Sandy 2012

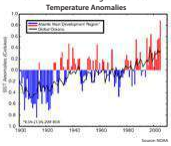
Facts

- Atlantic hurricane seasons since 1995 have been **significantly more active**, e.g. more hurricanes and more intense hurricanes, than the previous two decades. NOAA
- The past decade has seen increased U.S. hurricane landfalls. NOAA

Number of Hurricanes and Major Hurricanes in the Atlantic Basin 1945-2005


Source: NOAA

June-November Average Sea Surface Temperature Anomalies



Source: NOAA

Future Predictions

- A hurricane draws its energy from warm ocean water. The warmer the water, the more powerful hurricanes will be.
- There are recent studies that suggest the warming of the oceans in the Atlantic due to increased **greenhouse gas emissions will provide more fuel to the development and intensification of hurricanes.**
- Warming suggests we can expect more intense hurricanes and persistent active hurricane seasons.
- The average annual number of category 4 and 5 hurricanes, which together cause nearly half of all hurricane damage, has more than doubled since the early 1970's and is likely to continue to increase.

STORM SURGE & COASTAL INUNDATION


Storm Surge from Hurricane Isabel, 2003

Definition

Storm surge is an abnormal rise of water generated by a storm, over and above the predicted astronomical tides. Storm surge should not be confused with storm tide, which is defined as the water level rise due to the combination of storm surge and the astronomical tide. This rise in water level can cause extreme flooding in coastal areas particularly when storm surge coincides with normal high tide, resulting in storm tides reaching up to 20 feet or more in some cases. Storm surge is produced by water being pushed toward the shore by the force of the winds moving cyclonically around the storm. The impact on surge of the low pressure associated with intense storms is minimal in comparison to the water being forced toward the shore by the wind. Storm surges are extremely dangerous because they are capable of flooding large coastal areas, causing severe devastation.


Source: NOAA

Along the coast, storm surge is often the greatest threat to life and property from a hurricane. In the past, large death tolls have resulted from the rise of the ocean associated with many of the major hurricanes that have made landfall. Hurricane Katrina (2005) is a prime example of the damage and devastation that can be caused by surge. At least 1500 persons lost their lives during Katrina and many of those deaths occurred directly, or indirectly, as a result of storm surge.

History in Baltimore

A storm surge driven by winds from a weakening Hurricane Isabel produced the worst Chesapeake Bay flooding in 70 years. Waters up to 8 feet above normal tides surged into lower Fells Point and across Pratt and Light streets into downtown Baltimore. Hundreds of basements and businesses flooded. Hundreds of homes in Bowleys Quarters and elsewhere on the bay shore were badly damaged or destroyed. Property damage reached $410 million in Maryland alone.

Notable Storm Surge Events in the United States:

2012	Hurricane Sandy	NY, NJ	13 foot storm surge
2008	Hurricane Ike	Galveston, TX	15-20 foot storm surge
2005	Hurricane Katrina	New Orleans	25-28 foot storm surge
2005	Hurricane Dennis	Florida	7-9 foot storm surge
2003	***Hurricane Isabel***	***Maryland***	***8 foot storm surge***
1989	Hurricane Hugo	S. Carolina	19.8 foot storm surge


Fells Point, Hurricane Isabel, 2003


Fells Point, Hurricane Isabel, 2003

In Baltimore, Fells Point Historic District is in serious danger from flooding because of rising sea levels. Only 3 percent of Baltimore sits in a coastal floodplain, according to the EPA. But because the historic district and the Inner Harbor are in that area, increased flooding is likely to be quite costly for the city. Baltimore already has flooding problems, and they're likely to be made worse by the rising sea levels coupled with storm surge.

Economic Costs

The total impact of coastal inundation and storm surge depends on the depth of the floodwater and the type and number of assets exposed to flooding. Much of Baltimore's economic productivity and community assets are located along the waterfront.

Economic Costs of the Top 10 Most Expensive Hurricanes from 1980-2011

Hurricane	Billions of Dollars
Katrina (2005)	$145
Andrew (1992)	$43.5
Ike (2008)	$28.4
Wilma (2005)	$18.6
Rita (2005)	$18.6
Charley (2004)	$17.9
Ivan (2004)	$16.7
Hugo (1989)	$12.9
Frances (2004)	$10.7
Jeanne (2004)	$8.3

Coastal Inundation is the flooding of normally dry, low-lying coastal land, primarily caused by severe weather events along the coasts, estuaries, and adjoining rivers. These storms, which include hurricanes and nor'easters, bring strong winds and heavy rains. The winds drive large waves and storm surge on shore, and heavy rains raise rivers.

As destructive as Isabel was, recent computer simulations by government scientists - the most extensive ever for the Chesapeake Bay - show that hurricane storm surges here could get much, much worse.

All low-lying coastal regions, which can cover tens of miles inland, are vulnerable to flooding from storms, and the impact can be substantial.

Much of the densely populated Atlantic coastline lies less than 10 feet above mean sea level, within the reach of strong storm surge events.


Source: Army Corp of Engineers

Inundation events are among the more frequent, costly, and deadly coastal hazards that can impact coastal communities in the U.S. In confined harbors, the combination of storm tides, waves, and currents can severely damage boats, buildings and infrastructure. Salt water intrusion endangers the public health, kills vegetation, and can significantly impact underground infrastructure.

Future Predictions

- New research indicates that **rising sea level from climate change will roughly double the risks of storm-related flooding** in coastal communities in Maryland and nationwide.
- Even small amounts of sea level rise make rare floods more common by adding to tides and storm surge
- Historic local sea level rise rate is1.2 inches/decade. **Conservative sea level rise projections by 2050 is 13 inches or more.**


Flood Surge from Hurricane Isabel, 2003

Posters Developed for Public Meetings and Education

SEA LEVEL RISE

Definition

Sea Level Rise: Over the past century, the burning of fossil fuels and other human and natural activities has released enormous amounts of heat-trapping gases into the atmosphere. These emissions have caused the Earth's surface temperature to rise, and the oceans absorb about 80 percent of this additional heat.

The rise in sea levels is linked to three primary factors, all induced by this ongoing global climate change:

1. When water heats up, it expands. About half of the past century's rise in sea level is attributable to warmer oceans simply occupying more space. This process is called **Thermal expansion**.

2. Large ice formations, like glaciers and the polar ice caps, naturally melt back a bit each summer. Recently, persistently higher temperatures caused by global warming have led to **greater-than-average summer melting** as well as diminished snowfall due to later winters and earlier springs. This imbalance results in sea levels rising.

3. Increased heat is causing the **massive ice sheets** that cover Greenland and Antarctica to **melt at an accelerated pace**. Scientists also believe meltwater from above and seawater from below is seeping beneath Greenland's and West Antarctica's ice sheets, effectively lubricating ice streams and causing them to move more quickly into the sea. Moreover, higher sea temperatures are causing the massive ice shelves that extend out from Antarctica to melt from below, weaken, and break off.

Maryland's coastal areas are experiencing land subsidence (sinking). Sinking land, continued glacier melting, and climate change are causing sea level rise to accelerate. Sea level rise rates in Maryland are nearly twice the global average. Sea levels are expected to rise another 3-5 feet by the year 2100.

Since 1955, approximately 90% of the warming in the "earth system" has occured in the worlds ocean. - Sydney Levitus, NOAA

Consequences

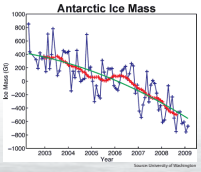
When sea levels rise rapidly, as they have been doing, even a small increase can have devastating effects on coastal habitats. As seawater reaches farther inland, it can cause destructive erosion, flooding of wetlands, contamination of aquifers and agricultural soils, and lost habitat for fish, birds, and plants.

Here in Baltimore, we must prepare for when large storms hit land. Higher sea levels mean bigger, more powerful storm surges that can strip away everything in their path. Thousands of people live in areas that will become increasingly vulnerable to flooding.

Oceans will likely continue to rise as, but predicting the amount is an inexact science. A recent study says we can expect the oceans to rise between 2.5 and 6.5 feet (0.8 and 2 meters) by 2100, enough to inundate many parts of Baltimore. More dire estimates, including a complete meltdown of the Greenland ice sheet, push sea level rise to 23 feet (7 meters), enough to submerge massive portions of the city. - National Geographic

The map to the right is an illustration of the impact of flooding that could occur in Baltimore's Inner Harbor and surrounding neighborhoods with a 10 foot storm surge. This map does not include sea level rise.

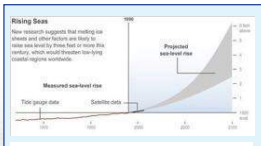
Facts

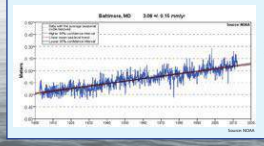


The chart on the left shows the ice mass changes in Antarctica for the period April 2002 to February 2009. The unfiltered data are blue crosses. Data filtered for the seasonal dependence are red crosses. The best-fitting quadratic trend is shown as the green line. - Velicogna 2009

This shows a significant trend. Every year, the rate of ice loss is increasing by 26 Gigatonnes per year.

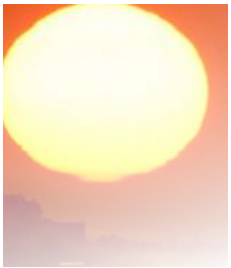
The effects of Arctic amplification will increase as more summer ice retreats over coming decades. Enhanced warming of the Arctic affects the jet stream by slowing its west-to-east winds and by promoting larger north-south meanders in the flow.





Despite uncertainty about the extent of sea level rise, we do know that higher mean sea levels will increase the frequency, magnitude and duration of flooding from storms. The biggest uncertainty is the amount of water that will come from melting glaciers.

The series below are images from a study called *Visualizing Sea Level Rise in Maryland's Chesapeake Bay* was created by Maryland Sea Grant staff and Dr. Michael Kearney of the University of Maryland Department of Geography, who estimated approximate sea level rise and storm surge for Baltimore's Inner Harbor.



EXTREME HEAT

Definitions

Excessive Heat Watches: are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. A Watch is used when the risk of a heat wave has increased but its occurrence and timing is still uncertain. A Watch provides enough lead time so that those who need to prepare can do so.

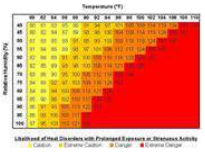
Excessive Heat Warning/Advisories are issued when an excessive heat event is expected in the next 36 hours. These products are issued when an excessive heat event is occurring, is imminent, or has a very high probability of occuring. The Warning is used for conditions posing a threat to life or property. An advisory is for less serious conditions that cause significant discomfort or inconvenience and, if caution is not taken, could lead to a threat to life and/or property.

Heat is the number one weather-related killer in the United States, resulting in hundreds of fatalities each year. In fact, on average, excessive heat claims more lives each year than floods, lightning, tornadoes and hurricanes combined. - NOAA

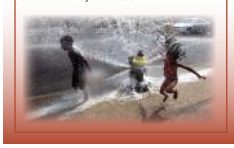
Heat Index

The Heat Index is a measure of how hot it really feels when relative humidity is factored with the actual air temperature.

To find the Heat Index temperature, look at the Heat Index chart below. As an example, if the air temperature is 96°F and the relative humidity is 65%, the heat index--how hot it feels--is 121°F. The Weather Service initiates alert procedures when the Heat Index is expected to exceed 105°-110°F (depending on local climate) for at least 2 consecutive days.



Since heat index values were devised for shady, light wind conditions, exposure to full sunshine can increase heat index values by up to 15°F. also, strong winds, particularly with very hot, dry air, can be extremely hazardous.



Urban Heat Island

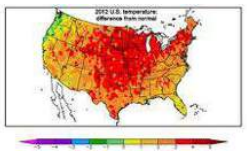
A Urban Heat Island (UHI) is a metropolitan area, which is consistently hotter than the surrounding area due to human activities. The main cause of the urban heat island is modification of the land surface by urban development which uses materials which effectively retain heat.

In general, cities are warmer than rural areas because asphalt, concrete, steel, and bricks absorb sunlight and release heat back into the atmosphere. The relationship between temperature and land cover is shown in this pair of images. The top image shows how developed the landscape around Baltimore is. Areas that are red have a high concentration of cement and asphalt (impervious surfaces), while white areas are primarily covered by plants. - NASA

This bottom image shows the approximate temperature of the land surface (how hot the land would be to the touch) on a summer's day in Baltimore. The highest temperatures are yellow, while cool temperatures are deep purple. Spikes in temperature away from the city occur along the spokes of development radiating out from the city and near the airport. - NASA

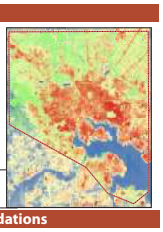
Heat Events in Baltimore

- According to the U.S. "State of the Climate" report released by NOAA's National Climatic Data Center, **2012 was the warmest year on record in the contiguous U.S.** (Lower 48 states), in records dating to 1895.
- Baltimore City had its warmest year on record since 1949
- Extreme heat can be lethal, especially for our most vulnerable citizens.



Future Predictions

- Average air temperatures are projected to increase by about 3°F by mid-century. Average summer temperatures could **increase by as much as 9°F with extended heat waves** later in the century under the higher emissions scenario.
- The number of days with air temperatures exceeding 90°F is **projected to double** (and could even triple) by the end of the century. Under the higher emissions scenario, each year could average more than 24 days of air temperatures exceeding 100°F.



Human Health Impacts and Recommendations

When the body heats too quickly to cool itself safely, or when you lose too much fluid or salt through dehydration or sweating, your body temperature rises and heat-related illness may develop. Heat disorders share one common feature: the individual has been in the heat too long or exercised too much for his or her age and physical condition.

Heat Cramps	Painful spasms of muscles. Heavy Sweating	Firm pressure on muscles, or gentle massage. Give sips of water. If nausea occurs, discontinue.
Heat Exhaustion	Heavy sweating, weakness, skin cold, pale and clammy. Weak pulse. Fainting.	Get victim out of sun. Lay down and losen clothing. Apply wet cloth. Give sips of water. If vomitting continues, seek medical attention.
Heat Stroke	High body temperature (106 F or higher). Hot dry skin. Rapid and strong pulse.	Find emergency medical assistance immediately. Move victim to cooler environment and reduce body temperature with a cool bath. Do not give fluids.

* Drink plenty of water or juice * Avoid alcohol and caffeine * Wipe skin with cool water as needed
* Reduce outside activities * Wear light-weight and light-colored clothing
* Stay inside during the hottest time of day (between 11 a.m. and 4 p.m.) * Seek relief in air-conditioning

AIR QUALITY

Definitions

Air pollution comes from many different sources: stationary sources such as factories, power plants, and smelters and smaller sources such as dry cleaners and degreasing operations; mobile sources such as cars, buses, planes, trucks, and trains; and naturally occurring sources such as windblown dust, and volcanic eruptions, all contribute to air pollution. Air Quality can be affected in many ways by the pollution emitted from these sources. These pollution sources can also emit a wide variety of pollutants.

EPA has concluded that there is compelling evidence that many fundamental measures of climate in the United States (e.g., air temperature) are changing, and many of these changes are linked to the accumulation of greenhouse gases (GHG's) in the atmosphere. GHG emissions from the U.S. have increased by approximately 7 percent since 1990 and global GHG emissions are increasing at an even greater rate. Among other impacts, climate change also contributes to worsening air quality that can endanger public health

Air Quality Index

The Air Quality Index (AQI) is an index for reporting daily air quality. It tells you how clean or polluted your air is, and what associated health effects might be a concern for you. The AQI focuses on health effects you may experience within a few hours or days after breathing polluted air.

EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, EPA has established national air quality standards to protect public health .

The Baltimore-Washington metropolitan region has the nation's second worst traffic and ozone problems. Chesapeake Bay Foundation

Air Quality in Baltimore

Many people live in areas where outdoor ozone, small particles, and toxic pollutants pose serious health concerns. Outdoor air pollution can affect our health over short periods of time and have a cumulative long-term impact. It can also damage vegetation, degrade water quality, and make our skies hazy. The Baltimore air quality index is a median value which considers the most hazardous air pollutants. Baltimore's air quality index is 0.3% greater than the Maryland average and 8.1% greater than the national average. The Baltimore, MD pollution index is the sum of the most hazardous air pollutants displayed in pounds. Baltimore's pollution index is 35.4% greater than the Maryland average and 48.3% greater than the national average.

Baltimore smog is sixth-worst among U.S. cities. USA Today

Air pollution can affect our health in many ways. Numerous scientific studies have linked air pollution to a variety of health problems including:

(1) aggravation of respiratory and cardiovascular disease;
(2) decreased lung function;
(3) increased frequency and severity of respiratory symptoms such as difficulty breathing and coughing;
(4) increased susceptibility to respiratory infections;
(5) effects on the nervous system, including the brain, such as IQ loss and impacts on learning, memory, and behavior;
(6) cancer; and
(7) premature death.

Some sensitive individuals appear to be at greater risk for air pollution-related health effects, for example, those with pre-existing heart and lung diseases (e.g., heart failure/ischemic heart disease, asthma, emphysema, and chronic bronchitis), diabetics, older adults, and children.

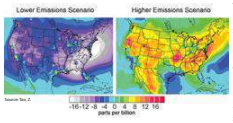
Airshed

An **airshed** is a geographic area where air pollutants from sources "upstream" or within the area flow and are present in the air. Much of our air originates in areas of the Midwest dominated by polluted emissions from powerplants and motor vehicles.

Nearly one-third of the nitrogen entering the Chesapeake Bay arrives through the air, and half of that loading originated as nitrous oxides rising from sources like coal-burning power plants and factories along the Ohio River valley (right) and other urban and industrial sites located far from the Bay. The Bay's airshed covers over 570,000 square miles and extends into 12 states.

Future Predictions

Weather has a major influence on the spreading and surrounding concentrations of air pollutants. Large high-pressure systems often alter the normal temperature profile, trapping pollutants at the Earth's surface. Increased summer temperatures will lead to an increase in air pollution concentrations in cities, including Baltimore. The maps show projected changes in ground-level ozone for the 2090's, averaged over the summer months, relative to 1996-2000, under lower and higher emissions scenarios (both GHG's and emissions).



Indoor Air Quality

The quality of indoor air is important for both comfort and health. Poor indoor air quality has been tied to symptoms like headaches, fatigue, trouble concentrating, and irritation of the eyes, nose, throat and lungs. Some specific diseases have been linked to specific air contaminants, like asthma with damp indoor environments. Poor ventilation (lack of outside air), problems controlling temperature, high or low humidity, and other activities in or near a building can affect indoor air quality.

ADDITIONAL NATURAL HAZARDS

Earthquakes

Most earthquakes occur when great stresses building up within the earth are suddenly released This sudden release of this stored energy causes movement of the earth's crust along fractures, called faults, and generates shock waves. These shock waves, or seismic waves, radiate in all directions from the focus, much as ripples radiate outward in two dimensions when a pebble is dropped into a pond. Although most earthquakes are associated with movement along faults, they can also be triggered by volcanic activity, by large landslides, and by some types of human activity. However, in areas not known for frequent earthquakes, pinpointing the cause of the rare tremor can be very difficult.

Very little is known about the causes of earthquakes in the eastern United States. In general, there is no clear association among seismicity, geologic structure, and surface displacement, in contrast to a common association in the western U.S.

The mid-Atlantic and central Appalachian region, including Maryland, is characterized by a moderate amount of low-level earthquake activity. In Maryland, there are numerous faults, but none is known or suspected to be active. Because of the relatively low seismic energy release, this region has received relatively little attention from earthquake seismologists. Bolinger

History

The earliest recorded earthquake in Maryland occurred in Annapolis, on April 24, 1758. The shock lasted 30 seconds and was preceded by subterranean noises. Additional felt reports were received from a few points in Pennsylvania. Since then, Marylanders have experienced a number moderate-sized earthquakes in nearby states with only minimal effects.

In August, 2011 an earthquake in central Virginia jolted Baltimore and much of the East Coast. Thousands of people felt the quake and small pockets of the city experienced moderate damage.

So many people East Coast crust is "older and colder," which makes it a more efficient transmitter of seismic energy. The Virginia quake also struck at a depth of just 6 kilometers. That's unusual as most strong quakes occur deeper in the Earth's crust. The depth of a quake has a direct relationship with how intense humans at the surface perceive its shaking to be.

Future Concerns

Data from the 2011 Virginia earthquake shows East Coast tremors can travel much farther and cause damage over larger areas than previously thought.
Based on current science and studies, Maryland has a very low chance of experiencing a damaging earthquake in a 50-year period. However, we should continue to plan ahead and be prepared for the chance of another earthquake impacting the area in the future.

Climate-Sensitive Diseases

Changes in climate may enhance the spread of some diseases. Disease-causing agents, called pathogens, can be transmitted through food, water, and animals such as deer, birds, mice, and insects. Climate change could affect all of these transmitters.

Food-borne diseases

• Higher air temperatures can increase cases of salmonella and other bacteria-related food poisoning because bacteria grow more rapidly in warm environments. These diseases can cause gastrointestinal distress and, in severe cases, death.

• Flooding and heavy rainfall can cause overflows from sewage treatment plants into fresh water sources. Overflows could contaminate certain food crops with pathogen-containing feces.

Water-borne Diseases

• Heavy rainfall or flooding can increase water-borne parasites such as Cryptosporidium and Giardia that are sometimes found in drinking water. These parasites can cause gastrointestinal distress and in severe cases, death.

• Heavy rainfall events cause stormwater runoff that may contaminate water bodies used for recreation (such as lakes and beaches) with other bacteria. The most common illness contracted from contamination at beaches is gastroenteritis, an inflammation of the stomach and the intestines that can cause symptoms such as vomiting, headaches, and fever. Other minor illnesses include ear, eye, nose, and throat infections.

Animal-borne Diseases

• The geographic range of ticks that carry Lyme disease is limited by temperature. As air temperatures rise, the range of these ticks is likely to continue to expand northward. Typical symptoms of Lyme disease include fever, headache, fatigue, and a characteristic skin rash.

• In 2002, a new strain of West Nile virus, which can cause serious, life-altering disease, emerged in the United States. Higher temperatures are favorable to the survival of this new strain.

Lightning

Lightning is a bright flash of electricity produced by a thunderstorm. All thunderstorms produce lightning and are very dangerous. If you hear the sound of thunder, then you are in danger from lightning. Lightning kills and injures more people each year than hurricanes or tornadoes; between 75 to 100 people. Lightning is an electric current. Within a thundercloud, many small bits of ice bump into each other as they move around in the air. All of those collisions create an electric charge. After a while, the whole cloud fills up with electrical charges. The positive charges or protons form at the top of the cloud and the negative charges or electrons form at the bottom of the cloud. That causes a positive charge to build up on the ground beneath the cloud. The grounds electrical charge concentrates around anything that sticks up, such as mountains, people, or single trees. The charge coming up from these points eventually connects with a charge reaching down from the clouds and - lightning strikes!

Flooding

Flooding is a very common weather event that has caused some of Maryland's worst disasters. From 1995-1996, Maryland had a number of major floods that resulted in two disaster declarations.

Rainfall

Heavy rainfall can lead to flash flood events. These tend to come after short periods of heavy rain and most often affect small streams and creeks. General flooding comes from more prolonged steady rain and tends to affect larger streams and rivers. Intense rainfall will likely grow significantly heavier in most of the United States by the final decades of the century.

Riverine

Riverine flooding is another way to say river floods. When a river reaches its floodstage, water can rise and spill over the banks of the river. The amount of flooding is usually a function of the amount of precipitation in an area, the amount of time it takes for rainfall to accumulate, previous saturation of local soils, and the terrain around the river system. With large rivers the process is relatively slow. The rain water enters the river in many ways. Some rain will fall into the river directly, but that alone doesn't make the river rise high. A lot of rain water will run off the surface when the soil is saturated or hard.

Coastal

Coastal flooding is commonly caused by a combination of tidal surges caused by winds and low barometric pressure, and they may be exacerbated by high upstream river flow. Coastal areas may be flooded by tropical storm events or hurricanes. A storm surge, from either a tropical storm, falls within this category and can cause devastating flooding. (See Storm Surge poster for more information)

Infrastructure Failures

Old infrastructure is a major problem in Baltimore. During the seasonal changes, the ground shifts and the water mains break. The City still has pipes that are over 100-years-old.

The failure of a dam or a levee can also cause catastrophic flooding in several ways: structural failures due to problems with construction, rainfall or flood waters that exceed their capacity or natural disasters that cause damage.

Our water infrastructure has been crumbling beneath our feet and cannot be ignored," - DPW worker

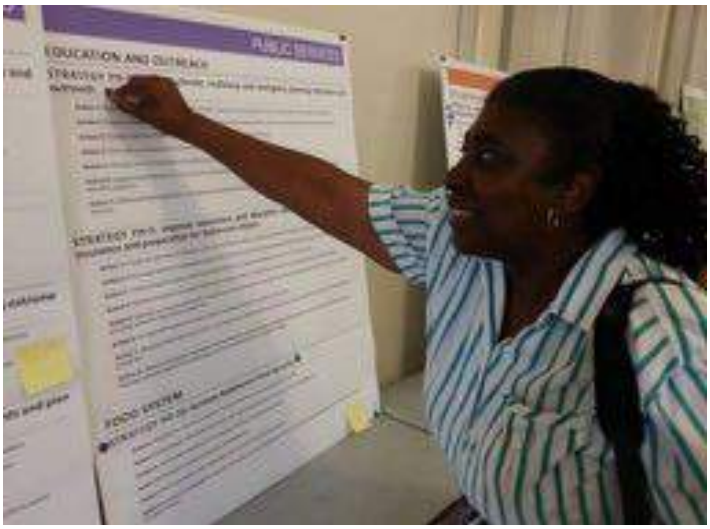
Snow Storm Images, Baltimore City

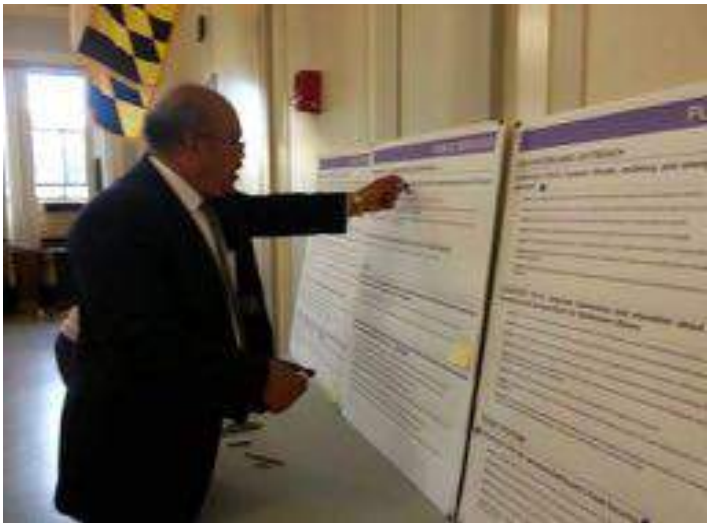
Interactive Feedback at Public Meetings

Voting Exercises

During the July 30th Town Hall, attendees were asked to participate in two voting exercises. First, as community members arrived, they were provided with six blue sticker dots. Attendees had been asked to place the stickers next to strategies they felt were most important. The DP3 strategies were displayed on a series of poster boards, shown in the photos below and in the samples at the right. Attendees were given the length of the event to contemplate their preferences and to indicate such through this exercises.

A total of nine strategies received ten or more stickers; four from infrastructure, two from natural systems, two from public services, and one from buildings. In general, the attendees were concerned with strengthening the resiliency of systems upon which residents depend on a daily basis.





INFRASTRUCTURE

ENERGY

STRATEGY IN-1: Protect and enhance the resiliency and redundancy of electricity system

Action 1: Work with the Maryland Public Service Commission (PSC) to minimize power outages from the local utility during extreme weather events by identifying and protecting critical energy facilities located within the City

Action 2: Evaluate the City of Baltimore utility distribution system, and identify "underground utility districts" using BGE's May 2013 short term reliability improvement plan

Action 3: Support BGE's collaboration with the Maryland Public Service Commission to implement various smart grid solutions that will provide the City with real-time access to data during events

Action 4: Identify, harden and water seal critical infrastructure relative to electrical, heating, and ventilation hardware within the flood plain

Action 5: Increase resiliency in our energy generation system by encouraging the development of decentralized power generation and developing fuel flexibility capabilities

Action 6: Develop a comprehensive maintenance and training program for City employees at facilities with backup generators to ensure proper placement, hook-up and ability to use during hazard events

Action 7: Install external generator hookups for critical City facilities that depend on mobile generators for backup power

Action 8: Partner with the Public Service Commission and the local electric utility to evaluate protecting power and utility lines from all hazards

Action 9: Determine low-laying substation vulnerability and outline options for adaptation and mitigation

Action 10: Evaluate and protect low laying infrastructure – switching vaults, conduit and transformers

STRATEGY IN-2: Increase energy conservation efforts

Action 1: Increase energy efficiency across all public and private sectors through education, efficiency retrofits, and building management systems

Action 2: Encourage critical facilities and institutions to connect to existing cogeneration systems, or develop new cogeneration systems

Action 3: Continue the City's electricity demand-response program during peak usage or pre-blackout periods

STRATEGY IN-3: Ensure backup power generation for critical facilities and identified key infrastructure during power outages

Action 1: Investigate off-grid, on-site renewable energy systems, generators, and technologies for critical facilities to ensure redundancy of energy systems

Action 2: Seek funding to purchase and install generators for all city building designated as critical to agency functions

Action 3: Develop Combined Heat and Power (CHP) co-generation plants at identified critical facilities

Action 4: Evaluate and ensure backup power generation is available to healthcare facilities (nursing homes, critical care facilities, hospitals, etc.)

LIQUID FUELS

STRATEGY IN-4: Protect and manage liquefied natural gas sites and (City) fueling stations before and during hazard events

Action 1: Work with BGE to ensure existing preparedness plans for Spring Gardens liquefied natural gas site incorporate its vulnerability to present and predicted flooding, storm surge and sea level rise

Action 2: Adopt building code that requires anchoring of 50 gallon storage tanks or larger

Action 3: Work with BEG to monitor efforts to protect the natural gas system against flooding

BUILDINGS

CITY CODES & DESIGN GUIDELINES

STRATEGY B-1: Develop and implement hazard resilience measures for critical facilities including hospitals, fire stations, police stations, hazardous material storage sites, etc.

Action 1: Require all hazardous materials within the floodplain to be elevated a minimum of three feet above the Base Flood Elevation (BFE)

Action 2: Require new critical facilities to be designed with redundant operating systems

Action 3: Require pre-wiring for generators at all facilities designated critical to agency operations and hazard response

Action 4: Develop stricter resiliency measures or flood mitigation practices for critical facilities

Action 5: Develop partnership with private fueling stations to provide backup generators in exchange for a commitment to fueling emergency response vehicles during a hazard event

Action 6: Ensure storage of and access to diesel fuel for generators in critical facilities

Action 7: Require backup solar powered street lights and signals are integrated along evacuation routes and high traffic areas

STRATEGY B-2: Enhance building codes that regulate building within a floodplain or near the waterfront

Action 1: Design projects to be resilient to a mid-century sea level rise projection and adaptable to longer-term impacts

Action 2: Incorporate climate change and coastal hazard considerations into building codes by increasing freeboard requirements to two feet as buildings are redeveloped and renovated

Action 3: Continue to regulate to the existing tidal floodplain delineation

Action 4: Incorporate outfall elevation regulations into buildings and natural resource codes

Action 5: Develop Construction Best Practices for development within floodplains

Action 6: Train all code enforcement and building inspectors about flood proofing techniques and the local floodplain ordinance

STRATEGY B-3: Strengthen city codes to integrate anticipated changes in climate

Action 1: Review zoning code (floodplain, drainage, stormwater management, erosion control) and strengthen code (where necessary) in order to better protect citizens and increase resiliency in buildings

Action 2: Review and amend existing codes to require more flood structures in the floodplain

Action 3: Reduce development in 100-year flood plain

Action 4: Utilize open space category in zoning code to protect sensitive areas (e.g. stormwater sites, steep slopes, floodways, etc.)

Action 5: Review and increase Base Floodplain Elevation (BFE) standards to the highest available State, Federal or local elevation level

Action 6: Evaluate and update stormwater management regulations to avoid increases in downstream flooding

Action 7: Adopt design requirements that include wet and dry flood proofing techniques

Action 8: Review and consider adoption of the International Green Construction code

Action 9: Strengthen city codes to help reduce urban heat island impacts

STRATEGY B-4: Update a list of flood prone and repetitive loss buildings to consider for acquisition

Action 1: Continue to acquire property (including repetitive loss properties) in the special flood hazard areas where feasible and appropriate

Action 2: Prioritize Hazard Mitigation Assistance funding for mitigation of repetitive loss properties and severe repetitive loss properties

Action 3: Develop a creative financing program to increase the flood resiliency of industrial buildings

NATURAL SYSTEMS

URBAN PARKS AND FOREST

STRATEGY NS-1: Utilize green corridors and parks to help protect surrounding communities from the impacts of hazard events

Action 1: Evaluate green corridors and parks for possible improvements for flood management and air quality improvement

Action 2: Increase the resiliency of park facilities and buildings

STRATEGY NS-2: Increase and enhance the resilience and health of Baltimore's urban forest

Action 1: Anticipate future changes in temperature and weather by developing a comprehensive list of plant and tree species or varieties known to have a broad range of environmental tolerances

Action 2: Establish and routinely update a comprehensive tree inventory to anticipate insect and forest structural impacts of climate change

Action 3: Establish a comprehensive maintenance program that includes pruning for sound structure and the removal of hazardous limbs and trees. First focus on vulnerable infrastructure nearby such as essential facilities and roads

Action 4: Continually adjust and modify planting details and specifications to assure the health and longevity of trees

Action 5: Increase the urban tree canopy and target areas with urban heat island impacts

Action 6: Proactively communicate and collaborate with the City of Baltimore on the removal of trees around electric distribution lines to minimize power outages

STRATEGY NS-3: Create an interconnected network of green spaces to support biodiversity and watershed based water quality management

Action 1: Support the Growing Green Initiative to increase green space and pervious services in areas where there is significant abandonment and opportunities to reduce the urban heat island effect

Action 2: Convert vacant and distressed row house lands into meaningful and connected space (parkland)

Action 3: Complete a watershed based habitat analysis for the City

Action 4: Create a strategic plan that identifies areas of focus for tree planting, stormwater management, and forest preservation

Action 5: Certify Baltimore as a Community Wildlife Habitat through the National Wildlife Foundation (NWF)

STRATEGY NS-4: Expand, protect and restore riparian areas in the city

Action 1: Conduct regular maintenance of stream restoration projects and stormwater quality facilities

Action 2: Require riparian buffers with all new development and capital projects

Action 3: Evaluate current regulations regarding stream buffers and floodplains and modify them (if appropriate)

STRATEGY NS-5: Preserve and create new ecological buffer efforts and support creating more (e.g. wetlands) along coastal areas

Action 1: Integrate natural buffer requirements, such as wetlands and soft shorelines, into new development or redevelopment

Action 2: Complete stream restoration projects in Baltimore City and County stream valleys that lead into the coastal wetlands so as to increase habitat and reduce sedimentation

Action 3: Identify and evaluate areas in the Critical Area buffer to prioritize ecological buffer restoration efforts and areas that could be enhanced to serve as natural storm surge barriers

PUBLIC SERVICES

EMERGENCY PREPAREDNESS & RESPONSE

STRATEGY PH-1: Strengthen emergency preparedness coordination between local government, NGOs, and private entities by updates to the City Emergency Operations Plan (EOP) and related Emergency Support Functions (ESF)

Action1: Identify and develop a common database that all city government agencies and departments should utilize for hazard information, preparedness and response

Action 2: Ensure consistency and integration with existing and future response plans within and between agencies

Action 3: Continue to identify and improve coordination with Key Partners including private sector, State partners, Federal partners, community, universities and industry leaders through Local Emergency Planning Committee

Action 4: Coordinate outreach efforts of the Mayor's Office of Emergency Management, Mayor's Office of Neighborhood and Constituent Services, Baltimore City Health Department and Maryland Emergency Management Agency (MEMA) to leverage messages related to all-hazards emergency preparedness

Action 5: Develop strong working relationships with local experts to provide technical assistance to refine and improve city government emergency preparations

Action 6: Review and improve specific response plans contained in the EOP and related ESFs that relate to extreme weather events (snow, heat, flood, wind, electrical outages, and other hazard events)

Action 7: Ensure equipment purchases and communication systems are compatible across agencies and jurisdictions

Action 8: Encourage all animal rescue and care shelters to further develop their internal plans for animal's health and safety during and after a hazard event

Action 9: Ensure all animal rescue and care shelters located within the floodplain are provided the support to apply for and obtain funds to relocate

Action 10: Develop and implement a case study of hospital-based practices that foster community resilience to climate change

STRATEGY PH-2: Develop a Hazard Awareness Program

Action 1: Create a standardized early warning system for citizens, as well as visitors

Action 2: Evaluate and improve community health center strategies for communicating with patients during an emergency

Action 3: Educate citizens about the early warning system and actions to take when enacted

Action 4: Prepare and integrate occupational health and safety message and instructions for first responders

Action 5: Hold climate specific seminars for hospital emergency and sustainability managers

STRATEGY PH-3: Designate community leaders and organizations that can assist and provide support during hazard events

Action 1: Prior to a hazard event, identify lead contacts serving vulnerable populations and coordinate actions to maximize safety and information sharing

Action 2: Develop a community group coordination plan and implementation guide

Action 3: Identify and evaluate plans already in place and work to improve utilization of community based leaders to assist in preparedness and response

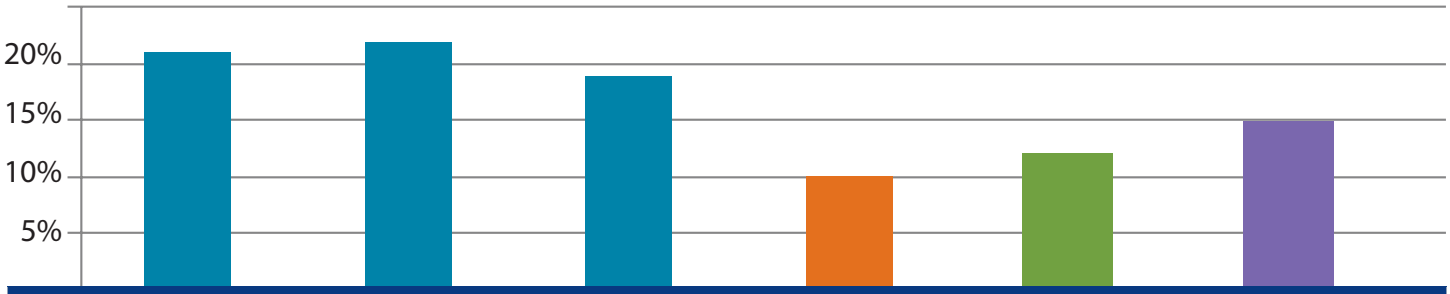
Interactive Feedback at Public Meetings

Budgeting Exercise

Upon their arrival at the Town Hall event, attendees were also given $500 in "DP3 Dollars." Participants were asked: "With a limited budget, where do you suggest the City spend money to create a more resilient Baltimore?" Each participant placed their DP3 money in the box or boxes to indicate which key strategies in which they wished the City to invest.

Their options included stormwater infrastructure, resilient energy systems, transportation infrastructure, human health programs, trees and greening, and building codes.

The funds were distributed relatively evenly; in total, 22 percent of the money had been "invested" in stormwater infrastructure, with 21 percent going towards resilient energy systems. The remaining money was allocated, in order of importance, to transportation infrastructure (19 percent), human health programs (15 percent), trees and greening (12 percent), and building codes (10 percent).



You decide

With a limited budget, where do you suggest the City spend money to create a more resilient Baltimore?

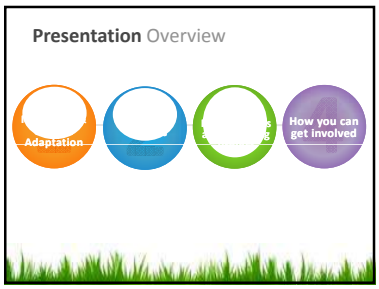
Please place the monopoly money in the box or boxes to show where you would like the City to focus its efforts.
Each participant has a limited budget to allocate to strategies in any way he/she desires (e.g. all of the money can be allocated to one strategy or divided across multiple strategies).

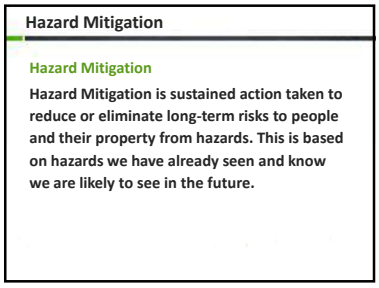
A	B	C	D	E	F
Resilient Energy System	Stormwater Infrastructure	Transportation Infrastructure	Building Codes	Trees and Greening	Human Health Programs

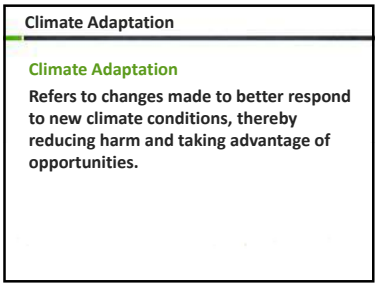

A
B
C
D
E
F

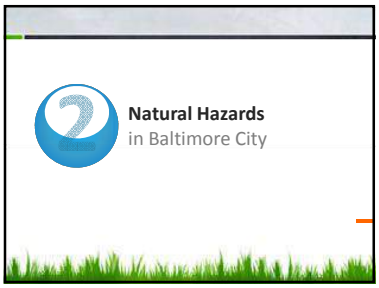
Town Hall Presentations

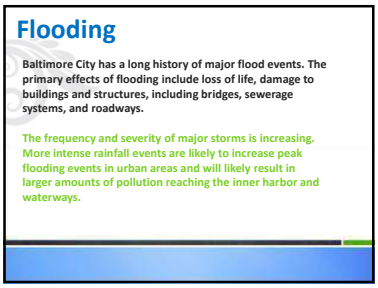
April 30, 2013











Rainfall related Flooding

Flat or low-lying areas where the ground is saturated and water either cannot runoff or cannot runoff quickly enough to stop accumulating.

Baltimore Sun July 19, 2012

"Back-to-back thunderstorms dumped a torrent of rain on Baltimore City. Parts of the region saw close to 2 ½ inches of rain between 6:30 p.m. and 7:30 p.m., a National Weather Service spokesman said. Substantial flooding in Fells Point closed multiple streets, forcing cars to stop. The intersection of Caroline and Aliceanna streets was submerged, as were sections of Lancaster Street."

"Water poured over ambulance ramps outside Hopkins Hospital's emergency room, seeping into the building before firefighters could respond to clear drains. Gary Stephenson, a hospital spokesman, said the flooding briefly interrupted normal operations."

Riverine Flooding

Increase flow of water due to sustained rainfall, rapid snow melt, or extreme storm events will cause rivers to overflow. Localized flooding may be exacerbated by drainage obstructions such as debris.

Coastal Flooding

Coastal flooding is the flooding of normally dry, low-lying coastal land, primarily caused by severe weather events along the coast, estuaries, and adjoining rivers. These floods events are some of the more frequent, costly, and deadly hazards that can impact coastal communities.

Flooding from Infrastructure Failures

"Our water infrastructure has been crumbling beneath our feet and cannot be ignored. During the seasonal changes, the ground shifts and the water mains break either in the winter or the spring when the temperature changes,"

Baltimore DPW worker

TROPICAL STORMS & SEA LEVEL RISE

Tropical Storms and SLR

Since the late 1800s, tide gauges have show that global sea level rise has risen about 8 inches. This rate of sea level rise is faster than at any time in the past 200 years.

More powerful rain and wind storms will strike Maryland as ocean waters warm. These will be accompanied by higher storm surges and rainfall.

Tropical Storms

There has been a substantial increase in hurricane activity in the Atlantic since the 1970's.

Recent Tropical Storms/Hurricanes in Baltimore:

2011 Tropical Storm Lee
2011 Hurricane Irene
2006 Tropical Storm Ernesto
2003 Hurricane Isabel

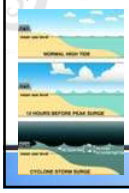
Sea Level Rise

Projected impact of ten foot sea level rise

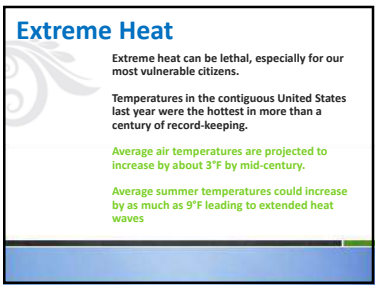
- The rate of sea-level rise is increasing
- After at least two thousand years of little change, sea level rose by roughly eight inches over the last century.
- The rate of rise over the past 20 years has roughly doubled

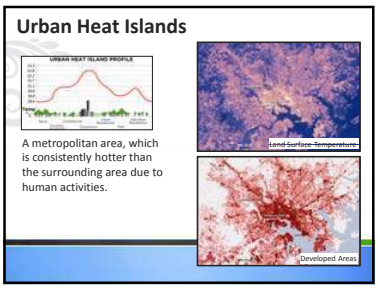
Storm Surge

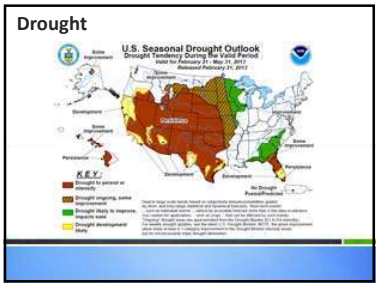
Rise of water associated with a storm, plus tide, wave run-up, and freshwater flooding.

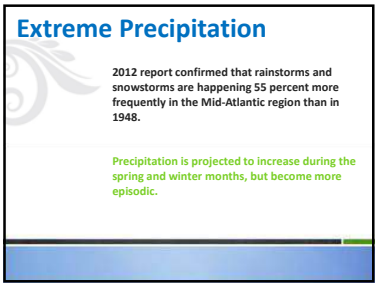


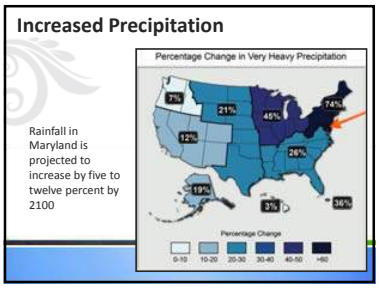
Town Hall Presentations, Continued

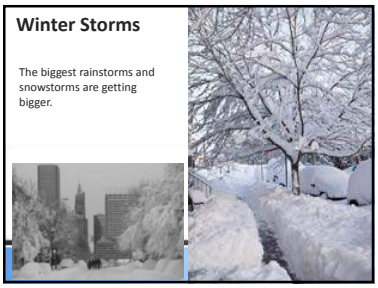


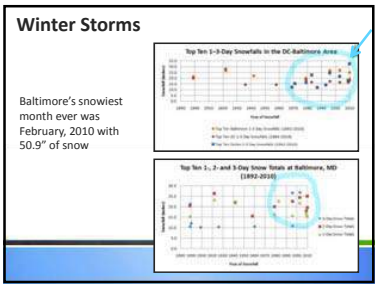








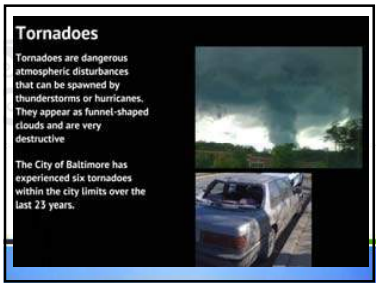


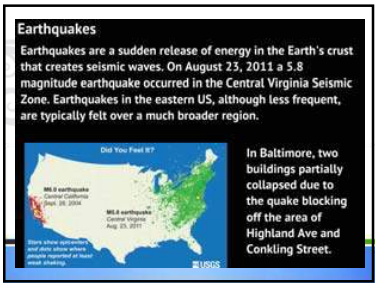



OTHER HAZARDS


Other Natural Hazards in Baltimore

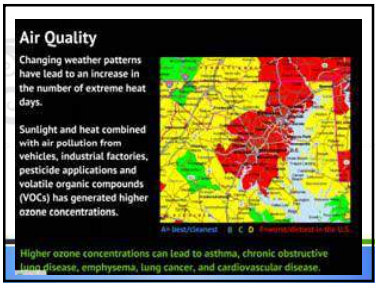

Extreme Wind Storms and Derechos
The June 2012 derecho was one of the most destructive and deadly fast-moving severe thunderstorm complexes in North American history.

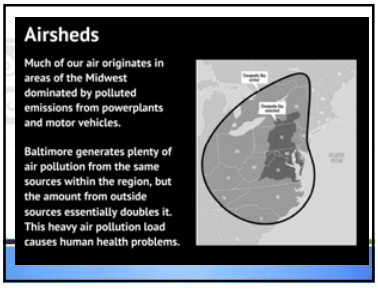

Tornadoes
Tornadoes are dangerous atmospheric disturbances that can be spawned by thunderstorms or hurricanes. They appear as funnel-shaped clouds and are very destructive
The City of Baltimore has experienced six tornadoes within the city limits over the last 23 years.


Earthquakes
Earthquakes are a sudden release of energy in the Earth's crust that creates seismic waves. On August 23, 2011 a 5.8 magnitude earthquake occurred in the Central Virginia Seismic Zone. Earthquakes in the eastern US, although less frequent, are typically felt over a much broader region.
In Baltimore, two buildings partially collapsed due to the quake blocking off the area of Highland Ave and Conkling Street.

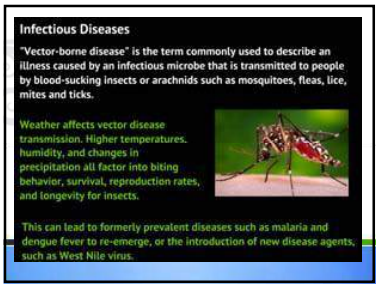

"After the blizzard of the century and the tornado and the floods, I don't think we should be surprised."
Mayor Stephanie Rawlings-Blake referring to the 2011 earthquake

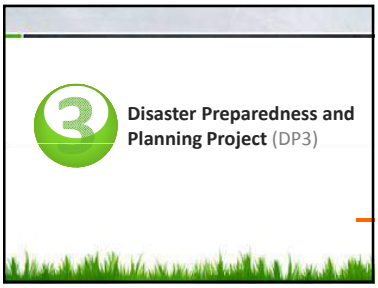

Lightning and Hail
Other dangers associated with increased storms are lightning and hail. Lightning occurs in all thunderstorms. A typical thunderstorm has three or more strikes per minute at its peak.
With increased number of extreme storm events will come increased risk from lightning strikes.
Lightning events may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, and fires.
Hail is possible within most thunderstorms. It can cause serious damage to automobiles, aircraft, structures, livestock, and crops.

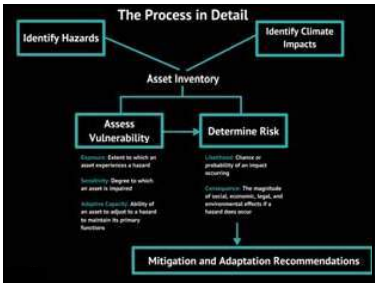

Air Quality
Changing weather patterns have lead to an increase in the number of extreme heat days.
Sunlight and heat combined with air pollution from vehicles, industrial factories, pesticide applications and volatile organic compounds (VOCs) has generated higher ozone concentrations.
Higher ozone concentrations can lead to asthma, chronic obstructive lung disease, emphysema, lung cancer, and cardiovascular disease.

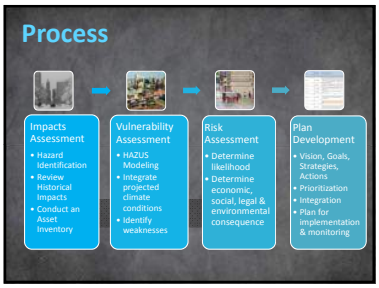

Airsheds
Much of our air originates in areas of the Midwest dominated by polluted emissions from powerplants and motor vehicles.
Baltimore generates plenty of air pollution from the same sources within the region, but the amount from outside sources essentially doubles it. This heavy air pollution load causes human health problems.

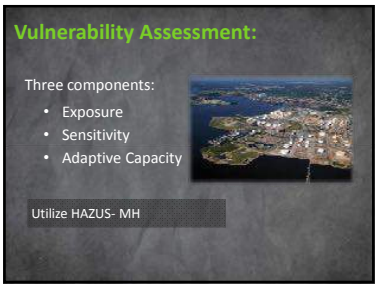
Town Hall Presentations, Continued












Risk Assessment
• Determine chance or probability of an impact occurring
• Determine the consequence of the impact occurring.


Advisory Committee:
• Key stakeholders
• 11 City Agencies, 11 community representatives, 4 State Agencies, NGO's, Private sector, and Federal government.
• Meet four times as a full committee and six times in subcommittees

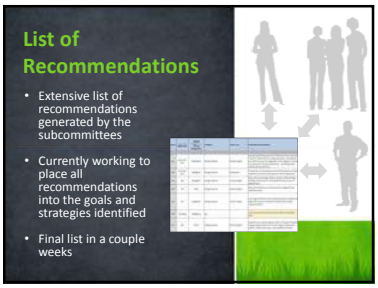

Subcommittees
• Infrastructure
• Buildings
• Natural Systems
• Public Health and Human Services

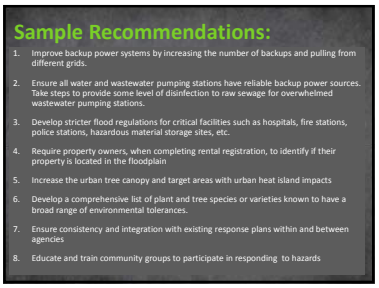

Infrastructure:
• Energy Systems
– Power supply, Substations
• Transportation Systems
– Highways and Roads, Bridges, Tunnels, Public Transportation
• Communication Systems
– Technology, Redundancy
• Water and Wastewater Systems
– Drinking Water, Water Supply, Sewers, Pumping Stations
• Stormwater Systems
– Flooding and Erosion, Maintenance
• Solid Waste System


Buildings:
• City Codes
– Building Codes, Zoning Codes
– Insurance
• Non-Structural
– Improve Efficiency
• Structural
– Retrofits and Upgrades, Flood proofing, Critical Facilities
• Design
– Design Guidelines

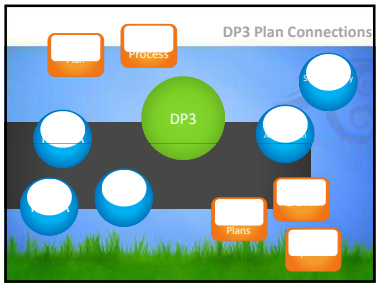

Natural Systems:
• Land Use
– Land Acquisition, Land Preservation
• Greening
– Tree Canopy, Landscape, Policy, Vacant Lots
• Maintenance and Operations
– Trees and Vegetation, Debris, Ecological Buffers
• Water Supply
– Drinking Water Quality and Supply, Drought Preparedness
• Stormwater Management

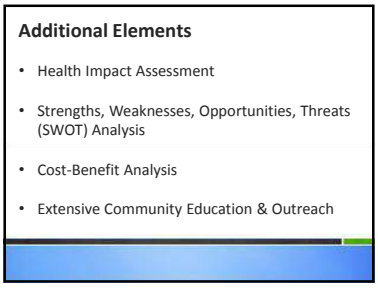

Public Health and Human Services:
• Organized by Hazard instead of Category
– All Hazards, Heat, Flooding, Extreme Storms, Sea Level, Air Quality
• Identified whether actions were Mitigation Measures, Preparedness, Response, Recovery and/or Policy
• Began process of identifying Education/Outreach Measures and Communication Measures associated with each action/recommendation.

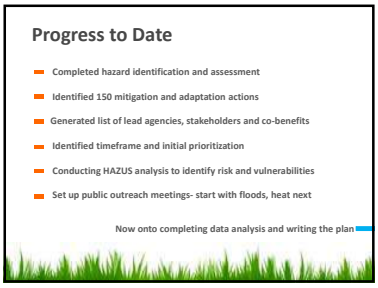

List of Recommendations
• Extensive list of recommendations generated by the subcommittees
• Currently working to place all recommendations into the goals and strategies identified
• Final list in a couple weeks

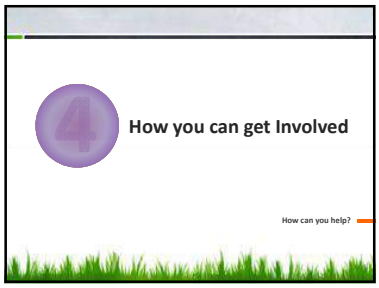

Sample Recommendations:
1. Improve backup power systems by increasing the number of backups and pulling from different grids.
2. Ensure all water and wastewater pumping stations have reliable backup power sources. Take steps to provide some level of disinfection to raw sewage for overwhelmed wastewater pumping stations.
3. Develop stricter flood regulations for critical facilities such as hospitals, fire stations, police stations, hazardous material storage sites, etc.
4. Require property owners, when completing rental registration, to identify if their property is located in the floodplain
5. Increase the urban tree canopy and target areas with urban heat island impacts
6. Develop a comprehensive list of plant and tree species or varieties known to have a broad range of environmental tolerances.
7. Ensure consistency and integration with existing response plans within and between agencies
8. Educate and train community groups to participate in responding to hazards

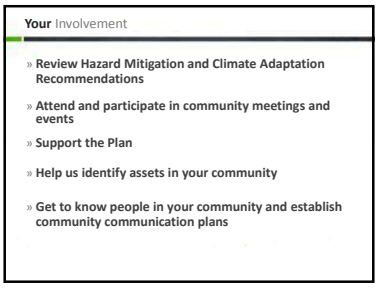
Town Hall Presentations, Continued





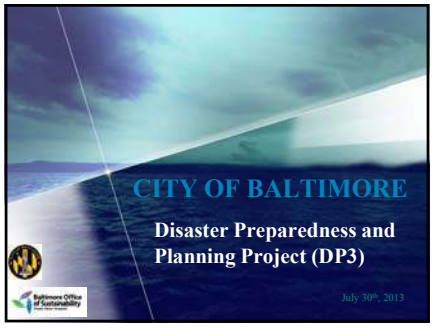






Town Hall Presentations

July 30, 2013



Hazard Mitigation

Hazard Mitigation

Hazard Mitigation is sustained action taken to reduce or eliminate long-term risks to people and their property from hazards. This is based on hazards we have already seen and know we are likely to see in the future.

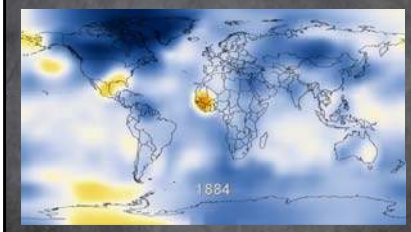
Climate Adaptation

Climate Adaptation

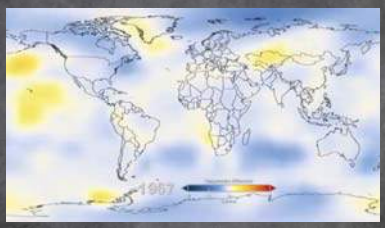
Refers to changes made to better respond to new climate conditions, thereby reducing harm and taking advantage of opportunities.

Why are we integrating these two plans?

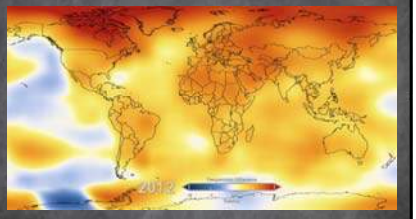
Global Surface Temperatures 1884



Global Surface Temperatures 1967



Global Surface Temperatures 2012



Preparedness
(Hazard Mitigation)
+
Planning
(Climate Adaptation)
= **Resilience**

Flooding

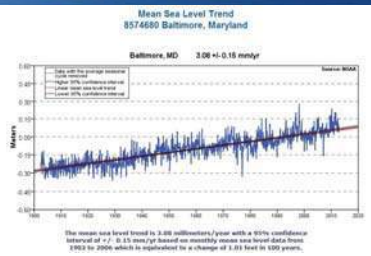
Tropical Storms

There has been a substantial increase in hurricane activity in the Atlantic since the 1970's.

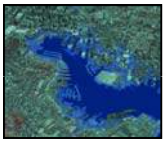
Recent Tropical Storms/Hurricanes in Baltimore:

2011 Tropical Storm Lee
2011 Hurricane Irene
2006 Tropical Storm Ernesto
2003 Hurricane Isabel

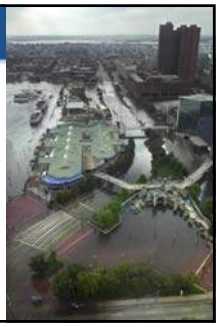
Sea Level Rise



Storm Surge



Storm surge with sea level rise



Storm Surge from Isabel, 2003

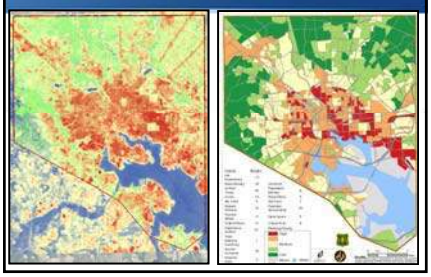
Extreme Heat

Temperatures in the contiguous United States last year were the hottest in more than a century of record-keeping.

Urban Heat Islands

A metropolitan area, which is consistently hotter than the surrounding area due to human activities.

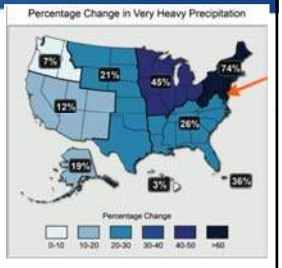
Urban Heat Island in Baltimore



Precipitation Variability

Rainfall in Maryland is projected to increase by five to twelve percent by 2100

Precipitation is projected to increase during the spring and winter months, but become more episodic.



Winter Storms

The biggest rainstorms and snowstorms are getting bigger.

July 30, 2013 Continued...

Winter Storms

Baltimore's snowiest month ever was February, 2010 with 50.9" of snow

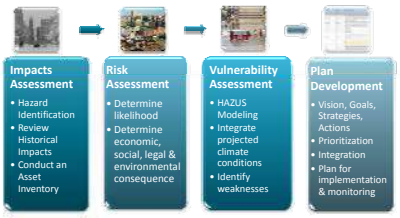
Drought

Other Natural Hazards in Baltimore

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

Process

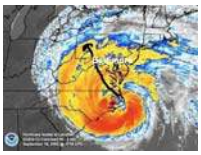


Impacts Assessment

- Identify Hazards
- Profile Hazards
- Historical Impacts of these Hazards
- Asset Inventory
  - Critical Facilities
  - Infrastructure
  - Historical Sites
  - Existing Development
  - Transportation

Risk Assessment

- Determine chance or probability of an impact occurring
- Determine the consequence of the impact occurring.



Vulnerability Assessment

Three components:

- Exposure
- Sensitivity
- Adaptive Capacity

Advisory Committee

- Key stakeholders
- 11 City Agencies, 11 community representatives, 4 State Agencies, NGO's, Private sector, and Federal government
- Meet five times as a full committee and six times in subcommittees

Progress to date

- Vision approved
- Goals approved
- Strategies approved
- Actions approved as of July 19th
- Currently focused on Public Input

Infrastructure

- **Energy**
- **Liquid Gas**
- **Communication Systems**
- **Waterfront**
- **Transportation**
- **Wastewater Systems**
- **Stormwater Systems**
- **Solid Waste**
- **Policy and Government Decision-Making**

Buildings

- **City Codes**
- **Structural**
- **Non-Structural**

Natural Systems

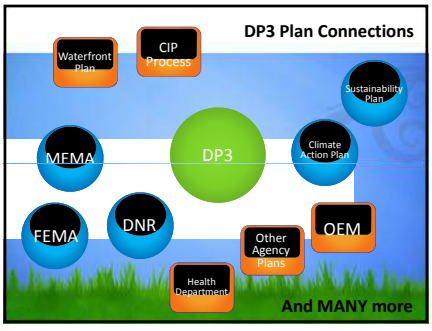
- **Urban Parks and Forest**
- **Water Supply and Management**

Public Services

- **Emergency Preparedness and Response**
- **Health**
- **Education and Outreach**
- **Food System**

Additional Elements

- Engineering Study focused on Fells Point waterfront
- Health Impact Assessment on Urban Heat with the Baltimore City Health Department
- Community Outreach and Collaboration
- Historical Considerations



July 30, 2013 Continued...

Community Outreach

Flood meetings

- Four flood meetings in both tidal and non-tidal
  - Two in tidal flooding areas
  - Two in non-tidal flooding areas
  - Focus on current flooding, potential flooding, behavior change, and preparedness

Community Outreach

Heat meetings

- Three meetings focused on extreme heat
  - Survey members of the community
  - Gather input
  - Focus on potential increase in high heat days, behavior change, and preparedness

Community Outreach

- Work with the EPA to host a meeting focused on flooding for city employees
  - City and County representatives
  - Reservoir representatives

Connection with Climate Action Plan

- **Infrastructure**
  - Increasing resiliency of the electricity system
  - Increasing energy conservation efforts
  - Alternative modes of transportation
  - Debris management
- **Buildings**
  - Strengthen city codes to integrate changes in climate
  - Improve resource conservation opportunities in buildings
- **Natural Systems**
  - Increase and enhance the resilience and health of Baltimore's urban forest
  - Water Supply
- **Public Services**
  - Integrate climate change and natural hazards planning into all City and community plans

Document Outline

- Chapter 1: Introduction
- Chapter 2: Mitigation and Adaptation
- Chapter 3: Hazard Identification
- Chapter 4: Risk and Vulnerability Assessment
- Chapter 5: Strategies and Actions
- Chapter 6: Adaptive Capacity
- Chapter 7: Implementation Guidan

Timeline

July 17th	Goals, Strategies, Actions Online
July 30th	Town Hall Meeting (Tonight)
August 9th	Final date for Public Comment on G,S,A
August 19th	Final Advisory Committee Meeting
August 21st	Draft Document Posted Online
August 27th	Present to Sustainability Commission
Sept 19th	Present to Planning Commission

Provide us with Feedback

The DRAFT list of goals, strategies and actions can be found here:

http://baltimorehazards.wordpress.com/disaster-preparedness/goals-strategies-and-actions/full-list-of-goals-strategies-and-actions/

or

http://baltimoresustainability.org/disaster-preparedness-and-planning-project

Keep in mind, while looking at the goals, strategies and actions, there will be additional content added which will further explain the purpose of the recommendation. Comments can be provided directly in the comment box on the bottom of the page or sent to Kristin.Baja@baltimorecity.gov.

Community Meetings

Flooding

April 30, 2013

The DP3 Project Staff worked in collaboration with a doctoral candidate at the University of Maryland, Estuarine and Environmental Science Program to conduct community meetings focused on flood risk. The team presented various flood risk scenarios based on historic floods and projected impacts from climate change. Participants were given the opportunity to use one of two modeling methods, HAZUS-MH or one developed by the doctoral candidate, to map the flooding in their neighborhood with projected sea level rise or increased precipitation.

The two methods made use of collaborative learning techniques by bringing members of the community together to discuss their collective options. One method utilized computer software operated by a skilled Geographic Information Systems (GIS) technician to illustrate the scenarios. This method is presently used most often by the Federal Emergency Management Agency (FEMA) to convey risk and risk-reduction strategies. The other method asked members of the community to interact directly with the computer model – they are the model-builders.

As these meetings were collaboration between the City of Baltimore and the University of Maryland doctoral candidate, there was a focus on determining the effectiveness of two different methods of communicating flood risk and risk-reduction strategies to communities and also measures their effectiveness at initiating risk-reduction actions. Both methods use computer-assisted simulation to illustrate flood risk – present and potential.

There were multiple benefits from conducting flood risk meetings. The sessions allowed participants to better understand their own risk to flooding, to better absorb information about future vulnerability, and to brainstorm actions that would help reduce risk in their communities. The sessions focused on preparedness measures and actions participants could take to reduce the chance of injury or damage if a hazard occurred. The brainstorming sessions also helped inform the strategies and actions established for the DP3 Plan.

Five community meetings were conducted throughout the spring and summer of 2013. These meetings were held in the following communities:

Name of Community	Number of Participants	Model Used
Canton	18	HAZUS
Westport Improvement Association	7	Stakeholder
Westport Neighborhood Association	6	Stakeholder
Dickeyville	6	HAZUS
Mt. Winans	8	HAZUS

Data was collected from the five communities in Baltimore. The HAZUS model was used for three communities while the stakeholder built model was used for the others two. Each community was presented with three flooding scenarios: historic risk, 100 year flood risk, and future flood risk. After the scenarios were presented and discussed, flood risk reduction strategies were provided for and brainstormed in each community.

For additional information about this project please visit: https://sites.google.com/site/floodmodeling1/

Heat

During an extended heat wave in Baltimore City over the summer, DP3 Planners attended two community association meetings, at the Sandtown-Winchester and Oliver Communities, to distribute information about extreme heat hazards and gauge resident awareness, preparedness, and risk of such events. The minutes from the Sandtown-Winchester meeting are below, and the feedback provided from both meetings are noted at the right.

Western District Community Council Meeting
July 18, 2013

Inez Robb called the meeting to order. Rev Merritt opened in prayer.

Police updates: Detective Robertson shared the police year-to-date stats for Western:

- Homicide, shootings, rape, robbery and assault are higher year to date than last year but overall violent crime is down 9%.
- Increased foot officers on Monroe area and Baltimore corridor near Central;
- Gilmore Homes remains a top priority for the Western district;
- Captain Bauer is new Deputy Director;
- Planning to set up a new tip line email address for email/text messages to get info right to the shift commander and captain;

Guest Speaker: Baltimore City Office of Sustainability-- Emergency Preparedness;

- Natural Hazards—Current and projected climate change
- Extreme heat is current risk: City's climate action plan includes saving energy and keeping people safe and reduce health risks;
- Next Disaster Preparedness and Planning Town Hall Meeting is Tues, **7/30, 6-8pm** at War Memorial Building, Lower level, 101 N Gay St.
- If you have any feedback/suggestions or want a presentation at your community meeting, contact Kristin at kristin.Baja@baltimorecity.gov, 410-396-5917.
- Some ideas that were shared:
  - -publicize cooling centers better with flyers, Internet, etc.
  - -make sure stores near bus lines have cool water to help elderly people;
  - -recruit neighborhood captains to share info with neighbors;
  - -advocate for fire stations to have ice or other resources to help neighborhood;
  - -think about visual campaigns and reaching people who don't have email;

If you are willing to serve as a Neighborhood Captain for Disaster Preparedness, be sure to sign up with Inez Robb or contact Kristin at 410-396-5917.

Mr. Johnson, Executive Director of Penn North Library, shared info about events:

- 8/24, 11am: CPR, fire safety and child ids;
- 8/17, 3pm: Troy Rawlings comedy act; 7:30pm adult version at Arch Social Club;
- Also, Ray Cruitt can help folks interested in starting nonprofit;

Fire Department:

- Call 311 to get a smoke alarm with a 10-year battery;
- Community will advocate for rodent control at with Pete Walsh & Demetrios Mallisham;

National Night Out, 8/6, 4-8pm at Target Mondawmin: fun, music, food, backpacks;

- Community associations and churches can share info;
- Volunteers to set up at 3pm: Frances Muldrow, Adrienne Ford, Curtis Lewis, Roxanne Prettyman, Romina Campbell; clean-up volunteers: Curtis, Inez, Roxanne.

Total attendance: 16 people.

Attendees who signed up to be Neighborhood Captains for Disaster Preparedness are:

Emma Scott, Housing Manager, Gilmor Homes, 410-396-0222
Rev Keith Bailey, 410-669-1999
Frances Muldrow, fmm_tnp@yahoo.com, 410-669-8009
Romina Campbell, 619 N Bentalou, romcmp7@verizon.net, 410-566-1660
Wanda McCoy, 1733 Moreland, wmmccoy@coppin.edu
David Brown, 1956 W Fayette, dbrown_@msn.com
Adrienne Ford, 1111 N Gilmor, drnnford@yahoo.com, 443-915-8278
Curtis Lewis, 39 Wheeler Ave, 410-947-0017
Roxanne Prettyman, 1125 McKean Ave, 443-398-4092

Handout Provided at Community Heat Meetings

City of Baltimore - Disaster Preparedness and Planning Project (DP3)

Community Meeting- Extreme Heat

July 18, 2013

Extreme heat is when prolonged temperatures are 10°F or more above the average high temperature for a region. Extended periods of extreme heat can tax the energy delivery system, leading to blackouts and/or "brownouts," and increase cooling costs. However, while extreme heat adversely affects structures or infrastructure, the most harmful costs of extreme heat are primarily related to human health.

"Over the past ten years heat has been the number one weather-related killer in the US, resulting in hundreds of fatalities each year. In fact, on average, excessive heat claims more lives each year than floods, lighting, tornadoes, and hurricanes combined" [NOAA]

IN THE LAST CENTURY

The last 23 years have been the warmest period of all global temperature records, starting in the mid-19th century [NOAA].

Average temperatures in Maryland have increased a total of 1.8°F. In Baltimore's past, between the 1950s and the 1970s, an average of 60% of summer days had met or exceeded maximum temperature extremes. In the 2000s, that percentage grew to approximately 75-90%.

CLIMATE PROJECTIONS- BALTIMORE IN 2100

- Average temperatures could be as much as 12°F warmer.
- Summer temperatures are projected to rise as much as 10.8°F degrees by 2100.
- As many as 95% of summer days will reach temperature extremes.
- As many as 41 days a year will be +90°F.
- Winters could be up to 10.6°F warmer.

URBAN HEAT ISLAND

In the summer months, **urban air temperatures can be up to 10°F higher** than surrounding suburban or rural areas — a phenomenon known as the ***urban heat island effect***. The main cause of urban heat island is urban development which uses materials, such as asphalt and concrete, which effectively retain heat. Many studies have shown the direct relationship between temperature and land cover. As temperatures continue to rise, heat events will increase in severity and intensity; especially in urban areas such as Baltimore City. Increasing the number of street tress and creating new urban forests are key strategies for both mitigating and adapting to impacts from urban heat.

SAMPLE DP3 HEAT-RELATED STRATEGIES

STRATEGY NS-2: Increase and enhance the resilience and health of Baltimore's urban forest

- **Action 1:** Anticipate future changes in temperature and weather by developing a comprehensive list of plant and tree species or varieties known to have a broad range of environmental tolerances
- **Action 2:** Establish and routinely update a comprehensive tree inventory to anticipate insect and forest structural impacts of climate change

STRATEGY PH-7: Protect Baltimore residents from the effects of hazard events and plan for more frequent hazard instances

- **Action 1:** Re-evaluate and update existing heat alerts, advisories, and updates to healthcare and emergency service providers
- **Action 2:** Ensure that residents and visitors have access and transportation to cooling centers during extreme heat events
- **Action 3:** Evaluate code red plans to ensure all agencies adequately protect their own workers
- **Action 4:** Consider extending hours for public wading pools during extreme heat events
- **Action 5:** Include information about Code Red in the event permitting process, and incorporate language that allows BCHD to cancel outdoor events
- **Action 6:** Work with Regional, State and Local partners to improve air quality and reduce respiratory illnesses
- **Action 7:** Create and implement programs to manage combined health impacts of heat and air pollution
- **Action 8:** Stay abreast of latest conduits for social media and capitalize on these methods to inform public during emergencies

TIMELINE

MID AUGUST	AUGUST 27th	SEPTEMBER 19th
Post document online for comment and review	Present to Sustainability Commission	Present to Planning Commission

SAVE THE DATE

The Disaster Preparedness and Planning Project (DP3) is hosting a second Town Hall Meeting
Date: Tuesday, July 30th
Time: 6 to 8 PM
Location: War Memorial Building, Lower Level, 101 N Gay St., Baltimore

FOR MORE INFORMATION

Kristin Baja, Hazard Mitigation Planner | Kristin.Baja@baltimorecity.gov
417 E. Fayette St., 8th Floor, Baltimore, MD 21202 | PHONE: 410-396-5917
www.BaltimoreSustainability.org/disaster-preparedness-and-planning-project

At each community meeting, residents were asked a series of questions that would help the DP3 process to better understand resident awareness of, and preparedness for hazards, and considered how different residents may be impacted by a hazard event. The answers below were combined from both Sandtown-Winchester and Oliver Communities, unless otherwise noted.

How do you cool your home?

- Central AC: 10-11
- Window unit: 6
- Only fans: 2

How do you notice the impacts?

- Asthma, trouble breathing
- Dfficulty sleeping; night sweats
- Lethargic, sluggish; experience exhaustion
- Buses without A/C; faint due to extreme shifts in temperature
- Difficulty staying hydrated (problematic for seniors)
- Not wanting to eat; lose strength
- Too few emergency cooling centers
- Car overheats/cuts out

Who here has used a cooling center? (Question not asked of Oliver community)

- Many attendees were unaware of center locations
- Some centers close too early (e.g. libraries, senior centers)

How can the city improve/prepare for the future?

- Request for more pools/splash pads, noting that heat may lead to violent behavior
- Better educate the public about resources, what to do, where to go, etc. Better communication about hazards
- Consider how to reach residents without computers
- Utilize community [memo] boards
- Create/use a calendar to share seasonal information and resources for addressing all hazards, year-round
- Provide/require free water distribution
- Use visual and easily understood campaigns
- Share information about senior residents who should be visited in hazard events
- Productive ice machines at firehouses
- Possible loan program for A/C units; Installation, use, and repair assistance; Provides fans for residents without

Why do you think people stay indoors during heat events? Question not asked of Oliver community)

- High crime activity/perception of crime
- Older people are often accustomed to closing the drapes and holding out indoors, but get dehydrated and suffer without air flow

Additionally, at each meeting, residents were asked to become Neighborhood Captains for Disaster Preparedness.

Workshops

City Agency Manager Flood Training

Stormwater Responses to Land Use and Climate Change Workshop

The City of Baltimore, Department of Planning collaborated with the Environmental Protection Agency (EPA) to host a stormwater and climate change workshop on May 20, 2013. The workshop brought together representatives from the Chesapeake Bay region with expertise in water quality and stormwater management.

Participants were given presentations on projected land use and climate change in the Baltimore City region and then participated in mapping exercises and facilitated discussions about stormwater management options, including green infrastructure and environmental site design strategies.

This workshop acted as an education and training session for many of the City's middle managers and focused on four high priority areas in the City: Fells Point, Mount Washington, Westport, and Cherry Hill.

The specific goals of the workshop had been to:

1. Explore the impacts of land use and climate change in the Chesapeake Bay watershed and the implications for water quality and stormwater management.
2. Explore stormwater management options (particularly green infrastructure or other environmental site design strategies) to prepare for anticipated changes in land use and climate in the Chesapeake Bay watershed.
3. Identify information gaps and other barriers preventing local-level consideration and implementation of green infrastructure or other environmental site design strategies to help control stormwater.

Some ideas that emerged from the workshop were:

1. An attractive pamphlet or two-pager
2. A 5-10 minute video to help explain why local elected officials may want to pay attention to changes in precipitation patterns and how green infrastructure may help
3. A guidebook/framework to help other municipalities integrate climate change into stormwater management decisions

Photos from the EPA Training Workshop

Participant Name	Title	Affiliation
Al Todd	Executive Director of Alliance for the Bay	Alliance for the Chesapeake Bay; Local Government Advisory Committee (LGAC)
Alison Prost	MD Executive Director	Chesapeake Bay Foundation
Allen Davis	Department of Civil and Environmental Engineering	UMD
Andy Miller	Professor - Hydrology	UMBC
Ashley Traut	Stormwater Porgram Manager	Blue Water Baltimore
Beth Chisle	Civic Works	
Beth Strommen	Director	Baltimore City Office of Sustainability
Brian Clevenger	Program Manager, Sediment, Stormwater and Dam Safety	MDE
Christina Bradley		Parks and People Foundation
Clark Howells	PCA Supervisor, DPW	City of Baltimore
David Thomas	Department of Public Works and Planning	Baltimore County
Dominique Luckenhoff		Office of State & Water - Region 3 EPA
Guy Hager	Senior Director of Great Parks	Parks and People Foundation
Holly Van der Gagg	Executive Director	Blue Water Baltimore
Jackie Carrera	President and CEO	Parks and People Foundation
Joe Piotrowski		EPA Region 3
John cyekoe	Civic Works	Civic Works
Ken Hranicky		
Kimberly Burgess	Division Chief- DPW Water & Wastewater	City of Baltimore
Kristin Baja	Hazard Mitigation Planner	Baltimore City Office of Sustainability
Lucinda Power		EPA Watershed Implementation Plan Specialist
Marcus Griswold	Project Manager - MADE CLEAR	University of Maryland Center for Environmental Science
Pradish Mystry	DPW Water & Wastewater	City of Baltimore
Sadie Drescher		Center for Watershed Protection
Sasha Land	Coastal Training Program Coordinator	MD DNR
Sean Williamson		UMD - Environmental Finance Center
Wazir Qadri	DPW Water & Wastewater	City of Baltimore
Zoe Johnson		MD DNR
Theo Ngongang	Department of Transportation	City of Baltimore
Stu Schwartz	Drinking Water Supply	Baltimore County
Don Outen	Drinking Water Supply	Baltimore County
Brent Flickenger	City Planner III	City of Baltimore
Mara D'Angelo	Department of Housing and Community Development	City of Baltimore
Dave Guinet	Department of the Environment	

Workshops, Continued

March 25, 2013

Greetings,

We are pleased to formally invite you to the *Stormwater Responses to Land Use and Climate Change in the Chesapeake Bay Watershed* workshop to be held **May 20, 2013,** in the **main conference room at the Baltimore Department of Planning**, located on the 8th floor of 417 E. Fayette Street, Baltimore, Maryland**.**

The City of Baltimore and EPA's Global Change Impacts and Adaptation program, in partnership with the Chesapeake Bay Program Office, the Chesapeake Bay Local Government Advisory Committee (LGAC) and the U.S. Global Change Research Program's National Climate Assessment, is undertaking an effort to assist local-level planners to explore the impacts of projected changes in land use and climate on stormwater runoff in the Chesapeake Bay watershed and potential management responses. The workshop will include discussions of the existing planning context, constraints, and opportunities in the City of Baltimore. Participants will hear presentations on projected land use and climate change and participate in mapping exercises and facilitated discussions about stormwater management options, including green infrastructure and other environmental site design strategies. The workshop will bring together representatives from the Chesapeake Bay region with expertise in water quality and stormwater management.

The specific goals of these workshops are to:

1) Explore the impacts of land use and climate change in the Chesapeake Bay watershed and the implications for water quality and stormwater management.
2) Explore stormwater management options (particularly green infrastructure or other environmental site design strategies) to prepare for anticipated changes in land use and climate in the Chesapeake Bay watershed.
3) Identify information gaps and other barriers preventing local-level consideration and implementation of green infrastructure or other environmental site design strategies to help control stormwater.

We hope that you will join us for this important workshop.

Please email Dana Spindler (Dana.Spindler@icfi.com) by **April 5, 2013** indicating if you will be able to participate in this workshop.

Sincerely,

Beth Strommen
Director of Baltimore Office of Sustainability
Baltimore, MD 21201
(410) 396-3860

Stormwater Responses to Climate and Land Use Change

Time and Date
Monday, May 20th 2013
9:00am – 4:45pm

Location
Main conference room on the 8th Floor of the Baltimore Department of Planning
417 E. Fayette Street, Baltimore, Maryland

Security
All visitors will need to check in downstairs and get a visitor's pass. Please allow time to check in at the workshop between 8:45-9:00am.

Lunch
University of Maryland Center for Environmental Science and the Town Creek Foundation have generously offered to provide lunch. We will have lunch catered by Boheme Café.

Workshop Goals
- Explore the impacts of changes in land use and precipitation-driven flooding and the implications for water quality and stormwater management.
- Explore stormwater management options.
- Identify information gaps and other barriers.

Workshop Agenda
Check-in 8:45 – 9:00 am

Welcome and Introductions 9:00 – 9:15 am

- Introduce project, partners, objectives, participants and goals for workshop
- Review agenda

Current Conditions 9:15 – 10:15 am

- Land use and historic growth patterns in the City of Baltimore
- Discuss development trends
- Floodplains and recurrent flooding
- Highlight four neighborhoods we will focus on throughout the workshop

Changes in Land Use 10:30 – 11:00 am

- Integrated Climate and Land Use Scenarios (ICLUS)
- Review outputs for population, housing density, and impervious surface

Agenda continued on next page.

Direct Feedback from Public Comment

May 13, 2013

Janette Wheeler, Mt. Winans CDC (Community Development Corporation)

When and if shelter-in place is no longer a viable option…The majority of homes in Mt. Winans are with arched roofs. Mt. Winans is prone to flooding and the school's roof (flat) was prev. used.

July 19, 2013

Eob999@comcast.net

These soon to be ordinary flooding events due to the rising of the oceans because of global warming are exactly why we should not invest taxpayer dollars in the Inner Harbor East development on the Super fund site. This soon to be Exelon bldg will be flooded and obsolete and once again the taxpayer will be holding the bag. This facility should be built near mass transit routes, like Baltimore & Light. It's why City's that have parks on their waterfronts buy time against global warming, like Vancouver. Vancouver is one of the most beautiful cities in North America due to its parks along the water. Folks are attracted to this and its how their cities remain livable. We should have a green ribbon of parkland all along the inner harbor and push the restaurants into the empty store fronts one block back. Sidewalk cafes could florish.

July 19, 2013

Dr. Shelley Sehnert, President, North Rolland Park Association

I suggest prioritizing the items within each section of infrastructure and then deleting the ones that are not relevant to a disaster preparedness plan (e.g., city gardens do not prepare large populations for natural disasters that compromise food safety or availability). Populations are not homogeneous and the needs of differently abled residents, senior citizens, vulnerable populations, etc., need to be considered at all appropriate levels. Hospital evacuation plans do not cover these people since they are an integral part of every community. Communication plans need to be flexible and include non-English speakers, events when power is absent, etc. and should not rely on the internet or other media alone. Often the community volunteers and associations are the best link to assisting people in times of natural disasters. Not all neighborhoods will be equally affected by all disasters, so focus on prioritizing and triaging strategies is important. Disasters cause other disasters, as seen with Superstorm Sandy, wherein flooding caused power outages that disrupted city services and impacted water quality and delivery, hospitals were closed, etc. Items on the list might be considered to be linked in priority or importance so that they can be part of an integrated strategy of preparedness across the plan. Decentralization of supplies, command centers, and response resources would be an example of a preparedness action that mitigates impact if transportation and power infrastructures are severely impacted in different areas of the city. Education of the population about disaster preparedness is more than instruction on not driving through standing water, it is partnering with communities to help empower them to participate in preparedness particular to their community geography, buildings, population, roads, culture, and businesses.

July 29, 2013

Linda Foy, BGE

As you probably know, BGE has been working with the City on the DP3 project and has recommended some changes to the draft as it moves through the approval process. We appreciate the opportunity to partner with the City on this project. While we don't anticipate making any public comments during the town hall meeting tomorrow, we would like the following statement to be entered into the official record:

BGE is very supportive of Baltimore City's efforts to reduce the impact of natural disasters on critical infrastructure. As a regulated utility, BGE believes the approach should be measured and balanced and initiated by the MD Public Service Commission.

Can you ensure this statement is captured for the official record? Thank you.

July 30, 2013

Randy H. Rowel, Associate Professor, Morgan State University

My name is Randy Rowel and I am sending these comments on behalf of Morgan State university Why Culture Matters Disaster Studies Project. With the help of two of our outstanding DrPh students (Francesca Weaks and Benika Dixon). Both students have experience in disaster planning at regional and national levels.

First, let me first compliment you and others in the development if this plan. We understand the plan is a work in progress and offer feedback with that understanding in mind. Overall the plan is very ambitious and leaves some concern about how will get done in times of budget restraints. Our comments are as follows.

1. Not sure why no objectives are associated with goals. Also no way of knowing which strategies are associated with goals listed.
2. Plan does not indicate how strategies will be achieved and what partnerships will be established to help accomplish proposed goals.
3. Although there are numerous higher education institutions throughout Baltimore, the plan does not include Campus Resilience.
4. **Emergency Preparedness Response Strategy PH-3; Action 1:**Plan does define vulnerable populations. Also not clear what level of leadership you seek to engage in the plan.
5. **Emergency Preparedness Response Strategy PH-6 Action** I am not sure if Baltimore is using ESSENCE Syndromic Surveillance sytem for early detection of outbreaks by way of emergency room data. If so, you might want to include.
6. **Education and Outreach:** Again, how will this be done. This is an area where MSU School of Community Health and Policy WCM Disaster Studies Project could be involved.

July 30, 2013

Angelica Willis, curious resident

As a young resident of Maryland, interested in relocating to Baltimore in the next few months, I think this is a good project to undertake. However, how much will it cost? Will there be an increase in taxes or toll fees for the transportation sector of the project, will the funding be provided by the new HB1515 bill? Also, if we cannot attend town hall meetings, where and how can we become more educated about this in order to protect ourselves? For energy conservation efforts, maybe something can automatically be printed on our BGE bill in summer months to remind us how to conserve energy.

August 1, 2013

Ann Stanley

The Town Hall appeared to be a success. In one of my previous lives I work for URS in their urban planning and hazard mitigation group. I have reviewed a few hazard mitigation plans for FEMA and getting adequate planning and public participation is a weakness of many plans. You had a great event by comparison.

I am currently doing some work for BIA in NY and NJ and noticed the inclusion of strategies in Baltimore's Hazard Plan that reflect the new learning curve. In reviewing NYC's post Sandy Resiliency Plan – I noticed the City had codified their Climate Change Commission and Task Force into law so any future developments related to climate/natural hazards could be reviewed and new strategies quickly adopted. I didn't know if Baltimore had done the same for the Sustainability Commission but might be a strategy to add.

Direct Feedback from Public Comment, Continued

August 8, 2013

Sara P. Hoverter, Georgetown Climate Center

General comments: the categories seem intuitive and are clear, but I wasn't sure whether the strategies were supposed to correlate to the goals directly or whether all together they accomplish them. Some of them seem to interact somewhat, too – making sure that energy supply is there during emergencies for things like communications systems, hospitals, etc. I assume that's built in.

More specific comments:

- For evacuation-related strategies/actions (IN-8 and others), you might want to think about explicitly designating special assistance/outreach plans for your most vulnerable residents. Some of that shows up elsewhere, but you might want it more than one place so that multiple departments are thinking about it.
- IN-11: I obviously like the fact that you're thinking about pavement that can withstand extreme heat – I would expand that to include pavement that will reduce heat as well.
- IN-13: one of the things that DC stormwater folks are worried about is that our stormwater outfalls are not always above the water line when the river runs high, which means backups. There's talk of theoretically trying to raise some of them, but I don't know how realistic that is. Does Baltimore have the same worry with sea level rise?
- B-3: Yay to changing city codes for urban heat adaptation. ☺
- NS-2: Yay for urban forestry, especially targeted to urban heat islands
- PH-2: Delaware is currently testing a heat health warning system that you might want to have your health folks look at when you're ready.
- PH-6: with the focus on vector-borne disease, etc., you might want to include an element of public health surveillance and reporting

August 16, 2013

Charles Rutheiser, resident

- Overall, a very solid piece of work.
- What happens after it is approved? Or, more specifically, what are the mechanisms for implementing and executing the various features of the plan, many of which will have profound implications for current and future development?
- The list is quite comprehensive, but I imagine there must be thoughts about prioritizing certain aspects rather than others, at least in a temporal sense.
- Has there been any effort to estimate the costs of the various recommendations? I realize this is in many ways an impossible task that would produce astronomical numbers, but there should be ways to identify those measures that have relatively low costs.
- As my introductory paragraph notes, I have concerns about the state of the city's social infrastructure and am wondering if there is more detail forthcoming on how items PH 3, 8 and 9 might be implemented. As you know all too well, these are issues that people don't think about, don't want to think about, and when they do think about them they think about them in highly individualistic ways that are not informed by science, probabilities, and a realistic understanding of the limits of government action.
- I only see one brief mention to pandemic disease, PH-6, I imagine that is covered in greater depth and detail in the Health Dept's mitigation plan?
- I think you have done a good job covering all the likely natural disasters and you have your plate full without thinking of more, but I am wondering who has the responsibility for thinking about and planning for un-natural disasters, such as failure of widespread and sustained failure of power and computer systems?

September 24, 2013

Lynn Heller

p.178, BL-2 #7:

7. Encourage green roof installations to include vegetated and reflective technologies for all new commercial, industrial, multifamily, and city-owned development. Vegetated roofs provide energy savings benefits, reduce the urban heat island effect, and increase rainwater capture. Where feasible, the use of vegetated **or reflective (add)** roofs for ~~**all**~~ **(delete "all")** new commercial, industrial, multi-family, and city-owned developments should be implemented.

p.184, BL-8:

2. Support **energy efficiency, weatherization and renewable energy generation** as part of Baltimore City schools ten-year plan (S)

Providing emergency shelter during hazard events, and serving as key community facilities throughout the year, school facilities will require additional measures to increase resiliency and prevent damage. To mitigate climate change and reduce energy demand, while at the same time increasing a building's capacity to withstand hazard events, **energy efficiency, weatherization, and renewable energy generation** should be incorporated into the Baltimore City School System's ten-year plan.

October 2, 2013

Miriam Avins

The research that my comments are based on was published in June, and then we did more on-the-ground research over the summer. So this is new stuff. Please call me if you want to talk about it.

Basically, we've learned that forest patches of at least 10K sf outside parks account for 20% of the city's tree canopy. (If we include those in parks, the number is 34%.) Some of those forest patches are in corridors, such as streams, but many are "islands." (Click here to see the paper if you wish.) Our on-the-ground research over the summer (not yet published in any way) showed that in many cases the islands are of higher quality than the corridors. It seems that invasive plants travel through the corridors, which also tend to be more narrow, so there's less interior space compared to edge. As a result, I hope that the Plan will reflect the importance and value of the island patches.

Here are my proposed changes:

NS- 1 Change "green corridors and parks" to "green corridors, forest patches, and parks" and follow this change through the text of the recommendation.

NS-2 – What do you mean by "urban forest"? Does this include forest patches? Mention specifically?

I would like to see a strategy under this goal about preservation of existing forest patches and tree canopy. We won't get anywhere on increasing the tree canopy if we let the big trees get cut down.

NS-3 – Could the goal talk of "an interconnected system of green spaces and natural features, *as well as "island" forest patches"*? That way, strategy 4, which includes forest preservation, can apply to the island patches.

Direct Feedback from Public Comment, Continued

[illegible]

Direct Feedback from Public Comment, Continued

Online Opportunities

Baltimore Office of Sustainability Website

The Baltimore Office of Sustainability website serves as the primary outlet for distributing information about sustainability news and ongoing efforts initiatives being pursued through BoS. Additionally, it is a main source for public feedback and interraction, allowing the City to gauge resident interest in, and reception of, sustainability initiatives.

The BoS website is constantly live and continually updating its content. On this website, for instance, residents and interested individuals can follow the development of programs, like the DP3, and may learn more about major plans, policies, and initiatives. Furthermore, the website serves to educate residents and others about these current sustainability topics by providing free, downloadable files through the Resource Center tab.

Baltimore Natural Hazards Website

The Baltimore City Natural Hazards website had been utilized throughout the DP3 development process in order to publically share draft documents for the purpose of soliciting public feedback. Additionally, the website serves to educate residents about the hazard mitigation and climate adaptation processes, conveying the importance of the DP3 by discussing some of the supporting science and presenting critical information about specific hazards.

In addition, the website details how the City of Baltimore is a participating community of the National Flood Insurance Program (NFIP) and is in the process of updating the City's database through Flood Insurance Rate Maps (FIRMs) and risk assessments.

Commission Presentations

Sustainability Commission

Presentation One

Date: April 23, 2013

Content: Basic Introduction to Natural Hazards

Hazard Identification

Climate Change

Initial DP3 Introduction

Presentation Two

Date: August 27, 2013

Content: Hazard Mitigation and Climate Adaptation

Overview of Hazards and Predicted Impacts of Climate Change

Public Process for DP3 Plan Development

Advisory Committee

Plan Structure

Connections with Existing Efforts and Plans

Timeline

Presentation Three

Date: September 24, 2013

Content: DP3 Plan Review

DP3 Public Input and Process

DP3 Advisory Committee Approval

Plan Structure and Final Content

Proposed Amendments

Request for Approval

Presentations available by request.

Planning Commission

Presentation One

Date: May 16, 2013

Content: Basic Introduction to Natural Hazards

Hazard Identification

Climate Change

Initial DP3 Introduction

Presentation Two

Date: August 29, 2013

Content: Hazard Mitigation and Climate Adaptation

Overview of Hazards and Predicted Impacts of Climate Change

Public Process for DP3 Plan Development

Advisory Committee

Plan Structure

Connections with Existing Efforts and Plans

Timeline

Presentation Three

Date: October 3, 2013

Content: DP3 Plan Review

DP3 Public Input and Process

DP3 Advisory Committee Approval

Plan Structure and Final Content

Proposed Amendments

Request for Approval

Presentations available by request.

Appendix F: HAZUS Summary Reports

Appendix- Table –1 Sum and Value of Facilities (By Type) Located in HAZUS Flood Extents

HAZUS-Flood: Sum of Facilities (type) located in HAZUS flood extents with their estimated total value (in thousands) and number of people						
	100 year			500 year		
Facilities (type)	Sum	Total Building damage	Total Content Damage	Sum	Total Building damage	Total Content Damage
Hospitals	0	0	0	0	0	0
Schools	0	0	0	2	$164.66	$897.81
Fire Stations	0	0	0	1	$132	$483
Police Stations	0	0	0	0	0	0
Emergency Operation Centers	0	0	0	0	0	0
Power Plants**	0	0	0	3	N/A	N/A
Waste Water Treatment Plants	0	0	0	2	$9,800	N/A
General Comments	225 buildings at least moderately damaged			475 buildings at least moderately damaged		
	22 buildings completely destroyed			48 buildings completely destroyed		
	2,035 people being displaced			4,175 people being displaced		
	1,093 people will seek shelter			2,409 people will seek shelter		
	Building Loss total: $2,001.74 million			Building Loss total: $3,501.78 million		

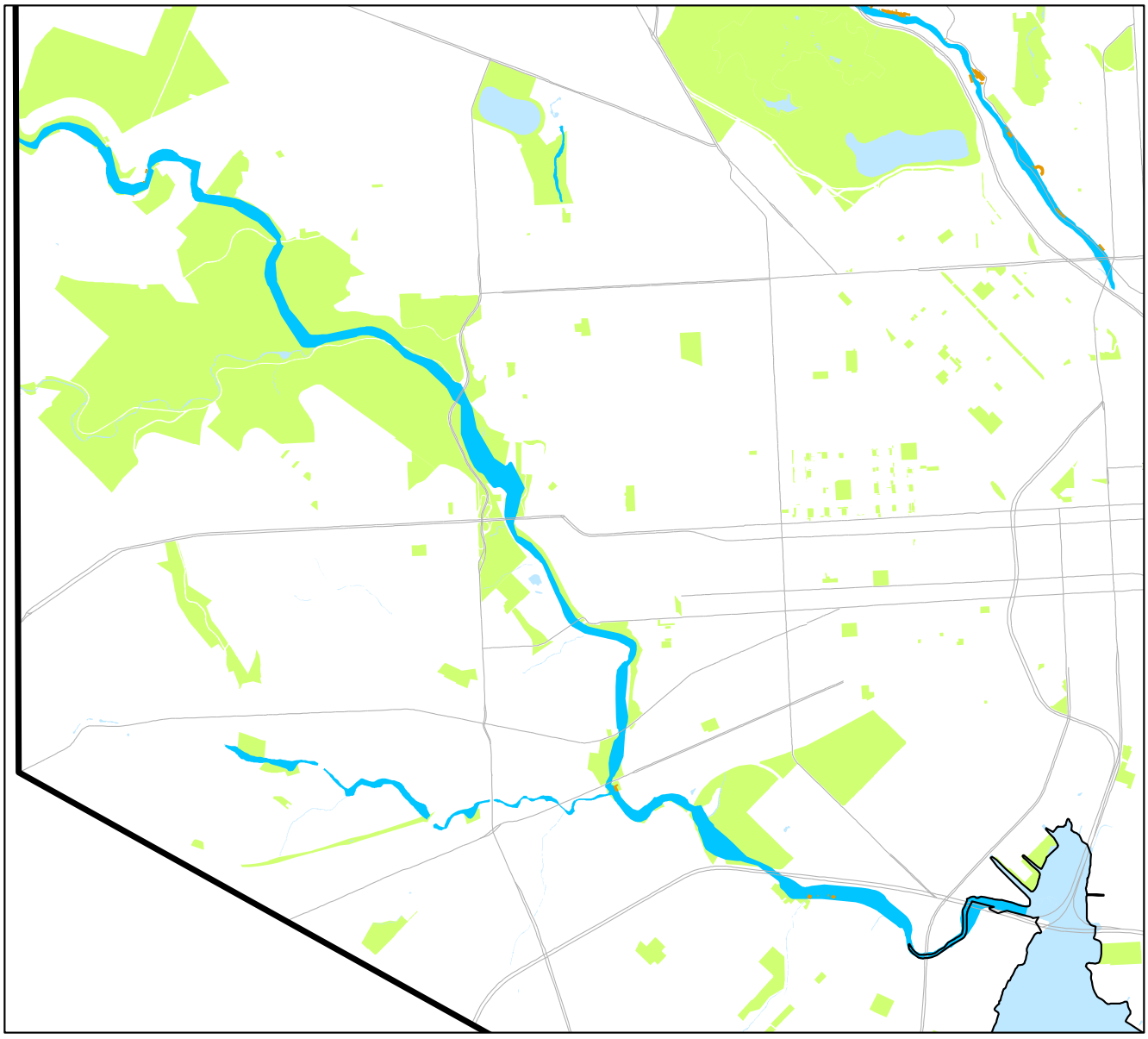
**Number based on HAZUS inventory

HAZUS did not provide information about damage costs for power plants.

(cont. from previous page)								
500 year + 3 ft SLR			500 year + 5 ft SLR			500 year + 7 ft SLR		
Sum	Total Building damage	Total Content Damage	Sum	Total Building damage	Total Content Damage	Sum	Total Building damage	Total Content Damage
0	0	0	0	0	0	0	0	0
2	$281.70	$1938.33	2	$352.14	$2,115.17	3	$497.79	$2430.11
1	$200	$1406	1	$267	$1761	1	$361	$1,923
1	$77.18	$132.31	1	$149.63	$713.49	2	$320.16	$1700.33
0	0	0	0	0	0	0	0	0
4	N/A	N/A	4	N/A	N/A	7	N/A	N/A
2	$29.900	N/A	2	$39,560	N/A	2	$39560	N/A
981 buildings at least moderately damaged			1,334 buildings at least moderately damaged			1,693 buildings at least moderately damaged		
60 buildings completely destroyed			94 buildings completely destroyed			174 buildings completely destroyed		
7,501 people will be displaced			9,114 people will be displaced			10,845 people will be displaced		
4,090 people will seek shelter			4,928 people will seek shelter			5,694 people will seek shelter		
Building Loss total: $7,033.92 million			Building Loss total: $10,058.35 million			Building Loss total: $13,373.50 million		

**Number based on HAZUS inventory

HAZUS did not provide information about damage costs for power plants.



Created: June 25, 2013
Source: Baltimore City Enterprise Geographic Information Services

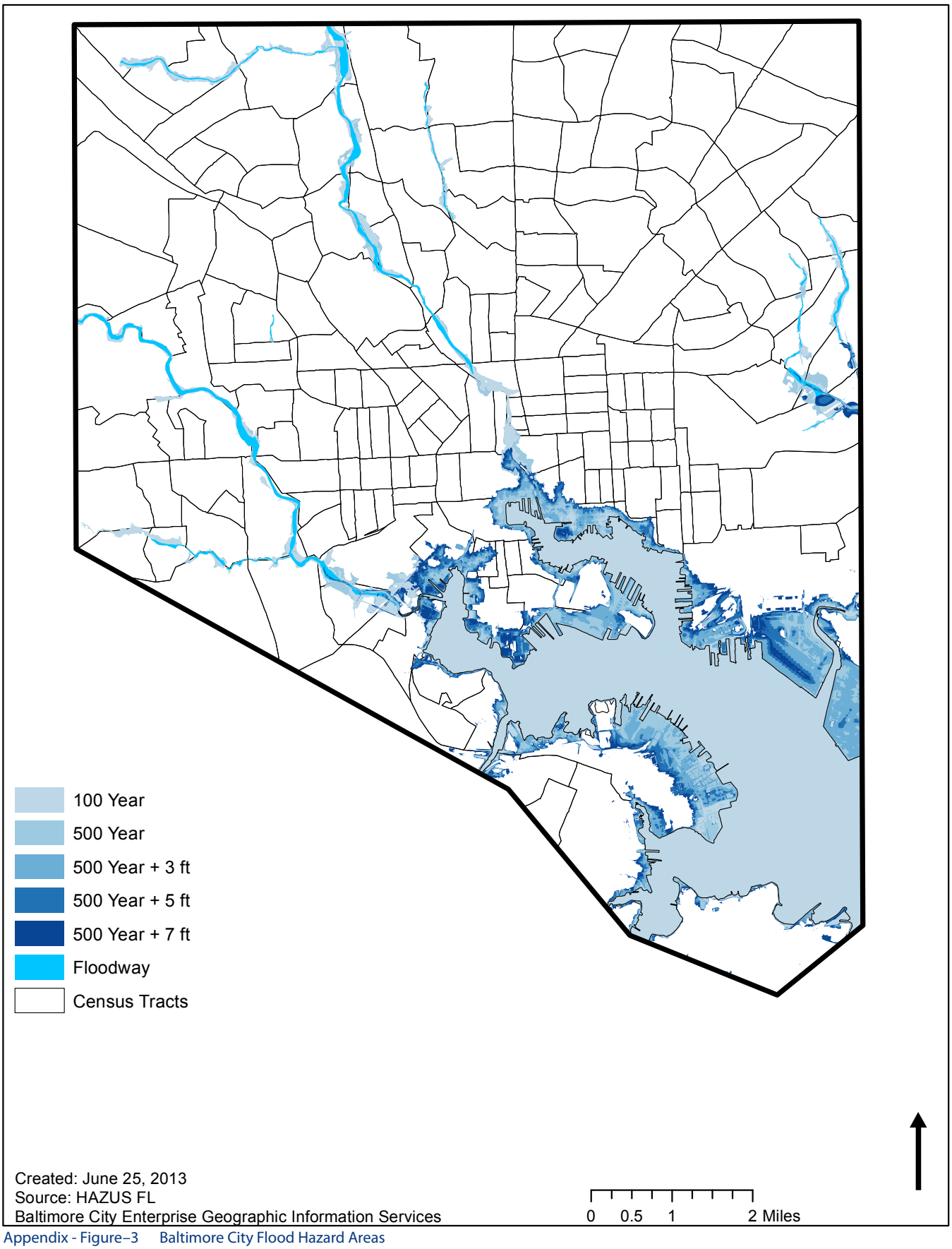
Appendix - Figure–1 Baltimore City Buildings in the Gwynns Falls Floodway

Baltimore City Boundary
Major Streets
Buildings
Floodway
Main Water Features
Parks

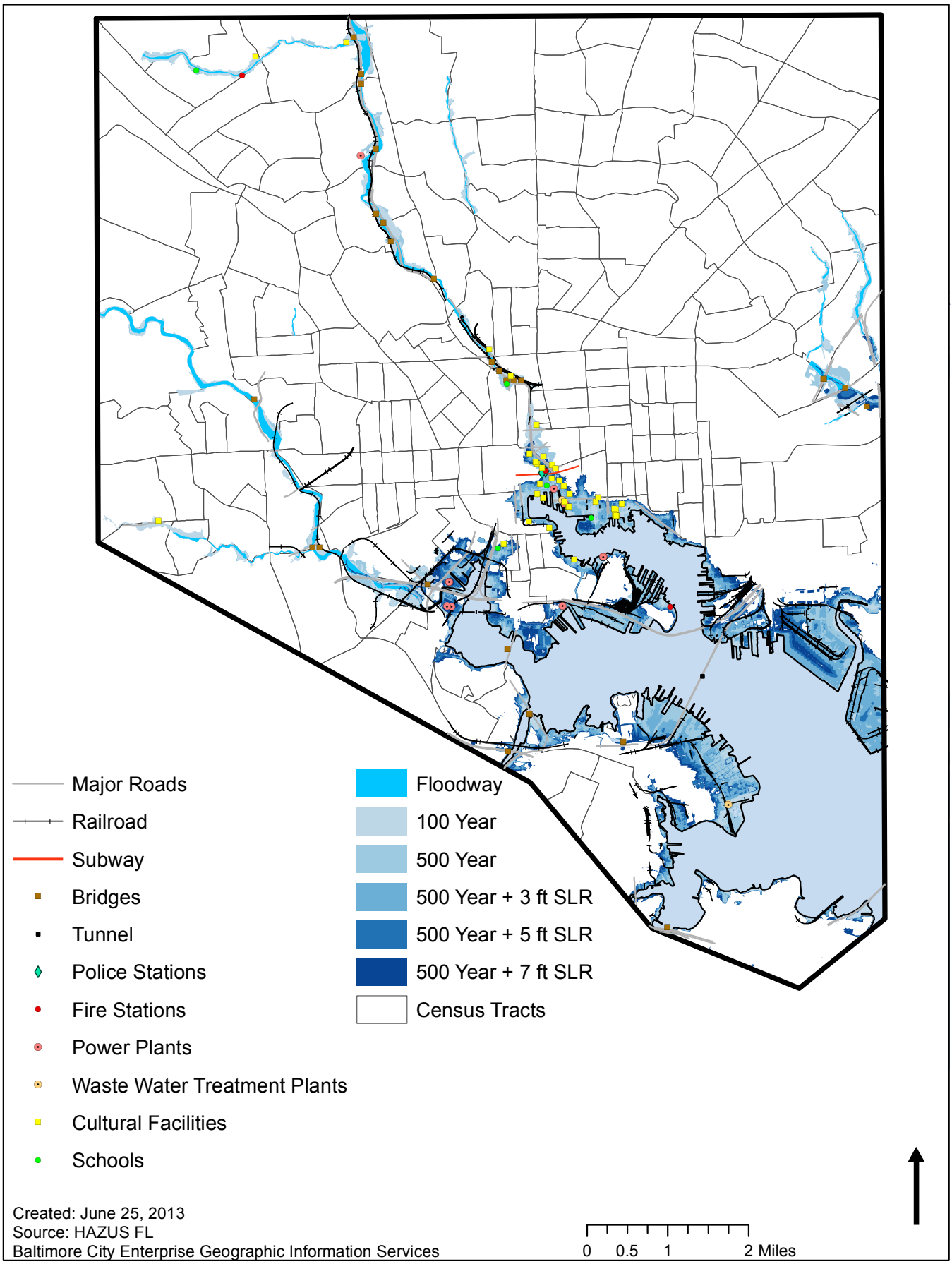
0 1,000 2,000 4,000 Feet

Created: June 25, 2013
Source: Baltimore City Enterprise Geographic Information Services

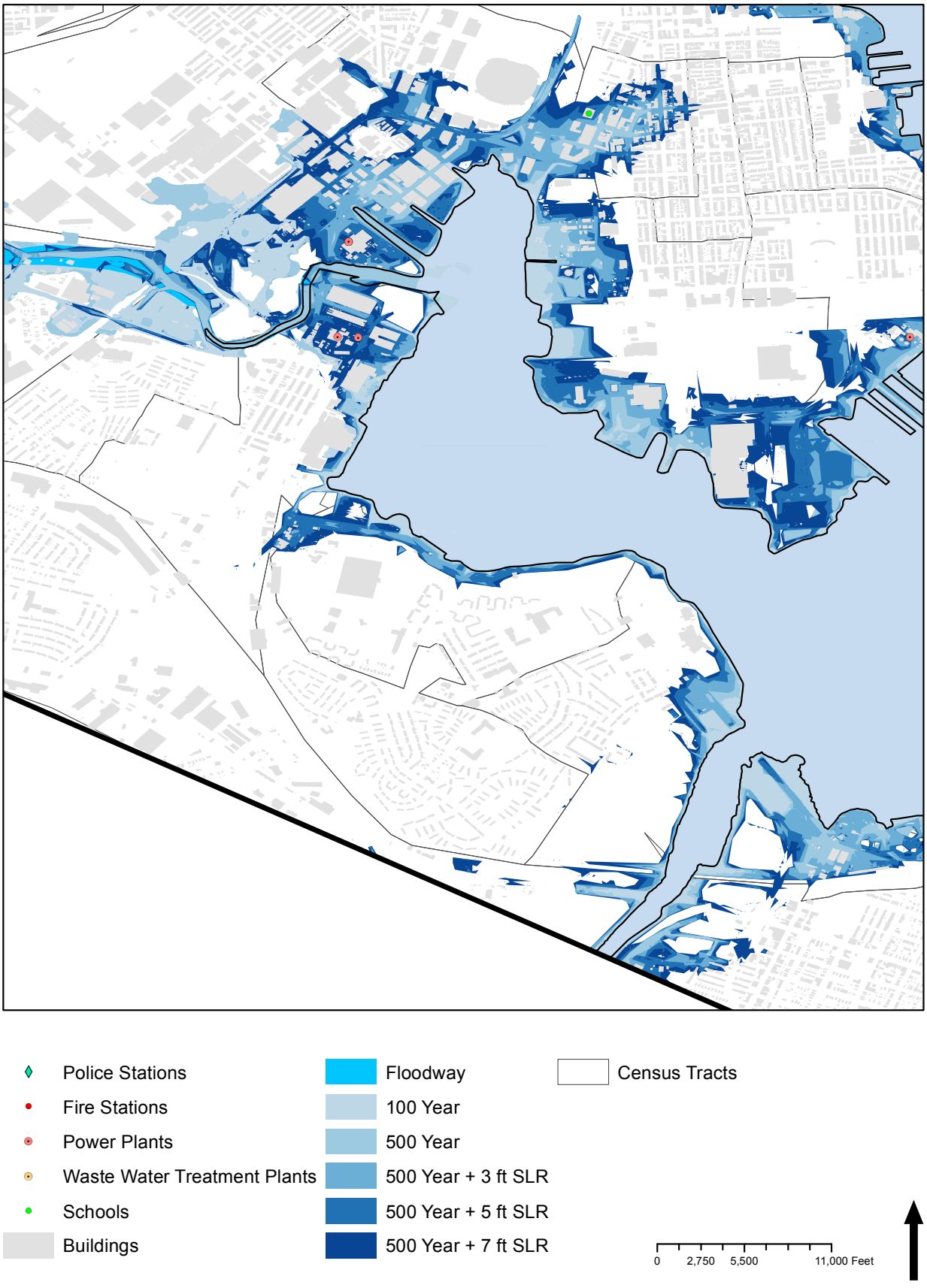
Appendix - Figure–2 Baltimore City Buildings in the Herring Run Floodway



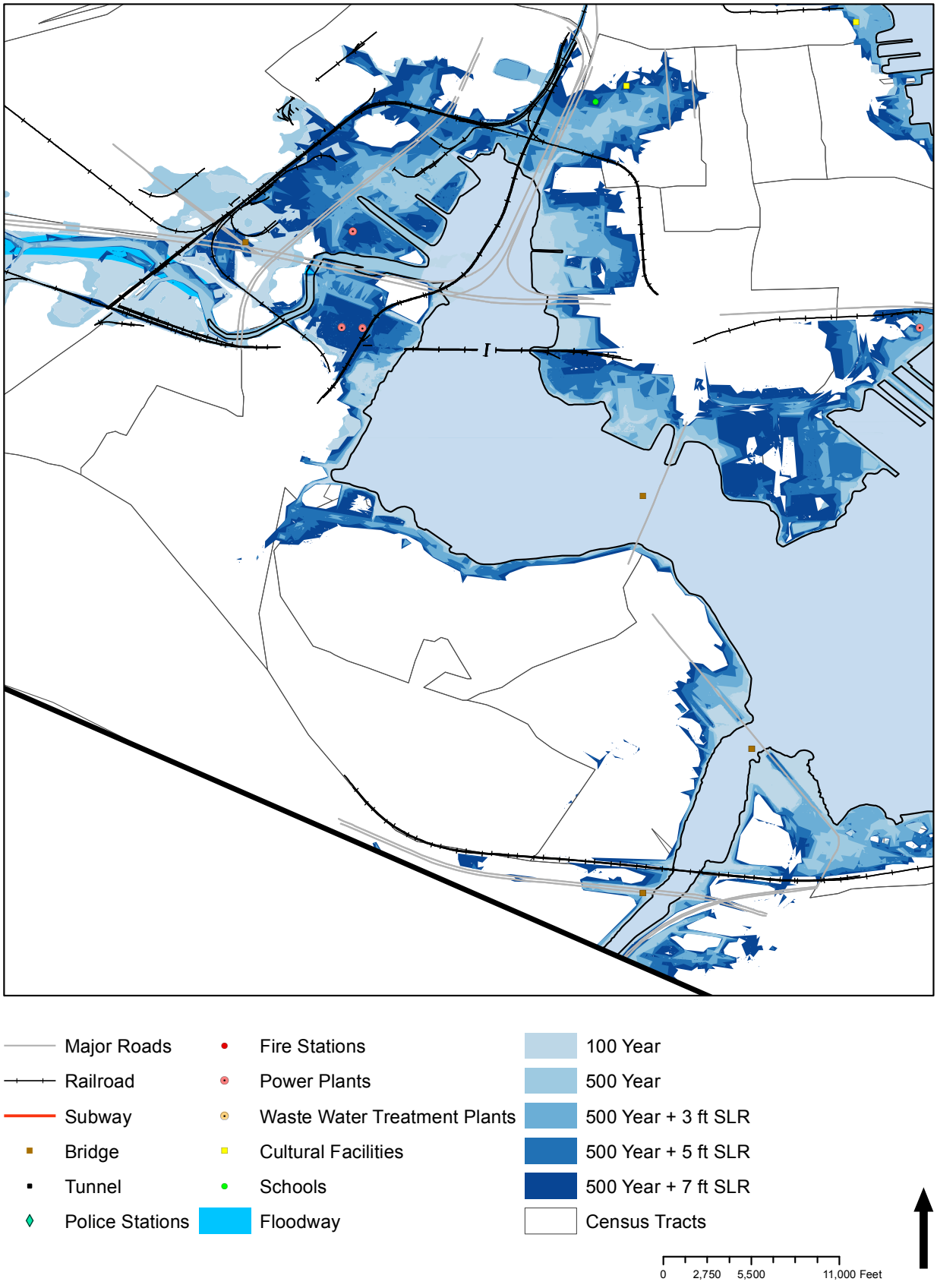
Appendix - Figure–3 Baltimore City Flood Hazard Areas



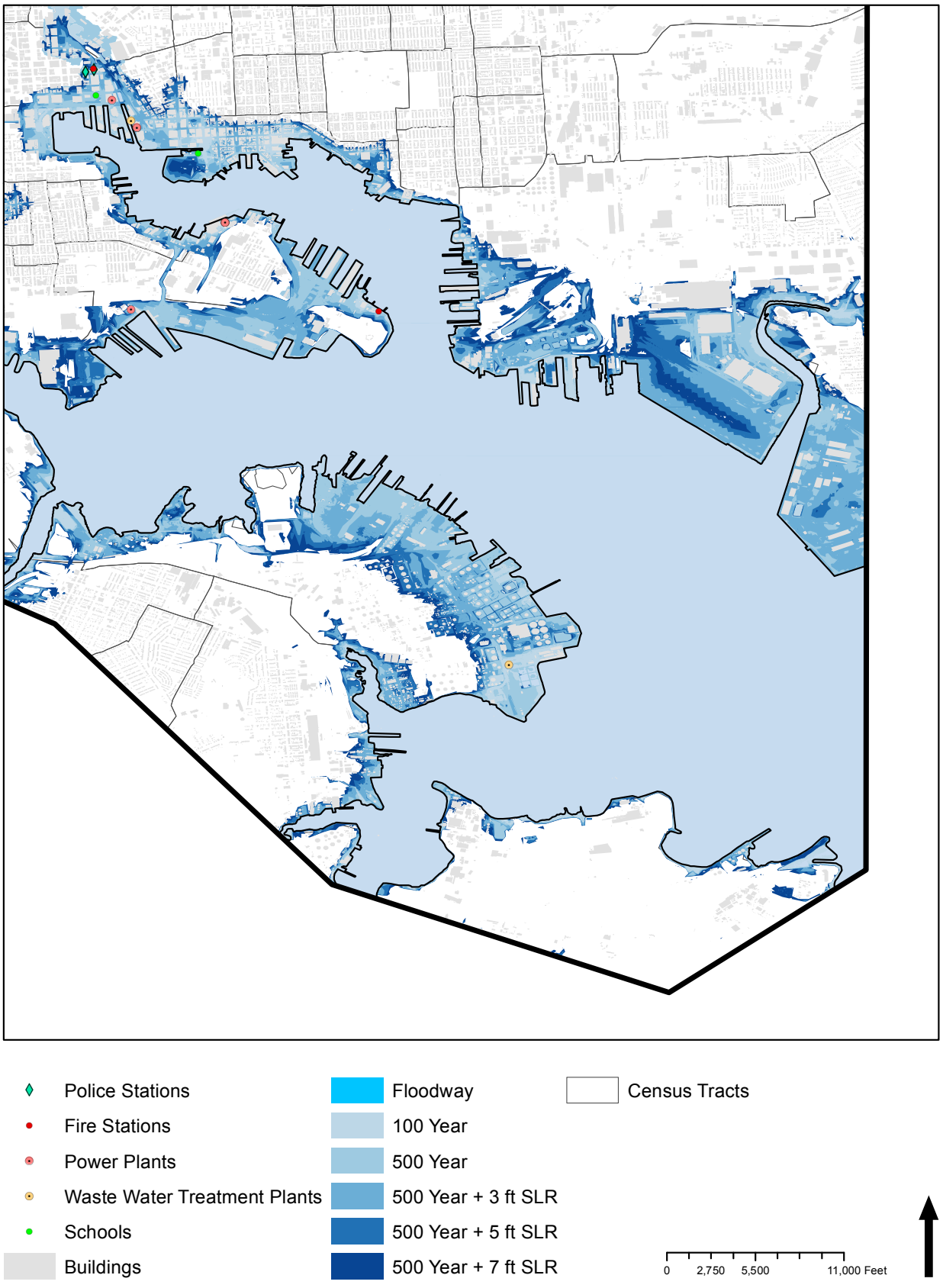
Appendix - Figure–4 Baltimore City Facilities in the Flood Hazard Areas



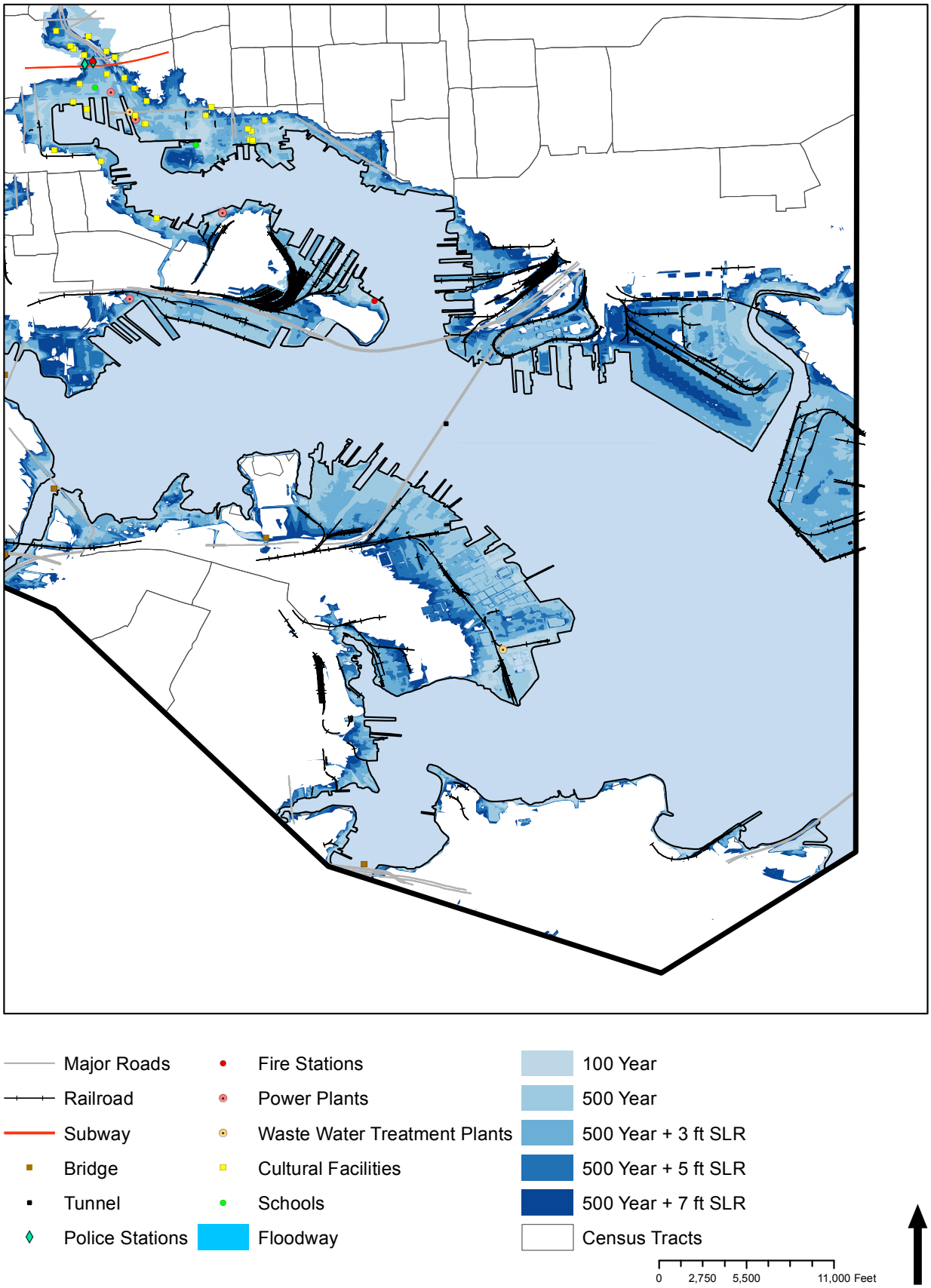
Appendix - Figure–1 Baltimore City Critical Facilities in Westport, Flood Exposure Zones *Source: HAZUS*



Appendix - Figure–2 Baltimore City Facilities (Critical and Other) in Westport, Flood Exposure Zones *Source: HAZUS*



Appendix - Figure–3 Baltimore City Critical Facilities in Industrial Port Areas, Flood Exposure Zones *Source: HAZUS*



Appendix - Figure–4 Baltimore City Facilities (Critical and Other) in the Industrial Port Areas, Flood Hazard Zones
Source: HAZUS

Prioritization

Appendix G: Spreadsheet of Strategies and Actions

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	ACTION LEAD AGENCY	STAKEHOLDERS	FINANCING OPTIONS	ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)	Financial Feasibility	Political Feasibility	Impact	Public Support	Overlap with CAP	Score
IN-1	**(MOEM)**	**Protect and enhance the resiliency and redundancy of electricity system**								
Work with the Maryland Public Service Commission (PSC) to minimize power outages from the local electric utility during extreme weather events by identifying and protecting critical energy facilities and located within the City	MOEM MEMA	BCRP (Forestry), BGE, Building Owners, DGS, DOT, DPW, Exelon, PSC, Utility customers, Veolia, Wheelabrator	• Baltimore City CIP • Federal Sources • BGE's existing funds allocated through the Smart Grid Investment Grant	Short	3	3	3	3	3	**15**
Evaluate the City of Baltimore utility distribution system, and identify "underground utility districts" using BGE's May 2013 short term reliability improvement plan	PSC DPW- city	BCRP (Forestry), BGE, Building Owners, DGS, DOT, DPW, Exelon, PSC, Utility customers, Veolia, Wheelabrator	• Baltimore City CIP • Federal Sources • BGE's existing funds allocated through the Smart Grid Investment Grant	Short	2	2	3	3	3	**13**
Support BGE's collaboration with the Maryland Public Service Commission to implement various smart grid solutions that will provide the City with real-time access to data during events	DPW	BCRP (Forestry), BGE, Building Owners, DGS, DOT, DPW, Exelon, PSC, Utility customers, Veolia, Wheelabrator	• Baltimore City CIP • Federal Sources • BGE's existing funds allocated through the Smart Grid Investment Grant	Short	3	2	2	2	3	**12**
Identify, harden, and water seal critical infrastructure relative to electrical, heating, and ventilation hardware within the flood plain	MOEM	BCRP (Forestry), BGE, Building Owners, DGS, DOT, DPW, Exelon, PSC, Utility customers, Veolia, Wheelabrator	• Baltimore City CIP • Federal Sources • BGE's existing funds allocated through the Smart Grid Investment Grant	Short-Medium	1	2	2	1	3	**9**
Increase resiliency in our energy generation system by encouraging the development of decentralized power generation and developing fuel flexibility capabilities	MOEM	BCRP (Forestry), BGE, Building Owners, DGS, DOT, DPW, Exelon, PSC, Utility customers, Veolia, Wheelabrator	• Baltimore City CIP • Federal Sources • BGE's existing funds allocated through the Smart Grid Investment Grant	Short-Medium	2	2	2	2	3	**11**
Develop a comprehensive maintenance and training program for City employees at facilities with backup generators to ensure proper placement, hook-up and function during hazard events.	MOEM	BCRP (Forestry), BGE, Building Owners, DGS, DOT, DPW, Exelon, PSC, Utility customers, Veolia, Wheelabrator	• Baltimore City CIP • Federal Sources • BGE's existing funds allocated through the Smart Grid Investment Grant	Short-Medium	1	2	2	2	0	**7**
Install external generator hookups for critical City facilities that depend on mobile generators for backup power	MOEM	BCRP (Forestry), BGE, Building Owners, DGS, DOT, DPW, Exelon, PSC, Utility customers, Veolia, Wheelabrator	• Baltimore City CIP • Federal Sources • BGE's existing funds allocated through the Smart Grid Investment Grant	Short-Medium	2	3	2	1	0	**8**
Partner with utility to evaluate protecting power and utility lines from all hazards.	MOEM	BCRP (Forestry), BGE, Building Owners, DGS, DOT, DPW, Exelon, PSC, Utility customers, Veolia, Wheelabrator	• Baltimore City CIP • Federal Sources • BGE's existing funds allocated through the Smart Grid Investment Grant	Short-Medium	**2**	**2**	**3**	**3**	3	**13**
Determine low-laying substation vulnerability and outline options for adaptation and mitigation.	PSC DPW- city	BCRP (Forestry), BGE, Building Owners, DGS, DOT, DPW, Exelon, PSC, Utility customers, Veolia, Wheelabrator	• Baltimore City CIP • Federal Sources • BGE's existing funds allocated through the Smart Grid Investment Grant	Short	2	2	3	2	3	**12**
Evaluate and protect low laying infrastructure - switching vaults, conduit and transformers	MOEM PSC	BCRP (Forestry), BGE, Building Owners, DGS, DOT, DPW, Exelon, PSC, Utility customers, Veolia, Wheelabrator	• BGE • Federal Funds • Local Funds	Short-Medium	2	2	2	1	3	**10**
IN-2	**(BoS)**	**Increase energy conservation efforts**								
Increase energy efficiency across all sectors through education, efficiency retrofits, and building management systems	BoS	BGE, Building owners, City Delegates, DOP, DPW, Energy Office, PSC	• MEA	Medium	3	3	3	3	3	**15**
Encourage critical facilities and institutions to connect to existing cogeneration systems, or develop new cogeneration systems	Energy Office (MEO)	BOS,BGE, Building owners, DOP, DPW, Energy Office, PSC	• Federal Emergency Grant Funds • Local Funds	Short-Long	2	2	3	2	3	**12**
Continue the City's electricity demand-response program during peak usage or pre-blackout periods	BGE	BGE, Building owners, City Delegates, DOP, DPW, Energy Office, PSC	• BGE • Federal Funds	Medium	2	3	2	1	3	**11**

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	**ACTION LEAD AGENCY**	**STAKEHOLDERS**	**FINANCING OPTIONS**	**ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)**	**Financial Feasibility**	**Political Feasibility**	**Impact**	**Public Support**	**Overlap with CAP**	**Score**
IN-3	**(MEO)**	**Ensure backup power generation for critical facilities and identified key infrastructure during power outages**								
Investigate off-grid, on-site renewable energy systems, generators, and technologies for critical facilities to ensure redundancy of energy systems	DGS	BGE, DGS, DHMH, DOP, DOT, DPW, MOEM	• Baltimore City CIP • Federal Programs	Medium	2	2	2	1	3	**10**
Seek funding to purchase and install generators for all city building designated as critical to agency functions	DGS	DGS, DOP, DOT, DPW, MOEM	• Federal Grants • State Grants	Short	2	2	2	1	0	**7**
Develop Combined Heat and Power (CHP) co-generation plants at identified critical facilities	MEO	DGS, DOP, DOT, DPW, MOEM	• Federal Funds • State Funds • Local Funds	Medium	2	3	3	1	3	**12**
Evaluate and ensure backup power generation is available to healthcare facilities (nursing homes, critical care facilities, hospitals, etc.)	MDH2E	DGS, DOP, DOT, DPW, MOEM	• Hospital Budgets • Federal Emergency Funds	Medium	2	2	3	2	0	**9**
IN-4	**(MOEM)**	**Protect and manage compressed liquefied natural gas sites and (city) fueling stations before and during hazard events**								
Work with BGE to ensure existing preparedness plans for Spring Gardens liquefied natural gas site incorporate its vulnerability to present and predicted flooding, storm surge and sea level rise	BGE	BGE, DGS, DOP, DOT, DPW, Veolia	BGE	Medium	1	2	3	1	0	**7**
Adopt building code that requires anchoring of 50 gallon storage tanks or larger	MOEM/HCD	MDE,BGE, DGS, DOP, DOT, DPW, Veolia		Medium	3	2	2	1	0	**8**
Support the Maryland Public Service Commission's effort to accelerate replacement of aging natural gas infrastructure which will harden the system against flooding	BGE	BGE, DGS, DOP, DOT, DPW, Veolia	BGE	Medium	2	2	2	2	0	**8**
IN-5	**(MOEM)**	**Evaluate and improve resiliency of liquid fuels infrastructure**								
Design and implement a generator program that assists private gas stations in securing backup generators, especially those stations along major evacuation routes	MOEM	BCFD, BCPD, DES, DOT, DPW, MOE	• Fuel Up Maryland • Federal Sources	Medium	2	3	2	1	0	**8**
Increase and ensure fuel availability during distribution disruptions	MOEM	BCFD, BCPD, DES, DOT, DPW, MOE		Medium	2	2	2	2	0	**8**
Ensure fuel for generators and delivery priority is given to critical facilities and emergency responders.	MOEM	BCFD, BCPD, DES, DOT, DPW, MOE		Medium	2	2	2	2	0	**8**
IN-6	**(MOEM)**	**Evaluate and improve resiliency of communication systems that are in place for sudden extreme weather events**								
Utilize new technologies such as fiber optics, external hook-ups, and mobile generators to improve resiliency	MOEM	BGE, DOT, Energy Office, FCC, MOIT, Private Entities, PSC	• Federal Grant Programs • State Grant Programs • Baltimore City CIP	Medium	2	2	2	3	0	**9**
Build redundancy into all public and inter-agency warning and communication systems	MOEM	BGE, DOT, Energy Office, FCC, MOIT, Private Entities, PSC	• Federal Grant Programs • State Grant Programs • Baltimore City CIP	Short	1	2	3	2	0	**8**
Identify best practices for the installation and management of flood proofing of all communications infrastructure at risk of water damage	DGS + DOP	BGE, DOT, MOE, MOEM, FCC, MOIT, Private Entities, PSC	• Federal Grant Programs • State Grant Programs • Baltimore City CIP	Short	2	2	2	2	0	**8**
Implement additional nurse triage phone lines and community health centers to reduce medical surge on hospitals	MDH2E	BGE, MOEM, DOT, Energy Office, FCC, MOIT, Private Entities, PSC	• Private Funding	Short	2	3	2	2	0	**9**
Evaluate and improve early warning systems for hazard events	MOEM	BCPD, BCFD, BGE, DHMH, DOP, DOT, Energy Office, FCC, JIS, MOIT, Private Entities, PSC	• Baltimore City CIP	Short	3	3	2	3	3	**14**
Ensure continued operation of city governments various computer mainframes for email, control systems, and internet service by having stand-by batteries for each with a capacity sufficient for backup generation to operate	MOIT	BGE, DOT, Energy Office, FCC, MOEM, Private Entities, PSC	• Baltimore City CIP	Short	2	2	2	2	0	**8**
Identify shared communication technology for emergency responders and government agencies to ensure continued and coordinated communication during emergency events	MOEM	BGE, DOT, Energy Office, FCC, MOIT, Private Entities, PSC	• Baltimore City CIP	Short	2	2	2	2	0	**8**
IN-7	**(DOT)**	**Integrate climate change into transportation design, building and maintenance**								

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	**ACTION LEAD AGENCY**	**STAKEHOLDERS**	**FINANCING OPTIONS**	**ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)**	**Financial Feasibility**	**Political Feasibility**	**Impact**	**Public Support**	**Overlap with CAP**	**Score**
Determine the coastal storm vulnerability and complete an exposure assessment of City transportation assets	DOT	CSX, DOT, DPW, MTA, Private Contractors	• Federal Grant Programs	Short	2	2	2	1	0	**7**
Improve stormwater management, operations and maintenance for stream flooding that erodes away bridge supports	DOT	CSX, DOT, DPW, MTA, Private Contractors	• Incorporate into existing Capitol Projects	Ongoing	2	3	2	2	0	**9**
Incorporate compliance with earthquake standards to withstand a magnitude eight earthquake for all new, improved and rebuilt bridges	DOT	CSX, DOT, DPW, MTA, Private Contractors	• Federal Funds • City Capitol Funds	Medium	2	2	2	2	0	**8**
Design bridges expansion joints for longer periods of high heat and develop a more robust inspection and maintenance process	DOT	CSX, DOT, DPW, MTA, Private Contractors	• Incorporate into existing Capitol Projects	Short	2	2	2	2	0	**8**
Research utilizing existing and new rating systems for all new infrastructure and road projects	DOT	CSX, DOT, DPW, MTA, Private Contractors		Medium	3	2	2	2	0	**9**
Identify, investigate, and incorporate Best Management Practices as they relate to transportation design, construction and maintenance	DOT	CSX, DOT, DPW, MTA, Private Contractors		Medium	3	2	2	2	0	**9**
Require that backup solar powered street lights and signals be integrated along evacuation routes and high traffic areas	DOT	CSX, DOT, DPW, MTA, Private Contractors	Emergency Grant Programs	Medium	1	2	3	1	3	**10**
IN-8	**(MOEM)**	**Identify additional alternative routes and modes for effective transport and evacuation efforts during emergency situations**								
Evaluate existing systems and develop a comprehensive evacuation plan	MOEM	BCFD, BCHD, DOP, DOT, MOEM	• Consider looking to MEMA or FEMA for planning assistance through the hazard mitigation grant program	Short	3	3	1	1	0	**8**
Coordinate evacuation plans with regional partners	MOEM	BCFD, BCHD, DOP, DOT, MOEM	• Federal Funds • State Funds • Local Funds	Short-Medium	3	3	3	3	0	**12**
Develop and prioritize clearance of specified transportation routes for delivery of emergency response supplies	DOT MOEM	BCFD, BCHD, DOP, DOT, MOEM	• Federal Funds • State Funds • Local Funds	Short	3	3	3	2	0	**11**
Educate the public on the dangers of driving through flooded roads	DOT MOEM	BCFD, BCHD, DOP, DOT, MOEM	• Federal Funds • State Funds • Local Funds	Short	3	3	3	3	0	**12**
Make available a network of dedicated pedestrian and bicycle transportation routes leading into and throughout the City	DOT	BCFD, BCHD, DOP, DOT, MOEM	• Federal Funds • State Funds • Local Funds	Ongoing	3	3	3	3	3	**15**
Identify and collaborate with bicycle groups and repair shops to assist in emergency response and accommodate alternate transportation needs	DOT	BCFD, BCHD, DOP, DOT, MOEM	• Private Funds	Short	3	3	3	3	0	**12**
IN-9	**(DOT)**	**Alter transportation systems in flood-prone areas in order to effectively manage stormwater**								
Prioritize infrastructure upgrades for roads identified at risk of flooding through the use of elevation data and Sea, Lake and Overland Surges from Hurricanes (SLOSH) model results	DOT	Amtrak, BCRP, CSX, Developers, DOT, DPW, FHWA, MDTA, MON, NGOs	• The City's existing capital plan	Long	1	1	2	2	0	**6**
Raise streets in identified flood prone areas as they are redeveloped	DOT	Amtrak, BCRP, CSX, Developers, DOT, DPW, FHWA, MDTA, MON, NGOs	• Federal Emergency Mangement Funding programs • Baltimore City Capitol Budget	Long	1	1	3	2	0	**7**
Encourage development of Green Streets in flood prone areas and throughout the City	Planning/ DOT	DOT, DPW, MON, Public, NGO's, Property Owners		Short-Ongoing	2	3	2	3	3	**13**
Encourage use of permeable pavement in non-critical areas – low-use roadways, sidewalks, parking lots and alleys where soils permit proper drainage	DPW	DOT, DPW, MON, Public, NGO's, Property Owners, Rec & Parks		Medium	1	2	1	1	0	**5**
Add pumps or other mitigation alternatives to streets as they are redeveloped (if needed)	DPW	Amtrak, BCRP, CSX, Developers, DOT, DPW, FHWA, MDTA, MON, NGOs	• Federal Emergency Mangement Funding programs • Baltimore City Capitol Budget	Long	2	2	2	2	3	**11**
Assess need for new culvert capacity and identify where upgrades are needed	DPW	Amtrak, BCRP, CSX, Developers, DOT, DPW, FHWA, MDTA, MON, NGOs	• Emergency Grant Programs	Long	2	2	2	3	0	**9**
Conduct an in-depth analysis of the impacts of drain fields that feed the harbor	DPW	Amtrak, BCRP, CSX, Developers, DOT, DPW, FHWA, MDTA, MON, NGOs	• Emergency Grant Programs	Medium-Long	2	2	2	2	0	**8**

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	**ACTION LEAD AGENCY**	**STAKEHOLDERS**	**FINANCING OPTIONS**	**ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)**	**Financial Feasibility**	**Political Feasibility**	**Impact**	**Public Support**	**Overlap with CAP**	**Score**
Expand and reinforce existing stormwater education programs	DPW	MTA, Amtrak, BCRP, CSX, Developers, DOT, DPW, FHWA, MDTA, MON, NGOs		Long	3	3	3	3	0	**12**
Design and implement floodgates and barriers in transportation tunnels	MOEM	Amtrak, BCRP, CSX, Developers, DOT, DPW, FHWA, MON, NGOs, MTA	• Funding options dependent on ownership of tunnel.	Long	1	1	3	1	0	**6**
Encourage Federal and State Government to design and install floodgates and barriers at vulnerable transportation tunnels	FHWA	Amtrak, BCRP, CSX, Developers, DOT, DPW, FHWA, MON, NGOs,MTA		Long	2	1	2	2	0	**7**
Upgrade existing floodgate hardware and mechanisms to control rise rate of water into all city tunnels	MOEM, CSX, Amtrak, MTA FHWA	Amtrak, BCRP, CSX, Developers, DOT, DPW, FHWA, MON, NGOs, MTA		Long	1	2	2	1	0	**6**
IN-10	**(CSX, Amtrack, MTA)**	**Ensure structural stability of all transportation tunnels to reduce impact from seismic activity**								
Repair cracks and leaks in all tunnels to reduce impact of seismic activity	CSX, Amtrak, MTA	Amtrak, CSX, DOT, DPW, FHWA, MDTA, MOEM, MTA	Funding options dependent on ownership of tunnel.	Medium	1	2	2	2	0	**7**
Follow Federal, State and Local criteria for the stabilization of Historic transportation tunnels (e.g. Howard Street)	CSX, Amtrak, MTA	Amtrak, CSX, DOT, DPW, FHWA, MOEM, MTA	Funding options dependent on ownership of tunnel.	Long	1	1	2	1	0	**5**
Install a seismically resistant fire standpipe, air monitoring, and automatic valve system in all tunnels to provide a fully automated and monitored fire suppression system	CSX, Amtrak, MTA	Amtrak, CSX, DOT, DPW, FHWA, MDTA, MOEM		Long	1	2	2	1	0	**6**
IN-11	**(DOT)**	**Evaluate changes to road maintenance and construction materials based on anticipated changes in climate**								
Implement a repaving strategy that reduces heat-related damage to asphalt and incorporates maintenance and operations that extend the life of the road surface	DOT	DOT, SHA	• The analysis of City infrastructure is an ongoing priority and could be completed as part of this ongoing process. • The City's existing capital plan	Long	2	2	1	3	3	**11**
Develop a reconstruction and repair strategy that reduces damage to concrete and incorporates better maintenance and operations	DOT	DOT, SHA	• The analysis of City infrastructure is an ongoing priority and could be completed as part of this ongoing process. • The City's existing capital plan	Long	2	2	2	3	0	**9**
Develop deicing strategies and materials that are effective in extreme cold temperatures and prolonged events to stabilize roadway and bridge surfaces	DOT	DOT, SHA		Long	1	1	2	3	0	**7**
Design pavement sections and materials that withstand longer periods of extreme heat events	DOT	DOT, SHA	• The analysis of City infrastructure is an ongoing priority and could be completed as part of this ongoing process. • The City's existing capital plan	Long	1	2	3	1	0	**7**
IN-12	**(DOT)**	**Enhance the resiliency of the City's waterfront to better adapt to impacts from hazard events and climate change**								
Raise bulkhead height along shoreline areas most at risk	DOT	BDC, Development Community, DGS, DHCD, DOP, DOT, MDE, MDNR, MOEM	• Federal Funding Sources	Long	1	1	3	1	0	**6**
Utilize vegetation and stone to stabilize and armor unprotected shorelines	DOT	BDC, Development Community, DGS, DHCD, DOP, DOT, MDE, MDNR, MOEM		Short	2	2	3	2	0	**9**
Encourage the development of integrated flood protection systems that use structural (engineering) and non-structural (wetlands) measures	USACE DOT MOEM DGS	BDC, Development Community, DGS, DHCD, DOP, DOT, MDE, MDNR, MOEM	• Federal Emergency Management Funds • Wetland and Wildlife funds • City Capitol Budget	Long	1	1	2	1	0	**5**
Review and enhance coastal area design guidelines to better mitigate the impacts of flooding	MDNR/ Planning	BDC, Development Community, DGS, DHCD, DOP, DOT, MDE, MDNR, MOEM	• Federal Funds • State Funds • Local Funds	Long	3	3	2	1	0	**9**
Enhance and strengthen waterfront zoning and permitting	Planning MDNR	BDC, Development Community, DGS, DHCD, DOP, DOT, MDE, MDNR, MOEM	• Federal Funds • State Funds • Local Funds	Long	3	2	2	1	0	**8**

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	**ACTION LEAD AGENCY**	**STAKEHOLDERS**	**FINANCING OPTIONS**	**ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)**	**Financial Feasibility**	**Political Feasibility**	**Impact**	**Public Support**	**Overlap with CAP**	**Score**
IN-13	**(DPW)**	**Increase the resilience of all wastewater systems and protect them from current and projected extreme weather events**								
Ensure all water and wastewater pumping stations have off-grid, on-site energy sources and/or reliable backup power sources by increasing the number of backups and pulling electricity from different grids	DPW/MEO	DPW, Energy Office, MOEM	• Utility CIP	Long	1	2	3	2	3	**11**
Evaluate the sewer system to identify and develop key areas for prevention of raw sewage overflows	DPW	DPW, MOEM	• Federal Funds • State Funds • Local Funds	Long	3	3	3	3	0	**12**
Develop and adopt increased level of protection for construction, redevelopment, and design of all water and wastewater facilities that incorporate future climate projections	DPW	DPW, Energy Office, MOEM	• Federal Funds • State Funds • Local Funds	Long	2	2	2	2	0	**8**
Retrofit and harden low-laying pumping stations and treatment plants in flood hazard areas	DPW	DPW, Energy Office, MOEM	• Utility CIP	Long	2	2	2	3	0	**9**
Ensure effective operations and security for wastewater treatment plants if facilities are overwhelmed by hazard event	DPW	DPW, Energy Office, MOEM		Long	2	2	2	1	0	**7**
Establish the capability of wastewater treatment plants to function during large storm events and establish protocols for storms that overwhelm the system	DPW	DPW, Energy Office, MOEM	Federal, State and Local funds	Long	2	2	2	1	0	**7**
Increase stormwater recharge areas and quantity management to prevent flooding from overflows	DPW	DPW, MOEM	• Utility CIP	Long	2	2	2	2	0	**8**
Conduct an assessment of the City's current water system to identify age, condition of infrastructure, capacity, weaknesses and areas for priority upgrades	DPW	DPW, MOEM		Long	1	2	3	3	0	**9**
Conduct and utilize a detailed risk assessment to determine vulnerability of the sewage treatment plant to prevent overflows from extreme storm events	DPW	DPW, Energy Office, MOEM	• Federal Funds • State Funds • Local Funds	Long	1	2	3	2	0	**8**
Determine the elevation of sewage treatment buildings, tank construction details, and if the plant is at risk of back flow, for improvements to withstand coastal storm events	DPW	DPW, Planning, MOEM	• Utility CIP	Long	1	2	3	2	0	**8**
Retrofit wastewater treatment facility and methane gas storage system to withstand seismic activity to protect against earthquakes. Design facility to exceed current building codes	DPW	DPW, DGS, MOEM	• Federal Funds • State Funds • Local Funds	Long	1	1	2	2	0	**6**
IN-14	**(DPW)**	**Integrate resiliency, redundancy, and structural stability into the City's drinking and water system to ensure safe and reliable water storage and distribution**								
Repair leaks and improve connection from all City reservoirs and the Susquehanna River	DPW	BCHD, BCRP, DHCD, DHMH, DOP, DOT, DPW, MCC, MDE, Regional Watershed Groups, Reservoir Watershed Management Committee, SHA, Water Utility	• The City's existing capital plan • Federal Funding Sources	Short-Long	1	1	2	2	0	**6**
Provide water conservation education, and continue to protect our watersheds to assist in maintaining water quality	DPW MDNR	BCHD, BCRP, DHCD, DHMH, DOP, DOT, DPW, MCC, MDE, Regional Watershed Groups, Reservoir Watershed Management Committee, SHA, Water Utility	• Grant Progams • Educational Budget of Stormwater Utility	Short	2	3	3	3	3	**14**
Ensure dam emergency plans account for impacts of climate change	DPW MOEM	BCHD, BCRP, DHCD, DHMH, DOP, DOT, DPW, MCC, MDE, Regional Watershed Groups, Reservoir Watershed Management Committee, SHA, Water Utility		Medium	2	2	2	2	0	**8**
Identify and document post damage responsibilities in memorandums of understanding as addendums to Reservoir Watershed Management Agreement	DPW	MOEM, Planning,		Short	3	3	3	3	0	**12**
Review dam capacity, load and failure points and review them against 1,000 year and 10,000 year precipitation events	DPW MOEM	BCHD, BCRP, DHCD, DHMH, DOP, DOT, DPW, MCC, MDE, Regional Watershed Groups, Reservoir Watershed Management Committee, SHA, Water Utility	Federal Emergency Grants	Medium	1	2	3	1	0	**7**
Conduct a study to determine seismic design standards and seismic resiliency of drinking water distribution system (tunnels, piping, clean water pump stations, dams, shafts, and tanks)	DPW	BCHD, BCRP, DHCD, DHMH, DOP, DOT, DPW, MCC, MDE, Regional Watershed Groups, Reservoir Watershed Management Committee, SHA, Water Utility	Federal Emergency Grants	Medium	1	1	2	1	0	**5**

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	**ACTION LEAD AGENCY**	**STAKEHOLDERS**	**FINANCING OPTIONS**	**ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)**	**Financial Feasibility**	**Political Feasibility**	**Impact**	**Public Support**	**Overlap with CAP**	**Score**
Increase stormwater recharge areas and quantity management	DPW	BCHD, BCRP, DHCD, DHMH, DOP, DOT, DPW, MCC, MDE, Regional Watershed Groups, Reservoir Watershed Management Committee, SHA, Water Utility		Short	2	2	2	2	3	**11**
Evaluate the impacts of sediment loading on reservoir capacity	DPW	BCHD, BCRP, DHCD, DHMH, DOP, DOT, DPW, MCC, MDE, Regional Watershed Groups, Reservoir Watershed Management Committee, SHA, Water Utility	Utility CIP funds	Short	1	1	2	1	0	**5**
Manage watershed forests to provide maximum benefits for water quality and to maintain resiliency during extreme weather events	MDNR	BCHD, BCRP, DHCD, DHMH, DOP, DOT, DPW, MCC, MDE, Regional Watershed Groups, Reservoir Watershed Management Committee, SHA, Water Utility		Short	2	3	3	3	3	**14**
Adopt new policies on salt application to prevent high salinization on drinking water supplies	DOT	DPW, MDE, SHA, Balto Co Govt, Regional watershed groups, NGO's	• Federal Funds • State Funds • Local Funds	Medium	2	2	3	1	0	**8**
Establish a structured Firming Program to maintain adequate storage and water quality in the source-water reservoirs during drought conditions	DPW MOEM	BCHD, BCRP, DHCD, DHMH, DOP, DOT, DPW, MCC, MDE, Regional Watershed Groups, Reservoir Watershed Management Committee, SHA, Water Utility		Medium	1	2	2	1	0	**6**
Maintain appropriate agreements with Susquehanna River Basin Commission (SRBC) and the Exelon Power Company to ensure adequate water withdraws from the Susquehanna River during drought emergency	DPW	BCHD, BCRP, DHCD, DHMH, DOP, DOT, MOEM, MCC, MDE, Regional Watershed Groups, Reservoir Watershed Management Committee, SHA, Water Utility		Medium	1	1	2	1	0	**5**
IN-15	**(DPW)**	**Conduct an assessment that evaluates and improves all pipes' ability to withstand extreme heat and cold**								
Replace old and malfunctioning pipes with new pipes or retrofit existing pipes with new lining	DPW	DOT	• The analysis of City infrastructure is an ongoing priority and could be completed as part of this ongoing process. • The City's existing capital plan	Short to Medium; Ongoing	1	2	2	3	3	**11**
Evaluate and utilize new technology that allows for greater flexibility in pipes as they are replaced	DPW	DOT	Federal Grant Programs, City Utility CIP	Short to Medium; Ongoing	1	2	2	1	0	**6**
IN-16	**(DPW)**	**Enhance and expand stormwater infrastructure and systems**								
Implement the requirements of Baltimore's MS4 (separate stormwater and sewer system) permit	DPW	Community Groups, DOT, DPW, MOEM, MDNR, NGOs, Private Developers, Stormwater Utility	• The Stromwater Utility existing capital plan	Short	3	3	3	2	0	**11**
Prioritize storm drain upgrades and replacement in areas with reoccurring flooding	DPW	DOT, Community Groups	Stormwater Utility	Short	2	2	2	3	0	**9**
Install backflow-prevention devices or other appropriate technology along waterfront to reduce flood risk	DPW	Community Groups, DOT, MOEM,	• Federal Funds • State Funds • Local Funds	Medium-Long	1	2	2	2	0	**7**
Preserve and protect natural drainage corridors	DPW	Community Groups, DOT, DPW, MOEM, MDNR, NGOs, Private Developers, Stormwater Utility	Ongoing as part of environmental enforcement efforts and stream restoration projects.	Short	2	2	2	2	0	**8**
Review and revise storm drain design on a continuous basis, to accommodate projected changes in intense rainfall	DPW	Community Groups, DOT, DPW, MOEM, MDNR, NGOs, Private Developers, Stormwater Utility, USACE	• The analysis of City infrastructure is an ongoing priority and could be completed as part of this ongoing process. • The City's existing capital plan	Long, Ongoing	1	2	3	2	0	**8**
IN-17	**(DOP)**	**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	Planning	BCRP, BDW, BDC, Citizens, DHCD, DOP, DOT, DPW, NGOs, Private Developers		Medium	2	2	2	2	0	**8**
Encourage urban landscaping requirements and permeable surfaces into community managed open spaces	Planning	BCRP, BDW, BDC, Citizens, DHCD, DOP, DOT, DPW, NGOs, Private Developers	Small grants programs at Parks and People, Other Foundation Grants	Short	2	3	2	3	0	**10**
Utilize water conservation elements such as green roofs, rain gardens, cisterns, and bioswales on residential, commercial, industrial, and City-owned properties to capture stormwater	HCD, Planning, DPW	BDC, BCRP, BDW, Citizens, DHCD, DOP, DOT, DPW, NGOs, Private Developers		Short-Medium	2	3	2	3	3	**13**

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	**ACTION LEAD AGENCY**	**STAKEHOLDERS**	**FINANCING OPTIONS**	**ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)**	**Financial Feasibility**	**Political Feasibility**	**Impact**	**Public Support**	**Overlap with CAP**	**Score**
Encourage permeable paving on low-use pathways	Planning	BCRP, BDC,, Citizens, DHCD, DOP, DOT, DPW, NGOs, Private Developers		Medium	1	2	2	2	0	**7**
IN-18	**(DPW)**	**Evaluate and support DPW's stream maintenance program.**								
Review and improve status of standing maintenance requirements	DPW	DOT, DOP, MDE, MDNR, MOEM, USACE	• The analysis of City infrastructure is an ongoing priority and could be completed as part of this ongoing process. • The City's existing capital plan	Ongoing	2	2	2	1	0	**7**
Ensure adequate funding is in place to support stream maintenance	DPW	DOT, DOP, MDE, USACE	Stormwater Utility CIP	Ongoing	1	2	3	3	0	**9**
Identify opportunities where stream restoration efforts will off-set maintenance costs	DPW	DOT, DNR, MDE, MDNR, MOEM, USACE		Ongoing	2	3	3	3	0	**11**
Identify interdependencies and benefits of stream maintenance with other transportation programs	DOT	DPW, MDE, MDNR		Ongoing	2	2	2	2	0	**8**
Clear streams on a regular basis, prioritize dredging the stream beds, and increase inspection and cleaning of culverts and storm drains to prevent flooding	DPW	DOT, MDE, MOEM, USACE	Stormwater and DOT ongoing maintenance programs	Ongoing	1	2	2	3	0	**8**
IN-19	**(DPW)**	**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)	DPW	BCRP, County Governments, DOP, DPW, MCC, MDNR, NGOs, Stormwater Utility		Ongoing	2	2	3	2	0	**9**
Encourage information sharing within the Chesapeake Bay community to assist in developing best management practices	DPW	County Governments, DOP, MDNR, NGOs		Ongoing	2	2	2	3	0	**9**
IN-20	**(DPW)**	**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	DPW	Planning, MOEM, R&P, MOEM, BGE, NGOs		Short	3	3	1	2	0	**9**
Expand and integrate existing programs to reduce or intercept debris before it gets into the streams and harbor	DPW	DPW, DOT, NGOs	Stormwater Utility Operating Progams and CIP	Medium	1	3	3	3	0	**10**
Develop and promote solid waste management actions for citizens to implement before a hazard event	DPW	DPW, MOEM, NGOs	Existing trash management education budgets.	Short	2	3	3	3	3	**14**
IN-21	**(DOP)**	**Encourage the integration of climate change and natural hazards into private and State planning documents, systems, operations, and maintenance**								
Incorporate consideration of hazards and climate adaptation efforts into all plans, systems, operations, and maintenance.	DOP	DPW, DOT, DGS, SHA, MTA, MEMA, MOEM		Medium	2	3	2	2	3	**12**
Ensure Red Line planning incorporates adaptation strategies.	MTA	DOT, DOP		Short	2	3	3	2	3	**13**
Ensure hazard scenarios, utilized in vulnerability assessments, are at a minimum 25% greater in intensity and impact than historical record events to date.	DOP	MOEM, DOT, Health Care Community, Hospitals, MD2HE, MEMA, MTA, MOEM, SHA		Ongoing	1	2	2	1	0	**6**
Develop guidelines for hospital, health care facilities and other institutional entities (e.g. Universities).	MOEM	DOT, Health Care Community, Hospitals, MD2HE, MEMA, MTA, MOEM, SHA	Utilize Hazard Mitigation Grant Programs	Ongoing	1	2	2	2	0	**7**
Partner with regional air quality institutions to integrate air quality measures and messaging into City climate change policy efforts	BCHD	Health Care Community, Hospitals, MD2HE, MEMA, MTA, MOEM, SHA		Ongoing	2	1	2	2	3	**10**
IN-22	**(DOP)**	**Develop City policy which requires new city government capital improvement projects to incorporate hazard mitigation principles**								
Discourage new public projects in hazard-prone areas such as floodplains or the coastal high hazard areas	DOP	BCHD, BCRP, DGS, DOP, DOT, DPW, MOEM	• The City's existing capital plan	Short to Medium; Ongoing	1	2	3	1	0	**7**
Utilize hazard mitigation design requirements that exceed minimum standards for critical facilities	DOP	BCHD, BCRP, DGS, DOP, DOT, DPW, Energy Office, MOEM		Short to Medium; Ongoing	1	2	2	1	0	**6**

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	**ACTION LEAD AGENCY**	**STAKEHOLDERS**	**FINANCING OPTIONS**	**ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)**	**Financial Feasibility**	**Political Feasibility**	**Impact**	**Public Support**	**Overlap with CAP**	**Score**
Use comprehensive infrastructure assessments to identify infrastructure in need of replacement and prioritize funding for those projects	DGS	BCHD, BCRP, DOP, DOP, DOT, DPW, Energy Office, MOEM		Short to Medium; Ongoing	1	2	3	1	0	**7**
B-1	**(MOEM)**	**Develop and implement hazard protections for critical facilities including hospitals, fire stations, police stations, hazardous material storage sites, etc.**								
Conduct educational outreach for city-owned, residential, commercial, and industrial buildings about proper storage and disposal of hazardous materials and heating oil	MOEM	BGE, DGS, DOP, DPW, Hospitals, Material Storage Sites	Utilize Hazard Mitigation Grant Programs	Short	3	3	1	3	0	**10**
Require hazardous materials stored in city-owned, residential, commercial, and industrial buildings within the floodplain to be elevated a minimum of three feet above the freeboard	MOEM	BGE, DGS, DOP, Hospitals, Material Storage Sites		Medium	3	3	3	3	0	**12**
Require new critical facilities to be designed with redundant operating systems	Planning MOEM	BGE, DGS, DOP, Hospitals, Material Storage Sites	Existing Capitol Budgets	Long	1	2	3	2	0	**8**
Require pre-wiring for generators at all facilities designated critical to agency operations and hazard response	DGS	BGE, DGS, DOP, Hospitals, Material Storage Sites	Existing Capitol Budgets	Medium	2	2	2	2	0	**8**
Develop stricter flood regulations for critical facilities	DOP	BGE, DGS, MOEM, Hospitals, Material Storage Sites		Medium	2	2	3	2	0	**9**
Develop partnership with private fueling stations to provide backup generators in exchange for a commitment to fueling emergency response vehicles during a hazard event	MOEM	BGE, DGS, DOP, Hospitals, Material Storage Sites		Medium	2	2	2	2	0	**8**
Ensure storage of and access to fuel for generators in critical facilities	MOEM	BGE, DGS, DOP, Hospitals, Material Storage Sites		Medium	3	3	3	2	0	**11**
B-2	**(DOP)**	**Enhance City building codes that regulate building within a floodplain or near the waterfront**								
Design new projects to be resilient to a mid-century sea level rise projection and adaptable to longer-term impacts	DOP, HCD, MOEM	Baltimore County, BDC, DPW, MDE, Utilities	Existing Capitol Budgets		1	2	3	1	0	**7**
Incorporate climate change and coastal hazard considerations into building codes by increasing freeboard requirements to two feet as buildings are redeveloped and renovated	DOP	Baltimore County, BDW, DHCD, DOP, DPW, MDE, Utilities		Short	1	2	3	1	0	**7**
Continue to regulate to the existing tidal floodplain delineation as adopted 2 February, 2012	DOP	Baltimore County, BDC, DHCD, DOP, DPW, MDE, Utilities		Short	1	2	3	1	0	**7**
Incorporate outfall elevation regulations	DPW, DOP	Baltimore County, BDW, DHCD, DOP, MDE		Short-Medium	2	2	3	1	0	**8**
Develop Construction Best Practices for development within floodplains	DOP	Baltimore County, BDC, DHCD, DOP, DPW, MDE, Utilities		Short	3	3	3	3	3	**15**
Train all code enforcement and building inspectors about flood proofing techniques and the local floodplain ordinance	MDE, DOP	Baltimore County, BDW, DHCD, DPW, MDE, Utilities		Medium	3	2	1	1	0	**7**
Encourage green roof installations to include vegetative and reflective technologies for all new commercial, industrial, multifamily, and city-owned development	HCD	BDC, DHCD, DOP, DPW, MDE, Utilities		Medium	2	2	3	3	3	**13**
B-3	**(DOP)**	**Strengthen City zoning, floodplain and construction codes to integrate anticipated changes in climate**								
Review zoning and strengthen language (where necessary) in order to better protect citizens and increase resiliency in buildings	DOP	BDC, City Government, Community Groups, DHCD, DGS, DPW, NAHB, NGOs, MDE, Private developers, Private land owners	Local Funding	Medium	3	3	1	2	0	**9**
Review and amend existing building and floodplain regulations to require more flood resistant new and existing structures when located in the floodplain	DOP	BDC, City Government, Community Groups, DHCD, DGS, DPW, NAHB, NGOs, MDE, Private developers, Private land owners	Local Funding	Medium, Ongoing	2	2	3	1	0	**8**
Utilize open space category in zoning code to protect sensitive areas (e.g. stormwater sites, steep slopes, floodways, etc.)	DOP	BDW, City Government, Community Groups, DHCD, DGS, DPW, NAHB, NGOs, MDE, Private developers, Private land owners		Medium	1	1	2	2	0	**6**
Review and increase Flood Protection Elevation (Base Flood Elevation + Freeboard) standards to the highest available State, Federal or local elevation level	DOP	BDW, City Government, Community Groups, DHCD, DGS, DPW, NAHB, NGOs, MDE, Private developers, Private land owners	• Federal Funds • State Funds • Local Funds	Short	2	3	2	2	0	**9**

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	**ACTION LEAD AGENCY**	**STAKEHOLDERS**	**FINANCING OPTIONS**	**ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)**	**Financial Feasibility**	**Political Feasibility**	**Impact**	**Public Support**	**Overlap with CAP**	**Score**
Evaluate and update stormwater management regulations to avoid increases in downstream flooding	DOP	BDC, Community Groups, DHCD, DGS, DPW, NAHB, NGOs, MDE, Private developers, Private land owners	• Federal Funds • State Funds • Local Funds	Short	1	2	3	2	0	**8**
Adopt design requirements that include wet and dry flood proofing techniques	DOP	BDC, Community Groups, DHCD, DGS, DPW, NAHB, NGOs, MDE, Private developers, Private land owners	• Federal Funds • State Funds • Local Funds	Short	2	2	3	3	0	**10**
Review and consider adoption of the International Green Construction code	HCD	BDC, DOP, Community Groups, DHCD, DGS, DPW, NAHB, NGOs, MDE, Private developers, Private land owners	Local Funding	Short Ongoing	2	2	3	2	3	**12**
B-4	**(DOP)**	**Update a list of flood prone and repetitive loss buildings to consider for acquisition**								
Continue to acquire property (including repetitive loss properties) in the special flood hazard areas where feasible and appropriate	DOP	DHCD, MEMA, MDE, Office of Real Estate	• Additional funds may be needed for print publications and web-based materials • Explore funding opportunities from MEMA, FEMA, MOEM, and other agencies	Ongoing	3	3	2	2	0	**10**
Prioritize Hazard Mitigation Assistance funding for mitigation of repetitive loss properties and severe repetitive loss properties	MOEM	DHCD, DOP, MEMA, MDE, Office of Real Estate	• Federal Funds • State Funds • Local Funds	Ongoing	3	2	2	2	0	**9**
Develop a creative financing program for flood resiliency in industrial buildings	BDC	DHCD, DOP, MEMA, MDE, Office of Real Estate	• Federal Funds • State Funds • Local Funds	Ongoing	1	1	2	2	0	**6**
B-5	**(DHCD)**	**Improve wind resiliency of new and existing structures**								
Review local building codes to determine if revisions are needed to improve the structures ability to withstand greater wind velocities and storm impacts	HCD	BDC, Commercial Building Owners, DGS, DOP, MDE, MOEM, Private Developers	• Federal Funding Sources	Short	3	3	1	1	0	**8**
Retrofit emergency shelter windows to withstand winds associated with coastal storm events	DGS	Commercial Building Owners, DCHD, DGS, DOP, MDE, MOEM, Private Developers	• Federal Emergency Management Funding	Long	1	2	2	2	0	**7**
B-6	**(DGS)**	**Evaluate various seismic design enhancements using prototypical Baltimore City building types**								
Determine engineering effectiveness and cost-benefit of various earthquake mitigation measures using computer modeling	DGS	DCHD, MOEM, USGS	• The analysis of City infrastructure is an ongoing priority and could be completed as part of this ongoing process. • The City's existing capital plan	Short	1	1	2	1	0	**5**
B-7	**(DOP)**	**Retrofit existing buildings in the designated Flood Area to increase resiliency**								
Target and encourage flood resiliency retrofits for buildings in the designated Flood Area	DOP	BDC, DHCD, DPW, Federal and State Partners, MCC, MON, NGOs, MOEM	• Federal Funding Sources • Housing Recovery Funding • NFIP • Commercial Insurance Policies • FEMA Public Assistance Program	Long	1	2	3	1	0	**7**
Prioritize retrofitting and increasing resiliency of Public Housing units in the designated Flood Area and other high risk areas	DHCD, DOP	BDC, DPW, Federal and State Partners, MON, MOEM		Long	1	1	2	2	0	**6**
Educate building owners within the floodplain to ensure that all electrical, mechanical, and key building systems are above the base flood elevation and meet existing codes	DOP	BDC, DHCD, DPW, Federal and State Partners, MCC, MON, NGOs, MOEM		Long	2	2	2	3	0	**9**
B-8	**(DGS)**	**Improve resource conservation practices in all city owned buildings**								
Install energy-efficient and low-water-use equipment during renovations in all City-owned buildings	DGS	MOE, BCPSS, DCHD, DGS, DOP	• MEA's Jane E. Lawton Conservation Loan Program • MEA's State Agency Loan Program (SALP)	Medium	2	3	3	2	3	**13**
Support energy efficiency and weatherization as part of Baltimore City schools ten-year plan	DOP	MOE, BCPSS, DCHD, DGS, DOP	BCPSS CIP	Short	3	3	2	3	3	**14**
Update Baltimore green building standards by offering multiple compliance paths for new and substantially renovated construction	DHCD, DOP	BCPSS, DCHD, DGS, DOP		Medium	2	2	2	2	3	**11**

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	**ACTION LEAD AGENCY**	**STAKEHOLDERS**	**FINANCING OPTIONS**	**ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)**	**Financial Feasibility**	**Political Feasibility**	**Impact**	**Public Support**	**Overlap with CAP**	**Score**
B-9	**(DOP)**	**Conduct educational outreach to increase resource conservation practices in private buildings**								
Conduct educational outreach and provide information about savings related to reduced water use	DPW	BCPSS, BGE, BOS, DOP, Exelon, MON, NGOs, MOEM	• Housing Recovery Funding • MEA's Jane E. Lawton Conservation Loan Program	Short	3	3	1	3	3	**13**
Educate and provide resources and information about utility rebate programs	BGE	BCPSS, DOP, DPW, Exelon, MON, NGOs, MOEM		Short	3	3	3	3	3	**15**
Provide energy efficiency education to include information on conserving electrical power. Emphasize reductions during summer peak demand hours	DOP	BCPSS, BGE, DPW, Exelon, MON, NGOs, MOEM	State, Local and Foundation Funding	Short	3	3	3	3	3	**15**
B-10	**(DOP)**	**Use HAZUS-MH computer modeling to determine losses generated by coastal storms**								
Utilize engineering studies and cost-benefit analyses to identify additional mitigation needs and actions	DOP	FEMA, MEMA, MOEM, NOAA	Emergency Management Grant Programs	Short	2	2	2	2	0	**8**
Evaluate various building design enhancements to reduce losses generated by earthquakes, floods, and storm surge	DOP	DHCD,FEMA, MEMA, MOEM, NOAA		Short	2	1	2	1	0	**6**
NS-1	**(BCRP)**	**Utilize green corridors and parks to help protect surrounding communities from the impacts of hazard events**								
Evaluate green corridors and parks for possible improvements for floodplain management	Rec & Parks	DOP, Community Groups, DPW, NGO's		Medium	1	2	1	2	3	**9**
Increase the resiliency of park facilities and buildings	R&P	DOP, MOEM, Community Groups, NGOs	Ongoing R&P Capitol Budget	Medium	1	2	2	2	3	**10**
NS-2	**(BCRP Forestry)**	**Increase and enhance the resilience and health of Baltimore's urban forest**								
Anticipate the impacts of future changes in temperature and weather on the urban forest by developing a comprehensive list of plant and tree species known to have a broad range of environmental tolerances	Rec & Parks	BGE, Community Groups, DOP, DOT, DPW, MDNR, NGOs	Local and Foundation Funding	Short	3	3	3	2	3	**14**
Establish and routinely update a comprehensive tree inventory to anticipate insect and forest structural impacts of climate change	Rec & Parks	BGE, Community Groups, DOP, DOT, DPW, MDNR, NGOs	State, Local and Foundation Funding	Short	3	3	3	2	3	**14**
Establish a comprehensive maintenance program that includes pruning for sound structure and the removal of hazardous limbs and trees. First focus on areas where vulnerable infrastructure is nearby such as energy supply and roads	Rec & Parks	USFS, BGE, Community Groups, DOP, DOT, DPW, MDNR, NGOs	R&P Operating Budget Federal, State, Local and Foundation Funding	Medium	2	3	3	2	3	**13**
Continually adjust and modify planting details and specifications to assure the health and longevity of trees	Rec & Parks	USFS, BGE, Community Groups, DOP, DOT, DPW, MDNR, NGOs	Federal, State, Local and Foundation Funding	Short	2	1	2	1	0	**6**
Increase the urban tree canopy and target areas with urban heat island impacts	Rec & Parks	USFS, BGE, Community Groups, DOP, DOT, DPW, MDNR, NGOs	Baltimore City Capitol Budget, Mitigation Funds, Forest Conservation Program	Ongoing	2	2	2	2	3	**11**
NS-3	**(DOP)**	**Create an interconnected network of green spaces to support biodiversity and watershed based water quality management**								
Utilize the Growing Green Initiative to increase green spaces in areas where there is available vacant land in order to reduce the heat island effect	Planning	HCD, DPW, Rec & Parks, BDC, State Agencies, Federal Agencies, NGO's, Community Groups	• Federal Grants • State Grants • Foundation Grants	Ongoing	2	3	3	2	3	**13**
Convert vacant land and row houses into meaningful and connected open space	HCD	BCRP, BDC, Community Groups, DHCD, DOP, DPW, Federal Agencies, MDNR, NGOs, State Agencies	• Baltimore City Bond Funds	Ongoing	2	3	3	2	3	**13**
Complete a habitat analysis and plan for the City	DOP	BCRP, BDC, Community Groups, DHCD, DOP, DPW, Federal Agencies, MDNR, NGOs, State Agencies	• Federal Grants • State Grants • Foundation Grants	Ongoing	3	2	1	2	3	**11**
Create a strategic plan that identifies areas of focus for tree planting, stormwater management, and forest preservation	DOP	BCRP, BDC, Community Groups, DHCD, DOP, DPW, Federal Agencies, MDNR, NGOs, State Agencies	• Federal Grants • State Grants • Foundation Grants	Ongoing	2	3	2	2	3	**12**
Certify Baltimore as a Community Wildlife Habitat through the National Wildlife Foundation (NWF)	NWF Planning	BCRP, BDC, Community Groups, DHCD, DOP, DPW, Federal Agencies, MDNR, NGOs, State Agencies	• Federal Grants • State Grants • Foundation Grants	Ongoing	3	3	2	2	0	**10**

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	**ACTION LEAD AGENCY**	**STAKEHOLDERS**	**FINANCING OPTIONS**	**ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)**	**Financial Feasibility**	**Political Feasibility**	**Impact**	**Public Support**	**Overlap with CAP**	**Score**
NS-4	**(DOP)**	**Expand, protect and restore riparian areas in the city**								
Conduct regular maintenance of stream restoration projects and stormwater quality facilities	DPW	BCRP, DOP, DPW	• Federal Grants • State Grants • Local Grants • Foundation Grants	Ongoing	1	3	3	3	3	**13**
Evaluate current regulations regarding stream buffers and floodplains and modify them (if appropriate) to assure they adequately protect perennial stream corridors	Planning	BCRP, DOP, DPW	• Federal Grants • State Grants • Local Grants • Foundation Grants	Ongoing	2	2	2	2	3	**11**
NS-5	**(DOP)**	**Preserve and create new coastal buffer efforts and support creating more wetlands and soft shoreline along coastal areas**								
Integrate natural buffer requirements, such as wetlands and soft shorelines, into new development or redevelopment	Planning	BCRP, BDC, DOP, DPW, NGOs, State Agencies, Waterfront Partnership	• Federal Grants • State Grants • Local Grants • Foundation Grants	Short	2	2	2	2	3	**11**
Complete stream restoration projects in Baltimore City and County stream valleys that lead into the coastal wetlands so as to increase habitat and reduce sedimentation	DPW	BCRP, BDC, DOP, DPW, NGOs, State Agencies, Waterfront Partnership	• Federal Grants • State Grants • Local Grants • Foundation Grants	Long	2	3	3	3	0	**11**
Identify and evaluate areas in the Critical Area buffer to prioritize ecological buffer restoration efforts	Planning	BCRP, BDC, DOP, DPW, NGOs, State Agencies, Waterfront Partnership	• Critical Area Buffer Offset Fees • Private Funds	Medium	2	2	2	2	0	**8**
NS-6	**(DPW)**	**Require the City's drought management plan to account for changes in climate**								
Map drought risks and water availability via climate change scenarios	DPW	BCHD, Water Utility	• Federal Grants • State Grants • Foundation Grants	Short	1	2	3	3	0	**9**
Update drought management plans to recognize changing conditions	DPW	BCHD, Water Utility		Short	2	3	2	2	0	**9**
NS-7	**(DOP)**	**Integrate climate change and natural hazards planning into small watershed action plans (SWAPs)**								
Review existing watershed management plans and identify future actions to address climate impacts		DOP, DPW, NGO's		Ongoing	3	3	3	3	0	**12**
NS-8	**(DOP)**	**Conduct detailed ongoing analysis of climate information, trends in storm events and hydrology to support policy changes responding to climate change**								
Expand the use of climate information (e.g. seasonal forecasts) in water resources planning and management.	Planning	BDC, FEMA, MDE, MDNR, MEMA, NGOs, State Agencies, Waterfront Partnership	State, Local and Foundation Funding	Short	3	2	2	1	0	**8**
Research and actively monitor trends in storm events, stream flow and other conditions affecting hydrology and water		BDC, FEMA, MDE, MDNR, MEMA, NGOs, State Agencies, Waterfront Partnership	• Federal Grants • State Grants • Foundation Grants	Ongoing	3	2	2	1	3	**11**
Update flood maps to reflect changing risk associated with climate change.	Planning	BDC, FEMA, MDE, MDNR, MEMA, NGOs, State Agencies, Waterfront Partnership	• Federal Grants • State Grants • Local Grants	Short	2	2	2	2	0	**8**
Continuously improve and enhance flood vulnerability data.	Planning	BDC, FEMA, MDE, MDNR, MEMA, NGOs, State Agencies, Waterfront Partnership	• Federal Grants • State Grants • Foundation Grants	Ongoing	1	2	3	2	0	**8**
PS-1	**(MOEM)**	**Strengthen emergency preparedness coordination between local government, NGOs, and private entities by updates to the City Emergency Operations Plan (EOP) and related Emergency Support Functions (ESF)**								
Identify and develop a common database that all city government agencies and departments should utilize for hazard information, preparedness and response	MOEM	BCHD, County Governments, DOP, DHMH, Humane Society, MOIT, PSC	• Federal Grants • State Grants • Foundation Grants	Short	2	3	3	3	0	**11**
Ensure consistency and integration with existing and future response plans within and between agencies	MOEM	BCHD, County Governments, DOP, DHMH, Humane Society, MOIT, PSC		Ongoing	2	2	3	2	0	**9**
Continue to identify and improve coordination with Key Partners including private sector, State partners, Federal partners, community, universities and industry leaders through Local Emergency Planning Committee	MOEM	BCHD, City Agencies, County Governments, DOP, DHMH, FEMA, General Public, Humane Society, MDE, MDNR, MEMA, MOIT, PSC	• Foundation Grants	Ongoing	3	3	3	3	0	**12**

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	**ACTION LEAD AGENCY**	**STAKEHOLDERS**	**FINANCING OPTIONS**	**ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)**	**Financial Feasibility**	**Political Feasibility**	**Impact**	**Public Support**	**Overlap with CAP**	**Score**
Coordinate outreach efforts of the Mayor's Office of Emergency Management, Mayor's Office of Neighborhood and Constituent Services and Baltimore City Health Department to leverage messages related to all-hazards emergency preparedness	MOEM DHMH	BCFD, BCHD, BCPD, Community Groups, County Governments, DOP, DHMH, Humane Society, MOEM, MOIT, MON, PSC	• State Grants • Local Grants • Foundation Grants	Medium	1	3	3	1	3	**11**
Develop strong working relationships with local experts to provide technical assistance to refine and improve city government emergency preparation	MOEM	BCHD, County Governments, DOP, DHMH, Humane Society, MOIT, PSC	• State Grants • Local Grants • Foundation Grants	Ongoing	3	3	2	1	3	**12**
Review and improve specific response plans contained in the EOP and related ESFs that relate to extreme weather events (snow, heat, flood, wind, electrical outages, and other hazard events)	MOEM	BCHD, County Governments, DOP, DHMH, Humane Society, MOIT, PSC	• State Grants • Local Grants • Foundation Grants	Ongoing	1	3	2	1	3	**10**
Ensure equipment purchases and communication systems are compatible across agencies and jurisdictions	PSC MOEM	BCHD, County Governments, DOP, DHMH, Humane Society, MOEM, MOIT, PSC	• Federal Funding • State Funding • Local Funding	Ongoing	2	3	3	2	0	**10**
Encourage all animal rescue and care shelters to further develop their internal plans for animal's health and safety during and after a hazard event	Humane Society	BCHD, County Governments, DOP, DHMH, Humane Society, MOIT, PSC	• Federal Funding • State Funding • Local Funding	Ongoing	2	2	2	3	0	**9**
Ensure all animal rescue and care shelters located within the floodplain are provided the support to apply for and obtain funds to relocate	Humane Society	BCHD, County Governments, DOP, DHMH, Humane Society, MOIT, PSC	• State Grants • Local Grants • Foundation Grants	Ongoing	1	2	2	3	0	**8**
Develop and implement a case study of hospital-based practices that foster community resilience to climate change		BCHD, County Governments, DOP, DHMH, Humane Society, MOIT, PSC	• Private funding	Ongoing	2	2	2	1	3	**10**
PS-2	**(MOEM)**	**Develop a Hazard Awareness Program**								
Create a standardized early warning system for members of the public	MOEM	BCHD, DHMH, DOP, MDH2E, MEMA, MOEM	• Local Funding	Short	1	3	3	3	0	**10**
Evaluate and improve community health center strategies for communicating with patients during an emergency	MOEM	BCHD, MDH2E, MEMA, MOEM	• Private funding	Ongoing	3	3	3	3	0	**12**
Educate citizens about the existing early warning systems and actions they should take when alarms sound	MOEM	BCHD, MDH2E, MEMA, MOEM	• Foundation Grants	Ongoing	3	3	3	3	3	**15**
Prepare and integrate occupational health and safety messages and instructions for first responders	DHMH	BCHD, DHMH, MDH2E, MEMA, MOEM	• Foundation Grants	Ongoing	2	2	2	1	3	**10**
Hold climate specific seminars, in partnership with MDH2E and MHA, for hospital emergency and sustainability managers	Local Hospitals	BCHD, MDH2E, MEMA, MOEM	• Federal Grants • State Grants • Foundation Grants	Ongoing	2	3	3	3	0	**11**
PS-3	**(MOEM)**	**Designate community leaders and organizations that can assist and provide support during hazard events**								
Prior to a hazard event, identify lead contacts serving vulnerable populations and coordinate actions to maximize safety and information sharing	MOEM DOP	BCFD, BCHD, BCPD, Community Groups, DOP, HABC, Hospitals, MOEM, MON	• Community Development Block Grant Program (CDBG)	Ongoing	3	3	3	3	0	**12**
Develop a community group coordination plan and implementation guide	MOEM	BCFD, BCHD, BCPD, Community Groups, DOP, HABC, Hospitals, MOEM, MON		Medium	2	3	1	1	3	**10**
Identify and evaluate plans already in place and work to improve utilization of community based leaders to assist in preparedness and response	MOEM	BCFD, BCHD, BCPD, Community Groups, DOP, HABC, Hospitals, MOEM, MON	• State Grants • Local Grants • Foundation Grants	Long	3	3	3	3	3	**15**
PS-4	**(MOEM)**	**Integrate climate change and natural hazards planning into all City and community plans**								
Develop guidelines to include proactive resilience planning into plan development process	DOP, DHCD	BCHD, MOEM, State and Federal Agencies	• Community Development Block Grant Program (CDBG)	Ongoing, Medium	2	3	2	1	3	**11**
Incorporate language that strengthens the ability of city government officials to enforce rules and restrictions that support public health, safety and welfare related to hazard events and conditions	MOEM	BCFD, BCHD, BCPD, DHCD, DOP, MOEM, State and Federal Agencies	• State Grants • Local Grants • Foundation Grants	Medium	2	2	2	2	0	**8**
Partner with Maryland Department of Health and Mental Hygiene or other pertinent entity to develop institutional checklist and materials for health care specific resilience plans	Local Hospitals	BCHD, DOP, MOEM, State and Federal Agencies	• Private funding	Ongoing, Medium	1	1	2	1	0	**5**

DP3 PRIORITIZATION TABLE					Score each measure: High=3, Medium=2, Low=1					
ACTION	**ACTION LEAD AGENCY**	**STAKEHOLDERS**	**FINANCING OPTIONS**	**ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)**	**Financial Feasibility**	**Political Feasibility**	**Impact**	**Public Support**	**Overlap with CAP**	**Score**
PS-5	**(MOEM)**	**Better equip emergency workers for natural hazards**								
Research and identify personal protective equipment (PPE) needs based on specific hazards	MOEM	BCFD, BCPD, MOEM	• State Grants • Local Grants • Foundation Grants	Ongoing	1	3	2	1	3	**10**
PS-6	**(BCHD)**	**Anticipate and address potential disease outbreaks caused by extreme weather events and changing climatic conditions**								
Support studies of heat and flood related vector borne diseases in the Baltimore the region based on changing temperature and moisture	BCHD	BCHD, CDC, DHMH, MDNR, MEMA, MH2E, MOEM, State Agencies	• Federal Grants • State Grants • Foundation Grants	Ongoing	3	1	2	2	3	**11**
Evaluate existing programs that detect disease outbreaks to determine their flexibility to respond to new conditions	BCHD	BCHD, CDC, State Agencies		Ongoing	1	2	2	1	0	**6**
PS-7	**(MOEM)**	**Protect Baltimore residents from the effects of hazard events and plan for more frequent hazard instances**								
Re-evaluate and update existing heat alerts, advisories, and updates to healthcare and emergency service providers	MOEM, BCHD	BCFD, BCHD, BCPD, BCRP, DHMH, Licenses and Permitting, MDE, MOEM, Healthcare providers	• State Grants • Local Grants • Foundation Grants	Short	2	2	1	1	3	**9**
Ensure that residents and visitors have access and transportation to cooling centers during extreme heat events	MOEM, BCHD	BCHD, BCRP, Community Groups, DHMH, Licenses and Permitting, MDE, MOEM, Transportation partners	• State Grants • Local Grants • Foundation Grants	Ongoing	2	1	3	1	3	**10**
Evaluate code red plans to ensure all agencies adequately protect their own workers	MOEM, BCHD	BCFD, BCHD, BCPD, BCRP, DHMH, Licenses and Permitting, MDE, MOEM, Agencies with outdoor workers	• Federal Grants • State Grants • Foundation Grants	Short	2	2	2	1	3	**10**
Consider extending hours for public wading pools during extreme heat events	MOEM, BCHD	BCHD, BCRP, Community Groups, DHMH, Licenses and Permitting, MDE	• State Grants • Local Grants • Foundation Grants	Medium	2	3	3	3	0	**11**
Include information about Code Red in the event permitting process, and incorporate language that allows BCHD to cancel outdoor events	MOEM, BCHD	BCHD, BCRP, Licenses and Permitting, MDE	• State Grants • Local Grants • Foundation Grants	Medium, Ongoing	1	1	2	3	0	**7**
Work with Regional, State and Local partners to improve air quality and reduce respiratory illnesses	MDE	BCHD, BCRP, Licenses and Permitting, MDE	• Federal Grants • State Grants • Foundation Grants	Medium, Ongoing	3	3	2	1	3	**12**
Create and implement programs to manage combined health impacts of heat and air pollution	BCHD	BCHD, BCRP, DHMH, Licenses and Permitting, MDE	• Federal Grants • State Grants • Foundation Grants	Medium, Ongoing	1	1	1	1	3	**7**
PS-8	**(MOEM)**	**Conduct climate, resiliency, and emergency planning education and outreach**								
Incorporate environmental health and climate change into curriculum at schools, universities and health care facilities	BCPSS	BCHD, DNR, DOP, DPW, DHMH, MH2E, MOEM, MOIT, MON, Hospitals	• Community Development Block Grant Program (CDBG) • Federal Funding Sources	Ongoing	1	2	2	3	0	**8**
Educate communities on how city agencies respond to hazard events, their role in an event, and how agencies work together	MOEM	BCHD, DNR, DOP, DPW, DHMH, MH2E, MOEM, MOIT, MON, Hospitals	• Federal Grants • State Grants • Foundation Grants	Ongoing	2	3	3	3	3	**14**
Educate and train community groups to participate in responding to hazards	MOEM	BCHD, DNR, DOP, DPW, DHMH, MH2E, MOEM, MOIT, MON, Hospitals	• Federal Grants • State Grants • Foundation Grants	Ongoing	2	3	3	3	3	**14**
Generate a comprehensive community-specific all hazards outreach campaign	MOEM DOP	BCHD, DNR, DOP, DPW, DHMH, MH2E, MOEM, MOIT, MON, Hospitals	• State Grants • Foundation Grants	Short	1	3	3	3	3	**13**
Develop and communicate a simplified process for Baltimore residents to follow after a hazard event	MOEM	BCHD, DNR, DOP, DPW, DHMH, MH2E, MOEM, MOIT, MON, Hospitals	• State Grants • Foundation Grants	Short	3	3	2	2	3	**13**
Create curriculum for hospitals to teach communities about climate change as part of hospital community benefits programs	MOEM	BCHD, DNR, DOP, DPW, DHMH, MH2E, MOEM, MOIT, MON, Hospitals	• Federal Grants • State Grants • Foundation Grants	Medium	1	3	3	1	3	**11**
Utilize existing preparedness messaging to include information on universal precautions to insect-borne and other infectious diseases	MOEM, BCHD	BCHD, DNR, DOP, DPW, DHMH, MH2E, MOEM, MOIT, MON, Hospitals	• State Grants • Foundation Grants	Short	1	2	2	1	3	**9**

DP3 PRIORITIZATION TABLE

ACTION	ACTION LEAD AGENCY	STAKEHOLDERS	FINANCING OPTIONS	ESTIMATED TIMEFRAME (short 1-2yrs, med 3-5yrs, long 6+)	Score each measure: High=3, Medium=2, Low=1					
					Financial Feasibility	Political Feasibility	Impact	Public Support	Overlap with CAP	Score
PS-9	**(FEMA/ MEMA)**	**Improve awareness and education about the importance of flood insurance and preparation for Baltimore citizens**								
Create an educational program centered on flood hazards, coastal construction practices and evacuation procedures	MOEM DOP	Community Groups, DHCD, DHMH, DOP, FEMA, MEMA, MOEM, MON, NFIP, NGOs, MOEM	• Housing Recovery Funding • NFIP	Short	3	3	2	2	3	**13**
Encourage owners of properties to purchase flood insurance and improve policyholder awareness at time of sale or renewal	FEMA, NFIP DOP	Community Groups, DHCD, DHMH, DOP, FEMA, MEMA, MOEM, MON, NFIP, NGOs, MOEM	• Housing Recovery Funding • NFIP	Ongoing	3	3	3	3	3	**15**
Inform property owners who have paid off their mortgage that flood insurance is still necessary	FEMA, NFIP DOP	Community Groups, DHCD, DHMH, DOP, FEMA, MEMA, MOEM, MON, NFIP, NGOs, MOEM	• State and Foundation Grants	Short	3	3	1	1	3	**11**
Identify programs and grants that assist citizens in purchasing flood insurance and making flood proofing changes	FEMA, NFIP DOP	Community Groups, DHCD, DHMH, DOP, FEMA, MEMA, MOEM, MON, NFIP, NGOs, MOEM	• Housing Recovery Funding • NFIP	Medium	3	3	3	2	3	**14**
Develop an annual newsletter to inform and remind owners of property in the floodplain about flood insurance and flood proofing activities they should undertake	FEMA, NFIP DOP	Community Groups, DHCD, DHMH, DOP, FEMA, MEMA, MOEM, MON, NFIP, NGOs, MOEM	• State Grants • Foundation Grants	Short, Ongoing	3	2	2	2	3	**12**
Provide information on how to file for reimbursement for impacts of hazards	MOEM	Community Groups, DHCD, DHMH, DOP, FEMA, MEMA, MOEM, MON, NFIP, NGOs, MOEM	• Federal Grants • State Grants • Foundation Grants	Short, Ongoing	2	2	2	1	3	**10**
Require a flood disclosure form, and educational information as part of lease agreements for commercial and residential properties	DOP	Community Groups, DHCD, DHMH, DOP, FEMA, MEMA, MOEM, MON, NFIP, NGOs, MOEM	• Federal Grants • State Grants • Foundation Grants	Short	1	1	2	1	3	**8**
Develop floodplain awareness information for rental tenants and ensure distribution as tenants change	HCD MOEM Planning	Community Groups, DHCD, DHMH, DOP, FEMA, MEMA, MOEM, MON, NFIP, NGOs, MOEM	• Federal Grants • State Grants • Foundation Grants	Ongoing	2	2	2	1	3	**10**
PS-10	**(DOP)**	**Increase Baltimore's Food Security**								
Double the size and number of food producing community gardens by 2025	DOP	BOS, DOP, MDA, Urban Farms and Community Gardens (P&P and CGRN)	• Community Development Block Grant Program (CDBG)	Ongoing, Long	2	3	3	3	0	**11**
Link Jessup, Maryland Food Hub, and regional/local food producers to local distributors	MD Dept of Agriculture	BOS, DOP, MDA, Urban Farms and Community Gardens (P&P and CGRN)	• Federal Grants • State Grants • Foundation Grants	Ongoing, Long	2	2	1	3	0	**8**
Incorporate Baltimore's food policy initiative into planning efforts	DOP	BOS, DOP, MDA, Urban Farms and Community Gardens (P&P and CGRN)	• Federal Grants • State Grants • Foundation Grants	Ongoing, Long	3	3	3	3	0	**12**
Develop a food security plan for Baltimore	DOP	BOS, DOP, MDA, Urban Farms and Community Gardens (P&P and CGRN)	• Federal Grants • State Grants • Foundation Grants	Ongoing, Long	1	3	3	3	0	**10**
Increase land under cultivation for commercial urban agriculture	DOP	BOS, DOP, MDA, Urban Farms and Community Gardens (P&P and CGRN)	• Federal Grants • State Grants • Foundation Grants	Ongoing, Long	2	3	3	3	0	**11**

Appendix H: Critical Facilities

Baltimore City Critical Facilities

Facility Type	Facility Name	Neighborhood
Fire Station	E-45 T-27 M-14	Mount Washington
Fire Station	E-46	Woodmere
Fire Station	E-40 T-12 BC-5	Dorchester
Fire Station	E-29 M-17	Central Park Heights
Fire Station	E-44 T-25	Roland Park
Fire Station	E-21 M-11	Hampden
Fire Station	E-31 M-3	Better Waverly
Fire Station	E-43 M-18, BC-4	Glen Oaks
Fire Station	E-4 T-29	New Northwood
Fire Station	E-56	Westfield
Fire Station	E-42 M-6, M-13	Lauraville
Fire Station	E-33 M-16 T-5	East Baltimore Midway
Fire Station	E-27 T-26	Parkside
Fire Station	E-20 T-18 M-8	Walbrook
Fire Station	E-30 T-8 M-12	Carroll-South Hilton
Fire Station	E-47	Morrell Park
Fire Station	E-14	Booth-Boyd
Fire Station	E-36	Midtown-Edmondson
Fire Station	E-52	Parkview/ Woodbrook
Fire Station	E-8 T-10 M-15 BC-3	Harlem Park
Fire Station	E-13 T-16 M-4	Madison Park
Fire Station	E-23 T-2 M-1 BC-6 R-1 AF-1	Downtown
Fire Station	Headquarters	Downtown
Fire Station	Communications	Downtown
Fire Station	E-6 T-1 M-7 BC-2 AF-2 Sh.Cmd	Oldtown
Fire Station	T-15	Broadway East
Fire Station	E-5 T-3 M-10	Upper Fells Point
Fire Station	E-51	Ellwood Park/ Monument
Fire Station	E-41 BC-1	Canton
Fire Station	E-50 M-2	Broening Manor
Fire Station	E-55 T-23	Washington Village
Fire Station	E-2	Federal Hill
Fire Station	T-6	Federal Hill
Fire Station	E-26 M-5	Riverside
Fire Station	FB-1 FRB-1	Locust Point Industrial Area
Fire Station	E-58	Westport
Fire Station	E-35 T-21 M-9 BC-6 Hazmat-1	Brooklyn
Fire Station	E-57	Curtis Bay
Fire Station	E-124 T-20	Hopkins Bayview
Fire Station	E-54 T-30	Cedmont
Fire Station	E-53	Hunting Ridge
Nursing Home	Alice Manor Nursing Home	Woodberry
Nursing Home	Blue Point Nursing Center	Levindale
Nursing Home	Caton Manor	Saint Agnes
Nursing Home	Crawford Retreat	Walbrook
Nursing Home	Fayette Health And Rehabilitation Center	Poppleton
Nursing Home	Frankford Nursing And Rehabilitation Center	Frankford
Nursing Home	Future Care Canton Harbor	Canton
Nursing Home	Future Care Charles Village, Llc	Charles Village
Nursing Home	Future Care Homewood	Charles Village
Nursing Home	Future Care Irvington, Llc	Irvington
Nursing Home	Future Care Sandtown-Winchester	Sandtown-Winchester
Nursing Home	Good Samaritan Nursing Center	Loch Raven
Nursing Home	Hamilton Center	Westfield
Nursing Home	Harborside Healthcare Harford	Lauraville
Nursing Home	Haven Nursing Home	Dolfield
Nursing Home	Homewood Center	Homeland
Nursing Home	Johns Hopkins Bayview Care Center	Hopkins Bayview
Nursing Home	Keswick Multi-Care Center	Roland Park

Facility Type	Facility Name	Neighborhood
Nursing Home	Levindale Hebrew Ger Ctr & Hsp	Levindale
Nursing Home	Lochearn Nursing Home, Llc	Seton Business Park
Nursing Home	Long Green Center	Homeland
Nursing Home	Manor Care Of Roland Park	Roland Park
Nursing Home	Maryland Baptist Aged Home	Mosher
Nursing Home	Northwest Health And Rehab	Parklane
Nursing Home	Overlea Health And Rehabilitation Center	Glenham-Belford
Nursing Home	Ravenwood Nsg. & Rehab. Ctr.	Seton Hill
Nursing Home	Rock Glen Nsg & Rehab Ctr	Westgate
Nursing Home	Roland Park Place	Roland Park
Nursing Home	Transitional Care At Good Samaritan	Loch Raven
Nursing Home	Transitional Care Services At Mercy Medical Center	Downtown
Nursing Home	Maria Health Care Center, Inc.	The Orchards
Nursing Home	THE VILLA	Bellona-Gittings
Headquarters	Headquarters	Downtown
Police Station	Central	Downtown
Police Station	Northern	Woodberry
Police Station	Northeastern	Morgan State University
Police Station	Northwestern	Woodmere
Police Station	Eastern	Berea
Police Station	Southern	Middle Branch/ Reedbird Parks
Police Station	Southeastern	Hopkins Bayview
Police Station	Southwestern	Gwynns Falls
Police Station	Western	Sandtown-Winchester
Salt Dome	Pulaski Industrial Area Salt Dome	Pulaski Industrial Area
Salt Dome	Brewers Hill Salt Dome	Brewers Hill
Salt Dome	Dolfield Salt Dome	Dolfield

Facility Type	Facility Name	Neighborhood
Salt Dome	Spring Garden Industrial Area Salt Dome	Spring Garden Industrial Area
Salt Dome	Guilford Salt Dome Salt Dome	Guilford
Salt Dome	Lakeland Salt Dome	Lakeland
Salt Dome	Jones Falls Area Salt Dome	Jones Falls Area
Emergency	American Rescue Workers	SBIC
Emergency	Aunt CC's Harbor House	Oldtown
Emergency	Baltimore Rescue Mission	Jonestown
Emergency	Christ Lutheran Place	Otterbein
Emergency (temporary)	Code Blue J, H & R	Jonestown
Emergency	Collington Square	Broadway East
Emergency	Helping Up	Jonestown
Emergency	House of Ruth ES	
Emergency	Interfaith ES	Sandtown-Winchester
Emergency	Karis House	Jonestown
Emergency	MCVET ES	Jonestown
Emergency	Prisoners AID ES	Charles Village
Emergency	Project PLASE ES	Greenmount West
Emergency	Salvation Army/Booth House	Mid-Town Belvedere
City Building	City Hall	Downtown
Housing	Southeastern Community Action Center	Highlandtown
Housing	Eastern Community Action Center	Dunbar-Broadway
Housing	Northern Community Action Center	Woodbourne-McCabe
Housing	Southern Community Action Center	Cherry Hill
Housing	Northwest Community Action Center	Forest Park
CARE	Oliver Center	Broadway East
CARE	Sandtown -Winchester Center	Sandtown-Winchester
CARE	Hatton Center	Canton

Baltimore City Critical Facilities Continued...

Facility Type	Facility Name	Neighborhood
CARE	Waxter Center	Mid-Town Belvedere
CARE	John Booth Senior Center	Highlandtown
CARE	Zeta Center	Central Park Heights
Commodity Distribution Center	Mondawmin Mall	Mondawmin
Commodity Distribution Center	PolyTechnic HS	Medfield
Commodity Distribution Center	Pimlico Race Course	Arlington
Commodity Distribution Center	Mary Our Queen Cathedral	Homeland
Commodity Distribution Center	Stadium Place/Hopkins Eastern	Better Waverly
Commodity Distribution Center	Harford Shopping Center	North Harford Road
Commodity Distribution Center	Oriole Park/Ravens Stadium	Inner Harbor
Commodity Distribution Center	Montgomery Park	Carroll - Camden Industrial Area
Commodity Distribution Center	MCJ Improvements	Hollins Market
Commodity Distribution Center	Oldtown Mall Parking Lot	Oldtown
Commodity Distribution Center	Greater Grace World Outreach Church	Frankford
Commodity Distribution Center	Wal-Mart Port Covington	Port Covington
Division of Correction Facility	Baltimore City Correctional Center	Penn-Fallsway
Division of Correction Facility	Baltimore Pre-Release Unit	Penn-Fallsway
Division of Correction Facility	Baltimore Pre-Release Unit for Women	Penrose/Fayette Street Outreach
Division of Correction Facility	Central Home Detention Unit	Barclay
Division of Correction Facility	Dismas House East	Oliver
Division of Correction Facility	Dismas House West	Union Square
Division of Correction Facility	Maryland Correctional Adjustment Center	Penn-Fallsway
Division of Correction Facility	Maryland Reception, Diagnostic, and Classification Center	Penn-Fallsway
Division of Correction Facility	Metropolitan Transition Center	Penn-Fallsway
Division of Correction Facility	Threshold	Charles North
Pretrial Detention Facility	Baltimore Central Booking & Intake Center	Penn-Fallsway
Pretrial Detention Facility	Baltimore City Detention Center	Johnston Square
Pretrial Detention Facility	Division of Pretrial Detention and Services	Penn-Fallsway
Dialysis Center	25TH Street Dialysis, Inc	Coldstream Homestead Montebello
Dialysis Center	Bertha Sirk Dialysis Center	Rosebank
Dialysis Center	BMA Baltimore	Hampden
Dialysis Center	Bon Secours Hospital	Penrose/Fayette Street Outreach
Dialysis Center	Charing Cross Dialysis	
Dialysis Center	Community Dialysis Centers, Inc	
Dialysis Center	Davita Baltimore Geriatric & Rehab Center	Hopkins Bayview

Facility Type	Facility Name	Neighborhood
Dialysis Center	Davita Catonsville	
Dialysis Center	Davita Dialysis Mercy	Downtown
Dialysis Center	Davita Harbor Park Dialysis	Cherry Hill
Dialysis Center	Davita Howard Street Dialysis	Downtown
Dialysis Center	Davita JB Zachary	Hopkins Bayview
Dialysis Center	Davita Maryland	Dunbar-Broadway
Dialysis Center	Davita North Rolling Road Dialysis	
Dialysis Center	Davita White Square	
Dialysis Center	DCA Baltimore	Irvington
Dialysis Center	DCA North Baltimore	Charles Village
Dialysis Center	Downtown Dialysis Center	Mount Vernon
Dialysis Center	Good Samaritan Hospital	Loch Raven
Dialysis Center	Good Samaritan Hospital at Cromwell Center	
Dialysis Center	Good Samaritan Hospital Lorien Frankford	Frankford
Dialysis Center	Greenspring Dialysis Center	Seton Business Park
Dialysis Center	Harford Gardens Dialysis	Lauraville
Dialysis Center	Harford Road Dialysis Center	Harford-Echodale/Perring Parkway
Dialysis Center	IDF Chestnut Square Dialysis Center	Hampden
Dialysis Center	IDF Deaton Center	Otterbein
Dialysis Center	IDF Parkview Center	Hollins Market
Dialysis Center	Johns Hopkins Outpatient Care	Dunbar-Broadway
Dialysis Center	Manor Care Dialysis	
Dialysis Center	Seton Drive Dialysis	Seton Business Park
Dialysis Center	Union Memorial Hospital Dialysis Unit	Charles Village
Dialysis Center	University of Maryland Medical System	University Of Maryland

Facility Type	Facility Name	Neighborhood
Emergency Operation Center-TMC	EOC1	Penn-Fallsway
Emergency Operation Center-Bunker	EOC2	New Northwood
Hospital	John Hopkins Hospital	Dunbar-Broadway
Hospital	Maryland General Hospital	Mount Vernon
Hospital	Bon Secours Hospital	Penrose/Fayette Street Outreach
Hospital	Sinai Hospital	Levindale
Hospital	Harbor Hospital Center	Middle Branch/ Reedbird Parks
Hospital	St. Agnes Hospital	Violetville
Hospital	Union Memorial Hospital	Charles Village
Hospital	Good Samaritan Hospital	Loch Raven
Hospital	John Hopkins Bayview Medical Center	Hopkins Bayview
Hospital	Mercy Medical Cen.	Downtown
Hospital	University of Maryland Medical Center	University Of Maryland
Hospital	VA Medical Center	University Of Maryland
Hospital	Kernan Hospital	Dickeyville
Non-Acute Hospital	Mt. Washington Pediatric Hospital	Mount Washington
Non-Acute Hospital	University Specialty Hospital	Otterbein

Appendix I: Engineering Study

Fells Point

The City of Baltimore DP3 Plan is a comprehensive first step in addressing sea level rise and developing mitigation and preparedness procedures to counteract predicted climate changes. In developing this plan, the City recognized the need to complete a more in-depth engineering assessment of high-risk areas and facilities. The City has contracted with a local engineering firm, Moffat & Nicol, to provide a more detailed analysis for high risk facilities and one identified community (Fells Point), to serve as a foundation for specific actions in these areas and improve disaster preparedness as recommended in the DP3.

The goals of the engineering analysis are as follows:

- Create a clear picture of potential physical impacts of sea level rise for educational and funding purposes;
- Increase City knowledge of the specific physical changes needed to adapt to sea level rise, including costs.
- Understanding the detailed risks to the structures of Critical Facilities; how might the City make physical and operational changes to adjust?

Scope of work:

Conduct a more detailed review of 'First Tier' critical facilities identified by HAZUS-MH

- Utilize HAZUS data already developed for Baltimore City to identify 'First Tier' critical facilities needing more detailed analysis of impacts.
- Gather more detailed information of the identified facilities.
- Provide recommendations regarding specific hazard related issues for identified facilities.

Coordination with City staff to identify a specific coastal community vulnerable to extreme impacts from sea level rise and conceptual engineering study of impacts and mitigation options for that specific community.

- Identify specific coastal flood/sea level rise impacts for the identified community (impacts on storm drain systems, road access, buildings, etc).
- Consider a range of possible solution alternatives, with conceptual-level opinion of probable construction costs.
- Recommend and prepare conceptual designs for up to two selected solution alternatives. The analysis will also consider and reflect residual flooding and potential new impacts to surrounding areas upstream.

Deliverables:

1. Case study report with detailed information regarding specific risks to critical facilities identified, with recommendations for physical and operational changes to address these risks.
2. An Appendix to the case study report concerning specific measures to address coastal flooding and sea level rise in the identified specific coastal community. The report will include maps, discussion of impacts and benefits, and a menu of solutions considered. The report will include conceptual designs for up to two specific, recommended solutions selected by City in consultation with consultant. If requested by the City, 3D renderings will be included for up to two selected conceptual designs for public presentation and review.

We anticipate completion of this analysis by 2014

An Aerial of Fells Point *Source: Bing*

Source: Flickr.com

Source: Baltimore Sun

Source: Joe Giza /Reuters

Appendix J: Health Impacts Assessment

Background

According to the National Research Council, HIA is a systematic process that uses an array of data sources and analytic methods, and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of those effects within the population. HIA provides recommendations on monitoring and managing those effects.

The Baltimore Office of Sustainability (BoS) worked with the Baltimore City Health Department (BCHD) to integrate a preliminary Health Impact Assessment (HIA) into the Disaster Preparedness and Planning Project (DP3). The HIA focused on one strategy and two specific actions of the plan:

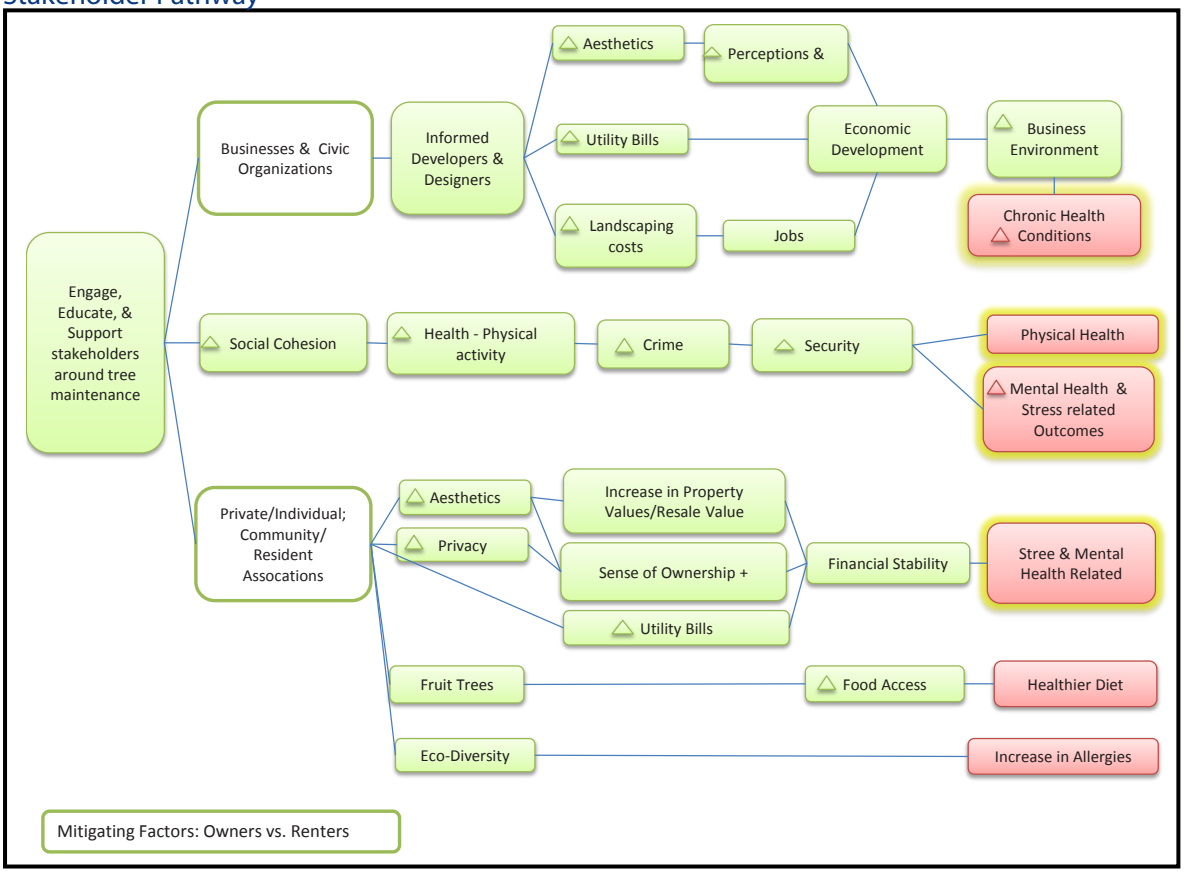
Strategy NS-2: Increase and enhance the resilience and health of Baltimore's urban forest

Action 3: Establish a comprehensive maintenance program that includes pruning for sound structure and the removal of hazardous limbs and trees. First focus on vulnerable infrastructure nearby such as essential facilities and roads

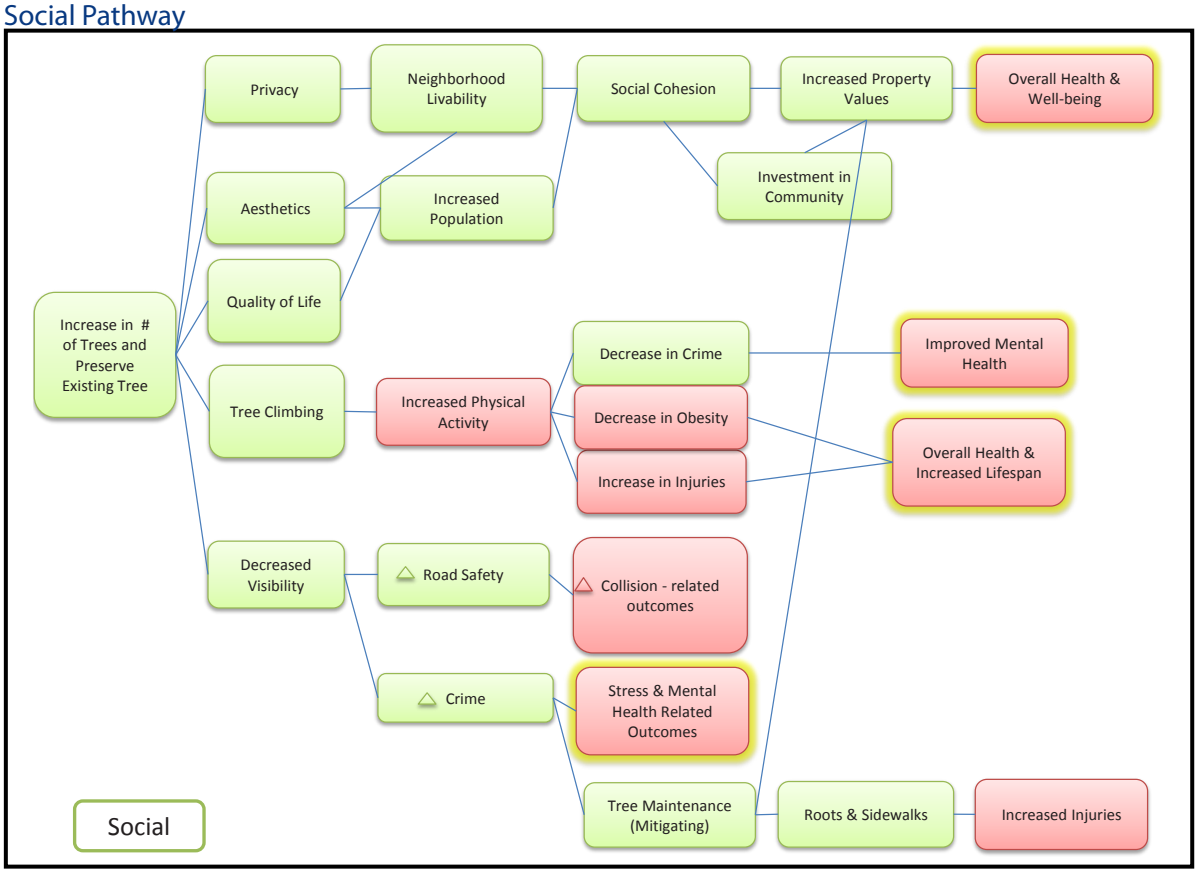
Action 5: Increase the urban tree canopy and target areas with urban heat island impacts.

The HIA team is currently in the process of developing formal recommendations concerning the types of trees, the locations of trees, the number of trees, and incentives for stakeholder engagement around tree maintenance. The following are the preliminary documents for this assessment.

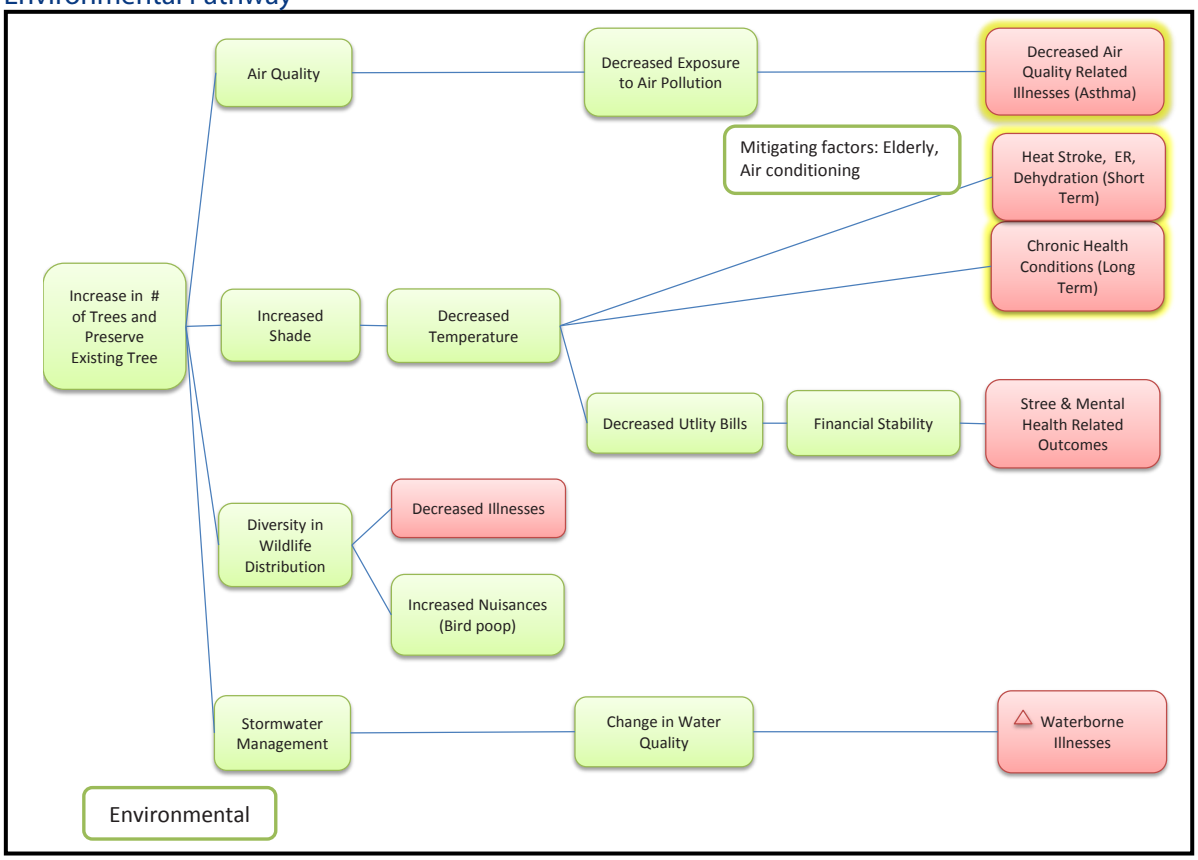
Stakeholder Pathway



Social Pathway



Environmental Pathway



Health Impacts Assessment, Continued

Stakeholder Workshop

Participants:

- Department of forestry
- Communities
- Mayor/city council
- Homeowners/land owners/associations
- Developers
- DOT
- Universities
- Businesses/Churches
- CAHT
- BGE
- TV
- Police

Tree Considerations

- High Canopy
  - Educate to debunk perceptions/myths about types of trees
  - Identify best practices and communicate
  - Point to resources
- Does well widely spaced
- Tap root
  - Respond to the negative perception by emphasizing the root structure and the canopy
  - Place-based: Right tree in the right location (different neighborhood needs & street vs. homeowner
- Improves air quality
- Minimal Debris:
  - Trees can be perceived as a nuisance. Emphasize the difference
- Grows well locally
  - Tree with long life span
- Cost (upfront and long term)
  - Year round canopy (pine)
  - Water conservation (high/low demand)
  - Tree dependent upon neighborhood

Maintenance Standards:

- Implement with the new revenue generated
  - Pay to have tree planted in someone's honor or memory
  - Composting leaves for community gardens and revenue generation
  - Tax abatements renter subsidies to maintain trees (based on property tax increase)
- Incorporate workforce around tree planting ("clean & green")
  - Engage volunteer base
  - When a tree dies, replace it with a new tree on public land, and neighborhoods below poverty line
  - Main incorporates:
    - » Neighborhood residents
    - » Churches
    - » Community associations
    - » Block solutions
    - » Neighborhood youth workers
- Education on Maintenance:
  - Applicable to individuals green planning
  - University/community partnership to assist with maintenance
- Other:
  - Incorporate tree maintenance into positive youth development
    - » Schools, service learning
  - Afro clean block model
  - Tree maintenance incorporation into message on annual clean-up (mayor)

Tree Planting Location Considerations:

- Public Land
  - Coordinate with only infrastructure planning
  - All new public buildings have a % requirement for tree planting per lot
  - Begin with public land first immediately via city controlled agencies
  - Development requirements strengthened
- High impermeable surfaces
  - Land set for demolition
- Neighborhoods with high crime
  - Around hospitals and schools
- Neighborhoods below poverty line
  - Empty lots, public schools, medians between roads
  - Possibly include fruit trees
  - Provide food, engage community
- Other:
  - Tap into 10year school construction plan to plant trees
  - "Adopt a tree" like "adopt a star"
    - » Create an app that tracks growth of tree that is connected to GIS mapping – public virtual space… *intended for engagement sheet

Stakeholders' Incentives:

- Engage owners in planting for cost savings
  - Engage media as stakeholder
  - Irrigation cost should be regulated to encourage homeowner buy in
  - Give ranking points, like the Green standards, for building…..?
- Consider fiscal incentives for planting
- Communication/branding
  - Educate communities about the benefits of trees before the trees are planted
  - Engage universities for planting trees or maintenance
    - » Use specific departments, such as, urban studies research, community services, "Adopt a Street"
  - Community associations, churches, schools, businesses
- Engage renters with incentives
  - Sponsor "clean block campaign" with flowers/ trees, such as, Afro campaign of past
  - Emergency services: mitigation of effects of catastrophic events
  - Public education on the benefits of trees to encourage buy in of stakeholders

Table 4–2 The Psychological Impacts of Climate Change and Extreme Weather

Health Impacts Assessment, Continued

Health Impact Assessment
Community Advisory Committee

Preliminary Recommendations
September 5th, 2013
11 am - 2 pm

HEALTHY BALTIMORE 2015

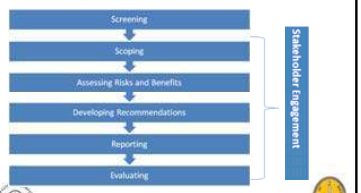
Today's Meeting Objectives

- HIA team will review the assessment findings for both DP3 and the Dive In Baltimore HIAs.
- Advisory group will discuss and characterize the assessment findings for both DP3 and the Dive In Baltimore HIAs.
- Advisory group will review, refine and supplement initial recommendations drafted by the HIA team.

HIA Quick Review

- **Health Impact Assessment (HIA)** is a means of assessing the health impacts of policies, plans and projects in diverse economic sectors using quantitative, qualitative and participatory techniques. (WHO)
- Its **fundamental purpose** is to promote positive health impacts and mitigate for negative health impacts as it relates to a specific policy, plan, or project

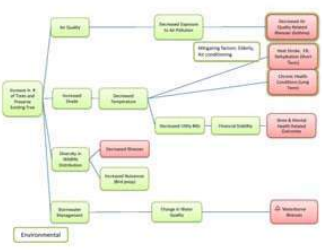
The HIA Process

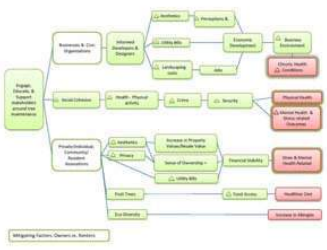


Disaster Preparedness & Planning Project (DP3) - Increasing Tree Canopy

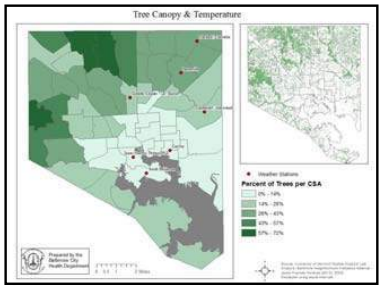
- **Strategy NS-2: Increase and enhance the resilience and health of Baltimore's urban forest**
  - Action 3: Establish a comprehensive maintenance program that includes pruning for sound structure and the removal of hazardous limbs and trees. First focus on vulnerable infrastructure nearby such as essential facilities and roads
  - Action 5: Increase the urban tree canopy and target areas with urban heat island impacts
- **Existing Tree Canopy: 27.4%**
- **Goal: 40% by 2040**

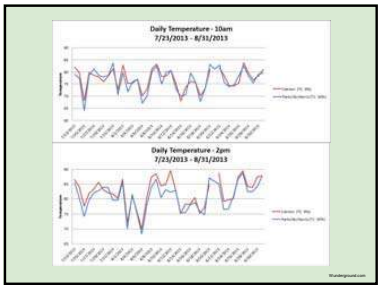
Pathways

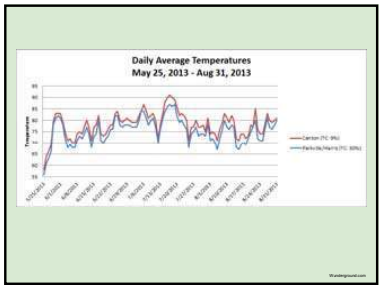


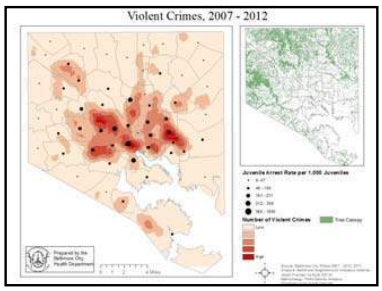


Data Analysis









Literature Review

Trees & Temperature

- NASA study found Baltimore temperatures dropped 10 degrees Celsius (18 °F) moving outward from city center, with low levels of plants and trees, to suburbs, with high levels of plants and trees. This urban heat effect was modified in city center "pockets" with more plants, particularly parks.
- Baltimore neighborhoods with more vulnerable populations were more likely to have higher land surface temperatures. These neighborhood characteristics were:
  - Lower levels of resident education and income
  - Greater percentages of minority residents and instances of crime
  - More elderly residents

Types of Trees

- Medium-sized tree can intercept as much as 2380 gallons of rainfall per yr
- Stormwater washes pollutants on streets and sidewalks into municipal separate storm sewer systems (MS4s), which eventually reach lakes, streams, rivers, bays, and oceans. This can affect drinking water.
- Street trees reduce pollutants from stormwater
- Large trees even more effective in pollution removal
- A 25-foot tree reduces annual heating and cooling costs of a typical residence by 8 to 12%, producing an average $10 savings per American household
- High Canopy Trees eliminate the visibility issue of criminal activities

Maintenance

- 25% of Baltimore trees are distressed, dead, or dying
- Prune branches to allow at least several feet clearance around the air conditioning equipment to encourage air flow.

Location

Energy Savings

- A one-fifth acre house lot with 30% vegetation cover dissipates as much heat as running two central air conditioners.
- 10% energy savings when cooling equipment is shaded
- Important that trees do not provide hiding places for criminals or block view. Street trees decreased crime in Portland, OR, because they did not block views and were further from houses, as opposed to yard trees.

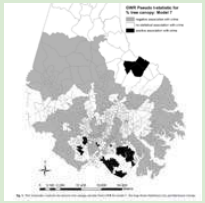
Health Impacts Assessment, Continued

Location

Crime

- Widely spaced trees have minimal effect on visibility . Residential vegetation has been linked with a greater sense of safety, fewer incivilities, and less aggressive and violent behavior.
- Trees as territorial markers; they serve as cues to care, suggesting that the inhabitants care about their territory and an intruder would be noticed
- Trees encourage more time outdoors which provides more opportunities to observe activity and behavior in neighborhood
- Increased neighborhood cohesion improves mental health
  - which can decrease crime

Study in Baltimore



- Magnitude of crime reduction on public trees is nearly 50% greater than that of private trees.
- 10% increase in tree cover would be associated with an 11.8% decrease in crime rate for Baltimore
- Researchers controlled for socioeconomic factors (race, income, housing age, etc.)

Location

Road Safety/Surfaces

- Trees in medians can cut cross glare. Zeigler (1986) also observed benefits: shade, windbreaks, visual buffer, physical protection for pedestrians from run-off-the-road vehicles, and contributions to historic character
- Shade casted by trees can significantly increase the life of road surfaces by reducing the temperatures which the surface reaches during hot weather
- Tree collisions numbered approximately 1.9% of all traffic accidents in 2002. 46% of these were severely injurious or fatal.
- Roadside crashes more frequent in rural than urban areas
- Study found that street landscape improvements, including trees along roadside, reduced accidents by 5% to 20% in Toronto, Canada

Stakeholders Incentives

- Shoppers willing to pay 11% more for goods and services on tree-lined streets
- Improved property values of homes between 3.5% - 6%
- Increased property values, increased tax revenues, increased income levels, faster real estate sales turnover rates, shorter unoccupied periods, increased recruitment of buyers, increased jobs, increased worker productivity, and increased number of customers have all been linked to tree and landscape presence

Clarifying and Characterizing Findings

- Any clarifying questions about the data?
- Think about the health outcomes that were priorities from the original pathways.
  - What surprised you?
  - What stands out as most important?

What is a Good Recommendation?

Recommendations should be made for the **most important impacts first**.It is best when recommendations are **specific**.

It is also best when recommendations:

- → call for an **action** or set of **actions**
- → can be **enforced**
- → can be **monitored**
- → can really be **accomplished** (= technically & economically feasible)
- → are known to be **effective**
- → do not cause any **negative health impacts**.

Recommendations Development

1. Who are we making recommendations to?
2. Review of Draft Recommendations & Gallery Walk
3. Full Group Review/Discussion

Dive In, Baltimore! Long Range Aquatics Plan

Current Pools

6 park pools, 13 neighborhood pools, 7 stand-alone (5-wading / 2 spray pads), and 3 indoor pools

2023 BCRP Aquatic Plan – Preliminary Options 7.16.2013

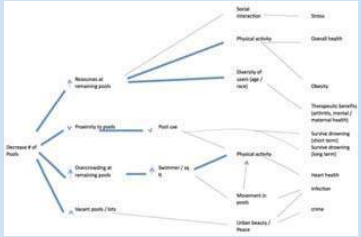
BCRP Aquatics System Options

All of the aquatic system options are based on:

- Co-locating facilities near recreation centers, parks, schools to provide a variety of facilities and programs
- Reconfiguring the existing outdoor aquatic system
- Enhancing the indoor pool system

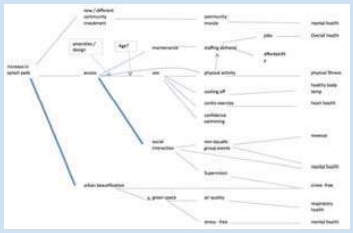
Pathways

Decreased # of Pools

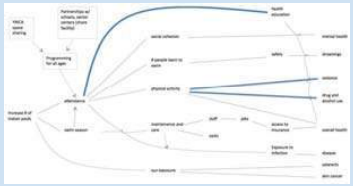


10/2/2013

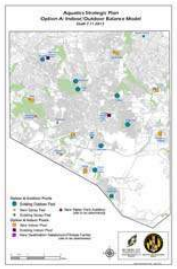
Pathways
Increase in Splash Pads

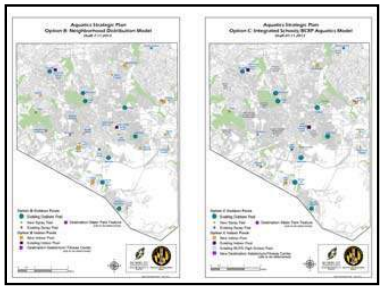


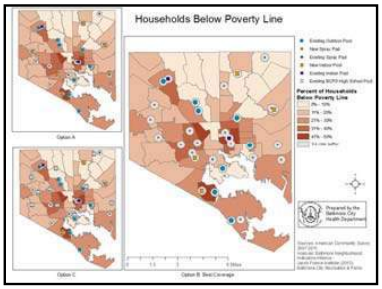
Pathways
Increase in Indoor Pools

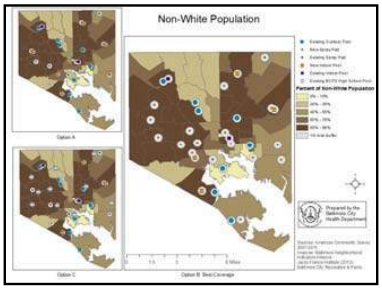


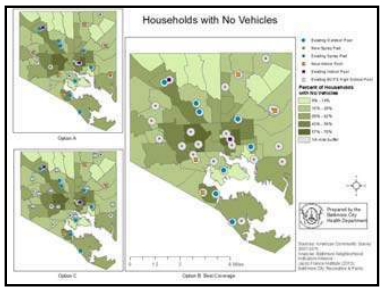
Aquatics Strategic Plan Options

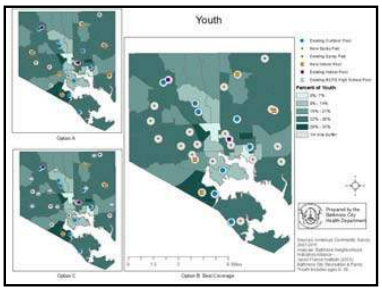












Swimming and Health

- Physical activity and health outcomes
  - Improved cardiovascular health, muscular and bone health, helps maintain healthy weight
  - Decreased risk of cardiovascular disease, diabetes and falls
- Accidents and drowning
  - Pools can be dangerous, especially for individuals who do not know how to swim

Source: US DHHS. 2008 Physical Activity Guidelines for Americans. Chapter 2: Physical Activity has Many Health Benefits

Health Impacts Assessment, Continued

Swimming and Health in Baltimore

- Physical Activity
  - Youth - 26.1% of high school students reported not participating in 60 minutes of physical activity any day of the week
  - Adults - 47% reported not meeting HP2010 activity guidelines every week in a month
- Obesity
  - Youth - 18.2%
  - Adults - 33.8%
- Drowning
  - 5.5% of deaths in children 1-17 due to drowning (MD)

Sources: YRBS 2007; Baltimore City Community Health Survey 2009; Maryland Child Death Report 2011

Pool Usage

- Proximity
- Type of Pool Facility
- Amenities

Proximity

- Proximity to parks associated with frequency of visits and self reported exercise (Cohen et al 2007)
- Cohen et al (2007) recommend cities should be designed so that all individuals have a park within one mile
- Perceived park walking proximity related to physical activity and frequency and duration of park use (Mowen et al 2007)
- Adolescents and parents of adolescents report that proximity and the ability to walk/bike to parks impacts their use of the space for physical activity (Grow et al 2008)

Type of Facility

- Indoor, Outdoor, Splash Pad
  - Swimmers prefer outdoor pools
  - Indoor pools are 2-3 times more expensive to build and operate
  - Desire to have multiple pools of water so that there are activities/areas for all ages – something for the whole family.

Sources: City of Dallas Aquatics Facility Plan, Soto and Schwartz 2008

Type of Facility by Age-Group

Age Group	Recreational Aquatic Age-Group National Trends
Age 0-3	Tot Pool, Tot Slides, Gentle Spray Features
Age 4-7	Water Sprayground, Zero-Depth Pool, Participatory Play Features, Sand Play
Age 8-11	Water Walks, Large Play Structures, Full-Size Waterslides, Open Water
Age 12-16	Water Walks, Large Waterslides, Open Water, Lazy River, Gathering Places, Sand Volleyball, Mat Racer, Diving Boards
Age 17-22	Action Island, Intense Waterslides, Flow Rider, Mat Racer, Climbing Wall, Open Water, Sand Volleyball, Drop Slides, Diving Boards
Age 23-45	Zero-Depth Pool (to be w/ children), Open Water, Spa, Sun Deck, Lap Lanes, Lazy River, Waterslides, Diving Boards
Age 46+	Spa, Sun Deck, Lap Lanes, Lazy River, Family-Friendly Waterslides

Source: Counsilman-Hunsaker, as reported in City of Dallas Aquatics Facility Plan

Amenities

- Parents will travel further distances for a park with more amenities
- Park renovations saw increase of youth of both genders and all ages attendance
- When recreation facilities at schools are made available to the public after hours they are used fairly frequently

Sources: Tucker et al 2007, Tester and Baker 2009, Evenson and McGinn 2004

Community Meetings

- Expressed desire for extended hours, improved programming, better publicity, and upgraded facilities (shade structures, seating, etc)
- Concern about transportation access to facilities
  - Safety - children traveling to pools by themselves
  - Cost - transportation is an added cost to pool fees
- Conflict on splash pads
  - Pro - provide locations for cooling down, kids like them, allows for neighborhood balance
  - Cons - don't allow the opportunity for kids to learn how to swim
- Curious about what will happen to locations where pool facilities were

Preliminary Survey Results

1. Survey of convenience conducted
   Online (still open)
   On site on 8/22 (Thursday) at 2pm (about 91° F and sunny)
2. 12 responses for each (still a very small sample)

Online trends

1. Respondents are widely distributed across the city
2. Respondents rarely go to the pools
3. The main reason being the "quality of the facilities"
4. Respondents are in the older age range.
5. Respondents use pools for health over recreation.

On site trends

1. 10 people were at the park pool, 2 at neighborhood pool, 0 at splash pad
2. All but one of the attendants that went to the park pool drove to the pool (median >5 miles)
3. Respondents valued proximity and affordability,
4. Respondents used the pools for recreation over health.

Upcoming Community Meetings

Each meeting will be held at the pool or adjacent recreation center of the following at 6:30-8 p.m:

Sept. 5—St. Luke's Episcopal Church, 217 N. Carey St. 21223

Sept. 10—Walter P. Carter Recreation Center, 820 E. 43rd St. 21212

Sept. 12—Liberty Recreation Center, 3901 Maine Ave. 21207

Sept. 17—Rita Church Community Center, 2101 Saint Lo. Dr. 21224

Sept. 30—BCRP headquarters, 3001 East Dr. 21217

Clarifying and Characterizing the Findings

- Any clarifying questions about the data?
- Think about the health outcomes that were priorities from the original pathways.
  - What surprised you?
  - What stands out as most important?

What is a Good Recommendation?

Recommendations should be made for the **most important impacts first**.It is best when recommendations are **specific**.

It is also best when recommendations:

- ➔ call for an **action** or set of **actions**
- ➔ can be **enforced**
- ➔ can be **monitored**
- ➔ can really be **accomplished** (= technically & economically feasible)
- ➔ are known to be **effective**
- ➔ do not cause any **negative health impacts**.

Recommendations Development

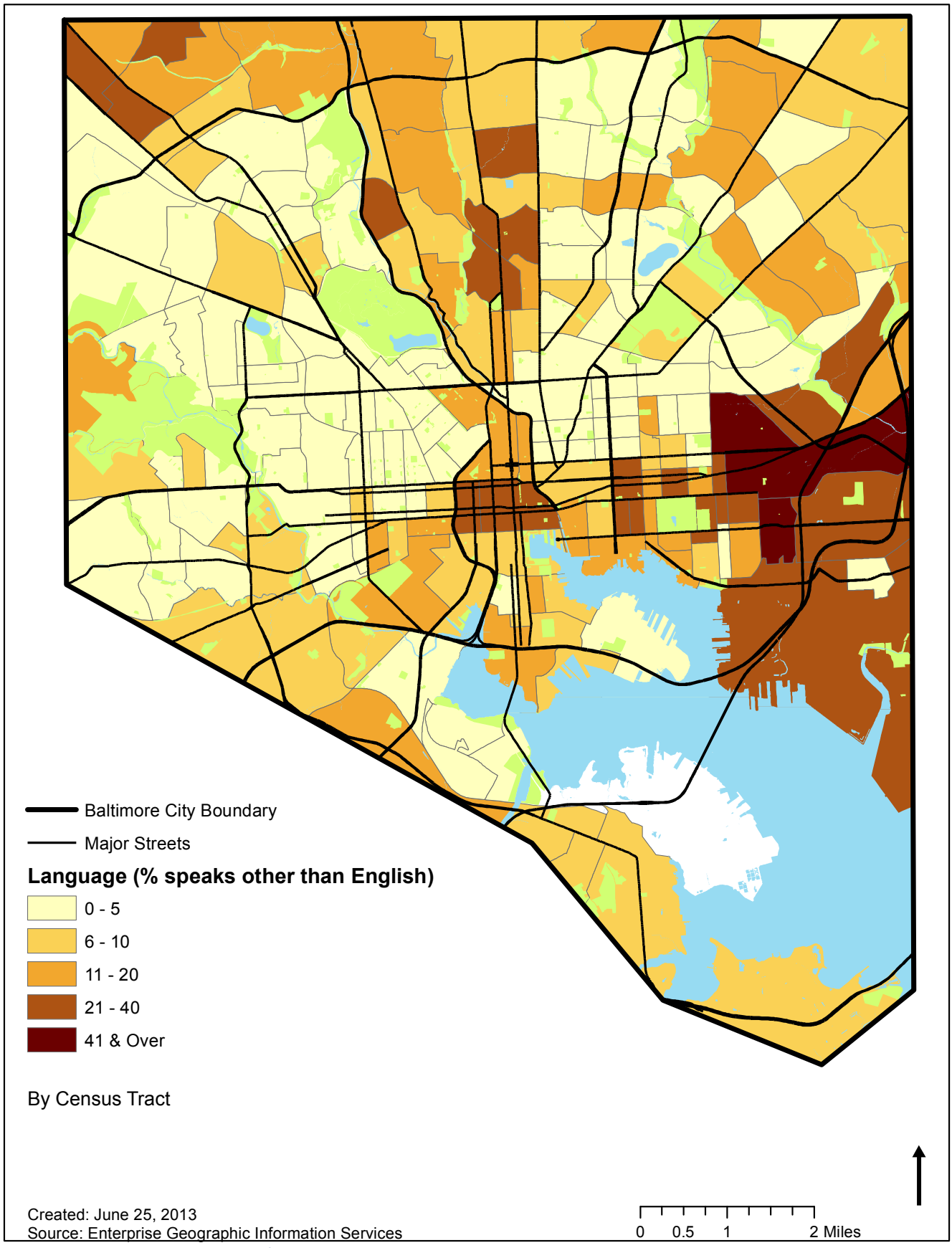
1. Who are we making recommendations to?
2. Review of Draft Recommendations & Gallery Walk
3. Full Group Review/Discussion

Next Steps

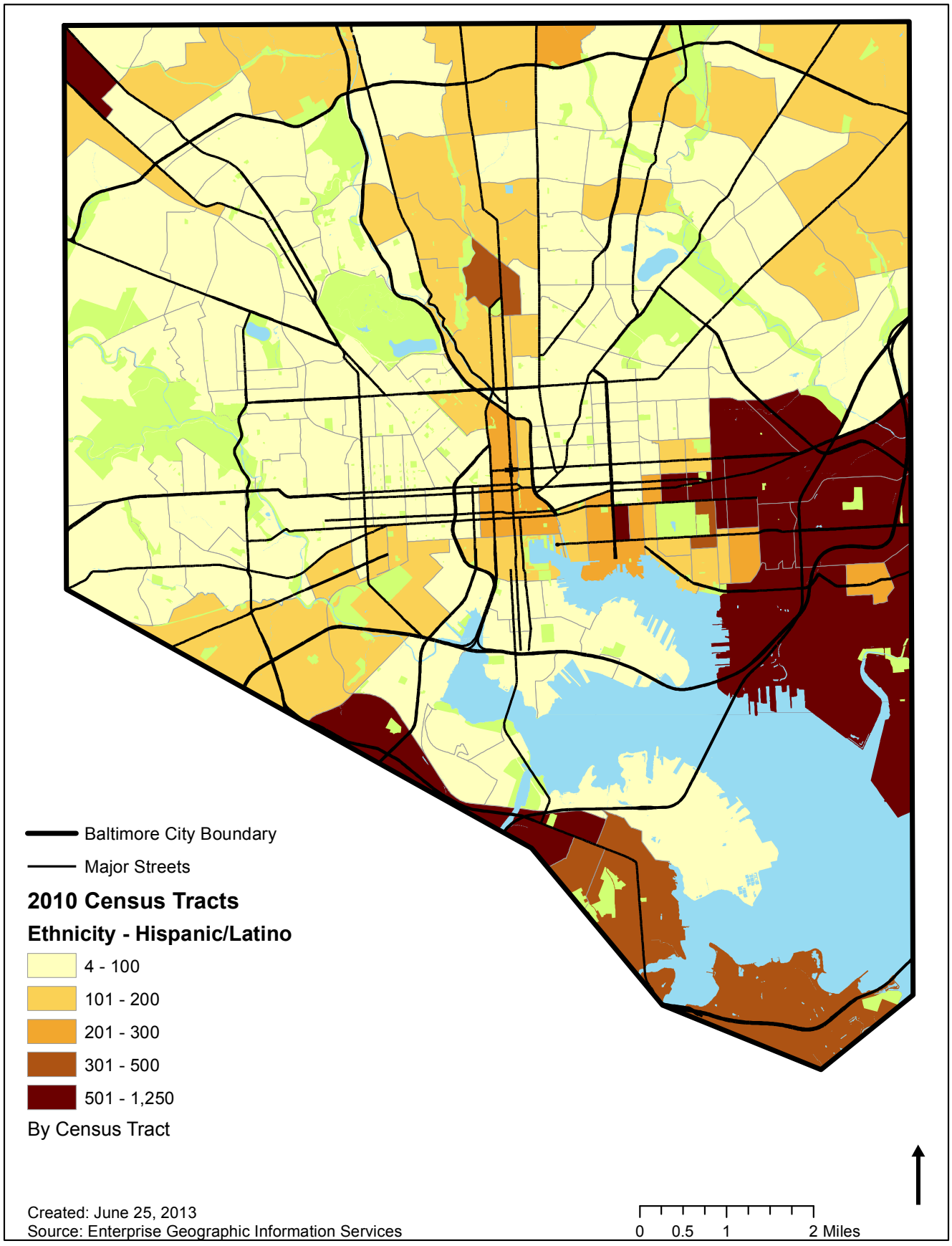
- Additional feedback on recommendations
- Report development and revisions
- Advice on methods for dissemination?

Appendix K: Supporting Information

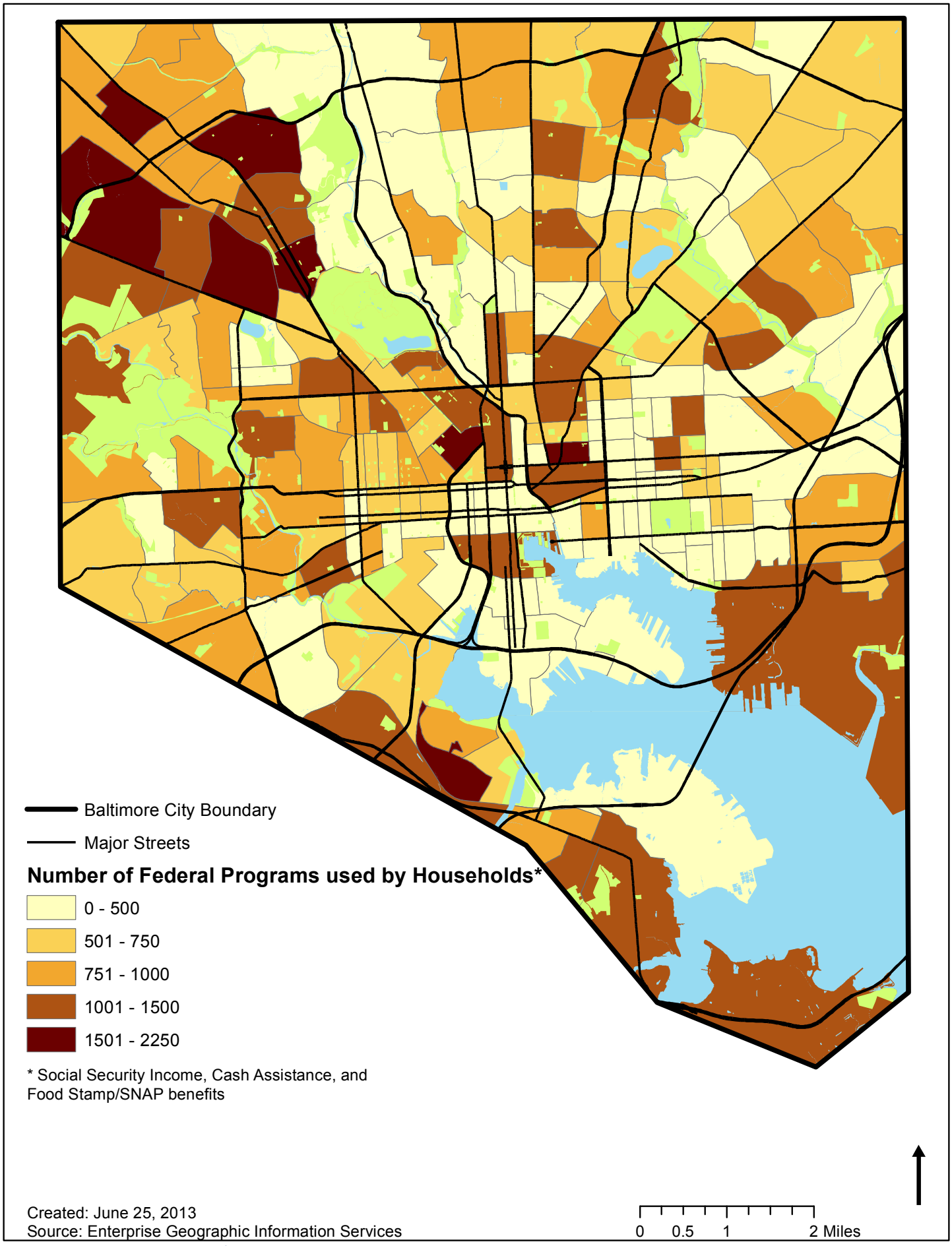
Background



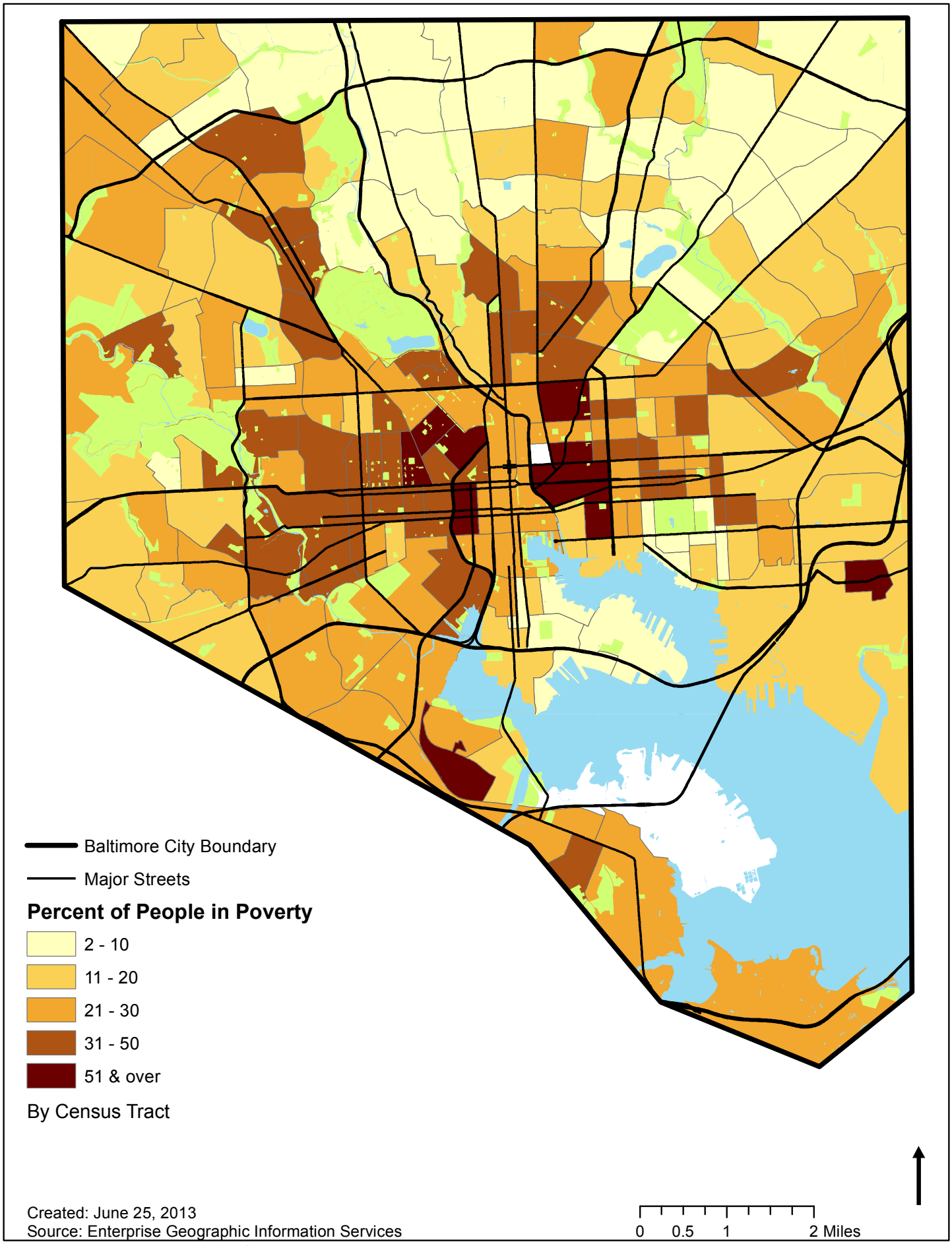
Appendix - Figure–5 Percentage of Residents Speaking Languages Other than English



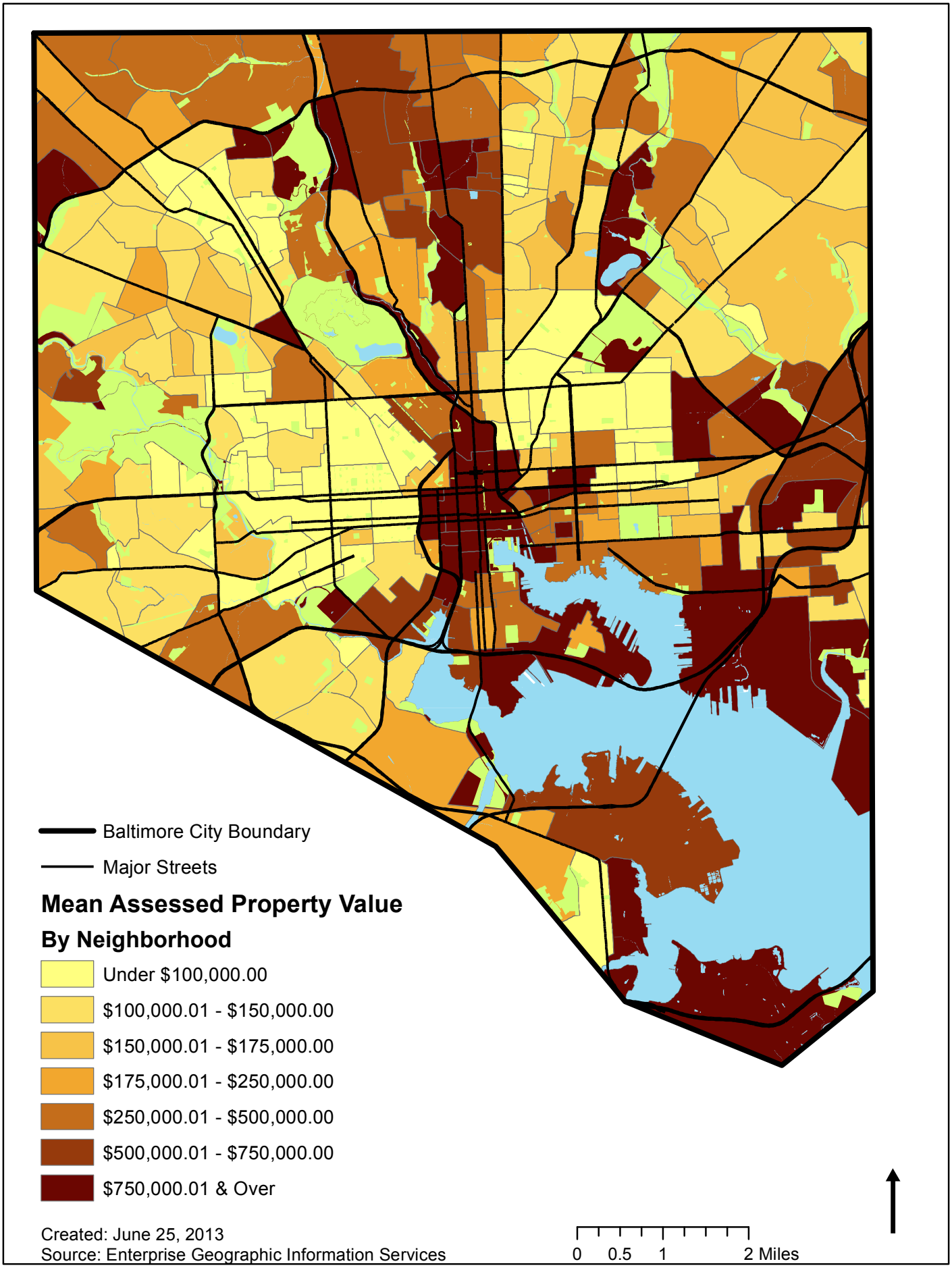
Appendix - Figure–6 Hispanic/Latino Residents



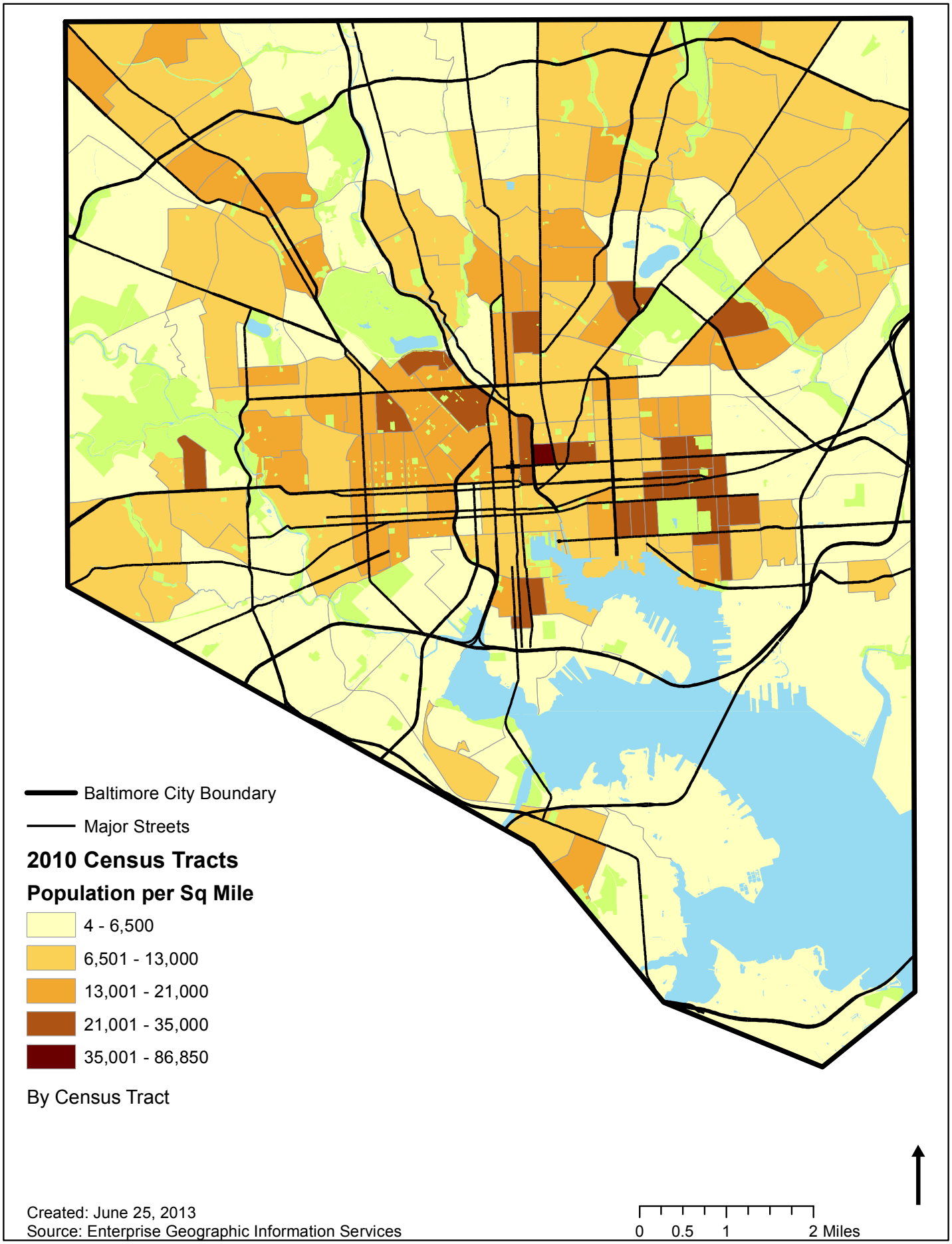
Appendix - Figure–7 Number of Federal Programs Used by Households



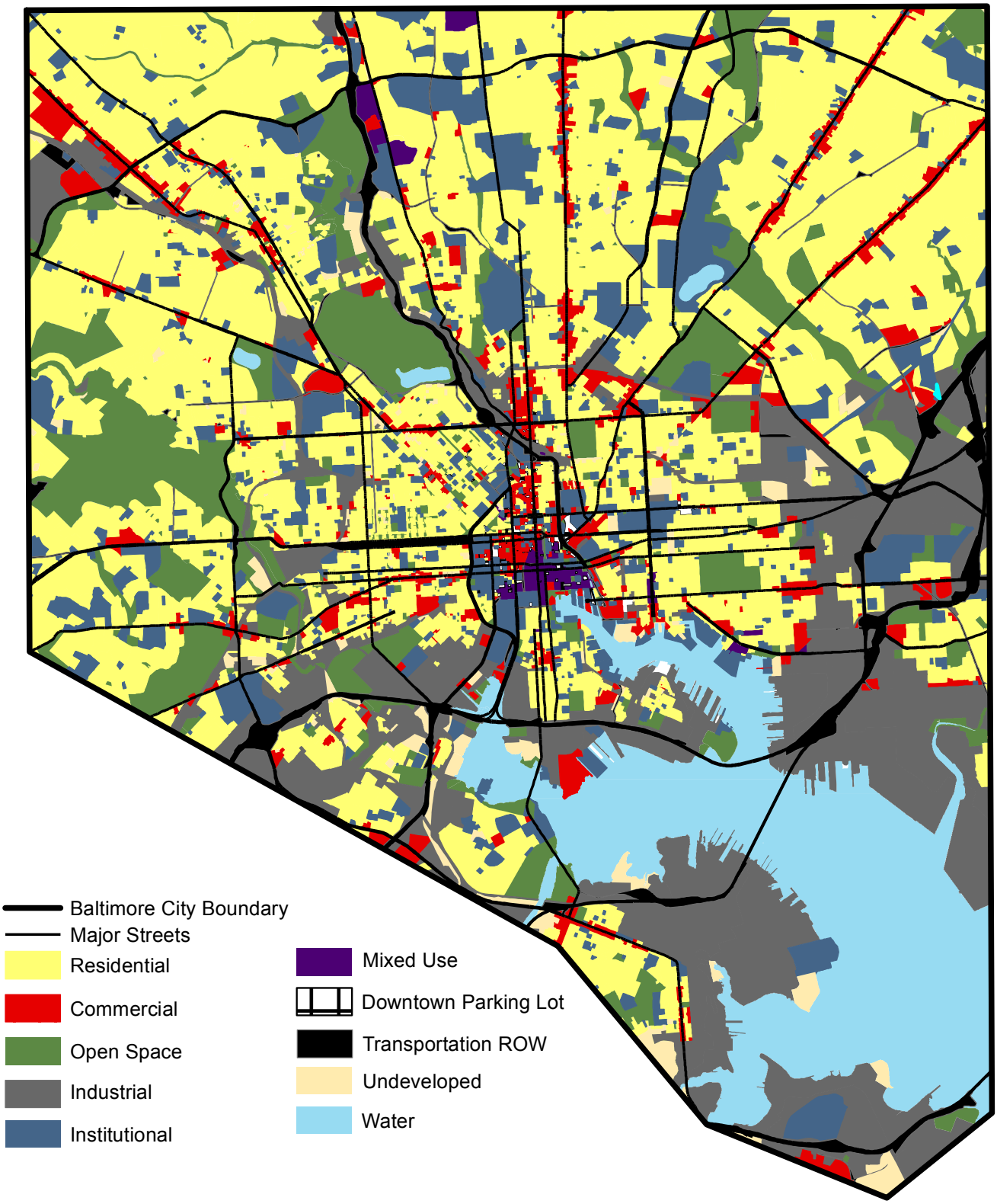
Appendix - Figure–8 Percentage of Population in Poverty



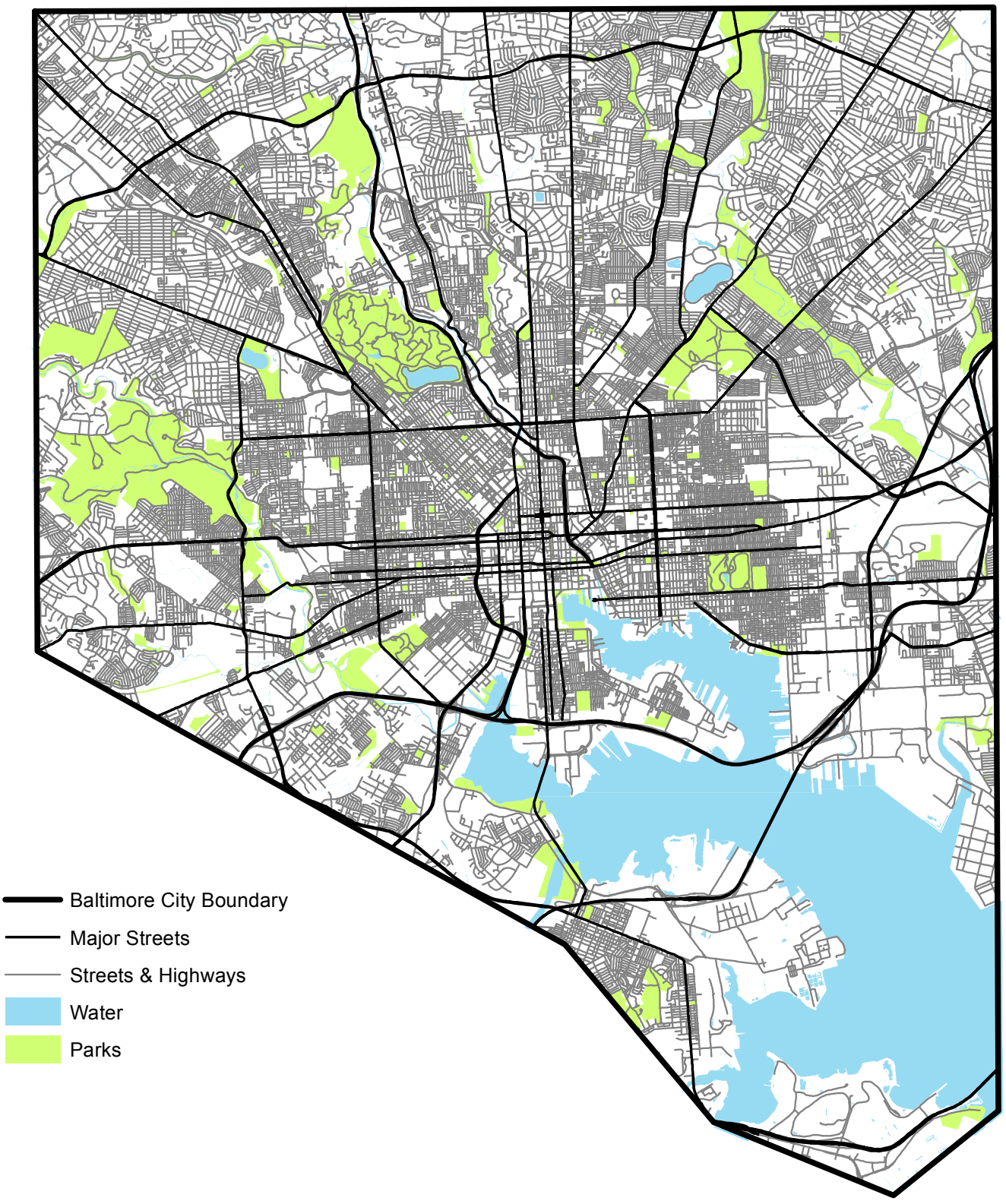
Appendix - Figure–9 Mean Assessed Property Value by Neighborhood



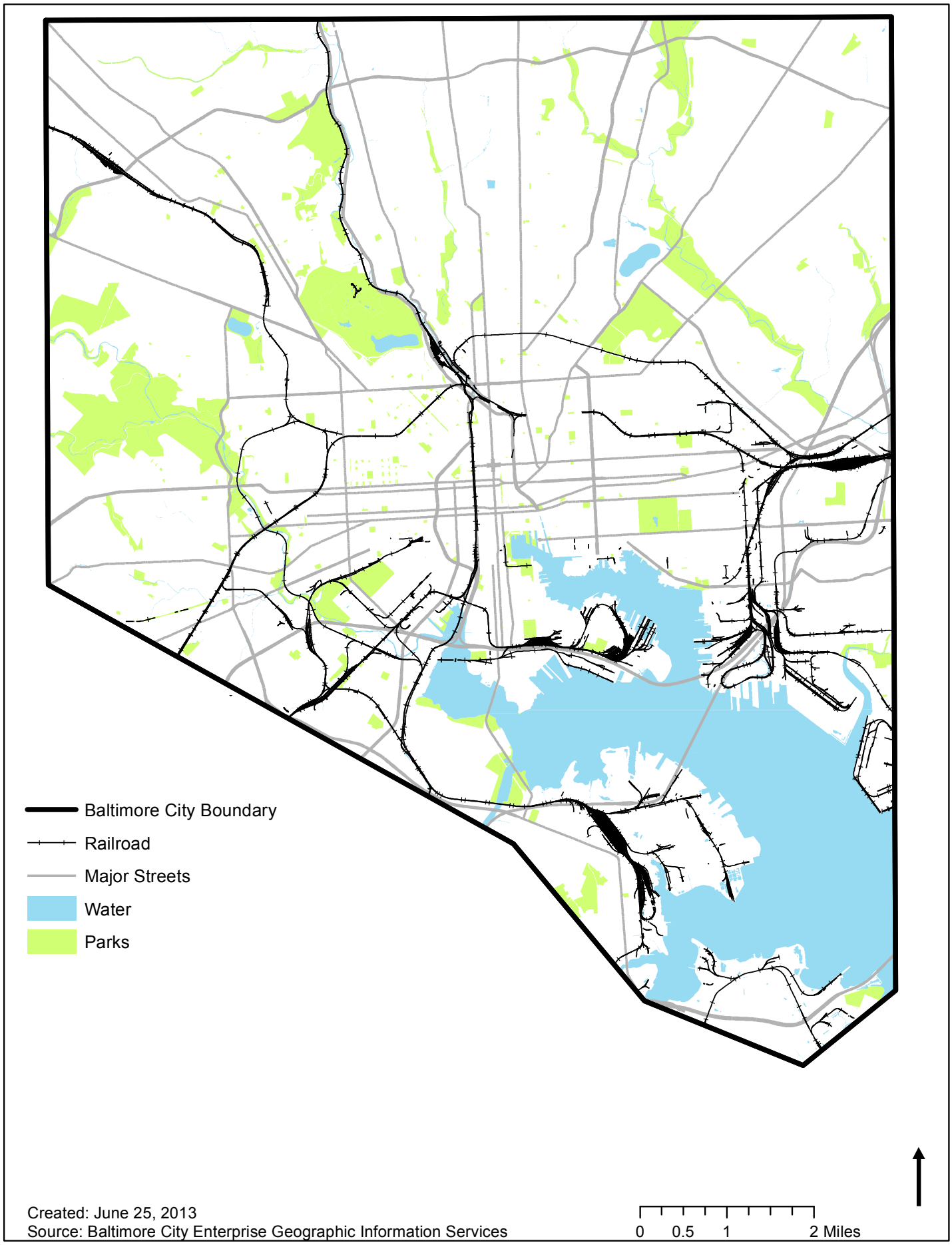
Appendix - Figure–10 Population Density



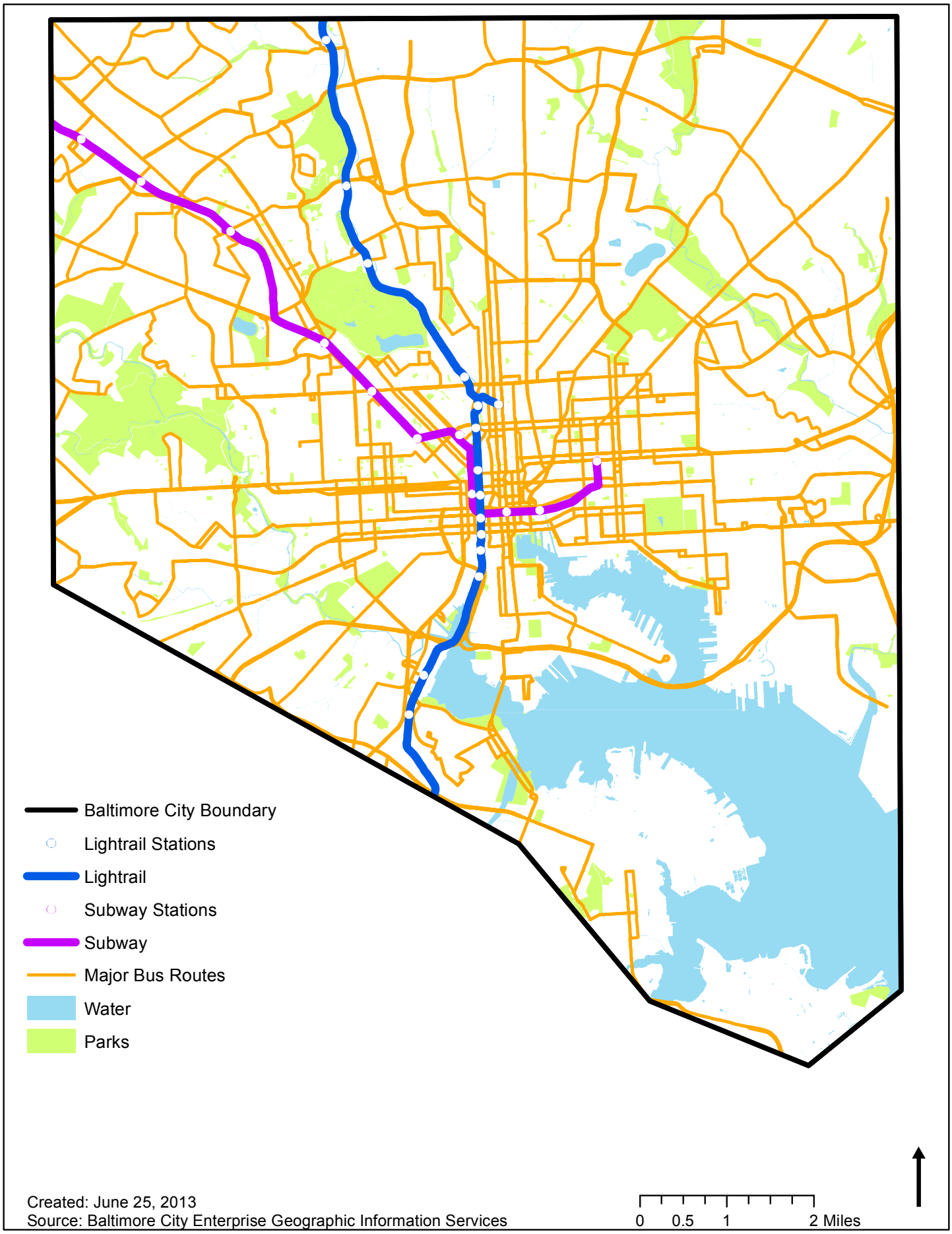
Appendix - Figure–11 Landuse



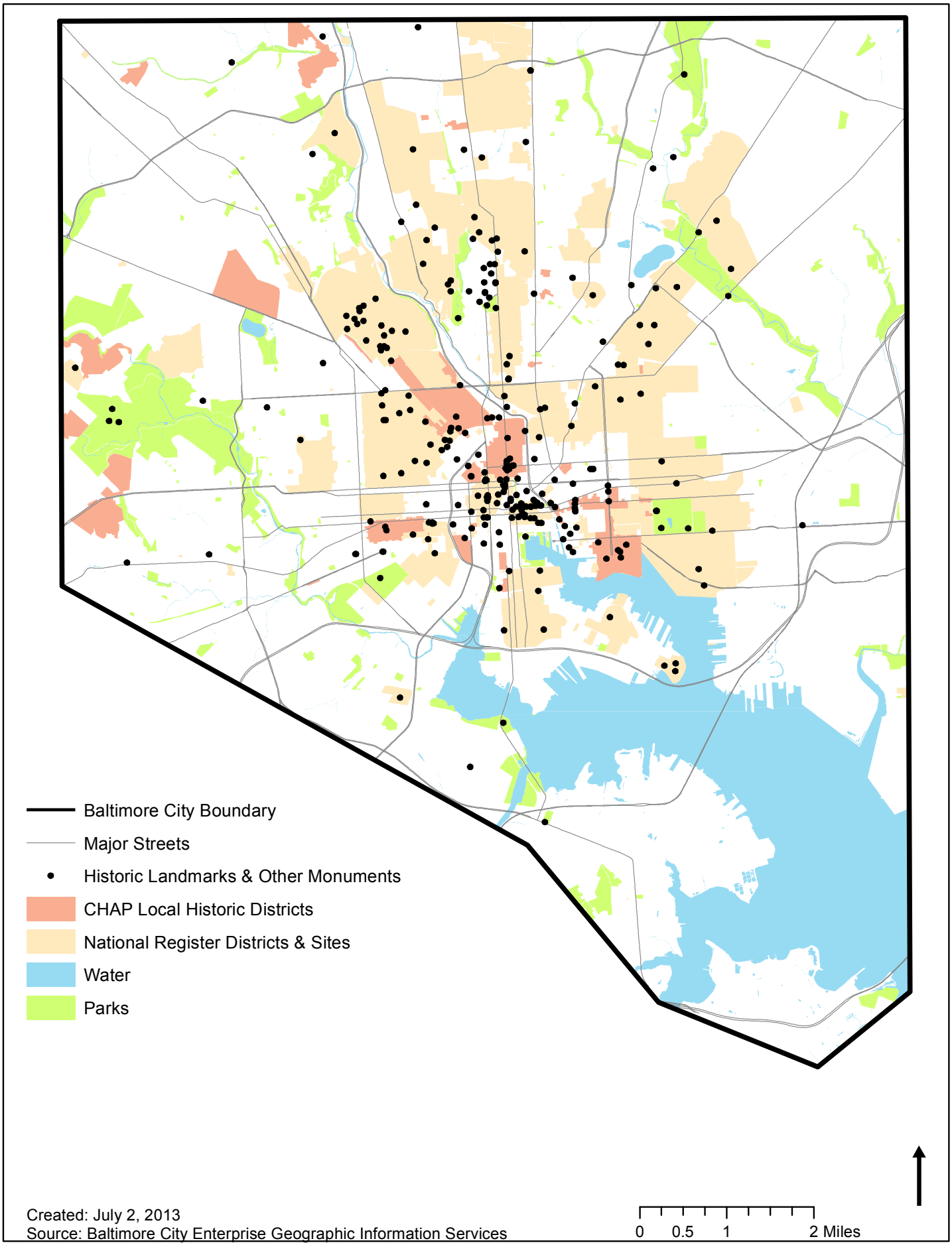
Appendix - Figure–12 Street and Highway Network



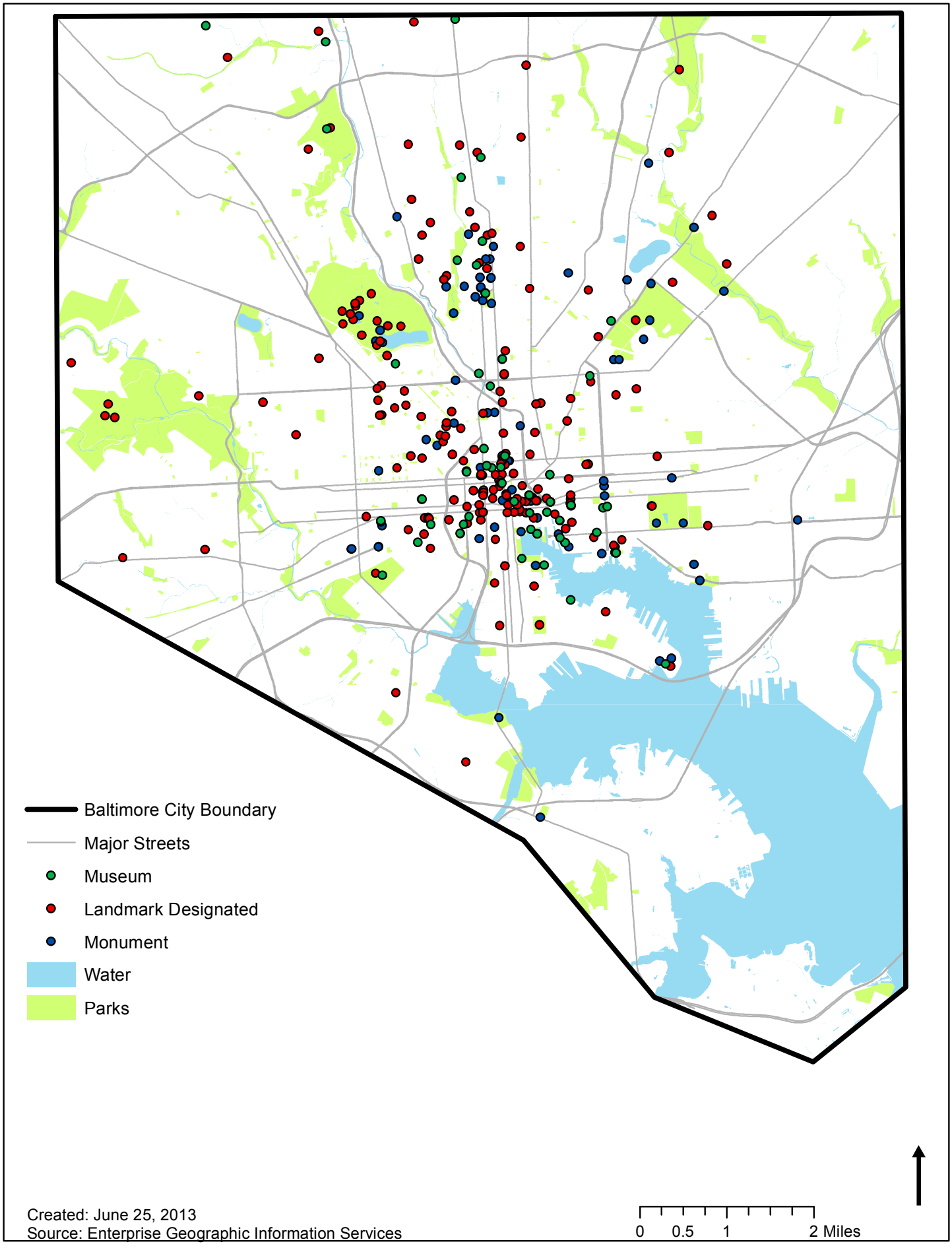
Appendix - Figure–13 Baltimore City Railroad Map



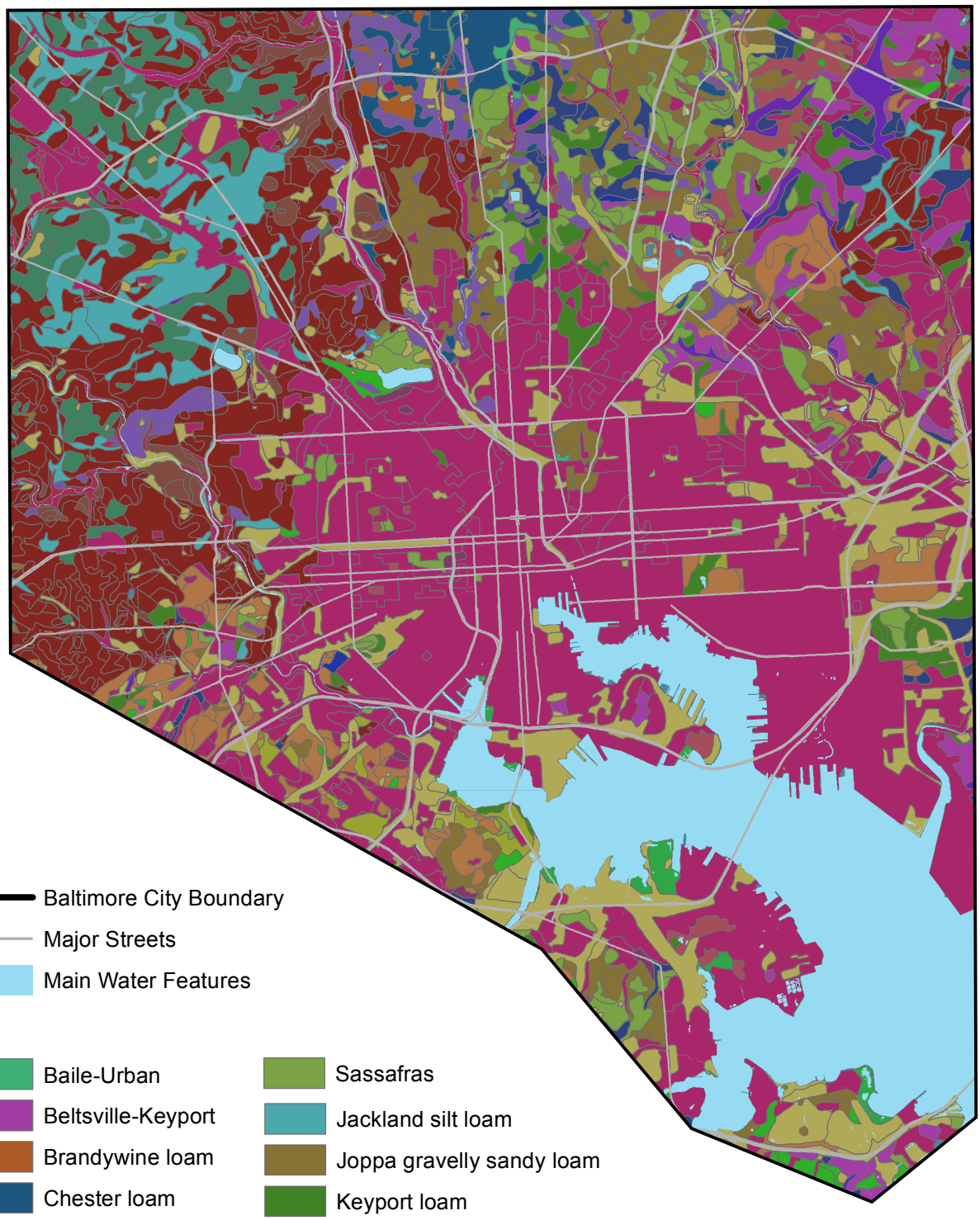
Appendix - Figure–14 Baltimore City Lightrail and Subway Routes



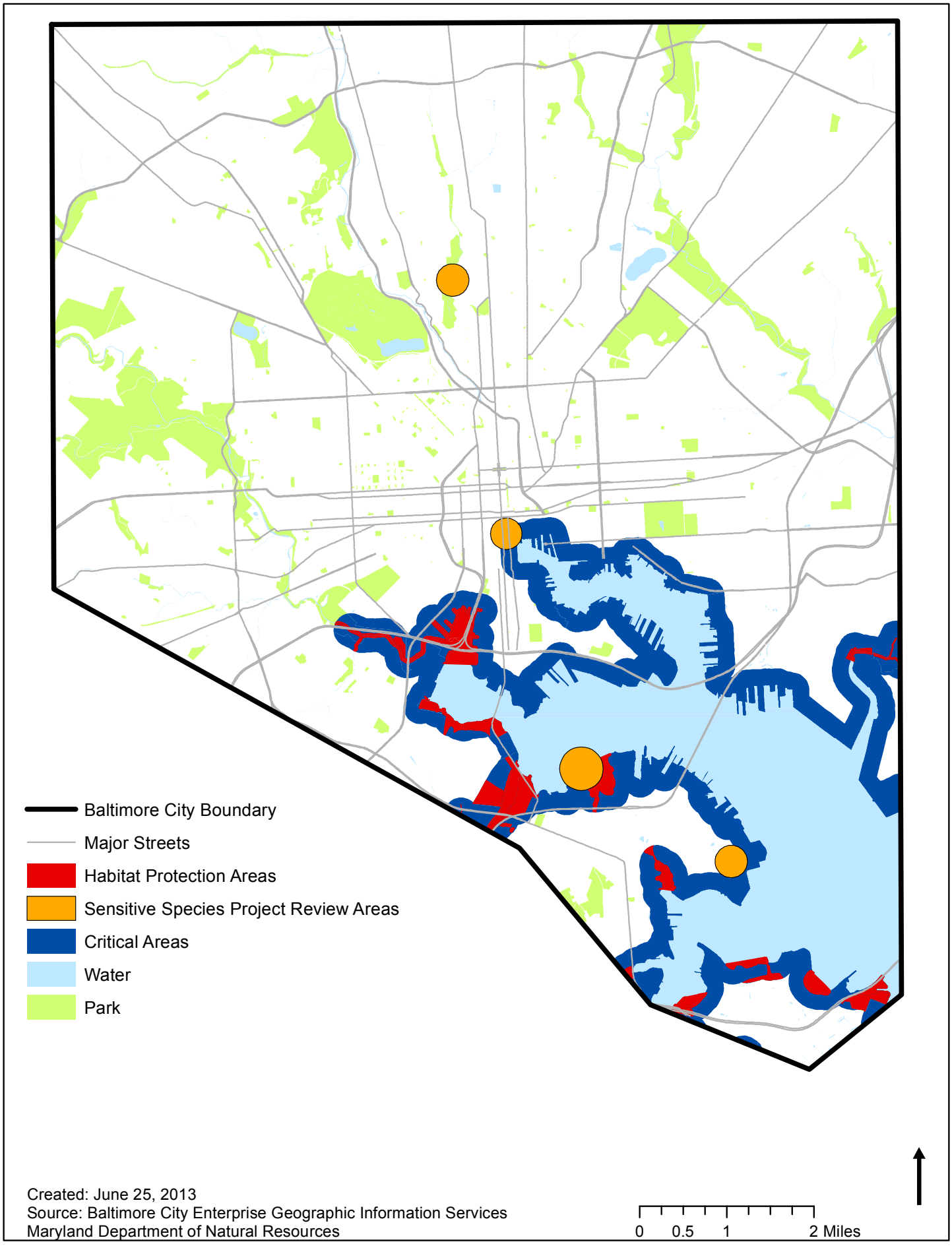
Appendix - Figure–15 Baltimore City Historic Sites



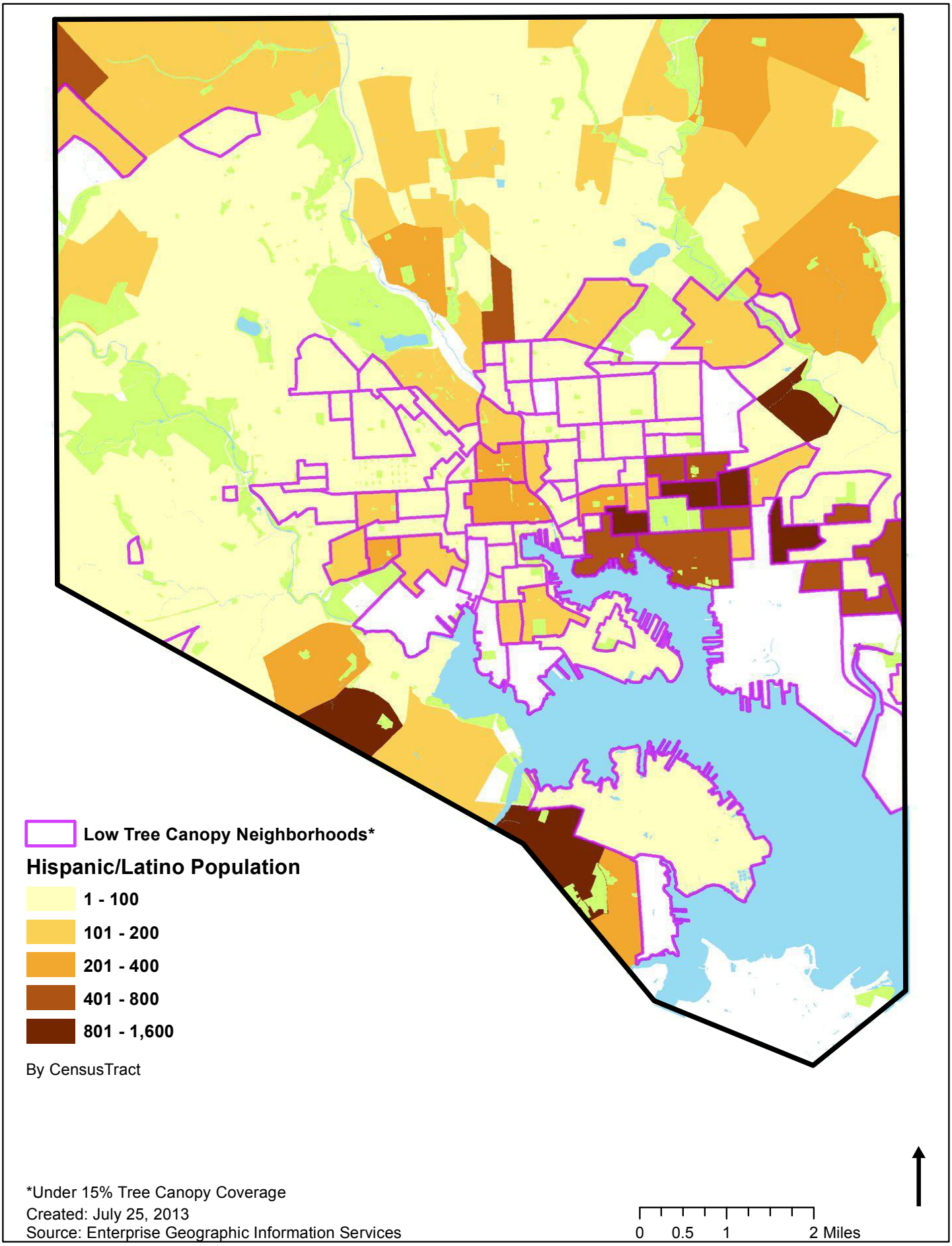
Appendix - Figure–16 Baltimore City Historic Assets by Type



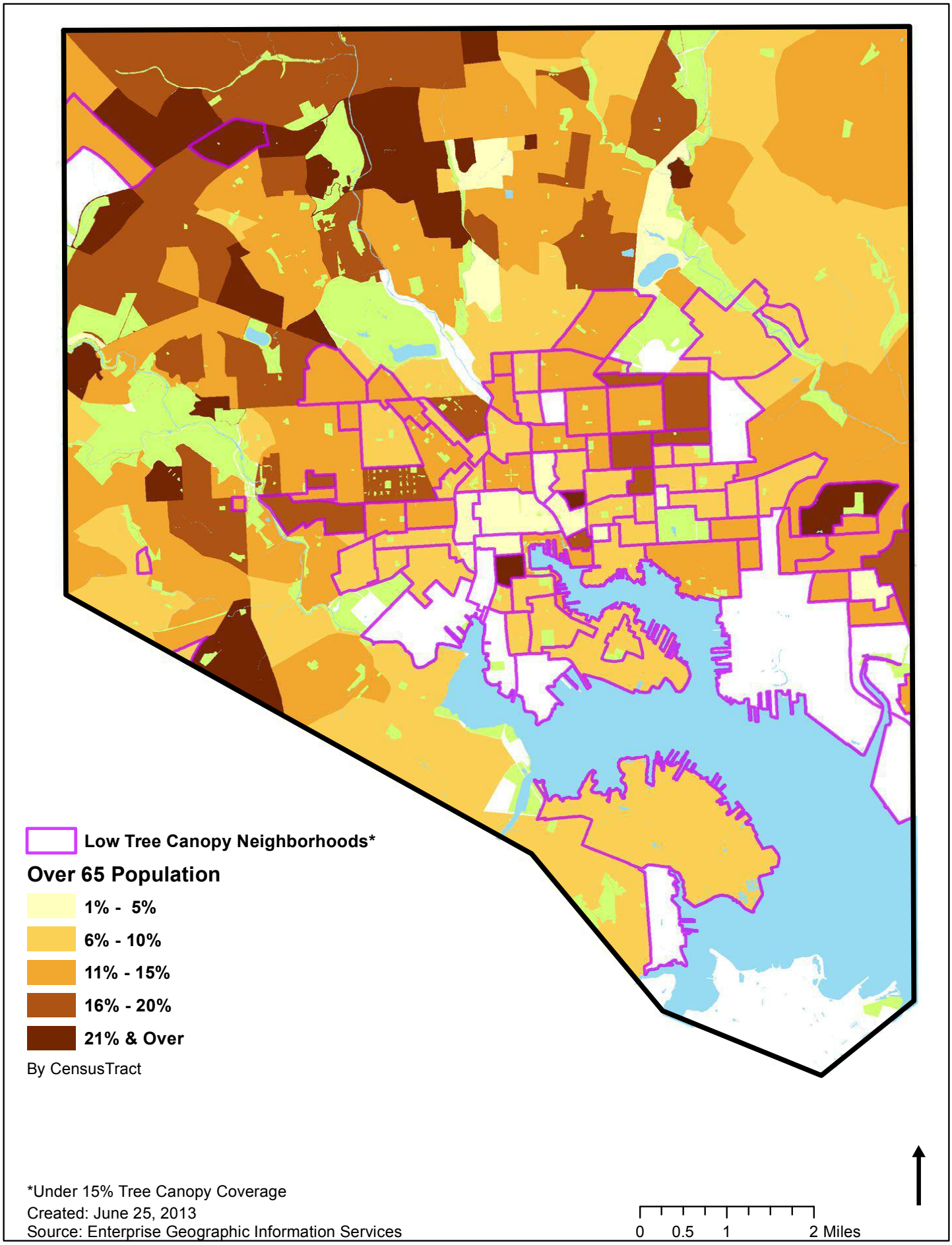
Appendix - Figure–17 Baltimore City Soil Types



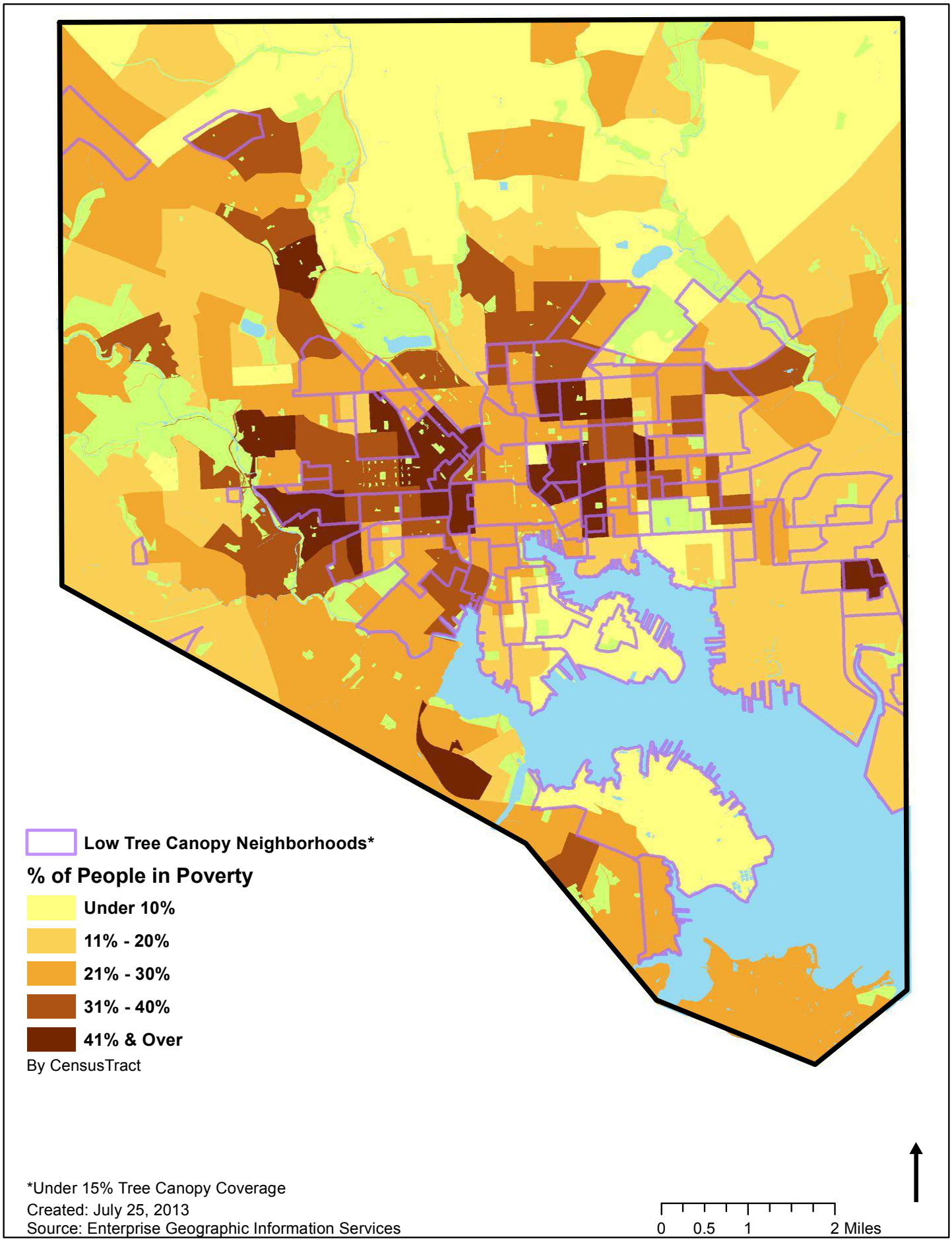
Appendix - Figure–18 Baltimore City Habitat Areas



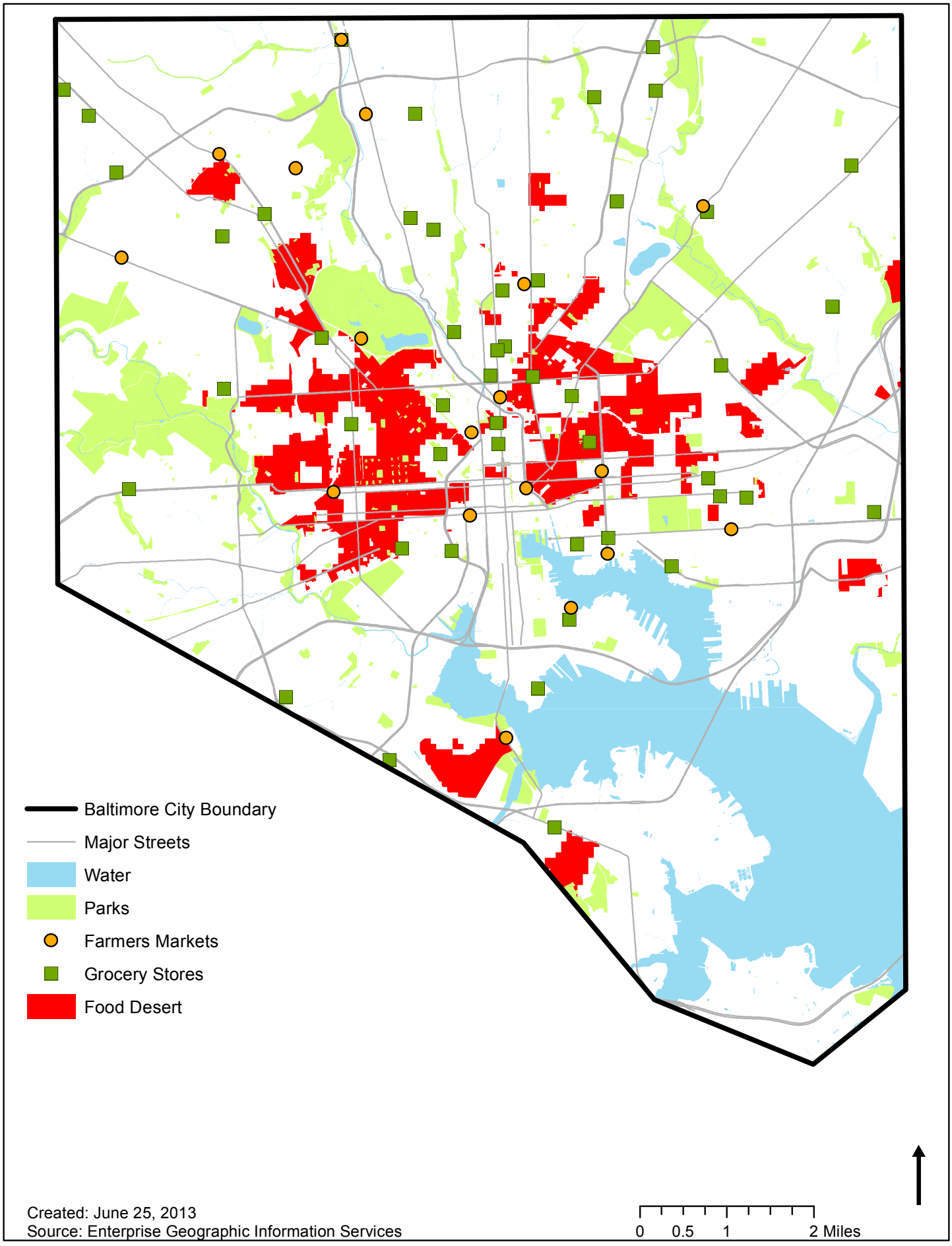
Appendix - Figure–19 Baltimore City Low Tree Canopy Neighborhoods with Hispanic/Latino Population



Appendix - Figure–20 Baltimore City Low Tree Canopy Neighborhoods with Eldery Population



Appendix - Figure–21 Baltimore City Low Tree Canopy Neighborhood with Populations Below the Poverty Level



Appendix - Figure–22 Baltimore City Food Deserts

Appendix L: References

Badger, Emily. (2012). How Bad Will Climate Change Get for the Eastern U.S.? Look at These Crazy Maps. The Atlantic Cities. Retrieved from http://www.theatlanticcities.com/neighborhoods/2012/12/how-bad-will-climate-change-get-eastern-us-look-these-crazy-maps/4208/

Baltimore Department of Planning; Maryland Department of Natural Resources; National Oceanic and Atmospheric Administration; & MEMA. (2000). Baltimore City Multi-Objective Floodplain Management Plan. Draft Report. Baltimore, MD.

Baltimore Department of Planning. (2013). Climate Action Plan. Retrieved from http://www.baltimoresustainability.org/sites/baltimoresustainability.org/files/BaltimoreCAP_FINAL_130415.pdf.

Banerjee, Neela. (2013, June 20). Study: U.S. fails to plan for weather, pays price. The Baltimore Sun, p. 5.

The City of Lewes. (2011). Lewes Hazard Mitigation and Climate Adaption Action Plan. Draft Report. Retrieved from http://www.ci.lewes.de.us/pdfs/Lewes_Hazard_Mitigation_and_CLimate_Adaptation_Action_Plan_FinalDraft_8-2011.pdf

CJ. (2013, July 16). States: Md. struggles to adapt to sea-level rise. Climate Wire. Environment and Energy Publishing. Retrieved from http://www.eenews.net/climatewire/2013/07/16/stories/1059984419

Climate Central. (2012). Facts and findings: Sea level rise and storm surge threats for Maryland. Fact Sheet. Retrieved from http://slr.s3.amazonaws.com/factsheets/Maryland.pdf

Dance, Scott. (2012). Derecho and heat wave in review: records, rankings and by the numbers. The Baltimore Sun. Baltimore, MD. Retrieved from http://articles.baltimoresun.com/2012-07-09/news/bal-wx-derecho-and-heat-wave-records-20120709_1_highest-temperature-temperature-records-derecho-storm

Federal Emergency Management Agency (FEMA). (1997). Multi-Hazard Identification and Risk Assessment.

FEMA. (1998). Managing Floodplain Development through the National Flood Insurance Program. Retrieved from http://www.fema.gov/pdf/floodplain/is_9_complete.pdf

FEMA. (2012). Flood Insurance Study for the City of Baltimore. Retrieved from https://www.rampp-team.com/county_maps/maryland/baltimore_city_coastal/baltimore_city_md_fis_tables_cpmr.pdf

Foot, Rich. (2013, June). Personal Communication.

Hirsch, Arthur. (2012, December 19). East Monument Street Reopens after $7 million sinkhole repair. Baltimore Sun: Baltimore, MD. Retrieved from http://articles.baltimoresun.com/2012-12-19/news/bs-md-ci-sinkhole-20121218_1_water-main-repairs-sinkhole-east-monument-street

Intergovernmental Panel on Climate Change [IPCC]. (2007). Fourth Assessment Report: Climate Change 2007 (AR4). Intergovernmental Panel on Climate Change. Cambridge University Press: New York, NY. Retrieved from http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#.UdRN2Xp1H3U

IPCC. (2007a). Climate Change 2007 – The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press: New York, NY. Retrieved from http://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html

IPCC. (2007b). Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press: New York, NY. Retrieved from http://www.ipcc.ch/publications_and_data/ar4/wg2/en/contents.html

James, R.W., Jr.; Moyer, W.J.; Wagner, A.J.; & Setzer, G.T. (n.d.). Maryland and the District of Columbia: Floods and Droughts. Retrieved from http://md.water.usgs.gov/publications/wsp-2375/md-dc/

Kasper, Matt. (2013, July 25). How Governor O'Malley Plans to Ensure Maryland Meets Its Greenhouse Gas Emissions Targets. ClimateProgress. Retrieved from http://thinkprogress.org/climate/2013/07/25/2356671/how-governor-omalley-plans-to-ensure-maryland-meets-its-greenhouse-gas-emissions-targets/

Klein, Jarred. (n.d.). The New 1981-2010 Climate Normals. Retrieved from http://www.erh.noaa.gov/lwx/climate/LWX_1981-2010_Normals_Website_pdf_version.pdf

Lemos, M. Carmen; Agrawal, Arun; Johns, Owen; Eaking, Hallie; Nelson, Don; Engle, Nate. (2011). Building Adaptive Capacity to Climate Change in Less Developed Countries. Retrieved from http://library.wmo.int/pmb_ged/wcrp_2011-lemos.pdf

Livingston, Ian Sean. (2011). 100 degree days at Washington, D.C., Baltimore, Md. and Dulles, Va.: Averages, extremes and what to look for. Retrieved from http://www.ianlivingston.com/2011/07/11/100-degree-days-at-washington-d-c-and-baltimore-md-yearly-counts-seasonal-average-and-extremes/

Local Governments for Sustainability USA. (2012). U.S. Cities Report Increase in Climate Change Impacts. Retrieved from http://www.sustainablecitynetwork.com/topic_channels/policy/article_e8f8eb72-af7d-11e1-b128-001a4bcf6878.html

MADE CLEAR. (2012). Climate Change in Maryland: A Resource for Educators. Draft Report. Retrieved from http://www.madeclear.org/wp-content/uploads/2012/02/MADE-CLEAR-Climate-Change-in-Maryland-Feb-20124.pdf

Maryland Commission on Climate Change. (2008). Maryland Climate Action Plan. Retrieved from http://www.mde.state.md.us/programs/Air/ClimateChange/Pages/Air/climatechange/legislation/index.aspx

Center for Integrative Environmental Research. (2008). Climate Change Impacts on Maryland and the Cost of Inaction. Retrieved from http://www.cier.umd.edu/climateadaptation/Chapter3.pdf In Maryland Commission on Climate Change. (2008). Maryland Climate Action Plan.

The Scientific and Technical Working Group. (2008). Comprehensive Assessment of Climate Change Impacts in Maryland. Retrieved from http://www.mde.state.md.us/programs/Air/ClimateChange/Documents/FINAL-Chapt%202%20Impacts_web.pdf In Maryland Commission on Climate Change. (2008). Maryland Climate Action Plan.

Maryland Emergency Management Agency. (2011). Maryland State Hazard Mitigation Plan Update.

Maryland Department of the Environment. (1997). Maryland Floodplain Manager's Handbook. Baltimore, MD.

Maryland Department of Natural Resources. (2005). An Assessment of Maryland's Vulnerability To Flood Damage. Retrieved from http://www.esrgc.org/pdf/hazus/An%20Assessment%20of%20Maryland%27s%20Vulnerability%20to%20Flooding.pdf

Maryland Geological Survey. (2010). Summary of Maryland Earthquakes, 1758-2005. Retrieved from www.mgs.md.gov/esic/brochures/earthquake.html, www.mgs.md.gov/esic/fs/fs13.html).

Metcalfe, John. (2013, 25 July). The Atmospheric 'Rivers' That Explain Why Flooding Has Gotten So Vicious. The Atlantic Cities. Retrieved from http://www.theatlanticcities.com/neighborhoods/2013/07/atmospheric-rivers-explain-why-flooding-has-gotten-so-bad/6319/

Ministry for the Environment. (n.d.) New Zealand. Retrieved from http://www.climatechange.govt.nz/glossary.html

National Climate Assessment and Development Advisory Committee (NCADAC). (2013, January 11). National Climate Assessment. Draft Report.

National Resource Defense Council [NRDC]. (2008). The Cost of Climate Change. Retrieved from http://www.nrdc.org/globalwarming/cost/cost.pdf

National Severe Storms Laboratory. (n.d.). Severe Weather 101: Frequently Asked Questions About Lightning. NOAA. Retrieved from http://www.nssl.noaa.gov/education/svrwx101/lightning/faq/

National Weather Service. (2012). The Derecho of June 29, 2012. Baltimore/Washington Forecast Office. Retrieved from http://www.erh.noaa.gov/lwx/events/svrwx_20120629/

National Wildlife Federation. (2013). Actions to Protect and Enhance the Health of Urban Forests. In Growing Greener: Eco-Structure for Climate Resilience. Retrieved from https://www.nwf.org/~/media/PDFs/Global-Warming/Climate-Smart-Conservation/Growing_Greener/GrowingGreener_Chapter3_Actions.ashx.

Northeast Climate Impacts Assessment (NECIA) Synthesis Team. (2007). Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions. Cambridge, MA: Union of Concerned Scientists (UCS). Retrieved from http://www.climatechoices.org/assets/documents/climatechoices/confronting-climate-change-in-the-u-s-northeast.pdf

Our Children's Trust. (n.d.). District of Columbia: Changing Climate. Retrieved from http://ourchildrenstrust.org/page/310/district-columbia-changing-climate

Oxfam America. (n.d.) Fact Sheet: The Social Effects of Global Warming, Maryland. Boston, MA. Retrieved from http://adapt.oxfamamerica.org/resources/factSheetsTables/Maryland_factsheet.pdf

Rector, Kevin. (2012, August 26). Heavy rains cause Monument Street sinkhole to reopen, widen. Baltimore Sun: Baltimore, MD. Retrieved from http://articles.baltimoresun.com/2012-08-26/news/bs-md-tornado-warning-20120826_1_heavy-rains-severe-thunderstorm-national-weather-service

Scientific and Technical Working Group. (2013). Updating Maryland's Sea-level Rise Projections. Maryland Climate Change Commission. University of Maryland Center for Environmental Science: Cambridge, MD. Retrieved from http://www.umces.edu/sites/default/files/pdfs/SeaLevelRiseProjections.pdf

Sherwood, T. (2004). A User's Guide to Karst and Sinkholes in Western Maryland. Retrieved from http://www.wmrcd.org/14374_lores_screen.pdf

Tallamy DW, Shropshire KJ. (2009). Ranking lepidopteran use of native versus introduced plants. Department of Entomology and Wildlife Ecology, University of Delaware: Newark, DE.

U.S. Department of Commerce. (2013). The Historic Derecho of June 29, 2012. Retrieved from http://www.nws.noaa.gov/os/assessments/pdfs/derecho12.pdf

U.S. Environmental Protection Agency (EPA). (2013, March 6). Heat Island Effect. Retrieved from: http://www.epa.gov/hiri/

Wheeler, Timothy. (2013, July 14). Trees can help with soot pollution, study finds. The Baltimore Sun: Baltimore, MD. Retrieved from http://articles.baltimoresun.com/2013-07-14/health/bs-hs-urban-trees-pollution-20130714_1_soot-pollution-health-benefits-urban-areas