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Rising Waters White Papers

1. Local Level Planning and Land Use Adaptation Policies
2. Creating and Sustaining a Public Education Program
3. Regulatory Codes for Adaptation Building Performance Standards
4. Adaptation Alternatives for Private Property Owners
5. Evaluating Cultural Resource Impacts and Adaptation Strategies
6. Structural Approaches to Adaptation in Public Space
7. Natural Resource Impacts and Adaptation Strategies
8. Quantifying the Economic Impacts of Action vs. Non-Action

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Planning and Land Use Adaptation Policies

Presented by: Sally Nash and Eileen Fogarty

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"Intelligent Adaptation to Rise with the Tides"
A Safe Approach to Planning for Sea Level Rise (SLR)
Presented by: John Englander, Rising Seas Group

- Most recent Federal study (2012) recommended planning for 6.6 feet SLR by end of century. In 2013 Maryland recommended 5.7 feet as a worst case scenario.
- In the last two years record levels of warming and melting of glaciers in Greenland and West Antarctica strongly suggest that SLR is accelerating and will continue to push those projections even higher.
- As a prudent guideline, we recommend planning for 3 feet of higher sea level by mid-century, and anticipating as much as 7 feet by the end of century.
- A 30-year Master Plan is strongly recommended to take into consideration the long duration of buildings, infrastructure, and code heights. Benefits of a longer term view are that investments today will have greater durability, have better community aesthetics, and likely produce a better return on investment

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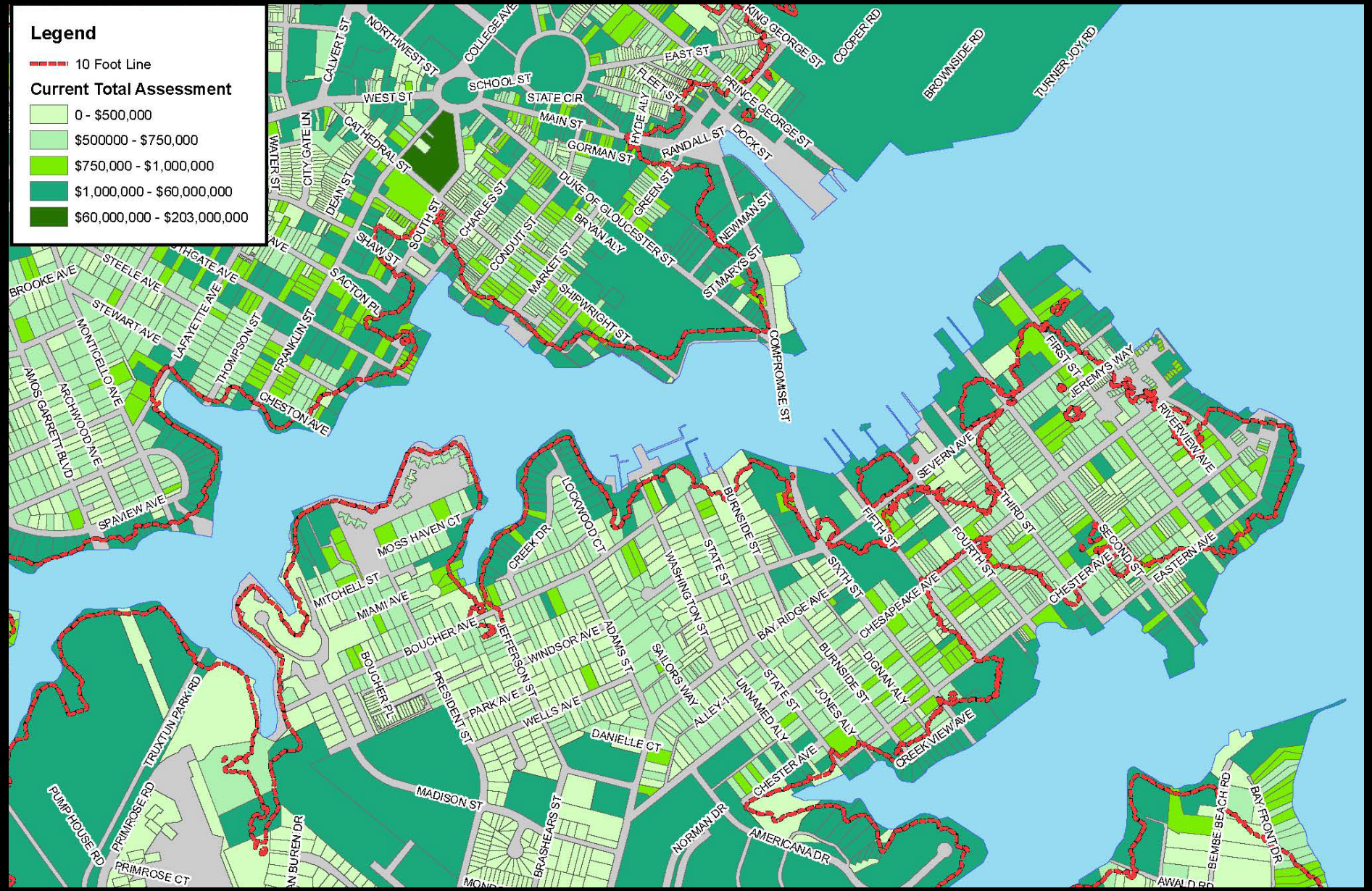

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Solutions?

Zoning Approaches

- Downzone
- Increase setbacks
- Increase freeboard
- Limit building size

Zoning Incentives

- Bonus Floor Area
- Transfer of Development Rights
- Reduction of on-site parking
- Exemptions from required minimum densities

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How do we retain our scale, character, and active waterfront?

<u>Policy Issues and Strategies for Annapolis</u>

Urban Land Institute:

- Create certainty
- Provide flexible options
- Recoup lost ground-level space
- Promote active street frontage
- Customize sea level rise strategy
- Take “multiple bites from the apple”

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Strategy: Incentivize Sea Level Rise Adaptation

Reward Compatible Uses

- Working maritime
- Water-dependent uses

OR

Provide Public Benefits

- Views
- Accessibility to water
- Open space
- Decreased paving

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Public Education Program for Adaptation
Presented by: Jennifer Wellock & Jenifer Eggleston
(National Park Service)

Creating and Sustaining a Public Outreach Program: Get Out There and Get Engaged

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Public Education (cont.)

Step 1: Build the Network, think outside of the box

Step 2: Create the Engagement Plan, with your network

Step 3: Communicate and Implement the Plan, keep talking

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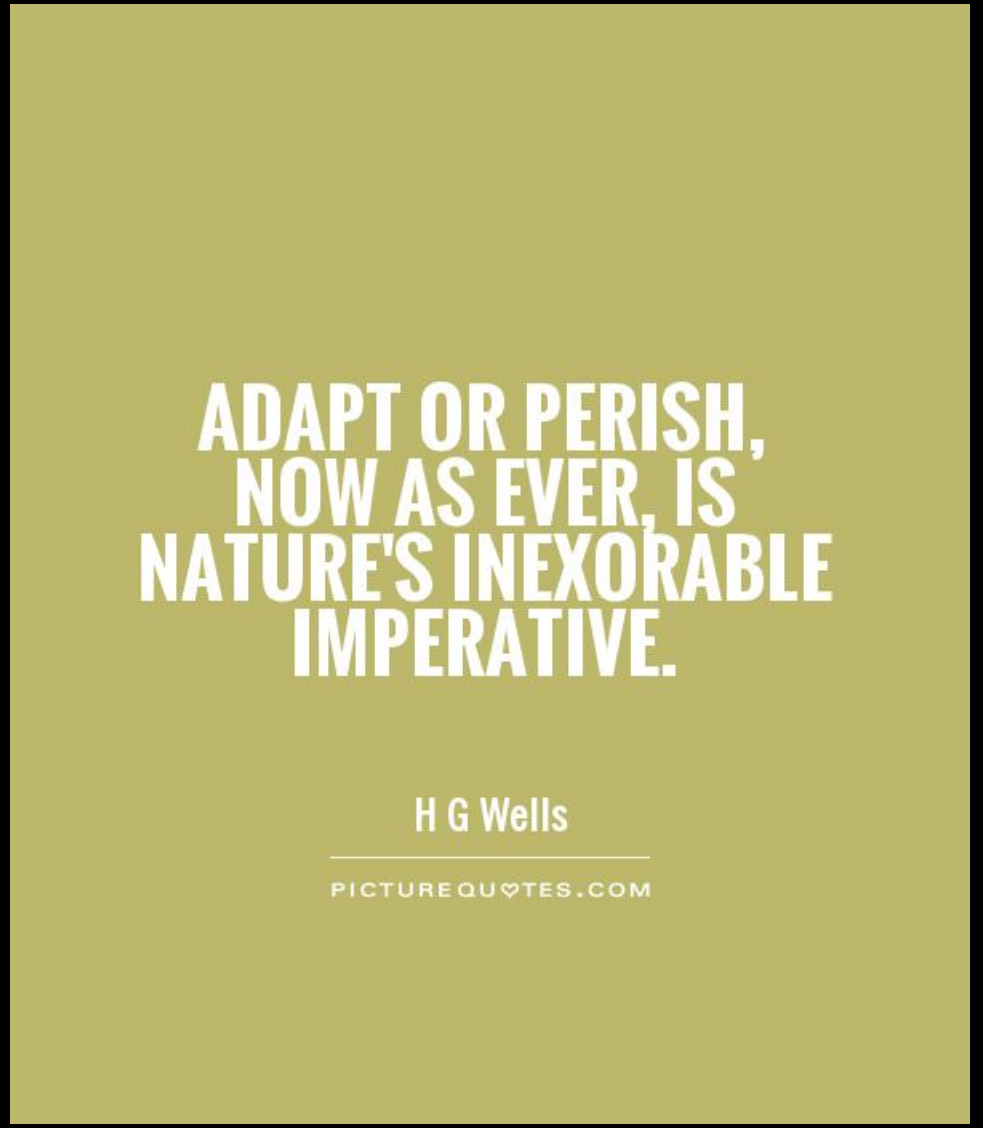
Public Education (cont.)

Step 4: Evaluate the Plan, be nimble

Step 5: Keep Engaging and Adapting, really keep talking



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Regulatory Codes for Adaptation

Presented by: Jen Sparenberg, CFM

1. When applying for a variance to the floodplain ordinance, require that the electrical and plumbing systems be relocated to the elevations required by §17.11.420, Buildings and Structures, if interior renovations are made to a historic structure;

2. When applying for a variance to the floodplain ordinance, require floodproofing to the extent practicable while preserving the exterior of the historic structure;

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Regulatory Codes for Adaptation

3. Amend the Approval of Exterior Changes in the Historic Overlay District to include a process for expedited approval of emergency repairs after a natural disaster (e.g. flood, fire, etc.);

4. Amend the Historic Overlay District to include language that addresses the installation of temporary storm protective measures (e.g. temporary floodwalls, storm shutters), and

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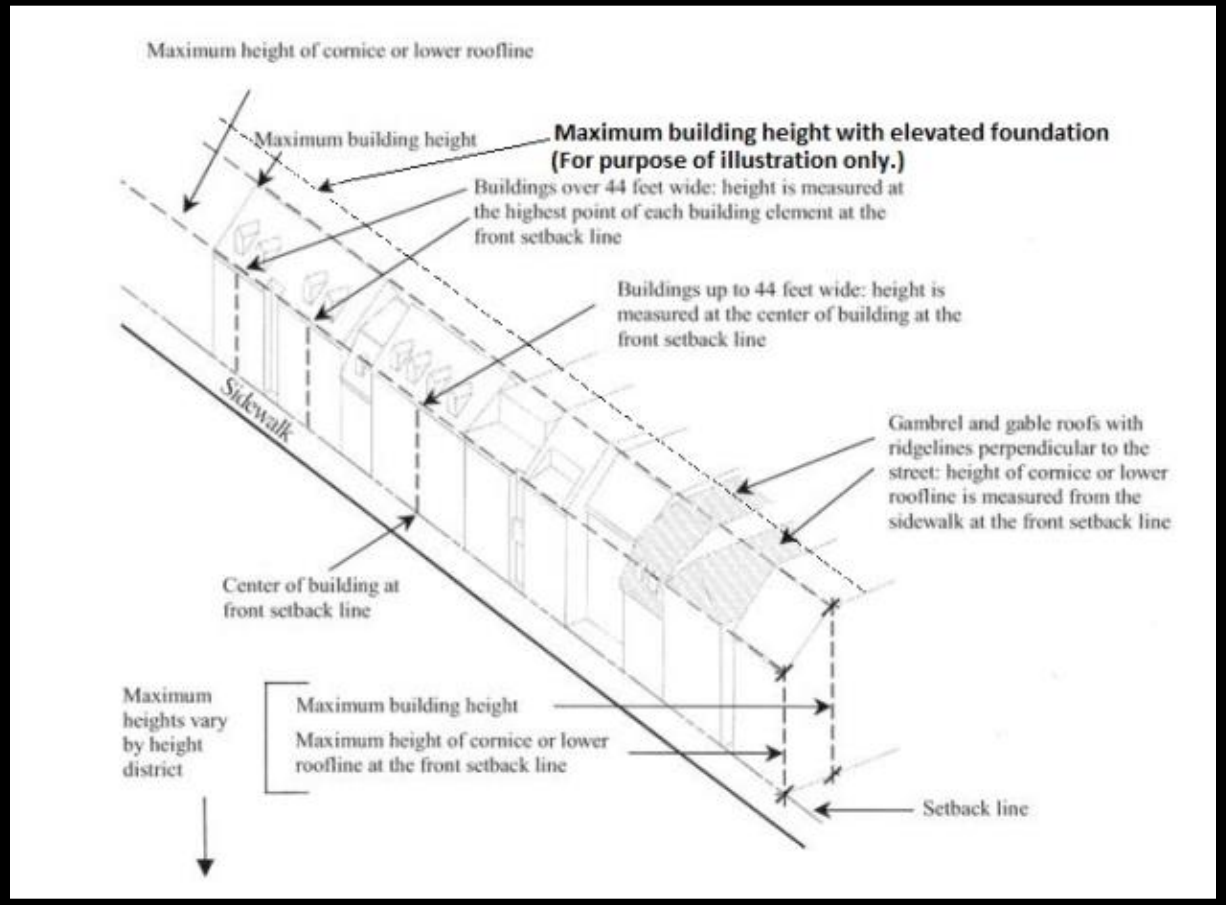
Regulatory Codes for Adaptation

5. Amend the height limits in the historic district overlay to accommodate the elevation of historic structures as a method of flood protection.



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Adaptation Alternatives – Private Property

Presented by: Michael Dowling, Architect

Traditional Flood Damage Mitigation

- Structural approaches include levees, canals, sea walls, water/tide gates, etc.
- Nonstructural approaches include relocation and acquisition and demolition of endangered properties

Neither of these approaches is truly suitable for the Annapolis Historic District. There are limited sites available to move buildings to, and the demolition of historic resources would destroy the character of Annapolis and remove valuable historic resources from our culture.

So what are the realistic adaptation measures for property owners?

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Realistic Adaptation Measures for Property Owners

Maintenance helps preserve the integrity of historic structures

- repair foundations as needed
- caulk/Fill penetrations of building envelope
- repoint masonry joints
- keep roofs, gutters, and downspouts in working condition
- keep the grade around the foundation sloping away from the building
- correct areas that trap unwanted moisture

Site changes to direct the water away from historic structures

- building up adjacent grade for positive drainage
- sidewalks slope away from the building.
- landscaping measures: swales, flood tolerant and erosion resistant plants
- bulkheads, sea walls, and freestanding permanent barriers

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Basic Flood Retrofit

- raising HVAC equipment, ductwork, and air handlers
- raising electrical service, switchgear, panels, outlets, etc.
- installing anti back flow valves on plumbing and drains
- filling in basements and crawl spaces below the buildings adjacent grade
- strengthening building structural systems against wind & hydrostatic forces:
  - Reinforce wall framing and fasteners,
  - Add hurricane and tie downs to secure roof and floors to walls
    - Anchor building frame to foundation
    - Check chimney, parapets, roof, flashing,
    - Secure rafters to wall

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Flood Proofing

Wet flood proofing strategy allows water during a flood event enter and leave a building, and will require remediation and damage repair after each event.

- install flood vents within 1’ of floor level & exterior grade.

Dry flood proofing is a strategy to keep water from entering a building. Semi-permanently in masonry buildings, or with temporary protection for frame buildings.

- install door and window dams; channels/panels stored on site
- treat masonry buildings with waterproof coatings appropriate to the material

Temporary measures (with) advanced warning of a flood

- sandbags can be deployed as a means to divert water
- installation of a sump pump with a power back-up

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Elevating Buildings

Elevating an historic property may be the best mitigation solution to protect the resource from flooding and sea level rise.

- commercial properties with high first floor ceilings can elevate the first floor
- raising buildings to an appropriate elevation above the expected flood level (this is possible for both frame and masonry buildings)
- the visual change could be mitigated through site grading and landscaping

Elevating historic structures is a difficult issue; historic buildings share important features (landscaping, alleyways, orientation and setback) that define a neighborhood's historic significance. While raising a building changes the historic relationship of the structure to its site, given the tragic losses that could occur through sea level rise and coastal flooding, it may be an appropriate preservation direction to take.

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Cultural Resource Impacts - Adaptation Strategies

Presented by: Nell Ziehl, Chief, Office of Planning, Education and Outreach Maryland Historical Trust

- Resist - Individual, District and Regional Adaptations
- Raise - Elevate Buildings (Interior and Exterior) and Districts
- Retreat - Move or Abandon Vulnerable Buildings or Areas

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Resist - Individual, District and Regional Adaptations

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Raise – Elevate Buildings (Interior & Exterior) and District

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Retreat - Move or Abandon Vulnerable Buildings or Areas

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Structural Adaptation – Public Space

Presented by: Stacey Underwood, U.S. Army Corps of Engineers

- Annapolis is at risk of flooding from high tides, floodwater backing up into storm drains, increased sea level rise and large storm surges from hurricanes/tropical storms
- Initial City focus will be Historic District/City Dock area
- Area frequently experiences localized flooding via storm drain system
- Structural solutions will need to be considered at City Dock as part of an overall solution

High Tide at City Dock

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Stormwater Improvements

- First priority - City must find ways to prevent high tides from backing up into the storm drain system and causing flooding

- Potential options:
  - Backflow preventers/flap valves
  - Realignment of storm drain system
  - Pumping station(s)

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Potential Structural Measures

- Second priority - City must find ways to reduce risk of flooding from sea level rise and large storms
- Potential options:
  - Floodwall/seawall
    - Aesthetics/view/access will be challenge
    - Unique designs exist to blend with downtown aesthetics
    - Permanent wall could be low, and higher wall could be manually or hydraulically erected prior to flood
    - Lower walls could be built to allow increased height over time
    - Walls must tie into high ground
    - Closure structures are required where openings are needed for access

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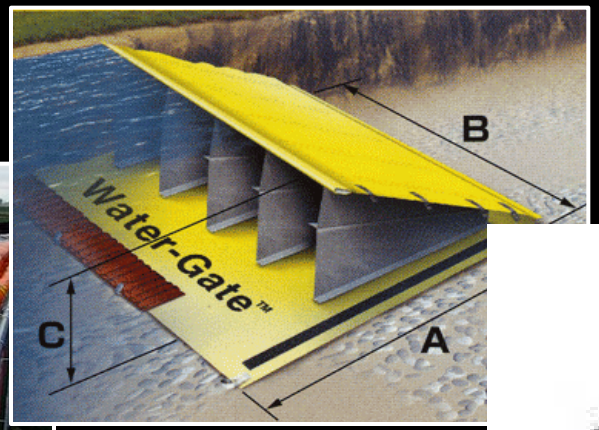
Potential Structural Measures

- Potential options (cont.):
  - Structural improvements such as raising roads or walkways
  - Temporary flood barriers that must be erected prior to flood (will not reduce tidal flooding from sea level rise)



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Natural Resource Impacts – Adaptation Strategies

Presented by: Doug Myers, Chesapeake Bay Foundation and Aaron Keel, EnviroProjects

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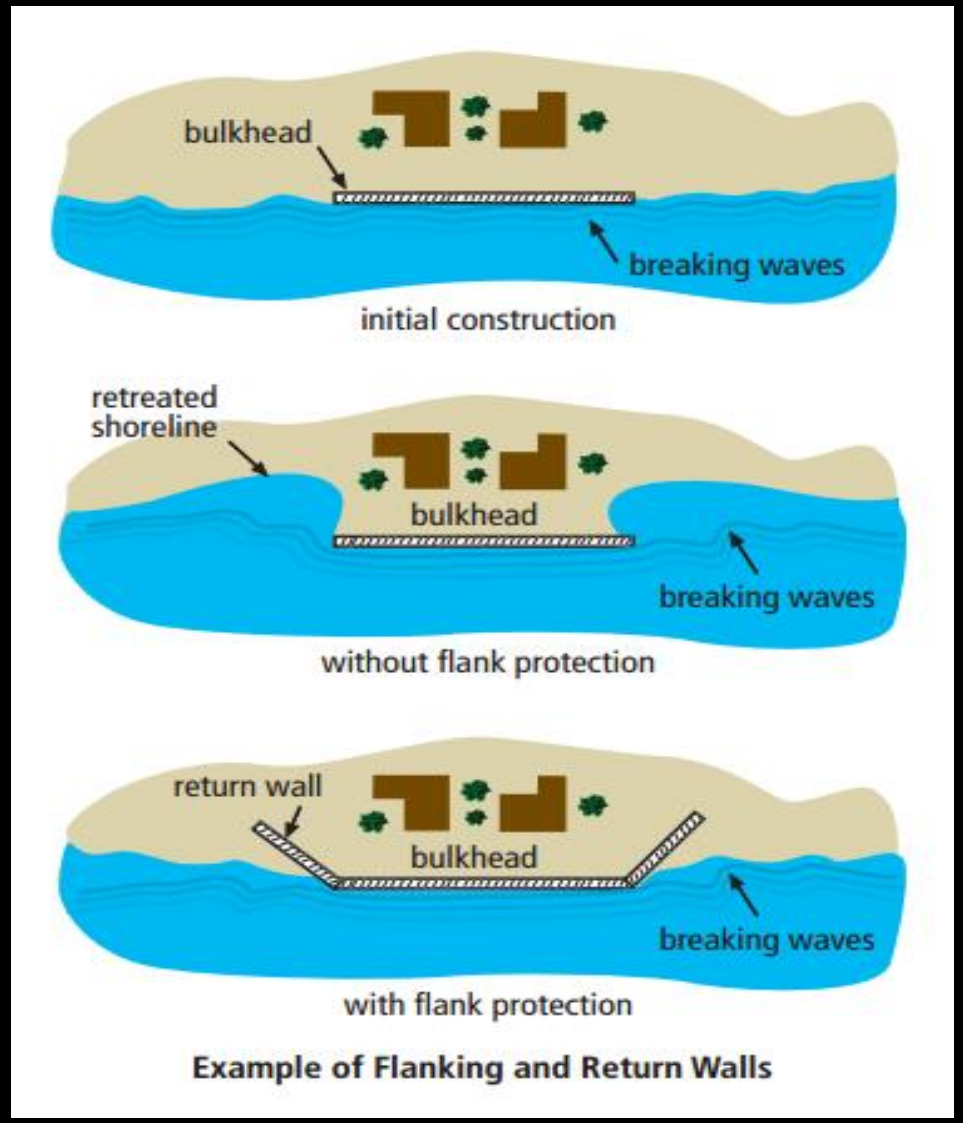
Natural Resource Impacts Adaptation Strategies

Knee-jerk reactions to shoreline erosion at the parcel scale will accelerate shoreline erosion at the neighborhood scale

Natural shorelines and their sediment transport processes are the best defense

Protecting upland infrastructure will not be possible everywhere



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Natural Resource Impacts – Adaptation Strategies

We can engineer resilient shorelines mimicking nature

- In situ dredging
- Shore adjacent reefs
- Living shorelines
- Reforestation

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Natural Resource Impacts – Adaptation Strategies

Managing total water volume will require redirection of runoff away from tidal outlets and a massive increase in infiltration throughout the landscape, not just in waterfront neighborhoods

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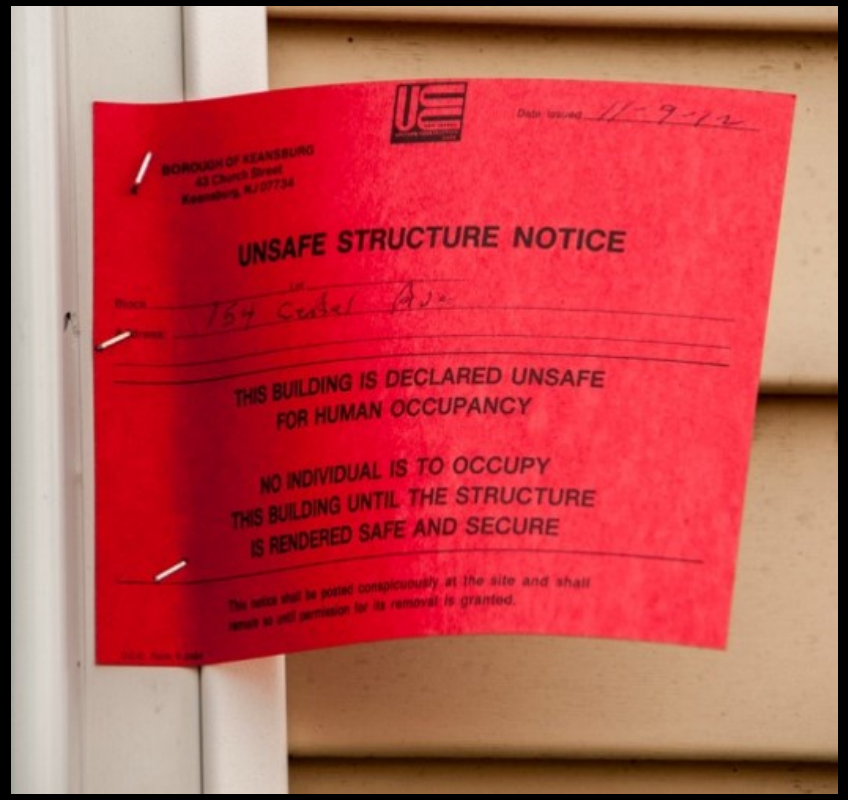
Quantifying the Economic Impacts of Adaptation Action vs. Non-Action

Presented by: Don M. Bain, P.E., Rising Seas Group & Hollis Minor, Economic Development, City of Annapolis



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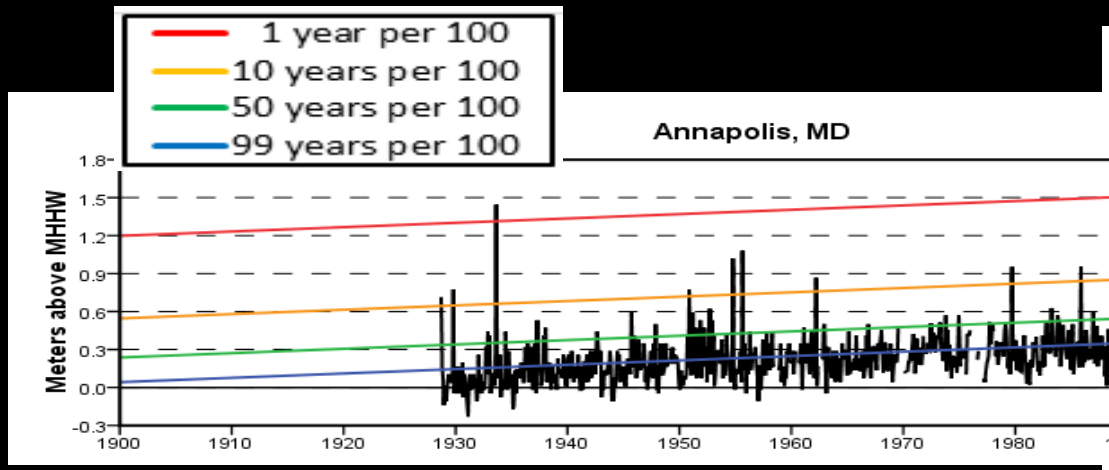
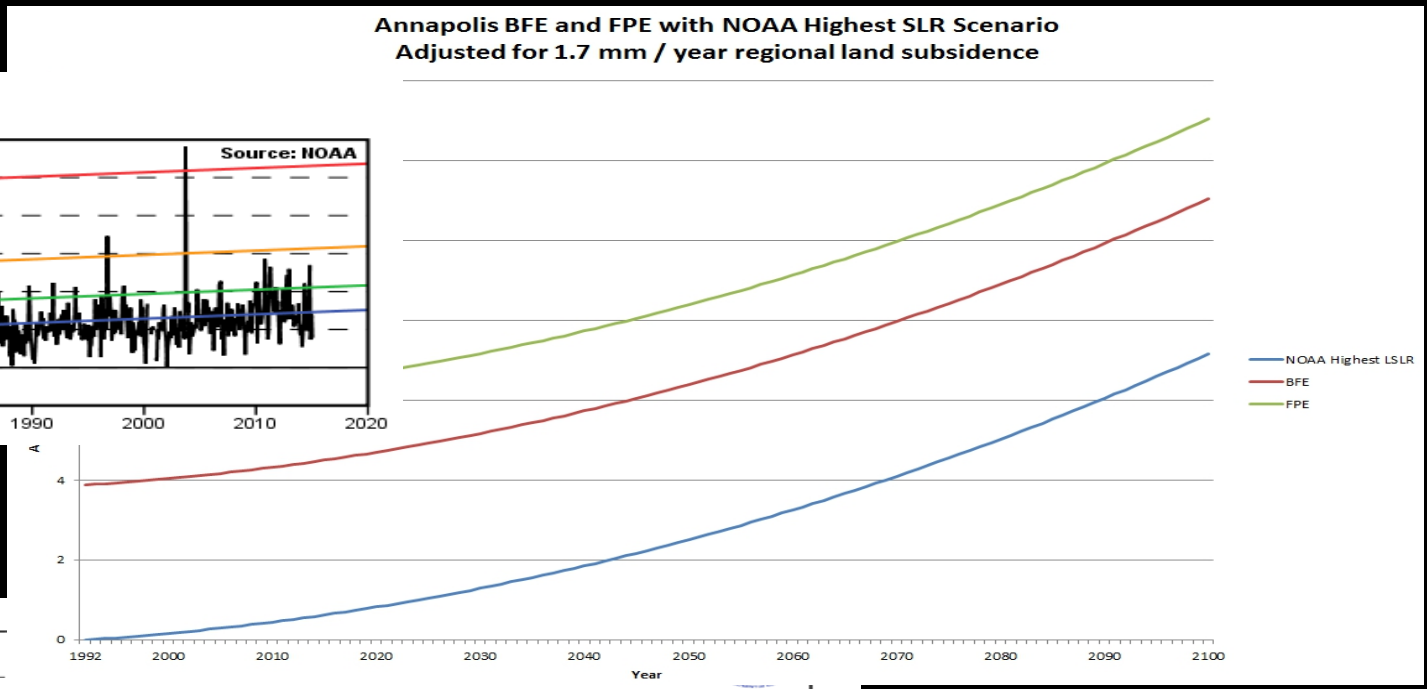
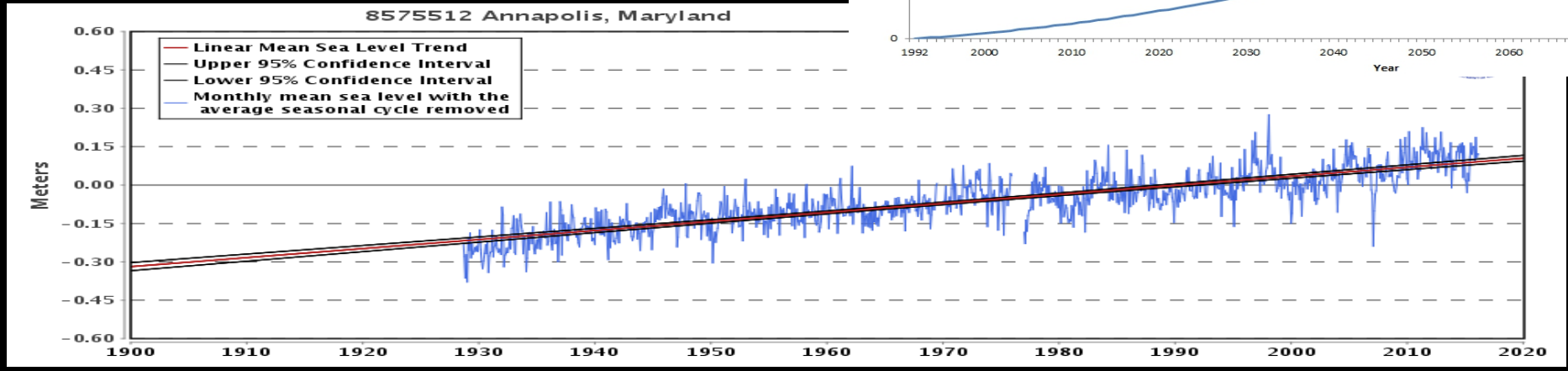
Flood Freq., Historic & Future Sea Level Rise







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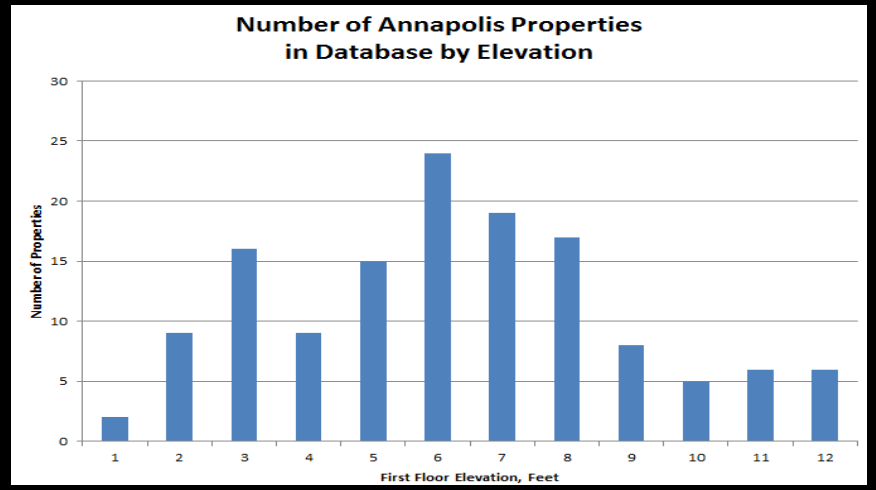
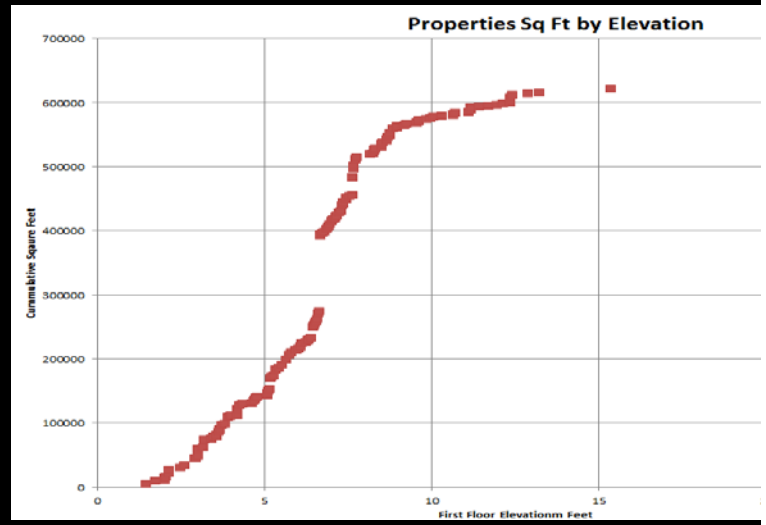
Annapolis Data

159 properties below 10 feet elevation

- Property data
- Elevation data





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Estimating Tools – Road Testing

Property Damage

Investment Flood proof

Investment Elevate

Business Loss

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Quantify Impacts and Response

Adaptation Responses		
Armor	Elevate	Retreat

Private Property

Business

Community

Private Sector

- Costs due to flood
- Investments to reduce flood damages

- It's really about economics
- Solutions in addition to technical and engineering

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Today's Objectives

- Confirm ability to translate science into economics
- Road test tools
- Feedback
- Prepare to make planning decisions

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Cost Considerations for Not Preparing for Continued Sea Level Rise

- Loss of business, sales, rental; lost income
  - disrupt business activities and sales while clean up and repairs are completed
- Loss to Building Structure
  - clean up, demolition, removal; disposal of ruined equipment
- Loss of Tourism
  - inconvenience of visiting at high water will discourage visitors
- Insurance
  - an increase in the cost of insurance
  - expected inability to obtain insurance
- Loss of Value
  - asset and market value
  - decreased property value
  - lower property tax and sales tax income
- Loss of Historic Resources and Neighborhood Character
  - these structures are extremely vulnerable to flood damage
  - interior plaster
  - framing
  - shifting due to hydrostatic pressure
  - old brick and oyster lime

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Cost Considerations for Preparing for Continued Sea Level Rise

Retrofit Costs

- Basic safeguards within a property:
  - raising utilities (HVAC and electrical) above the design flood level
  - installing anti back flow valves on building plumbing and drains
  - filling in basements and crawl spaces
  - site work to direct flow of storm water
- Wet Flood Proofing – Allowing flood waters to inundate the building
  - basic approaches described above
  - installing approved and appropriately sized flood vents
  - installing water resistant interior finishes
- Dry Flood Proofing – Creating barriers to inundation
  - installing hardware to allow door and window dams
  - treating masonry buildings with waterproof coatings
  - strengthening structural systems to withstand hydrostatic forces
  - installing temporary building wraps around the exterior
  - raising first floor in buildings with high first floor ceiling

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Intensive Approaches

Public infrastructure

- structural flood protection (seawalls, levees, water gates, etc.)
- storm water management

Property Owners

- raising buildings an appropriate elevation above the expected flood level
- raising, new structure, utility/infrastructure, steps, ramps
- public infrastructure