

This is a set of slides from a presentation given at

R I S I N G W A T E R S
Maryland Prepares for Floods & Sea Level Rise

2011 Water Resources Symposium

hosted by the Maryland Water Resources Research Center
at the University of Maryland, College Park
on Tuesday, Nov. 15, 2011

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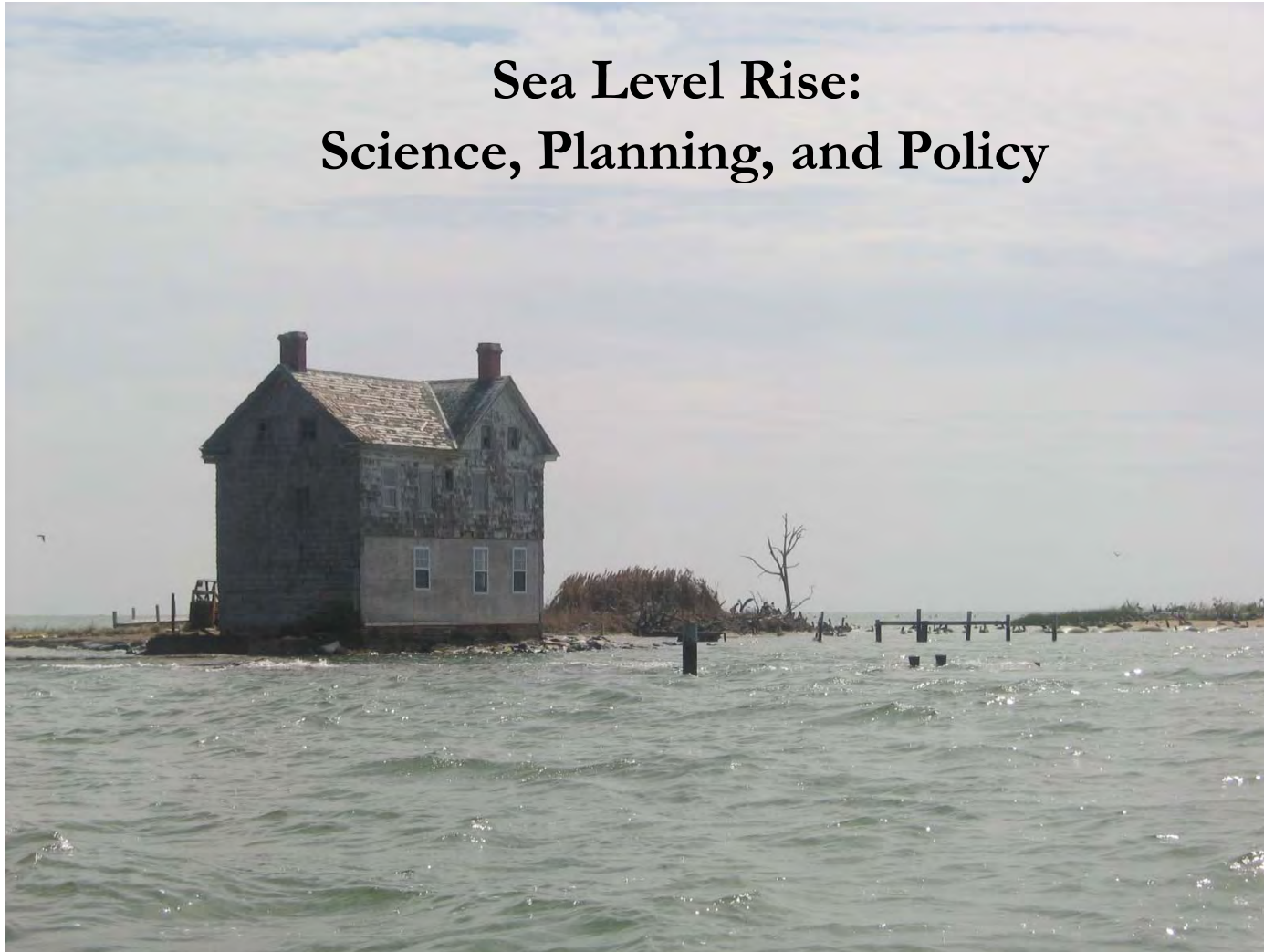
Johnson, Z. (2011). "Sea Level Rise: Science, Planning, and Policy Issues" (Presented at "Rising Waters: Maryland Prepares for Floods and Sea Level Rise, 2011 Water Resources Symposium," College Park, Md., Nov. 15, 2011, <http://www.waterresources.umd.edu/symp2011/>)

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Sea Level Rise: Science, Planning, and Policy



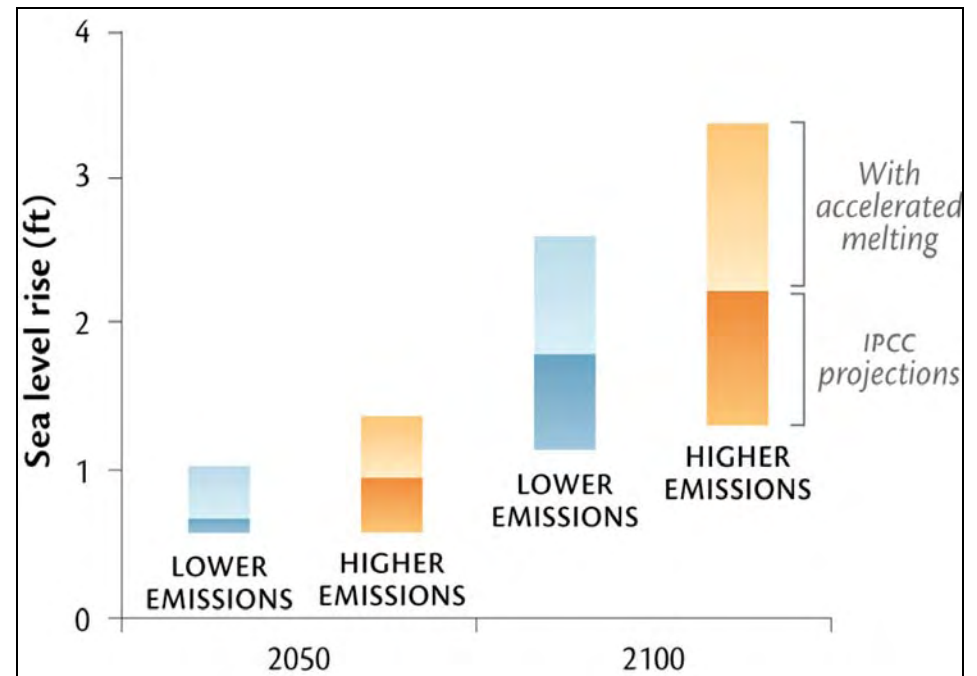
Sea Level Rise: The Science

Measured Sea Level Rise



(feet/century)

Future Projections

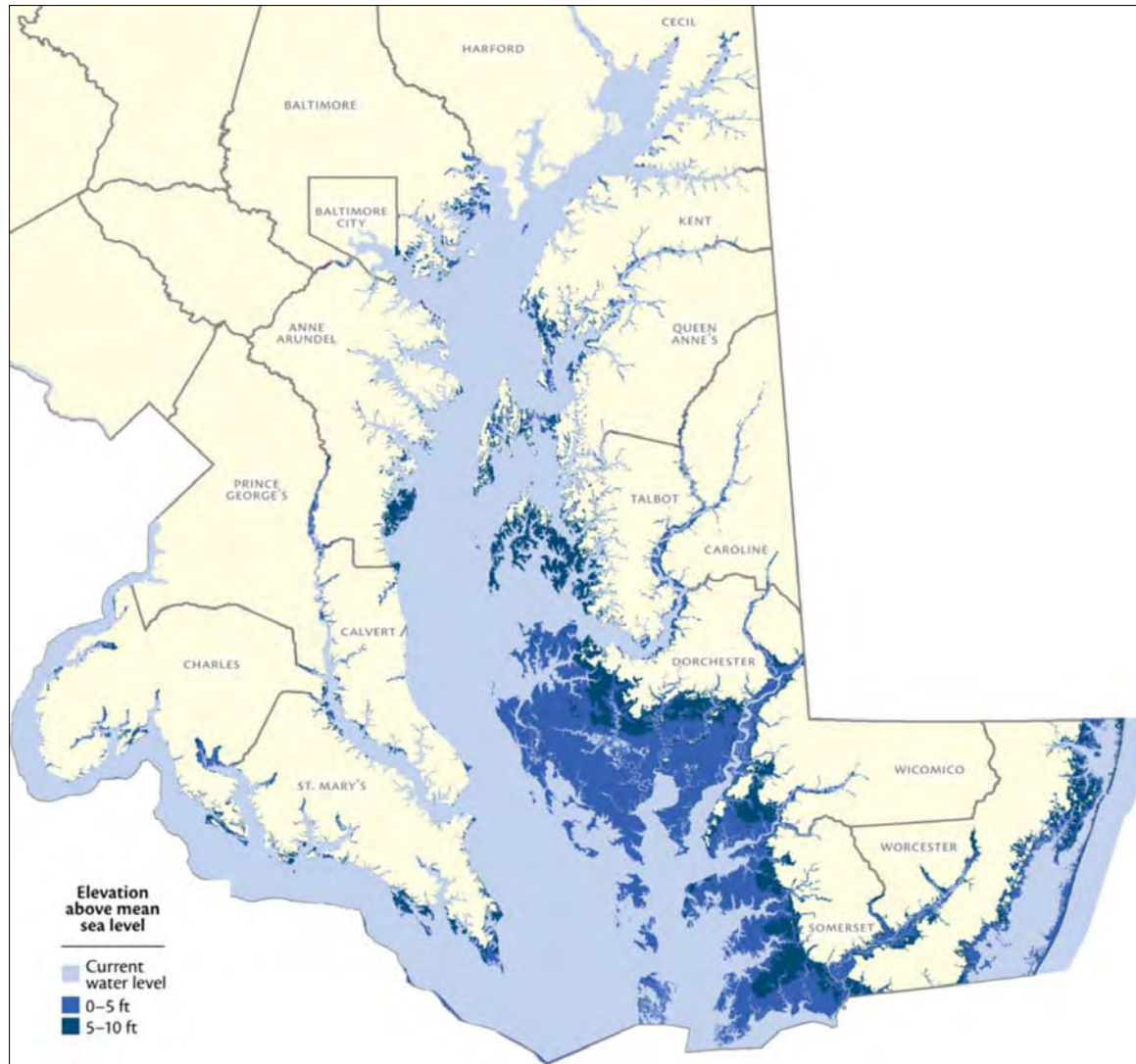


Impacts to the Coastal Zone

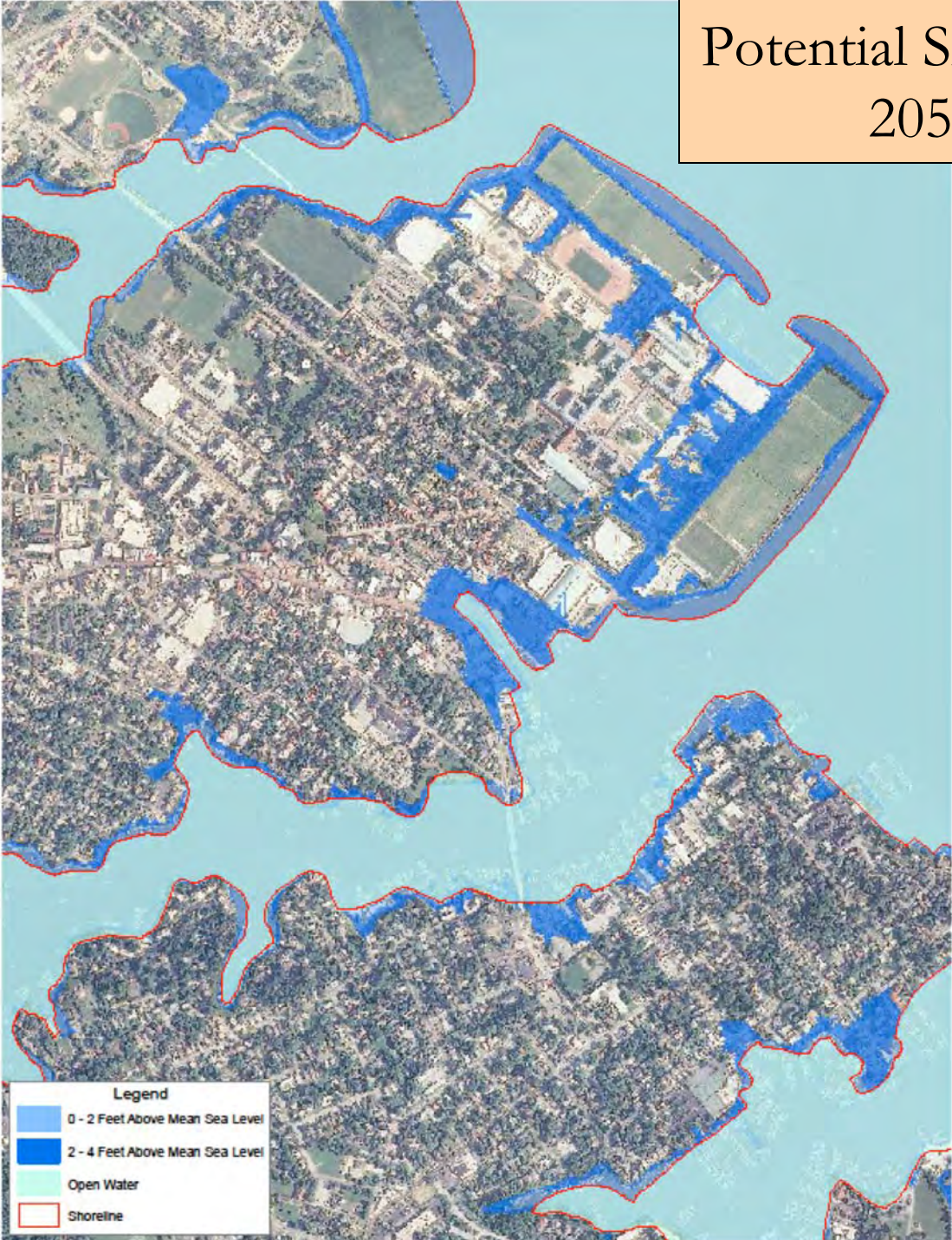
- Inundation of low-lying lands
- Increased flooding/storm surge
- More shoreline erosion
- Saltwater intrusion
- Higher water tables



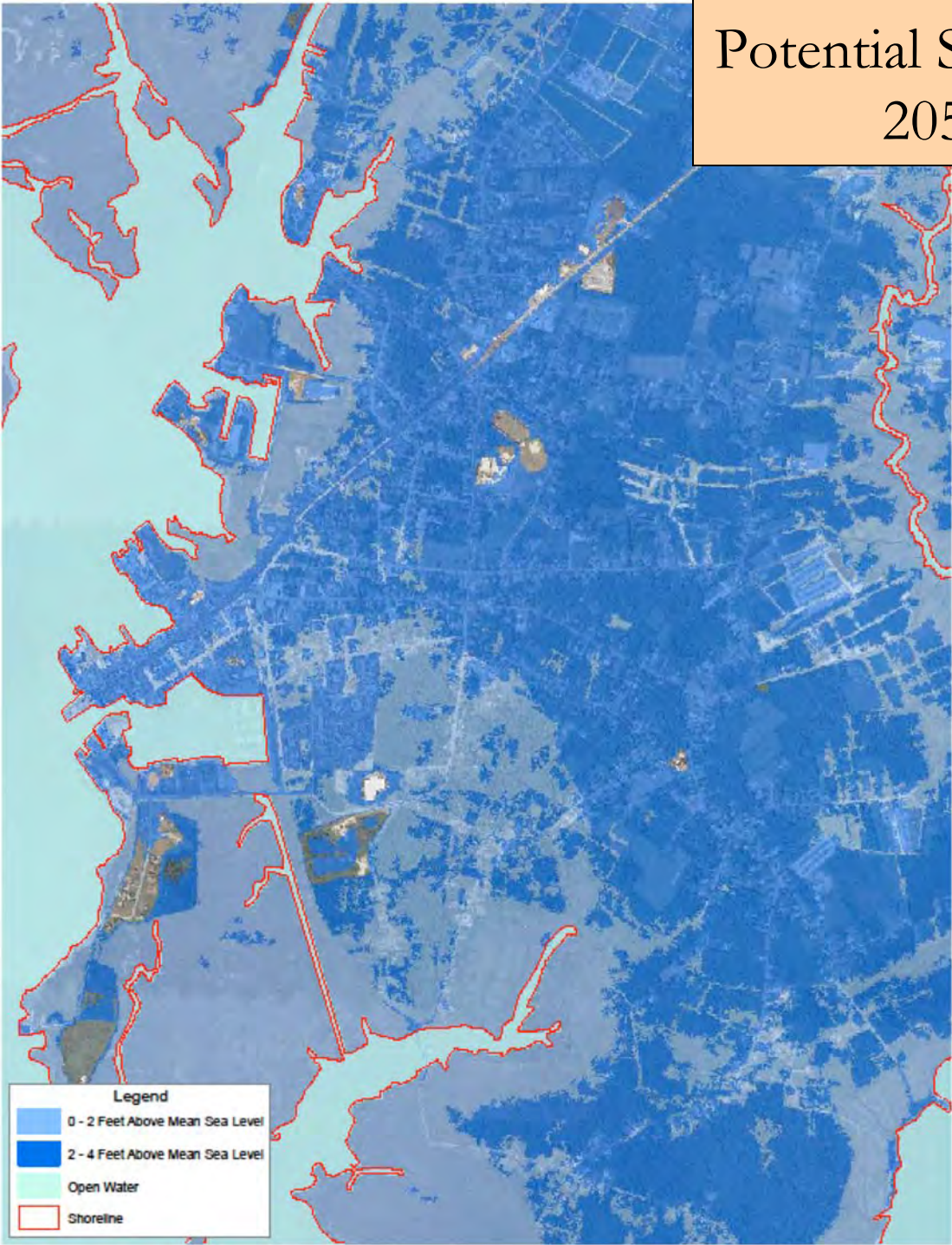
Maryland's Vulnerability



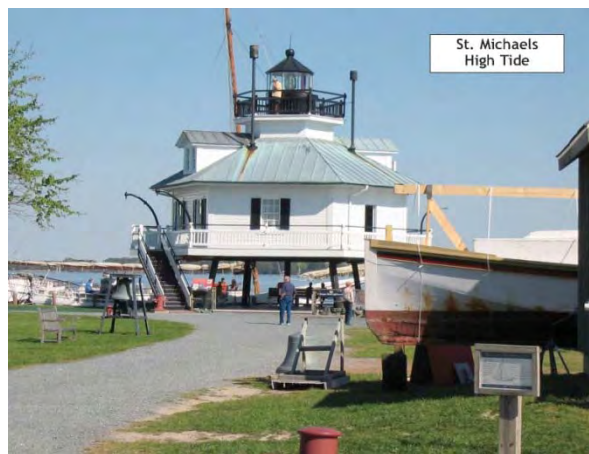
Potential SLR Inundation:
2050 - 2100



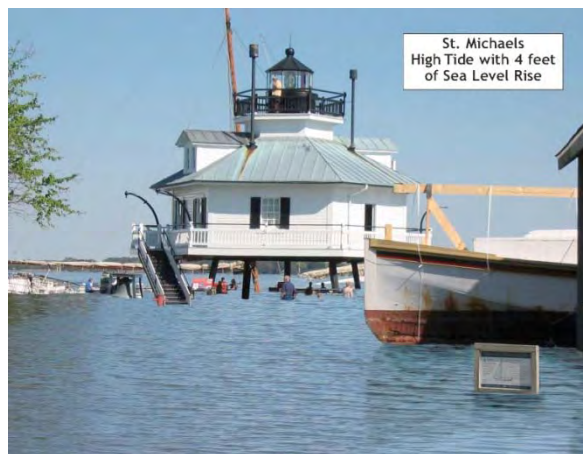
Potential SLR Inundation:
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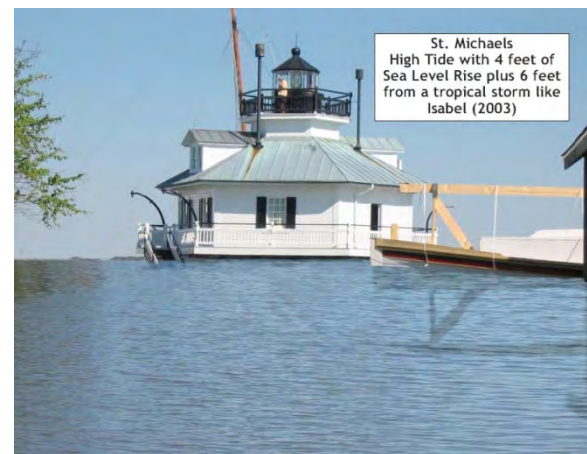
Coastal Flood Impacts



St. Michaels
High Tide



St. Michaels
High Tide with 4 feet
of Sea Level Rise



St. Michaels
High Tide with 4 feet of
Sea Level Rise plus 6 feet
from a tropical storm like
Isabel (2003)



Annapolis Harbor
High Tide



Annapolis Harbor
High Tide with 4 feet
of Sea Level Rise

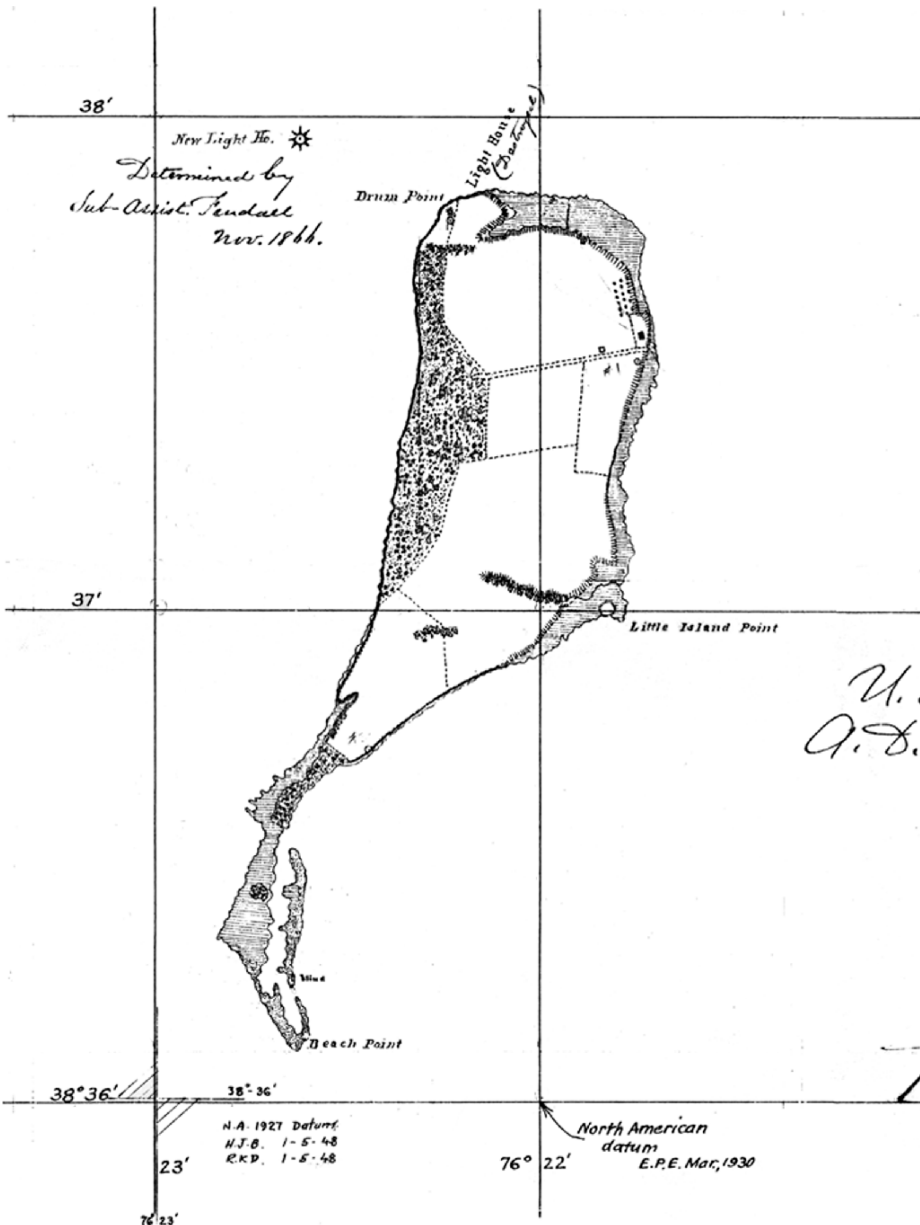


Annapolis Harbor
High Tide with 4 feet of Sea Level
Rise plus 6 feet from a tropical
storm like Isabel (2003)

Loss of Bay Islands and Communities

Island	Historic acreage (date)	Recent acreage (date)	% lost	Comments
Poplar	1400 (1670)	125 (1990)	91	Abandoned in 1930
Sharps	890 (1660)	0	100	Drowned in 1962
St. Clements	400 (1634)	40 (1990)	90	Abandoned in 1920's
Barren	700 (1664)	250 (1990)	64	Abandoned in 1916
Hoopers	3928 (1848)	3085 (1942)	21	Submerging
Bloodsworth	5683 (1849)	4700* (1973)	17	Submerging
Holland	217 (1668)	140 (1990)	35	Abandoned in 1992
Smith	11033 (1849)	7825 (1987)	29	Submerging
* mostly marsh				

Source: Leatherman et al., 1995.



*U. S. Coast Survey
A. S. Bach, Superintendent*

SHARPS ISLAND.

Surveyed 20th and 22nd of May, 1848.

Topography by Geo. S. Wain

Scale $\frac{1}{20,000}$

*Maryland
Register No. 9,51.*

Shore line 10 miles

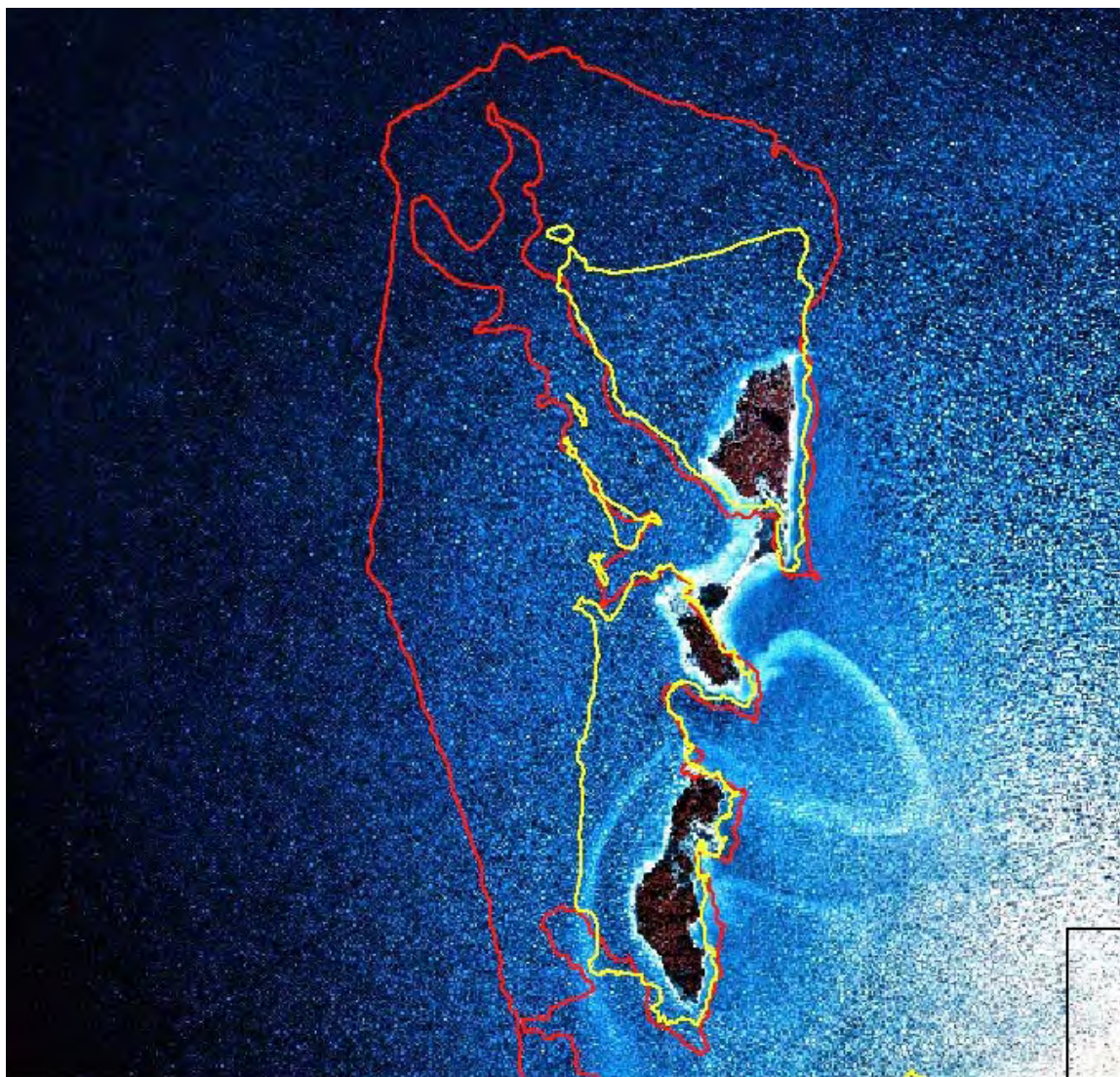
Dec 9, 1854 *W.S.*

438 ACRES LOST
6.2 ACRES/YEAR

Courtesy of Curtis Larsen. 1998. USGS

James Island (1847 - 1994)

147 years



884 ACRES LOST

6.0 ACRES/YEAR

— 1847
— 1942

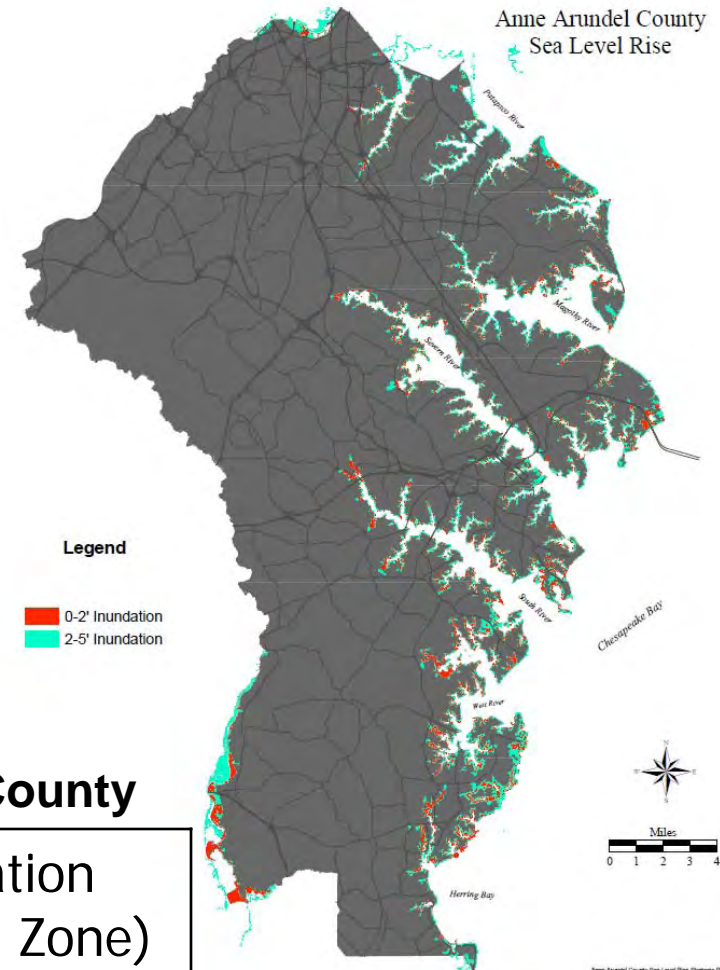
Date of Photography: 1994

Smith Island - Today



Human Health Impacts

- Septic systems located less than 2 feet above mean sea level are at risk of sea level rise inundation in the next 50 years.
- There are thousands of existing systems in this zone across the state (5,206 in Anne Arundel County alone).



Vulnerable Septic Systems in Anne Arundel County

0 – 2 ft Inundation (50-Year Impact Zone)	0 – 5 ft Inundation (125-Year Impact Zone)
5,206	7,238

Threats to Built Infrastructure

State Maintained Roads & Structures Vulnerable to Sea Level Rise

SLR Projection	Road Miles	Structures (#)
2 Feet	156	93
5 Feet	371	132
10 Feet	792	196

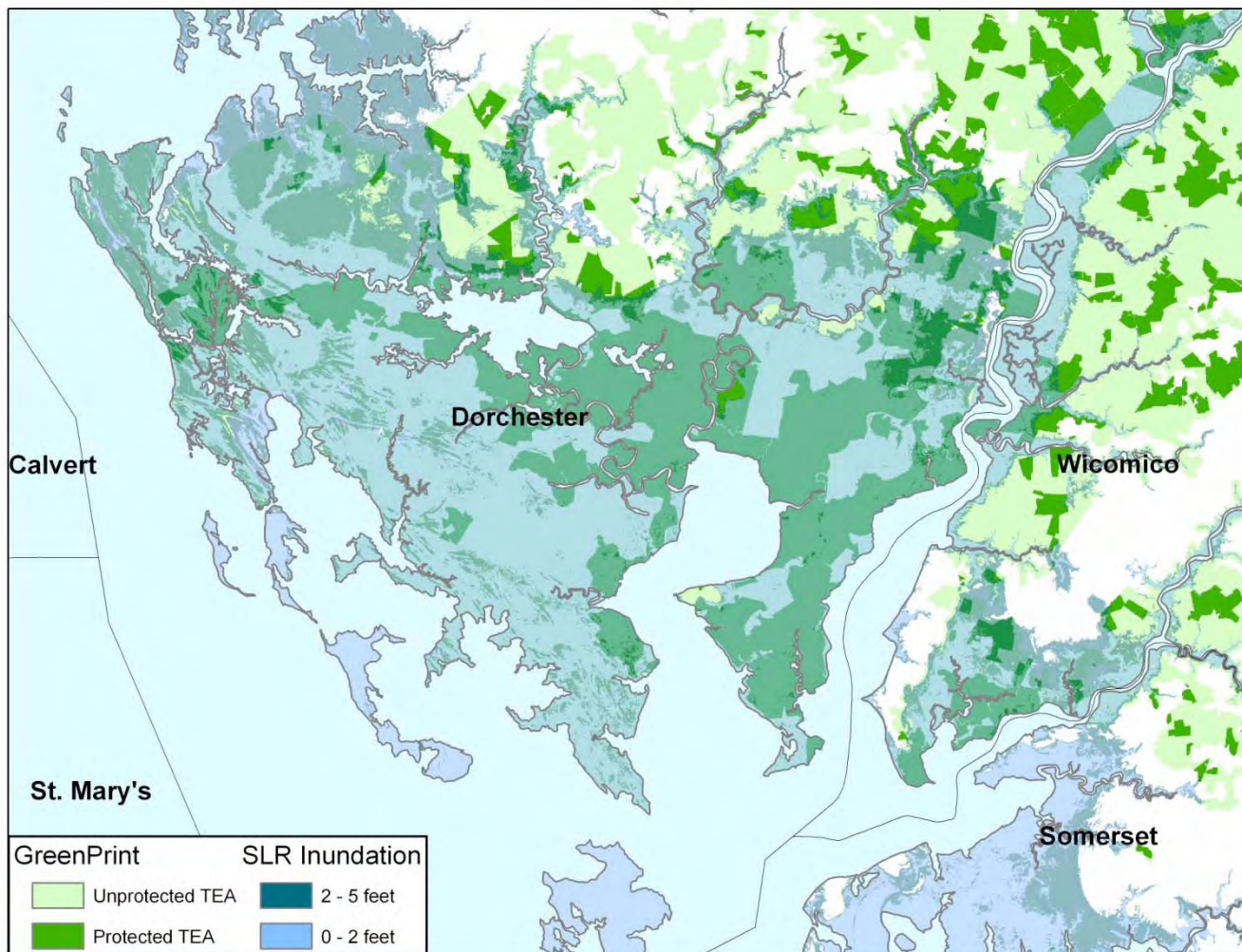


Loss of Historical, Archaeological & Cultural Resources

- More than 12,600 archeological sites have been inventoried statewide
- 2539 archeological sites are potentially vulnerable within the 0-5 ft boundaries. This represents 20% of all recorded archeological sites statewide, and 32% of all of the sites recorded in the coastal counties studied.
- The types of sites represented are predominantly prehistoric, ranging from Paleoindian to the contact period, but nearly a third have historic components, including 57 with identified 17th century components.
- Most at risk:
 - Paleoindian (9,000-11,000 BC)
 - Contact Period and 17th Century
 - Total of 228 sites statewide
 - 12 are already partially submerged

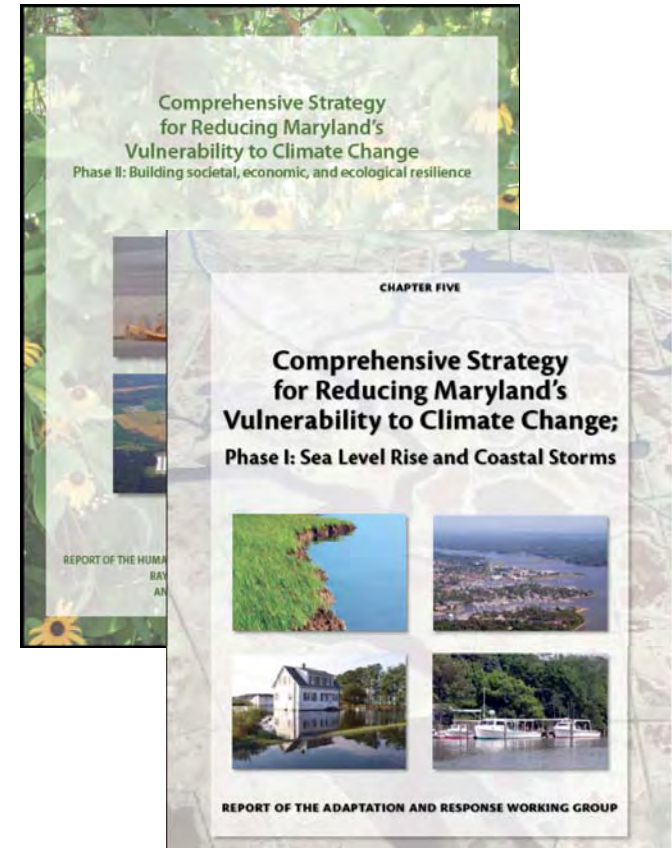
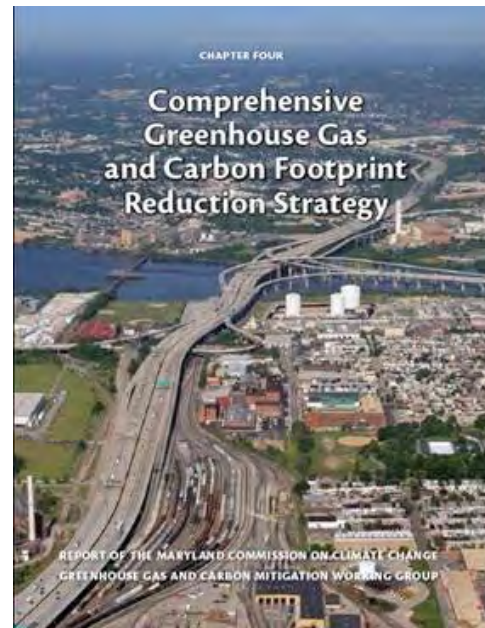
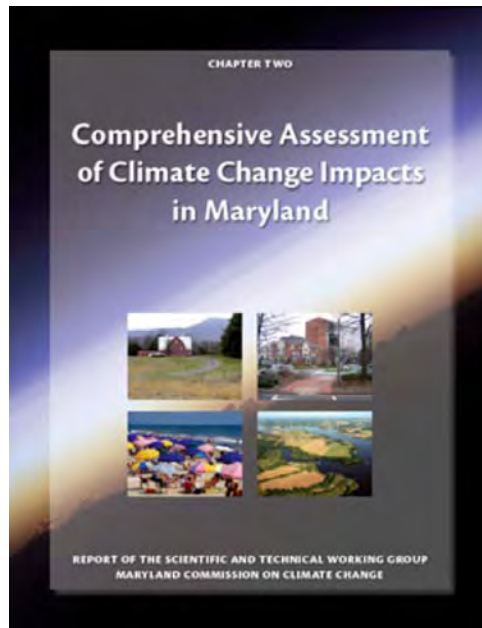


Loss of Coastal Ecosystems



Source: MD DNR (2010)

Maryland Climate Action Plan



Vision for the Future: Protect Maryland's People, Property, Natural Resources, and Public Investments



Promote programs and policies aimed at the avoidance and/or reduction of impact to the existing-built environment, as well as to future growth and development in vulnerable coastal areas



Shift to sustainable economies and investments; and, avoid assumption of the financial risk of development and redevelopment in highly hazardous coastal areas

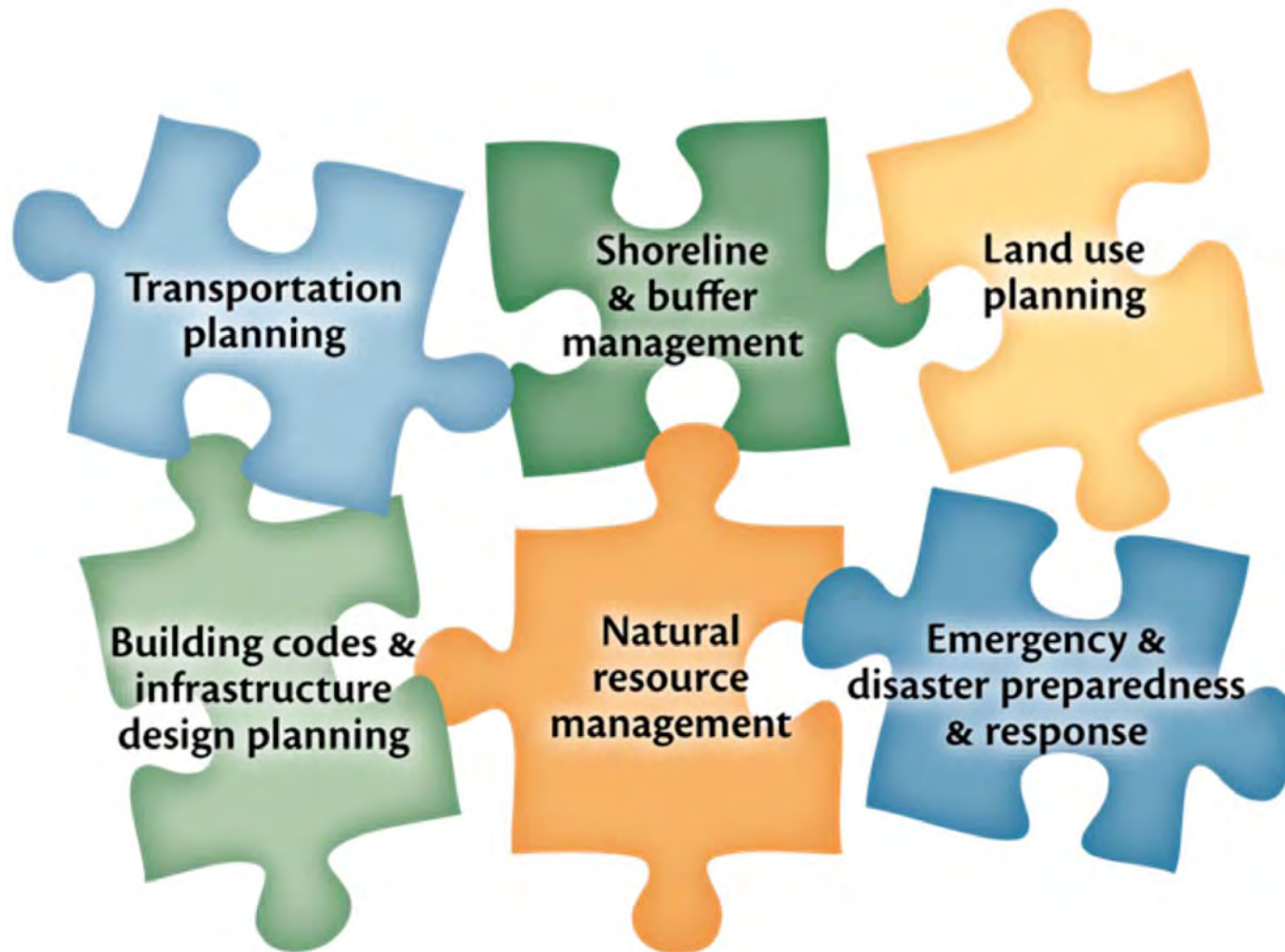


Enhance preparedness and planning efforts to protect human health, safety and welfare



Protect and restore Maryland's natural shoreline and its resources, including its tidal wetlands and marshes, vegetated buffers, and Bay Islands, that inherently shield Maryland's shoreline and interior

Strategy Development: An integrated approach

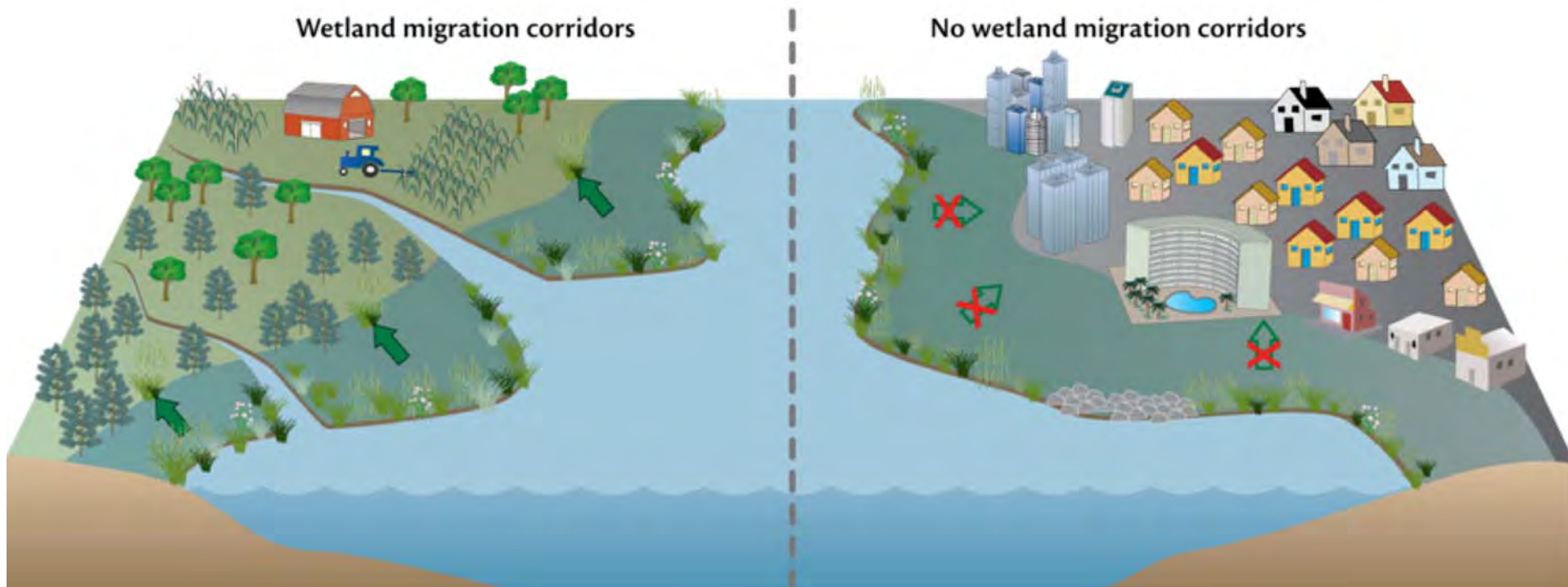


Strategy: Enhanced Siting & Design for Coastal Infrastructure



Elevate new and/or replacement structures 2+ feet
above the current 100-year base flood elevation

Strategy: Facilitate Landward Movement of Coastal Ecosystems



Conserve and restore habitat migration corridors

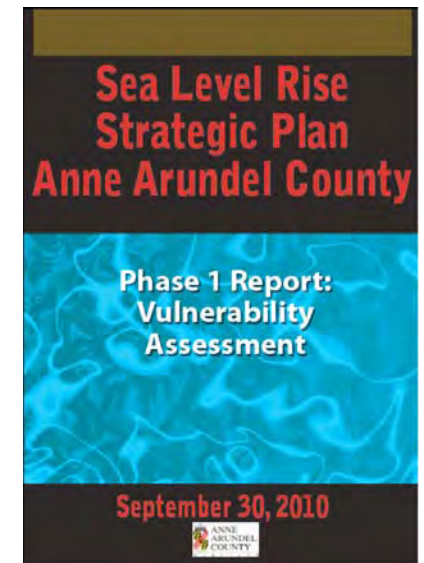
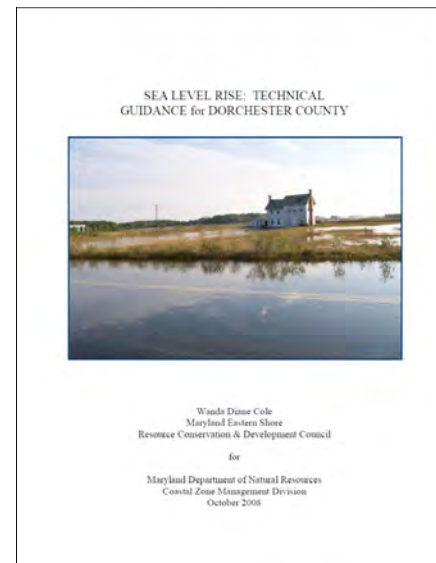
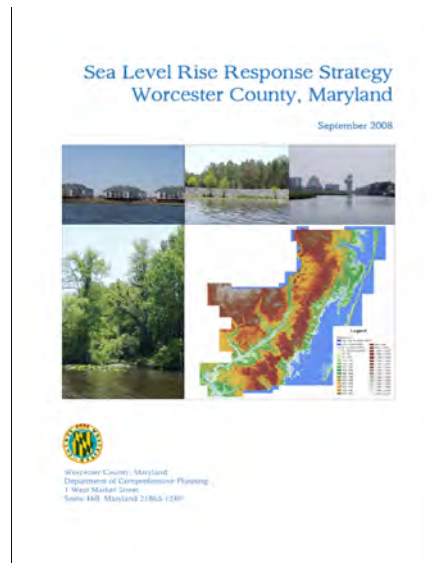
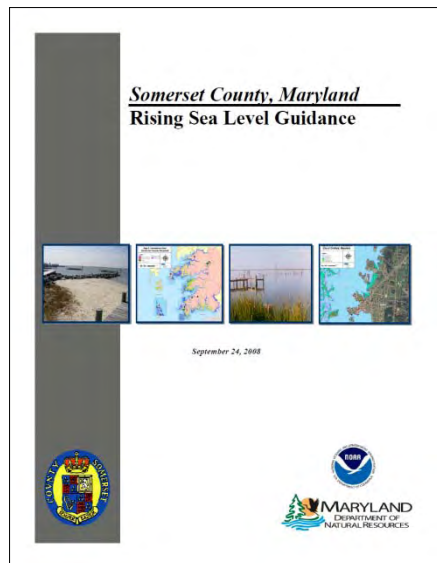
Strategy: Promote Sustainable Shoreline & Buffer Area Management

- Living Shoreline Protection Act (2008)
 - Requires non-structural shore protection practices unless proven infeasible
- Chesapeake & Coastal Bays Critical Area Amendments (2008)
 - Increased vegetative buffers
 - Updated jurisdictional boundaries to account for sea level rise
 - Allows for consideration of coastal impacts during growth allocation decisions



Strategy: Foster & Advise Local-Level Adaptation Planning

The Coastal Communities Initiative (CCI) competitive grant program provides financial and technical assistance to local governments to promote the incorporation of natural resource and/or coastal management issues into local planning and permitting activities.



Strategy: Lead by Example

Building Resilience to Climate Change

DNR policy to guide investments in and management of land, resources and assets so as to better understand, mitigate and adapt to climate change.

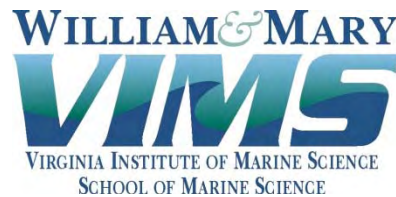
- New Land Investments
- Facility Infrastructure
Siting & Design
- Habitat Restoration
- Research & Monitoring
- Resource Planning
- Government Operations
- Advocacy

Adaptation 2011 - 2012

- Critical Area Jurisdiction Mapping Update (Lead: DNR)
- Living Shoreline Protection Act-Regulation Development (Lead: MDE)
- DNR “Lead by Example” Policy
 - Land Conservation Assessment & Targeting Criteria
 - Infrastructure Siting & Design Criteria
- Local Government Technical & Financial Assistance: *Building Coast-Smart Communities*: (Lead: DNR)
- Maryland State Hazard Mitigation Plan – Climate Change Risk Analysis (Lead: MEMA)
- SHA Transportation Vulnerability Assessment and Risk Policy (Lead: MDOT)
- Maryland Port Administration Vulnerability Assessment (Lead: MDOT)
- Historical, Archaeological, and Cultural Resources Vulnerability Study (Lead: MDP)
- Climate Change Insurance Advisory Committee (Lead: MIA)
- Wildlife Action Plan – Climate Change Element (Lead: DNR)
- Green Print Update – Incorporation of Marsh Migration Model (Lead: DNR)
- State Development Plan: PlanMaryland – Criteria for “Lands Subject to the Impacts of Climate Change” (Lead: MDP)
- Adaptation Toolbox: *The Coastal Atlas* (Lead: DNR)



Acknowledgements: It takes a collective effort





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<http://www.dnr.state.md.us/climatechange>

