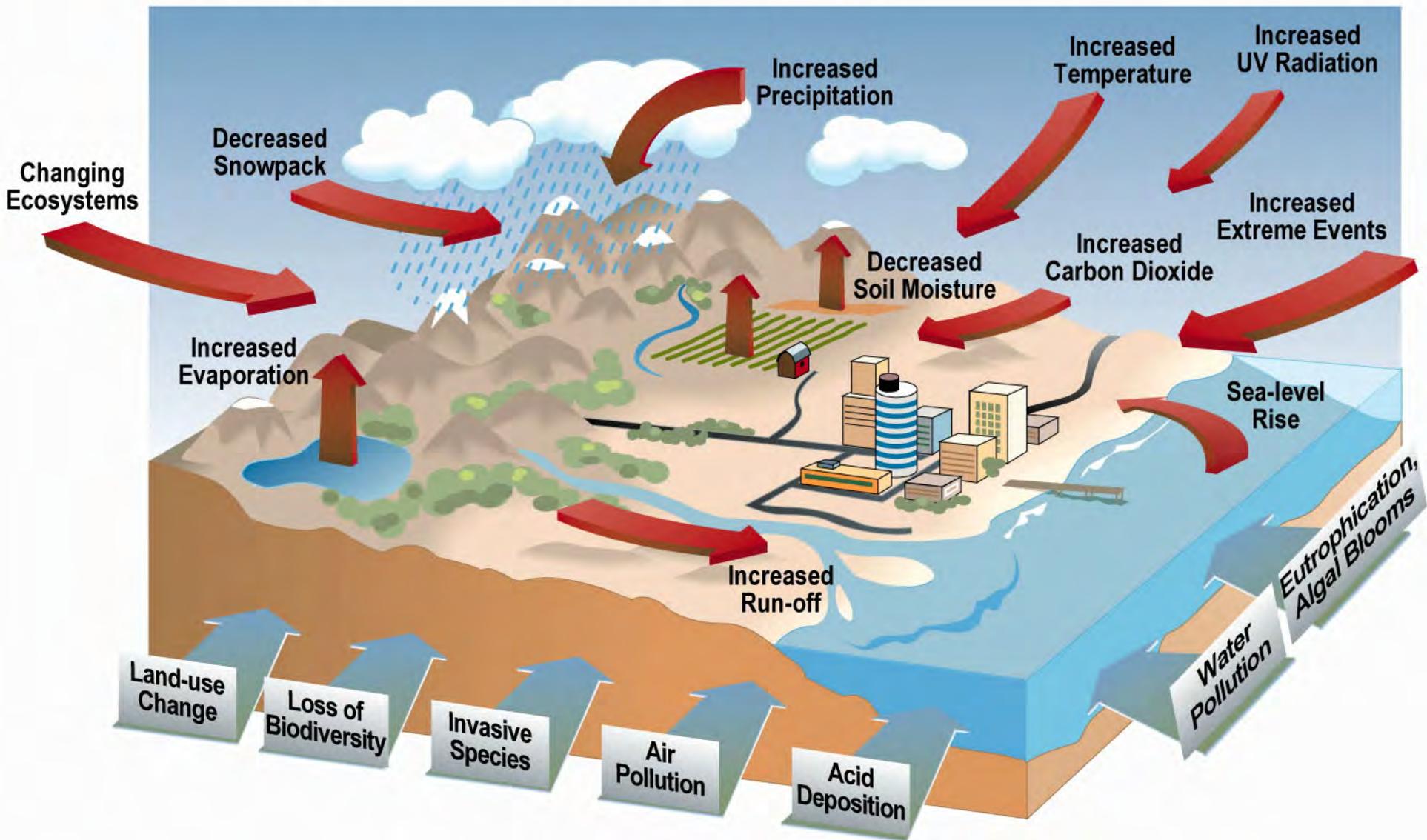


Advancing Adaptation Through State Strategies and Local Action



Julia Knisel
Coastal Resilience Coordinator
Massachusetts Office of Coastal Zone Management

Impacts of a Changing Climate



MA Adaptation Advisory Committee

Section 9 of Global Warming Solutions Act (2008)

- Analyze strategies for adapting to the predicted impacts of climate change
- Define predicted climate change
- Identify potential vulnerabilities due to climate change
- Report findings and recommendations to Legislature (Dec. 31, 2009)



Advisory Committee (35 members)

- Required expertise:

- low income consumers
- water supply and quality

Human Health and Welfare

- local government
- recreation

Local Economy

- transportation and built infrastructure
- commercial, industrial and manufacturing activities
- energy generation and distribution

Key
Infrastructure

- ecosystems dynamics
- land conservation
- rivers and wetlands

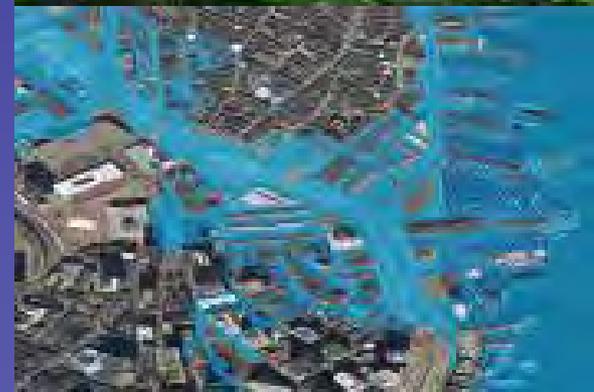
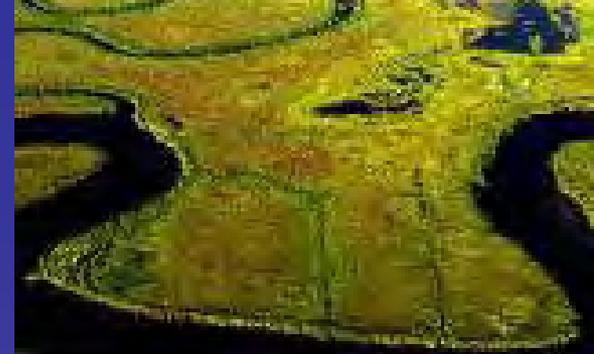
Natural Resources and Habitat

- coastal zone and oceans

Coastal Zone and Oceans

Coastal Zone and Oceans – Key Sectors

- Coastal habitats, resources and services
- Ocean habitats, resources and services
- Public structures and critical facilities
- Residential and commercial development
- Ports and harbors
- Public access, recreation, and tourism



Sea Level Rise Vulnerabilities



coastal inundation



storm surge



flooding



erosion

Additional Vulnerabilities

- Extreme weather events
 - Increased risks to **development** in vulnerable floodplains and along shorelines
 - Increased damages to **infrastructure**, **critical facilities** and **port assets**
- Precipitation
 - Increased polluted runoff and combined sewer overflow events with negative effects on estuarine and marine **water quality**
- Physical ocean conditions (temperature, pH, salinity, currents)
 - Shifts in coastal and marine **habitats**
 - Altered range and distribution of **species**
 - Risks to **commercial fishing** and **aquaculture** from new stress, diseases and pathogens
 - Increased **harmful algal blooms** and human health effects

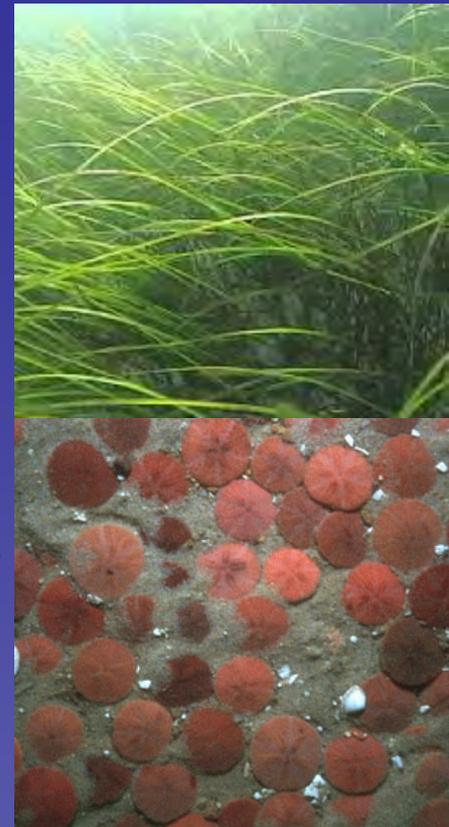
An aerial photograph showing a coastal town with a river and beach. The river is on the left, winding through a brown, arid landscape. The town is in the middle, with buildings and a road. The beach and ocean are on the right. The image is partially obscured by a blue background on the right side.

Key Findings

- 1. Enough now known to act, but continue to build on existing knowledge base**
 - sea level rise projections
 - risk identification
- 2. Prioritize protection requirements and opportunities for managed retreat**
 - Dense urban harbors v. less developed areas
 - Limited resources will constrain choices
- 3. Intensify efforts to reduce stress on natural systems and increase resiliency**
 - Most appropriate in non-urban areas
 - Essential for marine resources and coastal habitat
- 4. Integrate flexible practices into resource management to address cumulative impacts**
 - Monitoring is key

Strategies – Habitats, Resources, and Ecosystem Services

- Improve resiliency of natural habitats, communities, and populations
 - land conservation, habitat restoration, and “green” infrastructure
- Reduce anthropogenic stressors through directed improvements in estuarine and marine water quality
- Strengthen ecosystem-based approaches to fisheries management and allow flexibility in tools
 - quotas and catch-shares
- Improve shellfish management and aquaculture with better predictions of HABs, marine pathogens, and rainfall
- Increase estuarine and marine monitoring, observations, and assessments to track changing ecosystem processes



Adapting the Built Environment



protection?



siting? design?



managed retreat?

Strategies – Coastal Engineering for Shoreline Stabilization & Flood Protection

- Improve assessment of erosion and flooding and evaluation of design and placement of engineered approaches
 - Consider local conditions and sea level rise
 - Analyze new and replacement hard structures
 - Advance “soft” engineering to maintain sediment supply
 - Develop sand mining policy to guide use of public submerged resources
 - Prioritize placement of sediment on public beaches



Strategies – Residential and Commercial Development, Ports, and Infrastructure

- Site new development outside of projected high-risk and future resource areas
 - Consider risks over full project life
 - Use regulatory and policy tools
 - Evaluate market mechanisms – role of insurance
- Decrease risk and repetitive losses to existing development
 - **Expand State Building Code elevation and other requirements**
 - Acquire and protect high-risk properties in fee and through conservation restrictions
 - Direct redevelopment out of high-risk areas using Transfer of Development Rights or rolling easements
- Evaluate and update hazard mitigation, evacuation, and emergency response plans
 - Update risk and vulnerability assessments
 - Address increased frequency of hazards
 - Accommodate increased scale of effort needed



Massachusetts Building Code

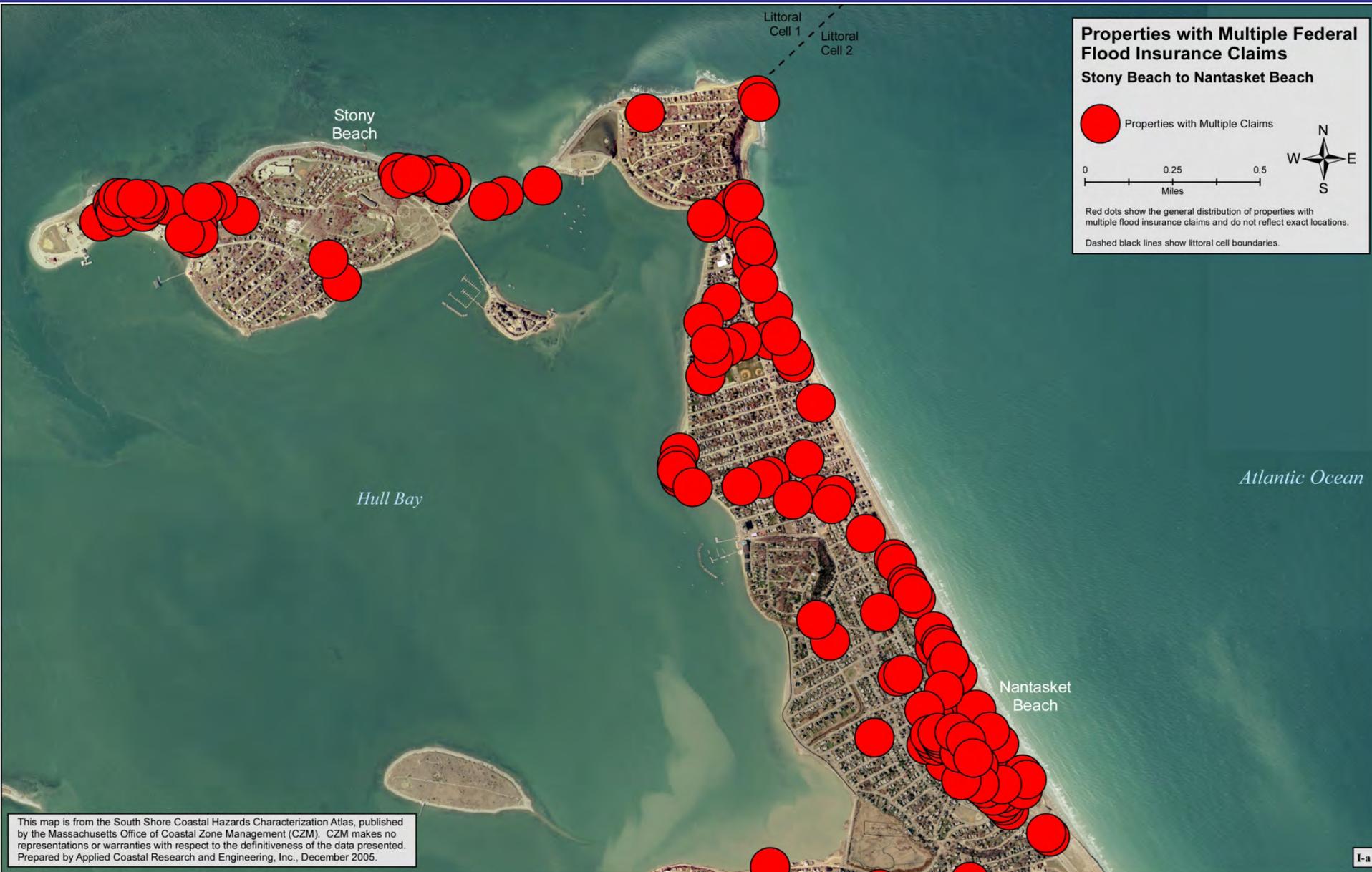
(G) Flood-Resistant Construction & Construction in Coastal Dunes

✓ Open pilings

✓ 2' freeboard in V Zone

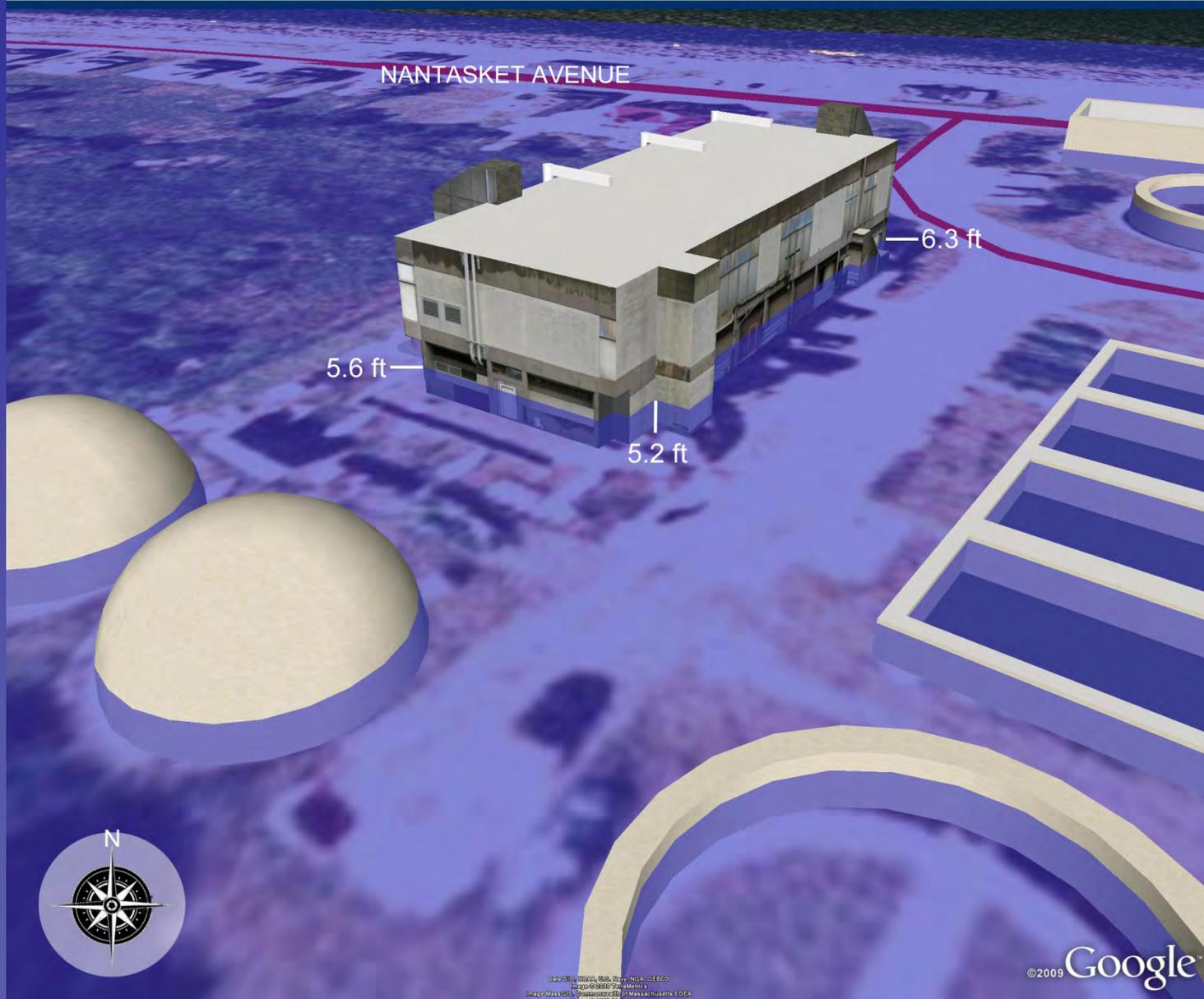


High-Risk Community – Hull





Base flood is the flood having a one percent chance of being equaled or exceeded in any given year. Base Flood Elevations were taken from the Federal Emergency Management Agency Preliminary Digital Flood Insurance Rate Map for Plymouth County dated November 7, 2008. Labels represent flood water depths measured from the foundation at ground level. Vertical accuracy is +/- 1.0 ft. Completed October 2009.



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Elevate Buildings/Utilities



Elevate residential and commercial buildings 2 feet above highest requirement for flood zone...reduce building department permit fees by \$500

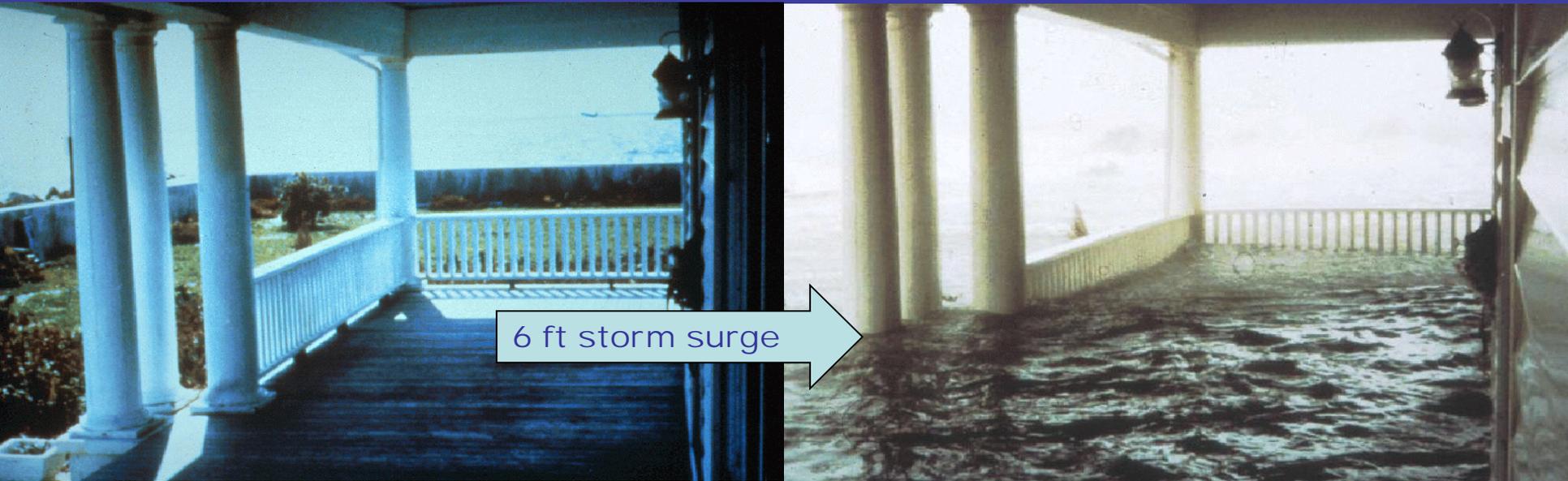
Freeboard = Homeowner Savings

~ 0.25 to 1.5% total new construction costs for each foot

	V Zone		A Zone	
	Annual savings in NFIP premiums	Savings over 30-year mortgage	Annual savings in NFIP premiums	Savings over 30-year mortgage
1' freeboard	\$1,360 (25%)	\$40,800	\$502 (41%)	\$15,060
2' freeboard	\$2,730 (50%)	\$81,900	\$678 (55%)	\$20,340
3' freeboard	\$3,415 (62%)	\$102,450	\$743 (60%)	\$22,290

Based on May 2007 NFIP rates for a 1-floor residential structure with no basement built after a FIRM was issued for the community. \$500 deductible, \$250,000 coverage for building, \$100,000 for contents

Questions...



Falmouth, Bob 1991 (courtesy of D. Vallee, NWS)