

City of Milford COASTAL RESILIENCE PLAN

Initial Public Meeting: Assessing Vulnerability and Risk

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Agenda

- **Project: *Funding and Planning Steps***
- **Resilience: *What is it?***
- **Identifying Risk**
- **Vulnerability: *Assets and Areas***
- **Options *for Adaptation***
- **Next Steps**
- **Discussion**

Project: Funding



Community Development Block Grant (CDBG): *Recovery Eligible Activities – Coastal Resilience Plan*

- Purpose is to increase social, economic, ecological resilience
- Respond to sea level rise, more frequent & severe storm surges, coastal floods, erosion
- Should benefit underserved, low-to-moderate income populations and their communities.
- These are located in the following areas:
 - *Wildemere Beach*
 - *Point Beach*
 - *Downtown Milford*
 - *Several non-coastal neighborhoods that are linked to the shoreline*

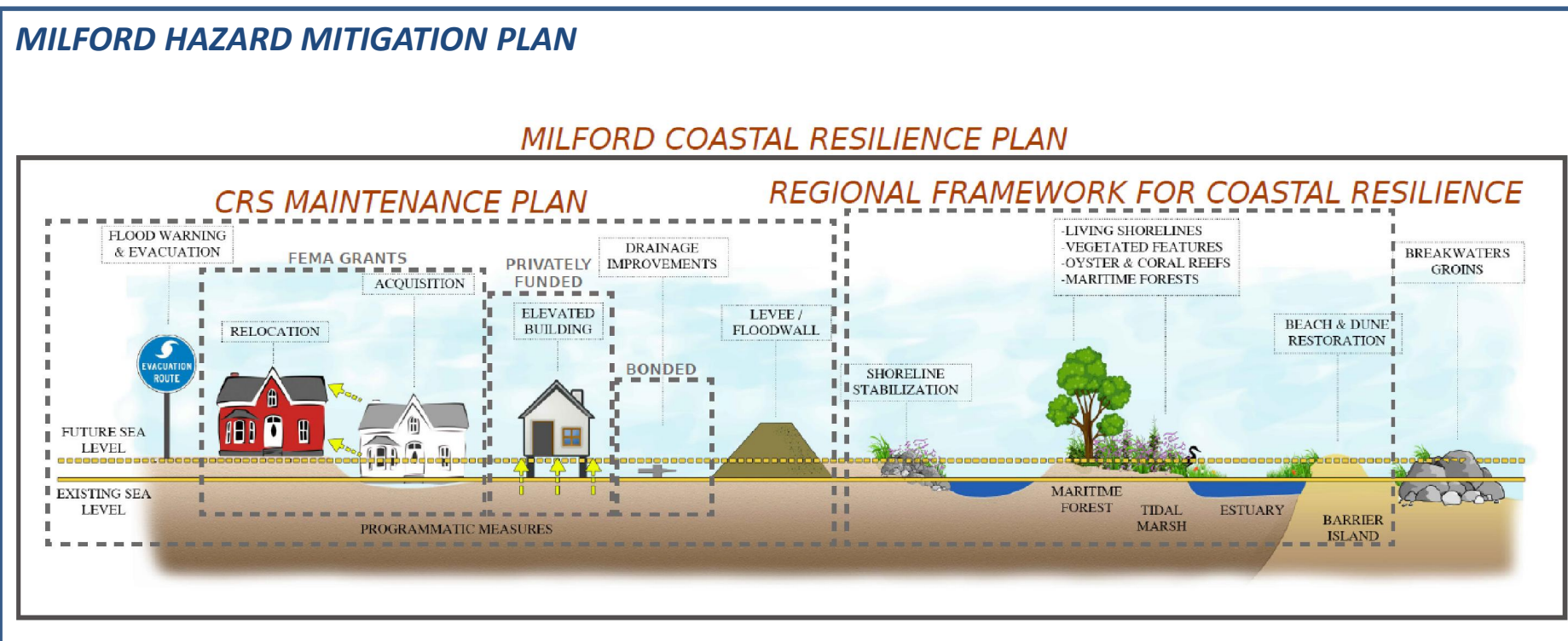
Project: Funding



Community Development Block Grant (CDBG): *Interface with other resilience efforts*

- Examples include the *Hazard Mitigation Plan*, the *Regional Framework for Coastal Resilience*, the *Milford Community Rating System (CRS) Plan*, and other resilience projects

MILFORD HAZARD MITIGATION PLAN



Project: Planning Steps



Project: Planning Steps

- Review Existing Capabilities**



Choosing Milford

Milford is highly vulnerable to coastal storms and flooding. Over \$60 million in flood insurance claims have been paid out in Milford between storms Irene and Sandy. As such, Milford has been invited to participate in a number of grant-funded studies that have been made available as a result of these 2 storms.

Milford's Factors

Coastal City: pop 50,000+	17 Miles of Coastline	Prone to Coastal Flooding
Dense Coastal Development	Pre-existing Data & Plans	Extensive Flood Claims

Current Plans and Active Committees



- | | |
|--|-----------------------------------|
| 1 Hazard Mitigation Plan | 5 Long Term Recovery Group |
| 2 CRS Plan & PPI Plan | 6 2015 FEMA Flood Insurance Study |
| 3 Plan of Conservation and Development | 7 State Hazard Mitigation Plan |
| 4 Emergency Operation Plan | 8 Regional Hazard Mitigation Plan |

Active Studies

10 Town Grant

Study on green infrastructure and coastal resiliency options for 10 CT towns. Four resiliency projects will be chosen for design

3 Town Grant

Branford, Madison and Milford are having coastal resiliency plans developed in conjunction with the 10 town grant, each town will receive a concept design for a project

Wind Resilience

Sea Grant study to examine the effects of wind vulnerability on homes that have been elevated due to flood risk

Wastewater

UConn study to investigate options for protecting wastewater treatment plants from flood.

TOD Study

SCRCOG study to investigate transit oriented development around the Milford train station

Sea Level Rise

CIRCA & UConn to take measurements off the coast of Milford for sea level rise data

Stabilization

Study beach stabilization at the Walnut and Wildemere beaches

Hardening

Studying hardening of Crescent Beach in Woodmont, using traditional and green infrastructure options

Erosion Control

Erosion is threatening to undermine a road in the Gulf Beach area and this study will examine options for remediation.

NOAA & MIT

MIT & NOAA coastal resilience program

NOAA & Rutgers

Study examining shoreline communications in regards to evacuations

RPA & Grants

The Regional Plan Association (NY) is using Milford as one of their case studies in a report that will examine the impacts and barriers on using grant funds for resilience and revitalization projects

Project: Planning Steps

- Review Existing Capabilities

The City of Milford Hazard Mitigation Projects 2008 (Flood-Specific)

Vulnerable Location	Mitigation Project	Current Status
City Beach Areas	Identify flood prone properties and develop flood mitigation projects including structural elevation, property acquisition and roadway/storm drain reconstruction	Properties identified, 2013 Project list contains more specific actions. Elevations, acquisitions and reconstruction occurring as needed
Point Beach	Upsize culverts Drainage Work Flapper Valve on Point Beach Drive	Done
Wepawaug River – Eisenhower Park	The pond will be dredged so it will be smaller and deeper. The dam will be repaired. A berm will be removed and a flood plain area of 4-5 acres will be restored.	Project designed, construction awaiting funding.
Local Roads and Highways	Evaluate structural projects	Considered standard business practice, specific actions outlined in 2013 plan list
Wepawaug River at Boston Post Road (Route 1)	Improve hydraulics of bridge to alleviate flooding	In the design phase as a state project
Wepawaug River – North Street	Channel improvement project	Project cancelled*
Silver Sands to Laurel Beach	Improve storm drain outfalls.	Ann St. completed, other areas pending funding

Figure 52: STAPLEE Evaluation of Municipal Mitigation Projects

Municipal Mitigation Project	STAPLEE Score	Project Priority Ranking
Naugatuck Avenue	7	High
Bayview Beach	5	High
Flood Gauges	5	High
Tumblebrook	4	Medium
Animal Shelter	4	Medium
Silver Sands	3	Medium
Generators	2	Medium
Beachland/Melba	1	Low
Creeland	-2	Low

HAZARD MITIGATION PLAN UPDATE 2013



MILFORD, CONNECTICUT

Revised August 12, 2013

What is Coastal Resilience?

Community Resilience

Prepare

Adapt

Withstand

Recover



Elevating Homes Protects them from Storm Surge.
Hillside Ave
Image: activerain.com

Coastal Resilience

Full/New Moon-Tide flooding

Sea level rise

Storm surges

Continued erosion

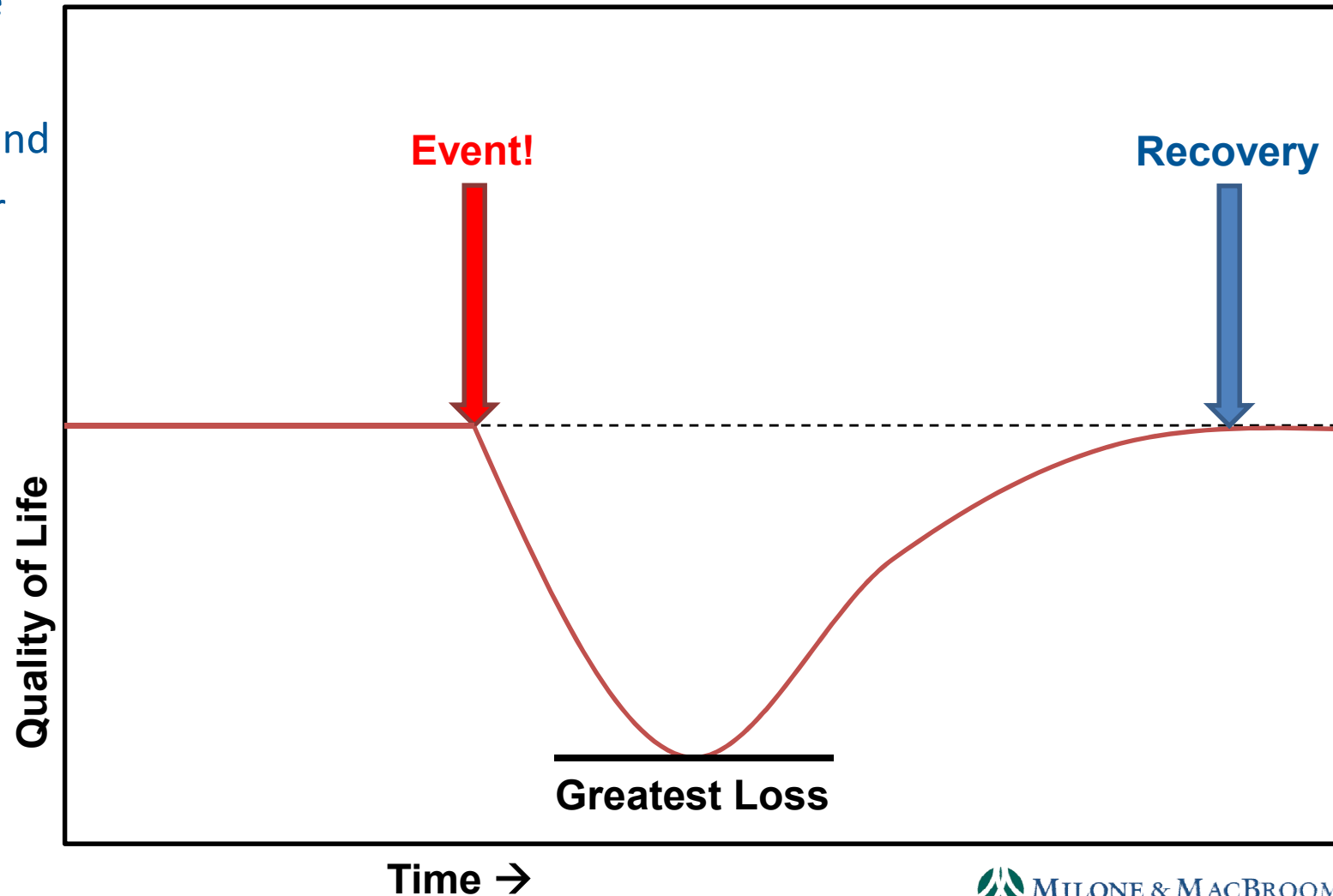


Walnut Beach
Image: David Murphy

What is Coastal Resilience?

Resilience

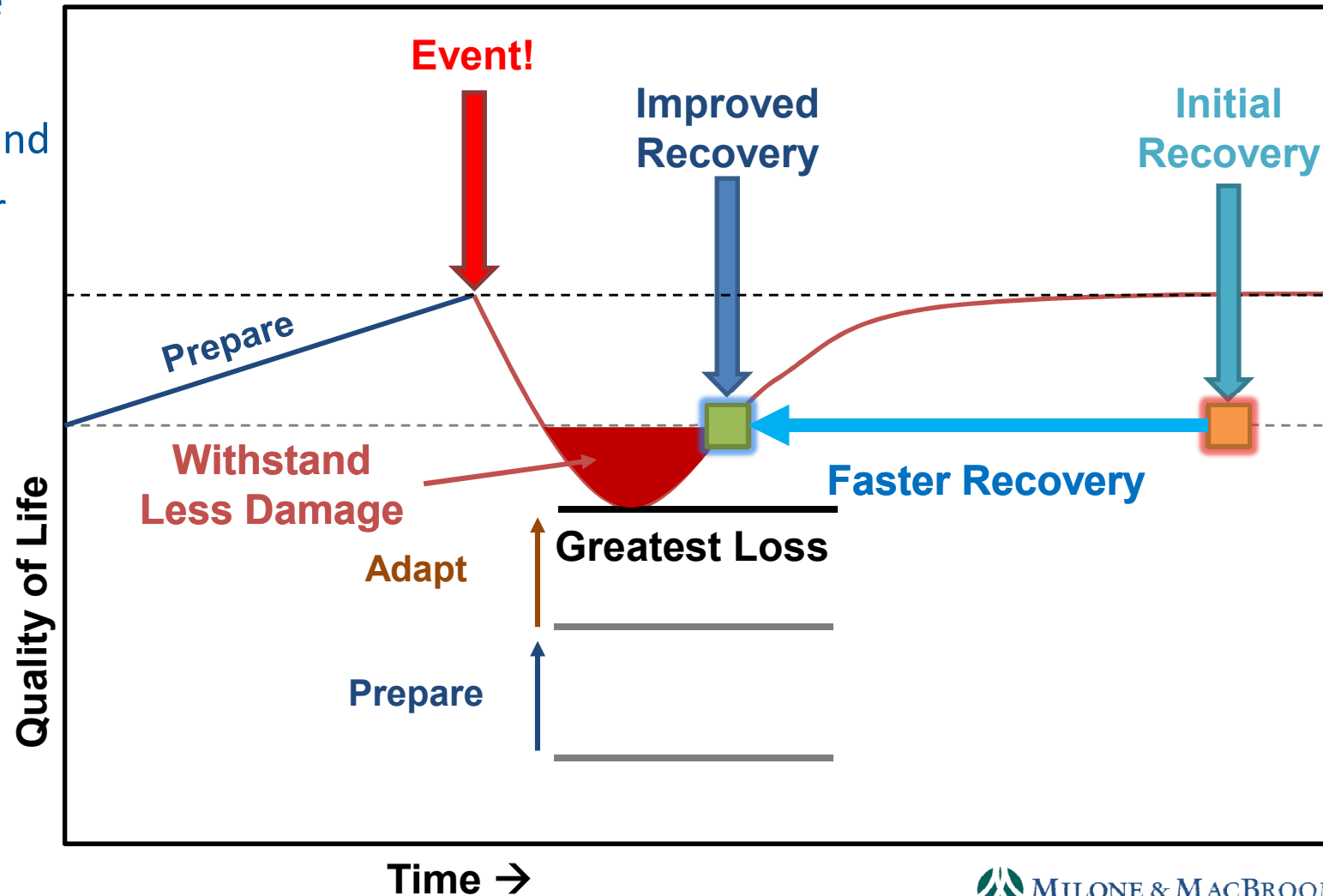
- Prepare
- Adapt
- Withstand
- Recover



What is Coastal Resilience?

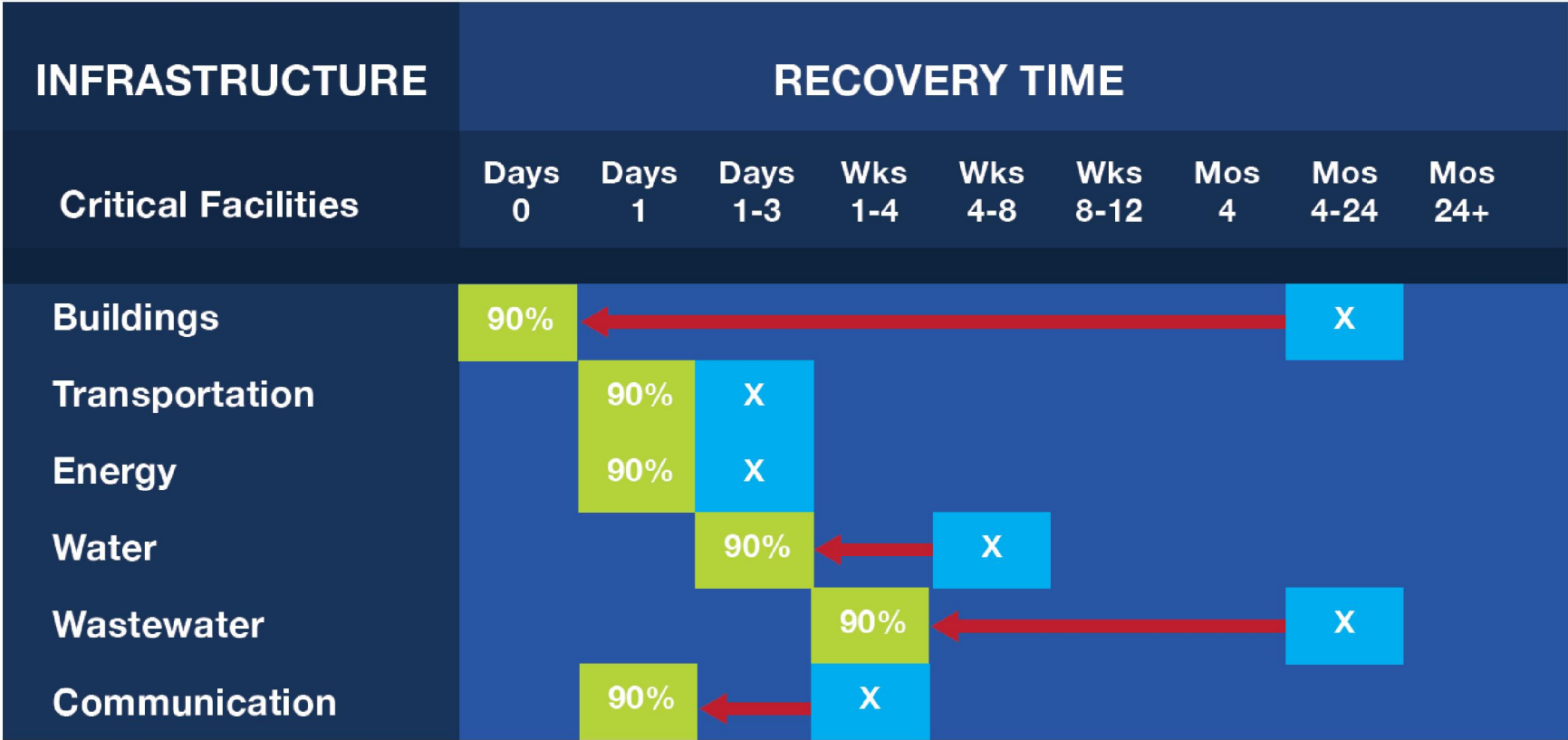
Resilience

- Prepare
- Adapt
- Withstand
- Recover



What is Coastal Resilience?

Resilience: Reducing Time to Recovery



 Where we want to be

 Where we are now

 Closing the gap

Risk

Risk = Vulnerability x Frequency

Vulnerability: how susceptible to loss or damage?

Frequency: how often does the event happen?

Risk from General Natural Hazards



Minor damage in Plainfield, CT, after a small quake in January

Photo: wtnh.com

		Vulnerability			
		Low	Med	High	
Frequency	Low	Bear Attack	Earthquake	Tornado	
	Med	Drought	Wildfire	Hurricane	
	High	Thunderstorm	Snow Storm	Flood	

Flash Flood in Milford, 2012

Image: NBConnecticut.com

Risk

Risk = Vulnerability x Frequency

Vulnerability: how susceptible to loss or damage?

Frequency: how often does the event happen?

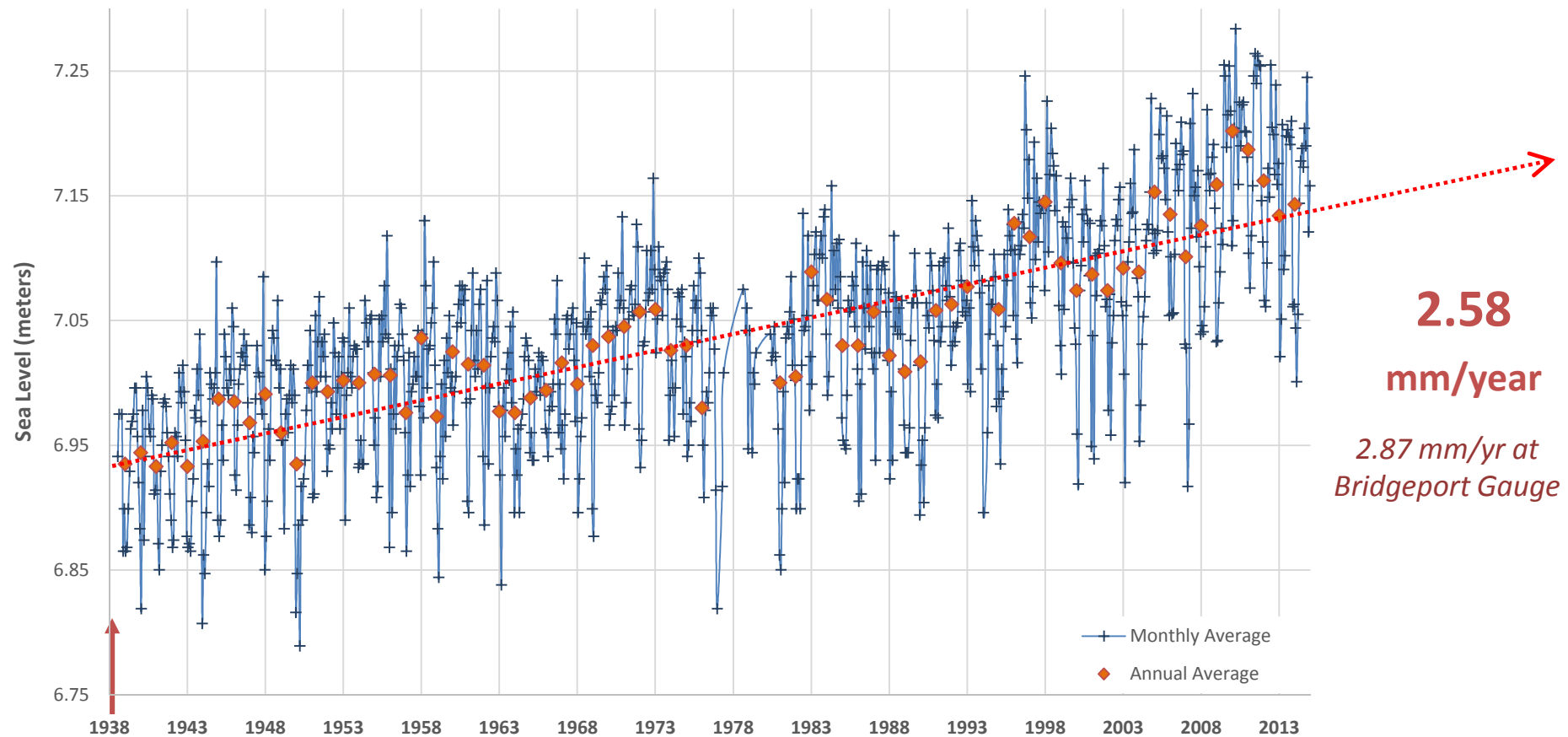
		Vulnerability		
		Low	Med	High
Risk from Coastal Storm Hazards	Low	Erosion of Uplands	Wastewater Plant Flooded	Major Roads Eroded
	Med	Wetlands Flooded	Businesses Flooded	Major Roads Flooded
	High	Beach Erosion	Septic System Failure	Drainage Infrastructure Flooded

Frequency is changing!

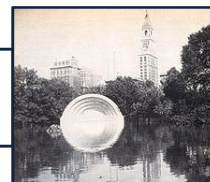
Risk

• Past Frequency: Sea Level Has Been Rising

- NOAA Tide Gauges, 1938 – 2015 (PSMSL data, New London)

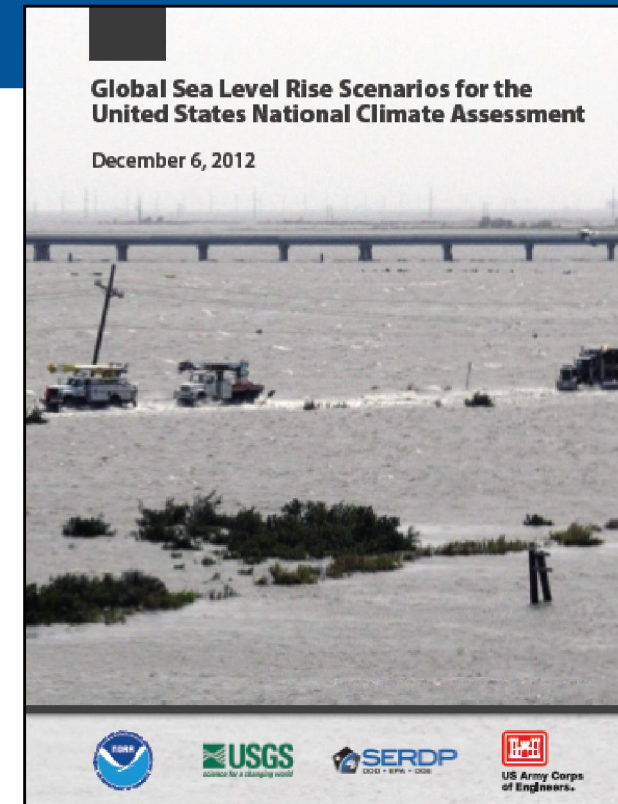
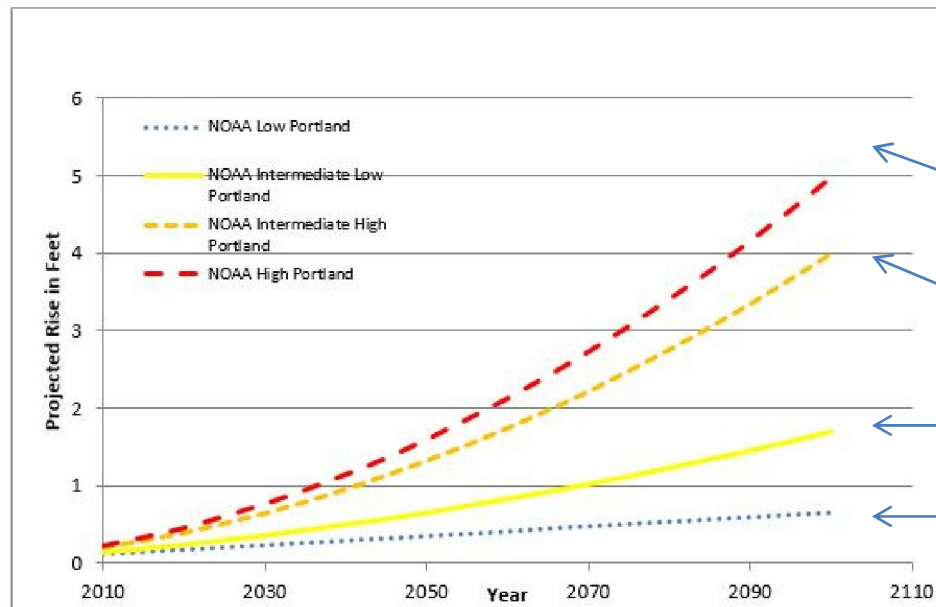


September 1938
"Long Island Express" New England Hurricane



Risk

- NOAA and the Army Corps of Engineers developed several sets of projections that were published in 2012



Ocean warming + highest polar ice melt

Ocean warming + some polar ice melt

Ocean warming

Continuation of historical trend

Risk

- **Future Frequency: Sea Level Rise Projections**

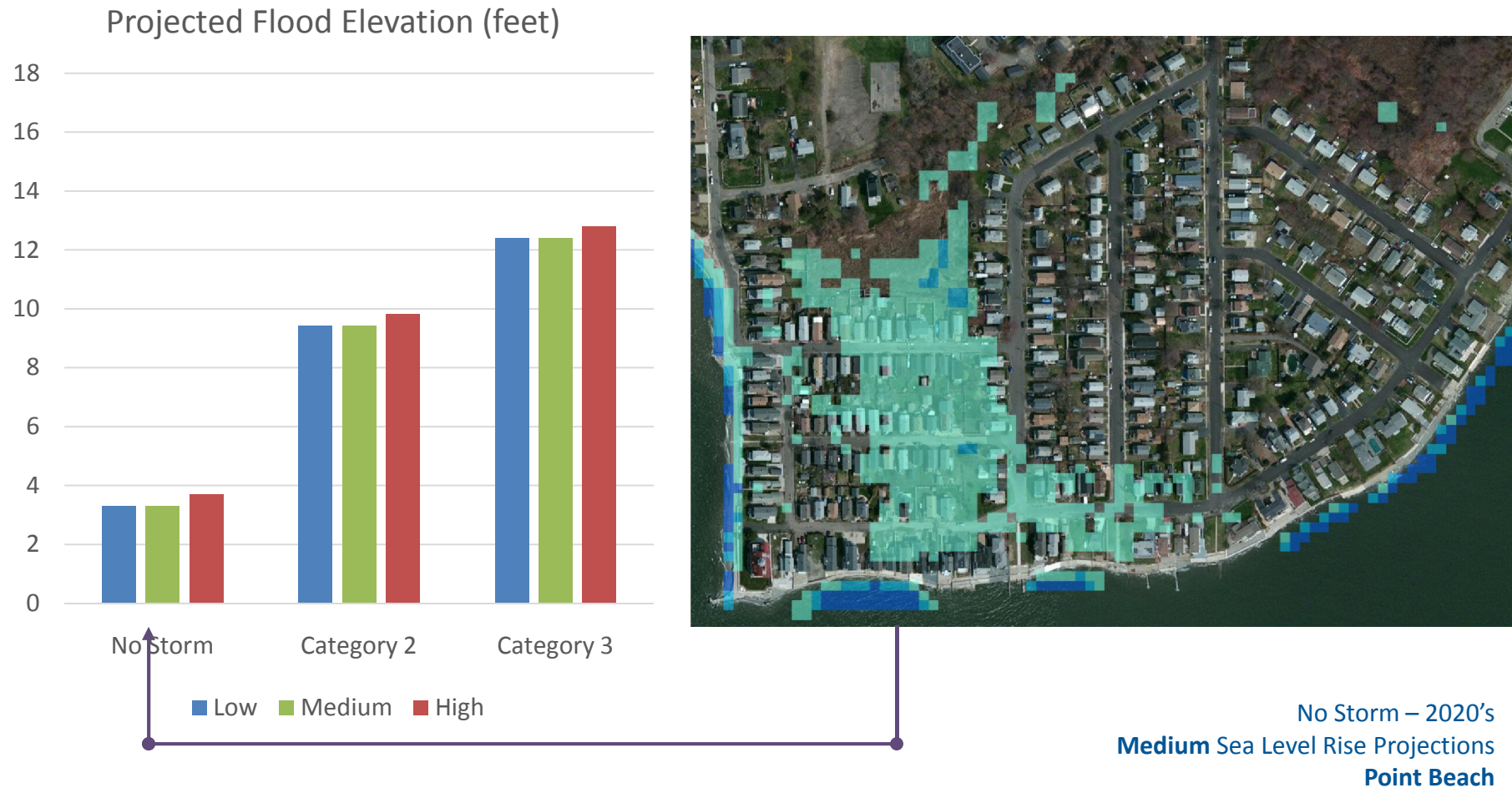
- The Nature Conservancy
- Columbia University Earth Institute
- NASA Goddard Institute for Space Studies
- *Analysis performed 2010-2011*

Projected Relative Sea Level Rise Averaged Across Long Island Sound (inches)

Scenario	2020's	2050's	2080's
Low	3.5	10	18.5
Medium	3.5	10	20
High	9	26	52

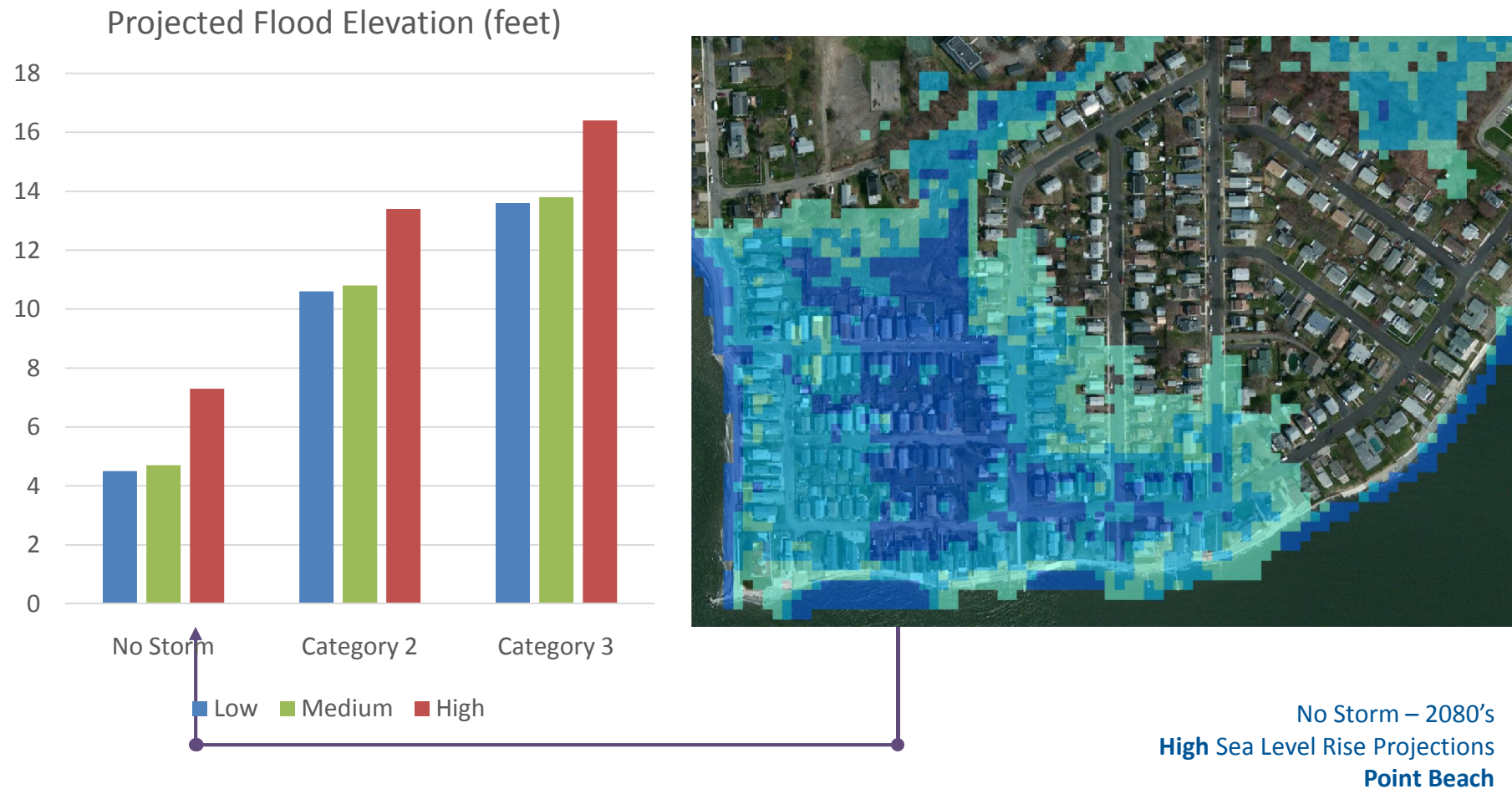
Inundation Risk

- **2020s: medium scenario mapped by TNC's coastal resilience viewer**



Inundation Risk

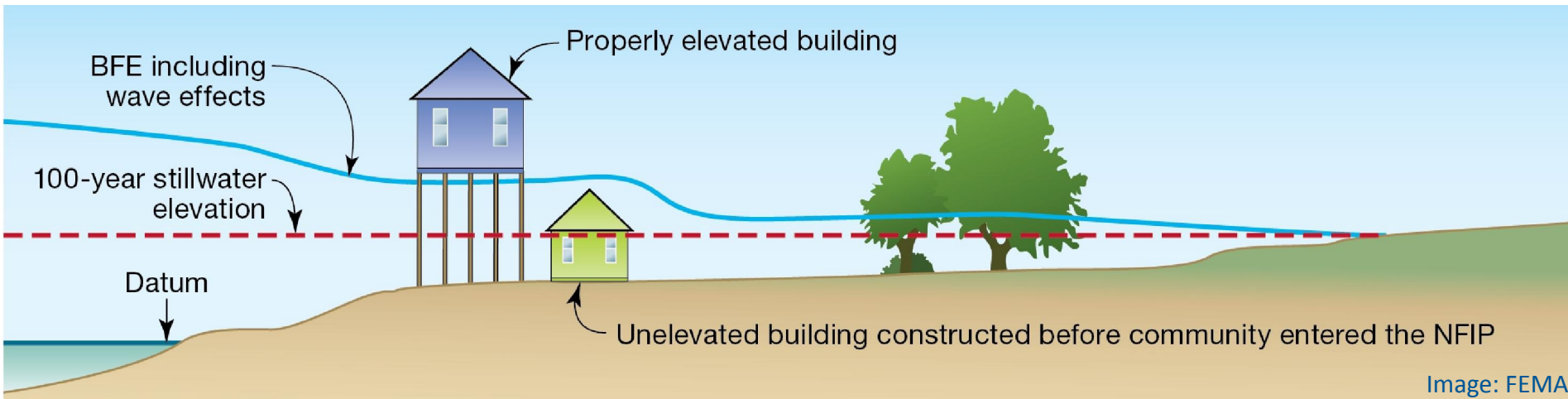
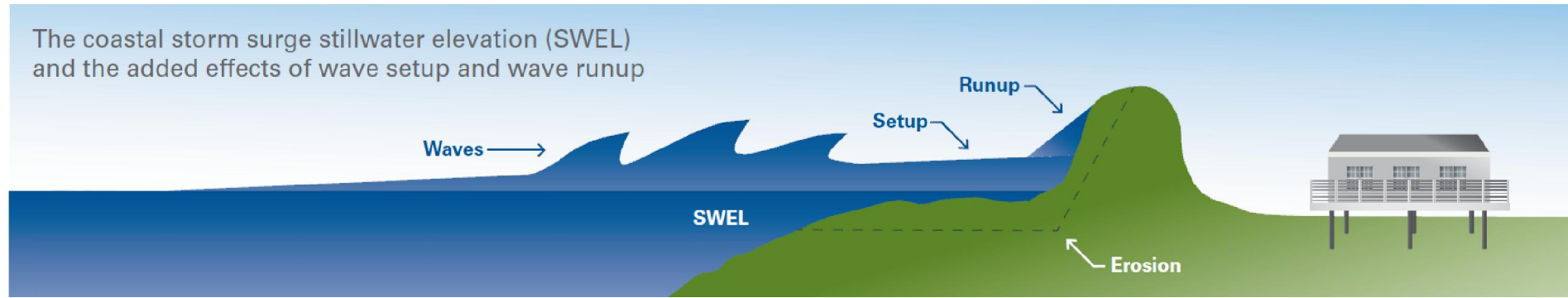
- 2080s: high scenario mapped by TNC's coastal resilience viewer



Wave Risk

Other Flood Risk Sources

FEMA Studies Provide Information not Captured by Coastal Resilience Tool



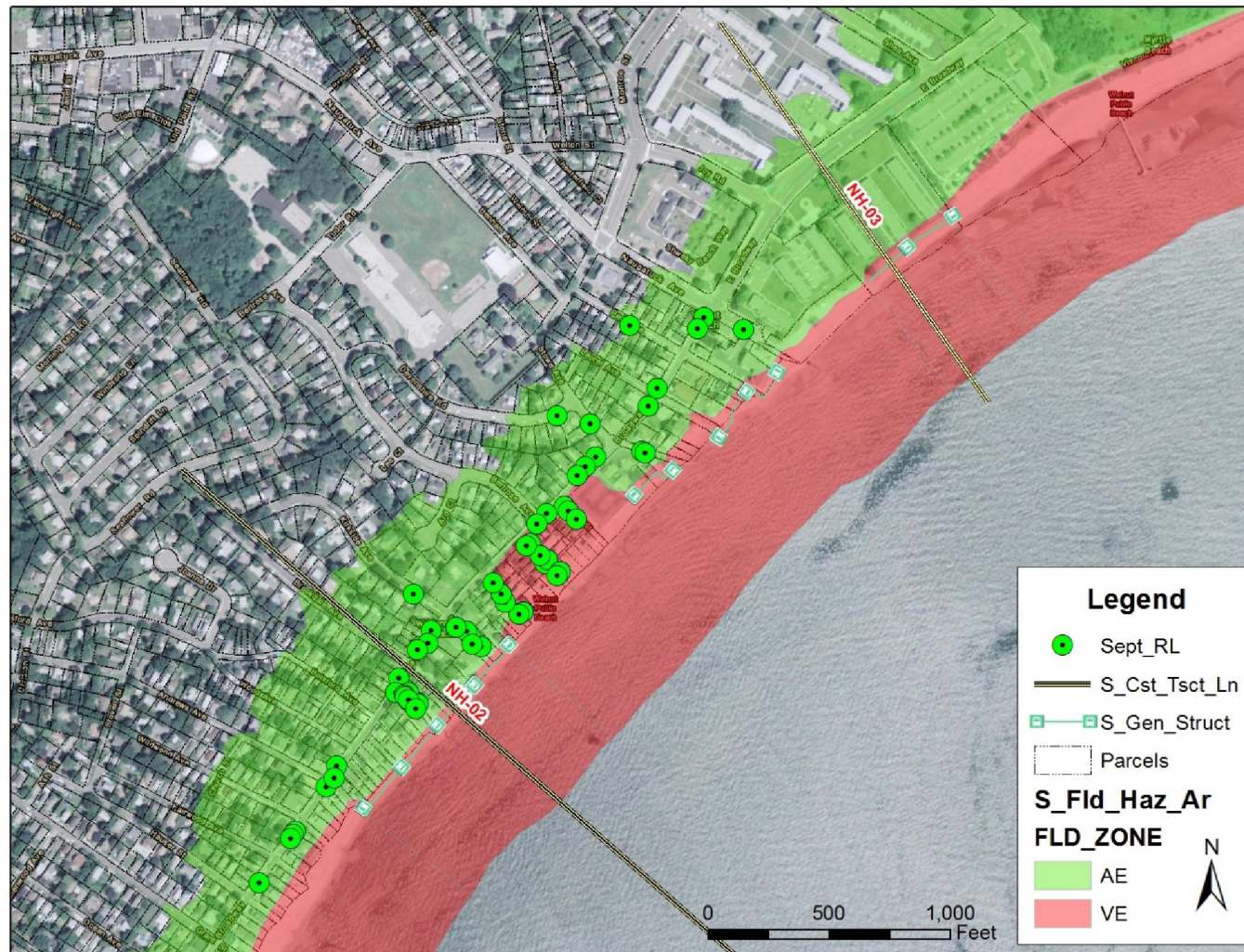
It's more complicated than a higher sea level

Wave Risk

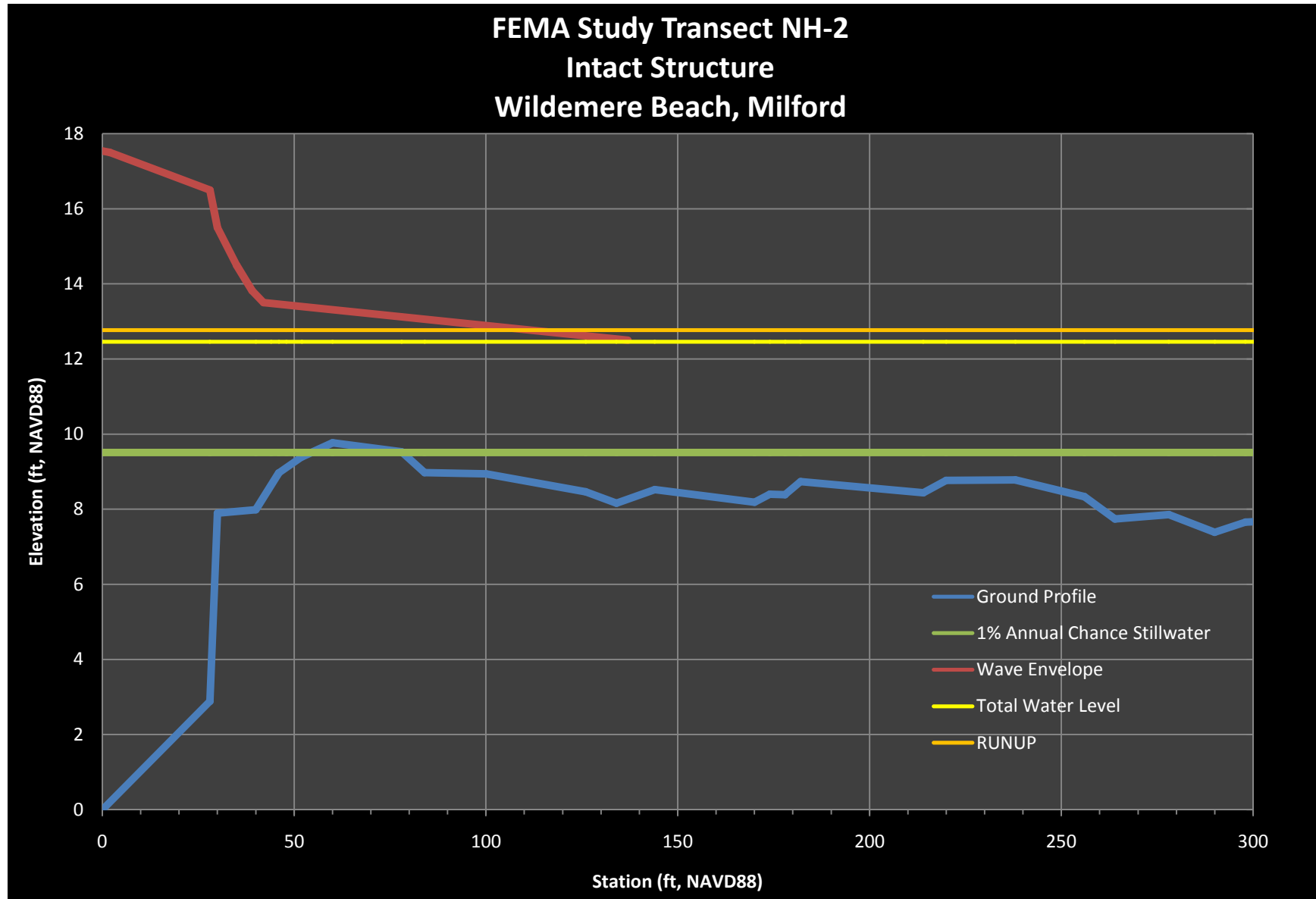
FEMA (PRELIMINARY) FLOOD INSURANCE STUDY

August 10, 2015

WALNUT AND WILDEMERE BEACH, MILFORD, CT



Wave Risk



Wave Risk

Milford – FEMA Coastal Study - NH-2

10% ft., navd88	2% ft., navd88	1% (incl. wave setup) ft., navd88	0.2% ft., navd88
7.4	8.9	9.5/11.72	10.8

Milford – USACE NACCS Water Levels (all return periods include wave setup)

10% ft., navd88	2% ft., navd88	1% ft., navd88	0.2% ft., navd88
8.4	10.1	11.1	14.1

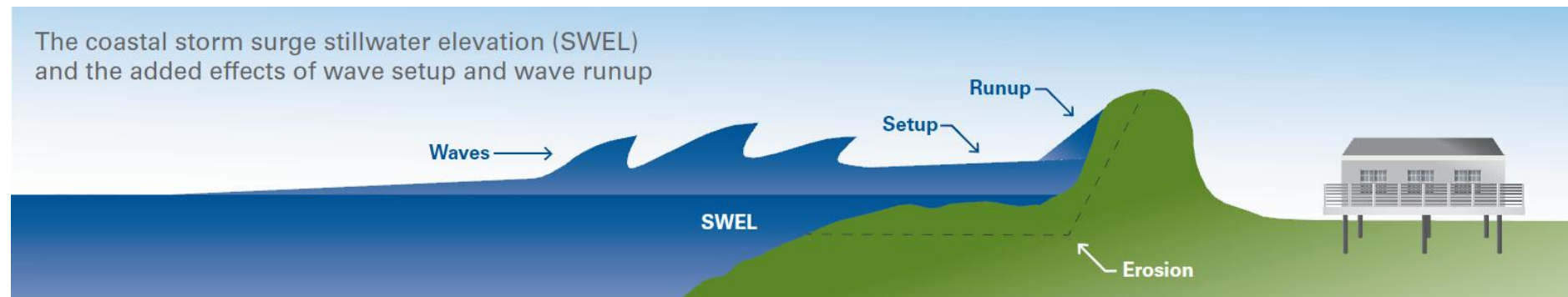
Wave Risk

SUMMARY OF PRIMARY HAZARDS: Wildemere and Walnut Beaches Milford

FEMA Coastal Study Transect NH-02 and NH-03:

Vertical concrete wall, 6 feet high (NH-02) and Gabion Revetment (NH-03)

- Wave runup elevations dominate over wave heights (steeply sloped beaches, bluffs, and/or shore-parallel flood protection structures)
- Wave Overtopping – Inland extent of Zone VE mapped to Wave Overtopping Splash Zone
- Overland Wave Inundation – Zone VE offshore and Zone AE mapped inland
- Velocity Zone at Shoreline
- 1-Percent-Annual-Chance Stillwater – 9.5 feet (Total Water Level = 12 feet includes wave setup), NAVD88



Wave Risk

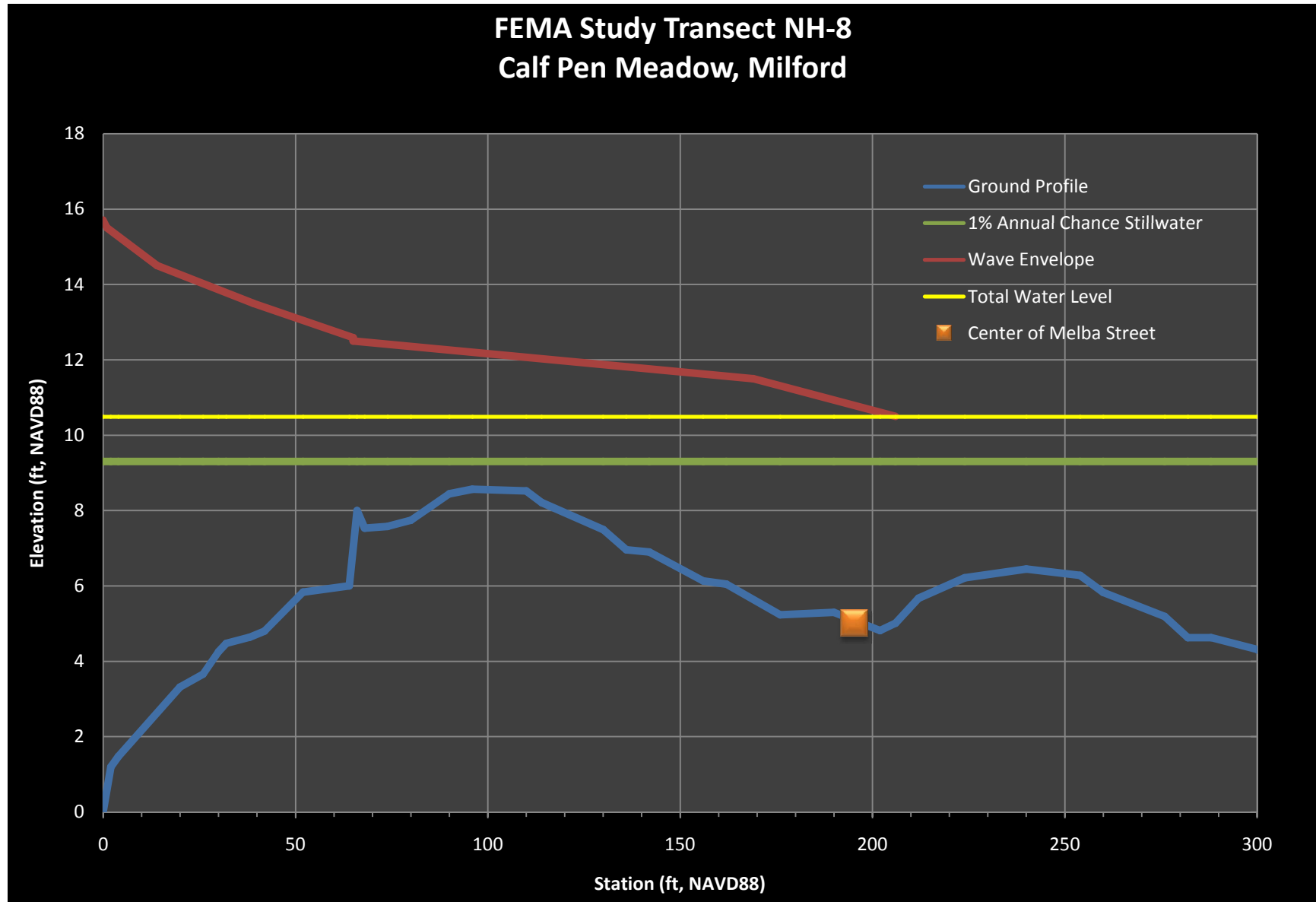
FEMA (PRELIMINARY) FLOOD INSURANCE STUDY

August 10, 2015

Calf Pen Meadow and Point Beach



Wave Risk



Wave Risk

Milford – FEMA Coastal Study - NH-8

10% ft., navd88	2% ft., navd88	1% (incl. wave setup) ft., navd88	0.2% ft., navd88
7.2	8.6	9.3/10.5	10.6

Milford – USACE NACCS Water Levels (all return periods include wave setup)

10% ft., navd88	2% ft., navd88	1% ft., navd88	0.2% ft., navd88
8.4	10.1	11.1	14.1

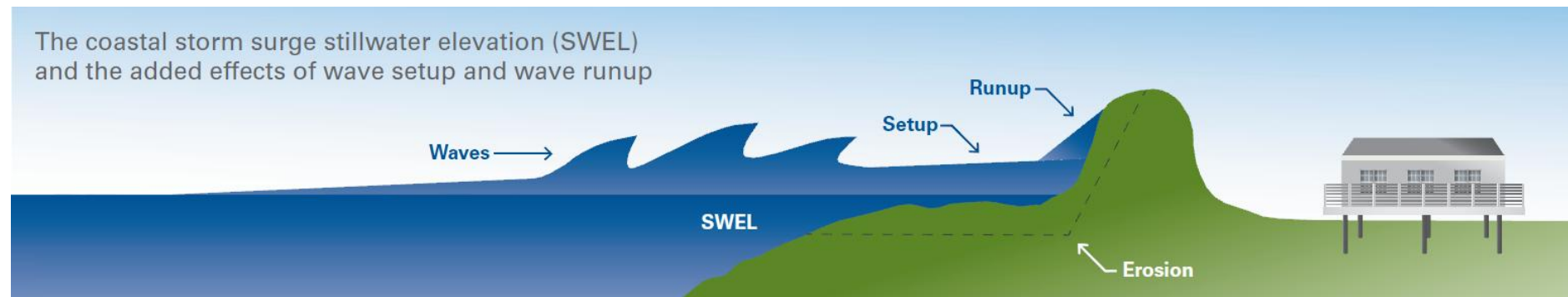
Wave Risk

SUMMARY OF PRIMARY HAZARDS: Calf Pen Meadow Milford

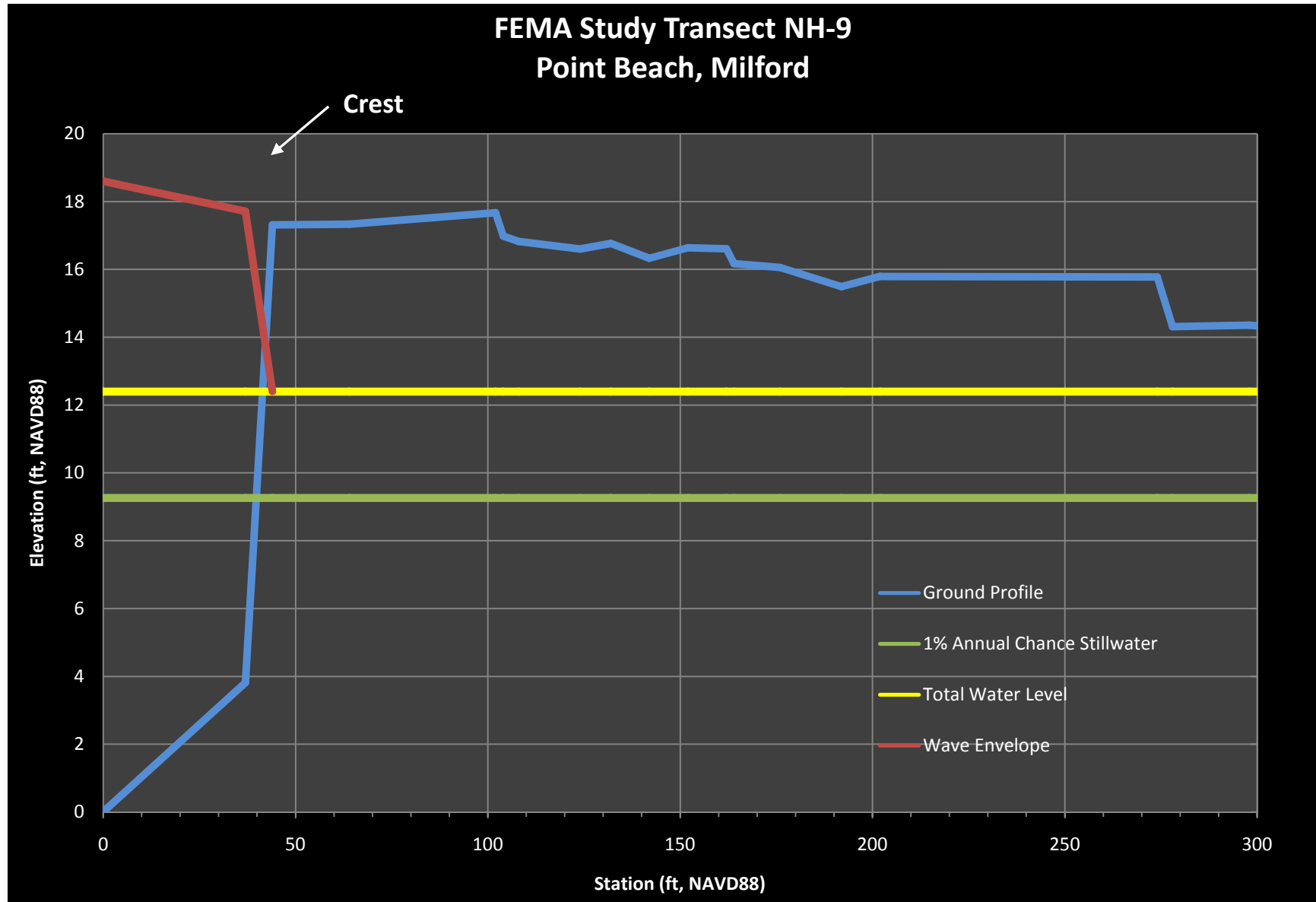
FEMA Coastal Study Transect NH-08:

Vertical concrete wall (NH-08)

- ❑ Overtopped– Structure crest is overtopped by the 1-Percent-Annual-Chance Stillwater
- ❑ Overland Wave Inundation – Zone VE offshore/extended inland of first row of homes and Zone AE mapped inland (Max. Wave Crest = 13 ft)
- ❑ Velocity Zone at Shoreline
- ❑ 1-Percent-Annual-Chance Stillwater – 9.3 feet (Total Water Level = 10.5 feet includes wave setup), NAVD88



Wave Risk



Wave Risk

Milford – FEMA Coastal Study - NH-9

10% ft., navd88	2% ft., navd88	1% (incl. wave setup) ft., navd88	0.2% ft., navd88
7.3	8.7	9.3/12.4	10.5

Milford – USACE NACCS Water Levels (all return periods include wave setup)

10% ft., navd88	2% ft., navd88	1% ft., navd88	0.2% ft., navd88
8.4	10.1	11.1	14.1

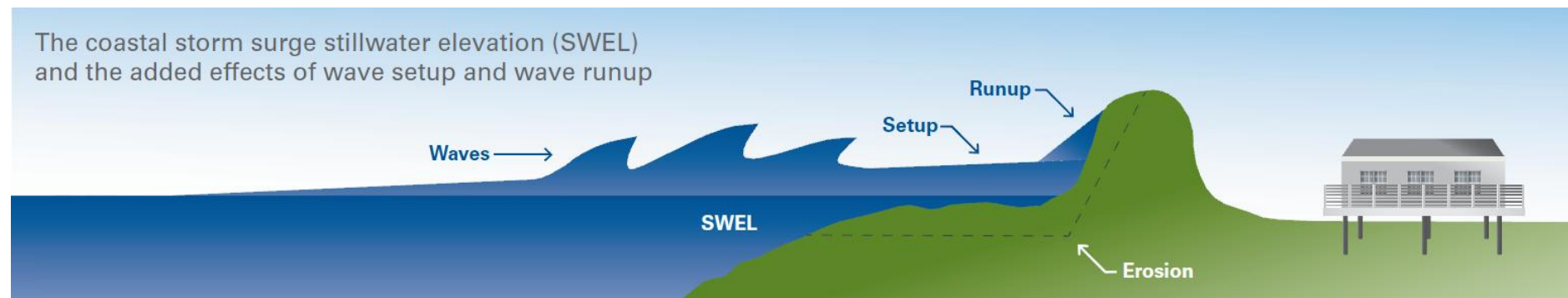
Wave Risk

SUMMARY OF PRIMARY HAZARDS: Point Beach Milford

FEMA Coastal Study Transect NH-09:

Vertical concrete wall

- ❑ Overland Wave Inundation – Zone VE offshore/extended inland of profile crest (Max. Wave Crest = 20 ft)/AE Zone mapped inland to the southwest of NH-09
- ❑ Runup was not mapped along this transect during the most recent FEMA coastal study however based on review of FEMA profile data should be considered a hazard at particular locations along this section of shoreline.
- ❑ Velocity Zone at Shoreline
- ❑ 1-Percent-Annual-Chance Stillwater – 9.3 feet (Total Water Level = 12.4 feet includes wave setup), NAVD88



Risk

Risk & Vulnerability Assessment: first step to Coastal Resilience Plan

		<u>Urgency</u>		
		2080's	2050's	2020's
Frequency	Category 3 Storm	?	?	?
	Category 2 Storm	?	?	?
	Daily	?	?	?

Infrastructure
 Economy
 Health & Safety
 Natural Resources
 Social Resources

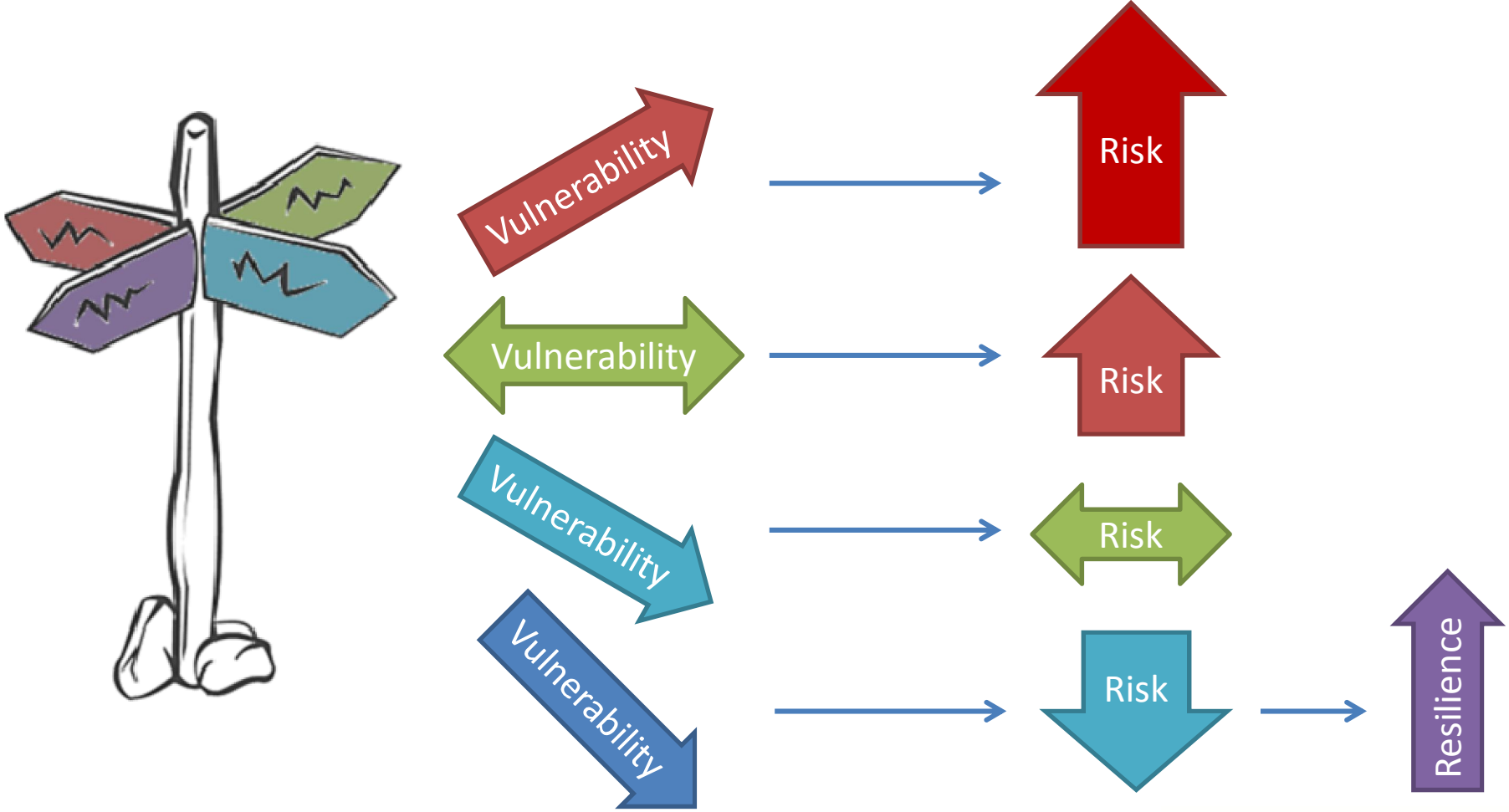
Risk

- **Recall that Risk = frequency x vulnerability**
 - Sea level rise is increasing frequency of events like daily inundation, damaging storm surges, and erosion
 - Vulnerabilities can remain static and risks will increase in the face of rising seas and increased coastal storm frequency or magnitude
 - Vulnerabilities can be reduced to hold risk at bay, or...
 - If vulnerabilities can be reduced even further, then risks can be lowered, leading to increased resilience

Risk and Resilience

Milford is at a Crossroads

Increasing frequency...



Vulnerability



Social/Economic

- Commerce, Industry, Tourism, Development, Health & Safety



Infrastructure

- Roads, Bridges, Flood Control Systems, Public Works, Sewer & Septic Systems



Utilities

- Water Distribution, Private Water Supplies, Electrical Grid, Communications



Critical Facilities

- Fire, Police, Shelters, Evacuation Routes, Healthcare, Senior Living Facilities

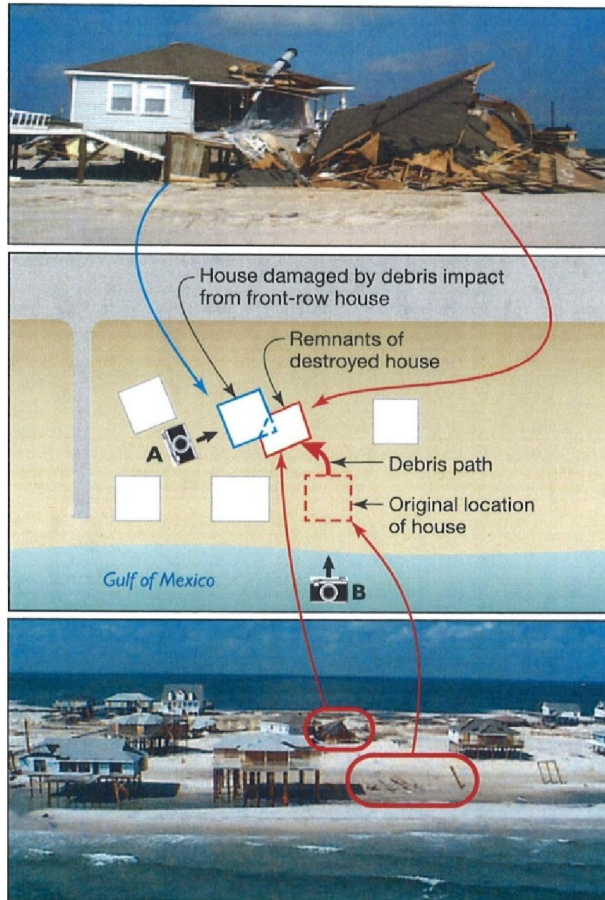


Natural Systems

- Tidal Wetlands, Coastal Landforms

Vulnerability

😊 Social/Economic



Home Damaged by Irene
Image: Bettina Hansen,
Hartford Courant



Flooding in Milford after Irene affects business operations
Image: Michelle Gervais

Vulnerability



Infrastructure

Flooding at High Tide
Image: MMI



Sandy Flooding in Milford
Image: REUTERS

Vulnerability

Sanitary Sewer Systems (and their components)

- ✓ Collection Systems
- ✓ Pumping Stations
- ✓ Treatment Facilities & Components
 - (Headworks, Pumps, Tanks, Lagoons)
- ✓ Treatment Facility Offices
- ✓ Chemical Storage Tanks & Areas
- ✓ Controls
- ✓ Outfalls
- ✓ Electricity for the Above
- ✓ Standby Power & Fuel
- ✓ Access Roads
- ✓ Personnel

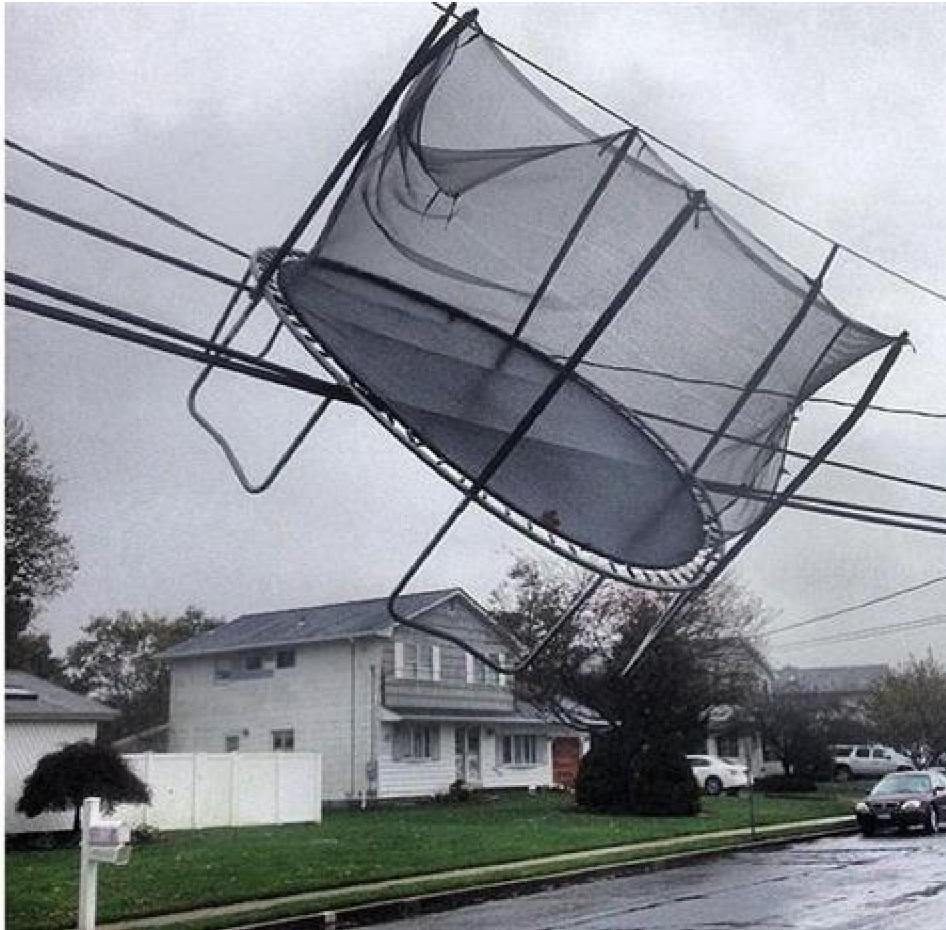
Beaver Brook WWTP
Image: carlincontracting.com



Vulnerability



Utilities



Trampoline in Powerlines after strong winds
Image: @JackieOConnor



Electric Crews Prepare to Work after Tropical Storm Irene
Image: FEMA

Vulnerability



Critical Facilities



Flooded Milford Street During Sandy
Image: Rich Scinto

Flood in Milford, 2014
Image: NBCConnecticut.com



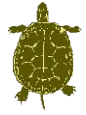
Rescue workers helping a Milford Couple during Irene
Image: NBC Connecticut

Vulnerability

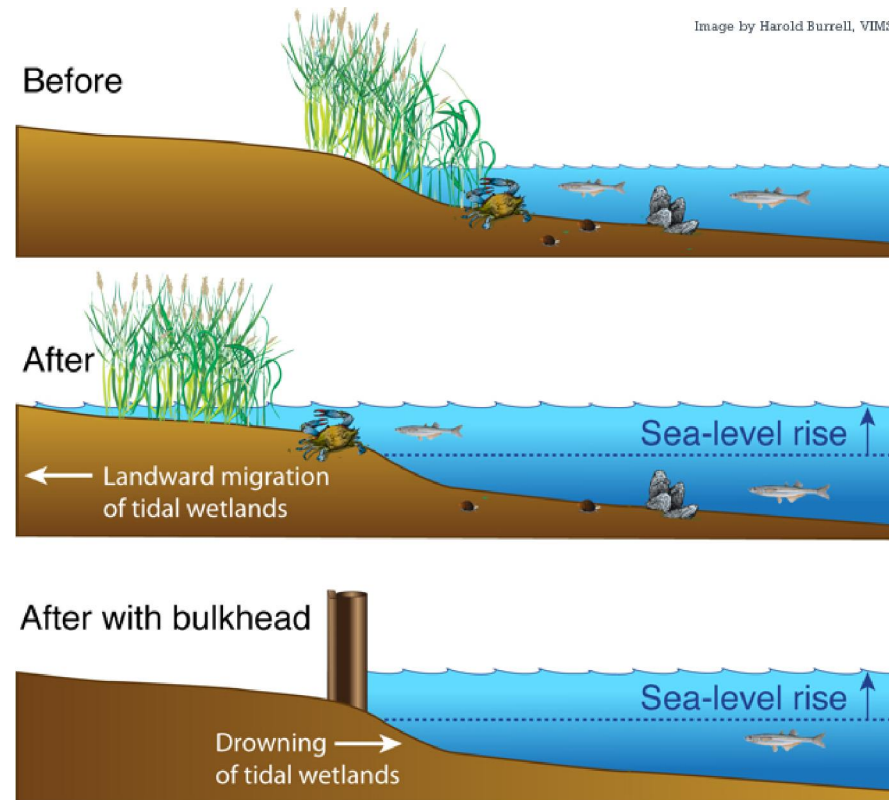
Critical Facilities



Vulnerability



Natural Systems



Tidal wetlands migrate inland as sea level rises.

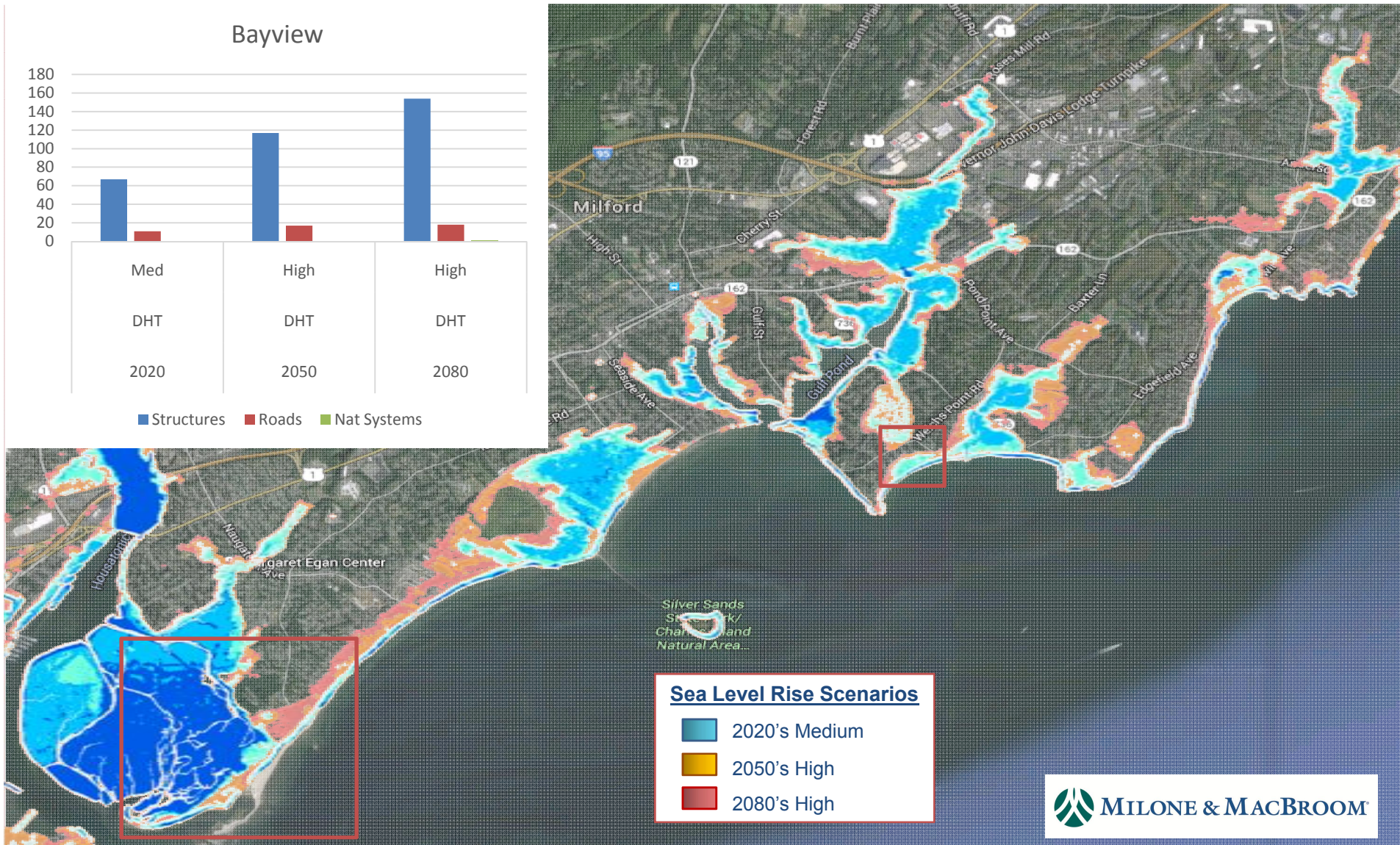
If sea level rise outpaces migration, wetlands drown.

If structures block migration, wetlands drown.

- Titus, J.G. 1991. Greenhouse Effect and Coastal Wetland Policy, *Environmental Management*. 15(1):39-58

Vulnerability

Vulnerable Areas



Vulnerability and Risk Discussion



TO THINK ABOUT

- What vulnerabilities are important to you?
- Where have you seen risks and vulnerabilities?
- What vulnerabilities do you see increasing in the future?

Resilience Options

3 General Types of Adaptation (IPCC, 1990)

- **Retreat**

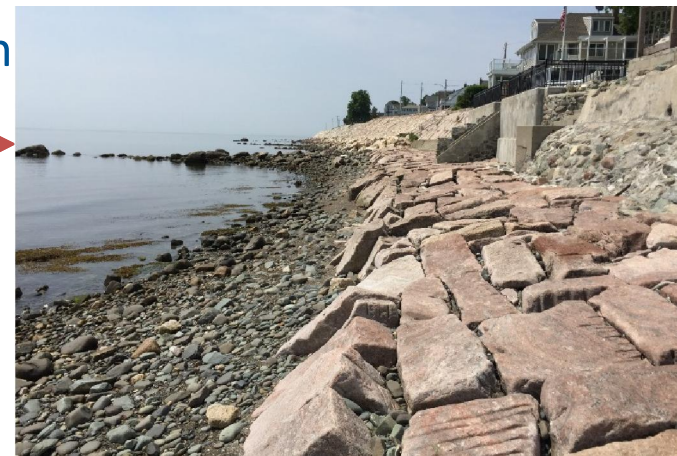
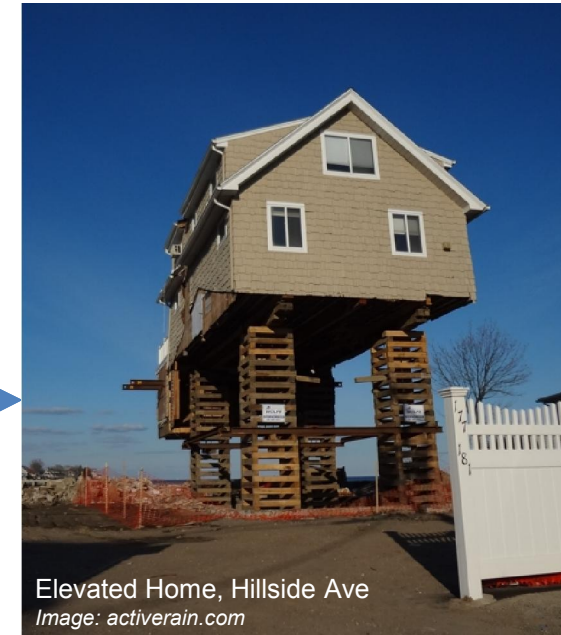
- No shoreline protection
- Abandon vulnerable area

- **Accommodation**

- No shoreline protection
- Remain in vulnerable area
- Adjust structures, infrastructure, land use, preparation & response

- **Protection**

- Shoreline protection
- Remain in vulnerable area
- No adjustment of structures, infrastructure, land-use, etc.



Resilience Options

7 Updated Categories of Adaptation (NOAA, 2010)

1. Impact Identification and Assessment

Know the facts

2. Awareness and Assistance

Share the facts

3. Growth and Development Management

Prevent creation of new vulnerabilities

4. Loss Reduction

Decrease existing vulnerabilities

5. Shoreline Management

Protect natural, aesthetic, & economic benefits of beach & shore

6. Coastal Ecosystem Management

Protect natural, aesthetic, & economic benefits of coastal ecosystems

7. Water Resource Management

Decrease unique risks to drainage & water supply infrastructure



FEMA specialists discuss mitigation options at a Milford Lowe's
Image: activerain.com

Resilience Options

Specific Options for Connecticut

- **Transportation Options**
 - Elevate or Retire Roads
- **Shoreline Management**
 - Living Shorelines, Beach Nourishment, Sediment Management, Dune-Management, Bioengineered Banks
- **Shore Protection Structures**
 - Seawalls, Bulkheads, Revetments
- **Home Elevation**
- **Water Resource Management**
 - Stormwater, Wastewater, Water Supply
- **Retreat**



Melba Street after Irene
Image: Cloe Poisson / Hartford Courant



Shoreview Condos
Image: David Murphy

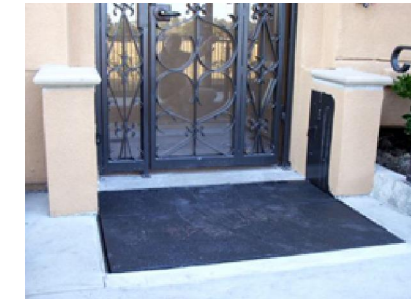
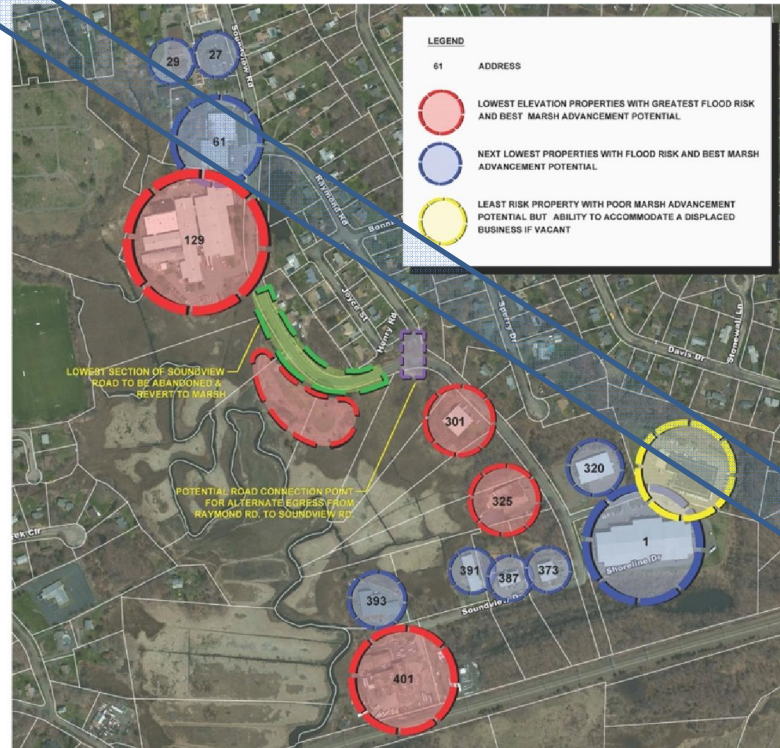
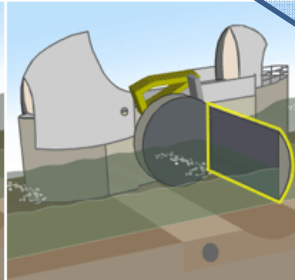
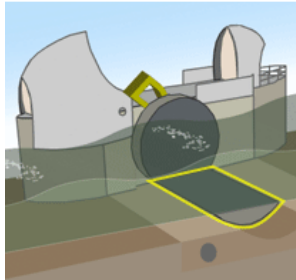
Resilience Options

Regional Scale



Open position

Closed position



Site-Specific Scale

Resilience Discussion



TO THINK ABOUT

- What options interest you?
- Where would specific options work?
- What challenges do you see to different options?

Next Steps

- **Incorporate YOUR Comments**
- **Develop Resilience Options**
 - **Citywide**
 - **Most Impacted Areas**
- **Develop Coastal Resilience Plan**
- **Prepare Conceptual Designs**
 - **Address specific vulnerabilities (eg homes, infrastructure)**



Questions and Discussion

- What vulnerabilities are important to you?
- Where have you seen risks and vulnerabilities?
- What vulnerabilities do you see increasing in the future?
- What options interest you?
- Where would specific options work?
- What challenges do you see to different options?

Participate in the Process!

- *Talk to us now*
- *Look at the printed maps and mark locations of concern*
- *<https://www.surveymonkey.com/r/MilfordCRP>*
- *Talk to your neighbors*

<https://www.surveymonkey.com/r/MilfordCRP>