ResilientWoodsHole

Steering Committee Meeting #3

April 13, 2022

Joe Famely, Climate & Sustainability Team Lead

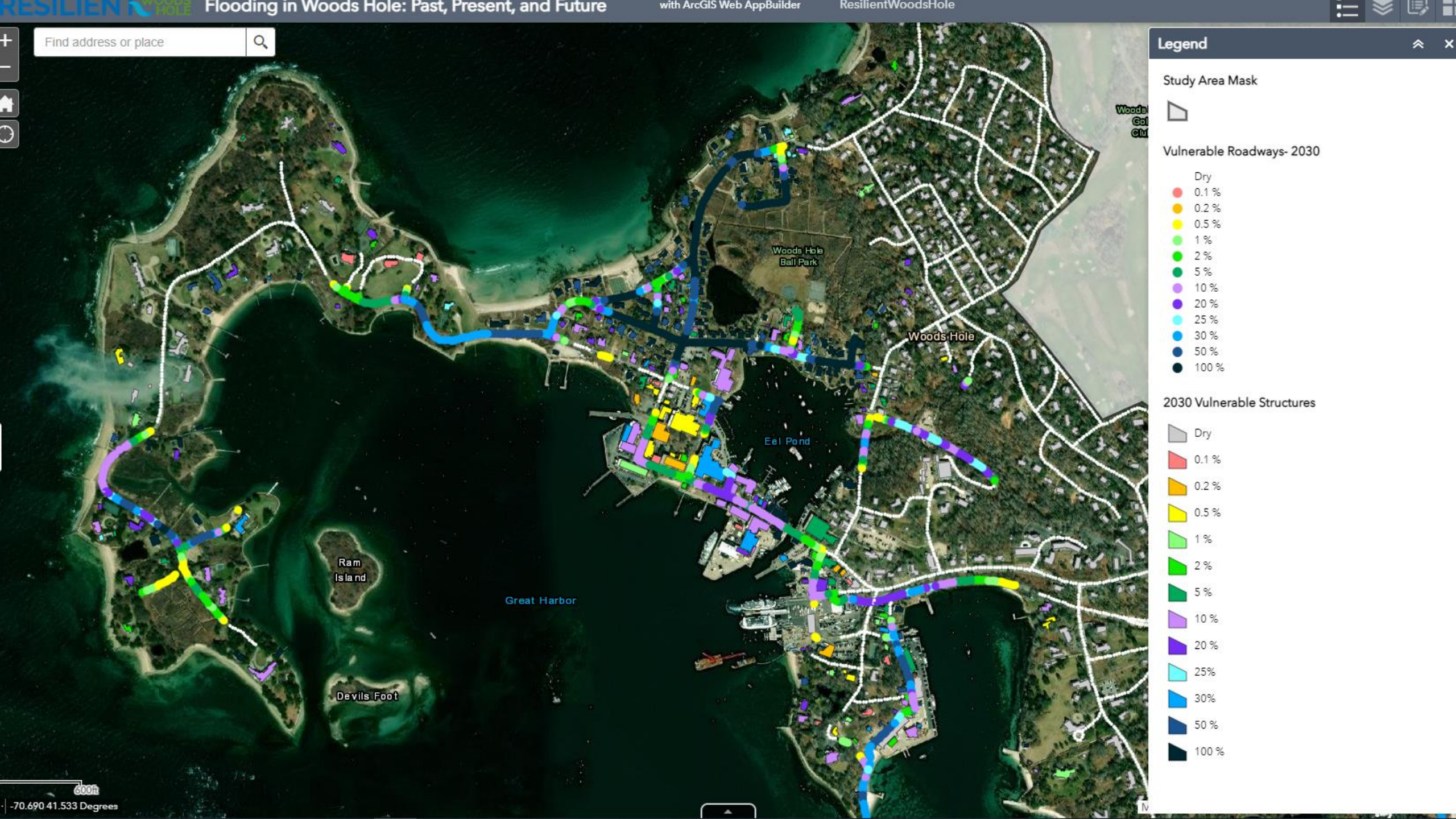
Woods Hole Group

Agenda

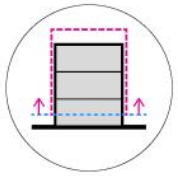
1. ResilientWoodsHole Phase 3 Project Overview
2. Summary of Stakeholder Feedback (survey)
3. Review Adaptation Themes
4. Review and Discuss Draft Adaptation Actions
5. Next Steps for this Project
6. Next Steps for ResilientWoodsHole (grant application)

WOODS HOLE GROUP
A CLS COMPANY


Penzance Rd
Penzance Rd
Penzance Rd
Gardiner Rd
Whitman Rd
Buzzards Bay Ave
Hyatt Rd
High St
Quissett Ave
Quissett Ave
Woods Hole Golf Club
Woods Hole Ball Park
Gosnold Rd
Bar Neck Rd
Bar Neck Rd
Millfield St
Woods Hole
Albatross St
Cow Bell Ln
Harbor Hill Rd
Mowing Way
Harbor Hill Rd
Eel Pond
School St
School St
Water St Waterfront Park
Water St
Sidney St
Woods Hole Rd
Woods Hole Rd
Steamship Authority-Woods Hole
Great Harbor
Ram Island
Devils Foot
Butler St


Flooding in Woods Hole: Past, Present, and Future
with ArcGIS Web AppBuilder
ResilientWoodsHole
Find address or place
Legend
Study Area Mask
Vulnerable Roadways- 2030
Dry
0.1 %
0.2 %
0.5 %
1 %
2 %
5 %
10 %
20 %
25 %
30 %
50 %
100 %
2030 Vulnerable Structures
Dry
0.1 %
0.2 %
0.5 %
1 %
2 %
5 %
10 %
20 %
25%
30%
50 %
100 %
Woods Hole Ball Park
Woods Hole
Eel Pond
Great Harbor
Ram Island
Devils Foot
600ft
-70.690 41.533 Degrees

Adaptation Strategies – Building Scale

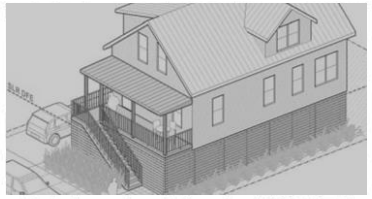


Building Form + Access

Elevate on extended foundation walls or open foundation

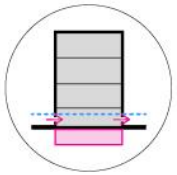
Elevate on fillI

Repurpose/Relocate Ground Floor Use



Exterior circulation to SLR-DFE

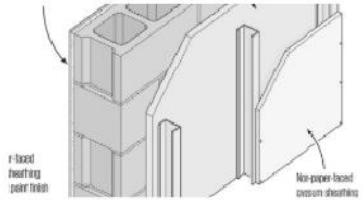
Interior circulation to SLR-DFE



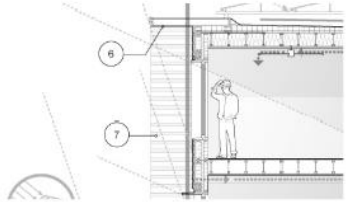
Building Adaptation

Wet Floodproofing

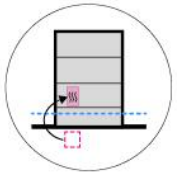
Dry Floodproofing



Flood Damage-Resistant Materials

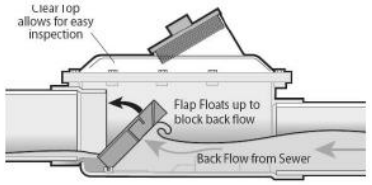


Enhanced Building Envelope



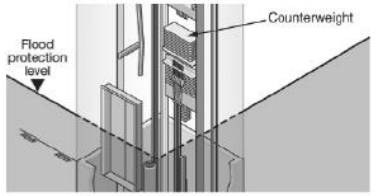
Building Systems

Protecting Critical Systems

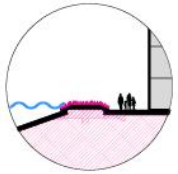


Backflow Prevention

Back-up Systems



Resilient Elevators



Site

Vegetated Berm

Deployable Barriers

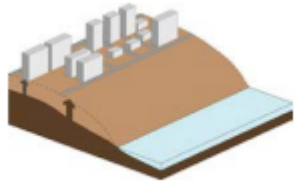
Perimeter Wall

(Credit: Modified from Boston Planning & Development Agency, Coastal Flood Resilience Design Guidelines)

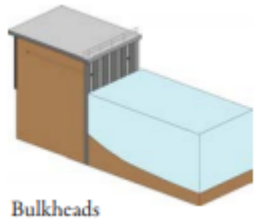
WOODS HOLE GROUP
A CLS COMPANY

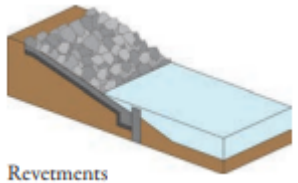
Adaptation Strategies –Landscape Scale

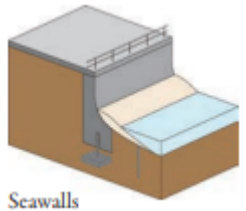
Protect (hardened infrastructure)

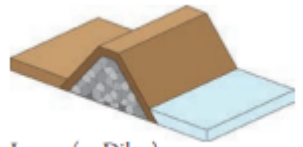

Elevation of Land and Streets

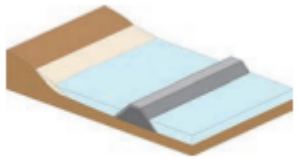

Floodwalls

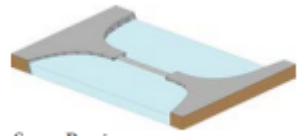

Bulkheads


Revetments

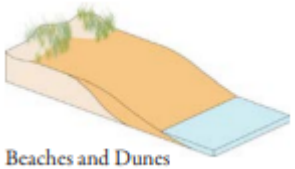

Seawalls

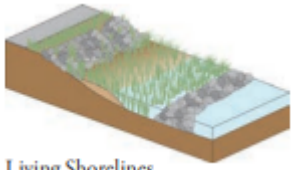

Levees (or Dikes)

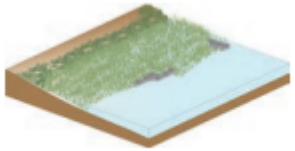

Breakwaters

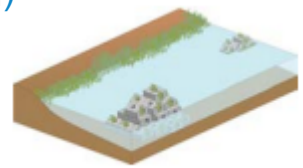

Surge Barriers

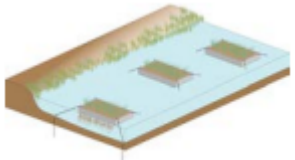
Protect (natural or nature-based infrastructure)

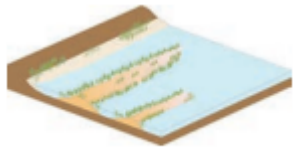

Beaches and Dunes


Living Shorelines


Constructed Wetlands


Artificial Reefs


Floating Islands


Constructed Breakwater Islands

Protect (hybrid infrastructure)


Waterfront Parks


Multi-purpose Levees

Relocate/Retreat


Strategic Retreat

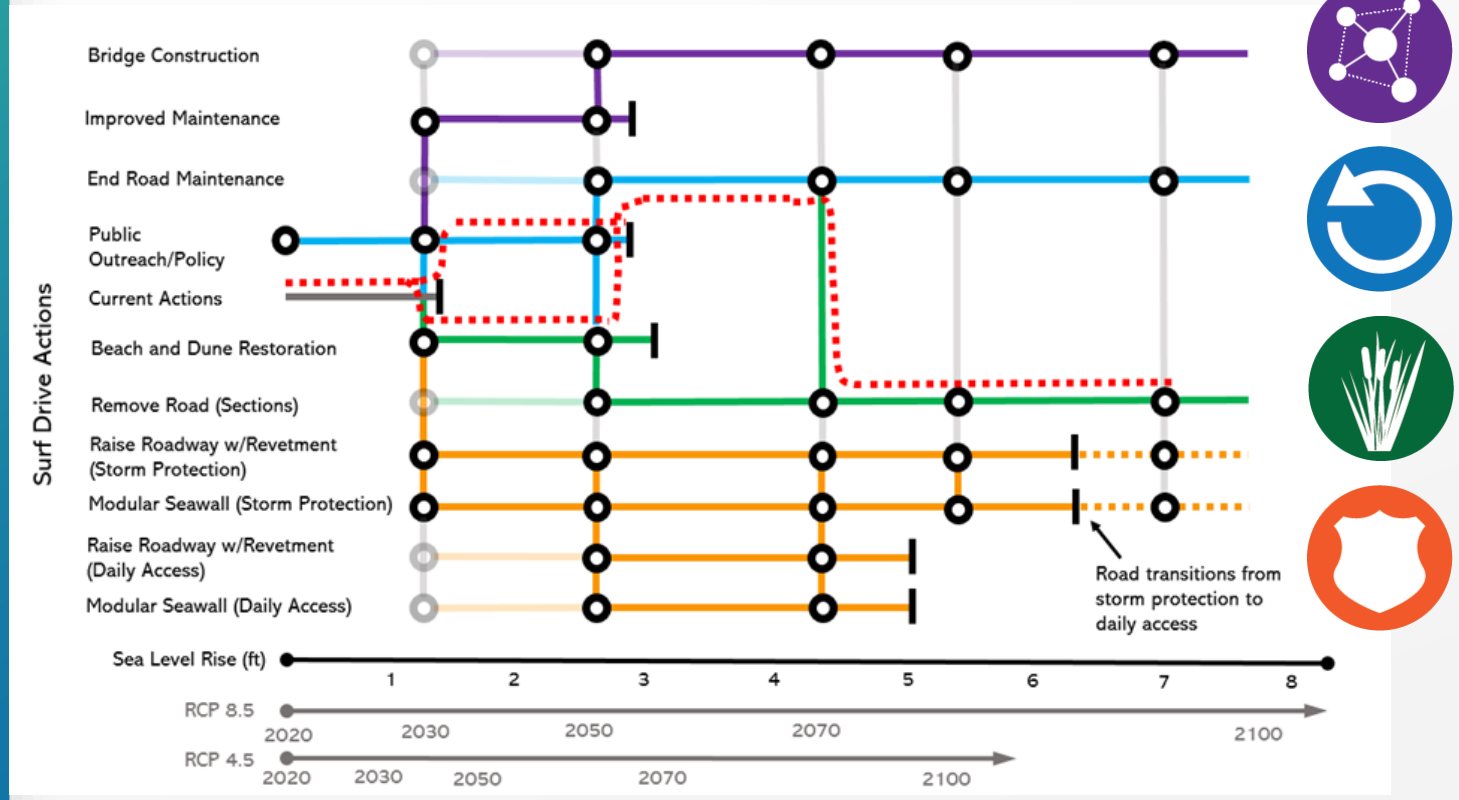
(Credit: Modified from NYCPlanning, Coastal Climate Resilience Urban Waterfront Adaptive Strategies)

WOODS HOLE GROUP
A CLS COMPANY

ResilientWoodsHole Phase 3 Overview

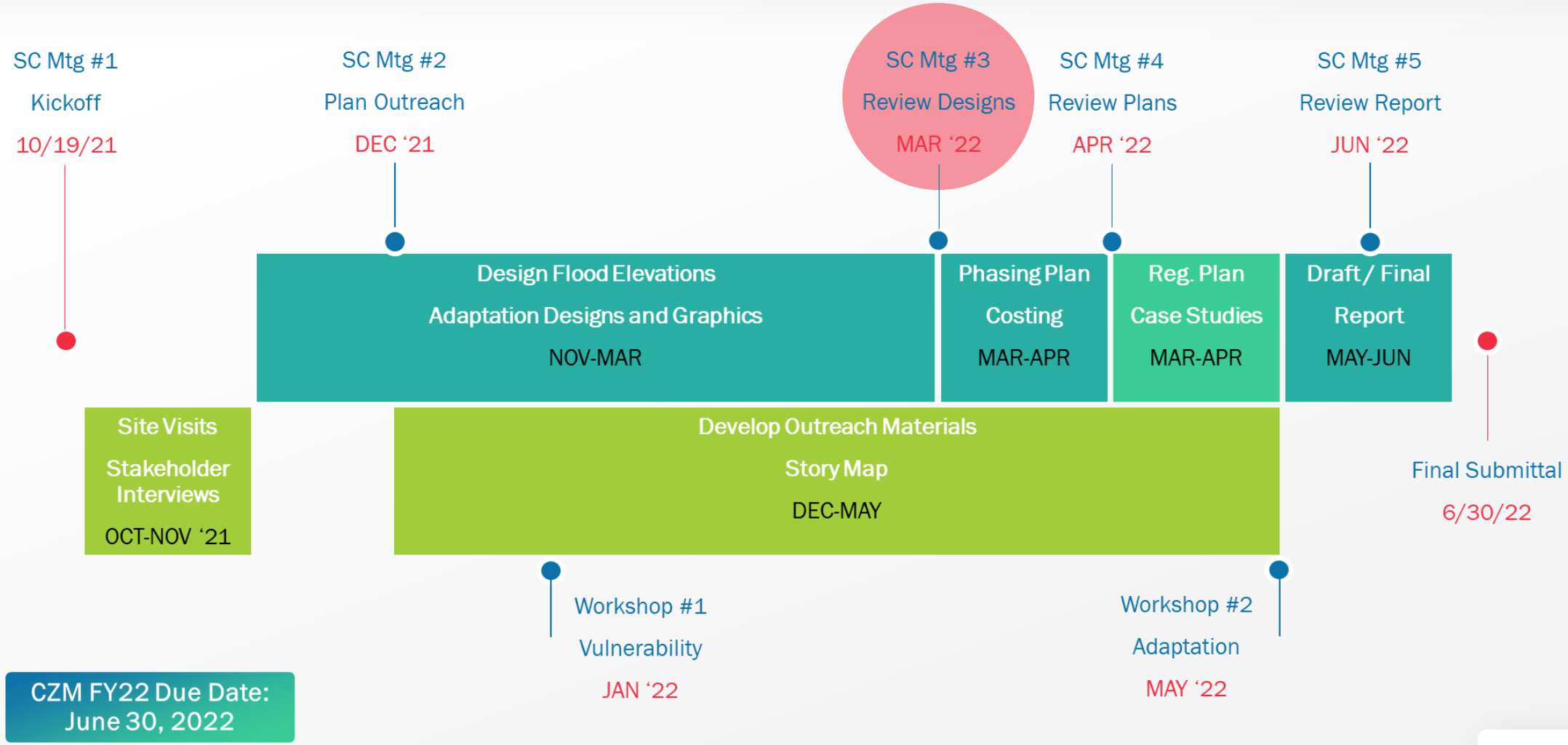
Comprehensive phased strategy that integrates resilient design concepts and community visioning

1. Develop community-wide **understanding of local climate impacts**.
2. Build effective **partnerships** for Village planning and visioning.
3. Develop **short-, mid-, and long-term climate adaptation actions** across strategic themes.
4. Identify key **thresholds and transition points**, based on adaptive management
5. Chart **dynamic adaptation pathways** that optimize community outcomes over time, based on community preferences and scientific projections.



WOODS HOLE GROUP
A CLS COMPANY

ResilientWoodsHole Phase 3 Schedule



WOODS HOLE GROUP
A CLS COMPANY

2/9/22 Public Forum and Survey

https://resilientwoodshole.org/

Input Map: Important Features

tinyurl.com/RWHimportant

Input Map: Adaptation and Vision

tinyurl.com/RWHadaptation

Input Map: Flooding

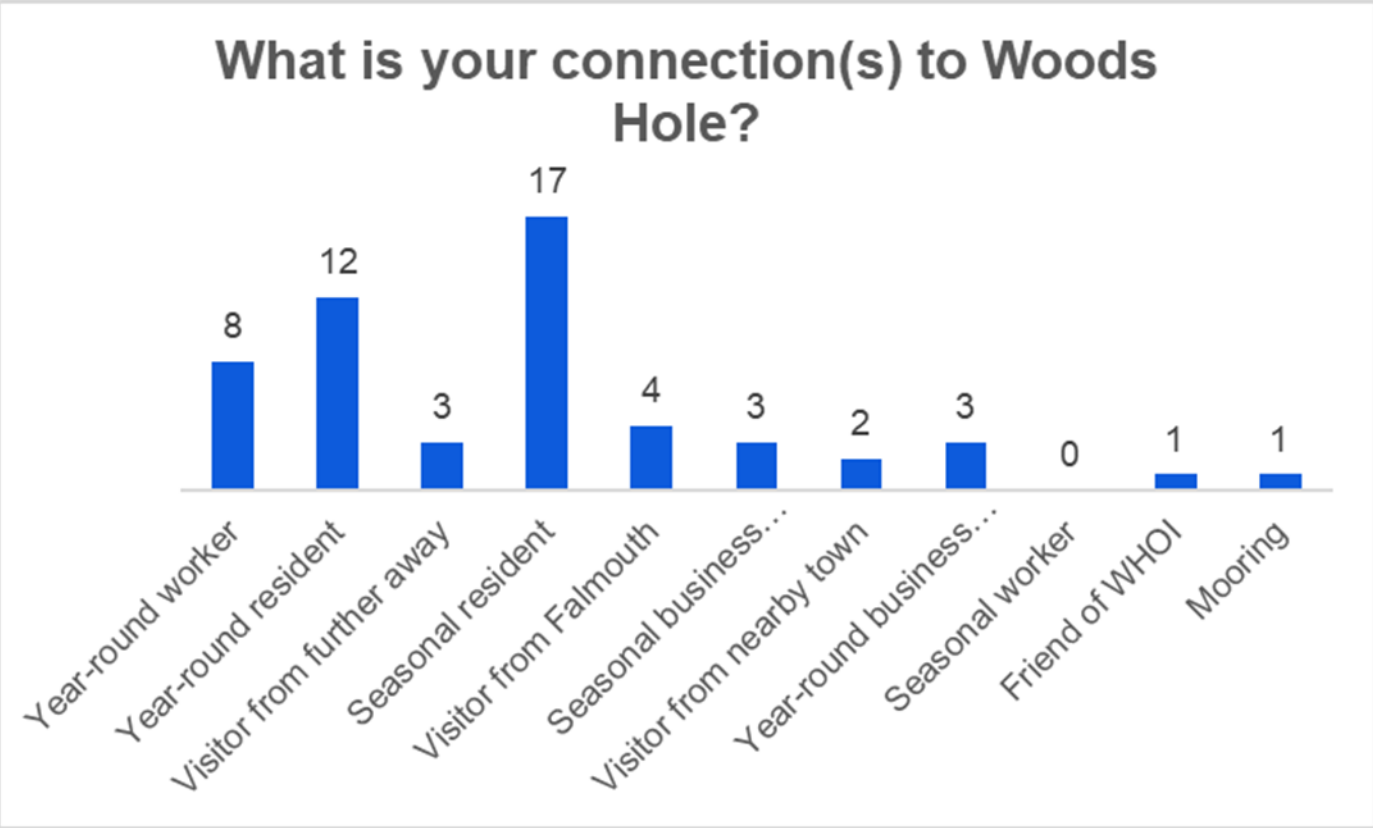
tinyurl.com/RWHflooding

Stakeholder Input Survey

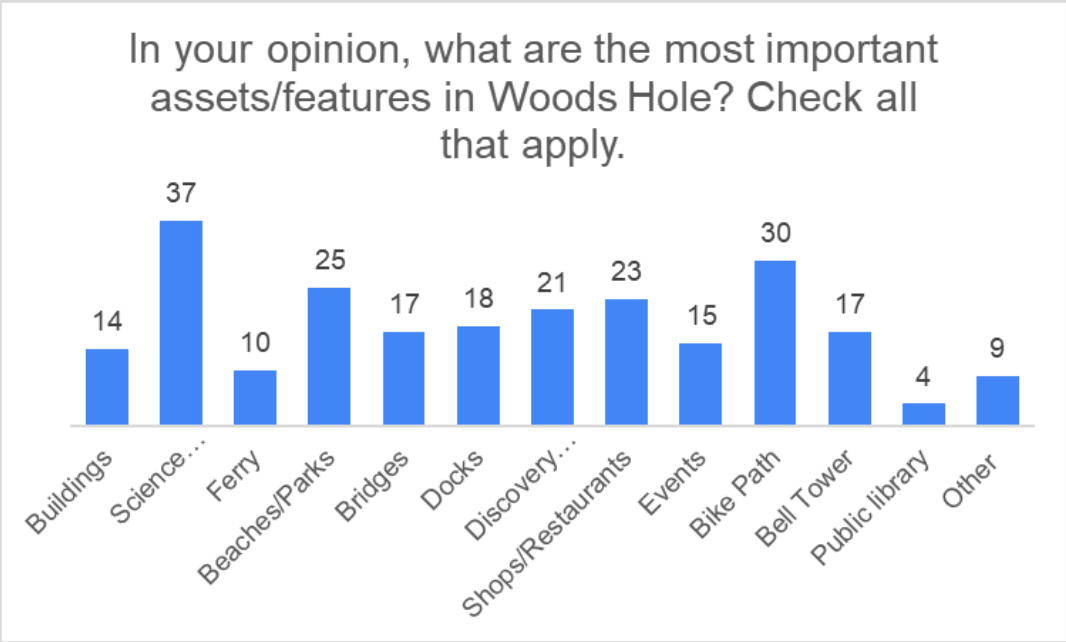
tinyurl.com/SurveyRWH

WOODS HOLE GROUP
A CLS COMPANY

Stakeholder Survey: Respondents



Stakeholder Survey: Important Features



All assets are important, but some have irreplaceable historical value, such as Woods Hole Library, Woods Hole Community Hall, Children's School of Science, Woods Hole Historical Museum, Waterfront Park and sculptures, NPR building.

Community, yacht club, Community Hall, Library, Museum, Post Office, Nobska

Daily life, friends, MBL, cemetery and related church activities. might want to add science education/science school to your list

Historical, education and physical nature

The harbors Great Harbor and Eel Pond

Museum

Harbor

Baseball field

Stakeholder Survey: What do you value here?

Overall themes

- Scientific Community (intellectual diversity)
- Community/Nostalgia/Deep Ties to the Village/Energy
- History
- Natural Environment

Woods Hole is a special community in which year-round and summer residents have been there for 3 or more generations. This allows for deep ties to each other and to the community. This also promotes a vibrant, engaged community that sponsors and supports events (talks, music, film series) that are almost unparalleled in a community of this size.

The unique mix of science, natural beauty and culture

A unique blend of history, science, charm and leisure

It's a very **nostalgic place** for me. I love the small town feel, the scientific community, and the practical modesty of Woods Hole - no chain stores, no flashy businesses. I have spent my adult life thinking "maybe some day I can retire in Woods Hole" and the fact that I am now living here and may be able to for the rest of my life is amazing! I know and love every house on the walk between my family's house and Stony Beach, the bell tower, the bridge, going to watch ferries load and unload (I still do this as an adult.) I and my children have attended CSS and visited the Aquarium (still mourning Bumper and LuSeal). It just feels like a community where I want to spend my life.

nostalgic pride

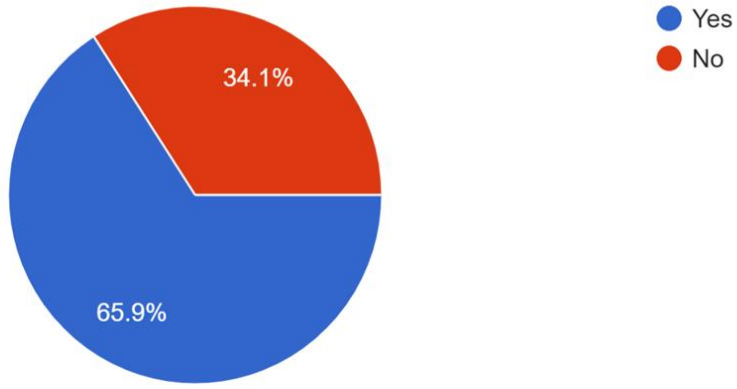
Long family history in the area

WOODS HOLE GROUP
A CLS COMPANY

Stakeholder Survey: Experience with Flooding

Have you experienced **high tide flooding** or **coastal storm flooding** in Woods Hole?

41 responses



Impacts:

- My property is right on the water and high tide flooding eats away at the sand bank
- Localized street flooding
- Covered our dock
- Unable to drive through shoreline roads and parts of village
- On the docks.
- Eroded shoreline, killed vegetation

Common Responses:

High Tide

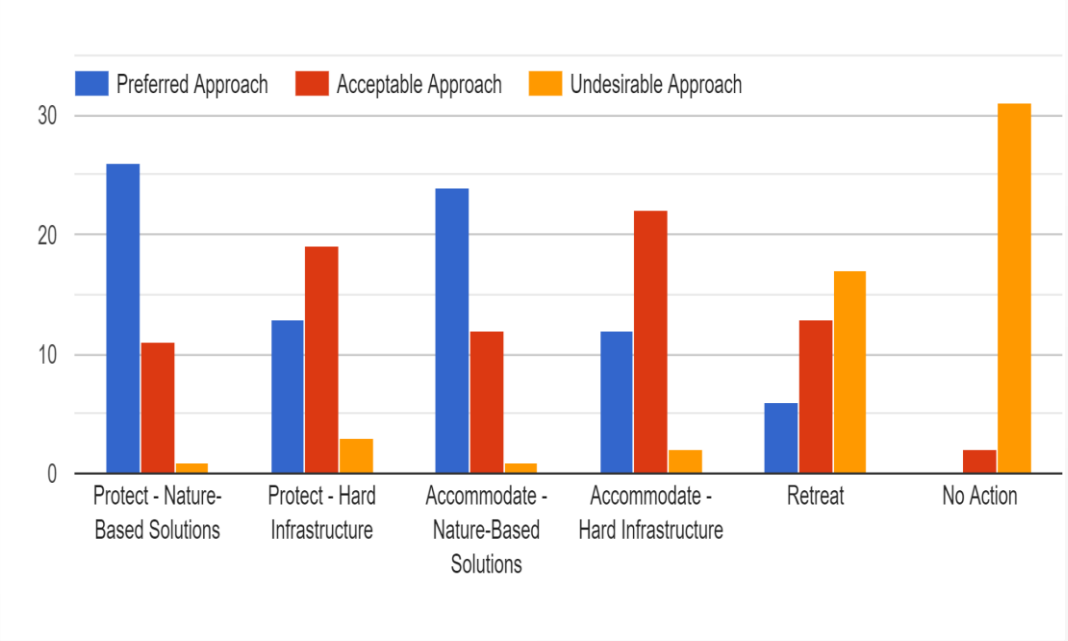
- Woods Hole Yacht Club and its docks
- Beaches (spec. Vinyard Sound and Stoney beach)
- Eel Pond

Coastal Storm

- Woods Hole Yacht Club and its docks
- Gardner Rd
- Millfield Street
- Mill Pond and marsh

WOODS HOLE GROUP
A CLS COMPANY

Stakeholder Survey: Adaptation Strategies



*preferences in response to storms were nearly identical to preferences in response to SLR

Nature-based solutions would build on the reasons that people come to Woods Hole in the first place -- they would increase populations of fish, shellfish, shorebirds, etc. and perhaps create new areas for visitors and residents to explore and enjoy nature. Hardening the shoreline may be necessary in spots but would make it less, rather than more, pleasant for people and useless for wildlife. Doing nothing is not an option because Woods Hole as we know it would disappear.

Hard infrastructure approaches to protection are short-term and expensive. Retreat is inevitable, just a matter of when.

It will likely take all aspects to remain resilient to the negative affect s from sea level rise and I think fortify existing costly infrastructure as we plan a phased retreat

WOODS HOLE GROUP
A CLS COMPANY

Stakeholder Survey: What should remain?

Overall themes

- Science Institutions need to be protected
- Utilities that help the village run protected
- Golf Course protected
- Tourism-based shops, events, etc should be relocated
- Non-useful infrastructure should cease to exist (playground, fields)

Science centers should stay in place to maintain the history of Woods Hole. Tourism-only shops may be able to be moved back from at-risk areas with little impact to their business if traffic could be directed inland.

Infrastructure such as water mains, sewer lines and pump stations, power lines, roads are required for the village to survive. The research institutes which provide much of the reason for the village to be, also seem critical. Features like the ball park and playground are not as unique or important to me and could be allowed to flood. I enjoy Stoney Beach but realize that it may be difficult to maintain with rising sea levels.

Science institutions. Coastal home, beaches, historical buildings, etc. can be found many places, but the scientific institutions of Woods Hole are unique and similar concentrations of oceanographic research organizations only exist at a few locations on Earth.

WOODS HOLE GROUP
A CLS COMPANY

Adaptation Theme: Maintain Character

Goal:

- Preserve the existing uses, historic character and community resources

Strategy:

- Leverage moderate and incremental strategies to steward the seaside community and the blue economy village identity

Representative Actions:

- wet floodproofing
- dry floodproofing
- site protection
- building systems protection
- moderate seawall/bulkhead elevation

WOODS HOLE GROUP
A CLS COMPANY

Adaptation Theme: Nature-based Focus

Goal:

- Use nature-based solutions to enhance resiliency and ecosystem services

Strategy:

- Where feasible, extend the effectiveness and potential longetivity of coastal green infrastructure and open space by facilitating the preservation, restoration, and migration of natural resource systems

Representative Actions:

- salt marsh migration/restoration
- beach/dune nourishment
- living shorelines
- living breakwaters/reefs

Adaptation Theme: Protect/Connect

Goal:

- Emphasize protection and maintenance of existing infrastructure and ensure vital connectivity

Strategy:

- Use hard and/or hybrid infrastructure solutions to reduce exposure of important features (municipal infrastructure, waterfront scientific assets, businesses and the residenital community) and preserve critical accessways (within Woods Hole and to the waterfront)

Representative Actions:

- seawalls
- bulkheads
- flood walls
- landscaped berms and terracing
- elevation of land/roads/buildings/infrastructure
- dry floodproofing
- wave attenuation features
- deployable flood barriers

WOODS HOLE GROUP
A CLS COMPANY

Adaptation Theme: Adaptive Realignment

Goal:

- Reimagine Woods Hole through the lens of living with water

Strategy:

- Where existing uses and configurations cannot reasonably continue (increasing cost/risk from daily tides or common storms), develop a multi-phased plan to accommodate water with lateral or vertical relocation based on shared understanding of risk tolerance

Representative Actions:

- wet floodproofing
- strategic elevation/relocation of buildings/infrastructure
- floating structures
- usage swapping
- undevelopment (retreat/buyout) for resilient open space

WOODS HOLE GROUP
A CLS COMPANY

Adaptation Actions: Management Areas

Fay Road

Nobska Point

Juniper Point

Waterfront

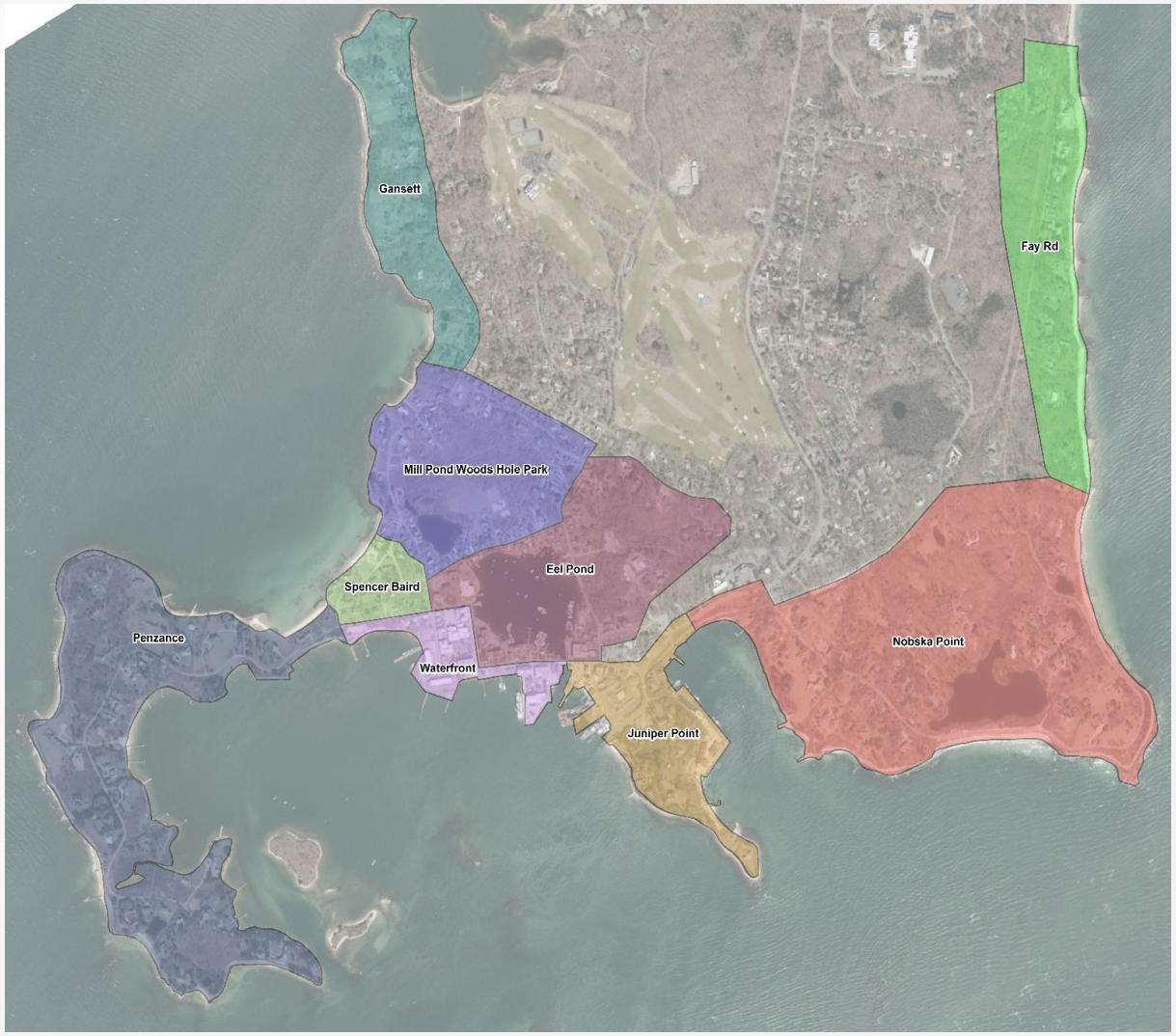
Penzance Point

Spencer Baird

Eel Pond

Mill Pond / WH Park

Gansett



WOODS HOLE GROUP
A CLS COMPANY

Adaptation Actions: Fay Road

Potential Adaptation Action
Deployable flood protection strategies for homes
Wet floodproofing for homes
Beach nourishment and dune enhancement
Landscape berm/terracing
Elevate roadway
Elevate low lying homes

WOODS HOLE GROUP
A CLS COMPANY

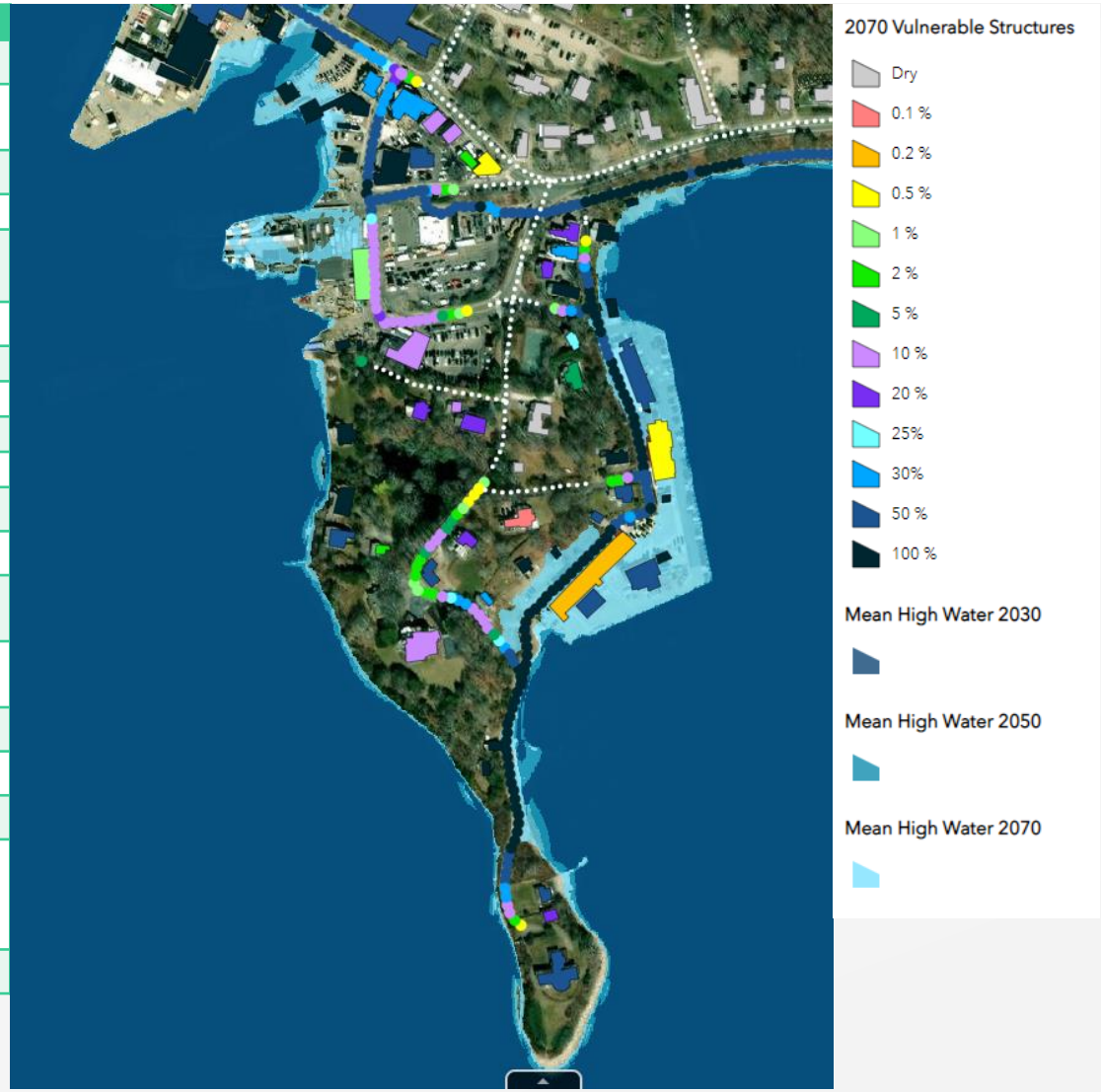
Adaptation Actions: Nobska Point

Potential Adaptation Action
Deployable flood protection strategies for low lying homes
Beach nourishment and dune enhancement
Elevate Nobska Rd
Wet floodproofing for low lying homes
Elevate low lying homes
Elevate and move Nobska Rd landward
Elevate or move low lying outbuildings landward
Elevate bikepath

WOODS HOLE GROUP
A CLS COMPANY

Adaptation Actions: Juniper Point

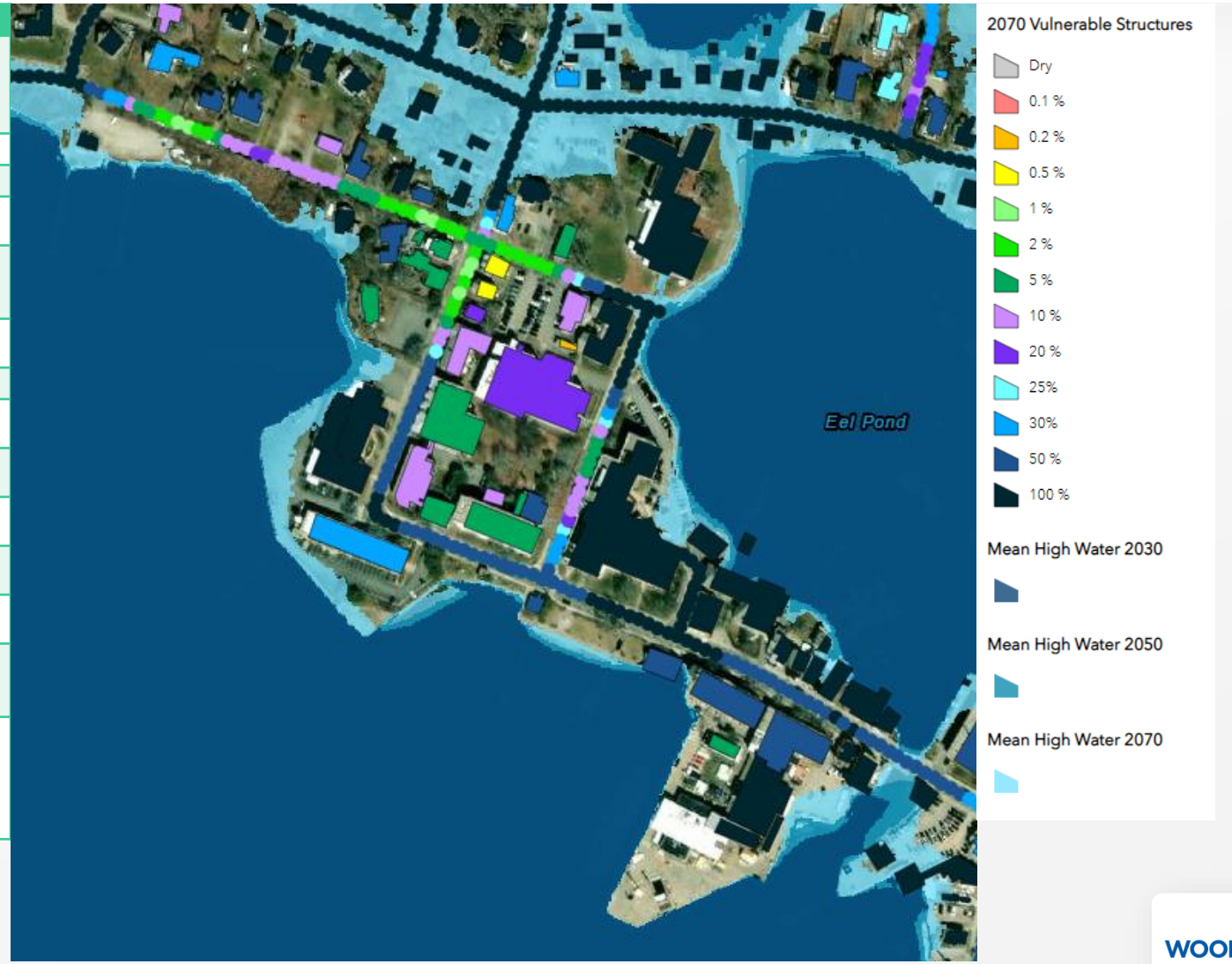
Potential Adaptation Action
Deployable flood protection strategies for low lying homes
Deployable flood barrier at bikepath under Crane St overpass
Wet floodproof low lying homes
Elevate low lying homes
Floodwall and deployable barriers - Little Harbor Rd and Hinckley Rd
Beach nourishment and dune enhancement - Hinckley Rd
Increase height of seawalls
Dry floodproof USCG buildings
Elevate USCG buildings
Elevate USCG bulkhead
Elevate Little Harbor Rd and Hinckley Rd
Reroute Little Harbor Rd and Hinckley Rd
Dry floodproof commercial buildings west of Luscombe Ave
Dry floodproof commercial buildings east of Luscombe Ave
Deployable barriers at Luscombe and Railroad Ave
Elevate commercial buildings west of Luscombe Ave
Elevate Steamship Authority bulkhead
Pull development from waterfront back to Luscombe Ave and created tiered resilient open space on water side
Elevate Luscombe Ave and Railroad Ave



WOODS HOLE GROUP
A CLS COMPANY

Adaptation Actions: Waterfront

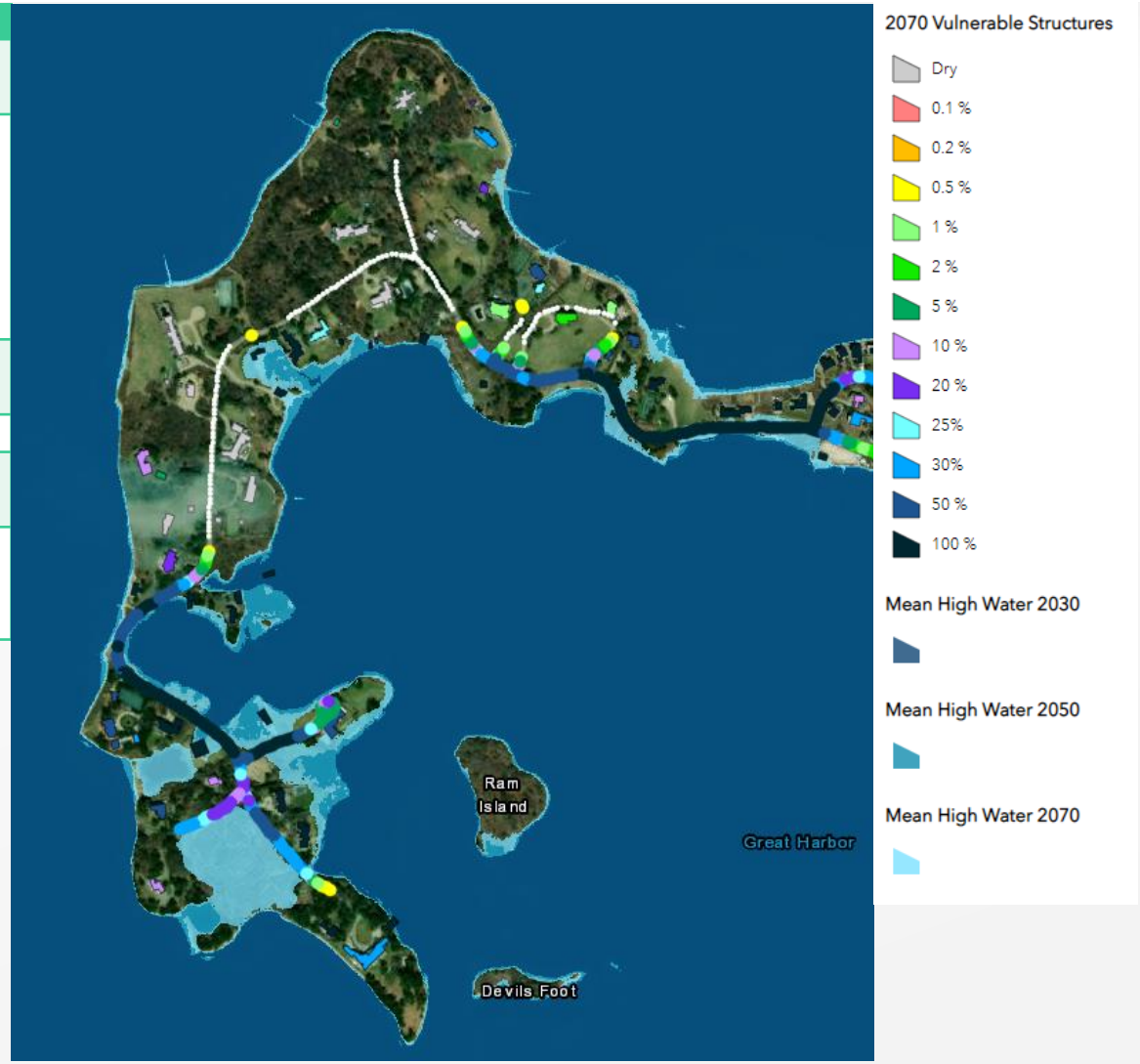
Potential Adaptation Action
Land/Streetscaping and deployables to reduce inundation on Water St and Albatross St
Elevated seawall
Dry floodproofing of facilities
Move facility mechanical equipment above first floor
Facility first floor reprogramming and retrofit to accommodate flooding
Integrate flood protection strategies for CWATER
Elevate NOAA bulkhead
Rebuild/elevate Waterfront Park with connection to NOAA
Living shoreline along Bar Neck Rd
Landscape terracing seaward of Bar Neck Rd
Elevate Water St and Albatross St
Dry floodproofing at Water St Sewer Lift Station
Move non-water dependent research/offices to upland facilities
Develop integrated elevated open space along Water St as non-resilient and non-water dependent facilities reach end of life



WOODS HOLE GROUP
A CLS COMPANY

Adaptation Actions: Penzance Point

Potential Adaptation Action
Deployable flood protection strategies for low lying homes
Beach nourishment and dune enhancement or living shoreline sideslope treatments for low lying segments of Bar Neck Rd and Penzance Rd
Wet floodproof low lying homes
Elevate low lying homes
Elevate low lying segments of Bar Neck Rd and Penzance Rd
Move low lying outbuildings away from tidal inundation zone



WOODS HOLE GROUP
A CLS COMPANY

Adaptation Actions: Spencer Baird

Potential Adaptation Action
Deployable flood protection strategies for low lying homes, identify location for communal storage
Beach nourishment and dune enhancement at Stoney Beach
Wet floodproof low lying homes
Elevate low lying homes
Elevate existing Buzzards Bay seawalls
Elevate low lying parcels and rebuild homes
Elevate Gosnold Rd, Spencer Baird Rd and Albatross St
Relocate low lying homes out of tidal inundation zone, repurpose land for flood storage and resilient open space

Adaptation Actions: Eel Pond

Potential Adaptation Action
Land/Streetscaping and deployables to reduce inundation on Water St and Albatross St
Increase height of existing Eel Pond bulkheads to address near-term pathways
Raise Millfield St
Deployable flood protection strategies for low lying Millfield St homes, identify location for communal storage
Wet floodproof low lying homes
Dry floodproofing of facilities and businesses
Move facility mechanical equipment above first floor
Elevate corner of MBL St and North St
Facility first floor reprogramming and retrofit to accommodate flooding
Elevate low lying homes
Tiered elevated pond edge treatment at MBL (Swope/Lillie) and Bell Tower Park
Elevate School St and increase culvert size, undevelop drive/parking east of Vincent House for marsh migration, move parking to Maury Ln
Move non-water dependent research/offices to upland facilities
Elevate low lying Millfield St parcels and rebuild homes
Elevate Water St and businesses
Construct flood control barrier at Eel Pond Channel
Relocate low lying Millfield Rd homes out of tidal inundation zone, repurpose land for flood storage and resilient open space

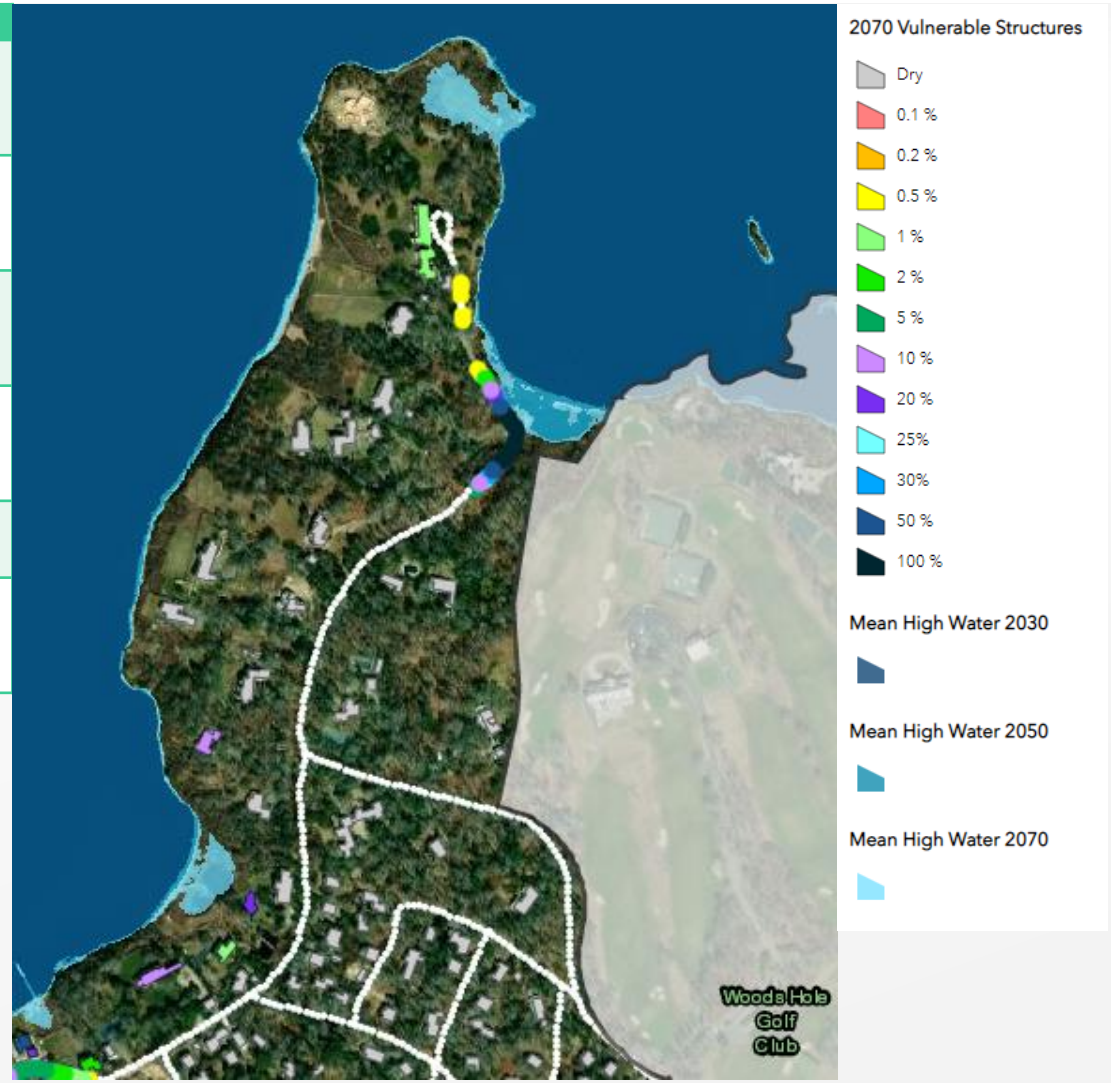
WOODS HOLE GROUP
A CLS COMPANY

Adaptation Actions: Mill Pond / Woods Hole Park

Potential Adaptation Action
Raise Millfield St and Gardiner Rd
Deployable flood protection strategies for low lying homes, identify location for communal storage
Wet floodproof low lying homes
Raise seawall at Gardiner Rd
Dry floodproof and/or elevate Park Rd Sewer Lift Station
Beach nourishment and dune construction modification to seawall at Gardiner Rd
Modify seawall at Gardiner Rd to enhance post-storm drainage
Landscape berm or elevated bulkheads system in backyards along Mill Pond and Woods Hole Park
Improve tidal connection between Eel Pond and Mill Pond for future salt marsh migration and drainage
Elevate low lying homes
Elevate low lying parcels and rebuild homes
Relocate low lying homes out of tidal inundation zone, abandon part/all of Gardiner/Millfield, repurpose land for flood storage and resilient open space
Transition Woods Hole Park to natural open space and resilient park
Relocate Park Rd Sewer Lift Station
Convert Park Rd Sewer service area to grinder pumps

Adaptation Actions: Gansett

Potential Adaptation Action
Raise seawall at lower Ganset Rd landing and tie back to high ground
Beach nourishment and dune enhancement at lower Gansett Rd landing
Raise parking lot and road at lower Ganset Rd landing and tie back to high ground
Deployable flood protection strategies for low lying homes on upper Gardiner Rd
Landscape berms for low lying homes on upper Gardiner Rd
Beach nourishment and dune enhancement along cove at upper Gardiner Rd



Next Steps for this project

Steering Committee Meeting #4

Wednesday 4/27 3:00-4:30 at AVAST

Review Phasing Plan

Public Forum #2

Thursday 5/19 5:00-7:00 (location?)

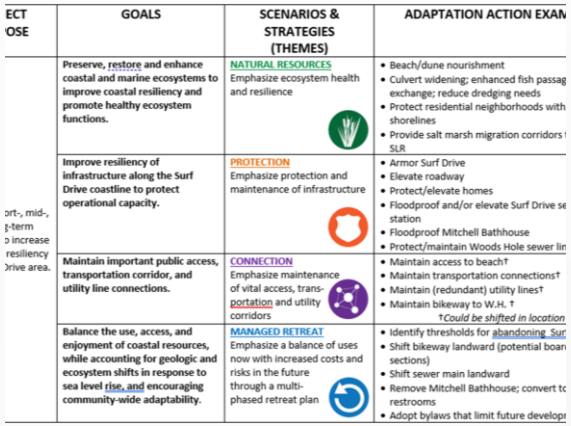
Share adaptation actions/phasing (pathways)

Gather public feedback for revision

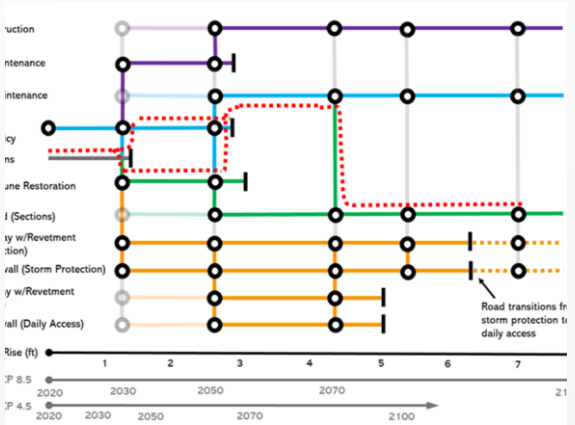
Final Report

Draft to Committee for review/comment

Due June 30



ECT OSE	GOALS	SCENARIOS & STRATEGIES (THEMES)	ADAPTATION ACTION EXAM
ort-, mid-, g-term increase resiliency Drive area.	**Preserve, restore and enhance coastal and marine ecosystems to improve coastal resiliency and promote healthy ecosystem functions.**	NATURAL RESOURCES Emphasize ecosystem health and resilience	• Beach/dune nourishment • Culvert widening; enhanced fish passag exchange; reduce dredging needs • Protect residential neighborhoods with shorelines • Provide salt marsh migration corridors SLR
	Improve resiliency of infrastructure along the Surf Drive coastline to protect operational capacity.	PROTECTION Emphasize protection and maintenance of infrastructure	• Armor Surf Drive • Elevate roadway • Protect/elevate homes • Floodproof and/or elevate Surf Drive se station • Floodproof Mitchell Bathhouse • Protect/maintain Woods Hole sewer lin
	Maintain important public access, transportation corridor, and utility line connections.	CONNECTION Emphasize maintenance of vital access, trans-portation and utility corridors	• Maintain access to beach† • Maintain transportation connections† • Maintain (redundant) utility lines† • Maintain bikeway to W.H. † †*Could be shifted in location*
	Balance the use, access, and enjoyment of coastal resources, while accounting for geologic and ecosystem shifts in response to sea level rise, and encouraging community-wide adaptability.	MANAGED RETREAT Emphasize a balance of uses now with increased costs and risks in the future through a multi-phased retreat plan	• Identify thresholds for abandoning Sur • Shift bikeway landward (potential boar sections) • Shift sewer main landward • Remove Mitchell Bathhouse; convert to restrooms • Adopt bylaws that limit future develop



WOODS HOLE GROUP
A CLS COMPANY

Next Steps for ResilientWoodsHole

CZM Coastal Resilience Grant

Demonstration projects?

Additional outreach/engagement?

ResilientWoodsHole initiative

Additional grant funding sources?

Existence beyond WHOI/MBL/NOAA?

WOODS HOLE GROUP
A CLS COMPANY

Credit: WHBA

Thank you

Joseph Famely

Climate & Sustainability Team Lead

Woods Hole Group

jfamely@woodsholegroup.com

508-495-6220

https://resilientwoodshole.org/

Next Public Workshop: 5/19/22