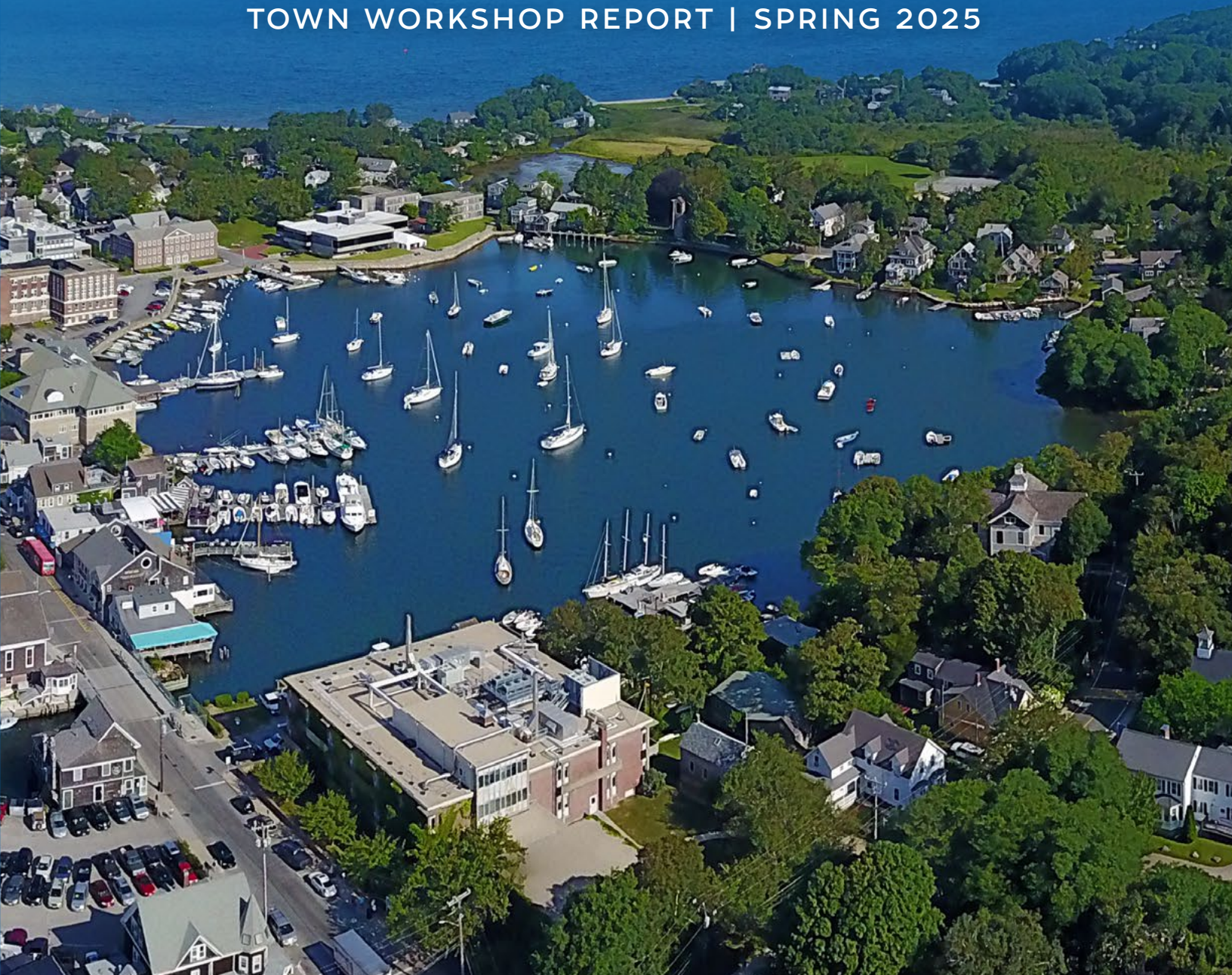


# RESILIENT WOODS HOLE

TOWN WORKSHOP REPORT | SPRING 2025





An aerial illustration of Woods Hole, Massachusetts. The scene shows a coastal town with a mix of residential houses and larger commercial buildings. A prominent harbor area contains several large ships, including a cargo ship and a fishing vessel, docked at piers. The surrounding water is a deep blue, with several sailboats visible in the distance. A small, tree-covered island is situated in the upper left, connected to the mainland by a narrow strip of land. The overall style is a detailed, hand-drawn map or illustration.

## MISSION:

*ResilientWoodsHole is a private-public initiative to ensure that the vibrant and productive village of Woods Hole prospers well into the future with the advent of major climate impacts.*

## EXECUTIVE SUMMARY:

Woods Hole Village is highly vulnerable to sea level rise and coastal storm flooding. While much work has been completed by the *ResilientWoodsHole* (RWH) initiative to identify areas vulnerable to climate impacts and develop adaptation solutions, the Town of Falmouth must take the lead in resolving these urgent town-managed infrastructure challenges.

The goal of the Climate Resilience Workshop was to start developing a conceptual infrastructure climate resilience plan for Woods Hole Village through engagement with and buy-in from the Town staff. The workshop focused on the climate vulnerabilities facing Woods Hole and discussed strategies to enhance the community's resilience to climate change. The workshop brought together Town of Falmouth staff, including boards, department leads, the Town Manager and Assistant Town Manager, Select Board members, as well as community members. This workshop examined Woods Hole's specific needs and participants set clear action items to address short and medium-term climate impacts.

Based on prior studies and community outreach led by the RWH initiative, two critical areas were identified for Town discussion: the Mill Pond/Eel Pond area and the Water Street area. These locations have been previously recognized as requiring urgent Town action due to flooding risks, infrastructure vulnerabilities, and their importance to the community. While these two areas were the primary focus, broader concerns across Woods Hole were also discussed. The following actions were identified for each area:

### Flood Management for Mill Pond/Eel Pond:

- Conduct a Feasibility Study for Mill Pond and Eel Pond,
- Replace the culverts between Mill Pond and Eel Pond,
- Addition of drainage under the Gardiner Road seawall

### Water St. Resilience:

- Flood proof sewer infrastructure
- Prioritize roads to raise to address flood risk
- Involve business community in resilience planning

## General Woods Hole:

- Develop a comprehensive emergency management plan
- Improve community communication of the updated emergency plan
- Establish a consistent and sustainable funding source for resilience projects

Throughout the workshop, the importance of community engagement was emphasized in establishing and ensuring ongoing communication channels with the community and decision-makers. It was also recognized that the success of any climate adaptation strategy depends on the collective effort of all stakeholders and a call for inclusive planning.

The workshop concluded with a commitment to move forward with select actions, emphasizing the need for continued collaboration between all stakeholders. Workshop participants also recognized the need to begin work immediately on these action areas. Moving forward, the focus will be on developing detailed action plans for each identified priority and securing necessary funding and resources. By taking concrete steps to address these vulnerabilities, Woods Hole can serve as a model for the broader Town of Falmouth and other coastal communities working to adapt to the challenges of climate change.

## INTRODUCTION AND CONTEXT

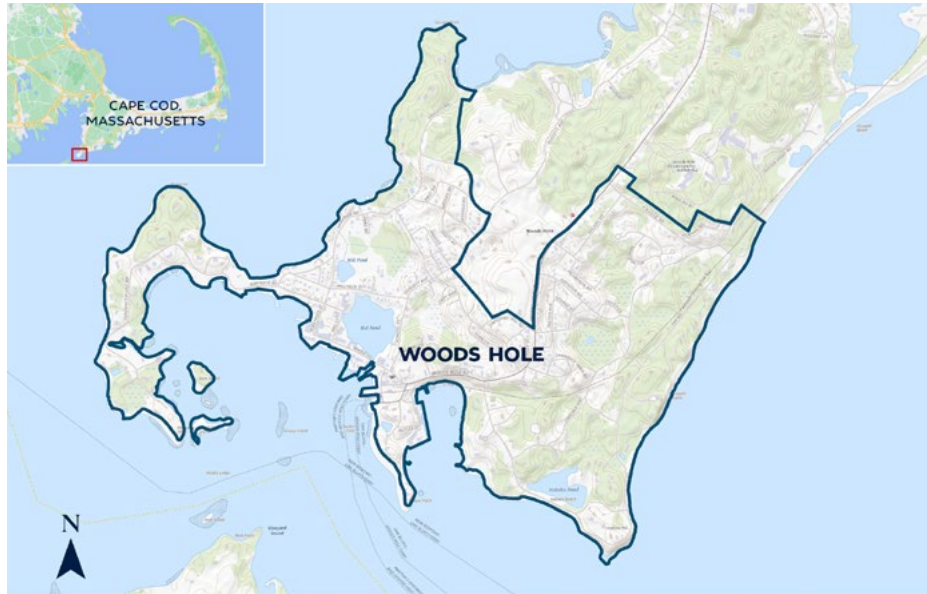
Leslie-Ann McGee, Program Director of the *RWH* initiative, started the workshop by providing context for the initiative. Woods Hole Village is located within the Town of Falmouth. Falmouth is characterized by nearly 70 miles of coastline, featuring beaches, wetlands, bluffs, salt marsh estuaries, and 14 distinct coastal ponds<sup>1</sup>. The Town has already taken steps to identify vulnerable areas at risk to sea level rise and coastal storm flooding for 2030, 2050, and 2070 with the *Falmouth Climate Change Vulnerability Assessment and Adaptation Planning Report (2020)*.

That report identified a significant portion of Falmouth's most vulnerable areas concentrated in Woods Hole Village, where the Park Road Lift Station, Woods Hole Park, Woods Hole Drawbridge, and Water Street are particularly at risk.

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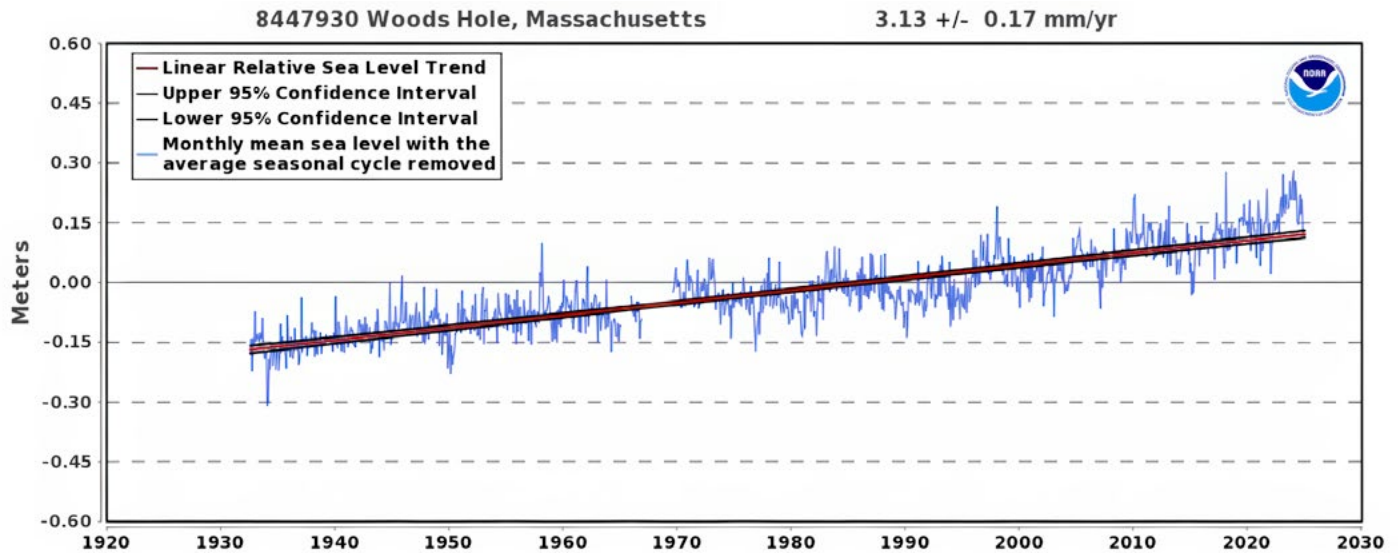
<sup>1</sup> Falmouth Climate Change Vulnerability Assessment and Adaptation Planning Final Report 2020





**Woods Hole Map:** *RWH* focuses its climate resilience work within the boundaries of Woods Hole, MA study area

Woods Hole stands out as a unique village within the Town of Falmouth, functioning as its economic and scientific core. With more than 1,700 employees across Woods Hole Oceanographic Institution (WHOI), National Oceanic and Atmospheric Administration (NOAA) Fisheries, and the Marine Biological Laboratory (MBL), these institutions have a combined annual budget exceeding \$385 million and conduct \$250 million in research annually (based on 2022 data). In addition, WHOI alone has spun off more than 20 businesses employing hundreds of employees in the region. Woods Hole also serves as a critical transportation hub with the Steamship Authority ferry providing access to Martha's Vineyard and in the process contributing \$137.1 million in revenue (based on 2023 data). Beyond its scientific significance, Woods Hole is a renowned tourist destination, offering a rich history, vibrant community, and small-town charm.



**Sea Level Line Graph:** Sea level rise data from Woods Hole NOAA tidal gauge

Since 1932, Woods Hole has experienced over one foot of sea level rise, a trend that is expected to accelerate (MA EOEEA, NOAA Tide Gauge), meaning that even smaller storms will be able to inflict more damage to the community. But storms are not getting smaller; they are becoming stronger, less predictable, and more frequent.

The local population, which includes individuals who both live and work in Woods Hole, is deeply committed to the village's future. In a survey, the community clearly voiced a desire to take action (taking no action was the least supported outcome). The community has also been clear about its climate resilience desires: addressing the major flood pathway in the village, strengthening critical infrastructure, developing emergency plans, engaging the community in the decision-making process, and providing accessible information for resilience planning and funding.

Given the clear vulnerability of Woods Hole, resilience planning is essential to safeguard its character, scientific institutions, key infrastructure and natural habitats. In response, the *ResilientWoodsHole* initiative was launched in 2019, spearheaded by WHOI, NOAA Fisheries, and MBL, to address coastal impacts

and vulnerabilities. Since its inception, *RWH* has expanded to include additional stakeholders, with the goal of implementing tangible, actionable solutions for the future of Woods Hole.

## WOODS HOLE'S CLIMATE VULNERABILITY AND ADAPTATION

Paul Speer, retired Chief Operating Officer of the MBL and a member of the *RWH* Leadership Team, presented an overview of the *RWH* initiative to workshop participants. The overview discussed Woods Hole's climate vulnerabilities, solutions for dealing with those vulnerabilities, and *RWH*'s efforts in outreach and engagement.

Grounded in the Massachusetts Coastal Flood Risk Model (MC-FRM), *RWH*'s assessments indicated that in the short term (2030), 4 miles of road and more than 27% of buildings and other assets in Woods Hole are vulnerable to sea level rise and coastal storm flooding. In the long term (2070), much of the village will be significantly impacted by sea level rise and coastal storm flooding. Using the MC-FRM model results, *RWH* also conducted a flood pathway assessment, which looked at primary, secondary, and tertiary routes of flood water movement during a strong storm. Through this work, *RWH* identified the Mill Pond/Eel Pond system as a primary flood pathway through the Village.

Following these assessments, *RWH* identified solutions for the Village, divided by each neighborhood (see Appendix). Through consultations with the community, four key adaptation solution themes were identified: (1) Adaptation strategies that maintain character of the Woods Hole community, (2) Strategies that focus on nature-based solutions, (3) Strategies that emphasize protection, (4) Strategies that involve “living with water.” Tailored solutions based on these themes were developed for each neighborhood. To make these solutions actionable for decision-makers, *RWH* created dynamic adaptation pathways, which outlined the proposed solutions for each neighborhood and tested their effectiveness under different future storm scenarios for the years 2030, 2050, and 2070.



### MAINTAIN CHARACTER

Solutions to preserve existing uses and maintain the historic character of Woods Hole. *Examples of these solutions are using flood barriers that can be deployed before a storm, and flood proofing buildings and utilities.*



### NATURE-BASED SOLUTIONS

Solutions that use natural features and processes to help promote climate resilience. *Examples include beach and dune restoration, restoring marshes, and creating living shorelines using plants and oyster beds.*



### PROTECT AND CONNECT

Solutions that provide physical protection and connection of infrastructure. *Examples of these solutions are seawalls and raising roads and buildings, and moving building systems like utilities to higher floors.*



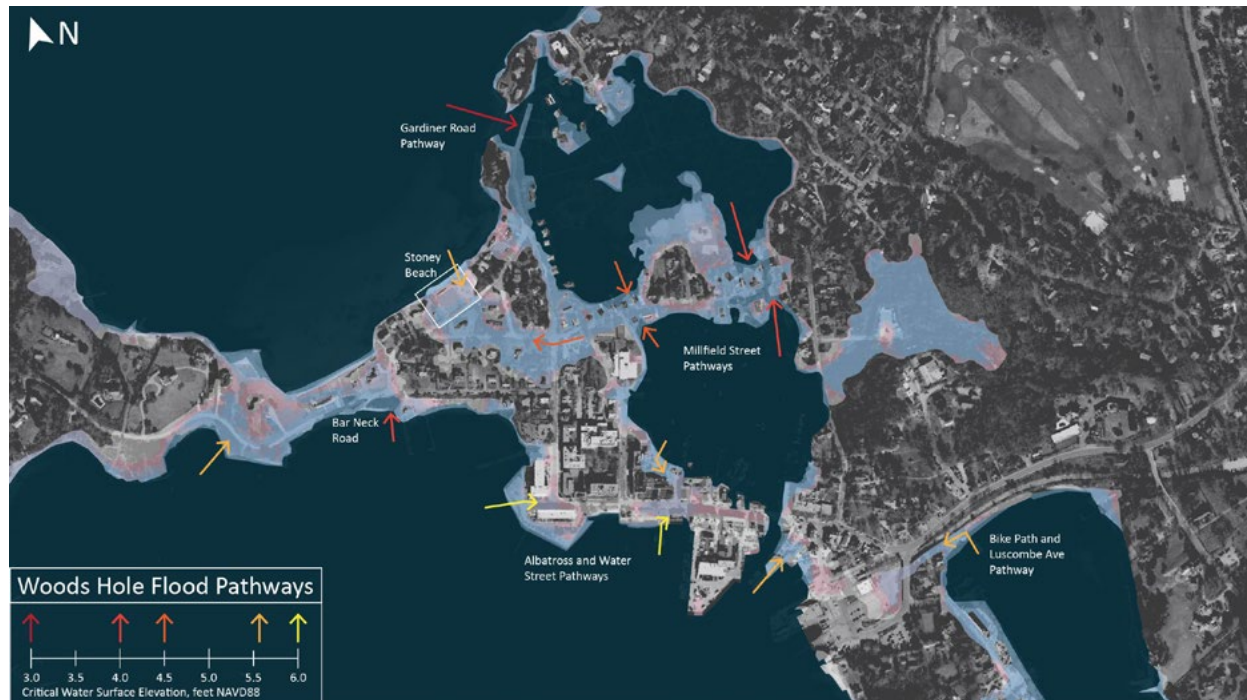
### LIVING WITH WATER

Solutions that reimagine Woods Hole Village through the lens of living with water. *Examples of these solutions include relocating buildings to higher elevations, or buying land from property owners that flood regularly.*

Over the course of its work, RWH has identified areas of high vulnerability requiring immediate action, namely Mill Pond/Eel Pond and the Waterfront.

**Mill Pond/Eel Pond** is the primary flood pathway in Woods Hole. This area is vulnerable due to several factors, including a seawall just northwest of Woods Hole Park and the condition of the culverts connecting Mill Pond and Eel Pond. This area is primarily residential but also includes Town and institutional infrastructure, such as the Park St sewer pump station located in Woods Hole Park, much of MBL's buildings, parking lots, and docks, as well as WHOI's parking lot.





**Mapping flood pathways:** Flood pathway analysis shows primary, secondary, and tertiary flood pathways in the Village

The **Waterfront** is another critical area. While it does not serve as a direct flood pathway, it is the location of community, businesses, and institutional assets. The area is densely built and vulnerable to flooding during major storms, making it crucial for resilience planning.

While Mill Pond/Eel Pond and Water Street are primary areas of concern, other parts of Woods Hole also remain vulnerable and will require resilient actions. To turn these actions into reality, town staff and *ResilientWoodsHole* must collaborate proactively to mitigate potential risks.

## COMMUNITY VISION

Irina Polunina-Proulx, *ResilientWoodsHole's* Project Coordinator, presented *RWH's* community outreach activities to the workshop participants and facilitated a discussion of community vision and needs. *RWH's* outreach activities to date have focused on engaging the local community through presentations on climate projections and vulnerability assessments, and on soliciting feedback on preferred resilient solutions.

Across all outreach activities, community members expressed similar needs.

- Address the major flood pathways in Woods Hole, especially the Mill Pond/Eel Pond system and Woods Hole Park,
- Strengthen critical infrastructure resilience (utilities, roads, bridges, sewer systems) and develop emergency preparedness plans,
- Involve the community in decision-making processes to shape a clear, long-term resilience strategy, and
- Provide accessible information for homeowners on adaptation options, address regulatory barriers to resilience actions, and identify funding sources to support these projects.

As a result of the outreach efforts, the vision expressed by the community is clear:

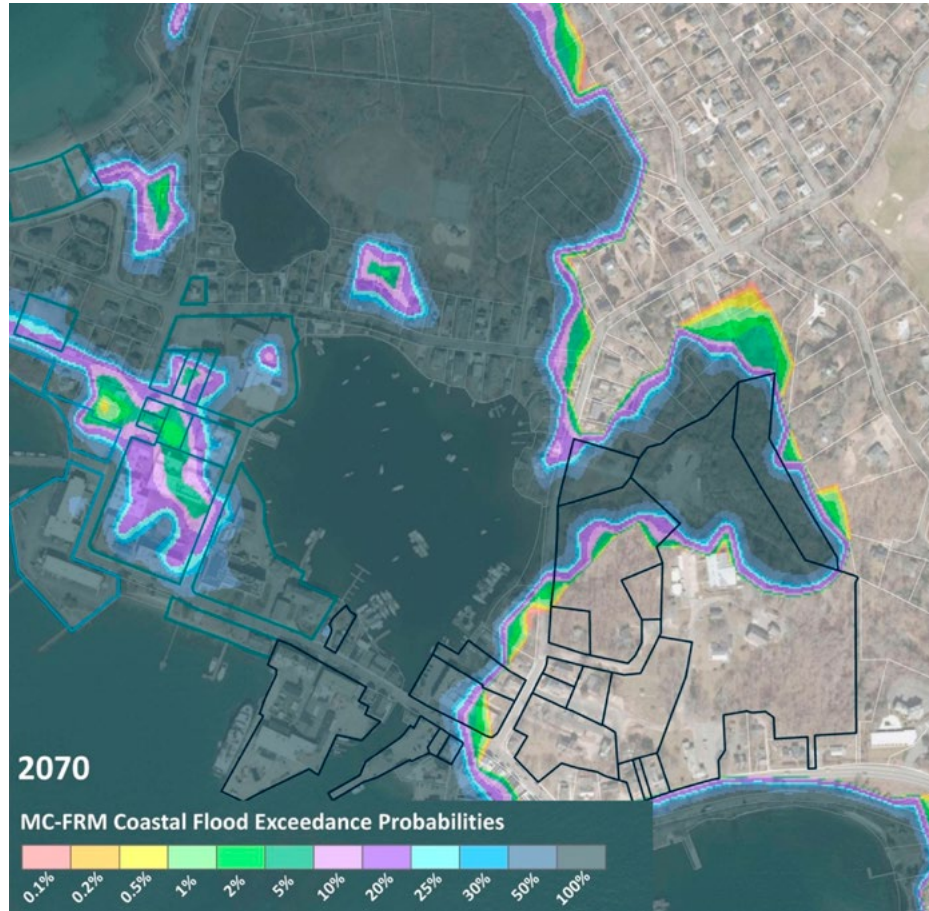
*“The Woods Hole community envisions a resilient future in which climate vulnerabilities are addressed through immediate and long-term solutions, while collaboratively engaging current and future generations in climate action planning.”*

## PRIORITY ACTIONS AND STRATEGIES

Given this background on *ResilientWoodsHole's* vulnerability assessments, adaptation strategies, and community outreach, participants were asked to identify the top 3-4 priority actions for each area, Mill Pond/Eel Pond, Water St, and Woods Hole in general, and develop action plans using Priority Action Planning cards that were developed for the workshop. These cards guided participants to outline specific details for each action (see Appendix).

At the end of the activity, a discussion was held to review and prioritize these actions for each area within the broader context of Woods Hole adaptation planning. The resulting priority actions for each area, as determined by the group, are presented below.

### Mill Pond/Eel Pond:



**Mill Pond/Eel Pond Map:** Probability of flooding from 1% storm in 2070 for the Mill Pond/Eel Pond Area.



The Mill Pond/Eel Pond neighborhood is highly vulnerable and serves as the primary flood pathway in Woods Hole. Our assessments indicate that by 2030, sea level rise and a 1% storm (“one in a hundred year”) will significantly impact residential, institutional, and town assets. These include Mill Pond itself, Woods Hole Park, WHOI parking, Stoney Beach, the Park Street Sewer Pump Station, Gardiner Road, Millfield Street, Spencer Baird, parts of Gosnold Road, and homes in the Mill Pond/Woods Hole Park, Spencer Baird, and Eel Pond neighborhoods.

By 2050 sea level rise and a 1% storm will expand flooding into all of these neighborhoods, exacerbating the impacts on residential, institutional, and town assets. This will also begin affecting MBL property along Eel Pond. By 2070, the combined effects of sea level rise and a 1% storm will severely impact nearly all residential homes in the three neighborhoods, as well as MBL and WHOI assets along Eel Pond. Access to key roads, including School Street, will also be reduced.

Workshop Participants identified several short-term actions for the Mill Pond/Eel Pond area:

1. Conduct a Feasibility Study for the Mill Pond/Eel Pond area to identify its vulnerability to flooding, possible solutions, costs, and other details.
2. Reduction of flood vulnerability through culvert replacements between Mill Pond and Eel Pond
3. Reduction of flood vulnerability through addition of drainage to the Gardiner Rd. seawall

#### **1. CONDUCT A FEASIBILITY STUDY FOR THE MILL POND/EEL POND AREA TO IDENTIFY VULNERABILITY, POSSIBLE SOLUTIONS, COSTS, AND OTHER DETAILS.**

*RWH* has conducted extensive analysis to assess flood risk, the vulnerability of buildings, roads, and lifelines, and to determine potential resilience solutions for the Mill Pond/Eel Pond area. We have also worked closely with the local community to help them understand the risks to their homes and have presented a variety of adaptation solutions through different outreach activities, such as the Interactive Maps, stakeholder surveys, and, more recently, the Neighborhood Working Groups. Additionally, we have connected community members with the Barnstable County Floodplain Coordinator, Shannon Hulst, who serves on

our Steering Committee. Shannon has met with residents one-on-one, as well as during the broader Neighborhood Working Group meeting.

In addition to *RWH*'s work, community members contributed to conceptual planning for the Gardiner Road seawall in 2008, including determining considerations for its restoration, improving drainage beneath the seawall, and adding a culvert under Gardiner Road. In addition, a hydrological assessment of the Mill Pond/Eel Pond drainage was completed. This work provides a good framework of what needs to be done to make this flood pathway more resilient.

*RWH* is currently preparing a Feasibility Study for the Mill Pond/Eel Pond area, which will incorporate all climate projections, vulnerability assessments, community engagement efforts, regulatory reviews, community contributions, and our recommendations for the area. This Feasibility Study will include the entire flood pathway starting from the Gardiner Rd seawall to the Eel Pond/Mill Pond connection. The completed study will be available on the *RWH* website under the Reports section.

## **2. REDUCTION OF FLOOD VULNERABILITY THROUGH CULVERT REPLACEMENTS BETWEEN MILL POND AND EEL POND**

The area between Mill Pond and Eel Pond is highly susceptible to flooding, especially during coastal storms. This flooding can damage local infrastructure, homes, and the surrounding pond and wetland ecosystems. One contributing factor may be the inefficient culverts that connect Mill Pond and Eel Pond, which fail to effectively drain water after storms. Two culverts under Millfield Street link Mill Pond and Eel Pond: one is small and aging, while the other has collapsed entirely.

Workshop participants identified a proposed action aimed at reducing flooding risk and improving the stormwater flushing rate by replacing these aging culverts and upgrading the stormwater management infrastructure between Mill Pond and Eel Pond. This action will not only reduce flood risk but also enhance ecological function by improving water flow, which could help mitigate invasive species. The proposed action involves several key components:

- Replace current culverts with new, larger culverts
- Upgrade stormwater management to improve drainage infrastructure
- Evaluate floodplain dynamics to ensure the project does not worsen flooding or disrupt existing floodplain functions.

While restoring the connection between Mill Pond and Eel Pond won't fully resolve flooding in the area, it will serve as a critical first step toward building resilience in this vulnerable neighborhood.

Additional aspects for this proposed action were discussed and are shown below:

FIELD	RESPONSES
Responsible Parties	<i>ResilientWoodsHole</i> , the Town of Falmouth Public Works Department, the Woods Hole Community Association, the Woods Hole Group, the Falmouth Conservation Commission, and local contractors.
Resources Needed	<b>Budget</b> - Over \$1 million, based on similar projects in Massachusetts - Spencer and Ashfield. <b>Permits</b> - This project will require numerous permits, such as approval from the Falmouth Conservation Commission and MassDEP.
Timeline	<i>RWH</i> 's assessments show that the Mill Pond/Eel Pond system is already vulnerable to coastal storms and will face heightened vulnerability by 2030. Therefore, the project should be prioritized in the near term, starting with identifying funding sources and applying to relevant agencies.
Community Engagement	<ul style="list-style-type: none"><li>• Continue the Neighborhood Working Groups as a stakeholder focus group</li><li>• Host public meetings and informational sessions</li><li>• Conduct surveys for feedback on designs and concerns</li><li>• Utilize social media and the <i>RWH</i> website for updates</li><li>• Collaborate with Woods Hole Community Association</li></ul>
Additional Considerations	<ul style="list-style-type: none"><li>• Potential environmental impact of increasing the flow between the ponds.</li><li>• Increased water flow could affect homes near Gardiner Road, which are in close proximity to Mill Pond.</li><li>• Regulatory hurdles may arise, particularly in obtaining environmental and construction permits.</li><li>• Culverts must be designed with future climate impacts in mind, including the potential for major flood events and sea level rise.</li></ul>

3. REDUCTION OF FLOOD VULNERABILITY THROUGH ADDITION OF DRAINAGE TO GARDINER RD. SEAWALL

Located northwest of Woods Hole Park and Mill Pond, the Gardiner Road seawall is a critical feature in protecting the homes and roads in the area from wave action. However, during storms, water often overtops the seawall and cannot drain effectively back into the ocean, flooding both the park and Mill Pond. This is due to the park's low elevation compared to the surrounding area, which causes water to pool within the park. Originally constructed in 1941, the seawall has been rebuilt several times after storm damage. Previous assessments during its reconstruction recommended improvements to enhance protection and reduce flooding, but these recommendations were not implemented.



Past work emphasized adding in drainage under the seawall for effectively managing the water that overtops the seawall during storms and subsequently floods homes and roads in the neighborhood. The proposed action involves adding a drainage system to the Gardiner Road seawall to redirect stormwater away from the road and improve overall stormwater management. The new drainage will be designed to handle larger volumes of water and be more resistant to clogging or damage during extreme weather events. The proposed action involves several key components:

- Addition of drainage to Gardiner Rd seawall to direct water away from road and back out into the ocean
- Addition of stormwater management system

While installing drainage in the Gardiner Road seawall will not completely resolve flooding in the area, it will provide significant benefits by improving stormwater drainage after large storms.

Additional aspects for this proposed action were discussed and are shown below:

FIELD	RESPONSES
<b>Responsible Parties</b>	Private residents who own the seawall, <i>ResilientWoodsHole</i> , the Town of Falmouth Public Works Department, the Woods Hole Community Association, the Woods Hole Group, the Falmouth Conservation Commission, and local contractors.
<b>Resources Needed</b>	<p><b>Budget</b> - ~\$1 million, based on earlier assessments conducted in 2008, though the budget is likely considerably higher in today's terms.</p> <p><b>Permits</b> - This project will require stormwater management and environmental permits, as it relates to the coastal habitats and local wetlands.</p>
<b>Timeline</b>	Climate projections show that the Mill Pond/Eel Pond system is already vulnerable to strong coastal storms and will become highly vulnerable by 2030. The seawall is a primary flood pathway for the village, making this proposed action urgent. Given future projections, it is critical to begin identifying funding sources and applying for financial support for the project now. Engaging with community members, especially those who own the seawall, is essential to move this project forward.
<b>Community Engagement</b>	<ul style="list-style-type: none"> <li>• Meetings with private owners of seawall</li> <li>• Reinstate the Neighborhood Working Groups</li> <li>• Host public meetings and informational sessions</li> <li>• Conduct surveys for feedback</li> <li>• Utilize social media and the <i>RWH</i> website for updates</li> <li>• Collaborate with Woods Hole Community Association</li> </ul>
<b>Additional Considerations</b>	<ul style="list-style-type: none"> <li>• Assess the potential unintended environmental impact of increasing the flow between the overtopped seawater and Mill Pond</li> <li>• Challenges with securing funding for the project since seawall is privately owned, but this project will benefit all homeowners in the area</li> </ul>

## Waterfront

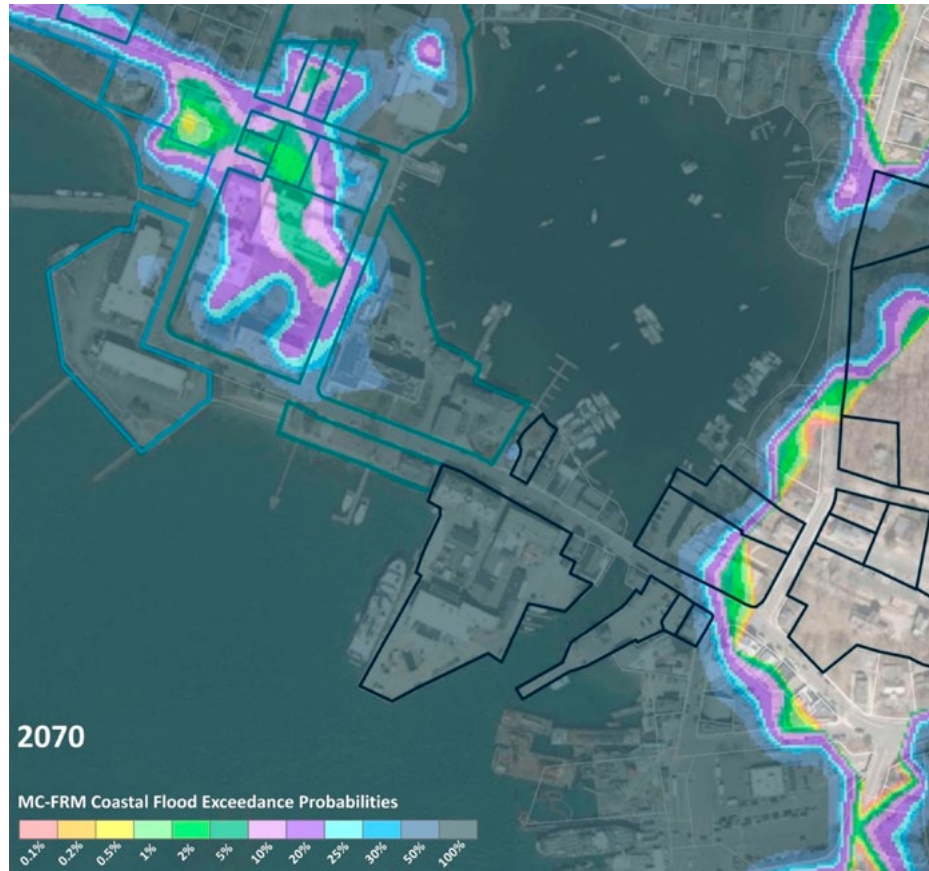
The Waterfront area, which includes Water Street, is home to numerous businesses, institutions, and town assets. Our assessments indicate that by 2030, sea level rise combined with a 1% storm event will cause some flooding affecting institutional, town, and business properties. This includes Community Hall, former fire station, and several restaurants, with only minor impacts on Waterfront Park and the Woods Hole sewer lift station. By 2050, sea level rise and a 1% storm will expand flooding risks to include WHOI, MBL, and NOAA Fisheries, as well as Water Street itself. In 2070, sea level rise and a 1% storm will significantly impact the entire Waterfront area, threatening key infrastructure and disrupting the normal operations of scientific institutions, businesses, and town services.

*RWH* has developed an extensive list of potential adaptation solutions for the Waterfront area, categorized by each of the adaptation themes outlined above and in the Appendix. Throughout our work, *RWH* engaged local community members and institutions in the development of these adaptation solutions. While many stakeholders, including WHOI and MBL, are taking independent actions on their properties, there has been a shared call for elevating Water Street and addressing the drawbridge as part of resilience efforts.

During the workshop, participants reviewed *RWH*'s materials for Water Street, proposed adaptation actions for the short-term, medium-term, and long-term, and prioritized the top 3-4 actions for further detailed planning.

Workshop participants identified several short-term actions for the Waterfront area, and one general action to accompany the Waterfront discussion:

1. Flood proofing sewer pump station and develop emergency plans for sewer infrastructure.
2. Prioritizing specific roads to raise
3. Engaging the local business community in resilience planning



**Waterfront Map:** Probability of flooding from 1% storm in 2070 for the Waterfront Area.

### 1. FLOOD PROOF SEWER PUMP STATION AND DEVELOP EMERGENCY PLANS FOR SEWER INFRASTRUCTURE.

Workshop participants identified the sewer infrastructure in Woods Hole Village as highly vulnerable to flooding, with potentially devastating consequences if the systems were damaged during storm events. There are two main sewer lift stations in the Village: one on Water Street (Woods Hole Lift Station), which serves local institutions, businesses, and residents, and another in Woods Hole Park (Park Road Lift Station), which serves 23 private homes.



The Woods Hole Lift Station was identified as a priority by workshop participants due to the number and diversity of entities (businesses, organizations, and residents) that it supports, with the goal of flood proofing the pump station to ensure it remains operational during flooding events. Additionally, there was a call for collaboration with local emergency management agencies to develop a coordinated plan for addressing potential sewer infrastructure failures or reduced operations during storm events. Previous studies conducted by the Town of Falmouth have highlighted the vulnerability of the sewer pump stations in Woods Hole and proposed resilient solutions, such as elevating electrical components and re-routing pipes from vulnerable roads. To move forward with this action, the following steps are necessary:

- Develop and implement floodproofing strategies on the sewer pump stations using strategies identified by earlier sewer infrastructure assessments that accommodate future climate projections
- Develop an emergency response plan to address potential sewer system failures due to flooding

Workshop participants agreed that flood proofing the Woods Hole Lift Station must be done in the near-term to avoid catastrophic consequences.

Additional aspects are discussed in the table below:

FIELD	RESPONSES
Responsible Parties	Town of Falmouth Wastewater Division, Falmouth Emergency Management Services, <i>ResilientWoodsHole</i> , consultants, local contractors, and residents who rely on the lift stations
Resources Needed	<b>Budget</b> - Workshop participants identified that securing funding and effective project management are critical resources for success. Workshop participants have stated that flood proofing the Woods Hole Lift Station will take ~\$200,000-\$300,000.
Timeline	Strong storms could force the lift stations offline, affecting residents, businesses, and institutions in Woods Hole. Therefore, designing and implementing floodproofing strategies, along with a sewer emergency management plan, must be prioritized in the near-term.
Community Engagement	<ul style="list-style-type: none"><li>• Public meetings, informational sessions, pamphlets, and mailings can help keep residents informed on sewer management plan</li><li>• Regular updates on the project and emergency plans can also be shared through social media and the Town of Falmouth website to ensure broad communication.</li></ul>
Additional Considerations	<ul style="list-style-type: none"><li>• Funding - previous assessments by the Town of Falmouth suggest multiple resilient solutions for the lift station, but the cost varies.</li></ul>

## 2. PRIORITIZING ROADS TO RAISE

During the workshop, raising vulnerable roads and improving their resilience emerged as a key action. The first step is to identify which roads are most critical for the community, emergency services, and the Town. Participants noted that the Town has already prioritized roads for snow removal after winter storms. Water Street was highlighted as a major concern in both *RWH's* work and Falmouth's vulnerability assessments. It is a vital access route to Woods Hole, serving residents, businesses, institutions, town infrastructure, and tourists. Although Water Street is not currently impacted by sea level rise, it has flooded during storms and is expected to become increasingly vulnerable over the next 50 years. Given these factors, planning to elevate Water Street should begin in the near-term.

The goal of the proposed solution is to reduce flood risk and improve the resilience of Water Street by raising its elevation in response to projected coastal storm flooding and sea level rise. Participants also stressed the importance of identifying other roads in the area for elevation and improved drainage. Key actions include:

- Conduct hydrological and flood risk assessments for Water Street at different elevations
- Upgrade drainage systems—gutters, culverts, and stormwater infrastructure—to match the new road height
- Elevate utilities (e.g., electrical poles, streetlights, water lines) to align with the raised roads
- Raise Water Street using fill to exceed projected flood levels
- Install or plan flood barriers and other protections along key road segments
- Prioritize additional roads in the area for elevation

Additional aspects for this proposed action are discussed in the table below:

FIELD	RESPONSES
<b>Responsible Parties</b>	<i>ResilientWoodsHole</i> , the Town of Falmouth Public Works Department, the Woods Hole Group, the Conservation Commission, local contractors, the Woods Hole Community Association, and MassDOT. It is noted that the Town of Nantucket is currently undertaking similar challenges and may be a good partner for collaboration and lessons learned.
<b>Resources Needed</b>	Successful completion of this project will require collaboration among all parties to obtain necessary permits, including environmental, stormwater management, and construction permits.
<b>Timeline</b>	Climate projections indicate that Water Street is already vulnerable to coastal storm flooding and will become even more susceptible by 2030. Water Street serves as the heart of Woods Hole, intersecting local businesses, the three major scientific institutions, and essential town infrastructure. It is also a key hub for community members and tourists. Given these factors, the proposed elevation of Water Street should be prioritized in the short term to prevent further disruption and enhance resilience.
<b>Community Engagement</b>	<ul style="list-style-type: none"> <li>• Public informational sessions and meetings</li> <li>• Active collaboration with institutions, businesses, and residents, including the Woods Hole Community Association.</li> </ul>
<b>Additional Considerations</b>	<ul style="list-style-type: none"> <li>• Elevating Water Street will require collaboration among all stakeholders, as road closures will occur during the project.</li> <li>• Utility adjustments must also be carefully managed to avoid disrupting essential services and business operations during construction.</li> <li>• Potential environmental impacts of the roadwork, particularly on surrounding habitats like Eel Pond, must be assessed to ensure that both the construction and stormwater management are handled properly.</li> </ul>

### 3. ENGAGE THE LOCAL BUSINESS COMMUNITY IN RESILIENCE PLANNING AND ACTION

Businesses on the Woods Hole Waterfront are already experiencing the impacts of coastal storm flooding, as many are located directly on the water. Some businesses have implemented adaptive measures to reduce their vulnerability, which are critical to maintaining business operations on the Waterfront, while others have not acted. It is crucial that businesses are involved in the climate adaptation process to ensure a viable business district for as long as possible. This proposed action will serve as a foundational step in building resilience within the local business community.

Workshop participants identified an approach to engage local businesses in resilience planning. The goal is to help businesses better adapt to sea-level rise, storm flooding, and other climate impacts. Key components of this proposed action include:

- Work with businesses to conduct vulnerability assessments and develop resilience plans.
- Develop a resilience toolkit to provide businesses with resources to improve infrastructure, operations, and emergency preparedness
- Establish financial programs such as grants or loans, to incentivize climate resiliency
- Establish a business resiliency network for local businesses to collaborate, share experiences, and exchange best practices for climate adaptation, through workshops and meetings.

Additional aspects for this proposed action are discussed in the table below:

FIELD	RESPONSES
Responsible Parties	Woods Hole Business Association, <i>ResilientWoodsHole</i> , consultants, and Town staff. Local business owners will play an active role in the assessments and the implementation of resilience measures.
Community Engagement	<ul style="list-style-type: none"><li>• Workshops, surveys, and active participation in the business resilience network</li></ul>
Additional Considerations	<ul style="list-style-type: none"><li>• Long-term sustainability of these efforts will include identifying ongoing sources of funding for resilience measures.</li></ul>

Woods Hole

As previously discussed, Woods Hole has several vulnerable areas, with Mill Pond/Eel Pond and the Waterfront being particularly critical. However, other neighborhoods in the village are also at risk, including Penzance Point, Spencer Baird, Millfield/Gardiner Rd, and Nobska Point. Each of these neighborhoods will face different vulnerabilities over time, and the proposed adaptation solutions vary based on the specific needs of each area.

Through our work, *RWH* engaged community members to gather their input on climate adaptation planning and to identify prioritized solutions for their neighborhoods. For this workshop, the focus was on the general concerns for Woods Hole outside of the Mill Pond/Eel Pond and Waterfront priority areas.



Workshop participants identified several key actions for Woods Hole, including:

1. Developing an integrated emergency management plan for pre-planning and post-recovery.
2. Improving community communication and preparedness for climate impacts.
3. Establishing funding sources for resilience projects.

#### **1. DEVELOP AN INTEGRATED EMERGENCY MANAGEMENT PLAN FOR PRE-PLANNING AND POST-RECOVERY.**

Historically, Woods Hole has been impacted by strong hurricanes and nor'easters, including Hurricane Bob, Hurricane Gloria, and most recently, a severe storm in December 2023 with flooding at various scales. Following these storms, recovery typically took days to weeks as the water receded and damage was assessed. Community members have said that emergency management, particularly communications, needs improvement, a sentiment shared by local institutions, businesses, and other stakeholders in Woods Hole.

Workshop participants identified the need to develop a comprehensive, integrated emergency management plan for Woods Hole. This plan would address both planning for emergencies and post-recovery efforts. It would aim to enhance the community's preparedness for climate-related risks, particularly coastal storm flooding, improve coordination during response efforts, and help ensure swift recovery after storms.

While Falmouth has developed emergency management infrastructure, this proposed action seeks to review these resources from the perspective of the Woods Hole community and develop a single comprehensive plan for the village. The action would include several key components:

- Collection and integration of existing resources, including risk assessments conducted by *RWH* on the village, pre-planning documentation such as evacuation routes, and existing emergency response and post-recovery plans for the Town of Falmouth
- Evaluation and suggestions for improvement of existing resources based on community need
- Development of any additional pre-planning strategies, emergency response protocols, or post recovery planning, as needed by community

- Actively involve community in the plan development process to ensure inclusivity and buy-in
- Train and coordinate with emergency services to ensure the plan's effectiveness and clear communication among all stakeholders

Additional aspects for this proposed action were discussed and included in the table below:

FIELD	RESPONSES
<b>Responsible Parties</b>	Town of Falmouth Public Safety Department, <i>ResilientWoodsHole</i> , first responders, local agencies and community members. It is essential for local first responders and Town departments to contribute to the development of the plan by providing insights into emergency response procedures, resources, and capabilities, as well as public health protocols, sheltering plans, and post-disaster recovery strategies.
<b>Resources Needed</b>	Additional resources required include a budget for project management, personnel time, and training for effective plan development.
<b>Timeline</b>	The timeline for this action should reflect the unpredictable nature of coastal storms, which can affect the village at any time. Therefore, it is crucial to start developing this comprehensive emergency management plan immediately to avoid being unprepared for future storms.
<b>Community Engagement</b>	<ul style="list-style-type: none"> <li>• Public meetings, workshops, and surveys will be used to gather input on the initial emergency management plan.</li> <li>• The Woods Hole Community Association will collaborate with <i>RWH</i> to facilitate outreach, ensuring that the community's needs and priorities are incorporated.</li> <li>• Local businesses will be involved to ensure the continuity of operations during recovery, and institutions and other organizations will contribute to the planning process.</li> <li>• Once feedback is integrated into the plan, further meetings and workshops will be held to ensure stakeholders are trained and familiar with the plan.</li> </ul>
<b>Additional Considerations</b>	<ul style="list-style-type: none"> <li>• Incorporation of projections to account for changing storm patterns, sea-level rise, and other climate-related risks into the plan.</li> <li>• Coordination will be necessary to ensure adequate resources, such as shelters, medical supplies, and emergency personnel, are available during emergencies.</li> <li>• Equity considerations will also be essential, ensuring that vulnerable populations—including low-income residents, the elderly, and those with mobility impairments—have equal access to resources during an emergency.</li> <li>• It will be vital to ensure that everyone is aware of the emergency plan and has received appropriate training.</li> </ul>

## 2. IMPROVE COMMUNITY COMMUNICATION AND PREPAREDNESS FOR CLIMATE IMPACTS.

Building on the previous action, workshop participants identified improving community communication and preparedness for climate impacts as a separate priority action. This reflects concerns from the earlier section, where community members said they felt unprepared to respond to emergency events, such as severe storms.

The goal of this action is to strengthen the ability of Woods Hole residents to respond to climate-related emergencies like extreme storms, flooding, and sea-level rise. Key components of the plan include developing clear messaging, assigning roles to key stakeholders, and providing clear and concise communication channels, such as flyers and in-person events. Additionally, early warning systems will be implemented to issue timely alerts about potential hazards.

This action seeks to educate residents, businesses, and the broader community on emergency preparedness, including evacuation plans and home storm-proofing techniques. Workshop participants also emphasized the need for a local climate action team to oversee communication efforts and explore additional methods, like using local media or creating an online hub as a centralized resource for information, emergency plans, and preparedness. This comprehensive approach will empower residents to take proactive measures in mitigating risks and responding effectively to climate emergencies, ultimately enhancing the overall resilience of the Woods Hole community.

### **3. ESTABLISH A CONSISTENT FUNDING SOURCE FOR RESILIENCE PROJECTS.**

A consistent funding source has been an ongoing challenge for climate resilience projects and organizations. For instance, *ResilientWoodsHole* was self-funded by NOAA, WHOI, and MBL during its early phases, while later phases of work were supported through the Massachusetts Office of Coastal Zone Management's Coastal Resiliency Grant Program.

Workshop participants highlighted the need for a reliable, long-term funding source to support resilience projects in Woods Hole. This is essential for ensuring the continuity of adaptation efforts as climate impacts grow. The goal of this proposed action is to identify a sustainable funding mechanism that ensures the ongoing implementation and maintenance of vital resilience initiatives, such as infrastructure improvements, coastal protection, and adaptation strategies. A reliable funding source will provide the financial stability necessary to address the impacts of sea-level rise and coastal storm flooding, helping to build resilience for future generations.

The proposed action involves establishing a dedicated resilience fund to support both current and future projects in Woods Hole. To create this fund, the following steps will be taken:

- Exploration of funding sources, including federal and state grants, local government funding, public-private partnerships, and community fundraising.
- Set-up of a resilience fund
- Identify sustainable, recurring revenue streams, such as taxes, fees, bonds, or pursue other external funding opportunities.

Additional aspects for this proposed action were discussed and put in the table below:

FIELD	RESPONSES
Responsible Parties	Town of Falmouth's Finance Department, <i>ResilientWoodsHole</i> and other community organizations to raise awareness and garner community support.
Community Engagement	<ul style="list-style-type: none"><li>• Public meetings, workshops, and surveys will offer opportunities for community input, and outreach efforts will ensure that diverse voices are included.</li><li>• Transparency will be emphasized throughout the process, with regular updates provided to the public on the fund's progress and outcomes.</li></ul>
Additional Considerations	<ul style="list-style-type: none"><li>• Securing political support is essential, as local government approval may be needed for certain funding mechanisms.</li><li>• Equity and access should be prioritized to ensure that resilience investments are accessible to all residents, businesses, and organizations.</li><li>• Engaging the private sector in contributing to the fund will help ensure a diverse and sustainable funding source, strengthening the overall resilience efforts and making them more comprehensive and effective.</li></ul>



SUMMARY OF PRIORITY ACTIONS

The following graphic summarizes the priority actions and their estimated impact to prepare Woods Hole for climate challenges compared to the cost to execute them.

AREA	PROJECT	IMPACT	COST	TIMEFRAME
Mill Pond/Eel Pond	Feasibility study	Low	Low cost	Short-Term
Mill Pond/Eel Pond	Culvert replacement between Mill Pond and Eel Pond	High	Medium cost	Short-Term
Mill Pond/Eel Pond	Gardiner Rd. seawall drainage	High	Medium cost	Medium-Term
Waterfront Area	Floodproof sewer pump stations	High	High cost	Short-Term
Waterfront Area	Raise priority roads	High	High cost	Long-Term
Waterfront Area	Engage business community	Medium	Low cost	Medium-Term
Woods Hole Village	Integrated emergency management plan	High	Low cost	Short-Term
Woods Hole Village	Community communication and preparedness	High	Low cost	Short-Term
Woods Hole Village	Establish a consistent funding source	High	High cost	Long-Term

## CONCLUSIONS AND LESSONS LEARNED

The Town of Falmouth Climate Resilience Workshop successfully engaged the Town of Falmouth staff and Select Board members on key climate vulnerabilities facing the Woods Hole community and encouraged buy-in on near-term priority actions. Participants collectively identified strategies to tackle climate vulnerabilities, focusing on critical areas such as Mill Pond/Eel Pond, the Waterfront, and generally on the entire village. One key takeaway from the workshop was the need to focus on actionable, near-term solutions that are feasible to implement. A challenge that emerged was balancing the urgency of action with the complexity of long-term solutions, including navigating regulatory restrictions and securing consistent funding. However, these challenges also present opportunities for innovation, particularly in developing creative, community-driven solutions and identifying potential funding sources to support resilience efforts. Moving forward, continued collaboration and a clear, shared vision will be essential for the successful implementation of these strategies.

## NEXT STEPS

In the immediate term, *ResilientWoodsHole* and the Town of Falmouth will prioritize three key projects: resilient sewer infrastructure, a feasibility study to replace culverts in the Mill Pond/Eel Pond area, and the development of a comprehensive emergency management plan. While other actions were also identified as priorities, these three were consistently emphasized during the workshop. Future workshops and meetings will be scheduled to further refine action plans for each area of Woods Hole, address emerging concerns, and track progress on the proposed strategies. These sessions will also provide additional opportunities for community input and collaboration. Ongoing community engagement remains a priority to ensure the planning process is inclusive, transparent, and responsive to the evolving needs of Woods Hole.

## APPENDIX:

### Workshop Invitation List:

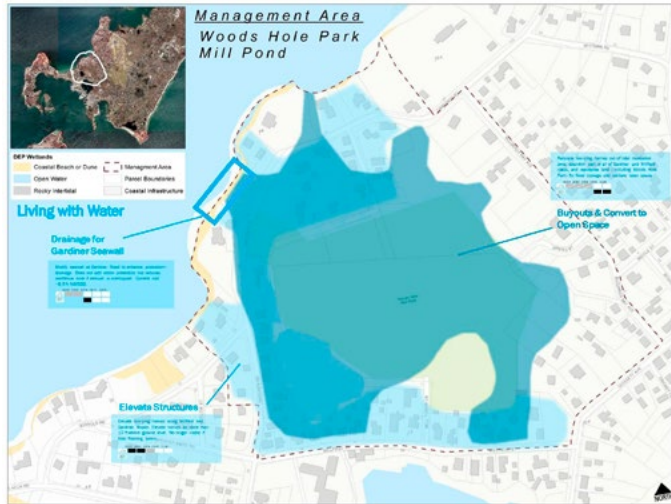
Doug Brown, Falmouth Select Board  
 Catherine Bumpus, Woods Hole Community Association  
 Nicole Cabana, NOAA NMFS NEFSC  
 Jed Cornock, Town Planner  
 Bob Davis, Steamship Authority  
 Paul Dreyer, Clerk/Secretary, Falmouth Planning Board  
 John Druley, Falmouth Planning Board  
 Greg Endicott, Facilities Manager  
 Joe Famely, Woods Hole Group  
 Jim Fox, Falmouth Planning Board  
 Gregg Fraser, Director, Marine & Environmental Services  
 Heather Goldstone, Falmouth Select Board  
 Jim Grady, Road Superintendent  
 Charlotte Harris, Chairman, Falmouth Planning Board  
 Pam Harvey, *RWH* Community Liaison  
 Shannon Hulst, Barnstable County Floodplain Manager/WHOI Sea Grant  
 Peter Jeffrey, *RWH* Community Liaison  
 Peter Johnson-Staub, Assistant Town Manager  
 Nathan Keith, NOAA NMFS NEFSC  
 Patricia Kerfoot, Vice Chairman, Falmouth Planning Board  
 Matt Lanen, Water Superintendent  
 Judy Laster, *RWH* Community Liaison  
 Robert Leary, Falmouth Planning Board  
 Jennifer Lincoln, Conservation Administrator  
 Jeff Lourie, Police Chief  
 Amy Lowell, Wastewater Superintendent  
 Chuck Martinsen, Marine & Environmental Services  
 Roy Martinson, Deputy Director, Marine & Environmental Services  
 Robert Mascali, Falmouth Select Board  
 Patrick Masterson, Woods Hole Business Association  
 Peter McConarty, DPW Director  
 Leslie-Ann McGee, WHOI

Steve McKenna, MA Office of Coastal Zone Management  
Jim McLoughlin, Town Engineer  
Rob Munier, WHOI  
Alyson Pitts, NOAA NMFS NEFSC  
Catherine Poquette, Marine & Environmental Services  
Mike Renshaw, Town of Falmouth – Town Manager  
Nancy Robbins Taylor, Chair, Falmouth Select Board  
CDR John Singletary, USCG  
Timothy Smith, Fire Rescue Chief  
Paul Speer, MBL  
Gary Street, Building Commissioner  
Rob Thieler, USGS  
Melinda Tondera, Assistant Town Planner  
Thomas Zine, Falmouth Planning Board  
Zach Zobel, Woodwell Climate Research Center  
Scott Zylinksi, Vice Chair, Falmouth Select Board

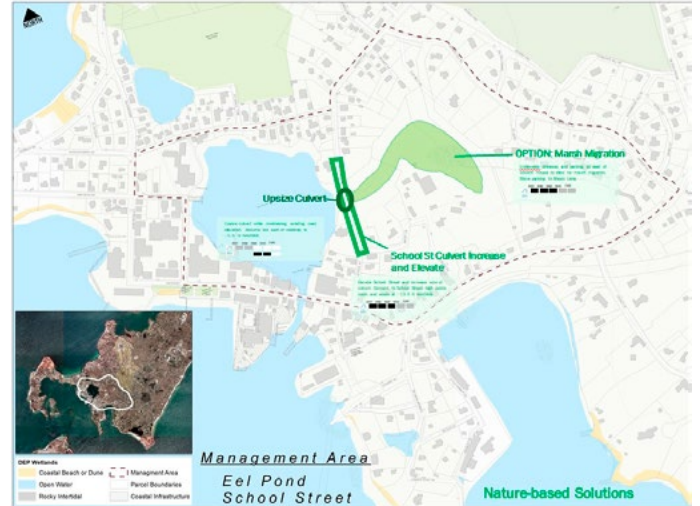


# ADAPTATION SOLUTION CHARTS:

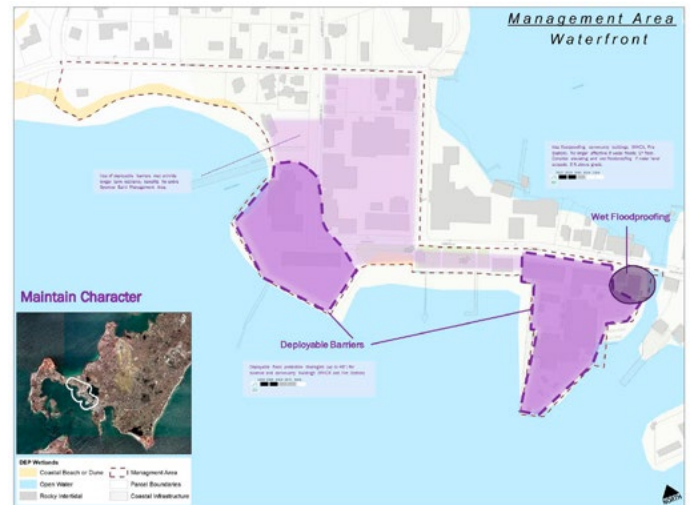
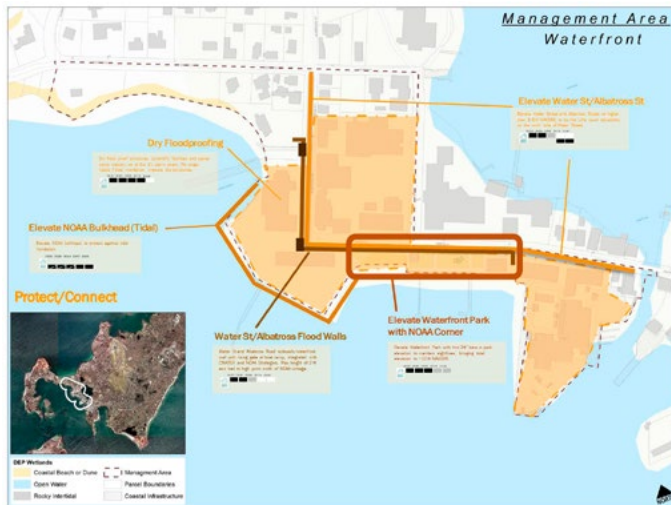
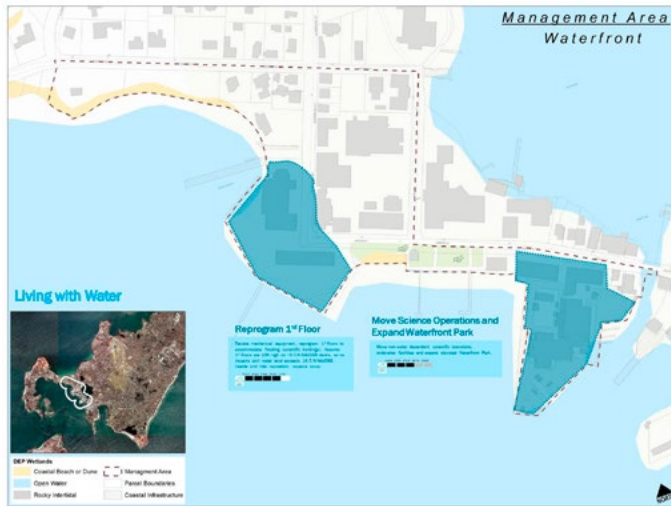
## Mill pond



## Eel pond



## Waterfront



## WORKSHOP AGENDA

**8:30-9:00:** Welcome and Introduction

**9:00-9:30:** Session 1 - Climate Vulnerability and Adaptation

**9:30-10:00:** Session 2 - Community Vision

**10:00-10:10:** Break

**10:10-11:25:** Session 3 - Priority Actions and Strategies

**11:25-12:10:** General Discussion

**12:10-12:30:** Next Steps and Wrap-Up



# ACTION PLAN TEMPLATES AND QUESTIONS

FRONT:

RESILIENTWOODS

General Action Card

Goal	
Action	
Responsible Parties	
Resources Needed	
Timeline	
Metrics for Success	
Priority	

FIELD	DESCRIPTION
Goal	What is our concern for this area? (Community Hall gets flooded during storms). Your goal is the opposite of your concern. <b>Example:</b> "Reduce flooding risk on Community Hall during coastal storms."
Action	Provide a description of an action or strategy to meet your goal. Explain what will be done, and how. <b>Example:</b> "Install deployable flood barriers at Community Hall."
Responsible Parties	Who is responsible? Identify the specific departments or individuals who will lead. <b>Example:</b> "Town of Falmouth Public Works, Woods Hole Community Association, <i>RWH</i> team, local contractors."
Resources Needed	What resources (budget, tools, personnel) are required to carry out this action? <b>Example:</b> "Funding for flood barriers (\$500,000), personnel for installation, planning permits, project management."
Timeline	What are the milestones for this action? Include an time-sensitive steps (like climate projections for this area). <b>Example:</b> "Install barriers by Fall 2026, complete initial planning and permits by Spring 2025."
Metrics for Success	How will success be measured? Define an indicator for evaluating the action's effectiveness. <b>Example:</b> "Flood barrier installed successfully; stormwater flooding reduced by 75%."
STOP! WAIT UNTIL ALL OTHER SOLUTIONS ARE FINISHED BEFORE MOVING ON TO PRIORITY	
Priority	In context of other short-term solutions for this area, what would you prioritize this action?

BACK:

RESILIENT <small>WOODS</small> HOLE		Priority Action Card
Goal		
Action		
Necessary Steps		
Community Engagement		
Additional Considerations		

FIELD	DESCRIPTION
Action	Reinstate the specific action identified in Session 3.
Goal	Reinstate the specific goal identified in Session 3.
Necessary Steps	Identify the steps required to implement this action. Break it down into manageable tasks. Include assessments, permits, and other preparatory work. Example: “Conduct flood risk assessment, apply for stormwater management permits, engage with community stakeholders.”
Community Engagement	How will you gather community input on this action? Consider methods for engagement and feedback. Example: “Hold a public meeting to discuss proposed flood barriers and collect feedback through surveys.”
Additional Considerations	What factors or challenges should be considered? This could include environmental impact, social considerations, or potential roadblocks. Example: “Community buy-in for flood mitigation measures, environmental review for barrier installation.”

