Town of Yarmouth

Community Resilience Building Workshop Summary of Findings

June 2019

PREPARED FOR:
Town of Yarmouth
Planning Division
1146 Route 28
Yarmouth, MA 02664

PREPARED BY:
Woods Hole Group, Inc.
A CLS Company
107 Waterhouse Road
Bourne, MA 02532 USA

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1.0 OVERVIEW

The Town of Yarmouth, like many coastal communities throughout the Commonwealth, has experienced more frequent and more impactful climate-related natural hazards in recent years. Events such as the Blizzard of 2015, heavy rainfall in July 2017, and powerful Nor'easters in January and March 2018 exposed both strengths and vulnerabilities in the Town, and reinforced the urgent need to proactively plan and mitigate climate-related risks through a community driven process. Planning for current and future hazards through the engagement of a diverse cross-section of stakeholders in Yarmouth will build on existing initiatives and develop new strategies to reduce climate-related vulnerabilities for the Town's citizens, infrastructure, and natural systems.

Acknowledging this need for proactive climate adaptation planning, the Town of Yarmouth enrolled in the Municipal Vulnerability Preparedness (MVP) program, administered by the Massachusetts Executive Office of Energy and Environmental Affairs, which provided funding to conduct a Community Resilience Building (CRB) Workshop – a framework for community driven climate adaptation planning (https://www.communityresiliencebuilding.com/) developed by The Nature Conservancy.

The Yarmouth Planning Division convened a core team – including representatives from Conservation, Economic Development, Engineering, Fire, Highways, Natural Resources, and Public Works – to guide and organize the CRB process. This core team selected Woods Hole Group as the Town's Certified MVP Provider. Woods Hole Group and the core team collaborated on preparing for the CRB Workshop, including identifying stakeholders from a broad cross section of the community to invite to participate in the process.

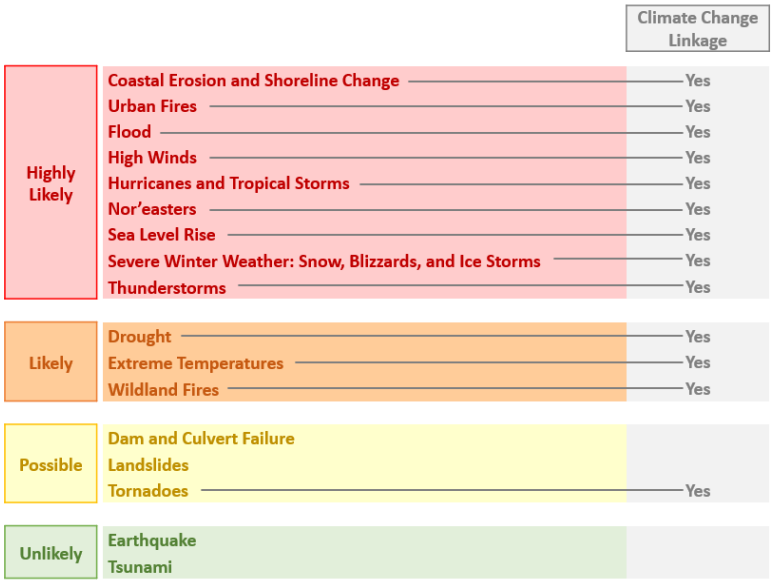
The Woods Hole Group facilitated an 8-hour CRB Workshop for the Town of Yarmouth on March 22, 2019. The Workshop's central objectives were to:

- Define top local natural and climate-related hazards of concern;
- Identify existing and future strengths and vulnerabilities;
- Develop prioritized actions for the Community; and
- Identify immediate opportunities to collaboratively advance actions to increase resilience.

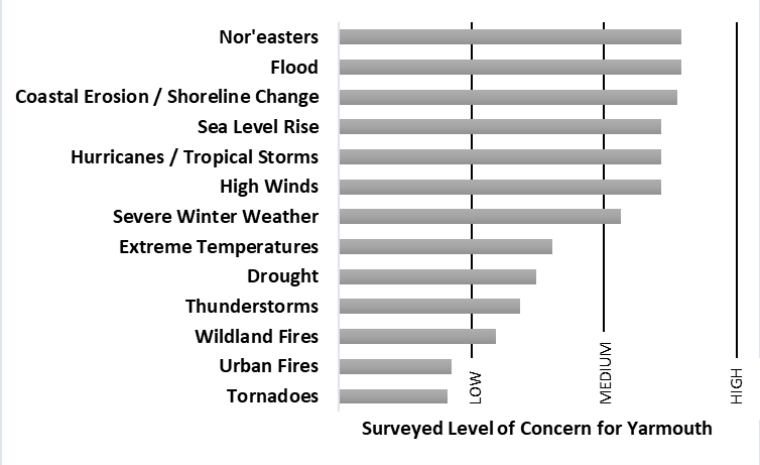
There were 22 stakeholders in attendance at the CRB Workshop, comprised of Town employees, citizens engaged in relevant boards and committees, as well as representatives of the business community, residential associations, non-profits, and Barnstable County. The CRB's Risk Matrix format, large-scale maps of the Town of Yarmouth (Appendices A and B), and various datasets on natural hazards (Appendices C and D) were integrated into the workshop process to provide both decision support and risk visualization for workshop participants. The workshop included a combination of large group presentations and small group discussions. The large group presentation outlined the workshop process/goals, presented relevant hazard and community data, shared example actions, and provided an update on local planning efforts and initiatives. Participants also had an opportunity to work together in small groups consisting of 8 people with different roles, responsibilities and expertise to foster an exchange of ideas and perspectives. Spokespersons from the small groups then reported their findings back to the larger group. This workshop process, rich with information, and experiences and dialogues from the participants produced the findings detailed in this summary report. This report provides an overview of the top hazards, current concerns and challenges, current strengths and vulnerabilities, and recommends actions to improve the Town of Yarmouth's resilience to natural and climate-related hazards today and in the future.

2.0 TOP HAZARDS AND VULNERABLE AREAS

The recently completed 2017 Yarmouth Hazard Mitigation Plan provided a sound basis from which to select top natural hazards for the Community Resilience Building Workshop. Prior to the Workshop on March 22, 2019, invited stakeholders were asked to identify the top natural hazards of concern for the Town of Yarmouth based on past/present experience as well as anticipated future conditions.



Invitations to the workshop were distributed with a link to a pre-workshop online survey and RSVP page. Respondents first reviewed a ranked list of the hazards considered in the Hazard Mitigation Plan which was annotated to highlight those natural hazards with linkages to climate change. Next, the online survey provided a brief series of downscaled climate change projections for the Cape Cod region from the Massachusetts Climate Change Clearinghouse (resilient MA) – including temperature, precipitation, sea level rise, and storm surge. Following review of the climate change projections, respondents were asked to report their level of concern for each climate-related natural hazard considering current conditions and Yarmouth's climate future. The results of the survey were used to select the top hazards for the Workshop.



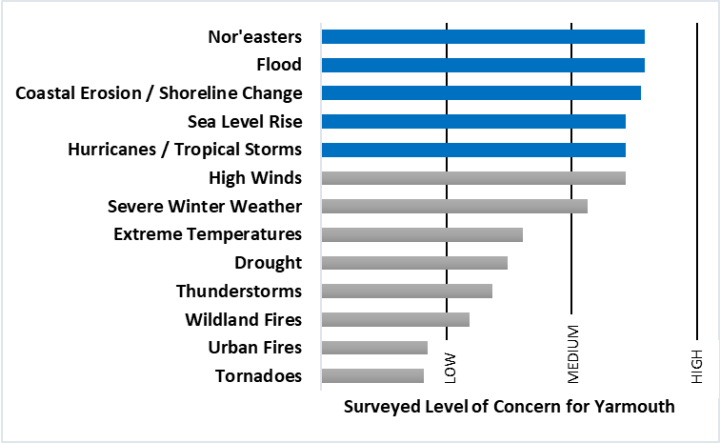
There were thirty-three responses to the hazard survey. On average, stakeholder concern was highest for coastal hazards such as flooding, sea level rise, and coastal erosion. Related to these coastal concerns were high concerns regarding storms such as Nor'easters and hurricanes, and associated high winds. As is true for many communities on Cape Cod, these

coastal threats loom large in the collective consciousness of Yarmouth stakeholders. Respondents also expressed concern about impacts from extreme heat, drought, fire, and thunderstorms – though to a lesser degree than the coastal hazards.

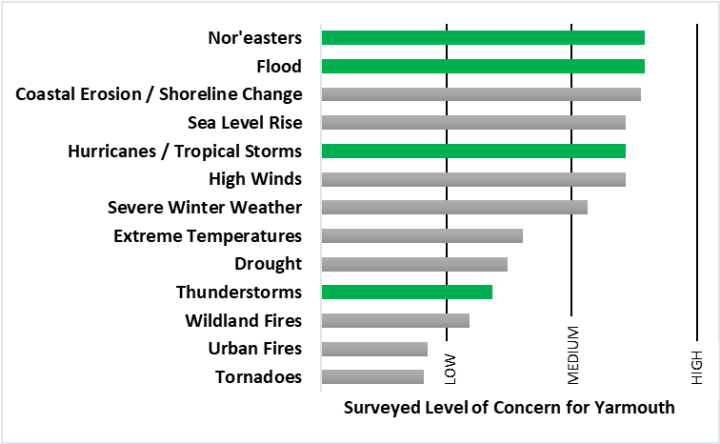
Top Hazards

After reviewing the survey results, and considering recent experience with the impacts of heat, heavy rain, snow and ice, and inland flooding due to high groundwater events, the CRB Workshop Project Team grouped the hazards into four overarching Top Hazard categories:

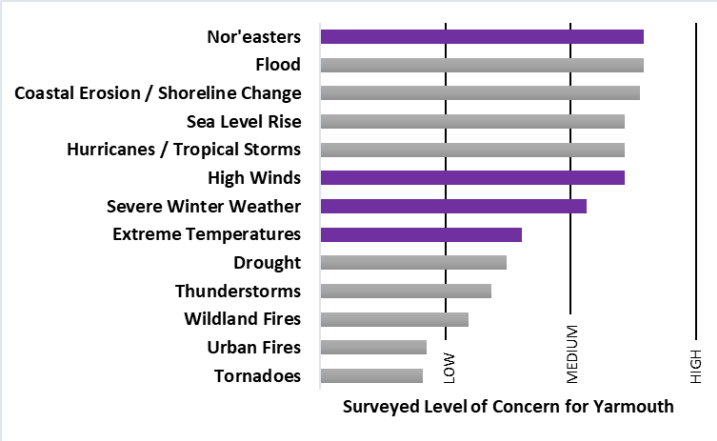
1. Coastal Flooding and Erosion – *Periodic and episodic flooding of coastal areas due to sea level rise and storm surge (e.g. hurricanes and Nor'easters) and the resultant changes to the landform.*



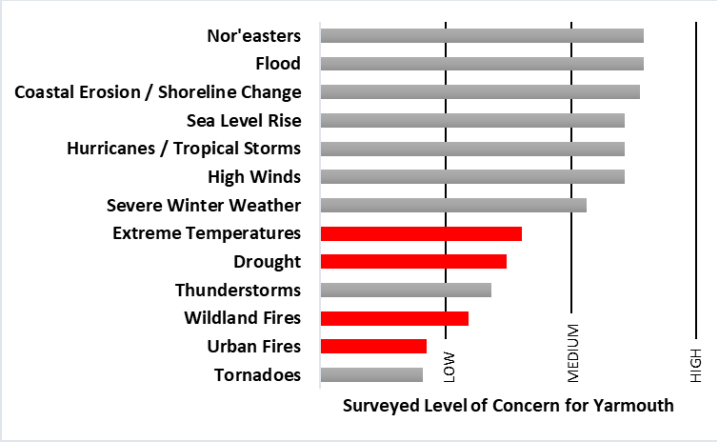
2. Inland Flooding – *Flooding of inland areas due to precipitation and high groundwater.*



3. Extreme Cold and Winter Storms – *Low temperatures coupled with wind, snow, sleet, and/or freezing rain associated with winter storms.*



4. Heat, Drought, and Fire – *High temperatures and associated impacts from drought and/or fire.*



Areas of Concern

Neighborhoods – Captains Village, Swan Pond Village, King's Way, Hyannis Park, business districts, hotel/resort districts

Populations – Senior citizens (retirement communities, assisted living facilities, aging-in-place), environmental justice (low-income) communities, preschools and daycare facilities, seasonal visitors and tourists

Ecosystems and natural resources – Lewis Bay, Bass River, Beach and dune systems(Bay View, Colonial Acres, Englewood, Seagull, Smuggler's, Parker's River, Sea View, South Middle, Wilbur Park, Windmill, Gray's), tidal creeks and marsh ecosystems (Lonetree

Creek, Center Street Marsh, Parker's River, Stage Island, Mill Pond and Crab Creek, Lewis Pond, Mill Creek), freshwater ponds (Plashes Pond, Long Pond), shellfish aquaculture and herring runs, pine barren habitat, open space and cranberry bogs, drinking water aquifers

Transportation – Low-lying roads (Route 28, Route 6A, New Hampshire Avenue, Shore Road, Great Island Road), traffic signals (numerous), bridges (Route 6, Parker's River, Bass River)

Infrastructure – Aging/failing culverts (numerous), septic systems, storm drains, utilities, internet and cellular service, water pump stations

Facilities – Fire stations (1 and 2), Town Hall, Cape Cod Hospital, marinas and fueling stations

3.0 CURRENT CONCERNS AND CHALLENGES PRESENTED BY HAZARDS

The Town of Yarmouth has many concerns and faces multiple challenges stemming from the impacts of climate-related natural hazards. These concerns and challenges were highlighted at core team meetings, during pre-workshop interviews with municipal staff, and during the CRB Workshop; they were further corroborated by the 2017 Yarmouth Hazard Mitigation Plan.

In recent years, Yarmouth has experienced a series of highly disruptive and damaging weather events – including the Blizzard of 2015 (30 inches of snow, widespread power outages, high winds and coastal storm surge), torrential rains in July 2017 (3.4 inches of rain), and multiple large Nor'easters in January and March 2018 (heavy snow, high winds, power outages, extreme storm surges and ice flows). These and other extreme weather events are occurring more frequently, and exact tremendous impacts on municipal budgets, infrastructure, environmental resources, and business continuity. Examples of the impacts from extreme weather include flash flooding (damaging infrastructure and property, requiring additional maintenance to stormwater infrastructure, and impairing travel), tree damage and widespread power outages (damaging property and utility infrastructure, disrupting business activity, and requiring

resources to operate shelters), burdensome and expensive snow removal and road treatment activities, and coastal flooding and erosion (damaging property, infrastructure, beaches and dunes).

The frequency of the storms in March 2018 exacerbated the impacts, as the Town was still recovering from the last storm when the next one arrived. In Yarmouth, these storms resulted in over 100 downed trees (since high winds followed heavy rain and snow), damage to culverts and undermining of town roads, damage to coastal infrastructure (including the Town's iconic Bass Hole Boardwalk), and cascading impacts due to flooding (uncontrolled discharge of basement flooding pumpouts re-froze on public streets causing safety issues). The magnitude and severity of the impacts of these storms produced a heightened level of awareness in Yarmouth and provided additional motivation to comprehensively improve resilience and reduce local vulnerabilities to natural hazards.

In addition to these significant episodic events, Yarmouth is experiencing more periodic impacts related to climate change, which are projected to increase in the future. For example, in many parts of Town, high groundwater conditions flood roads – causing immediate impacts to transportation as well as long term damage from undermining. Such high groundwater events will become more frequent as precipitation increases and sea level rise continues. Sea level rise also has implications for the long-term viability of coastal assets. King Tides in October 2016

provided a glimpse of future shorelines and highlighted areas where rising waters will conflict with existing uses (e.g. overtopping piers and roadways). These more regular impacts are high priority issues for the Town, since they are beginning to affect daily operation and maintenance, and the long-term usefulness of infrastructure.

There was consensus among Workshop participants that the Town of Yarmouth is experiencing more intense and frequent storms, which has greatly exacerbated inundation and erosion issues, as well as longer term shifts in temperature, sea level, and depth to groundwater. It was clear from the Workshop that stakeholders in Yarmouth are committed to addressing these concerns in ways that build long-term resilience throughout the community.

Specific Categories of Concerns and Challenges

Coastal Resources

Workshop participants acknowledged the important role coastal natural resources (salt marshes, beaches, dunes, coastal banks) play in the Town of Yarmouth. Not only do these resources attract tourist activity for their recreational amenities and aesthetic value (and are therefore an essential economic driver) but they also provide critical ecosystem services (e.g. carbon sequestration, storm surge attenuation, pollutant filtration, and critical habitat). There was widespread concern for the sustainability of these important natural resources in the face of climate change. Challenges facing coastal green infrastructure include sea level rise outpacing salt marsh accretion, development impinging on the ability of salt marshes to migrate with sea level rise, and storm events eroding beaches, dunes, and coastal banks.

Vulnerability of Culverts and Other Infrastructure

There was widespread concern among each of the working groups for the long-term viability of Town infrastructure given the projected climate change impacts. Notably, there are many aging and failing culverts that are vulnerable to wash-out and failure during coastal storms and/or large precipitation events. There was also concern for low-lying roads, since they already experience flooding and undermining from high groundwater and storms. Workshop participants also expressed concern for other

vulnerable municipal infrastructure – including drinking water pump stations, bridges, generators for municipal buildings, stormwater systems, and municipal/emergency facilities.

Vulnerable Populations

Between senior citizens, low-income residents, and non-English speaking communities, there was concern among the Workshop participants for vulnerable populations and environmental justice communities. The demographics of the Town of Yarmouth show an aging population – according to the 2010 Census, the median age in Yarmouth is 51.4 years. The Town is home to multiple continuing care and retirement communities. Additionally, Workshop participants noted that many residents are aging-in-place, and a large portion of the Town's seasonal residents are retired, which results in year-round and summer populations that may require special attention during emergency situations. Specific challenges, especially for aging populations, include vulnerabilities to power outages (due to the need to keep medications refrigerated and medical equipment online), sensitivities to extreme heat and cold, and reduced abilities to cope with flooding (reduced mobility and ability to evacuate). Sensitivities to these hazards in low-income communities and non-English speaking communities are amplified due to barriers to communication and limited resources.

Vulnerable Properties

Areas in Yarmouth that are vulnerable to flooding (both coastal and inland) are well documented. Flooding that is episodic in nature (storms or high groundwater) presently is expected to occur more frequently, and may eventually become periodic in nature (tides). These natural hazards pose economic and safety threats under current conditions, and may force conversations about long-term usability under future conditions. Workshop participants cited concerns about low-lying coastal areas with dense business and residential development facing repetitive impacts from flooding in the future. One member of the Core Team noted that certain portions of Town that are presently vulnerable to flooding were developed during an extended period of draught in the region. In addition to vulnerable residential and business districts, it was noted that some Town properties – specifically the Fire Department Headquarters on Old Main Street – are vulnerable to flooding now and in the future. These types of vulnerabilities can have significant impacts on the Town's abilities to provide effective municipal and emergency services.

Wastewater Management

Wastewater management is an ongoing concern for the Town of Yarmouth, as it is for many municipalities across Cape Cod. Widespread use of traditional septic systems throughout Town contribute to eutrophication of coastal embayments and ponds, prompting the development of TMDLs for the multiple waterbodies of concern in Yarmouth. While the Town has a septage treatment facility designed to convert septage

into useable resources, there are ongoing initiatives to install sewer systems in Town. Considering sea level rise, increased frequency and intensity of coastal storms, and increased precipitation, there was concern amongst Workshop participants for the potential impacts of climate change on wastewater management in the Town of Yarmouth. Specific challenges for existing septic systems noted by Workshop participants included the potential for reduced functionality and failure due to saltwater intrusion and/or higher water tables, the potential for damage to coastal units due to erosion, and the potential for increased mobilization of nutrients due to increased precipitation.

Communication and Coordination

Stakeholders in the Town of Yarmouth expressed concerns about the ability of citizens, businesses, municipal officials, and emergency responders to maintain effective communication and coordination when facing climate-related hazards. Equitable access to reliable internet and cellular service was cited as a specific challenge, which impedes residents (especially vulnerable populations), businesses, and visitors in Yarmouth from effectively coping with the impacts of climate-related hazards. Workshop participants also recognized a knowledge gap – municipal officials do not currently know what local businesses have in the way of emergency provisions and/or equipment – that further impedes the efficiency and coordination of emergency response.

Seasonal Visitors

As a vacation destination, the Town of Yarmouth benefits greatly from the tourism economy. During the summer months, the population reportedly swells from 24,000 to approximately 74,000. This seasonal surge in residents and visitors can put a strain on municipal services, and is especially of concern considering potential impacts from storms and extreme heat. Workshop participants acknowledged that some larger hotels and resorts may have emergency plans, but recognized a potential gap in communicating emergency procedures to visitors renting individual vacation homes or staying at smaller facilities.

4.0 CURRENT STRENGTHS AND ASSETS

Based on pre-Workshop interviews with core team members, and based on conversations among the Workshop participants, it was evident that a key strength in the Town of Yarmouth are its people. When asked to describe the community's strengths, stakeholders cited a strong sense of community, productive and collaborative working relationships between municipal staff, and an active and engaged citizenry (many residents serving on municipal boards and committees also have significant roles in other aspects of the community). These community characteristics will provide Yarmouth with a strong foundation on which to build resilience to climate change and extreme weather.

Additionally, many workshop participants cited the Town's coastal and terrestrial natural resources as a key strength. Yarmouth has approximately 35 square miles of estuarine waters, 4 square miles of inland freshwater bodies, and almost 8 square miles of open space and protected land (approximately one-third of Town land). Stakeholders acknowledged that natural resources are a primary driver for Yarmouth's tourism economy, and also provide significant ecosystem services (including salt marshes and dune systems buffering inland areas from coastal storm surge).

Other strengths noted by participants in the CRB Workshop include:

- The Town of Yarmouth recently completed an update to its Hazard Mitigation Plan (2017). Therefore, many municipal departments are keenly aware of the impacts natural hazards may have on their operations, and have already developed plans for addressing these hazards and reducing risk.
- Dennis-Yarmouth Regional High School, which is the Town's primary shelter and a regional shelter, is located out of the floodplain and has backup generators. In fact, all Dennis-Yarmouth schools in Yarmouth are located out of the floodplain and can serve as emergency shelters, and warming/cooling stations.
- Many Town facilities already have backup generators, including the schools, the Senior Center, the Emergency Operations Center (Police Department), and water system pump stations. Additionally, the State Police Barracks near Town Hall can provide additional support in an emergency and also have backup generators. These backup power sources provide the Town of Yarmouth with continuity of service in the event of an emergency, and support the resilience of the community.
- Coastal morphology in some parts of Yarmouth provide additional protection to inshore areas by intercepting wave action and constricting storm surge. For example, Great Island and the barrier beach complex to its North provide some protection for the shoreline of Lewis Bay by reducing wave action. Stage Island and West Dennis Beach (Town of Dennis) provide wave reduction and storm surge attenuation for areas up the Bass River.

- Shellfish aquaculture is widely regarded as a strength to the community, since it improves water quality and provides a local food source.
- Many ongoing initiatives – including beach nourishment, wetlands restoration, and stormwater management – will further enhance Yarmouth's resilience to future climate-related natural hazards, and provide a strong foundation of experience from which to develop additional projects and initiatives.
- The Town of Yarmouth has demonstrated leadership and forward thinking on climate-related hazard mitigation with recent "un-development" projects. Such methods for acquiring properties in sensitive resource areas and creating open space can be a model for future resilience initiatives.

5.0 TOP RECOMMENDATIONS TO IMPROVE RESILIENCE

A common theme throughout the Workshop discussions (and in pre-workshop interviews with Core Team members) was a recognition of the importance of natural resources and sense of community and collaboration throughout the Town. As a coastal community, Yarmouth relies on the quality of its natural environment to attract visitors and residents. The Town's infrastructure enables Yarmouth to accommodate these populations safely, and there is increasing focus on implementing sustainable strategies to reduce human impacts on natural resources. Simultaneously, natural hazards have the capacity to impact all facets of the Town's character. Therefore, there was broad consensus among Workshop participants that there was a need to build resilience in environmental resources, societal resources, and infrastructure in the face of current and future hazards.

The following are the Top Priority Actions developed by each working group, and later aggregated by common themes. After each working group presented their top five priority actions, and these actions were grouped by similar themes, the large group voted on all priority actions (5 voting dots per workshop participant). These top priority actions are presented below in order of votes received.

1. Coastal Natural Resource Resilience

The Town of Yarmouth recognizes the great value of its natural resources. Many conversations among the working groups cited the important ecosystem services (such as flood protection, stormwater management and filtration, and carbon sequestration) provided by coastal resources, and expressed concern for the sustainability of these natural features in the face of sea level rise and storm surge. Additionally, workshop participants acknowledged that tourism is a major part of the local economy, and that tourism is directly linked to the quality of natural resources in Yarmouth. Finally, Town staff and residents indicated that Yarmouth maintains a strong identity as a coastal community, and that this identity is also directly linked to these natural resources.

Workshop participants prioritized actions to build resilience in salt marsh and dune resource areas. Specifically, initiatives to build resilience in salt marsh and dune resource areas should begin with an assessment of their current status and an analysis

of future vulnerabilities. Next, the Town should identify opportunities to restore and enhance salt marsh and dune systems to continue to provide those important ecosystem services as climate change produces higher seas and stronger storms. Some workshop participants were particularly interested in identifying borrow sites within each littoral cell and exploring the beneficial use of dredged material for developing sustainable sources of sand for salt marsh enhancement and dune restoration. This initiative would build on the success of the existing dredging and beach nourishment program.

In parallel, workshop participants suggested the Town complete a review of existing wetland by-laws, and consider incorporating climate resilience and best management practices into these regulations in order to protect and sustain these important coastal buffers into the future.

2. Infrastructure Vulnerability Assessment and Repair

Each working group expressed concerns about Yarmouth's aging infrastructure and its capacity to handle the additional stressors associated with climate change – in particular coastal flooding, inland flooding, and winter storms. Particular concerns centered on bridges (Parkers River Bridge), culverts (especially Mill Lane, Seagull Beach, Bay View, and Thatcher Beach), and low-lying roads (e.g. Route 28, New Hampshire Avenue, and Shore Road).

Workshop participants strongly supported the development of a detailed vulnerability assessment to prioritize resilience actions for Town infrastructure. This analysis should consider potential impacts to infrastructure from coastal inundation, but – given the concerns and priority hazards for Yarmouth – could also be extended to consider inland inundation and winter storms. A particular concern for roads within the Town is flooding due to high groundwater events.

3. Wastewater Initiatives

Wastewater is a significant issue on Cape Cod, and efforts to address eutrophication in estuaries are ongoing. Septic systems are vulnerable to multiple climate related hazards, including exposure to erosive and destructive storm surge as well as reduced effectiveness due to increased temperatures and higher groundwater tables. Currently, the Town of Yarmouth is developing a Town-wide wastewater plan which identifies sewering of Route 28 and South Shore Drive as Phase 1 of a multi-phased implementation plan.

Workshop participants supported the continuation and expansion of these efforts to reduce nutrient loading into coastal waterbodies because increases in sea level, storm intensity, precipitation, and temperature can have cascading impacts on septic systems – with severe consequences for local water quality. Additionally, stakeholders recommended taking measures to increase the resilience of wastewater treatment

systems as they are built, including working with adjacent communities and designing systems to handle future conditions.

4. Resilient Power and Communications

Many workshop participants and pre-workshop survey respondents expressed concern about the resilience of utilities, communications, and internet. Businesses reported extended internet and power outages hindering normal operations after storms had passed. Stakeholders expressed interest in building more resilient power and communications systems and improving communications between the Town, businesses, and residents.

Recommendations for improving the resilience of utilities and communications included developing a comprehensive strategy for equitable access to wifi and communications infrastructure Town-wide, supporting the strategic placement of cellular towers to improve emergency communications, and the development of backup power sources for critical facilities.

5. Un-development

Among Yarmouth's many strengths, workshop participants highlighted that nearly one third of the Town's land area is protected open space. Additionally, stakeholders identified recent success stories in the municipal acquisition of underperforming/deteriorated developed properties, and subsequent "un-development" to protect sensitive resource areas and provide open space for habitat, recreation, and scenic vistas.

Workshop participants viewed this process of land acquisition and un-development as a strategic tool to reduce vulnerabilities to coastal flooding – proposing the Town identify priority parcels (including repetitive loss and those vulnerable to sea level rise and/or storm surge) for future acquisition and/or protection. This strategy could also be employed to address other climate hazards, including inland flooding and heat/fire/drought.

6. Aging in Place and Vulnerable Populations

Yarmouth is home to many vulnerable populations, including elderly, low-income, and minority. The Massachusetts Executive Office of Energy and Environmental Affairs lists 5 block groups (total population 4,783 from 2010 census) in Yarmouth as Environmental Justice populations, based on income. Workshop participants expressed concern for vulnerable populations, including elderly populations that are aging-in-place, given the potential impacts from all four priority climate-related hazards.

Recommendations for building resilience in Yarmouth's vulnerable populations included developing a better understanding of their specific needs, creating a system for targeted

wellness checks and evacuations, and expanding educational outreach on climate-related hazards. Such a needs study would inform a preparedness plan for vulnerable populations.

7. Hazard Recovery

Workshop participants noted that, while each municipal agency is effective in responding to the demand on their resources in the wake of a natural hazard event, the Town would greatly benefit from a more streamlined approach to storm/hazard recovery.

To enhance resilience and build a robust and efficient storm/hazard response network, the Town should develop a Town-wide plan for storm/hazard recovery. Such a plan would include, among other elements, (1) a debris management plan, (2) identification of post-hazard roles for Town staff, volunteers, and State and Federal resources, and (3) a mechanism for streamlined permitting through the Building Department. The development of a Town-wide Hazard Recovery Plan would enhance resilience in Yarmouth, and provide additional benefit by enabling access to grants for mitigation.

8. Hazard Preparedness

One of Yarmouth's greatest strengths evident throughout the workshop was the highly collaborative nature of the Town's staff. Municipal departments have a good record of working together on issues affecting different facets of the Town. It was noted that focusing these working relationships on hazard preparedness would build resilience in the community. Department heads in attendance at the workshop noted that they work on emergency/hazard preparedness within their own departments, but don't often have the opportunity to consider these issues across departments or outside of the municipal footprint.

To foster increased collaboration around hazard preparedness, it was suggested that the Town convene an annual interdepartmental meeting, and engage County and State resources as available, to discuss cross-disciplinary emergency and hazard preparedness. Such meetings might utilize a workshop format, and would be designed to share ideas and develop multi-layered strategies for coastal flooding, inland flooding, extreme cold and winter storms, and heat/fire/drought. These annual meetings would also facilitate the development and implementation of public outreach and education around these hazards.

9. Drinking Water Well Protection

The Town provides clean drinking water from twenty-four (24) groundwater wells drawing on two aquifers. The 2017 Annual Drinking Water Quality Report noted stormwater runoff and septic system leachate as potential threats to drinking water quality in the Town. Climate-related impacts to drinking water aquifers are possible

from sea level rise and high water tables decreasing septic system functionality, and precipitation events mobilizing contaminants.

Workshop participants prioritized maintaining and expanding protections for potable water, especially for those sources located in the vicinity of septic systems.

10. Relocate Fire Station

Multiple working groups noted that Yarmouth's Fire Station No. 1 (on Old Main Street) is vulnerable to flooding from storm surge (now, and increasingly in the future). Increases in coastal and inland flooding will reduce this critical facility's ability to provide emergency services (due to impacts on the facility and access along Route 28), which will reduce Yarmouth's resilience overall.

Workshop participants discussed the option to relocate Fire Station No. 1 outside the hazard area or to build a centralized Fire Station (to replace both Fire Station No. 1 and Fire Station No. 2 on Route 6A). A Feasibility Study was suggested to evaluate these alternatives.

In addition to developing, grouping, and ranking these top priority actions, Workshop participants developed a larger suite of recommended actions. These additional recommended actions to build resilience in the Town of Yarmouth were ranked by each working group in terms of their priority (High/Medium/Low).

High Priority Actions:

- Comprehensive assessment of low-lying roads vulnerable to coastal/inland flooding. Implement highest priority projects.
- Using existing DY wastewater treatment system to address vulnerable communities to septic, including Captains Village.
- Investigate expansion of Open Cape Network
- Build resilience of existing beach/dune resource areas. ID strategies for beach/dune management; opportunities to expand and renew existing comprehensive dredge/disposal permits (additional sites, new shoaling, etc.).
- Town wide assessments of vulnerable parcels/areas/locations. Develop strategies for community education regarding vulnerabilities/opportunities for retreat; un-development.
- Identify opportunities for ecological restoration project implementation/development and directly address water quality concerns; shellfish impacts.
- Conduct hydrological/ecosystem study to understand any tidal/infrastructure restrictions for restoration purposes (e.g. Run Pond and Crab Creek Mill Pond).
- Develop protocol for communication between municipality and business community in the event of emergency. Inventory of existing businesses to consider what businesses have emergency provisions. Help local businesses plan/prepare for impacts in order to empower businesses to take an active role in community
- Develop municipal plan using available data sources. Identify suite of alternatives for sheltering based on intensity of event. Develop communication strategy for outreach/notification to redefine “code red communication.”
- Reach out to vulnerable individuals to identify those that need additional help during an emergency.
- Reinforce current cellphone towers and augment emergency communication capabilities.
- Conduct a “needs study (what vulnerable individuals are dealing with-immobility, oxygen, etc.)” of vulnerable population and create a preparedness plan to serve those populations for hazard response.
- Review/Update bylaws to adapt to hazards to ensure town functionality.

Medium Priority Actions:

- Prioritize and replace undersized culverts throughout the town. Address inland flooding and stormwater runoff.
- Identify emergency storage of septic and other waste.
- Create and implement education strategy regarding coastal erosion, shoreline protection and beach nourishment to private property owners.
- Increase awareness of amenities/features available to seasonal visitors. Emergency communication recommendations/checklists/protocols for visitors.

- Coordinate with town business/hotels/resorts/rental properties regarding the relaying info to guests. Help implement education outreach.

Lower Priority Actions:

- Conduct town inventory for in-house generators and facilities capabilities of storing supplies/perishables like food and medication.
- Update bylaws with climate change considerations.
- Providing back-up power and resources for senior and vulnerable populations during emergencies.

6.0 CRB WORKSHOP PARTICIPANTS

The Town of Yarmouth invited 56 Town employees, residents, and local business owners, as well as non-profit, county, state, and federal partners. All were invited to participate in a survey to select hazards of concern for the Town. In total, there were 33 responses to the survey, and 22 participants in the workshop on March 22, 2019.

Workshop Attendees

Workshop Participant	Town Affiliation
Tom Baron	Planning Board/Community Housing Committee
Kathy Williams	Town Planner
Karl von Home	Division of Natural Resources Director
Mark Grylls	Building Commissioner / Director of Inspectional Services
Nicholas Aguiar	Engineering Division
Kyle Pedicini	Community Development, Economic Development Coordinator
Christine Marzigliano	Open Space Committee
Jon Sawyer	Fire Deputy Chief
Mary Vilbon	Yarmouth Chamber of Commerce, Executive Director
Roby Whitehouse	Waste Management, Superintendent
Shannon Hulst Jarbeau	Barnstable County Cape Cod Cooperative Extension and Woods Hole Sea Grant
Richard Carroll	Community Housing committee
Jeff Colby	DPW Director
Sandra Cashen	DY Regional School District, Facilities Manager
Kathi Bailey	Senior Services Director
April Wobst	Association to Preserve Cape Cod
Ellie Lawrence	Conservation Commission
Susan Starkey	Energy Committee
Rachel Youngling	Hyannis Park Civic Association
Phil Simonian	Fire Chief
Rick Bishop	Conservation Commission
Kelly Grant	Conservation Administrator


YARMOUTH
FIRE • RESCUE

Invited (unable to attend)

Invited Participant	Town Affiliation
Richard Gegenworth	Old Kings Highway
Katherine Parsons	Mass Audubon
Jeannie Fay	The Davenport Companies
Rick Kelley	Highway Department
Kevin Lennon	Police Department
Pat Armstrong	Community Services and Recreation
Dan Knapik	Administration
Mark Forest	Board of Selectmen
Norm Weare	Planning Board/CEDC
Tom Roche	Planning Board/Bass River Civic Association
Chris Vincent	Planning Board/Design Review Committee
Brad Goodwin	Planning Board
Ken Smith	Community and Economic Development Committee
Ryan Castle	Community and Economic Development Committee
Jan Hively	Age Friendly Community Team
Julie Mockabee	Historical Commission
Dick Martin	Design Review Committee/Zoning Board of Appeals
Gary Ellis	Community Preservation Committee
Dorcas McGurrin	Recreation Commission/CPA
Bob Churchill	Waterways Committee/Friends of Bass River/Realtor
Lauren Wolk	Cultural Center of Cape Cod
Bob Nash	Cultural Center of Cape Cod
Gail Staff	South Yarmouth Association
Chris Geeley	Hyannis Park Civic Association
Rich Bilski	MassDOT/Citizen
Rob Angell	Citizen
Charles Spooner	Citizen
Tom Nickinello	Chamber President/Business Owner
Eric Derleth	US Fish & Wildlife Service
Steve Spear	Natural Resources Conservation Service
Sean Duffy	MA Office of Coastal Zone Management
Ed Hoopes	Former Conservation Commission Chairman
Gabby Sakolsky	Cape Cod Mosquito Control
Chloe Shafer	Cape Cod Commission
Heather McElroy	Cape Cod Commission
Steve Tupper	Cape Cod Commission

7.0 SUMMARY OF COMMUNITY FEEDBACK

The Town of Yarmouth conducted a public listening session at Town Hall on April 30, 2019 and solicited feedback on the draft of this report until May 17, 2019. Notes from the listening session and comments submitted via email are presented in Appendix E.

Some concerns and recommended actions highlighted in these public comments that reiterate or expand on concerns addressed in the CRB workshop include:

- The need for an effective emergency communications system that reaches vulnerable residents (Appendix E, J.Hively email). This recommendation relates to Top Priority Action #6 "*Aging in Place and Vulnerable Populations*" from the CRB Workshop.
- Recommendations for making information on residential resiliency available to Yarmouth citizens, specifically the updated USEPA publication "*Planning for Natural Disaster Debris*" (Appendix E, M.Waygan email). This suggestion relates to and expands upon Top Priority Action #7 "*Hazard Recovery*" from the CRB Workshop.
- Recommendation to explore the potential for restoration of abandoned cranberry bogs to enhance flood storage capacity and facilitate wetlands migration (Appendix E, M.Forest email). This suggestion relates to and expands upon Top Priority Action #6 "*Coastal Natural Resource Resilience*" from the CRB Workshop, and is further discussed in the Listening Session Notes (Appendix E).

A concern highlighted in these public comments that was not previously discussed in the CRB workshop was:

- Concern about a recent report of poor air quality in Barnstable County (Appendix E, C.Marzigliano email). This concern is discussed further in the Listening Session Notes (Appendix E), and the Town may elect to pursue additional investigation of the issue given the potential linkage to climate change (high temperatures may facilitate the production of ground-level ozone).

8.0 CITATION

Town of Yarmouth (2019) Community Resilience Building Workshop Summary of Findings. Yarmouth Planning Division, Woods Hole Group. Yarmouth, Massachusetts.

9.0 CRB WORKSHOP PROJECT TEAM

The CRB Workshop Project Team was composed of key Town of Yarmouth staff (many of whom were involved in the development of the 2017 Yarmouth Hazard Mitigation Plan) and MVP Providers from Woods Hole Group. Kathy Williams, PE (Town Planner) led the Project Team for Yarmouth.

Town of Yarmouth

Kathy Williams, PE	(Town Planner, Planning Division)
Nicholas Aguiar	(Civil Engineer, Engineering Division)
Jeff Colby	(Director, Department of Public Works)
Kelly Grant	(Administrator, Conservation Division)
Richard Kelley	(Superintendent, Highway Division)
Kyle Pedicini	(Coordinator, Economic Development Division)
Philip Simonian	(Chief, Fire Department)
Karl von Hone	(Director, Division of Natural Resources)

Woods Hole Group

Joseph Famely	(Project Manager, Lead Facilitator)
Adam Finkle	(Facilitator)
Brittany Hoffnagle	(Facilitator)
Kalinda Roberts	(Facilitator)

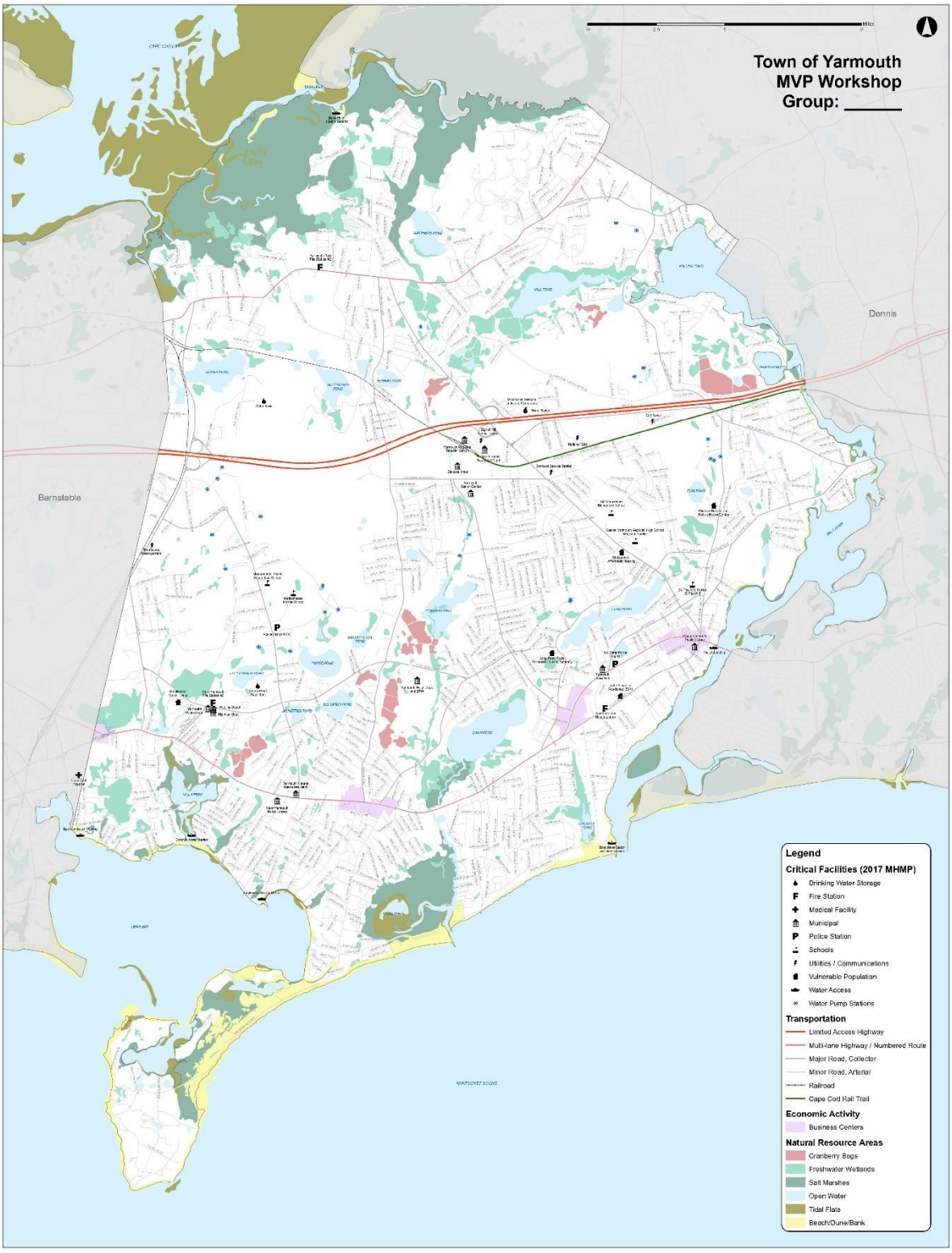
10.0 ACKNOWLEDGEMENTS

Special thanks to the dedicated and collaborative leaders from the Town of Yarmouth for contributing their time, energy, and ideas to this process. In particular, we would like to thank Kathy Williams, Kyle Pedicini, Kelly Grant, Karl von Hone, Jeff Colby, Phil Simonian, and Rick Kelley for their time and effort organizing and preparing for the workshop. Thank you to Bruce Barrow, GIS Specialist for the Town of Yarmouth, for providing GIS data and expertise of town infrastructure. Thanks also to Gary Prahm at the Cape Cod Commission for providing GIS data and hazard maps from the Yarmouth Hazard Mitigation Plan.

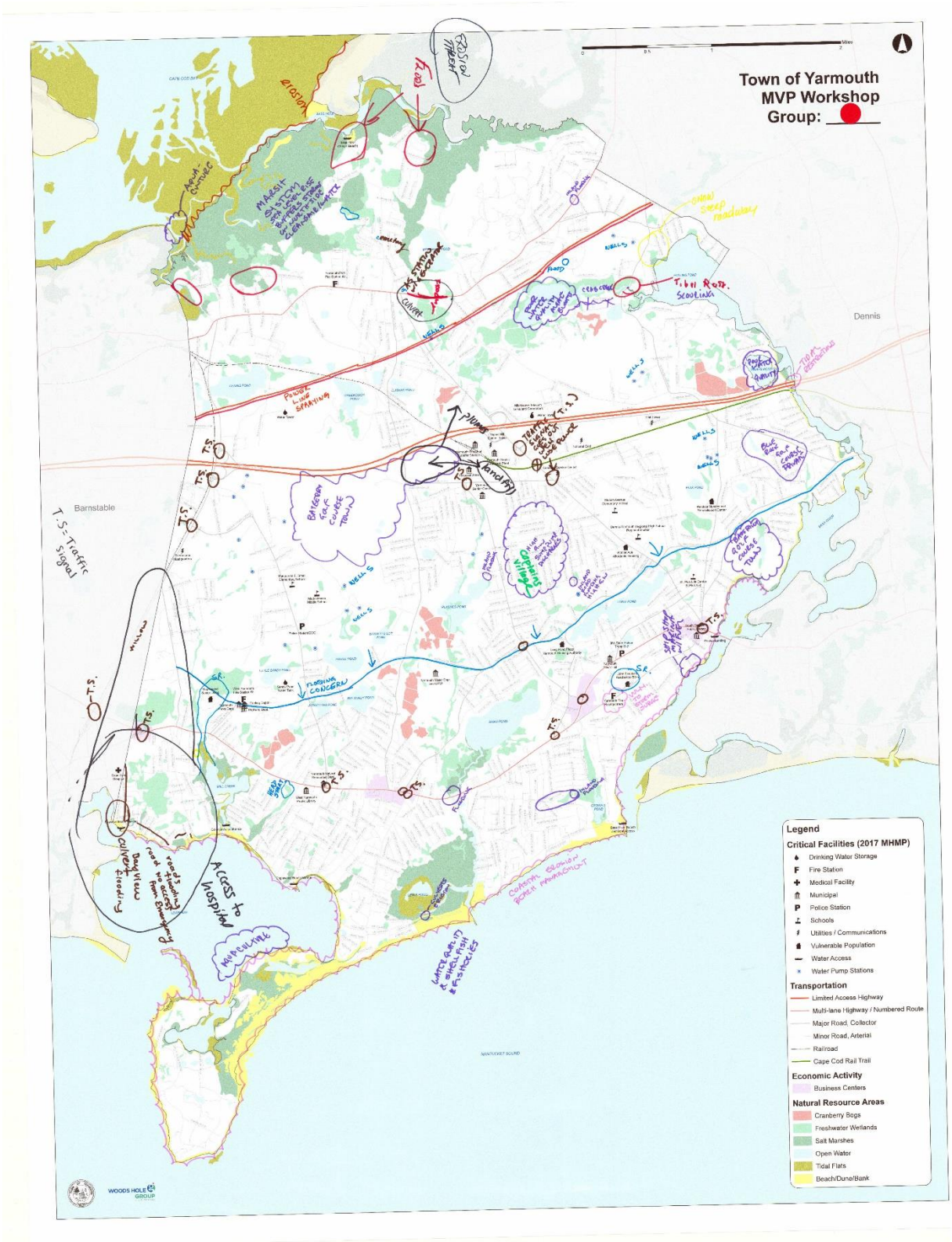
The CRB Workshop was held at the Lorusso Lodge at Flax Pond. Lunch and refreshments were provided by the Picadilly Deli & Café. We are grateful to the AmeriCorps Cape Cod volunteers who provided excellent notetaking services for each working group: Amberly Bark, Collin Buckner, Samuel Collins, and Samantha Pierce.

This project was made possible through funding from the Massachusetts Executive Office of Energy and Environmental Affairs' Municipal Vulnerability Preparedness (MVP) Grant Program, and the guidance provided by the Community Resilience Building framework.

APPENDIX A. WORKSHOP BASE MAP


Town of Yarmouth
MVP Workshop
Group: _____
Dennis
Barnstable
Legend
Critical Facilities (2017 MHMP)
Drinking Water Storage
Fire Station
Medical Facility
Municipal
Police Station
Schools
Utilities / Communications
Vulnerable Population
Water Access
Water Pump Stations
Transportation
Limited Access Highway
Multi-lane Highway / Numbered Route
Major Road, Collector
Minor Road, Arterial
Railroad
Cape Cod Rail Trail
Economic Activity
Business Centers
Natural Resource Areas
Cranberry Bogs
Freshwater Wetlands
Salt Marshes
Open Water
Tidal Flats
Beach/Dune/Bank

APPENDIX B. WORKSHOP RESULTS (MAPS / MATRICES / NOTES / TOP ACTIONS)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Town of Yarmouth
MVP Workshop
Group:
Dennis
Barnstable
Environ. Justice
Current Septic issues
High Groundwater
Septic Prob?
Septic Prob.?
Erosion of structure (Bridge)
1st Relay (historic)
D. River BRIDGE
Green = strength.
Town Dock
Environ. Justice
Seagull Beach
Washover
PRIVATE
* storm drain outfalls - work underway (?) Stop flow into Bass R.
yellow = flooding zone
Legend
Critical Facilities (2017 MHMP)
Drinking Water Storage
Fire Station
Medical Facility
Municipal
Police Station
Schools
Utilities / Communications
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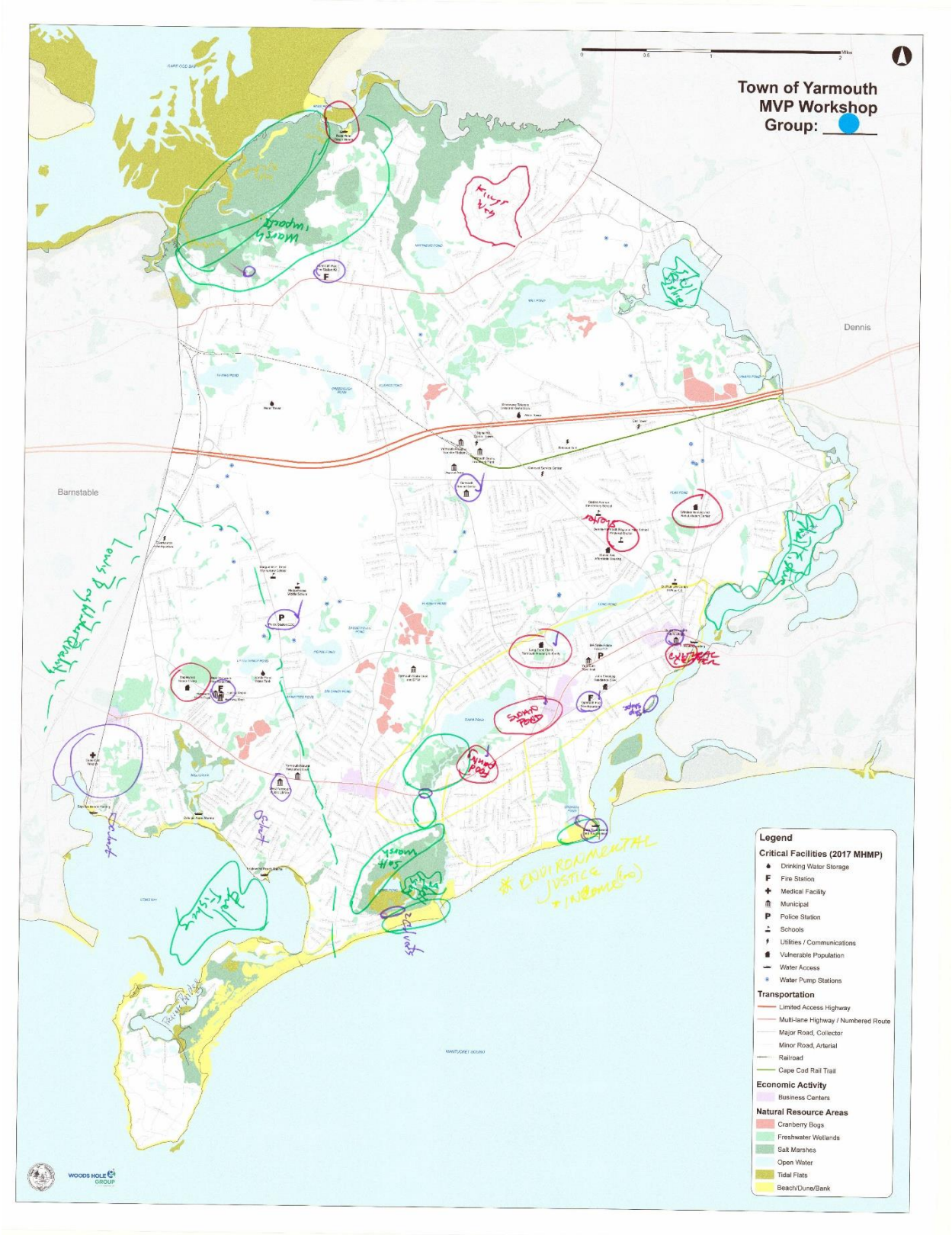
WOODS HOLE GROUP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WOODS HOLE GROUP

Town of Yarmouth MVP Workshop Risk Matrix

V = Vulnerability **S** = Strength
Ownership Types
T = Town **S** = State **F** = Federal **P** = Private

Top Priority Hazards

A) Coastal Flooding/Erosion B) Inland Flooding C) Extreme Cold/Winter Storms D) Heat/Drought/Fire

Infrastructural Features	Ownership	V or S	Societal Features (Americore Rail Trail, Boy Scout camp/Camp Wingate Kirkland)	Ownership	V or S	Environmental Features	Ownership	V or S
Fire station #1 vulnerable	T/S/F/P	V / S	Senior Center	T/S/F/P	V / S	Coastal Beaches - beach houses - bathrooms	T/S/F/P	V / S
Culverts Sea gull Rd Aging culverts	T/S/F/P	V / S	Highschool - Regional shelter DY	T/S/F/P - municipal	V / S	Bass River G C - water quality + all GC	T/S/F/P	V / S
Bass River Bridge	T/S/F/P	V / S	Emergency Services - ambulance - police	T/S/F/P	V / S	Aqua culture - oysters - quohogs - wild shellfish - quality of life	T/S/F/P	V / S
Rt 6 Bridge	T/S/F/P	V / S	EOC - Police Dept.	T/S/F/P	V / S	Salt marshes - SLR - disappearance	T/S/F/P	V / S
Parkers River Bridge	T/S/F/P	V / S	State Police Barracks	T/S/F/P	V / S	Estuary Water quality	T/S/F/P	V / S
Utilities cell cable power - power lines - Internet	T/S/F/P	V / S	~~Town Wide~~ Elderly pop	T/S/F/P	V / S	Land aquisition / undevelop	T/S/F/P	V / S
CC Hospital - access	T/S/F/P	V / S	Assited Living/nursing homes ~~Senior Center~~ memory center.	T/S/F/P	V / S	Wildlife Fisheries - migrating birds - ospreys - herons - sharks	T/S/F/P	V / S
Captains Village	T/S/F/P	V / S	Tourist population	T/S/F/P	V / S	Cranberry Bogs	T/S/F/P	V / S
Traffic Signals -	T/S/F/P	V / S	Environ. Justice	T/S/F/P	V / S	Pine Barren Habitat	T/S/F/P	V / S
Pump stations - back up generators	T/S/F/P	V / S	Storm Recovery -	T/S/F/P	V / S	Open Space ~1/3 of town	T/S/F/P	V / S
Water / cell towers	T/S/F/P	V / S	Marinas - tourism - economic Shipshop - fuel	T/S/F/P	V / S	Lack of Sewer - cesspools - title 5	T/S/F/P	V / S
Generators - multiple municipal buildings	T/S/F/P	V / S	Golf - Bass River golf course most vulnerable	T/S/F/P	V / S	Stormwater Runoff	T/S/F/P	V / S
Gas stations / Grocery w/ Generators?	T/S/F/P	V / S	Fisheries - Jobs!!!	T/S/F/P	V / S	Capped Landfill - plumes methane	T/S/F/P	V / S
Tourist Housing / Infra Hotels Resorts	T/S/F/P	V / S	Trails/Recreation conservation / Vistas	T/S/F/P	V / S	Pesticide spraying - Power lines.	T/S/F/P	V / S
Tidal Restrictions ex - crab creek - bass River	T/S/F/P	V / S	Civic Associations - engaged groups	T/S/F/P	V / S	Water for residents - Water supply	T/S/F/P	V / S
Private septic Systems	T/S/F/P	V / S	Schools - Education aspect	T/S/F/P	V / S	FW Ponds	T/S/F/P	V / S
Solar - ground based	T/S/F/P	V / S	Pre-schools - head start - building	T/S/F/P	V / S	Aquifer	T/S/F/P	V / S

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Infrastructural Features	Ownership	V or S	Societal Features	Ownership	V or S	Environmental Features	Ownership	V or S
Bass River Bridge	T/S/F/P	(V) S	Gray's Beach	(T)S/F/P	(V)/(S)	Water Wells	(T)S/F/(P)	(V) S
Route 28	T/(S)F/P	(V) S	Senior Center	(T)S/F/P	V /(S)	Underground Fuel Tanks	(T)S/F/(P)	(V) S
Willow St (to hospital)	(T)(S)F/P	(V) S	South: West Y. Libraries	(T)S/F/P	(V) S	Lewis Bay Oyster Farm/Shellfish	(T)S/F/(P)	(V)/ S
GA	T/(S)F/P	(V)(S)	Cell Towers	T/S/F/(P)	V / S	Great Island	T/S/F/(P)	V /(S)
Parker's River Bridge	T/(S)F/P	(V) S	Env. Justice Neighborhoods - Capt. Village, Kings Way	T/S/F/(P)	(V) S	Seagull Beach	(T)S/F/P	(V)/ S
Town Hall	(T)S/F/P	(V) S	Nursing Homes/Retirement Communities	T/S/F/(P)	(V)(S)	Bird Habitat - Rovers East Common Terns	(T)(S)F/P	(V) S
Fire Dept./Water Dept.	(T)S/F/P	(V) S	Agriculture/Con. Bogs	(T)S/F/(P)	(V) S	Herring Run - Parkers River - Bowker	(T)S/F/P	(V)/ S
Two Trail Bridges	(T)(S)F/P	(V)(S)	Power Lines/Outages	T/S/F/(P)	(V) S	Fisheries Large Marsh System North Side	(T)S/F/P	(V)/(S)
NH ave/Shore Rd	(T)S/F/P	(V) S	Economics/Tourism/Commercial along 28 (route)	T/S/F/(P)	(V)/(S)	Stage Island	(T)S/F/P	V /(S)
Town Docks	(T)S/F/P	(V) S	Hospital	T/S/F/(P)	(V)(S)	Parker's River Salt Marsh	(T)S/F/P	(V)/(S)
Thatcher Shore Culvert	(T)S/F/P	(V) S	Increased Accidents/Icy Roads	T/S/F/P	(V) S	Marinas	T/S/F/(P)	(V) S
Seagull Beach Culverts	(T)S/F/P	(V) S	Evacuation Plan	(T)S/F/P	(V)(S)	Packet's Landing	(T)S/F/P	(V)/ S
State Police Building	T/(S)F/P	(V) S	Regional Transit Authority	T/S/F/P Regional	(V) S	Landfills/	(T)S/F/P	(V)/ S
Bridgewater State College	T/S/F/(P)	(V) S	Banks	T/S/F/(P)	(V)(S)		T/S/F/P	V / S
Captains Village - Septic Systems	T/S/F/(P)	(V) S	Transfer Station - Trash Removal	(T)(S)F/P	(V) S		T/S/F/P	V / S
DY Schools	(T)S/F/P	V /(S)	Green Community Status	(T)S/F/P	V /(S)		T/S/F/P	V / S
Utilities/Nat. Grid	T/S/F/(P)	(V)(S)	Historic Features: Homes/Museums/ Windmill Baxter Grist Mill 6A Historic District	(T)S/F/(P)	(V)(S)		T/S/F/P	V / S

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Infrastructural Features	Ownership	V or S
★ Seagull Beach Culverts (Aged/Failed Culverts around Town)	T/S/F/P	V / S
Storm Drains / Stormwater Mgmt.	T/S/F/P	V / S
3x Fire Stations	T/S/F/P	V / S
Public Safety Office	T/S/F/P	V / S
Libraries 3x (2x Town 1x Private)	T/S/F/P	V / S
Senior Center	T/S/F/P	V / S
Parkers R. Bridge	T/S/F/P → Funding	V / S
Bass Hole Boat Ramp/Parking	T/S/F/P	V / S
Bass Hole Boardwalk	T/S/F/P	V / S
Electrical Utility	T/S/F/P	V / S
Great Island Bridge/Road	T/S/F/P	V / S
★ Communication (Internet/Cell)	T/S/F/P	V / S
Fuel Delivery (Home Heat Transport)	T/S/F/P	V / S
Healthcare Facilities	T/S/F/P	V / S
★ Low-Lying Roads	T/S/F/P	V / S
Marinas/Fueling Stations	T/S/F/P	V / S
★ Sewer/Septic	T/S/F/P	V / S

Societal Features	Ownership	V or S
★ Long Pond Housing Authority	T/S/F/P	V / S
★ Swan Pond (multi-unit) Low-Income	T/S/F/P	V / S
Food Pantry	T/S/F/P	V / S
★ Kings Way Neighborhood	T/S/F/P	V / S
★ Aging-in-Place Communities	T/S/F/P	V / S
★ Main Bus. District	T/S/F/P	V / S
★ Enut. Justice Comm.	T/S/F/P	V / S
Warming Stations	T/S/F/P	V / S
★ Shelter (DY HS)	T/S/F/P	V / S
Churches / Outreach/Resources	T/S/F/P	V / S
Open Space	T/S/F/P	V / S
Disability Commission	T/S/F/P	V / S
★ Tourism/Boating	T/S/F/P	V / S
Rt. 28 Cemetery	T/S/F/P	V / S
Grocery Stores	T/S/F/P	V / S
Gas Stations	T/S/F/P	V / S
	T/S/F/P	V / S

Environmental Features	Ownership	V or S
★ Salt Marshes	T/S/F/P	V / S
★ Beaches/Dunes	T/S/F/P	V / S
★ ~~Open~~ Conservation Easements/Buffer Zones	T/S/F/P	V / S
Shellfishing Resources	T/S/F/P	V / S
Lewis Bay H_2O Q	T/S/F/P	V / S
★ Tidal Restrictions	T/S/F/P	V / S
Fisheries Resources	T/S/F/P	V / S
Septic Leaching Impacts	T/S/F/P	V / S
Bass River Erosion/Scour	T/S/F/P	V / S
Bass River/Parkers River Shoaling	T/S/F/P	V / S
Wildlife / Wildlife-Based organizations	T/S/F/P	V / S
~~Cape Wide~~ Cable Impacts (Vineyard)	T/S/F/P	V / S
N_2 Runoff (Golf Course, Private)	T/S/F/P	V / S
	T/S/F/P	V / S
	T/S/F/P	V / S
	T/S/F/P	V / S
	T/S/F/P	V / S

Town of Yarmouth MVP Workshop Risk Matrix

WOODS HOLE GROUP

Priority Level:
H = High M = Medium L = Low
Time : S = Short L = Long O = Ongoing

Top Priority Hazards

A) Coastal Flooding/Erosion B) Inland Flooding C) Extreme Cold/Winter Storms D) Heat/Drought/Fire

	Action Items	Hazards Addressed	Priority / Time
Infrastructural Features			
*Culverts	Design/Permit/Fund Mill Lane Culvert, Seagull Beach, Bay View, Thatcher Shores	A/B/C/D	H/M/L S/L/O
Fire Station #1	Feasibility study to Relocate fire station #1 out of flood zone	A/B/C/D	H/M/L S/L/O
Utilities – Internet/Cable	Investigate expansion of Open Cape. (fiber optics network)	A/B/C/D	H/M/L S/L/O
*Waste water (lack of sewer)	Complete phase I of ~~the~~ sewering Rt 28 + South Shore drive	A/B/C/D	H/M/L S/L/O
Societal Features			
Town Function –	Review/update by-laws to adapt to hazards	A/B/C/D	H/M/L S/L/O
*Storm Preparedness	Conduct annual/town meeting of ~~offices/dept~~ dept. to discuss preparedness + implement public educational outreach emergency/hazard	A/B/C/D	H/M/L S/L/O
*Storm Recovery	Develop a post storm recovery plan for town	A/B/C/D	H/M/L S/L/O
Elderly Population/Vulnerable Pop	Conduct a "need Study" of Vulnerable pop and create a preparedness plan to serve those populations for hazard response.	A/B/C/D	H/M/L S/L/O
Environmental Features			
Coastal Beaches	~~dam~~ Create and implement Education Strategy and beach maintainment → private properties Regarding Coastal erosion, Shoreline Protection	A/B/C/D	H/M/L S/L/O
Salt Marsh/Habitat – Run Pond crab creek millpond	Conduct hydrological ecosystem study to understand any tidal/infrastructure restrictions for restoration purposes	A/B/C/D	H/M/L S/L/O
Salt marshes	Feasibility study to identify ways to protect, conserve, bolster Great Salt marsh from the impact of SLR	A/B/C/D	H/M/L S/L/O
*Land acquisition/underdevelopment	Identify parcels that could lead to undevelop land for land acquisition or protection. Include repetative loss, dead prop, high ~~risk~~ vulnerable properties to SLR	A/B/C/D	H/M/L S/L/O

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	Action Items	Hazards Addressed	Priority / Time
Infrastructural Features			
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
Societal Features			
Tourism	Coordinate w/ town businesses/Hotels/Resort/rental prop. Re: relaying info to guests. Help implement edu. outreach.	A/B/C/D	H/M/L S/L/O
Gas Stations/Grocery stores/Supplies/Drug Stores	Conduct town inventory for in-house generators and facilities capabilities of storing supplies/perishables like food/medication	A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
Environmental Features			
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O

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	Action Items	Hazards Addressed	Priority / Time
Infrastructural Features			
* Fire Department	Centrally located & reinforced new office – abandon previous station located in flood hazard (Stations 1 & 2)	(A)(B)(C)(D)	(H)/M/L S/(L)/O
Resizing Undersized Culverts	Prioritize & replace undersized culverts throughout the town Address inland flooding & stormwater run off	(A)(B)C/D	H/(M)/L S/L/(O)
* Infrastructure Vulnerability Assessment	Assess & prioritize town infrastructure assets & their vulnerabilities to coastal resiliency	(A)(B)(C)D	(H)/M/L S/L/O
** Septic/Wastewater Issues	Using existing DY Wastewater Treatment System to address vulnerable communities to septic, including Capt's Village	(A)(B)C/D	H/(M)/L S/(L)/O
Societal Features			
*** Communications	Reinforce current cellphone towers & augment emergency communication capibilities	A/B/(C)/D	(H)/M/L (S)/L/O
Senior ~~Center~~/populations	Providing back-up power & resources for senior & vulnerable populations during emergencies	(A/B/C/D)	H/M/(L) S/L/(O)
~~Shelter Capacity~~ Education/Outreach Vulnerable Populations	~~Increase~~ Reach out to vulnerable individuals to identify those that need additional help during an emergency	(A/B/C/D)	(H)/M/L ~~S~~/L/(O)
		A/B/C/D	H/~~M~~/L S/~~L~~/O
Environmental Features			
Septic/Other Waste	Identify emergency storage	(A)(B)C/D	H/(M)/L S/(L)/O
** Water Wells	Addressing & protecting clean water (potable) – Concerns near septic	A/(B)/C/D	(H)/M/L S/(L)/O
**** Dune Protection/Restoration	Protect & increase dune restoration along the coast	(A)(B)(C)D	(H)/M/L S/(L)/O
**** Marsh Restoration	Increase marsh restoration for protection of the coastal resources - Stage Island,	(A)(B)/(C)/D	(H)/M/L S/(L)/O

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	Action Items	Hazards Addressed	Priority / Time
Infrastructural Features			
Bylaws	Update bylaws with climate considerations	A/B/C/D	H/M/L S/L/O
*** Back Up Power / Communication	Create additional back up power sources for emergency facilities ; communications, potentially battery source	A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
Societal Features			
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
Environmental Features			
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O

Town of Yarmouth MVP Workshop Risk Matrix

WOODS HOLE GROUP

Priority Level:
H = High **M** = Medium **L** = Low
Time : **S** = Short **L** = Long **O** = Ongoing

Top Priority Hazards

A) Coastal Flooding/Erosion B) Inland Flooding C) Extreme Cold/Winter Storms D) Heat/Drought/Fire

	Action Items	Hazards Addressed	Priority / Time
Infrastructural Features			
★ Aging / Failing Culvert (s)/ Catch basins	Comprehensive assessment of vulnerable culverts / catch basins Town-wide. Implement highest priority projects.	A/B/C/D	H/M/L S/L/O
Low-Lying Roads	Comprehensive assessment of low-lying roads vulnerable to coastal / inland flooding. Implement highest priority projects.	A/B/C/D	H/M/L S/L/O
★ Communications (cell, internet)	Define "code red" communication. Develop comprehensive strategy for equitable access to cell / WiFi community-wide.	A/B/C/D	H/M/L S/L/O
★ Sewer/Septic	Continue to develop / implement Town-wide plan. Continue to work w/ adjacent communities to maximize resilience.	A/B/C/D	H/M/L S/L/O
Societal Features			
★ Aging-in-Place / Vulnerable Populations (Envt. Justice +)	Review definition / context of ~~environmental~~ justice - see if possible to include aging-in-place populations / vulnerable populations. Develop dataset re: weakest / most vulnerable populations w/i community. Targeted wellness checks / evacuations. Better understand specific needs of vulnerable populations.	A/B/C/D	H/M/L S/L/O
Sheltering Alternatives / (Warming + Cooling Stations)	Develop municipal plan using available data sources ~~for developer suite~~ → identify suite of alternatives for sheltering - based on intensity of event. Develop strategy (communication) for outreach / notification → redefine "code red communication"	A/B/C/D	H/M/L S/L/O
Main Business District	Develop protocol for communication between municipality ↔ bus. community in the event of emergency. Inventory of existing businesses - what businesses have emergency provisions (generator, etc.). Help local businesses plan/prepare for impacts → empower businesses to take an active role in community.	A/B/C/D	H/M/L S/L/O
Tourism / Amentities	Increase awareness of amentities / features available to seasonal visitors. Emergency communication recommendations / checklists / protocols for visitors.	A/B/C/D	H/M/L S/L/O
Environmental Features			
★ Salt Marshes	Evaluate existing s.m. resources and associated vulnerabilities. Identify opportunities to build / enhance s.m. resilience. Review of existing wetland bylaws to incorporate climate resilience / BMPs.	A/B/C/D	H/M/L S/L/O
Beaches / Dunes	Build resilience of existing beach / dune resource areas. ID strategies for beach/dune MGMT; opportunities to expand existing comprehensive dredge / disposal permits (addl. sites, new shoaling, etc.) and renew	A/B/C/D	H/M/L S/L/O
Tidal Restrictions	ID opportunities for ecological restoration project implementation / development. → Directly address H_2OQ concerns; shellfish impacts.	A/B/C/D	H/M/L S/L/O
Conservation Easements / Buffers	Town-wide assessment of vulnerable parcels / areas / locations. Develop strategies for community education re: ~~vulnerable~~ vulnerabilities / opportunities for retreat; de-construction	A/B/C/D	H/M/L S/L/O

Yarmouth Municipal Vulnerability Preparedness (MVP) Program Workshop
3/22/2019
Red Group Notes
Scribe: (AmeriCorps Cape Cod)

(9:45) Small Group Discussion:

- Mapping flood prone areas (coastal and inland/road) based on experience/record
    - Apache and Rte 6A
    - Eroding culvert on Seagull
    - Captains Village neighborhood, Cedar swamp high ground water flooding
    - South Yarmouth barrier beach is eroding/breaking through
    - North Yarmouth beach is eroding

Infrastructural Features

- Fire Station #1- Town (Vulnerability)
    - 500 year flood zone, vulnerability
    - Fire Station #2 and #3 are strengths
- Failing Culverts – Town (Vulnerability)
    - Seagull Road
- Bass River Bridge, Rte 6 Bridge, Parkers River Bridge – State (Vulnerability)
    - Flooding, Storm Surge, Collapse
    - Underground utilities susceptible to failure
    - Power, Internet, Cable, Cellular
- Underground utilities – Town (Vulnerability)
    - Above Ground utilities should have been built to be resilient
- Cape Cod Hospital – Private (Vulnerability)
    - Floodzone, WHOI received grant to study and mitigate flooding potential
    - Access to, and operation of hospital
- Captains Village – Private (Vulnerability)
    - High Discharge, flooding
    - Roads are mix of public and private
    - Village owned by residents
- Traffic Signals – Town/State (Vulnerability
    - Rte 28, Four Corners, Forest Road, Station Ave, Willow Street, Higgins Crowell Road, Buck Island, Exit 8
    - Power Outages, emergency access
- Pump Stations – Town (Strength/Vulnerability)
    - Backup Generators, susceptible to failure
- Water Towers – Town (Strength/Vulnerability)
    - Cellular boosters on them, susceptible to failure
- Multiple Municipal Facilities – Town (Strength)
    - Backup generators

- Gas Stations/Grocery Stores – Private (Strength)
    - Backup generators (unknown if all have them), critical fueling stations
    - Concern if stores use backup generator, citizens might use stores despite being told not to go outside
- Tourist Housing and Infrastructure – Private (Vulnerability)
    - Hotels, Restaurants, recreation etc
- Tidal Restrictions – Town and State (Strength and Vulnerability)
    - Crab Creek, Bass River
- Private Septic Systems – Private (Vulnerability)
    - Susceptible to failing
    - Loss of property
    - Infrastuctural, societal, environmental impacts
- Ground Based Solar Arrays – Private and Town (Strength/Vulnerability)
    - Roofs for parking lots

Societal Features

- Senior Center – Town (Strength)
    - Backup generator, warming and cooling shelter (Local shelter)
- Dennis Yarmouth High School – Town (Strength)
    - Regional Shelter (REPC)
- Emergency Services – Public (Vulnerability and Strength)
- EOC – Police Department – Town (Strength)
    - Backup Generator
- State Police Barracks – State (Strength)
    - Backup Generator
- Elderly Population – Town (Vulnerability)
    - Mobility challenges
    - Minimal public transportation
    - Vulnerable health issues, exacerbated by power outage
    - Facilities could lose backup generators as well (Cape Cod Hospital)
    - Senior Homes (3 in town) can take additional senior populations (Private) (Strength)
- Maplewood Memory Center – Private (Strength)
- Tourist Population – Private (Strength/Vulnerability)
    - Don’t know who’s in town
    - Services meant for permanent population might be over capacity
    - Upwards of 75,000 additional people in town during summer season
- Environmental Justice – Town (Vulnerability)
    - Storm response and recovery, particularly financially
    - Those who can’t afford large scale property recovery
- Marinas – Town/Private (Strength/Vulnerability)

  - Economic Income with tourism season
  - Fuel Storage at Ship Shops (Private)
  - Water Quality
- Golf Courses – Private (Strength/Vulnerability)
  - Economic Source, drives hospitality
  - Outrageous Coastal Footprint
- Trails, Recreations, and Vistas - Town (Strength)
  - Conservation
- Aquaculture and fisheries –Town/Private (Strength/Vulnerability)
  - Driver for economic, cultural and tourism development
  - Quality of life
  - Loss of aquaculture leads to job loss
- Civil Associations – Private (Strength)
  - Engaged citizenry
- Schools and education aspect – Town (Strength)
  - Educating the youth about climate change
  - Environmental activism
- Preschools –Private (Strength/Vulnerability
  - Structure and critical population
  - Environmental education
  - Head Start Preschool especially susceptible
- Boy Scouts, Windgate Senior Residences and Rail Trail – State, Private (Strength/Vulnerability)
- AmeriCorps Cape Cod!!! – Federal (Super Strength)

Environmental Features

- Coastal Beaches – Town/Private (Strength/Vulnerability)
  - Erosion, coastal storm surge
  - Economic and recreational asset for town
  - Housing, Parking lots, Bathrooms
- Bass River Gold Course – Private (Strength/Vulnerability)
  - Water Quality and coastal vulnerability
- Aquaculture-Town/Private (Strength/Vulnerability)
  - Oysters and Quahogs
  - Water quality
- Salt Marshes – State (Strength/Vulnerability)
  - Buffers storm damage
  - Carbon Storage and intake
  - Loss to sea level rise
  - Crab Creek, Mill Pond, Run Pond
- Estuary Water Quality – Town,State,Private, Federal (Strength/Vulnerability)

    - Loss of production and storage of contaminants
- Land Acquisitions – Town (Strength)
    - Undevelop
- Wildlife Fisheries – Town,State,Private,Federal (Strength/Vulnerability)
    - Loss of habitats for birds, fisheries, environmental production
    - Migrating Ospreys, herons, sharks
- Cranberry Bogs-Town,Private (Strenth,Vulnerability)
    - Loss due to market dip, lapse in cultivation
    - Economic and Environmental Strengths and Vulnerabilities
- Pine Barren Habitat – Town (Strength/Vulnerability)
    - Wildfires, Insects and diseases
    - Recreational strength
- Open Space – Town (Strength)
    - Approximately 1/3 of Town is open space
- Lack of Sewage infrastructure – Town, State, Private (Vulnerability)
    - More commercial sewer south of 6, near coast
    - Cesspools, Title V septic systems
- Storm Water Run-Off- Town,State (Strength/Vulnerability)
    - Straight discharges into marshes and cesspools from roads
    - Pollutants
    - South of 28, water flowing into Title V zones
- Capped Landfills – Town (Vulnerability)
    - Pollution plumes increased from flooding and increased precipitation
    - Methane flare being closely monitored, increased by warmer temperatures
- Pesticide Spraying – Private (Vulnerability)
    - Power lines through environments
    - Warmer temperatures leads to large insect population, more use for hazardous chemicals and pest/insecticides
- Residential Water Supply – Town (Vulnerability)
- Fresh Water Ponds – Town,Private (Strength/Vulnerability)
- Single Source Aquifer – Town, State, Private, Federal (Strength/Vulnerability)

12:45 Small Group Discussion

Infrastructural Features

- Culverts
    - **Action Item:** *Design/Permit/Fund Mill Lane, Seagull Beach, Bay View, Thatcher Shore, Culverts*
    - **Hazards:** *Coastal Flooding/Erosion, Inland Flooding, Extreme Cold/ Winter Storms*
    - **Priority/Time:** *High/Long Term*
- Fire Station #1
    - **Action Item:** *Feasibility to relocate fire station #1 out of flood zone*

    - **Hazards:** *Coastal Flooding/Erosion, Inland Flooding*
    - **Priority/Time:** *High/Long Term*
- Underground Utilities (Internet and Waste Water)
    - Hydrological forces can breach and rupture underground storage
    - Utility redundancy for internet
    - Use digging operations to investigate waste water potential when the ground is open
    - Water, waste water, electricity, internet, cable
    - Open Cape Network does not yet exist yet for Yarmouth, It does in Barnstable
    - **Action Items:** *Investigate expansion of Open Cape Network (Fiberoptic)*
    - **Hazards:** *Extreme Cold/Winter Storms*
    - **Priority/Time:** *Medium/Long Term*
    - **Action Items:** *Complete Phase I of Sewer Backbone along Rte. 28 and South Shore Drive*
    - **Hazards:** *Coastal Flooding/Erosion*
    - **Priority/Time:** *High/Long Term*
- Gas Stations and Grocery stores
    - Inventory of their supplies and fuel pumps, storage and generators
    - Are their employees/staff going to be present?
    - MOU of remaining open during storms for storm response operation
    - Stocking shelters with food (milk, water etc)
    - Location, distribution and expiration of supplies
    - **Action Items:** *Conduct town inventory for in house generators and facility capabilities for storing supplies and perishables like food and medication*
    - **Hazards:** *Coastal Flooding/Erosion, Inland Flooding, Extreme Cold/Winter Storms, Heat/Drought/Fire*
    - **Priority/Time:** Low*/Ongoing*

Societal Features

- Town Functions
    - **Action Items:** *Review/update bylaws to adapt to hazards*
    - **Hazards:** *Coastal Flooding/Erosion, Inland Flooding, Extreme Cold/Winter Storms, Heat Drought Fire*
    - **Priority/Time:** *High/Long term, Ongoing*
- Storm Preparedness
    - Town and county resources towards disaster preparedness (storms particularly)
    - Encourage more preparation through education and outreach
    - Tabletop Exercises in municipalities
    - Critical groups and organizations collaboration
    - Annual conversations with multiple municipal agencies (DPW, DNR, Public Safety, Planning etc…)

  - Educating public about Sheltering and emergency response plan from county (REPC, MACC etc…)
  - Keep the residents aware of the response effort, keeps residents comforted through the storm
  - Inter-Town and Inter Department communication during storms
  - **Action Items:** *Conduct Annual Town meetings with departments and organizations to discuss emergency/hazard preparedness and implement public educational outreach*
  - **Hazards:** *Coastal Flooding/Erosion, Inland Flooding, Extreme Cold/Winter Storms, Heat/Drought/Fire*
  - **Priority Time:** *High/Long Term*
- Storm Recovery
  - Permitting process at building department
  - Debris management plan
  - Access to grants for mitigation
  - Indentifying roles of town staff and volunteers, state and federal resources
  - Opening Shelters and Multi Agency Coordination Center (MACC)
  - **Action Items:** *Develop a post storm recovery plan for town*
  - **Hazards:** *Coastal Flooding/Erosion, Inland Flooding, Extreme Cold/Winter Storms, Heat/Drought/Fire*
  - **Priority Time:** *High/Long Term*
- Elderly and Vulnerable Population
  - Limited Mobility, lack of public transportation, lack of safe transportation in wintry conditions
  - Several needs of population, physical and mental health, financial need etc.
  - Limited outreach about pre-event alerting of elderly population ("T-12 Hours to storm")
  - Open Shelters well in advance, sheltering volunteers don't want to leave homes
  - Gather list of elderly and vulnerable population and their needs from facilities and organizations in community
  - **Action Items:** *Conduct a 'need study' of vulnerable population and create a preparedness plan to serve those populations for hazard response*
  - **Hazards:** *Coastal Flooding/Erosion, Inland Flooding, Extreme Cold/Winter Storms, Heat/Drought/Fire*
  - **Priority/Time:** *High/Ongoing*
- Tourism
  - **Action Items:** *Coordinate with business community to provide information with guests, particularly during storm season about storm preparedness, available resources, evacuation route, without scaring guests away*
  - **Hazards:** *Coastal Flooding, Extreme Cold/ Winter Storms*

- **Priority/Item:** *Medium/ Ongoing*

Environmental Features

- Coastal Beach Renourishment
  - Dredge sand from local sources, have to get private property owners permits for dredge
  - Incentivize private residents through lower costs associated with town operated dredge
  - Change bylaws to prohibit and restrict beach armoring,
  - Sand dredged by town onto town beaches naturally ends up on private beaches
  - Educational/outreach piece to property owners
  - **Action Item:** *Create and Implement Education Strategy to Private Property owners, regarding coastal beach renourishment, coastal erosion, shoreline protection*
  - **Hazards:** *Coastal Flooding/Erosion*
  - **Priority/Time:** *Medium /Long Term and Ongoing*
- Salt Marsh Habitat Restoration
  - Run Pond, Crab Creek, Mill Pond
  - Threatened by sea level rise
  - Study raising profile of salt marshes against sea level rise
  - Develop plan to make salt marsh more robust and durable, modify cranberry bogs to act as buffer
  - **Action Item I:** *Conduct hydrological ecosystem study to understand any tidal/infrastructure restriction for restoration purposes (Run, Crab, Mill)*
  - **Hazards:** *Coastal Erosion/Storm, Inland Flooding*
  - **Priority/Time:** *Medium**/**Long Term*
  - **Action Item II:** *Feasibility study to identify ways to protect, conserve, bolster Great Salt Marsh from the impacts of sea level rise*
  - **Hazards:** *Coastal Flooding/Erosion, Inland Flooding, Extreme Cold/Winter Storms*
  - **Priority/Time:** *High/Long Term, Ongoing*
- Land Acquisition and Undevelopment
  - Purchasing properties and structures immediately threatened by coastal storms and sea level rise, always facing problems won't be able to sell , structurally unsound
  - **Actions Items:** *Identify parcels that could lead to undeveloped land for land acquisition or protection include repetitive loss and ongoing threat from sea level rise*
  - **Hazards:** *Coastal Flooding/Erosion, Inland Flooding*
  - **Priority/Time:** *High/Long term, Ongoing*

Top Five Actions:

Culverts; Sewer; Storm Response; Storm Recovery; Land Acquisition

Yarmouth Municipal Vulnerability Preparedness (MVP) Program Workshop
3/22/2019
Green Group Notes
Scribe: (AmeriCorps Cape Cod)

Small group #1-

- Priority: Keeping Route 28 open for emergency vehicles because it is the most direct route to the hospital but everything south is in a flood zone
    - Willow St. to the hospital
- Strength: 6A being state owned and has funding for repairs, All DY schools on high ground and serve as shelters during storms
- Weakness: Parker's River Bridge, Senior housing north of 6A in flood zones, NH Ave. & Shore Rd. under water during "sunny day tides", Town Hall's past flooding issues, cell towers and current reception issues.
    - Entire area south of Route 28 will be under water during flood/storm surge, built during 7-year drought.
- Nursing homes have the potential to be a strength by being privately owned and having their own evacuation plan but this proved to be a failure last year when generators broke and entire nursing facilities moved into Cape shelters
- Great Island is privately owned. The owners have the resources to fix any damages that occur to this property and also have the funding to make the property more resilient, further protecting inland public land.
- Current evacuation plan- many people do not leave or evacuate, ultimately left behind.
- RTA- strength for getting mass amounts of people over the bridge but once the roads close or are generally unsafe they close down as well.

Small group #2-
Infrastructural

- Resizing undersized culverts- the town already has a list of all culverts, prioritizing/replacement can be done quickly. (Address inland flooding or keep separate?) (M&O)
- Fire department- centrally located, close stations 1 and 2 (see chief) (#4)
- Infrastructure vulnerability assessment- see where storm water will go first to know how to prioritize. (H&S) (#3)
- Septic vulnerability- use existing DY wastewater system to address environmental justice issues, inland flooding due to groundwater (Captain's village) (M&L)
- Bylaws- update with climate considerations (L&O)
- Backup power source for emergencies- Eversource being fined $1 mil/day is unrealistic, putting powerlines underground (Last year's storms) (FD has new mobile generator)

Societal

- Communication- reinforcement of cell towers due to strategic placement, social media (H&S) (#2)
- Senior center/population- back up power so we don't have to relocate (already addressed) (H&O) review and expand list of vulnerable individuals, expand educational outreach (Code RED)
- Tourism- evacuating mass amounts of tourists, their knowledge of current evacuation plan, extra sheltering capacity for growing population and neighboring towns (already addressed) All schools have the ability to be shelters

Environmental

- Water wells- potential leeching of chemicals, protecting clean water (H&L) (#5)
- Emergency trash plan
- Landfill/Septic waste- identify temporary emergency storage (M&L)
- Dune Protection- protect and increase restoration, grass planting, marsh restoration for protection from coastal erosion (stage island) (H&O) (#1)

Yarmouth Municipal Vulnerability Preparedness (MVP) Program Workshop
3/22/2019
Blue Group Notes
Scribes: Collin Buckner & Amberly Bark (AmeriCorps Cape Cod)

Small Group: Identifying Vulnerabilities and Strengths

Infrastructure

- (Negative) Flooding and sea rise (Parker River Bridge)
- (Negative) No sewer system
- (Negative) Non-single event high water
- (Negative?) Ship Shop In-ground tank and other marinas/fuel infrastructure
- (Negative) Fire Station in flood plain
- (Negative) Most of route 28 in flood plain or flood often
- (Negative) 6A and Station Ave can be blocked during high precipitation events and flooding
- (Positive) DY High School as primary shelter/warming/cooling station
    - Difficulty in communication, especially with older population
    - Transportation to shelters from aging communities
- (Negative) Warming/cooling stations like the library only open during office hours
- (Negative) Culverts are failing everywhere
- (Negative) Storm drains – were engineered without as much concern for high precipitation events

Societal Features

- Swan Pond (Prone to Flooding)
- Aging communities
- No ADA commission in place
- Low income housing prone to flooding
- Tourism -

Environmental Features

- Losing marsh in South Yarmouth
- Possible changing of landscape in North Yarmouth due to lengthening creek from Dennis Coastline
- Luis Bay losing sediment, housing developments there could be compromised
- Possible Great Island isolation from marsh flooding
- Route 6 is causing tidal restrictions
- Septic system leaching because of flooding – talked about possibility of sewer system

- Wildlife/ IFAW/ animal response/ animal shelters – need to be protected

Small Group: Resilience Building Actions

Infrastructure

- Culverts/Parker River Bridge – assessments of culverts in addition to the ones the town already knows about
- Low Lying Roads
- Cell Towers/Improved – Zoning issue. When. Private and municipal communication
- Police and Fire Communication Center – Police have to refer calls to fire
- Public Information System during an emergency (Need)
- Sewer Septic System (Need)
- Communication Cod Red System needs to be (re)defined. Used now for non-emergencies. Need policy in place that addresses all populations including vulnerable communities. Cannot assume everyone has WiFi access in their homes.

Societal Features

- Aging-in-place communities including other vulnerable populations (low income, minority, etc.)
- Eversource life saving device registry (Not available)
- Databases in general need improvement
- What vulnerable populations cannot remain in their homes during an event.
- Shelters/Warming-Cooling stations
- Shelter Knowledge needs to be disseminated (Food, Healthcare, Animals, Available resources at Shelters).
- Lack of Communication of Municipality to Business community is heavily lacking.
- Tourism and Amenities
- Plan for vulnerable communities in crisis
- Surveyed high school seniors to asses vulnerable households
- Life saving device registry. Eversource used to collect this information, but no longer does, so it is up to Yarmouth to have this data readily available – targets the weakest and most vulnerable populations
- No formal communication protocol for business districts. Hotels/business open their space for emergency professionals, but there is no communication plan in place. What businesses have backup generators and are able to open in times of emergencies?

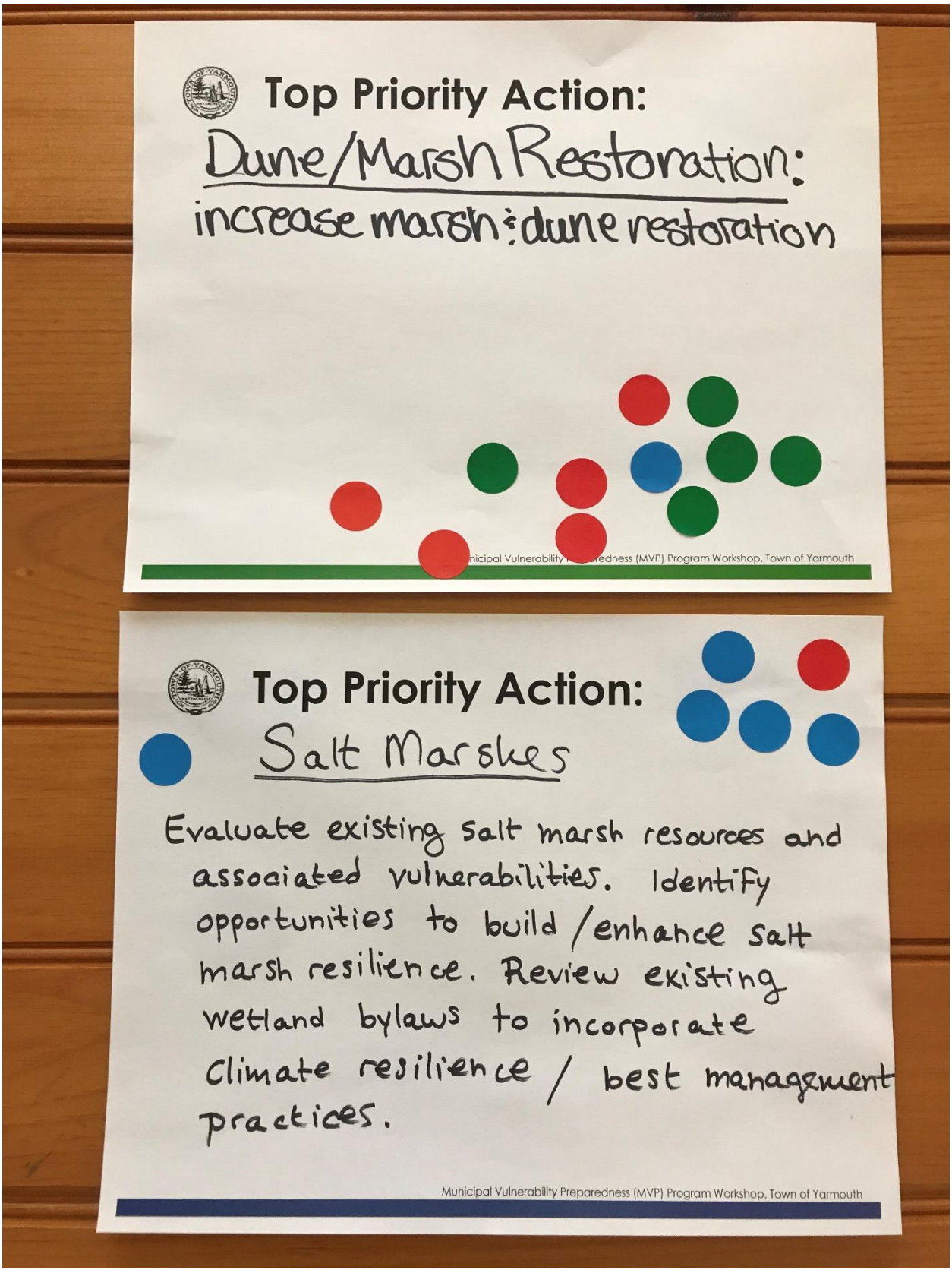
- The town helps small businesses better prepare/deal with storms, and in turn, businesses can help residents deal with emergencies by providing shelter, support, and resources
- Having hotels, Airbnbs, etc. reach out to customers during in an emergency. County sends alert to business, and business text or call tenants

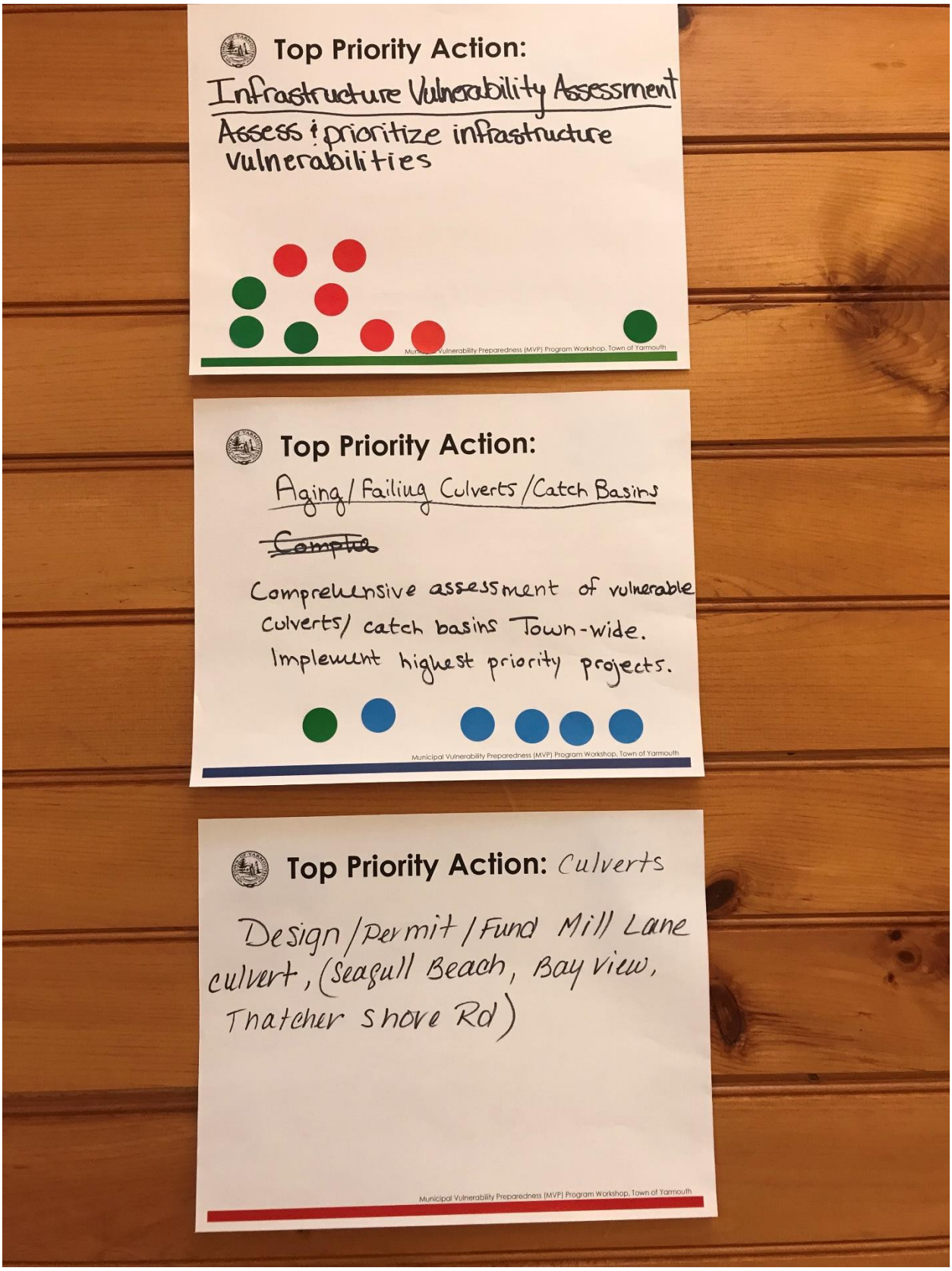
Environmental Features

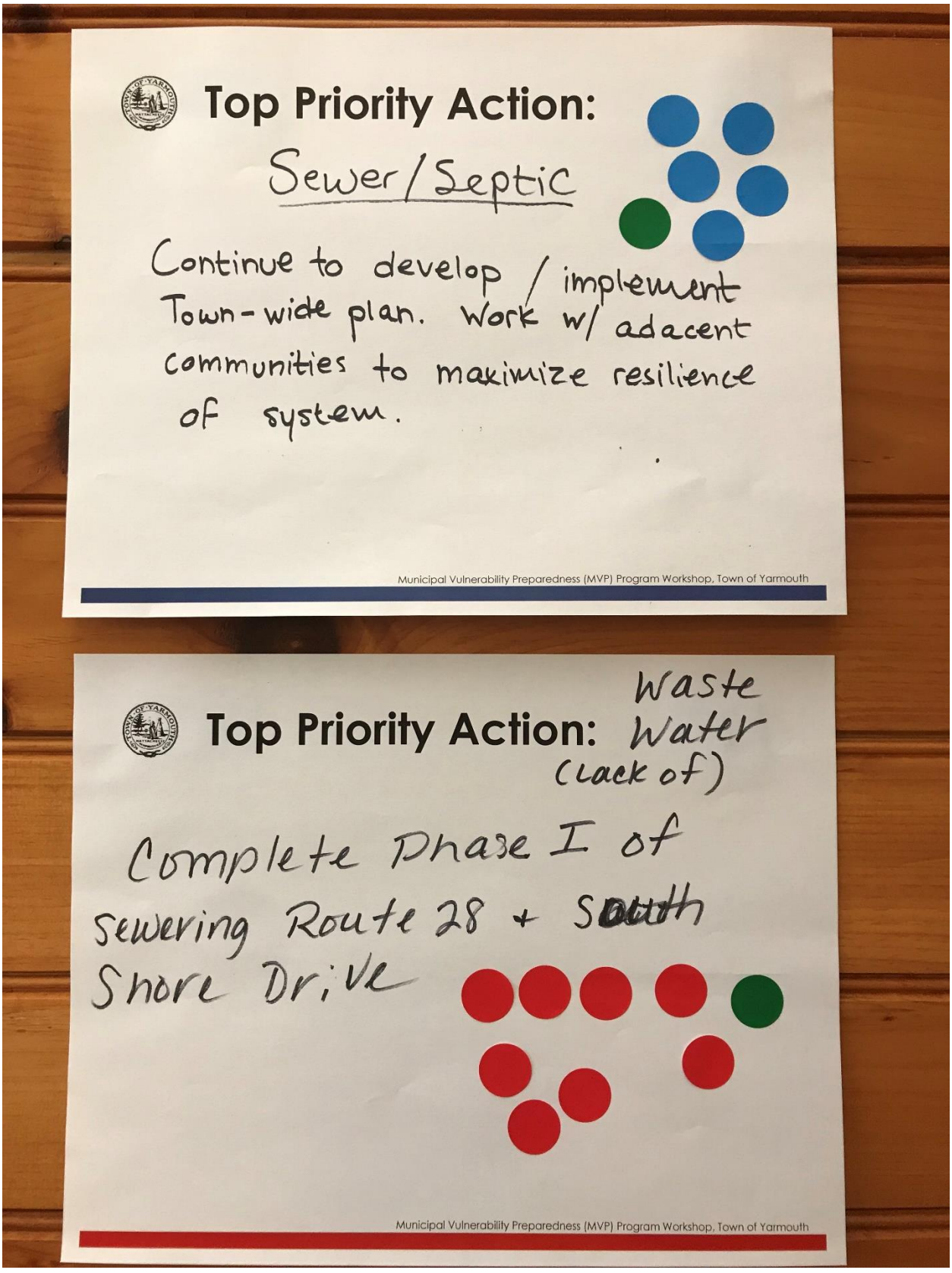
- Salt Marsh – Evaluation of salt marshes resources and associated potential vulnerabilities. Identify opportunities to enhance salt marsh resilience.
- Beaches/Dunes – Building resiliency of existing beach/dune resource areas.
- Renew Beach/Dune Permit
- Sea level rise effect barrier and buffer beaches for natural resource and recreation/tourism use.
- Tidal restrictions
- Opportunities to acquire conservation easement land to act as buffer zones too.
- Aforementioned topics address underlying issues as well such as shellfishing, and nitrogen runoff.
- Parcels purchased by town over the years
- Taking properties off tax roles
- Why effort to raise and replace (knock down a building just to replace it) given the sea rise
- Town wide assessment of vulnerable parcels

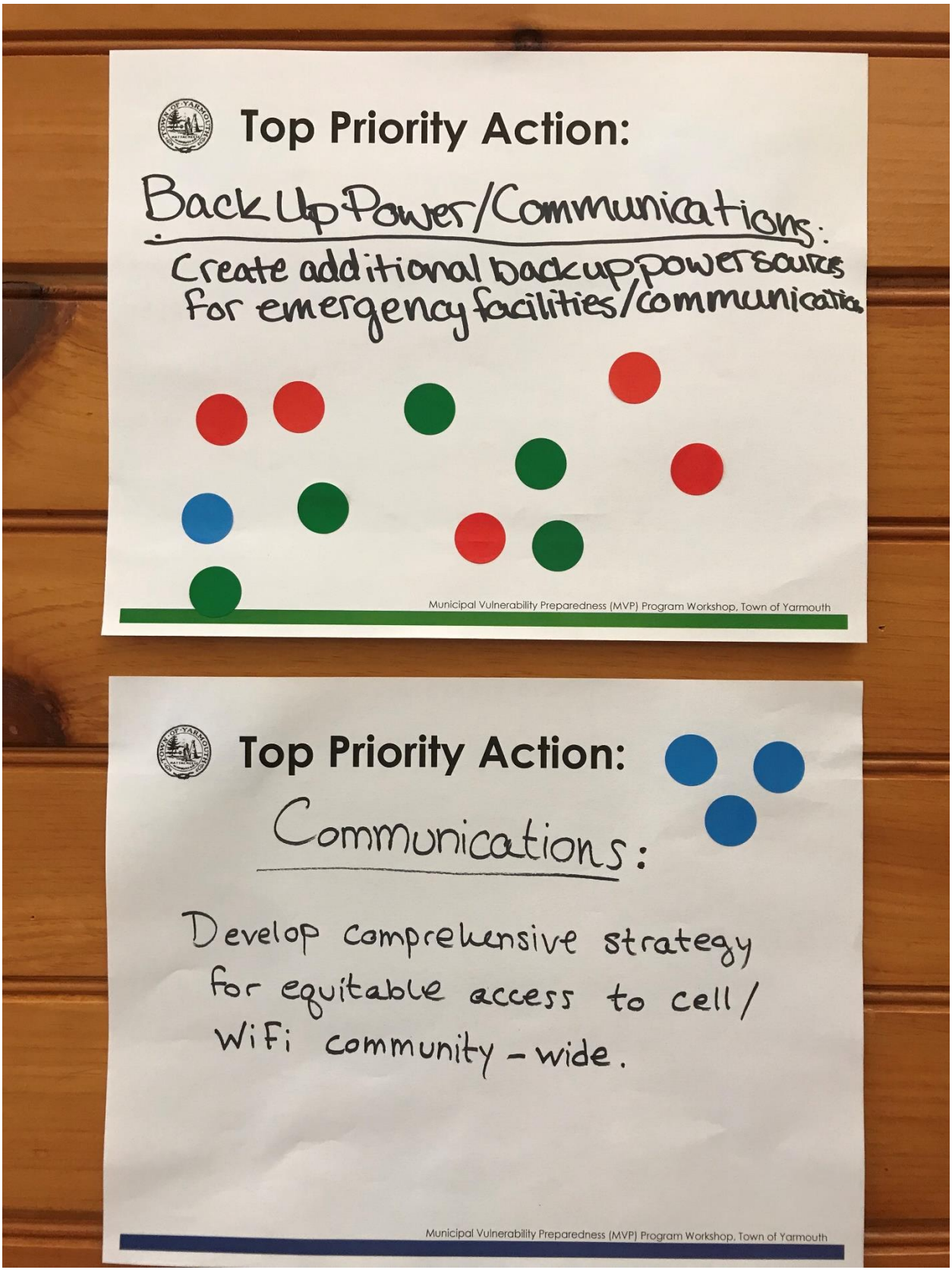
Top 5 Priority Hazards:

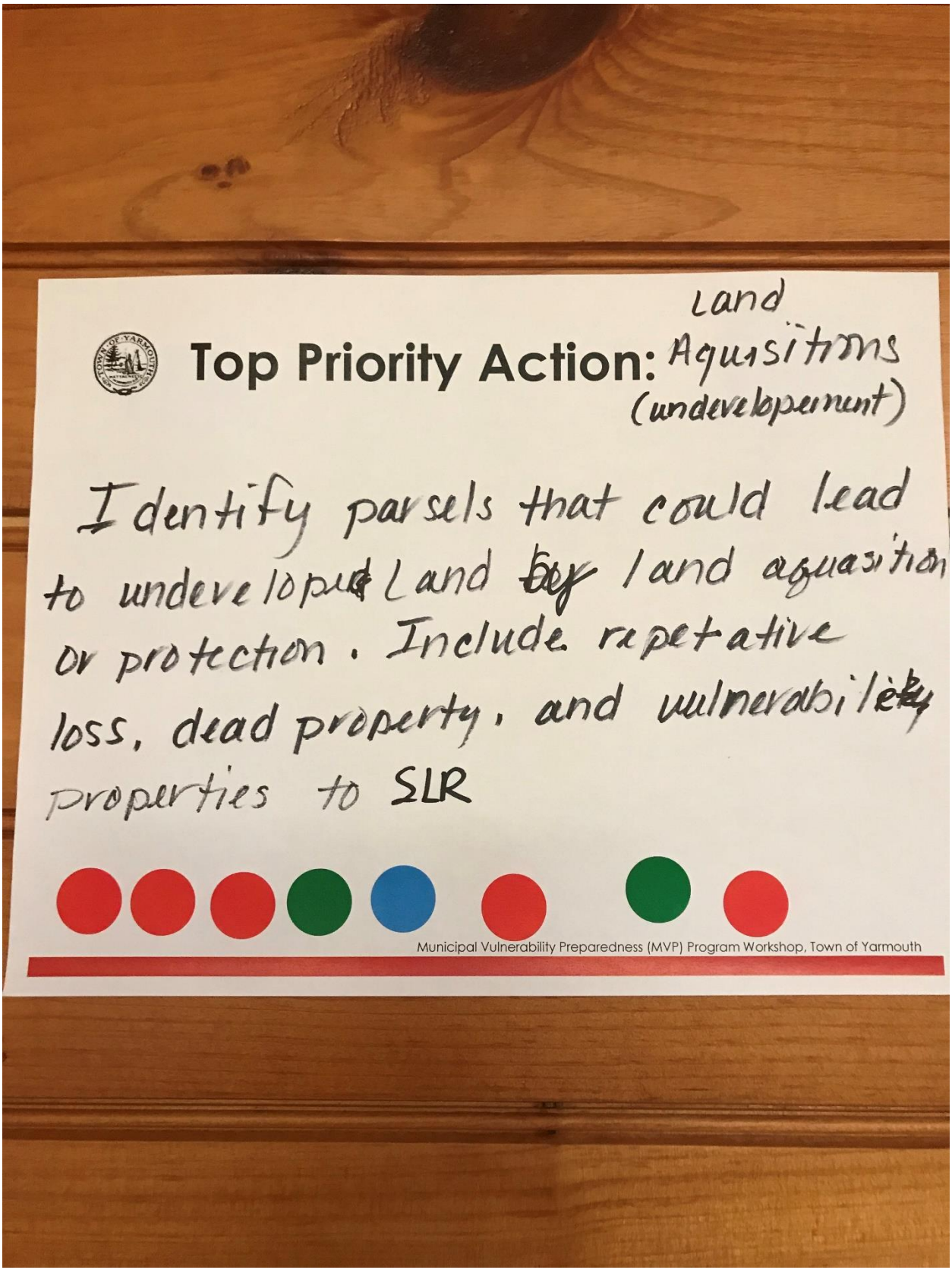
Culverts; Communication; Salt Marshes; Aging-in-Place and Vulnerable Populations; Sewer/Septic

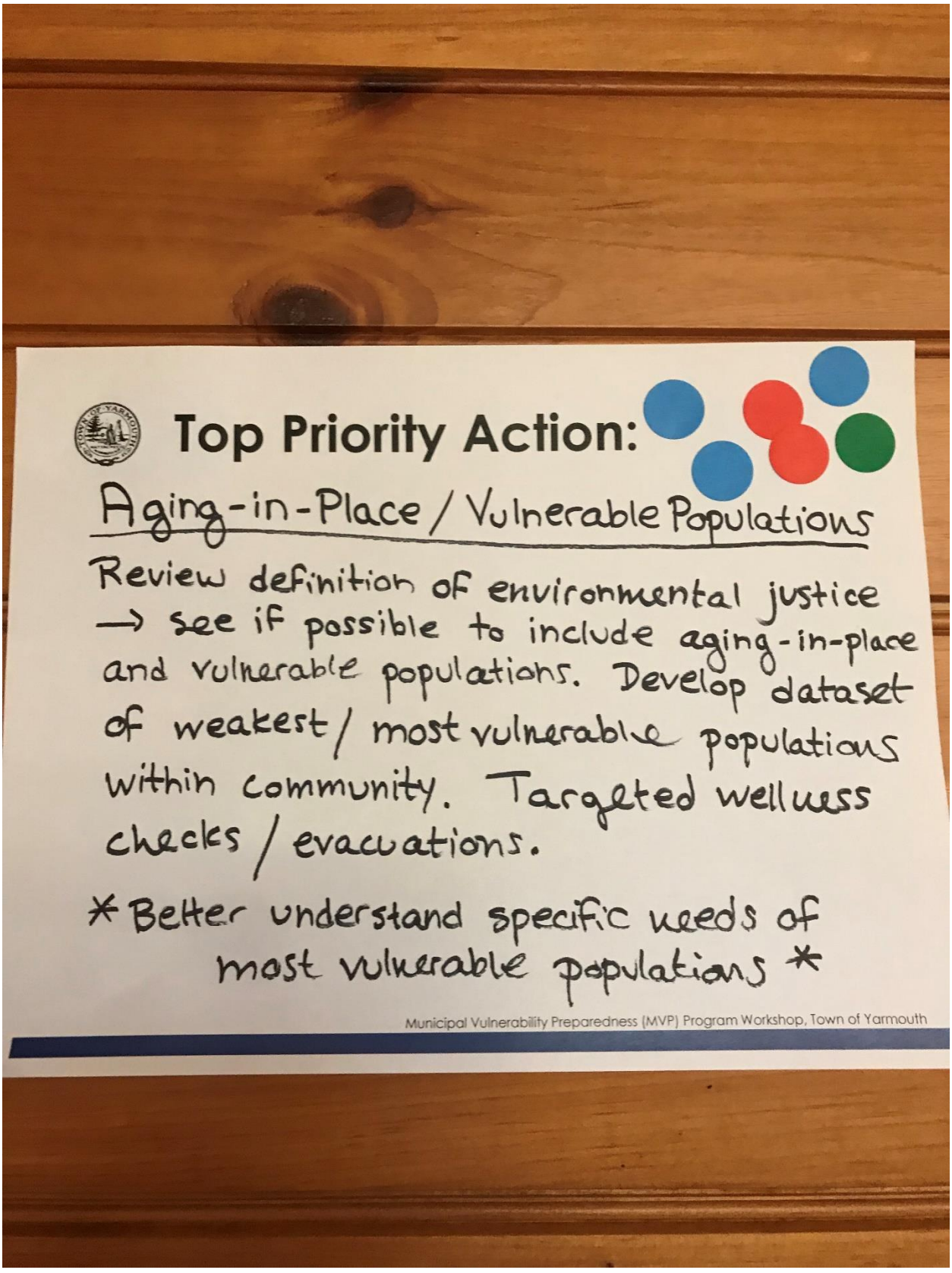

Top Priority Action:
Dune/Marsh Restoration:
increase marsh : dune restoration
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth
Top Priority Action:
Salt Marshes
Evaluate existing salt marsh resources and associated vulnerabilities. Identify opportunities to build / enhance salt marsh resilience. Review existing wetland bylaws to incorporate Climate resilience / best management practices.
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth

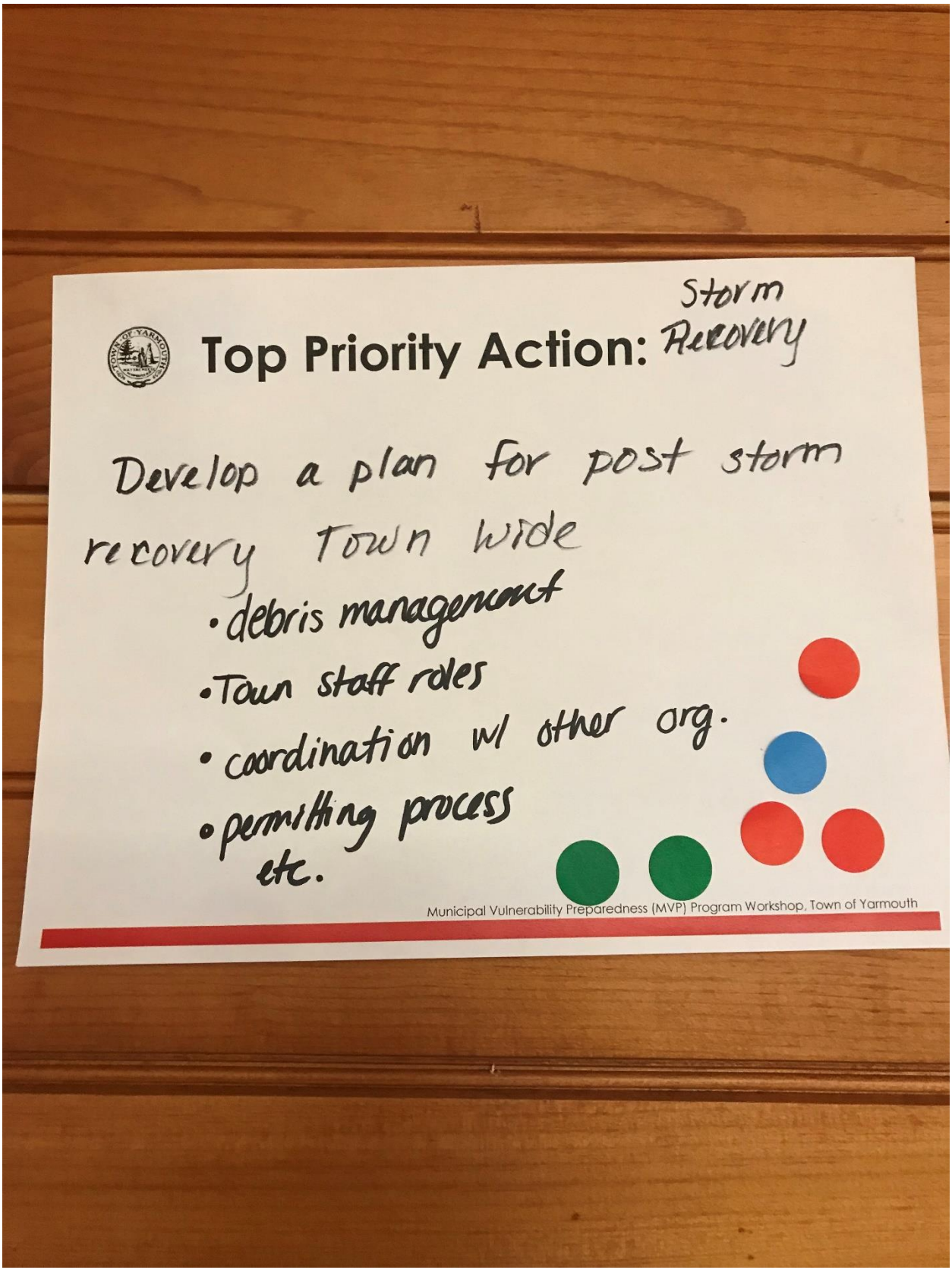

Top Priority Action:
Infrastructure Vulnerability Assessment
Assess & prioritize infrastructure vulnerabilities
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth
Top Priority Action:
Aging / Failing Culverts / Catch Basins
~~Complete~~
Comprehensive assessment of vulnerable culverts/ catch basins Town-wide.
Implement highest priority projects.
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth
Top Priority Action: Culverts
Design / Permit / Fund Mill Lane culvert, (Seagull Beach, Bay View, Thatcher Shore Rd)
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth

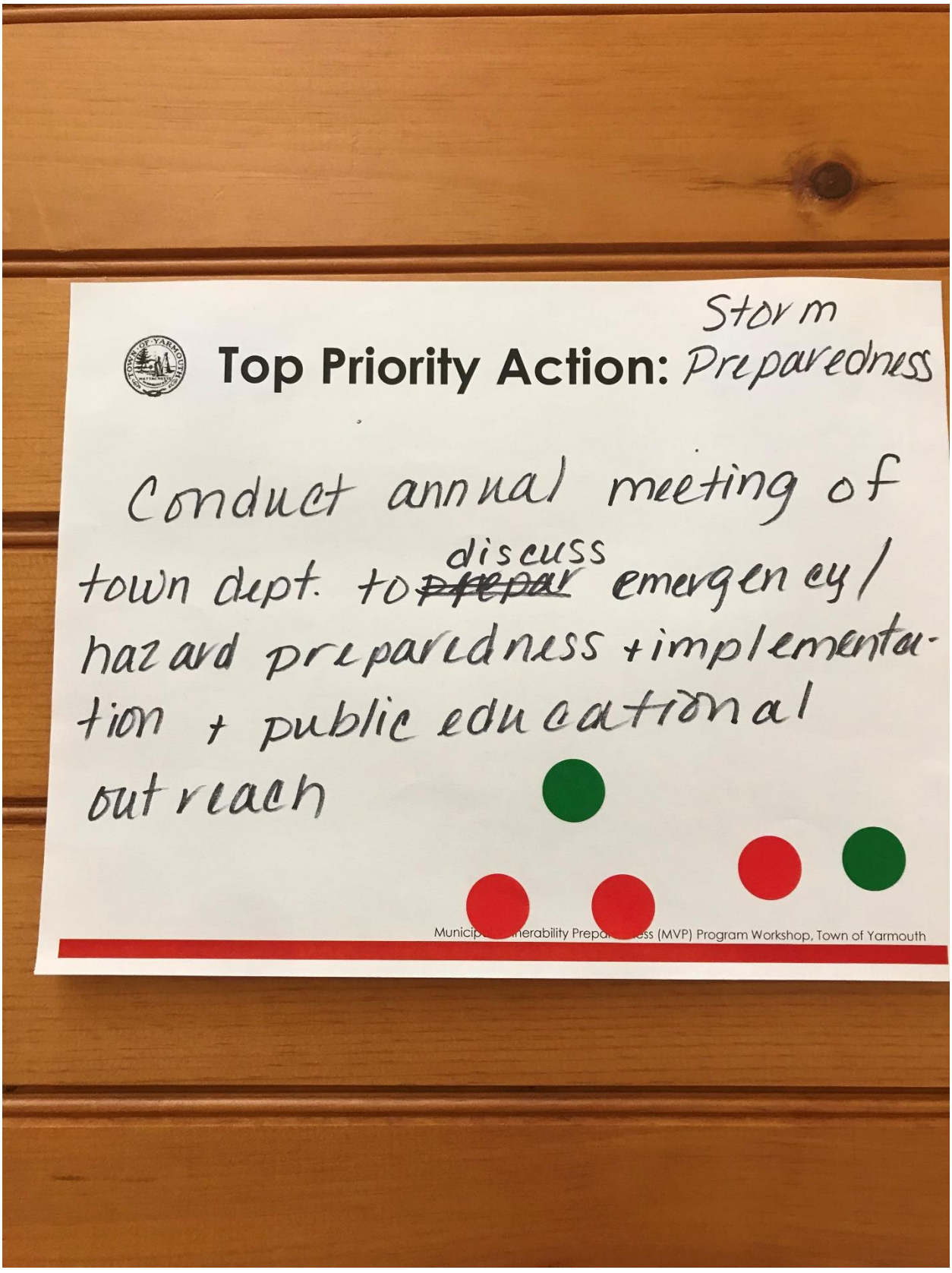

Top Priority Action:
Sewer/Septic
Continue to develop / implement Town-wide plan. Work w/ adacent communities to maximize resilience of system.
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth
Top Priority Action:
Waste Water (lack of)
Complete Phase I of sewering Route 28 + South Shore Drive
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth

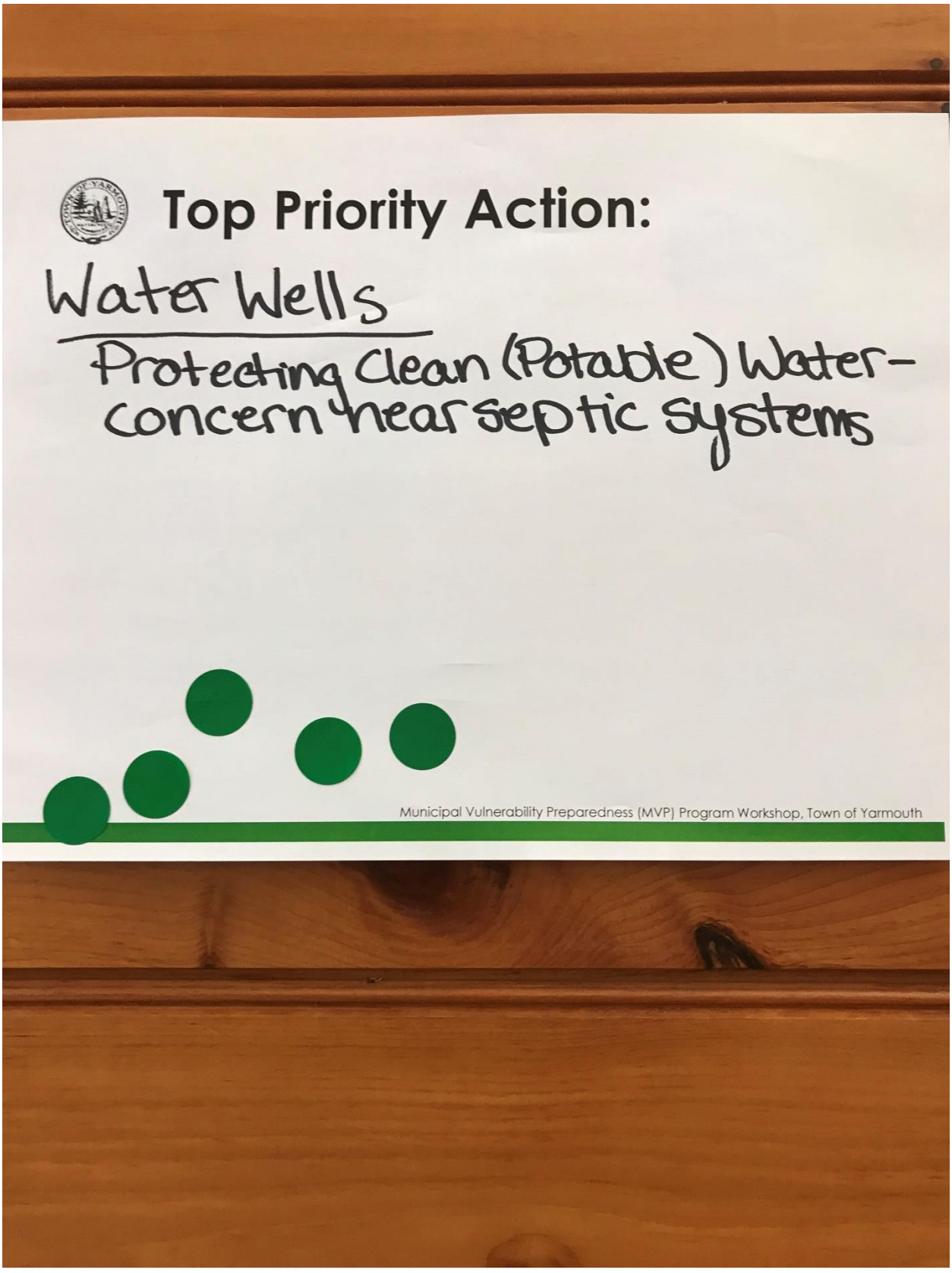

Top Priority Action:
Back Up Power/Communications:
Create additional backup power sources for emergency facilities/communicatio
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth
Top Priority Action:
Communications:
Develop comprehensive strategy for equitable access to cell/WiFi community-wide.
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth

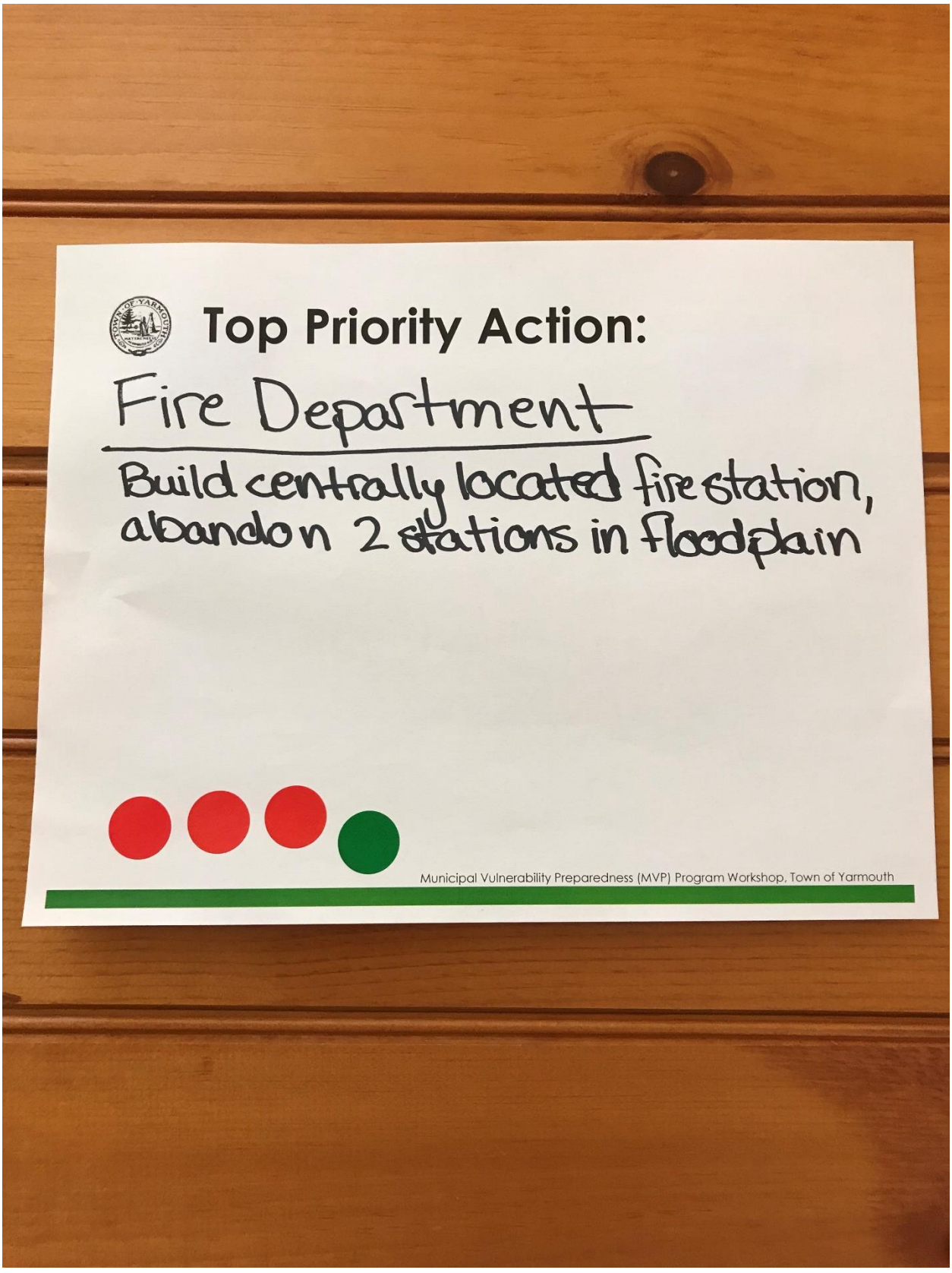

Top Priority Action: Land Aquisitions (undevelopement)
Identify parsels that could lead to undeveloped Land for land aquasition or protection. Include repetative loss, dead property, and vulnerabilety properties to SLR
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth


Top Priority Action:
Aging-in-Place / Vulnerable Populations
Review definition of environmental justice → see if possible to include aging-in-place and vulnerable populations. Develop dataset of weakest / most vulnerable populations within community. Targeted wellness checks / evacuations.
* Better understand specific needs of most vulnerable populations *
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth

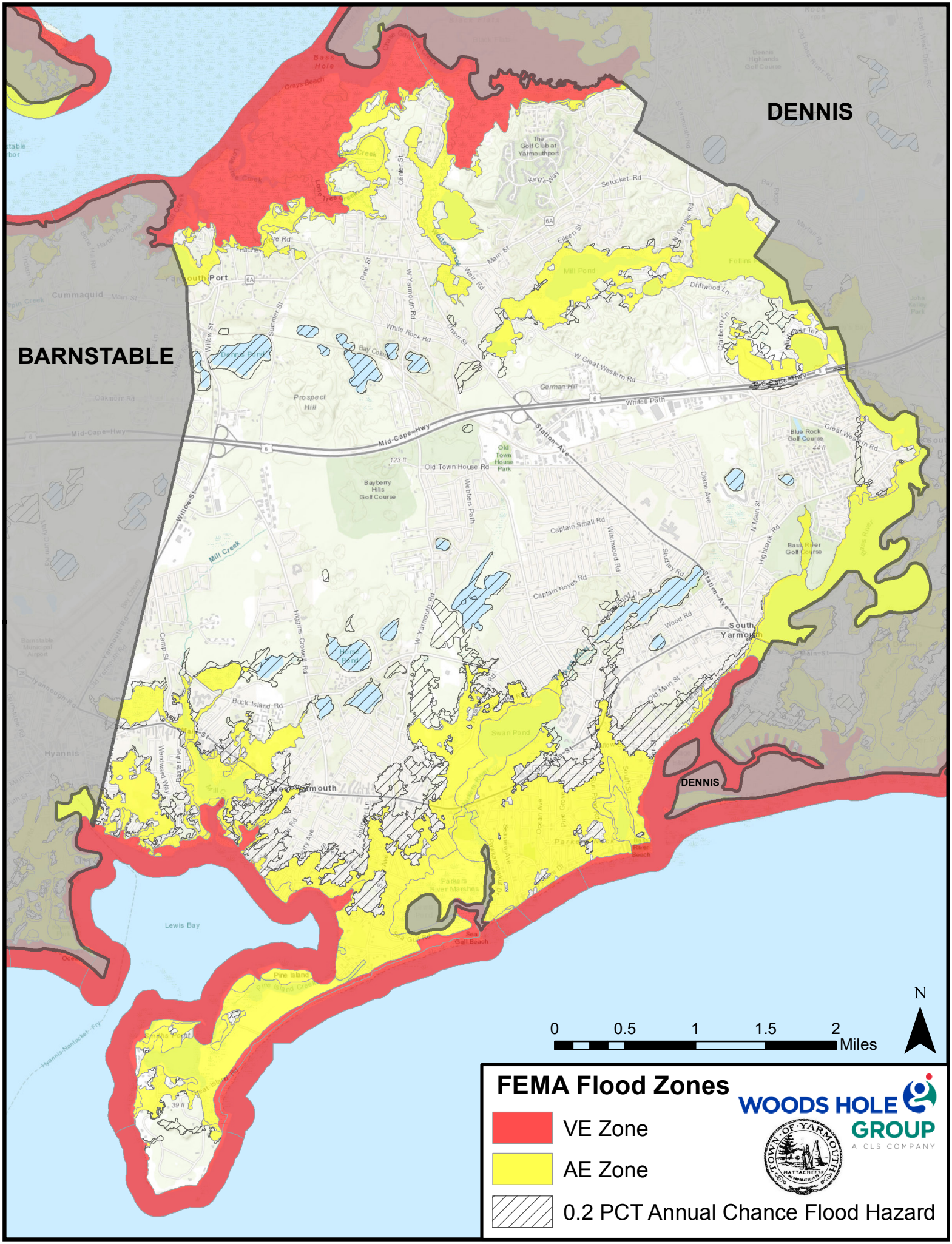

Top Priority Action: Storm Recovery
Develop a plan for post storm recovery Town wide
• debris management
• Town staff roles
• coordination w/ other org.
• permitting process
etc.
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth

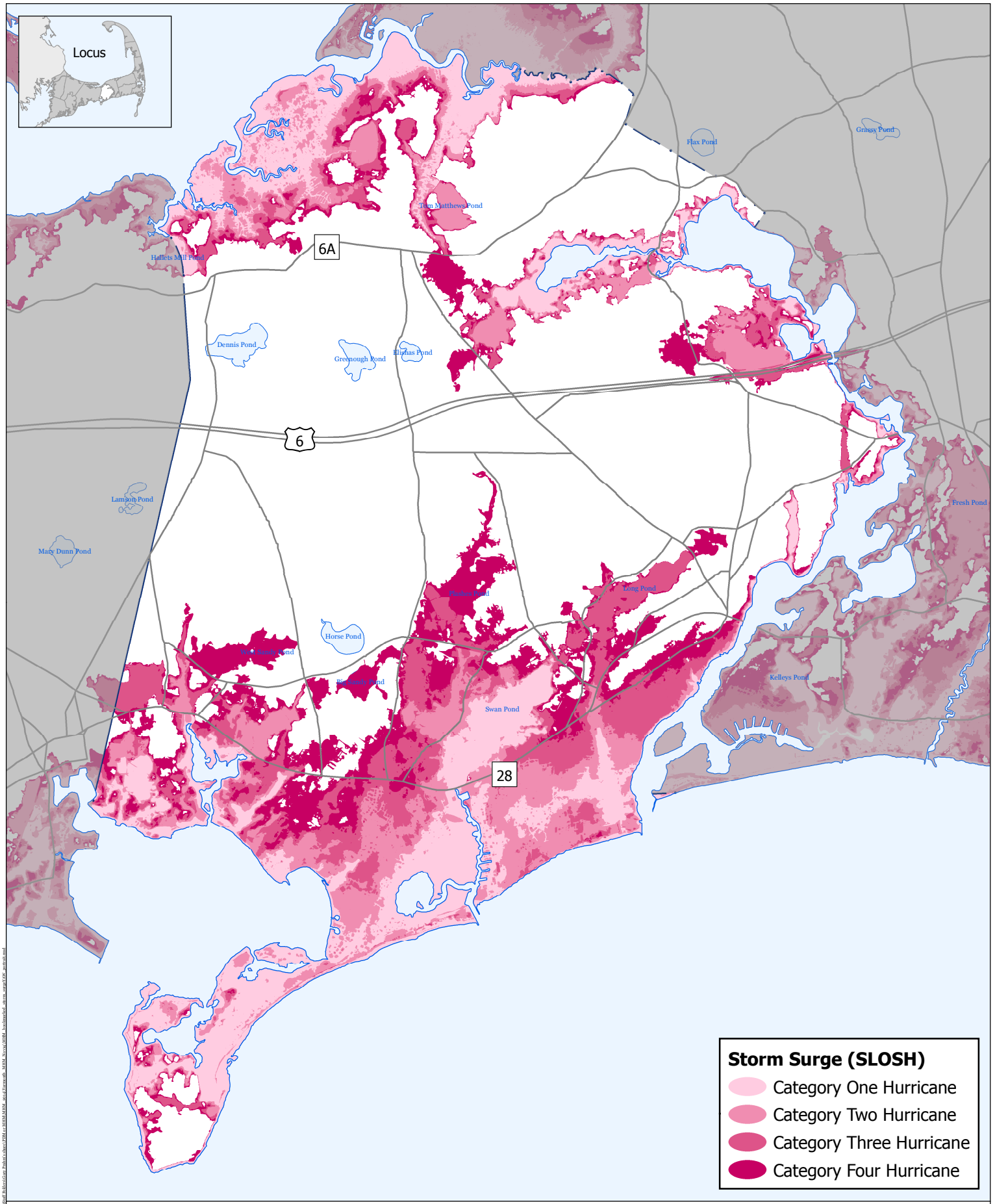

Top Priority Action: Storm Preparedness
Conduct annual meeting of town dept. to discuss emergency/ hazard preparedness + implementation + public educational outreach
Municip erability Prepa ess (MVP) Program Workshop, Town of Yarmouth


Top Priority Action:
Water Wells
Protecting Clean (Potable) Water-
concern near septic systems
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth


Top Priority Action:
Fire Department
Build centrally located fire station, abandon 2 stations in floodplain
Municipal Vulnerability Preparedness (MVP) Program Workshop, Town of Yarmouth

APPENDIX C. HAZARD AND FEATURE MAPS USED DURING WORKSHOP


DENNIS
BARNSTABLE
DENNIS
0
0.5
1
1.5
2
Miles
N
FEMA Flood Zones
VE Zone
AE Zone
0.2 PCT Annual Chance Flood Hazard
WOODS HOLE GROUP
A CLS COMPANY



Storm Surge (SLOSH)

Yarmouth

Sources:
Strom Surge (SLOSH): Army Corps of Engineers, 2013.
Base map features: MassGIS and Cape Cod Commission.
This map is produced by the GIS Department of the Cape Cod Commission, a division of Barnstable County, 2014.

The information depicted on these maps is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel level analysis. It should not substitute for actual on-site survey, or supersede deed research.

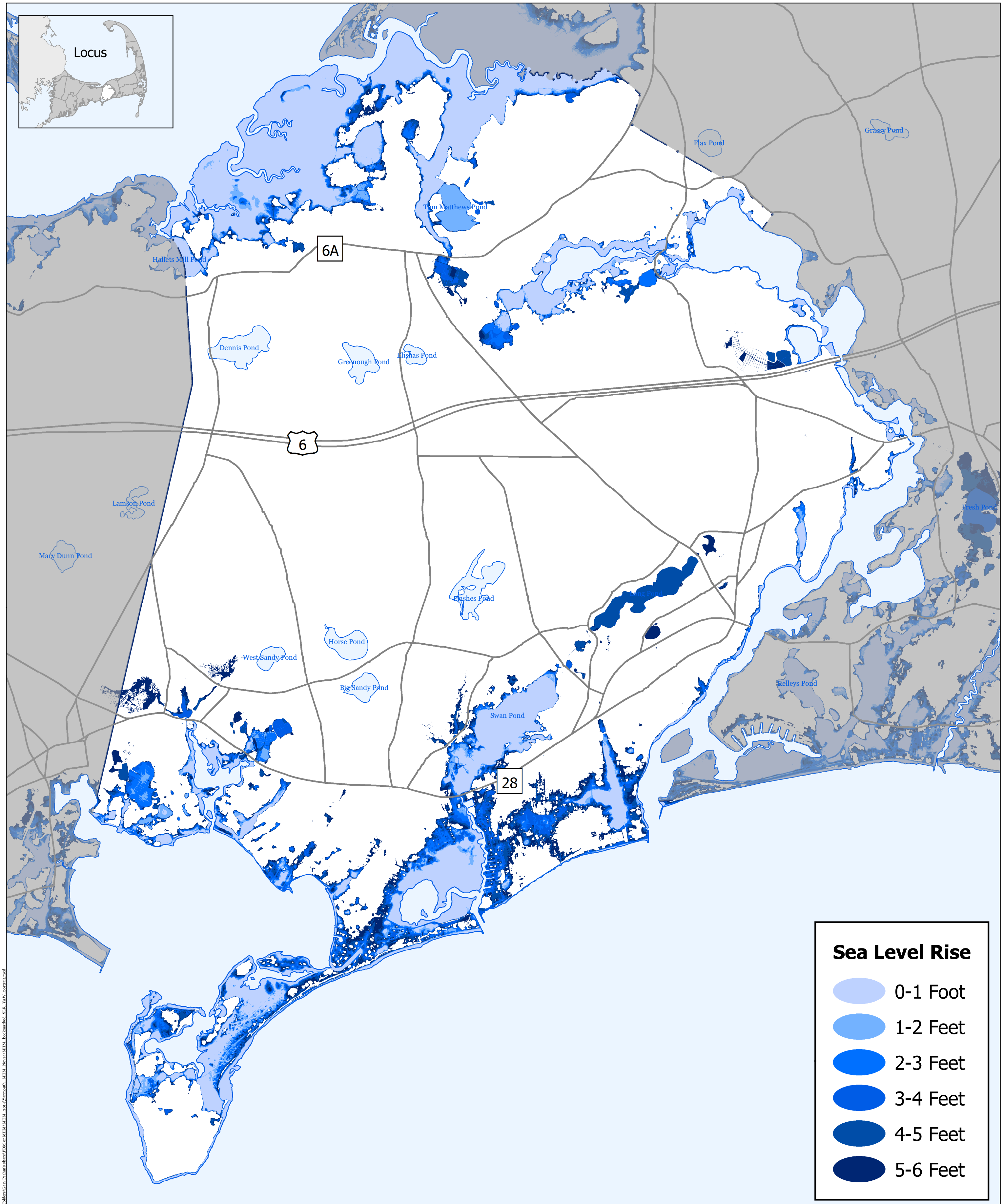
User: gprahm

Date: 12/9/2014

0.2 0 0.2 0.4 0.6 0.8 1

Miles

CAPE COD COMMISSION



Sea Level Rise

Yarmouth

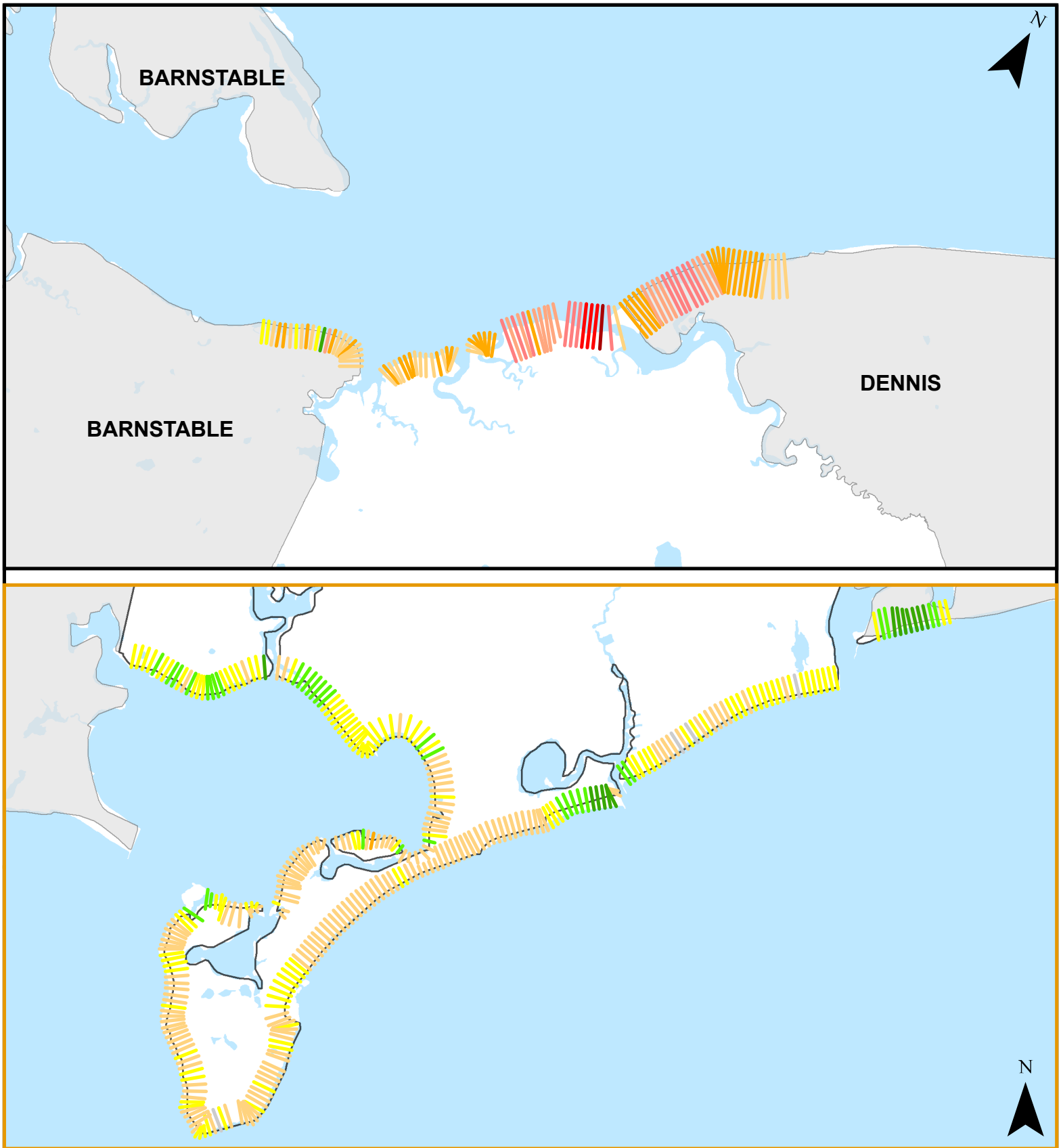
Sources:
Sea Level Rise: MassGIS LIDAR data processed by CCC, 2013.
Base map features: MassGIS and Cape Cod Commission.
This map is produced by the GIS Department of the Cape Cod Commission, a division of Barnstable County, 2014.

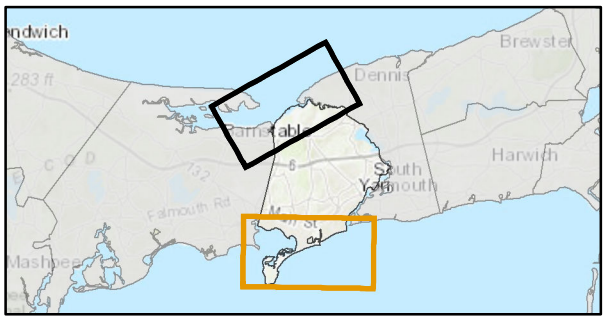
CAPE COD COMMISSION

The information depicted on these maps is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel level analysis. It should not substitute for actual on-site survey, or supersede deed research.

User: gprahm

Date: 12/9/2014





Shoreline Change (1970- Present)

N

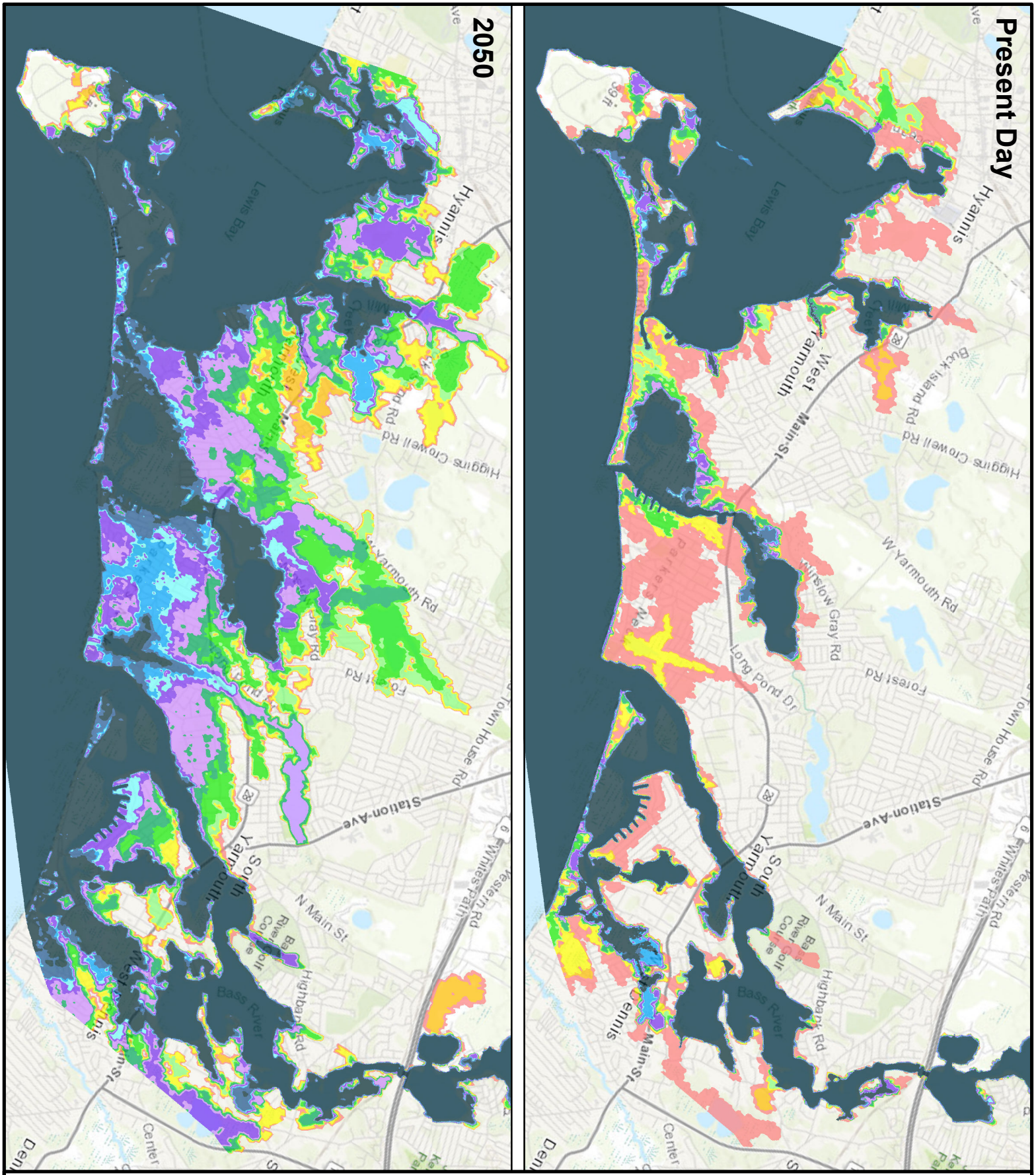
> 4 ft/yr	0 to -4 ft/yr	-12 to -20 ft/yr
2 to 4 ft/yr	-4 to -8 ft/yr	-20 to -24 ft/yr
0 to 2 ft/r	-8 to -12 ft/yr	< -24 ft/yr
0 ft/yr		

0 0.25 0.5 1 Miles

TOWN OF YARMOUTH MASSACHUSETTS

WOODS HOLE GROUP A CLS COMPANY

MASS GIS



Massachuesetts Coastal Flood Risk Model

WOODS HOLE GROUP
A CLS COMPANY

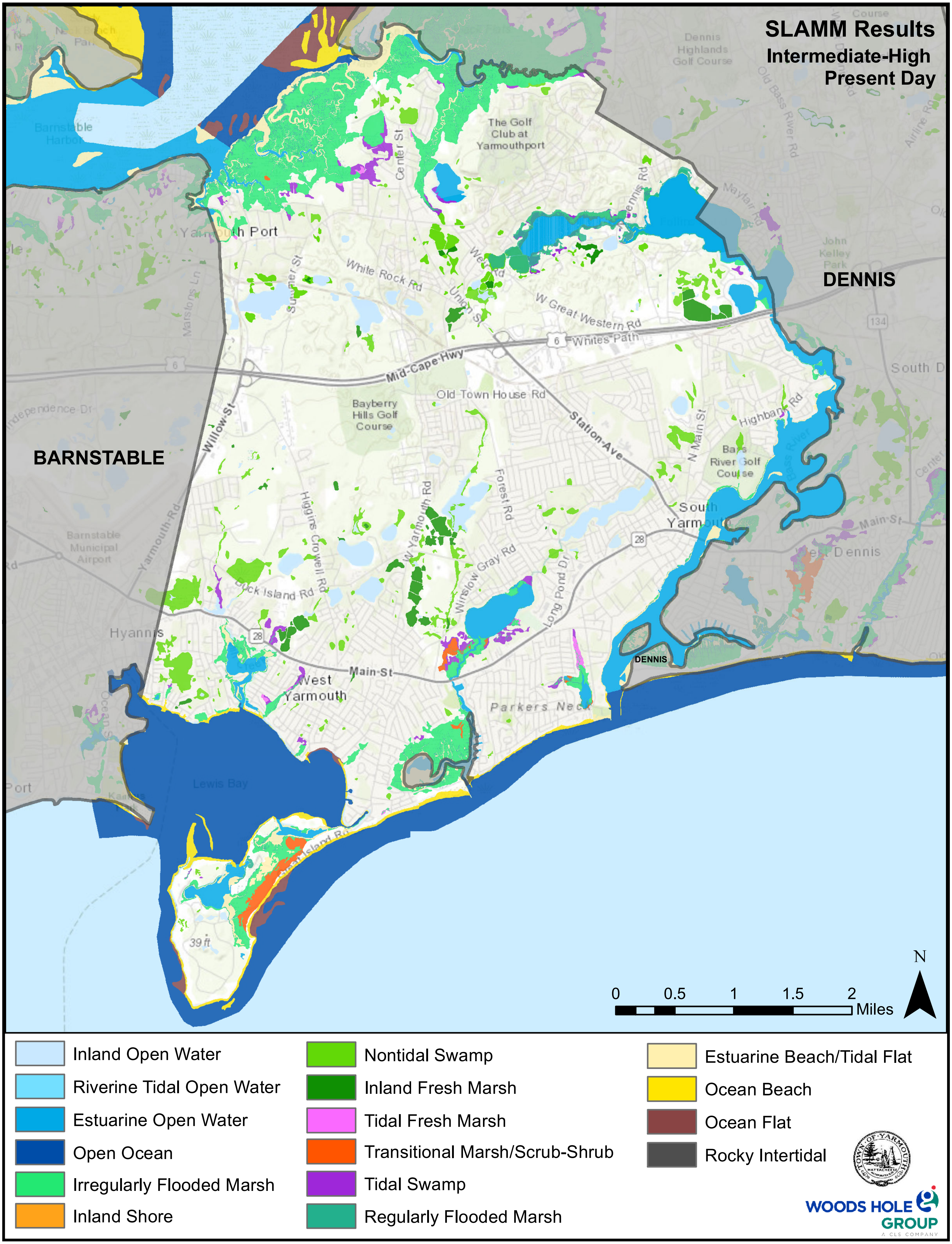
massDOT
Massachusetts Department of Transportation

0 0.75 1.5 2.25 3 Miles

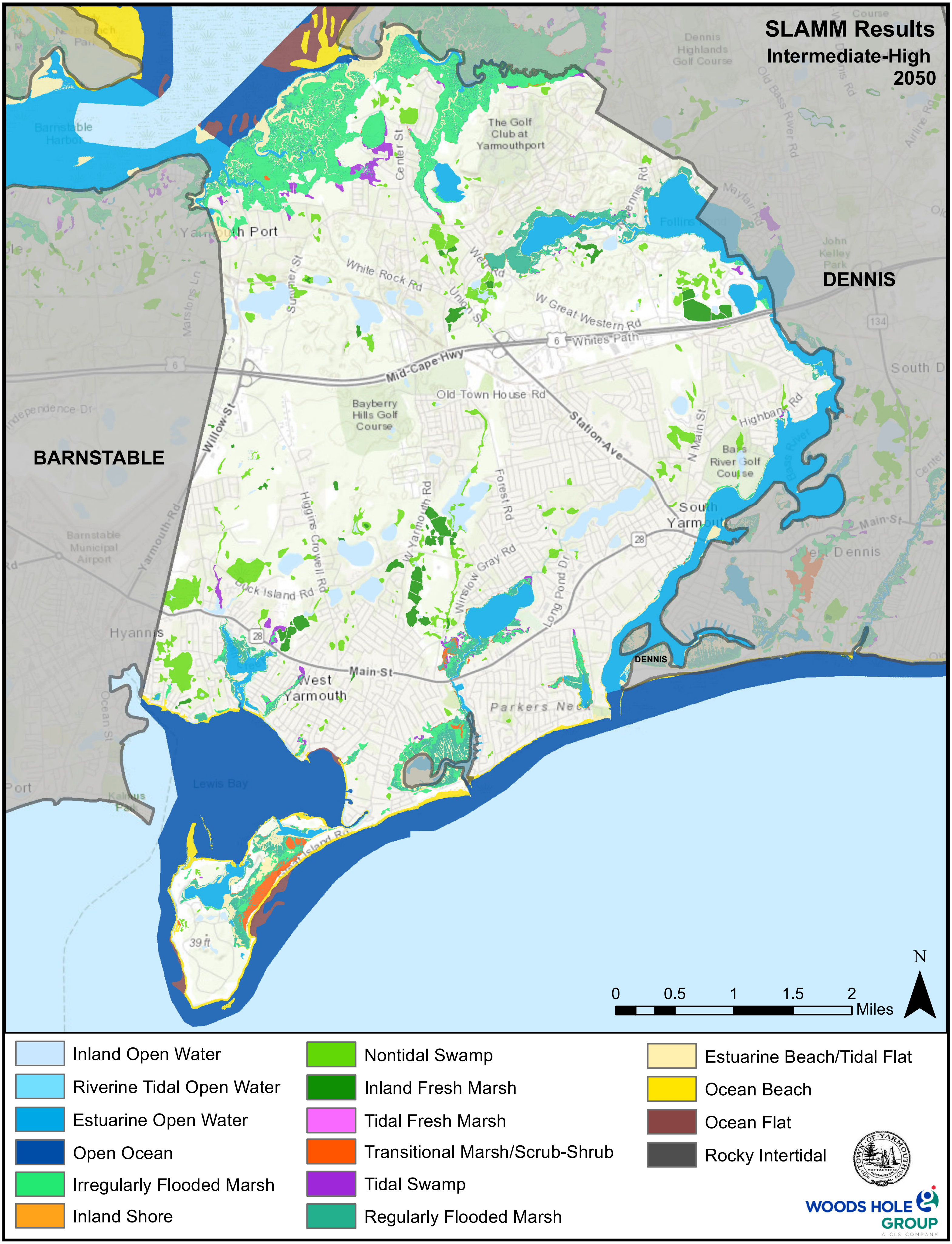
N

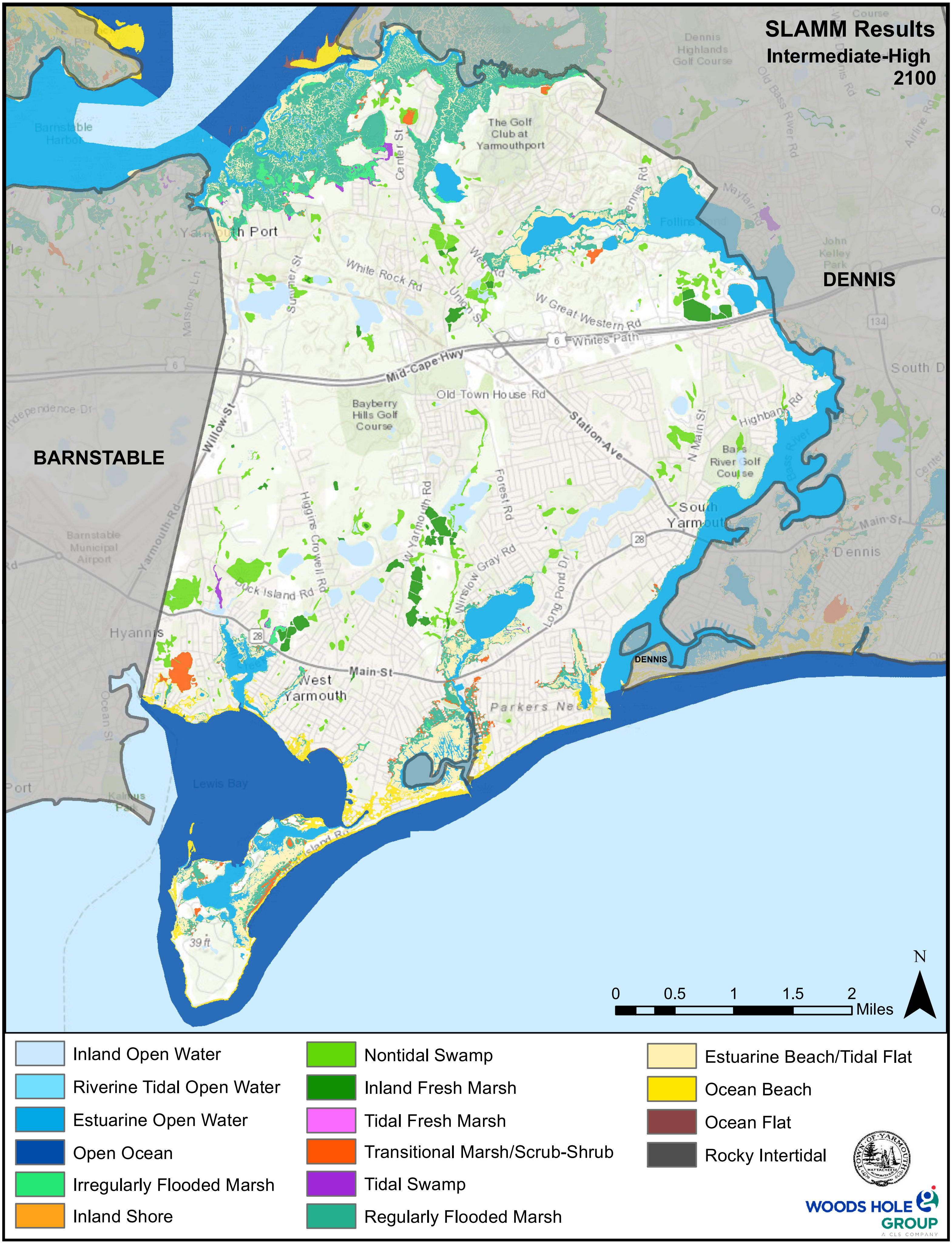
Probability of Inundation

0.1% 0.2% 0.5% 1% 2% 5% 10% 20% 25% 30% 50% 100%



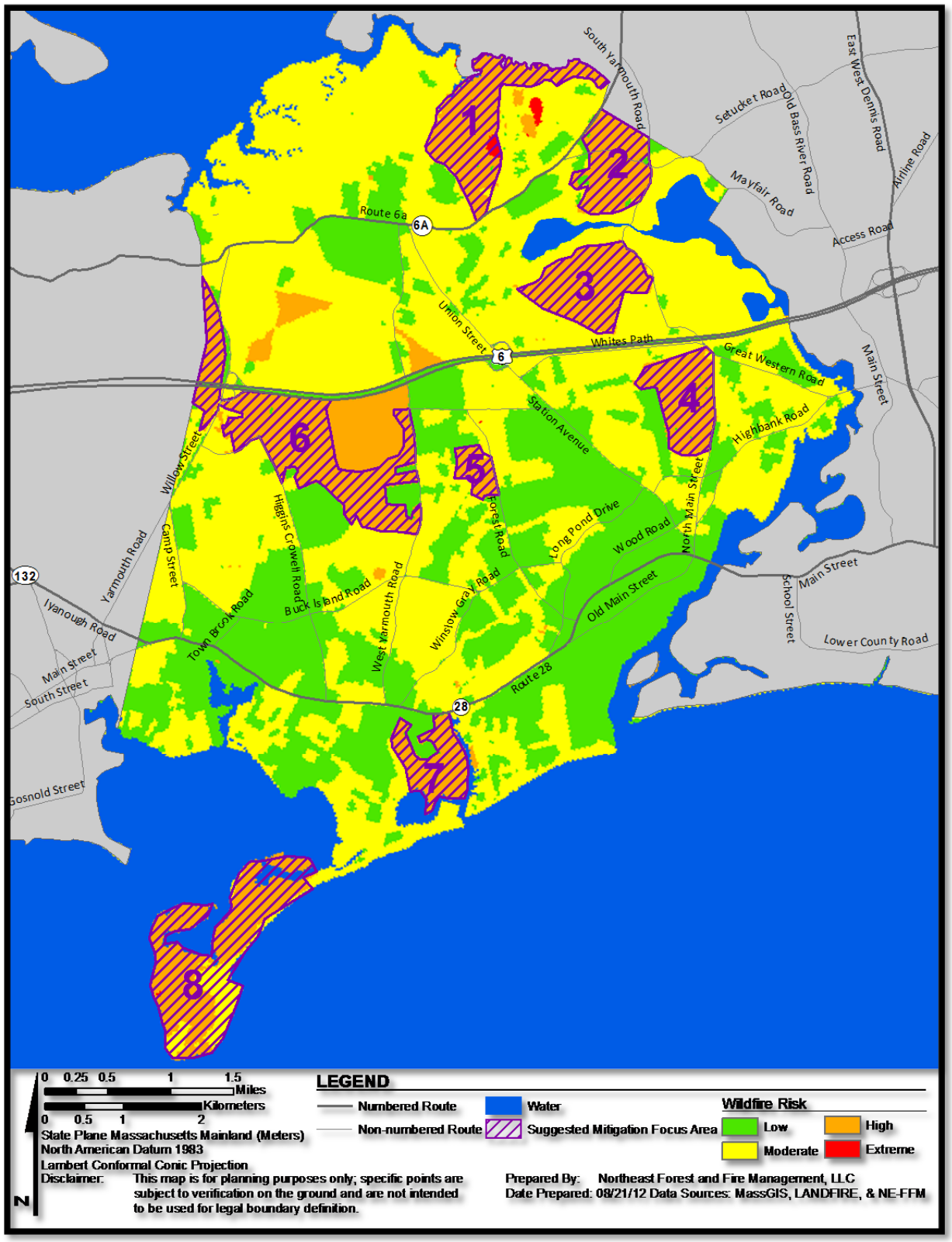
SLAMM Results
Intermediate-High
Present Day
DENNIS
BARNSTABLE
Yarmouth Port
South Yarmouth
West Yarmouth
Parkers Neck
Lewis Bay
Barnstable Harbor
Hyannis
West Dennis
The Golf Club at Yarmouthport
Bayberry Hills Golf Course
Bass River Golf Course
Dennis Highlands Golf Course
John Kelley Park
Barnstable Municipal Airport
Mid-Cape Hwy
White Rock Rd
W Great Western Rd
Whites Path
Old Town House Rd
Station Ave
Willow St
Higgins Crowell Rd
W Yarmouth Rd
Forest Rd
Winslow Gray Rd
Long Pond Dr
Buck Island Rd
Main St
Center St
Union St
Summer St
N Main St
Highbank Rd
Yarmouth Rd
Marstons Ln
Old Bass River Rd
39 ft
0
0.5
1
1.5
2
Miles
N
Inland Open Water
Riverine Tidal Open Water
Estuarine Open Water
Open Ocean
Irregularly Flooded Marsh
Inland Shore
Nontidal Swamp
Inland Fresh Marsh
Tidal Fresh Marsh
Transitional Marsh/Scrub-Shrub
Tidal Swamp
Regularly Flooded Marsh
Estuarine Beach/Tidal Flat
Ocean Beach
Ocean Flat
Rocky Intertidal
WOODS HOLE GROUP
A CLS COMPANY


SLAMM Results
Intermediate-High
2050
DENNIS
BARNSTABLE
Yarmouth Port
South Yarmouth
West Yarmouth
Parkers Neck
Hyannis
West Dennis
The Golf Club at Yarmouthport
Bayberry Hills Golf Course
Bass River Golf Course
Dennis Highlands Golf Course
John Kelley Park
Barnstable Municipal Airport
Barnstable Harbor
Lewis Bay
Mid-Cape Hwy
Old Town House Rd
Station Ave
White Rock Rd
W Great Western Rd
Whites Path
Willow St
Yarmouth Rd
Higgins Crowell Rd
W Yarmouth Rd
Forest Rd
Winslow Gray Rd
Long Pond Dr
Buck Island Rd
Main St
Center St
Summer St
Union St
N Main St
Highbank Rd
Dennis Rd
Old Bass River Rd
Marstons Ln
Ocean St
39 ft
0 0.5 1 1.5 2 Miles
N
Inland Open Water
Riverine Tidal Open Water
Estuarine Open Water
Open Ocean
Irregularly Flooded Marsh
Inland Shore
Nontidal Swamp
Inland Fresh Marsh
Tidal Fresh Marsh
Transitional Marsh/Scrub-Shrub
Tidal Swamp
Regularly Flooded Marsh
Estuarine Beach/Tidal Flat
Ocean Beach
Ocean Flat
Rocky Intertidal
WOODS HOLE GROUP
A CLS COMPANY


SLAMM Results
Intermediate-High
2100
DENNIS
BARNSTABLE
Yarmouth Port
South Yarmouth
West Yarmouth
Parkers Neck
Lewis Bay
Barnstable Harbor
The Golf Club at Yarmouthport
Bayberry Hills Golf Course
Bass River Golf Course
Mid-Cape Hwy
White Rock Rd
W Great Western Rd
Whites Path
Old Town House Rd
Station Ave
Main St
Willow St
Higgins Crowell Rd
W Yarmouth Rd
Forest Rd
Winslow Gray Rd
Long Pond Dr
N Main St
Highbank Rd
Center St
Summer St
Union St
Buck Island Rd
0 0.5 1 1.5 2 Miles
N
Inland Open Water
Riverine Tidal Open Water
Estuarine Open Water
Open Ocean
Irregularly Flooded Marsh
Inland Shore
Nontidal Swamp
Inland Fresh Marsh
Tidal Fresh Marsh
Transitional Marsh/Scrub-Shrub
Tidal Swamp
Regularly Flooded Marsh
Estuarine Beach/Tidal Flat
Ocean Beach
Ocean Flat
Rocky Intertidal
WOODS HOLE GROUP
A CLS COMPANY

Town of Yarmouth

TOWN OF YARMOUTH WILDFIRE RISK MAP



BARNSTABLE COUNTY WILDFIRE PREPAREDNESS PLAN
Community Wildfire Protection Plan

TOWN OF YARMOUTH SUMMARY STATISTICS

Town:	Yarmouth	Population Density (people/*mi.*²):	979.1
Land Area (*mi.*²):	24.3	Home Density (housing units/*mi.*²):	718.7
Town Hosing Units Vacant for Seasonal/Recreational Use (%):		27.9%	

Percent of Town Classified by Wildland Urban Interface Types

Urban/No Vegetation	Uninhabited	Interface	Intermix
45.7%	14.0%	24.2%	14.2%

Percent of Town by Modeled Wildfire Risk

Low	Moderate	High	Extreme
15.7%	67.2%	16.8%	0.2%

Percent of Town by Modeled/Calculated Wildfire Risk Inputs

Flame Length		Rate of Spread		Fire Type		Dist. from Fire Station		Pop. Density	
0 – 4 (ft.):	22	0 – 5 (ch./hr.):	12	No Data:	19	0 – 0.5 (mi.):	14	0 – 5 (people/*mi.*²):	63
4 – 8 (ft.):	25	5 – 15 (ch./hr.):	7	Surface Fire:	44	0.5 – 1.0 (mi.):	23	5 – 60 (people/*mi.*²):	9
8 – 12 (ft.):	27	15 – 40 (ch./hr.):	49	Passive Crown Fire:	32	1.0 – 1.5 (mi.):	27	60 – 525 (people/*mi.*²):	18
> 12 (ft.):	26	> 40 (ch./hr.):	33	Active Crown Fire:	5	> 1.5 (mi.):	36	> 525 (people/*mi.*²):	10

Fire Department Statistics

Fire Stations: 3 Fulltime Firefighters: 65 Call Firefighters: 10

Water Tender		Wildland Engines	Standard	Brush Breaker
Type 1:	0	Type 3:	0	
Type 2:	0	Type 4:	0	
Type 3:	0	Type 5:	0	
Structure Engines		Type 6:	1	
Type 1:	6	Type 7:	0	
Type 2:	0			

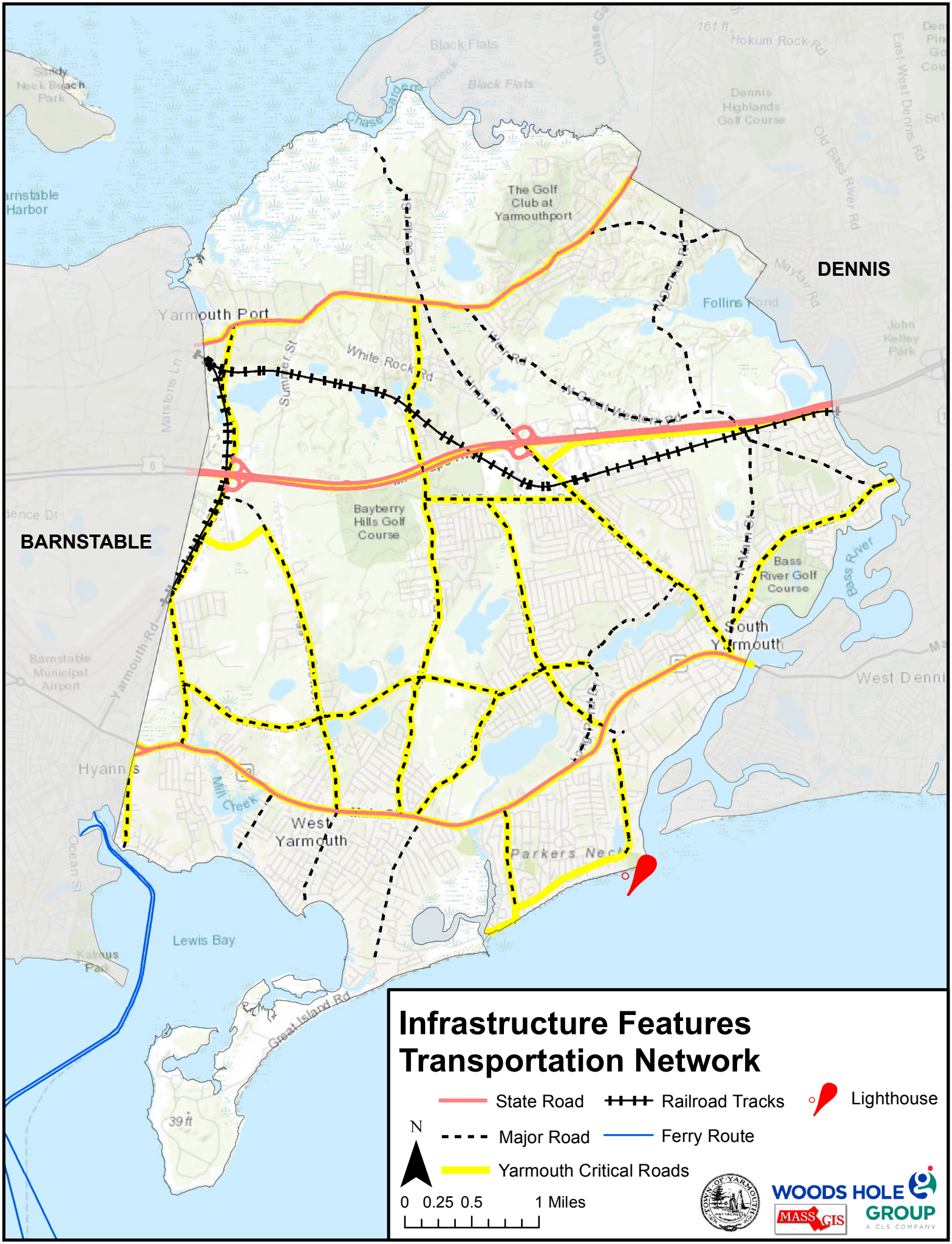
NOTE: Data provided by Massachusetts Department of Conservation and Recreation

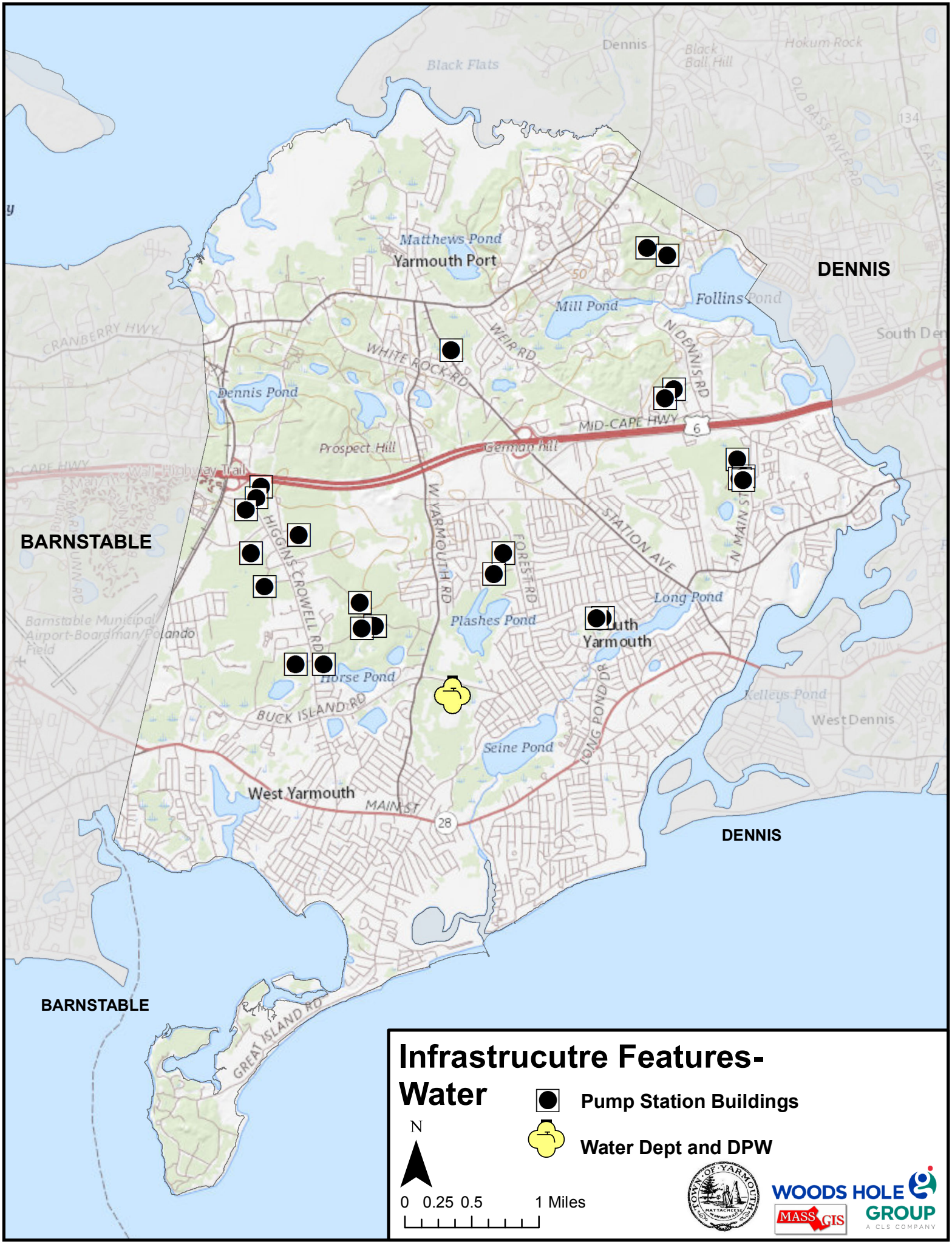
Current Fire and Fuel Management Programs and Plans

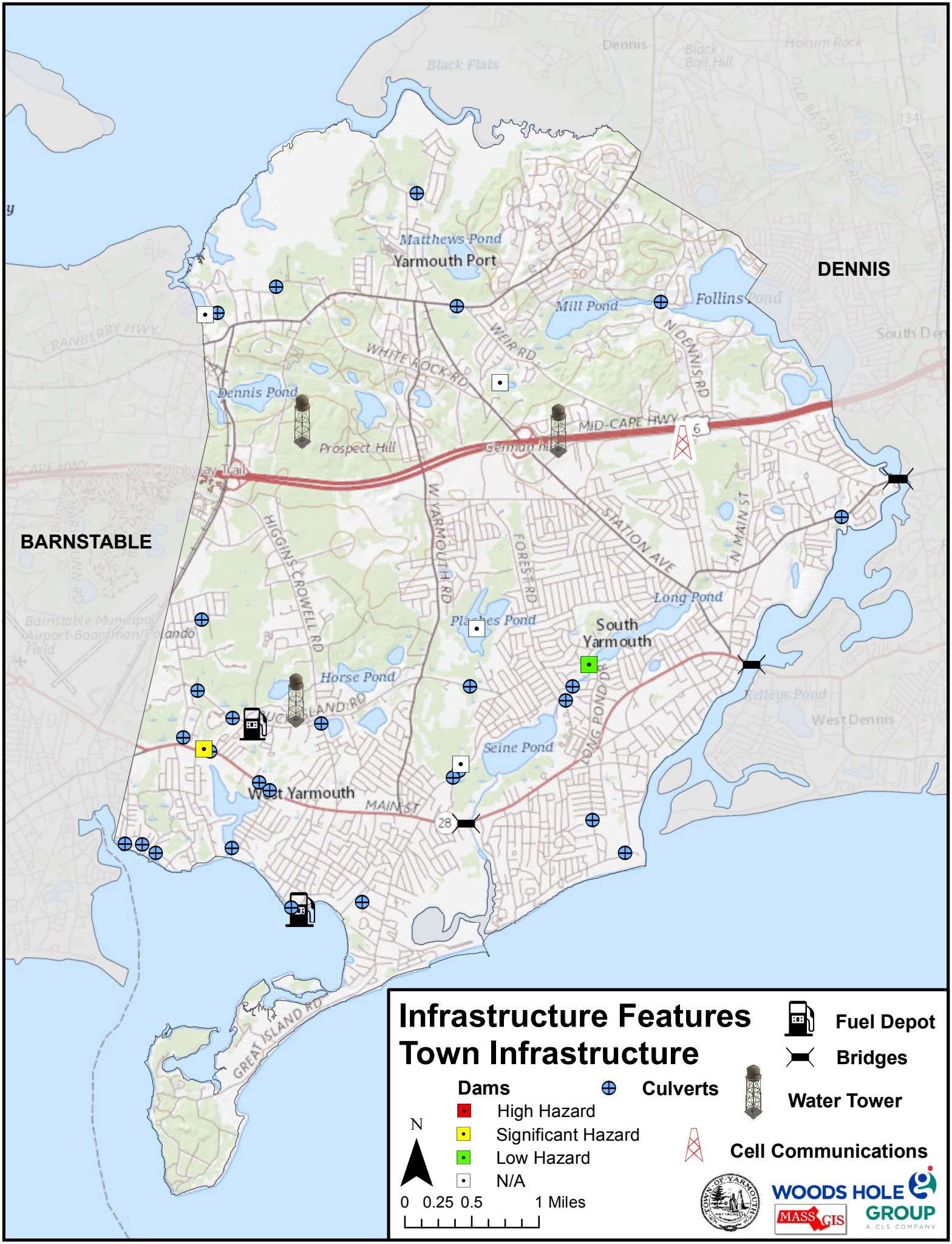
- Yarmouth Town Lands - Wildfire Preparedness Plan (CWPP)
- Town of Yarmouth Prescribed Burn Program

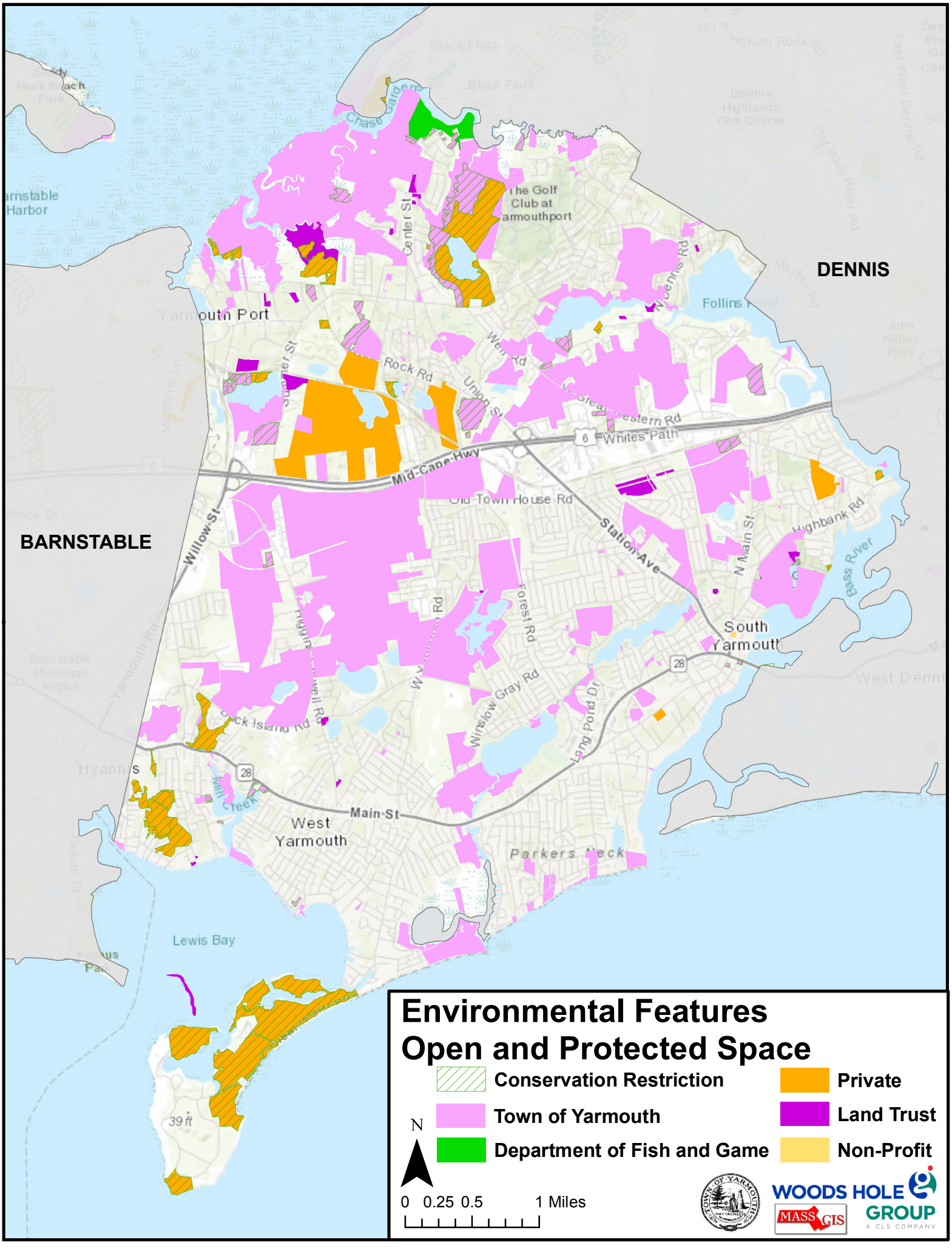
Suggested Mitigation Focus Area (See Town Wildfire Risk Map)

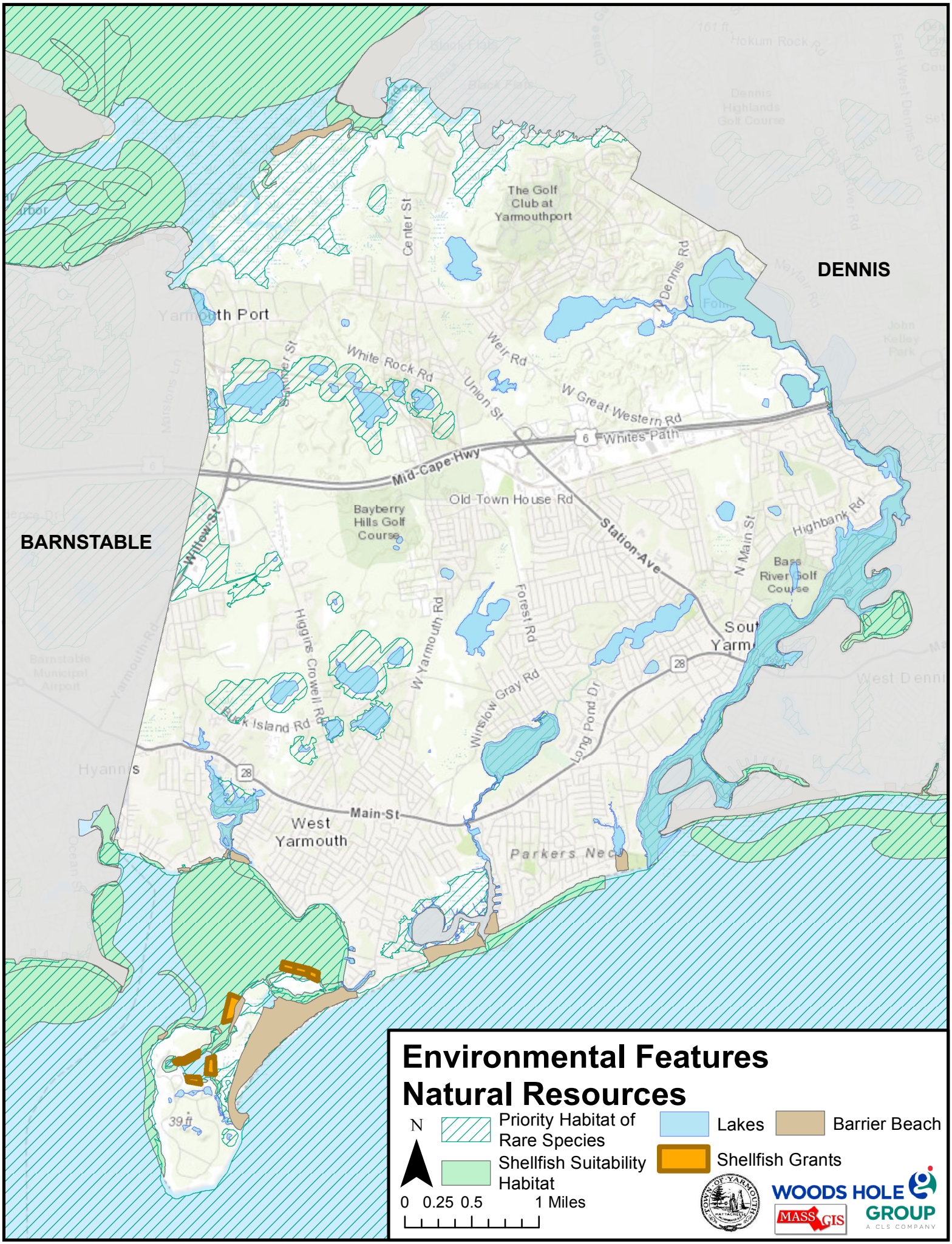
Area ID	Area Acres	High Risk Present	Likely Management Action (See Management Recommendations)
1	373	Yes	Fuel Treatments and/or Structural Ignitability Reduction
2	232	No	Fuel Treatments and/or Structural Ignitability Reduction
3	282	No	Fuel Treatments and/or Structural Ignitability Reduction
4	221	No	Fuel Treatments and/or Structural Ignitability Reduction
5	62	No	Fuel Treatments and/or Structural Ignitability Reduction
6	585	No	Fuel Treatments and/or Structural Ignitability Reduction
7	168	No	Fuel Treatments and/or Structural Ignitability Reduction
8	587	No	Fuel Treatments and/or Structural Ignitability Reduction

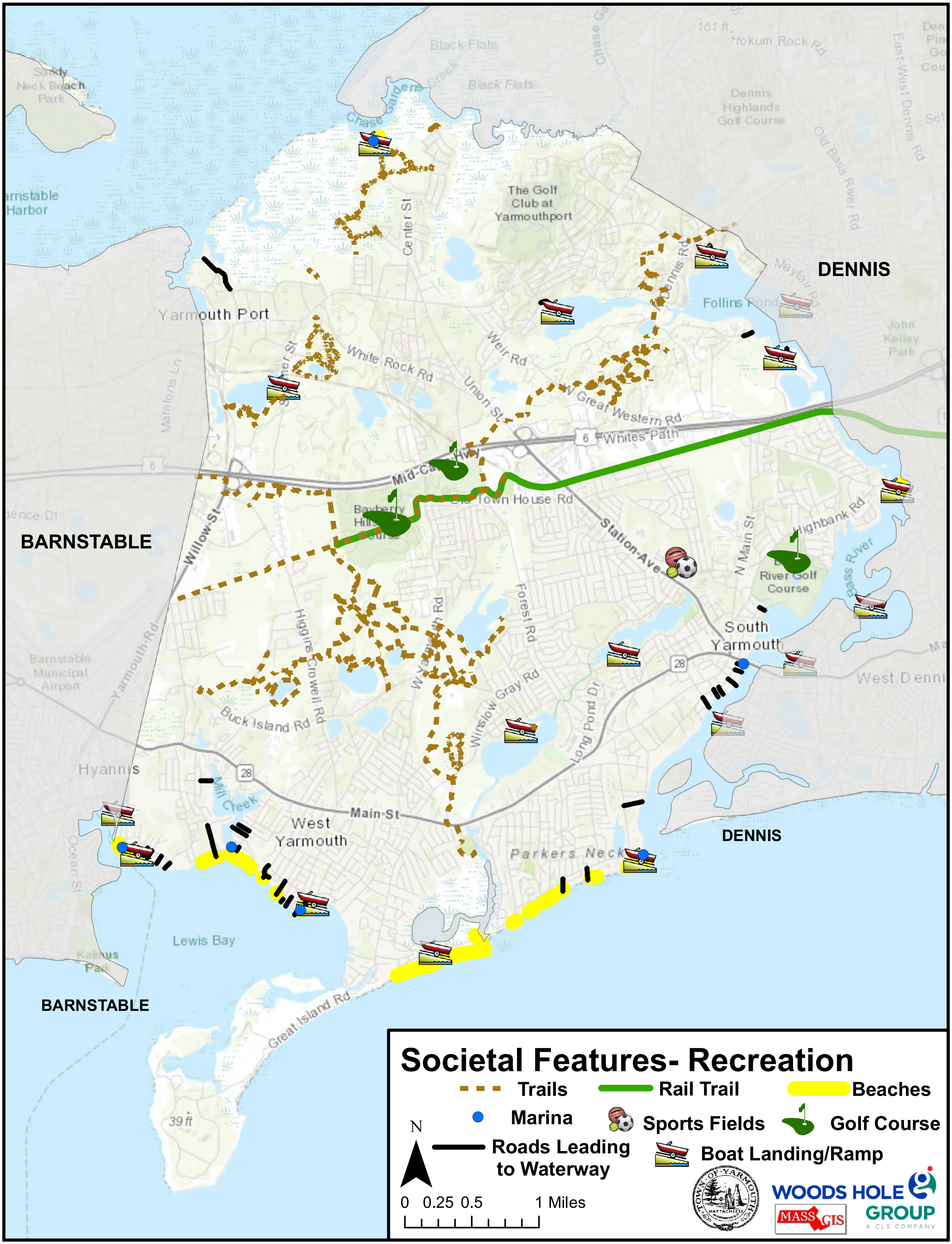

DENNIS
BARNSTABLE
Yarmouth Port
The Golf Club at Yarmouthport
Dennis Highlands Golf Course
Bayberry Hills Golf Course
Bass River Golf Course
South Yarmouth
West Yarmouth
Hyannis
Barnstable Municipal Airport
Lewis Bay
Parkers Neck
Great Island Rd
Follins Pond
Black Flats
Hokum Rock Rd
White Rock Rd
Yarmouth Rd
Bass River
Infrastructure Features
Transportation Network
State Road
Railroad Tracks
Lighthouse
Major Road
Ferry Route
Yarmouth Critical Roads
N
0 0.25 0.5 1 Miles
WOODS HOLE GROUP
A CLS COMPANY
MASS GIS

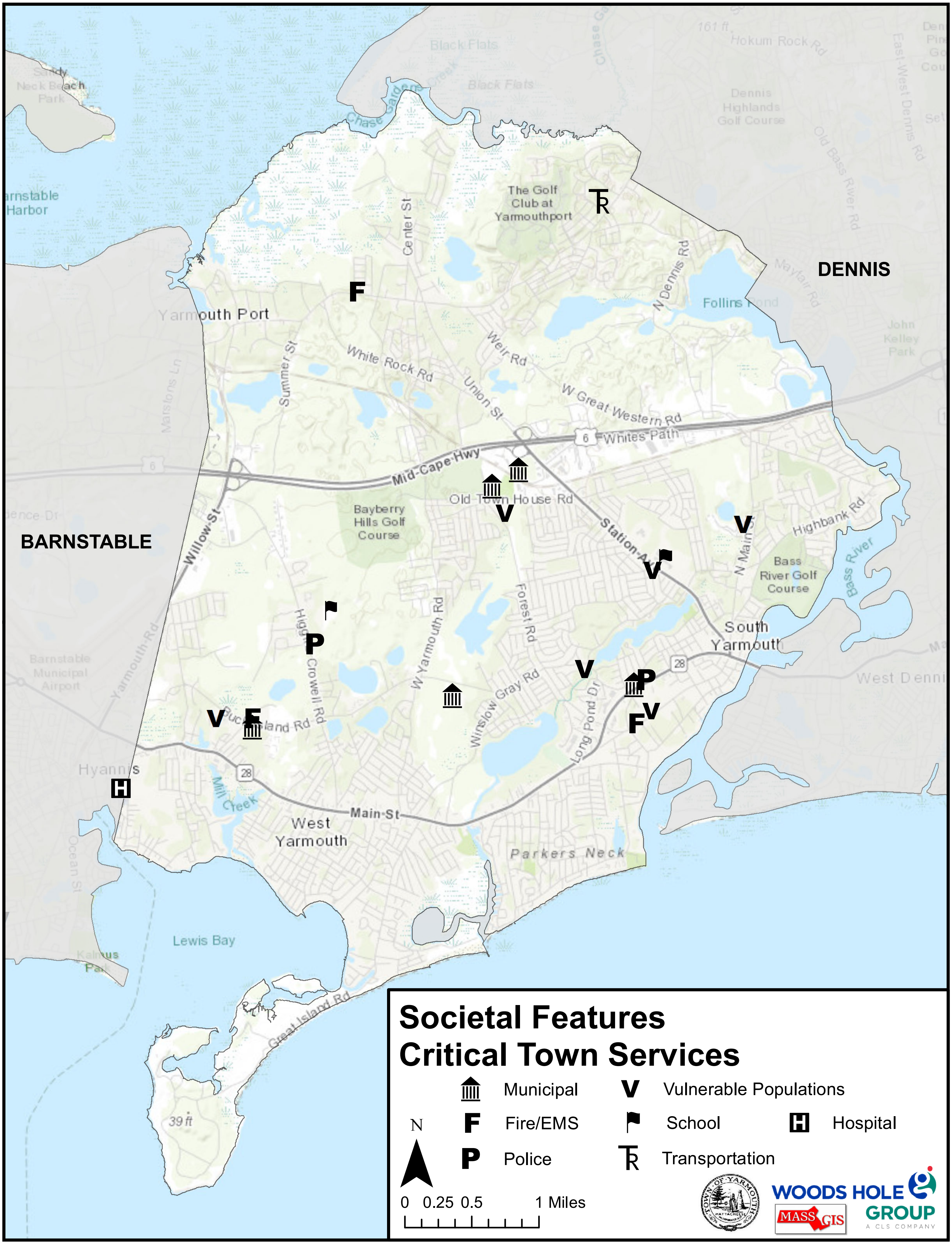

Infrastrucutre Features-
Water
Pump Station Buildings
Water Dept and DPW
N
0 0.25 0.5 1 Miles
DENNIS
BARNSTABLE
West Yarmouth
Yarmouth Port
Matthews Pond
Mill Pond
Follins Pond
Dennis Pond
Prospect Hill
German Hill
Plashes Pond
Long Pond
Horse Pond
Seine Pond
Kelleys Pond
West Dennis
Hokum Rock
Black Flats
Black Ball Hill
MID-CAPE HWY
WHITE ROCK RD
WEIR RD
N DENNIS RD
W YARMOUTH RD
HIGGINS CROWELL RD
FOREST RD
STATION AVE
N MAIN ST
LONG POND DR
BUCK ISLAND RD
MAIN ST
GREAT ISLAND RD
CRANBERRY HWY
OLD BASS RIVER RD
Barnstable Municipal Airport-Boardman/Polando Field
Cape Cod Rail Trail
WOODS HOLE GROUP
A CLS COMPANY
MASS GIS


Infrastructure Features
Town Infrastructure
Dams
High Hazard
Significant Hazard
Low Hazard
N/A
Culverts
Fuel Depot
Bridges
Water Tower
Cell Communications
N
0 0.25 0.5 1 Miles
DENNIS
BARNSTABLE
Yarmouth Port
South Yarmouth
West Yarmouth
West Dennis
Matthews Pond
Mill Pond
Follins Pond
Dennis Pond
Prospect Hill
German Hill
Horse Pond
Seine Pond
Long Pond
Kelleys Pond
MID-CAPE HWY
WHITE ROCK RD
WEIR RD
N DENNIS RD
W YARMOUTH RD
HIGGINS CROWELL RD
FOREST RD
STATION AVE
N MAIN ST
LONG POND DR
MAIN ST
GREAT ISLAND RD
WOODS HOLE GROUP
A CLS COMPANY
MASS GIS


DENNIS
BARNSTABLE
Mid-Cape-Hwy
Main St
West Yarmouth
South Yarmouth
Lewis Bay
Parkers Neck
Environmental Features
Open and Protected Space
Conservation Restriction
Town of Yarmouth
Department of Fish and Game
Private
Land Trust
Non-Profit
N
0 0.25 0.5 1 Miles
WOODS HOLE GROUP
A CLS COMPANY
MASS GIS


DENNIS
BARNSTABLE
The Golf Club at Yarmouthport
Center St
N Dennis Rd
White Rock Rd
Weir Rd
Union St
W Great Western Rd
Whites Path
6
Mid-Cape Hwy
Old Town House Rd
Station Ave
Bayberry Hills Golf Course
Whitew St
N Main St
Highbank Rd
Bass River Golf Course
Forest Rd
W Yarmouth Rd
Higgins Crowell Rd
Buck Island Rd
Winslow Gray Rd
Long Pond Dr
28
Main St
West Yarmouth
Parkers Neck
39 ft
Environmental Features
Natural Resources
N
Priority Habitat of Rare Species
Shellfish Suitability Habitat
Lakes
Barrier Beach
Shellfish Grants
0 0.25 0.5 1 Miles
WOODS HOLE GROUP
A CLS COMPANY
MASS GIS


Societal Features- Recreation
Trails
Rail Trail
Beaches
Marina
Sports Fields
Golf Course
Roads Leading to Waterway
Boat Landing/Ramp
N
0 0.25 0.5 1 Miles
WOODS HOLE GROUP
A CLS COMPANY
MASS GIS
DENNIS
BARNSTABLE
DENNIS
BARNSTABLE
Yarmouth Port
South Yarmouth
West Yarmouth
Parkers Neck
Lewis Bay
Hyannis
Follins Pond
The Golf Club at Yarmouthport
Dennis Highlands Golf Course
Bass River Golf Course
Bayberry Hills Golf Course
Barnstable Municipal Airport
Barnstable Harbor
Sandy Neck Beach Park
Kalmus Park
John Kelley Park
Black Flats
Chase Garden Creek
Mill Creek
Bass River
White Rock Rd
Weir Rd
Union St
W Great Western Rd
Whites Path
Mid-Cape Hwy
Old Town House Rd
Station Ave
Highbank Rd
N Main St
Forest Rd
Winslow Gray Rd
Long Pond Dr
Higgins Crowell Rd
Buck Island Rd
Willow St
Yarmouth Rd
Main St
Great Island Rd
Ocean St
Center St
Dennis Rd
Old Bass River Rd
East-West Dennis Rd
Hokum Rock Rd
Maylair Rd
Marstons Ln
West Dennis
161 ft
39 ft


Societal Features
Critical Town Services
Municipal
Vulnerable Populations
Fire/EMS
School
Hospital
Police
Transportation
N
0
0.25
0.5
1 Miles
WOODS HOLE GROUP
A CLS COMPANY
MASS GIS
DENNIS
BARNSTABLE
Yarmouth Port
South Yarmouth
West Yarmouth
West Dennis
Hyannis
Parkers Neck
Lewis Bay
Black Flats
Sandy Neck Beach Park
Barnstable Harbor
The Golf Club at Yarmouthport
Dennis Highlands Golf Course
Bayberry Hills Golf Course
Bass River Golf Course
John Kelley Park
Barnstable Municipal Airport
Kalmus Park
Follins Pond
Bass River
Mill Creek
Chase Garden Creek
Mid-Cape Hwy
Whites Path
W Great Western Rd
White Rock Rd
Weir Rd
Union St
Center St
Summer St
Willow St
Yarmouth Rd
Old Town House Rd
Station Ave
Highbank Rd
N Main St
N Dennis Rd
Maylair Rd
Old Bass River Rd
East-West Dennis Rd
Hokum Rock Rd
Higgins Crowell Rd
W Yarmouth Rd
Forest Rd
Winslow Gray Rd
Long Pond Dr
Buck Island Rd
Main St
Great Island Rd
Ocean St
Marstons Ln
161 ft
39 ft

APPENDIX D. CLIMATE CHANGE PROJECTIONS

CAPE COD BASIN

MUNICIPALITIES WITHIN CAPE COD BASIN:

Barnstable, Bourne, Brewster, Chatham, Dennis, Eastham, Falmouth, Harwich, Mashpee, Orleans, Provincetown, Sandwich, Truro, Wellfleet, Yarmouth

Many municipalities fall within more than one basin, so it is advised to use the climate projections for the basin that contains the majority of the land area of the municipality.

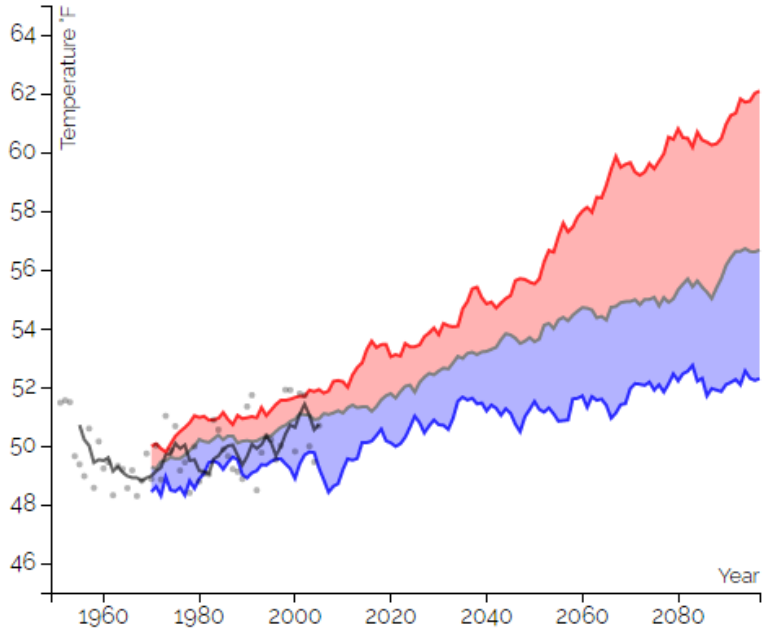
CAPE COD BASIN

Cape Cod Basin		Observed Baseline 1971-2000 (°F)	Projected Change in 2030s (°F)	Mid-Century Projected Change in 2050s (°F)	Projected Change in 2070s (°F)	End of Century Projected Change in 2090s (°F)
Average Temperature	Annual	49.92	+1.78 to +3.41	+2.41 to +5.39	+2.74 to +7.78	+3.11 to +9.52
	Winter	31.92	+1.76 to +3.72	+2.50 to +5.70	+3.07 to +7.69	+3.35 to +9.20
	Spring	45.98	+1.73 to +3.23	+2.16 to +5.04	+2.59 to +6.74	+2.94 to +7.69
	Summer	68.15	+1.50 to +3.62	+2.08 to +5.66	+2.45 to +8.58	+3.03 to +10.43
	Fall	53.32	+1.92 to +3.83	+3.03 to +5.86	+2.85 to +8.29	+3.35 to +10.06
Maximum Temperature	Annual	57.74	+1.63 to +3.38	+2.19 to +5.23	+2.43 to +7.73	+2.82 to +9.26
	Winter	39.76	+1.52 to +3.60	+2.10 to +5.27	+2.60 to +7.27	+3.01 to +8.65
	Spring	53.74	+1.44 to +3.11	+1.92 to +4.80	+2.30 to +6.54	+2.62 to +7.55
	Summer	75.95	+1.35 to +3.48	+1.95 to +5.60	+2.29 to +8.47	+2.68 to +10.27
	Fall	61.24	+1.84 to +3.80	+2.81 to +5.83	+2.76 to +8.00	+3.08 to +9.97
Minimum Temperature	Annual	42.09	+1.92 to +3.53	+2.67 to +5.50	+3.06 to +7.84	+3.42 to +9.67
	Winter	24.08	+2.06 to +3.97	+2.90 to +6.16	+3.53 to +8.34	+3.81 to +9.85
	Spring	38.23	+1.74 to +3.47	+2.51 to +5.28	+2.71 to +6.93	+3.19 to +7.83
	Summer	60.35	+1.65 to +3.75	+2.23 to +5.72	+2.61 to +8.66	+3.32 to +10.64
	Fall	45.41	+1.92 to +4.01	+3.14 to +5.88	+2.96 to +8.49	+3.63 to +10.28

- The Cape Cod basin is expected to experience increased average temperatures throughout the 21st century. Maximum and minimum temperatures are also expected to increase throughout the end of the century. These increased temperature trends are expected for annual and seasonal projections.
- Seasonally, maximum summer and fall temperatures are expected to see the highest projected increase throughout the 21st century.
    - Summer mid-century increase of 2 °F to 5.6 °F (3-7% increase); end of century increase of 2.7 °F to 10.3 °F (4-14% increase).
    - Fall mid-century increase of 2.8°F to 5.8°F (5-10% increase); end of century increase by and 2.8 °F to 5.8 °F (5-16% increase).
- Seasonally, minimum winter and fall temperatures are expected to see increases throughout the 21st century.
    - Winter mid-century increase of 2.9 °F to 6.2 °F (12-26% increase); end of century increase by 3.8 °F to 9.9 °F (16-41% increase).
    - Fall mid-century of 3.1 °F to 5.9 °F (7-13% increase); end of century increase of 3.6 °F to 10.3 °F (8-23% increase).

Annual Average Temperature

Cape Cod



Download Data

Observed	°F
5-yr Mean	

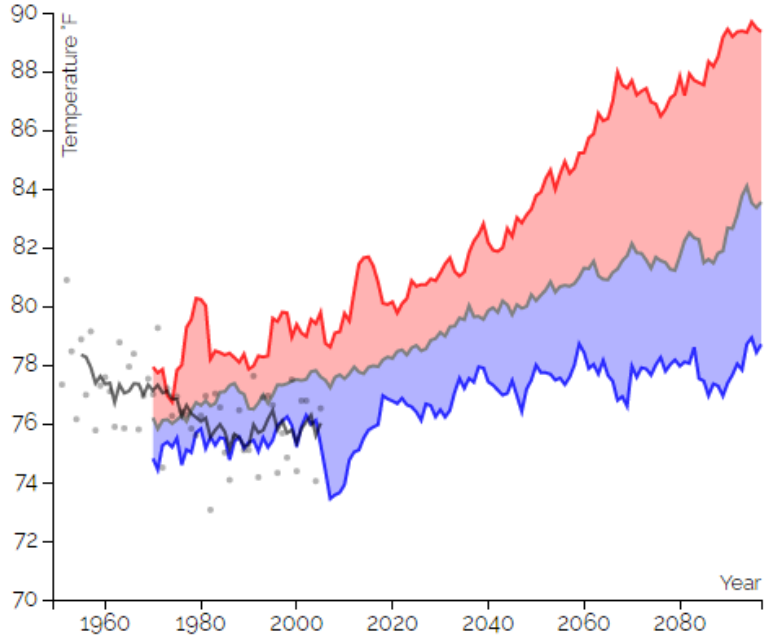
Modeled °F

Max	
Median	
Min	

Changes from 1971-2000 for:	
2020 - 2049	3.19°F
2040 - 2069	4.39°F
2060 - 2089	5.16°F
2080 - 2097	5.87°F

Summer Maximum Temperature

Cape Cod



Download Data

Observed	°F
5-yr Mean	

Modeled °F

Max	
Median	
Min	

Changes from 1971-2000 for:	
2020 - 2049	3.28°F
2040 - 2069	4.41°F
2060 - 2089	5.28°F
2080 - 2097	6.15°F

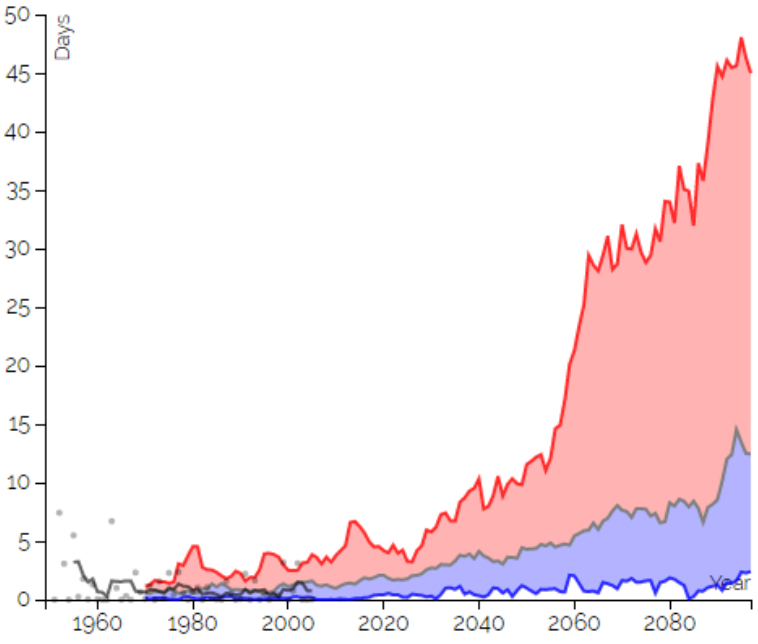
CAPE COD BASIN

Cape Cod Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Days with Maximum Temperature Over 90°F	Annual	0.76	+1.17 to +3.89	+1.93 to +9.25	+2.46 to +21.33	+3.23 to +33.89
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.01	-0.02 to +0.09	-0.02 to +0.13	+0.00 to +0.20	+0.00 to +0.29
	Summer	0.73	+1.06 to +3.58	+1.79 to +8.62	+2.34 to +19.96	+3.04 to +31.61
	Fall	0.01	+0.06 to +0.28	+0.10 to +0.68	+0.13 to +1.26	+0.19 to +2.26
Days with Maximum Temperature Over 95°F	Annual	0.06	+0.08 to +0.63	+0.19 to +1.88	+0.25 to +4.51	+0.26 to +9.49
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.00 to +0.01	-0.00 to +0.02	+0.00 to +0.05	+0.00 to +0.08
	Summer	0.06	+0.07 to +0.61	+0.18 to +1.85	+0.25 to +4.32	+0.26 to +9.11
	Fall	0.00	+0.00 to +0.03	+0.00 to +0.06	+0.00 to +0.17	+0.00 to +0.42
Days with Maximum Temperature Over 100°F	Annual	0.00	+0.00 to +0.07	+0.00 to +0.31	+0.01 to +0.80	+0.03 to +1.71
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.01
	Summer	0.00	+0.00 to +0.07	+0.00 to +0.31	+0.01 to +0.80	+0.02 to +1.69
	Fall	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.01	+0.00 to +0.04

- Due to projected increases in average and maximum temperatures throughout the end of the century, the Cape Cod basin is also expected to experience an increase in days with daily maximum temperatures over 90 °F, 95 °F, and 100 °F.
    - Annually, the Cape Cod basin is expected to see days with daily maximum temperatures over 90 °F increase by 2 to 9 more days by mid-century, and 3 to 34 more days by the end of the century.
    - Seasonally, summer is expected to see an increase of 2 to 9 more days with daily maximums over 90 °F by mid-century.
    - By end of century, the Cape Cod basin is expected to have 3 to 32 more days.

Summer Days with Maximum Temperature Above 90°F

Cape Cod



Download Data

Observed

days

5-yr Mean

Modeled days

Max

Median

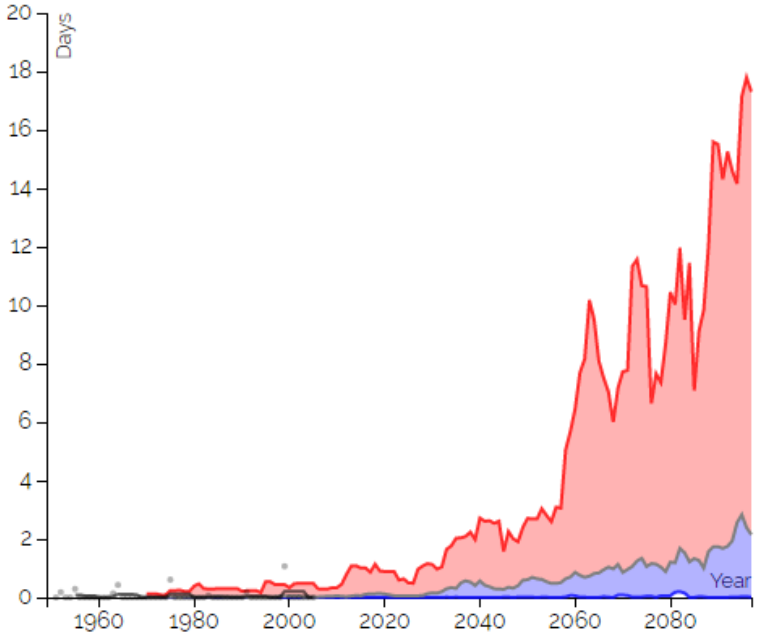
Min

Changes from 1971-2000 for:

2020 - 2049	2.59 days
2040 - 2069	4.20 days
2060 - 2089	7.13 days
2080 - 2097	8.04 days

Summer Days with Maximum Temperature Above 95°F

Cape Cod



Download Data

Observed

days

5-yr Mean

Modeled days

Max

Median

Min

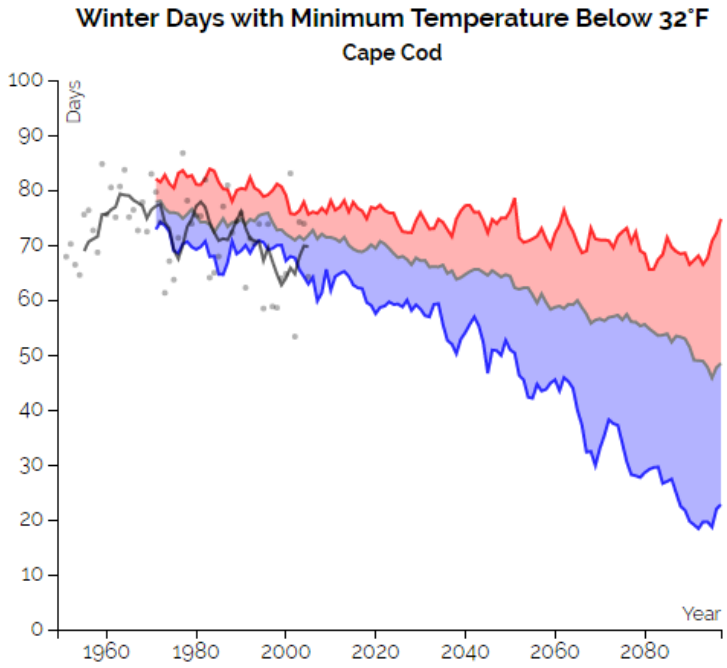
Changes from 1971-2000 for:

2020 - 2049	0.29 days
2040 - 2069	0.61 days
2060 - 2089	1.06 days
2080 - 2097	1.68 days

CAPE COD BASIN

Cape Cod Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Days with Minimum Temperature Below 0°F	Annual	0.79	-0.08 to -0.37	-0.09 to -0.39	-0.14 to -0.4	-0.15 to -0.4
	Winter	0.79	-0.08 to -0.37	-0.09 to -0.39	-0.14 to -0.4	-0.15 to -0.4
	Spring	0.00	-0.01 to -0.00	-0.01 to -0.00	-0.01 to -0.00	-0.01 to -0.00
	Summer	0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00
	Fall	0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00
Days with Minimum Temperature Below 32°F	Annual	104.75	-13.60 to -27.72	-19.29 to -41.91	-23.29 to -54.38	-24.54 to -66.71
	Winter	70.7	-5.68 to -12.20	-7.00 to -20.22	-10.21 to -29.71	-11.46 to -38.36
	Spring	23.8	-5.16 to -11.14	-7.22 to -14.64	-7.87 to -17.32	-9.50 to -18.96
	Summer	0.00	-0.05 to -0.00	-0.04 to -0.00	-0.04 to -0.00	-0.05 to -0.00
	Fall	10.16	-3.40 to -6.37	-4.69 to -8.2	-5.09 to -9.62	-5.34 to -10.71

- Due to projected increases in average and minimum temperatures throughout the end of the century, the Cape Cod basin is expected to experience a decrease in days with daily minimum temperatures below 32 °F and 0 °F.
- Seasonally, winter, spring and fall are expected to see the largest decreases in days with daily minimum temperatures below 32 °F.
    - Winter is expected to have 7 to 20 fewer days by mid-century, and 11 to 38 fewer days by end of century.
    - Spring is expected to have 7 to 15 fewer days by mid-century, and 10 to 19 fewer days by end of century.
    - Fall is expected to have 5 to 8 fewer days by mid-century, and 5 to 11 fewer days by end of century.



Download Data

Observed

days

5-yr Mean

Modeled days

Max

Median

Min

Changes from 1971-2000 for:

2020 - 2049	-5.79days
2040 - 2069	-10.26days
2060 - 2089	-15.50days
2080 - 2097	-19.15days

CAPE COD BASIN

Cape Cod Basin		Observed Baseline 1971-2000 (Degree-Days)	Projected Change in 2030s (Degree-Days)	Mid-Century Projected Change in 2050s (Degree-Days)	Projected Change in 2070s (Degree-Days)	End of Century Projected Change in 2090s (Degree-Days)
Heating Degree-Days (Base 65°F)	Annual	5956.64	-475.48 to -913.39	-685.90 to -1374.26	-773.67 to -1828.23	-854.04 to -2171.56
	Winter	2996.33	-164.51 to -347.77	-220.16 to -520.87	-277.06 to -697.53	-304.13 to -831.96
	Spring	1753.89	-152.01 to -285.19	-190.19 to -444.68	-229.91 to -584.74	-267.48 to -649.94
	Summer	94.49	-30.02 to -57.56	-41.95 to -69.89	-44.65 to -80.65	-44.99 to -85.45
	Fall	1105.61	-131.82 to -268.87	-226.73 to -393.30	-215.14 to -547.22	-242.01 to -619.87
Cooling Degree-Days (Base 65°F)	Annual	435.71	+144.74 to +364.43	+224.26 to +601.17	+250.48 to +965.18	+314.49 to +1226.21
	Winter	nan	+0.13 to +1.43	+0.38 to +3.50	+0.92 to +3.19	-0.34 to +3.91
	Spring	7.08	+3.48 to +9.44	+4.94 to +20.08	+5.86 to +34.34	+7.02 to +52.03
	Summer	384.03	+107.28 to +279.41	+148.81 to +457.16	+184.27 to +701.82	+229.32 to +875.35
	Fall	43.77	+30.85 to +80.41	+41.77 to +138.18	+48.96 to +224.33	+71.67 to +296.72
Growing Degree-Days (Base 50°F)	Annual	2421.38	+343.19 to +690.79	+460.30 to +1078.12	+519.05 to +1678.13	+617.96 to +2104.38
	Winter	4.84	+0.24 to +9.74	+0.28 to +15.26	+2.10 to +25.74	+4.23 to +35.89
	Spring	197.63	+50.56 to +105.22	+69.23 to +195.43	+77.64 to +277.13	+77.88 to +342.92
	Summer	1669.64	+137.95 to +332.36	+190.73 to +520.48	+224.93 to +789.31	+278.12 to +958.80
	Fall	546.41	+107.92 to +248.13	+174.67 to +396.65	+168.86 to +571.84	+215.05 to +716.85

- Due to projected increases in average, maximum, and minimum temperatures throughout the end of the century, the Cape Cod basin is expected to experience a decrease in heating degree-days, and increases in both cooling degree-days and growing degree-days.
- Seasonally, winter historically exhibits the highest number of heating degree-days and is expected to see the largest decrease of any season, but spring and fall are also expected to see significant change.
    - The winter season is expected to see a decrease of 220-521 degree-days by mid-century (a decrease of 7-17%), and a decrease of 304-832 degree-days by the end of century (a decrease of 10-28%).
    - The spring season is expected to decrease in heating degree-days by 11-25% (190-445 degree-days) by mid-century, and by 15-37% (267-650 degree-days) by the end of century.
    - The fall season is expected to decreases in heating degree-days by 21-36% (227-393 degree-days) by mid-century, and by and 22-56% (242-620 degree-days) by the end of century.
- Conversely, due to projected increasing temperatures, summer cooling degree-days are expected to increase by 39-119% (149-457 degree-days) by mid-century, and by 60-228% (229-875 degree-days) by end of century.

- Seasonally, summer historically exhibits the highest number of growing degree-days and is expected to see the largest decrease of any season, but the shoulder seasons of spring and fall are also expected to see an increase in growing degree-days.
    - The summer season is projected to increase by 11-31% (190.73-520.48 degree-days) by mid-century, and by 17-57% (278-959 degree-days) by end of century.
    - Spring is expected to see an increase by 35-99% (69-195 degree-days) by mid-century and 39-174% (78-343 degree-days) by end of century.
    - Fall is expected to see an increase by 32-73% (175-397 degree-days) by mid-century and 39-131% (215-717 degree-days) by end of century.

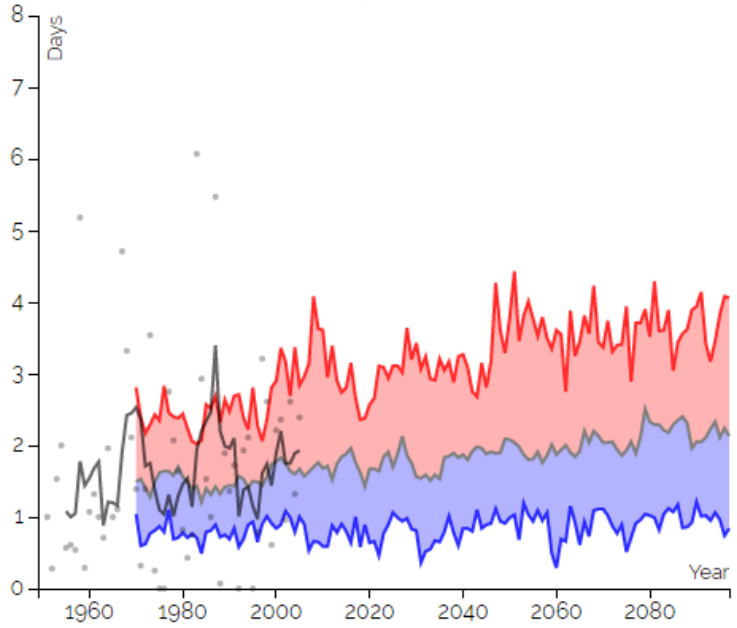
CAPE COD BASIN

Cape Cod Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Days with Precipitation Over 1”	Annual	7.02	+0.16 to +1.76	+0.66 to +2.66	+0.45 to +2.92	+0.55 to +3.41
	Winter	1.45	-0.10 to +0.62	+0.08 to +0.67	+0.02 to +1.04	+0.09 to +1.35
	Spring	1.65	+0.08 to +0.65	+0.08 to +0.90	+0.22 to +1.05	+0.29 to +1.20
	Summer	1.92	-0.18 to +0.55	-0.13 to +0.78	-0.40 to +0.66	-0.46 to +0.58
	Fall	2.01	-0.23 to +0.62	-0.13 to +0.85	-0.31 to +0.94	-0.35 to +1.11
Days with Precipitation Over 2”	Annual	0.75	-0.04 to +0.43	+0.07 to +0.52	+0.08 to +0.71	+0.05 to +0.74
	Winter	0.09	-0.05 to +0.16	-0.02 to +0.15	-0.02 to +0.20	-0.02 to +0.27
	Spring	0.05	-0.03 to +0.13	+0.01 to +0.18	+0.02 to +0.19	-0.01 to +0.25
	Summer	0.33	-0.07 to +0.15	-0.05 to +0.23	-0.05 to +0.20	-0.05 to +0.22
	Fall	0.28	-0.04 to +0.13	-0.01 to +0.20	-0.01 to +0.23	-0.07 to +0.31
Days with Precipitation Over 4”	Annual	0.01	+0.00 to +0.03	+0.00 to +0.03	-0.01 to +0.05	-0.01 to +0.05
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.01	-0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.00 to +0.01	+0.00 to +0.00	+0.00 to +0.01	+0.00 to +0.00
	Summer	0.00	-0.01 to +0.02	-0.01 to +0.02	-0.01 to +0.03	-0.01 to +0.03
	Fall	0.01	-0.00 to +0.02	+0.00 to +0.01	+0.00 to +0.02	+0.00 to +0.03

- The projections for expected number of days receiving precipitation over one inch are variable for the Cape Cod basin, fluctuating between loss and gain of days.
    - Seasonally, the winter season is generally expected to see the highest projected increase.
    - The winter season is expected to see an increase in days with precipitation over one inch of 0-1 days by mid-century, and by 0-1 days by the end of century.
    - The spring season is expected to see an increase in days with precipitation over one inch of 0-1 days by mid-century, and by 0-1 days by the end of century.

Spring Days with Precipitation > 1"

Cape Cod



Download Data

Observed

days

5-yr Mean

Modeled days

Max

Median

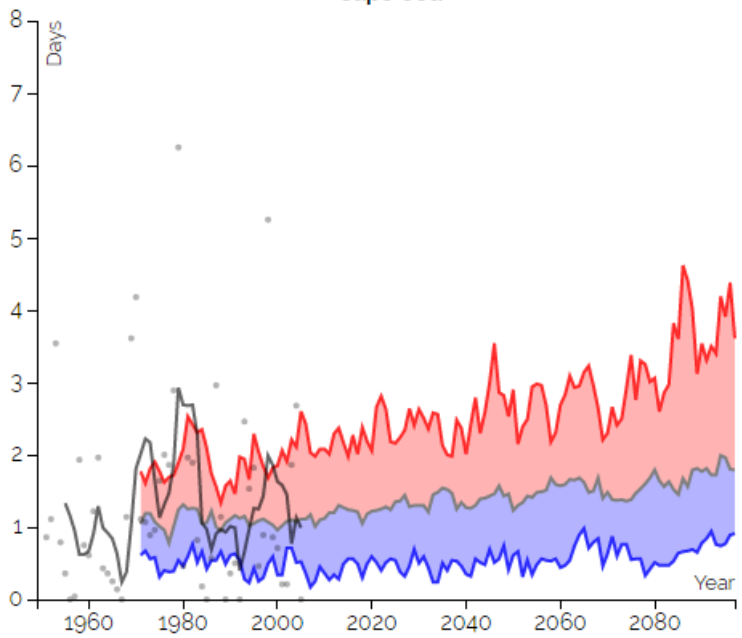
Min

Changes from 1971-2000 for:

2020 - 2049	0.39days
2040 - 2069	0.46days
2060 - 2089	0.59days
2080 - 2097	0.78days

Winter Days with Precipitation > 1"

Cape Cod



Download Data

Observed

days

5-yr Mean

Modeled days

Max

Median

Min

Changes from 1971-2000 for:

2020 - 2049	0.33days
2040 - 2069	0.45days
2060 - 2089	0.55days
2080 - 2097	0.73days

CAPE COD BASIN

Cape Cod Basin		Observed Baseline 1971-2000 (Inches)	Projected Change in 2030s (Inches)	Mid-Century Projected Change in 2050s (Inches)	Projected Change in 2070s (Inches)	End of Century Projected Change in 2090s (Inches)
Total Precipitation	Annual	44.94	-1.08 to +3.47	-0.38 to +4.54	-0.78 to +5.79	-0.83 to +5.45
	Winter	11.63	-0.40 to +1.24	-0.22 to +1.59	-0.05 to +2.10	-0.04 to +3.13
	Spring	11.51	-0.04 to +1.48	-0.26 to +1.67	-0.21 to +2.08	+0.08 to +2.45
	Summer	10.24	-0.95 to +1.19	-1.05 to +1.73	-1.64 to +2.00	-2.22 to +1.66
	Fall	11.62	-0.96 to +0.90	-0.99 to +1.09	-1.40 to +1.64	-1.52 to +1.26

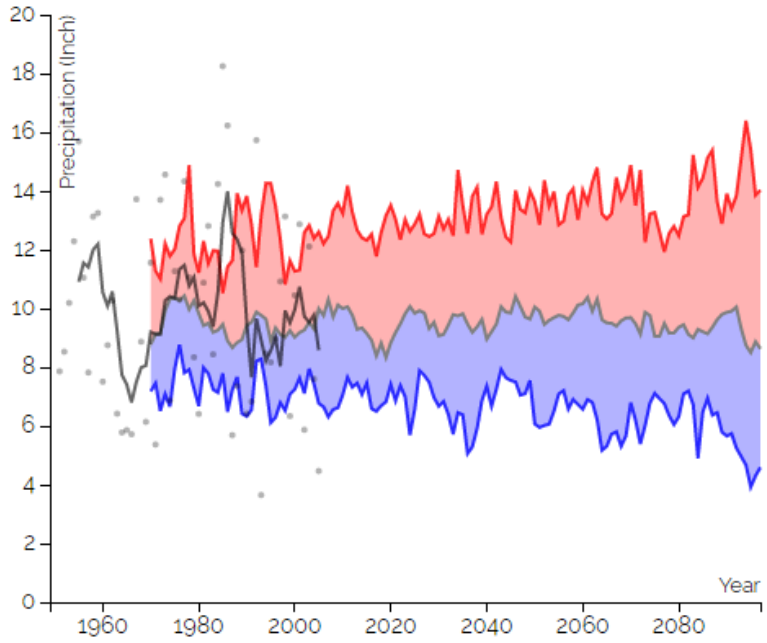
- Similar to projections for number of days receiving precipitation over a specified threshold, seasonal projections for total precipitation are also variable for the Cape Cod basin.
    - The winter season is expected to experience the greatest change with a decrease of 2% to an increase of 14% by mid-century, and an increase of 0-27% by end of century.
    - Projections for the summer and fall seasons are more variable, and could see either a drop or increase in total precipitation throughout the 21st century.
        - The summer season projections for the Cape Cod or basin could see a decrease of 1.1 to an increase of 1.7 inches by mid-century (decrease of 10% to increase of 17%), and a decrease of 2.2 to an increase of 1.7 inches by the end of the century (decrease of 22% to increase of 16%).
        - The fall season projections for the Cape Cod basin could see a decrease of -1 to an increase of 1.1 inches by mid-century (decrease of 9% to increase of 9%), and a decrease of 1.5 to an increase of 1.3 inches by the end of the century (decrease of 13% to increase of 11%).

Cape Cod Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Consecutive Dry Days	Annual	18.72	-1.06 to +1.99	-0.56 to +2.62	-0.34 to +3.63	-0.26 to +4.65
	Winter	10.19	-0.52 to +1.53	-0.44 to +1.46	-0.31 to +1.83	-0.94 to +1.97
	Spring	11.59	-0.99 to +1.21	-0.86 to +1.50	-1.00 to +1.48	-1.34 to +1.58
	Summer	15.38	-1.00 to +2.02	-0.83 to +2.61	-0.89 to +4.38	-1.03 to +5.26
	Fall	13.05	-0.57 to +2.45	-0.04 to +2.29	+0.17 to +2.82	+0.04 to +3.45

- Annual and seasonal projections for consecutive dry days, or for a given period, the largest number of consecutive days with precipitation less than 1 mm (~0.04 inches), are variable throughout the 21st century.
    - For all the temporal parameters, the Cape Cod basin is expected to see a slight decrease to an increase in consecutive dry days throughout this century.
    - Seasonally, the fall and summer seasons are expected to continue to experience the highest number of consecutive dry days.
        - The summer season is expected to experience a decrease of 1 day to an increase of 5 days in consecutive dry days by the end of the century.

Summer Total Precipitation

Cape Cod



Download Data

Observed

Inches

5-yr Mean

Modeled Inches

Max

Median

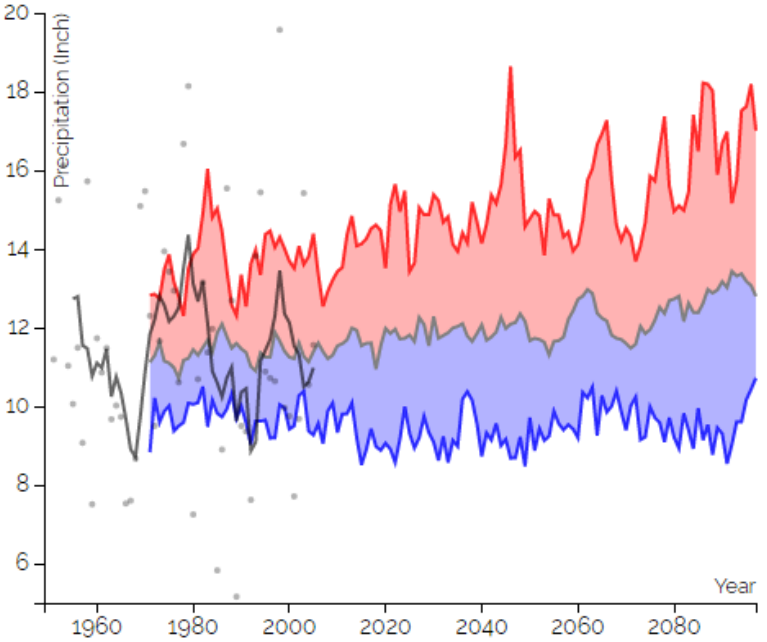
Min

Changes from 1971-2000 for:

2020 - 2049	-0.74"
2040 - 2069	-0.65"
2060 - 2089	-0.89"
2080 - 2097	-1.07"

Winter Total Precipitation

Cape Cod



Download Data

Observed

Inches

5-yr Mean

Modeled Inches

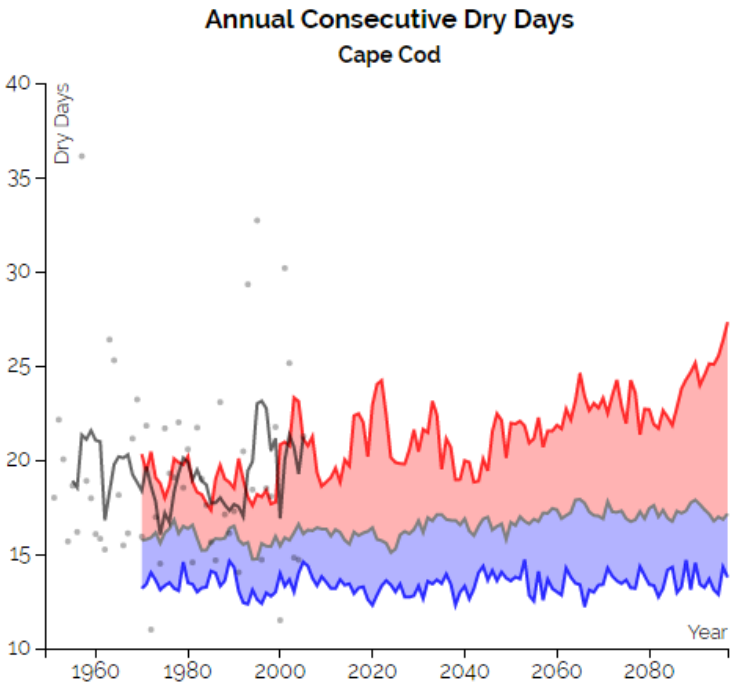
Max

Median

Min

Changes from 1971-2000 for:

2020 - 2049	0.80"
2040 - 2069	0.90"
2060 - 2089	1.25"
2080 - 2097	1.80"



Download Data

Observed

days

5-yr Mean

Modeled days

Max

Median

Min

Changes from 1971-2000 for:

2020 - 2049	-2.02days
2040 - 2069	-1.58days
2060 - 2089	-1.22days
2080 - 2097	-1.23days

Table 7, Figure 1: Relative (or local) mean sea level projections for the Boston, MA tide station based on four National Climate Assessment global scenarios with associated probabilistic model outputs from the Northeast Climate Science Center. Each of the scenarios—Intermediate, Intermediate-High, High, and Extreme—is cross-walked with two to three probabilistic model outputs. Modeling considered two future concentrations of greenhouse gas emissions (referred to as representative concentration pathways [RCP]) and two methods of accounting for Antarctic ice sheet contributions to sea level rise. A 19-year reference time period for sea level (tidal epoch) centered on the year 2000 was used to minimize biases caused by tidal, seasonal, and inter-annual climate variability. Sea level projections for the Boston tide station are referenced to the North American Vertical Datum of 1988 (NAVD88).

Relative mean sea level (feet NAVD88) for Boston, MA					
Scenario	**Probabilistic projections**	**2030**	**2050**	**2070**	**2100**
Intermediate	Unlikely to exceed (83% probability) given a high emissions pathway (RCP 8.5)	0.7	1.4	2.3	4.0
Intermediate- High	Extremely unlikely to exceed (95% probability) given a high emissions pathway (RCP 8.5)	0.8	1.7	2.9	5.0
High	Extremely unlikely to exceed (99.5% probability) given a high emissions pathway (RCP 8.5)	1.2	2.4	4.2	7.6
Extreme (Maximum physically plausible)	Exceptionally unlikely to exceed (99.9% probability) given a high emissions pathway (RCP 8.5)	1.4	3.1	5.4	10.2

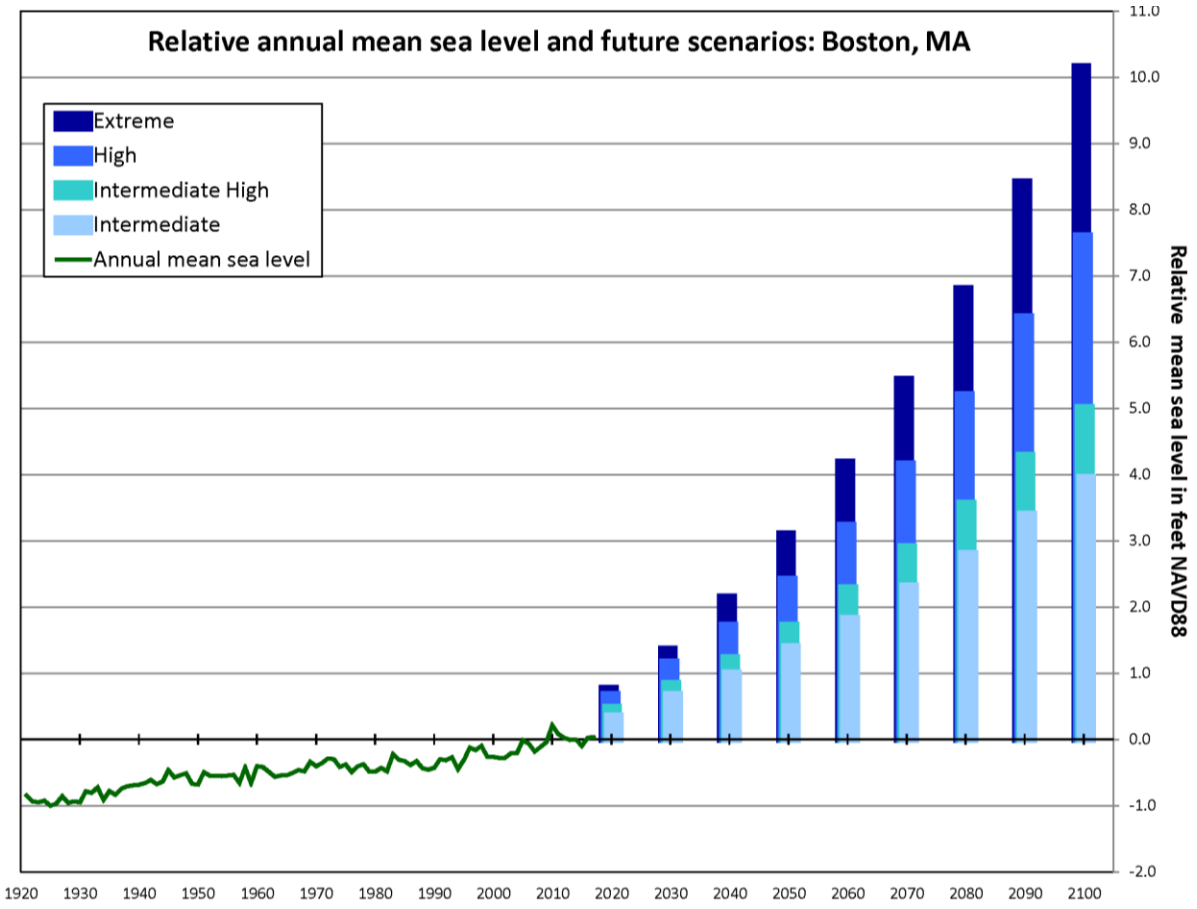
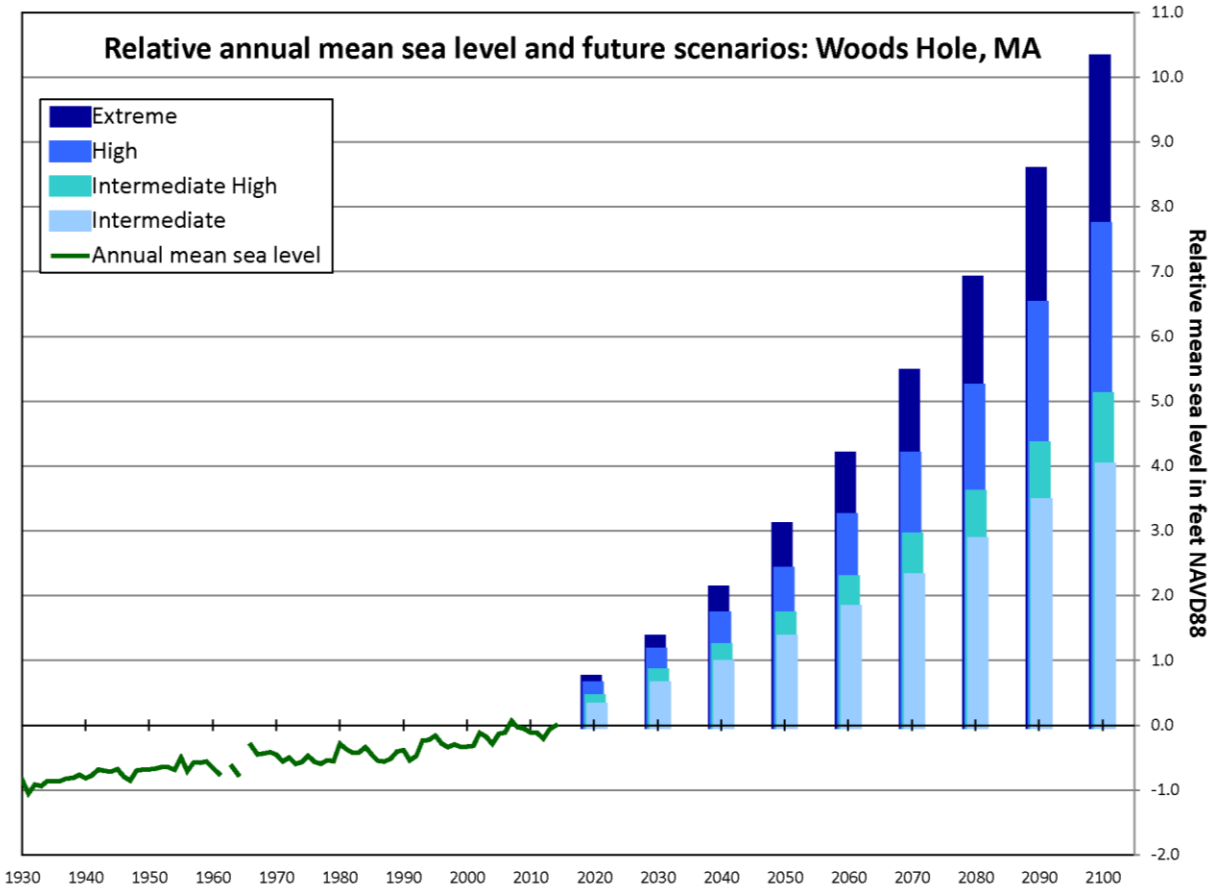
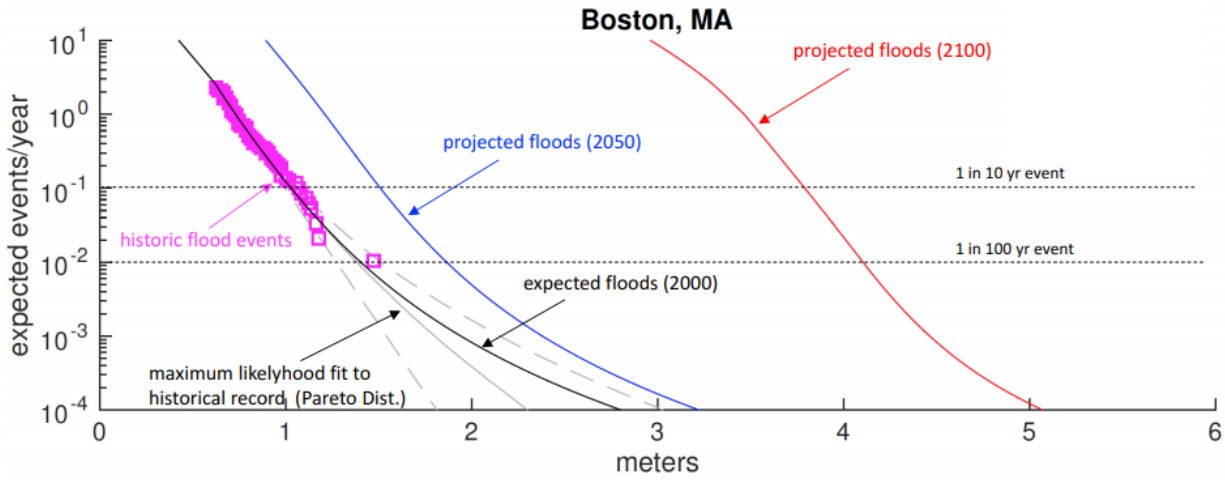


Table 8, Figure 2: Relative (or local) mean sea level projections for the Woods Hole, MA tide station based on four National Climate Assessment global scenarios with associated probabilistic model outputs from the Northeast Climate Science Center. Each of the scenarios—Intermediate, Intermediate-High, High, and Extreme—is cross-walked with two to three probabilistic model outputs. Modeling considered two future concentrations of greenhouse gas emissions (referred to as representative concentration pathways [RCP]) and two methods of accounting for Antarctic ice sheet contributions to sea level rise. A 19-year reference time period for sea level (tidal epoch) centered on the year 2000 was used to minimize biases caused by tidal, seasonal, and inter-annual climate variability. Sea level projections for the Woods Hole tide station are referenced to the North American Vertical Datum of 1988 (NAVD88).

Relative mean sea level (feet NAVD88) for Woods Hole, MA					
Scenario	**Probabilistic projections**	**2030**	**2050**	**2070**	**2100**
Intermediate	Unlikely to exceed (83% probability) given a high emissions pathway (RCP 8.5)	0.6	1.3	2.3	4.0
Intermediate- High	Extremely unlikely to exceed (95% probability) given a high emissions pathway (RCP 8.5)	0.8	1.7	2.9	5.1
High	Extremely unlikely to exceed (99.5% probability) given a high emissions pathway (RCP 8.5)	1.1	2.4	4.2	7.7
Extreme (Maximum physically plausible)	Exceptionally unlikely to exceed (99.9% probability) given a high emissions pathway (RCP 8.5)	1.3	3.1	5.4	10.3





Recurrence frequencies were also provided for Nantucket, Woods Hole, and Newport, RI

after Buchanan et al., (2016)

APPENDIX E. LISTENING SESSION AND PUBLIC COMMENTS

Notes from April 30, 2019 Listening Session

The Yarmouth MVP Public Listening Session was held at Town Hall in Yarmouth. The following public comments were generated during the Listening Session:

- One participant requested Woods Hole Group to further explain the type of grants the Town will be eligible for once the Town becomes MVP Certified. *(A brief summary of MVP Action Grants was given, and the participant was referred to a packet provided at the Listening Session summarizing MVP Action Grant program eligible projects. It was also noted that MVP Certification is viewed as a benefit and sometimes given extra points in other grant programs.)*

- One participant expressed concern regarding the ozone and air quality on Cape Cod. After reading a recent article, this participant learned that Cape Cod was identified as having high ozone. This participant asked what is impacting this characterization and how will it be affected by future climate change projections. *(Ground-level ozone is formed by the chemical reaction between NOx and VOCs in the presence of heat and sunlight. NOx and VOCs are emitted from industrial sources, motor vehicles, gasoline vapors, and chemical solvents; they are related to development but can also be transported by wind from other places. A potential climate change linkage is that higher average temperatures and more frequent extreme heat days may facilitate the production of ground-level ozone in the presence of the component chemicals.)*

- Another participant noted the importance of cranberry bogs in Yarmouth, in particular their potential capacity for water storage during storm surge and other hazard events. *(The restoration of coastal wetlands, facilitation of salt marsh migration, and "rewildling" of cranberry bogs are all important components in the coastal resilience toolkit. The commenter was asked to submit written comments, and discussion continued about potential linkages to existing grant funding. The Town expressed interest in this particular avenue for developing flood storage and coastal resilience in the Town of Yarmouth.)* The conversation among attendees and the commenter is summarized below:
    - Many of the bogs located in Yarmouth are no longer operational and are starting to turn into more upland habitats.
    - Concern was expressed of the potential loss of water storage capacity as they convert to upland habitat and what will become of these bogs in the future.
    - Yarmouth needs to find ways to ecologically restore these cranberry bogs to their natural habitat in order to increase water storage and restore natural herring habitat.
    - Is it possible to receive MVP Action Grant money to do some ecological restoration of these cranberry bogs?

  - Inundation events are already happening, therefore there needs to be a continued discussion about the potential increase in storage capacity not just in the future but NOW.
  - A potential knowledge gap between stakeholders of restoration efforts and residents was highlighted:
    - Local match funding for projects like this has always been difficult.
    - Restoration efforts of these habitats have been a hot topic among residents. Residents need to support these efforts but there are knowledge gaps regarding the importance of these restoration efforts.
    - Residents are already calling DPW and police asking for solutions to prevent water from flooding their roads.
    - If the public understood the broader agenda and importance of these efforts, they may be more supportive.
    - There needs to be evidence that restoring these cranberry bogs to increase water storage and removal of nitrogen has been effective in other areas.
  - Cranberry bogs in Yarmouth have low productivity (non-operational) but can experience extreme flooding. Maybe Yarmouth needs to look at the groundwater flow especially through Captains Village and through the cranberry bogs. Generally, within Yarmouth, groundwater flows in the southwest direction.
  - The cranberry bogs attached to Mill Pond is another area of concern. These bogs are unproductive because the hydrology throughout this system is insufficient.

- Another attendee expressed concerns about the wetlands surrounding Cape Cod Hospital. *(This area was identified as a vulnerability during the workshop, and further discussion of restoration potential occurred among attendees and Town staff.)*
  - What role does the district have in restoring the wetlands in this area to increase water storage, remove nitrogen, and improve the natural habitat for herring and other wildlife?
  - There is a need to determine the type of restoration- how to vegetate, how to provide stormwater remediation, how to prevent stormwater overflow into adjacent communities and how to protect the hospital.
  - To what degree will ecological restoration protect this entire area?

- One attendee questioned where to view the maps that were completed during the workshop and where to obtain the climate change data used in the presentation. *(The commenter was directed to the Draft MVP report and the resilientMA data portal)*

- Another attendee expressed concern regarding the high-speed ferries that enter Lewis Bay and dock in Hyannis. This person was concerned about the erosional issues along Bay View Beach resulting from the wake of the ferries. Since the start of the ferries, a lot

of changes have occurred. *(The Massachusetts Office of Coastal Zone Management, USGS Woods Hole Coastal and Marine Science Center, Woods Hole Sea Grant, and Barnstable County's Cape Cod Cooperative Extension all work on and monitor coastal erosion issues in the region. Their data, or a site-specific study, may be informative as to the contributing factors to erosion in Lewis Bay as well as potential solutions.)*

Williams, Kathleen

From: Jan Hively <hivel001@umn.edu>
Sent: Monday, April 22, 2019 4:56 PM
To: Williams, Kathleen
Cc: Bailey, Kathleen; Pamela Glynn; Susan Starkey
Subject: Draft MVP Report and Public Listening Session

Dear Kathy..
I've just read through the draft of your excellent Community Resilience Building Workshop report. Well done!

Unfortunately, I'll be in New York City on April 30, preparing for a May 2 meeting of the UN's NGO Committee on Ageing. Sorry to miss your Public Listening Session.

My comment simply reinforces the last cluster of items on the "High Priority Actions" list that address the need for an effective emergency communications system that reaches vulnerable residents who are alone and homebound because of age and/or disabilities. The Police Commissioner's phone messages are terrific -- until the electricity goes out and the landline phone system, radio and TV along with it. The now-retired secretary at our UU Church in Barnstable told me about spending 3 days in her studio apartment in Hyannis without contact because the elevator went out along with the refrigerator and heat and phone system and computer access and there was no generator back-up. What would work?

I know that Yarmouth has a great neighborhood security group system as an offshoot of the Police Department. I wish that we could have something like a neighborhood phone tree, where a volunteer makes home visits with a set group of residents on his/her list for those needed contact or assistance.

I'll look forward to seeing the final report. Many thanks for your good work!

Warm regards,
Jan Hively

--
Jan (Janet M.) Hively, PhD
Co-Founder and U.S. Liaison
The Pass It On Network
Accredited member of the UN Open-Ended Working Group on Ageing
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121 Camp St #100
West Yarmouth MA 02673
HIVEL001@umn.edu
Home/office: 508-957-2620

Williams, Kathleen

From: Waygan, Mary
Sent: Wednesday, May 1, 2019 10:47 AM
To: Williams, Kathleen
Cc: Greene, Karen
Subject: Comment on Yarmouth MPV Draft Report

Hi Kathy,

US EPA recently updated their publication on "PLANNING FOR NATURAL DISASTER DEBRIS" found at:
https://www.epa.gov/sites/production/files/2019-04/documents/final_pndd_guidance_0.pdf

This publication has some good materials to include or cite in Yarmouth's Municipal Vulnerability Preparedness Report, for example here is the text from Figure 2:

Figure 2. Enhancing Residential Resiliency

Residents can take certain actions to limit the damage to their homes during natural disasters, decreasing the amount of debris generated, such as:

- Brace hot water heaters to keep them from toppling and rupturing gas lines to prevent fire outbreaks.
- Strengthen walls, foundations, and chimneys to limit damage.
- Bring inside or secure (e.g., with ground anchors or straps) all outdoor objects, such as trash cans and recycling bins, patio furniture, grills, and lawn ornaments (e.g., garden gnomes), to reduce potential projectiles and debris. If trash cans and recycling bins are left outside, strap down their lids (e.g., secure the lid with duct tape).
- Secure propane and other tanks and containers to limit spills and releases.
- Place barriers (e.g., sandbags) around structures to help divert debris and water.
- Remove dead or diseased trees and trim limbs away from buildings and water pipes to help prevent dislodged trees and branches and damage from flying vegetative debris.
- Cover and secure windows and doors (e.g., with protective shutters) to prevent damage from flying debris and reduce the risk of water damage.
- Use fire-safe landscaping and fire-resistant building materials (e.g., metal roofs and stucco) to reduce damage from fire.

Mary Waygan
Affordable Housing/CDBG Program Administrator
Town of Yarmouth
1146 Route 28, South Yarmouth, MA 02664
508-398-2231 X 1275 mwaygan@yarmouth.ma.us

Williams, Kathleen

From: Williams, Kathleen
Sent: Wednesday, May 1, 2019 2:25 PM
To: 'Mark Forest'
Subject: RE: MVP - Abandoned Cranberry Bogs.

Hi Mark,

I will forward your comments to Joe Famely and request he include this in the MVP to expand grant funding opportunities.

Thanks,
Kathy

Kathy Williams, PE
Yarmouth Town Planner
1146 Route 28
South Yarmouth, MA 02664-4492
(508) 398-2231 Ext 1276
kwilliams@yarmouth.ma.us

From: Mark Forest [mailto:mark.r.forest@me.com]
Sent: Wednesday, May 1, 2019 2:04 PM
To: Williams, Kathleen <kwilliams@yarmouth.ma.us>
Subject: MVP - Abandoned Cranberry Bogs.

Kathy -

I very much appreciate all the hard work to create an MVP plan to guide town officials on how best to address climate change.

I am very interested in the problems associated with coastal flooding and the need for more water storage during coastal storms and flooding.

The continued loss of coastal wetlands is a serious issue throughout the country. In Yarmouth we have a number of abandoned cranberry bogs that were once valuable coastal wetlands. As bogs are abandoned they appear to be converting to uplands and will offer minimal flood storage benefits. As sea level rises, the loss of old bogs could worsen the situation and adversely impact more residential areas in Yarmouth.

I would like to see the consultants address the potential benefits of converting abandoned cranberry bogs back to wetlands and creating more water/flooding storage. I noted from last night's meeting that the state may have funds to do this kind of work.

I would be happy to elaborate further. Feel free to contact me if you have any questions.

_____
Mark. R. Forest,
Chairman
Cape Cod Conservation District
West Yarmouth MA
Phone: 508-776-3246

Williams, Kathleen

From: Christine <cmarzigliano@comcast.net>
Sent: Thursday, May 2, 2019 9:23 AM
To: Williams, Kathleen
Subject: Air Quality

Hi Kathy:

If you Google WBZ Air Quality you will see the report from 4/24 on Ozone stating that Barnstable County has poor air quality.

Christine Marzigliano

Sent from Mail for Windows 10