Town of Norwell
Community Resilience Building Workshop
Summary of Findings
February 2020

Summary of Findings

Overview

Recent years have seen notable weather extremes in Norwell. The winter of 2015 brought record-breaking snow, resulting in downed trees and power outages. The following year the Norwell area was under a drought warning from July to November 2016, leading to extreme low flows in many of Norwell's brooks. The winter of 2018 once again brought severe winter storms with a succession of four nor'easters pummeling the town in March. In March 2010 rainfall was so significant that a federal disaster was declared for eastern Massachusetts, resulting in $59 million in assistance to individual households and $26 million in reimbursements to the state and municipalities. In Norwell, 87 properties received flood insurance or disaster assistance. Globally, the past five years are the hottest in recorded history.

In 2017, the Commonwealth of Massachusetts inaugurated the Municipal Vulnerability Preparedness (MVP) program to assist municipalities in planning for and implementing strategies to adapt to predicted changes in our warming climate. The predicted changes include both increased flooding from large rain events and a greater likelihood of drought, increased extreme heat days and heat waves, and increased flooding from sea level rise.

The Town of Norwell, seeking to be proactive in addressing future climate threats, applied for a state grant to complete the Community Resilience Building (CRB) Workshop under the MVP program. Concurrent with the MVP program, Norwell is updating its Hazard Mitigation Plan (HMP). The HMP is a five-year plan, developed under the auspices of FEMA, that identifies strategies to address natural hazards. Upon completion of the projects, the Town of Norwell will be eligible to apply for state and federal grant to address natural hazards and climate risks.

The Town of Norwell is partnering with the Metropolitan Area Planning Council (MAPC) to complete the MVP program and the Hazard Mitigation Plan. The MVP Core Planning Team identified and recruited community stakeholders to participate in the one-day CRB Workshop. Forty-one people representing Norwell town staff, members of Norwell Boards and Commissions, and Norwell community organizations gathered on November 7, 2019 (see Workshop Participants page 8). 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;
- Identify immediate opportunities to collaboratively advance actions to increase resilience.

Materials provided for the workshop included local and regional data for changes in temperature, precipitation, and sea level recorded to date, as well as future projections to the end of the century. Posters provided data and mapping specific to Norwell infrastructure, demographics, and natural resources (see Appendix A).

The participants considered Norwell's strengths and vulnerabilities focusing on infrastructure, society, and the environment. Working in small groups, and then together as a large group, they prioritized actions designed to increase Norwell's resilience to future extreme weather events.

Top Hazards and Vulnerable Areas

The Core Planning Team identified the top natural hazards. Based on their recent work on the Hazard Mitigation Plan and review of workshop materials, the team identified flooding, heat waves and drought, severe storms (wind, ice, snow) and sea level rise as the climate hazards of greatest concern facing Norwell. Flooding, drought, and severe storms have all affected Norwell in recent years. Although Norwell is not located on the open coast, sea level rise will impact the town because the tidal portion of the North River runs along Norwell's southern border. Considering town demographics, the team also included extreme heat as a top hazard.

Top Hazards

- Flooding
- Heat Waves/Drought
- Severe Storms (wind, ice, snow)
- Sea Level Rise

Current Concerns and Challenges Presented By Hazards

Participants and town officials noted the increasing frequency and intensity of storms, including heavy rain events; the recent period of drought; and nor'easters that brought damaging winds and snowfall. The principal threats from nor'easters are power outages and damage from falling trees and limbs, as well as travel restrictions due to heavy snow. Large rain events result in flooding when stormwater drainage capacity is exceeded and when groundwater levels are high. Droughts are harmful to local aquatic resources and vegetation; participants referenced low-flow and no-flow

events in local streams during periods of drought. Participants expressed concern for water quality and quantity as Norwell relies on groundwater resources for water supply. As these issues are not new, the Town of Norwell, through its emergency management activities and hazard mitigation planning, has taken many steps to prepare for extreme weather and prevent harm to people and property. Workshop participants shared concerns that climate projections will heighten current challenges, particularly flooding, water quality and supply; and damage to, and from, trees.

Areas of Concern

Geographic:

Norwell's climate challenges tend to be widespread across the town. These include stormwater flooding and damage from falling trees. The claims from 2010 identify a significant cluster of flood claims along Washington Street in the northwest corner of the town. Concern for forest and brush fires is concentrated in Norwell's larger tracts of forested land.

Source: Norwell Fire Department

Societal:
Potential vulnerable populations identified include seniors, people with medical needs, and low-income residents. Participants prioritized ensuring that emergency communications reach these populations. The Council on Aging was highlighted as a town strength for the services they provide. The need to assist businesses that suffer power outages was also identified.

Environmental:
The need for tree management was a significant concern. Climate impacts on the resilience of local forests was also identified. Concerns included impacts to town waters from pollutants associated with flooding, and lack of river flow and drinking water supply due to drought.

Infrastructure:
The need for new or updated generators for many of the town facilities was highlighted. Facilities noted where flooding has occurred previously, or in flood-prone areas, include nursing homes and Urgent Care, town Police, Fire and the Council of Aging. Spotty cell service across town was identified as vulnerability during emergencies. The mobile home parks were of concern for risk of damage from falling trees.

CURRENT STRENGTHS AND ASSETS

Workshop participants identified numerous Norwell strengths and assets that will support resilience to future climate impacts. As shown below, participants identified many town strengths across environment, infrastructure and society.

Environment

- Strong local wetlands bylaw and wetlands protection.
- Proactive protection of open space and use of Community Preservation Act funds for preservation, including the purchase of the Main Street fields.
- Town natural resources including the North River, vernal pools, parks, ample groundwater, extensive green space and, rural landscaping.
- The restoration of river herring through removal of several dams.
- Extensive tree cover and its cooling effect on temperatures.
- Highway Department tree management.

Infrastructure

- Removal of dams was also seen as a strength from an infrastructure perspective.
- Town road maintenance during storms and relatively limited roadways (80 miles).
- The Public Safety building has a continuous fiber loop for the Emergency Operations Center.
- Shared regional dispatch with Hull, Hingham, and Cohasset.
- Route 3 is an accessible evacuation route.
- The Council on Aging has a backup generator and serves as a day shelter and warming center.

- Good working relationship with National Grid. Upgrades to National Grid transmission lines and Mt. Blue substation. National Grid Energy Audit program.
- BDA infrastructure installed in schools to boost radio coverage.
- The town reverse 911 (RAVE) system.
- The projected sea level rise locations do not impact industry.
- The substation is not in a vulnerable area.
- The Water Department has backup generators.
- Plastic gas lines are better protected from flooding.

Society

- Strong Council on Aging with good outreach, a list for at-risk seniors, and a check-in program (with the police).
- Good town support for the schools. School Resource/Response officer.
- The Housing Authority has a generator for warming and cooling, septic and the kitchenette. The new library community room is a warming and cooling center with a generator.
- Many residents have generators.
- The town makes an extraordinary effort to transport seniors and the disabled even during storms.
- The town has good multimedia communications during emergencies.
- Big Y has a generator and tries to stay open during emergencies.
- Town staff and community collaborators are a strong, dedicated group that work well together.
- There is a strong community of churches and non-profits.
- The town has a good network of volunteers with expertise.
- South Shore Medical Center is an important resource.

Top Recommendations to Improve Resilience

Each of the five workshop groups identified vulnerabilities and suggested solutions. The solutions were prioritized as High, Medium, or Low. Each group then identified their four highest priorities. The participants voted for their personal top four priorities from among the table group priorities. There was overlap in the top priorities of the five groups. Eight distinct areas of focus emerged from the twenty highest priorities identified by the groups. The highest priorities are listed below in order of the number of votes they received. See Appendix B for all the recommendations.

Highest Priorities

Forest and Tree Management: All five groups highlighted concerns regarding town forests and trees. Concerns range from the health of forested lands to power outages from falling trees. Developing and funding a Forestry Management Plan was suggested to address the health of trees, dangers to people and infrastructure, as well as fires, pests, and resources for staffing. The need to ensure Fire Department access and equipment to reach forested land and the need to remove brush were proposed to address fire risks. Other suggestions included expanding the

hazard tree program, increasing coordination between the town and utilities, working regionally, community outreach regarding privately owned trees, and widening sidewalks to create more of a buffer. Also suggested was greater National Grid staffing for storm response and pro-active tree management. (39)

Generators: Four of the groups highlighted the need to identify and prioritize municipal facilities that need improved generator capacity. Police and Fire, as well as Town Hall, the Middle School and the DPW campus were identified as locations with need. As part of this priority a Task Force to identify potential shelter sites and address deficiencies in the availability of generators was proposed. (33)

Outreach to older adults, vulnerable populations, and the public at large: Several groups proposed increased outreach to seniors and low-income populations. A focus of suggestions was assessing needs and vulnerabilities and, ensuring that residents are connected to emergency communications as well as pro-active education. It was suggested that the Board of Selectmen work with the Emergency Management Team to develop a policy for public communication during storm events. Another suggestion was a user-friendly web mapping program that could help communicate and coordinate challenges such as downed trees, power outages, road closures, and flooding. (21)

Stormwater Management: Proposals included creating a Low Impact Development/Green Infrastructure plan as well as policies and regulations to support the plan. Also suggested was a prioritization plan for drainage upgrades. (12)

Improved Water Supply Management: Suggestions included water conservation, drought tolerant landscaping, onsite infiltration, developing a water banking policy and, education to reduce the use of automatic irrigation systems and to explain water tier restrictions. (8)

Power Resilience: Consider a bylaw that would require larger developments to build in resilience and secondary power supplies. (8)

Infrastructure Management: Several groups offered related suggestions regarding town asset management. One suggesting funding for a comprehensive assessment of aging infrastructure including culverts, dams and power utilities. Similarly, a computerized system that would track infrastructure type, condition and maintenance schedules for infrastructure and, for trees, was proposed. (7)

Outreach to Children: Continue the Risk Awareness for Children in Elementary Schools (RACES) program. Develop emergency plans and work with educators to develop age-specific programs. (3)

High Priorities

- Work with MA DOT to investigate and reduce salt use to protect drinking water quality.
- Partner with the North and South Rivers Watershed Association to implement water conservation measures and regulations.

- Strengthen Board of Health regulations for septic separation from groundwater. Consider neighborhood treatment systems to replace failed septic systems. Regulate new development for impact on groundwater levels.
- Ensure the Norwell Downtown economic development plan considers flooding and heat zones; be proactive to minimize vulnerability. Make private owners accountable if lack of maintenance causes flooding. Improve stormwater management.
- Do utility tree trimming and maintenance more frequently than every 5 years.
- Improve backup heating and get a generator for the Housing Authority Community Room.
- Go to cloud-based server and IP phones. Develop business recovery "go" boxes.
- Include needed generators in capital budget planning.
- Do outreach to low-income residents, in particular reach out to the two trailer parks where access is limited.
- Reach out to the Chamber to coordinate response to power outages for businesses.
- Do outreach to the public about security needs during emergencies (for example, don't ignore closed roadway signs).

Medium Priorities

- Identify resources for sheltering pets.
- Consider updating the stormwater bylaw to capture runoff from small developments.
- Continuously update wetlands and ANR regulations to account for changing conditions.
- Do education and outreach for Lyme and EEE. Use natural controls. Work with the Board of Health for policies that reduce pest habitat.
- Do education, outreach, pre-treatment, and retrofits to reduce runoff impacts on wetlands considering the potential for increased winter rains.
- Address salt marsh erosion and green crabs with pilot studies, restore mosquito ditches, harvest green crabs, reduce fertilizer use.
- Address pollutants in the North River with better stormwater and septic management.
- Increase Parks and Recreation budget to enhance connectivity, access and public use.
- Need study for strategies to address tree damage at Brigantine Circle.
- Educate the public about the hazards of brush fire due to human actions.
- Investigate "right to trim" bylaw to protect power lines, review and improve subdivision regulations for tree placement and species.
- Consider dam removal on 2nd Herring Brook. Address downstream flood storage, emergency traffic re-routing, report on altered flows/levels, have a stream release O+M plan.
- Install repeaters to address poor cell service in some town buildings. Work with cell providers on dead zones, town flexibility on siting cell towers.
- Investigate transition to fiber to replace copper wire (vulnerable to flooding).
- Study traffic to address roads and intersections that are not adequate for evacuation/access. Prioritize areas needing improvement.
- Connect SSRECC to fiber; create better access and maintenance (Judge's Hill radio tower).
- Need more vehicles and drivers for the limited shuttle service available from COA and schools
- Do feasibility study to integrate power supply for police and fire.
- COA flooding in the basement needs evaluation and repair.

- Get data on status of aging power lines, natural gas steel pipes.
- Regional planning and support to address travel time to hospital, town desire to build on-ground emergency/hospital support for severe conditions.
- Review, revise, and publicize "know your zone" evacuation plan.
- ID vulnerable populations through a neighbor-to-neighbor program/foster improved communications.
- Create a phone tree, and joint emergency plan with COA, Senior Housing, and Public Housing.
- Work on water conservation and enforcement. Optimize water withdrawals to address inadequate stream flows, particularly in 3rd Herring Brook.
- To address inadequate flood storage, consider land preservation, stormwater regulations, and adopting a stormwater utility to provide a funding source.
- Hire a consultant to create an integrated emergency communications plan.

Low Priorities

- Bridge Street bridge needs to be enlarged so it doesn't restrict river flow.
- Regional county spraying for vector borne diseases.
- At next renovation of Pine Street fields improve the drainage to address flooding.
- Determine if Route 3 ice melt runoff is a threat to drinking water wells. Include contaminated snow melt in emergency debris management.
- Seek to add two towns to regional dispatch.
- Restrict development of new roads
- Pursue funding to study locations for additional cell towers.
- Use CERT program to address lack of overnight shelter in Norwell, lack of capacity for those with special needs.
- Communicate with homeowners about sea level rise impacts on property and property values.
- Do flood risk outreach and education to the 50% of Norwell homes with finished basements.
- Continue town conversations about the tension between the need for green space and tax dollars.
- Facilitate a partnership with local businesses and the Chamber for communication during emergencies.
- Consider zoning to address lack of hotel and lodging for power company employees, first responders, and residents during storms.
- Maintain extensive tree cover.
- Backup generators for all critical facilities; use renewable energy.

No Priority Listed

- Work with the Water Department to monitor septic systems and groundwater levels.
- Assess impacts and develop solutions for rising groundwater levels.
- Schools should not be shelters, develop the Cushing Center as a shelter.
- Ensure funding and equipment for road maintenance is maintained. Plan for a road maintenance cycle.

- Public safety is understaffed; provide more resources for staffing.
- Create a Hazard Mitigation Officer position.
- Provide a small budget to support the CERT.

LISTENING SESSION

Participants highlighted support for the priorities that included forest management, generators, and stormwater management and bylaw updates. Support was also expressed for the proposal to go to cloud-based servers and IP phones, and to develop business recovery "go" boxes.

CRB Workshop Invited Participants

* = representative attended
Norwell Building Department
Norwell Conservation*
Norwell Council on Aging*
Norwell Facilities*
Norwell Fire*
Norwell Health
Norwell Planning*
Norwell Highway*
Norwell Police*
Norwell Schools*
Norwell Town Administrator*
Norwell Water
Norwell Community Emergency Management Team*
Norwell Town Technology Committee*
Norwell Board of Selectmen*
Norwell Historical Commission*
Norwell Planning Board
Norwell Housing Authority*
Coastal Zone Management*
Massachusetts Emergency Management Agency*
Mass DCR
Mass DOT
North and South Rivers Watershed Association*
Mass Bays
Royal Skilled Nursing
South Shore Natural Science Center
The Weather Company*
Warming Citizen Center
Arbour Counselling*
Axiom
Big Y*
Stop and Shop
Chessia Consulting
Cavanaro Consulting
Foxrock Properties
Merrill Inc.*
Norwell General Store
National Grid*
Summerfest*
Zildjian*

CRB Workshop Project Team

Norwell Core Team

Jeff Simpson	Deputy Fire Chief, Project Co-coordinator
Nancy Hemingway	Conservation Agent, Project Co-coordinator
Alison Demong	Selectwoman, Project Co-coordinator
Arthur Joseph	CERT Civilian Coordinator
Kenneth Kirkland	Town Planner
Ted Ross	Police Chief
Carol Brzuszek	Deputy Police Chief
Joseph Conlon	Assistant Director, Tree and Grounds, Highway, Cemetery, Engineering
Glenn Ferguson	Director, Tree and Grounds, Highway, Cemetery, Engineering
Ted Nichols	Facilities Manager
Allen Perlin	Water Treatment Manager
Andrew Reardon	Fire Chief

Facilitation Team

Anne Herbst	Metropolitan Area Planning Council (Lead Facilitator)
Darci Schofield	Metropolitan Area Planning Council
Courtney Lewis	Metropolitan Area Planning Council
Martin Pillsbury	Metropolitan Area Planning Council
Iolando Spinola	Metropolitan Area Planning Council
Ralph Wilmer	Metropolitan Area Planning Council

Citation

Metropolitan Area Planning Council. 2019. Town of Norwell Municipal Vulnerability Preparedness Program. Community Resilience Building Workshop Summary of Findings. Norwell, Massachusetts

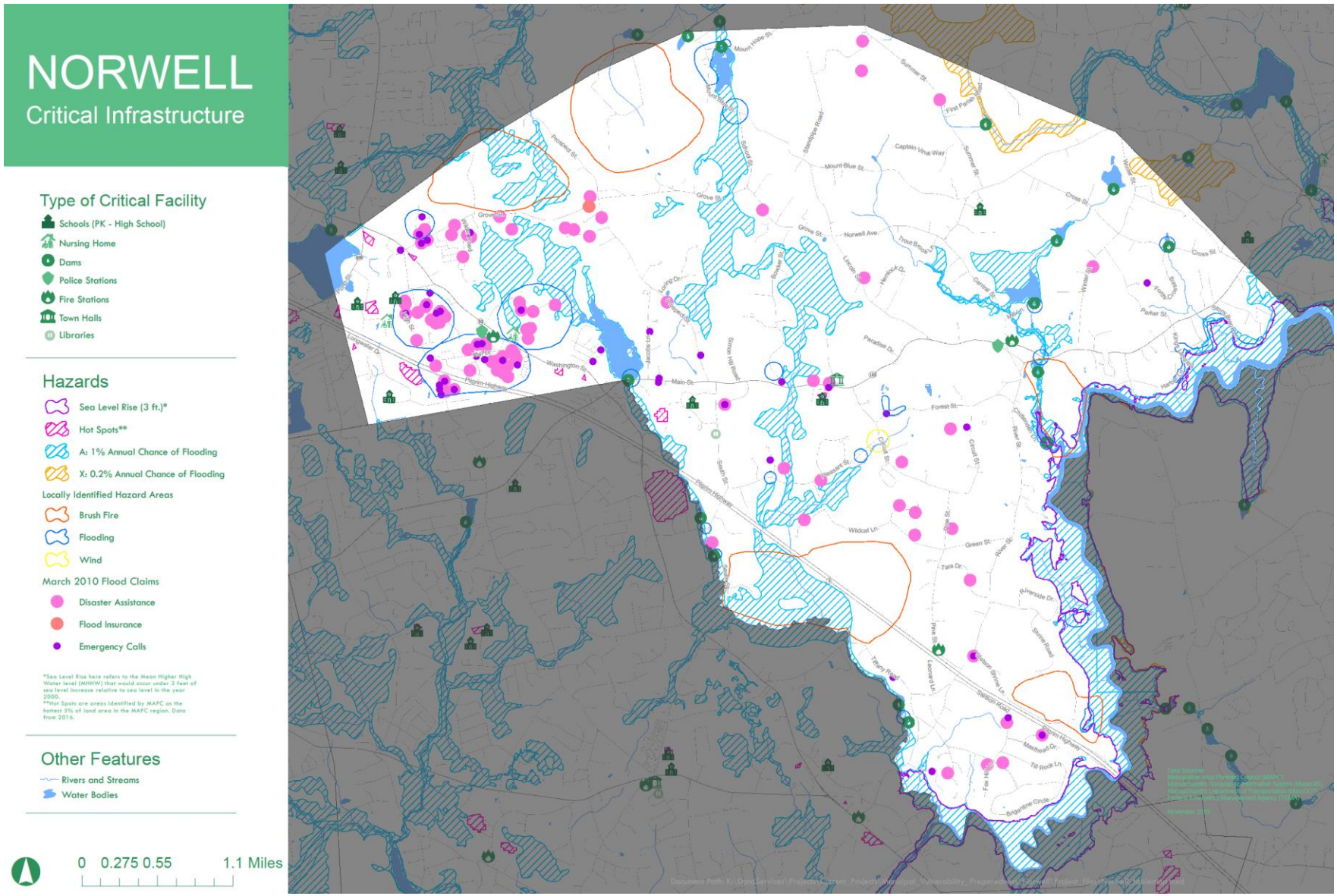
Acknowledgements

Thank you to the MVP Core Team members, CRB workshop participants, and to Deputy Fire Chief Jeff Simpson, Conservation Agent Nancy Hemingway, and Selectwoman Alison Demong who served as local Project Coordinators. Also thank you to Deputy Chief Simpson for providing the welcoming address to the workshop. Funding for the CRB Workshop was provided by the Commonwealth of Massachusetts through a grant from the Municipal Vulnerability Preparedness program.

Appendix A–Action Prioritization, Base Map, and Workshop Materials

Actions Prioritization

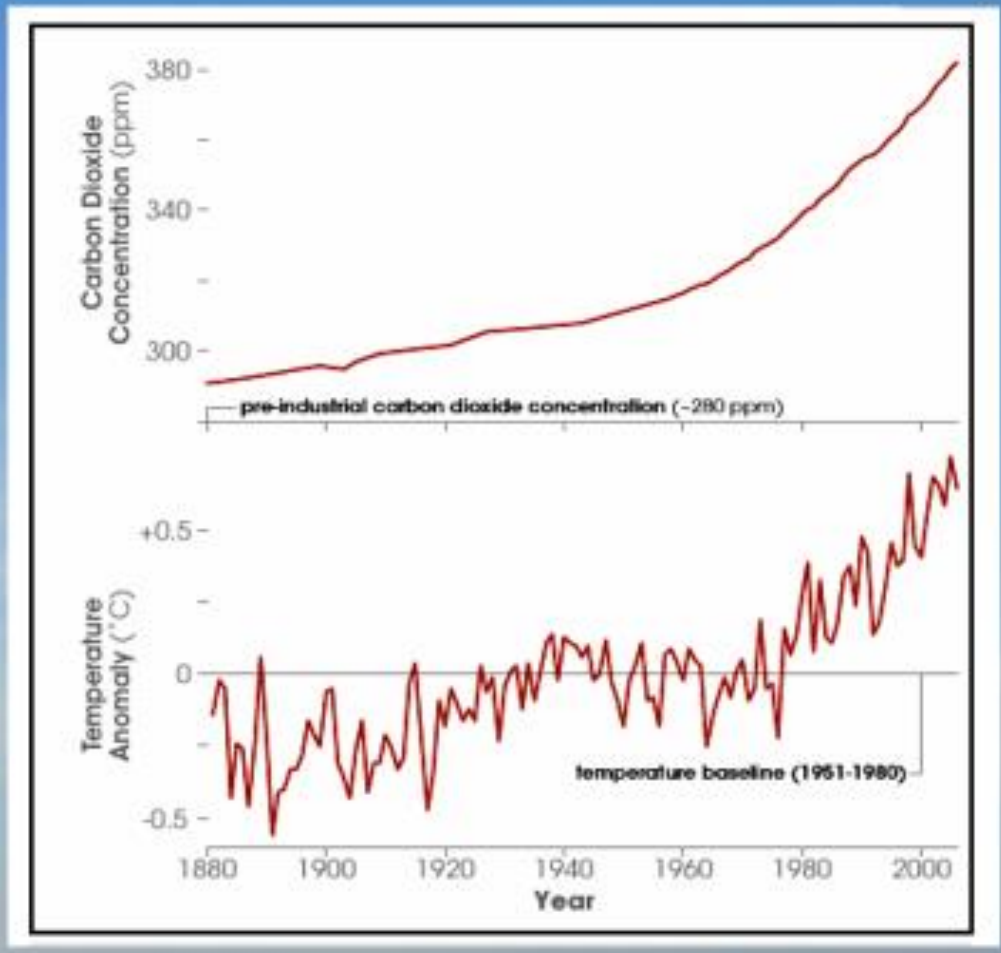
Base Map


NORWELL
Critical Infrastructure
Type of Critical Facility
Schools (PK - High School)
Nursing Home
Dams
Police Stations
Fire Stations
Town Halls
Libraries
Hazards
Sea Level Rise (3 ft.)*
Hot Spots**
A: 1% Annual Chance of Flooding
X: 0.2% Annual Chance of Flooding
Locally Identified Hazard Areas
Brush Fire
Flooding
Wind
March 2010 Flood Claims
Disaster Assistance
Flood Insurance
Emergency Calls
*Sea Level Rise here refers to the Mean Higher High Water level (MHHW) that would occur under 3 feet of sea level increase relative to sea level in the year 2000.
**Hot Spots are areas identified by MAPC as the hottest 3% of land area in the MAPC region. Data from 2016.
Other Features
Rivers and Streams
Water Bodies
0 0.275 0.55 1.1 Miles

PowerPoint


Our Warming Planet
Some energy is reflected back out to space
Earth's surface is heated by the sun and radiates the heat back out towards space
Greenhouse gases in the atmosphere trap some of the heat
Solar energy from the sun passes through the atmosphere

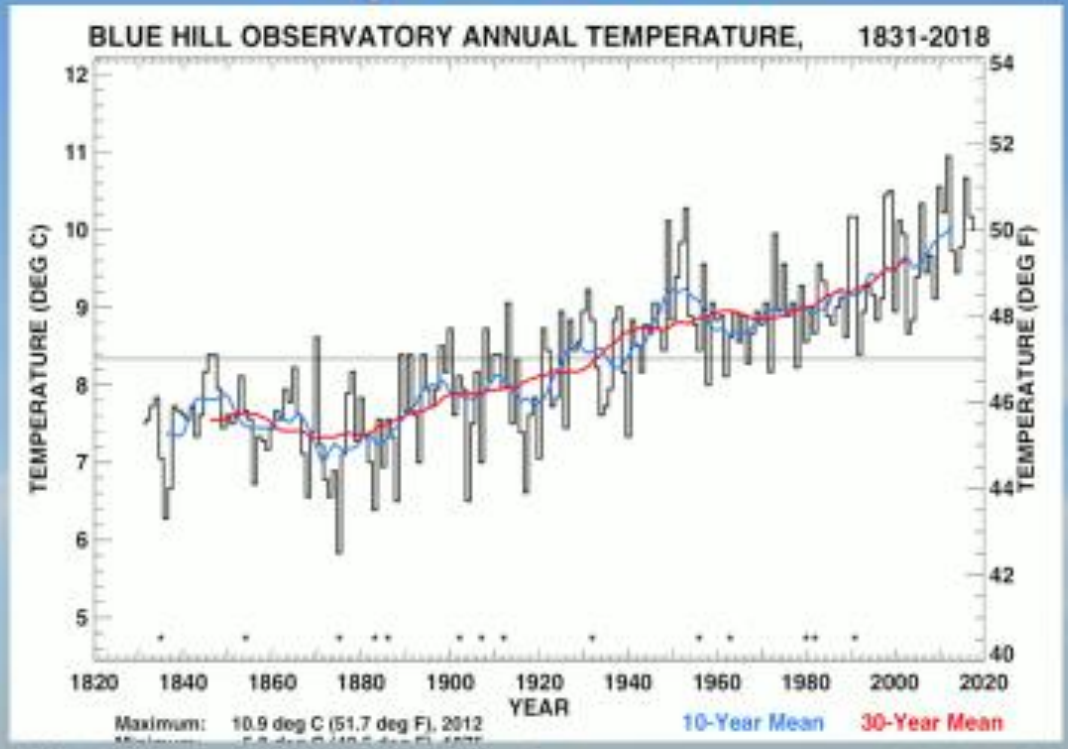
Global Temperature and CO_2 Trends



Source: MA Climate Change Adaptation Report 2011

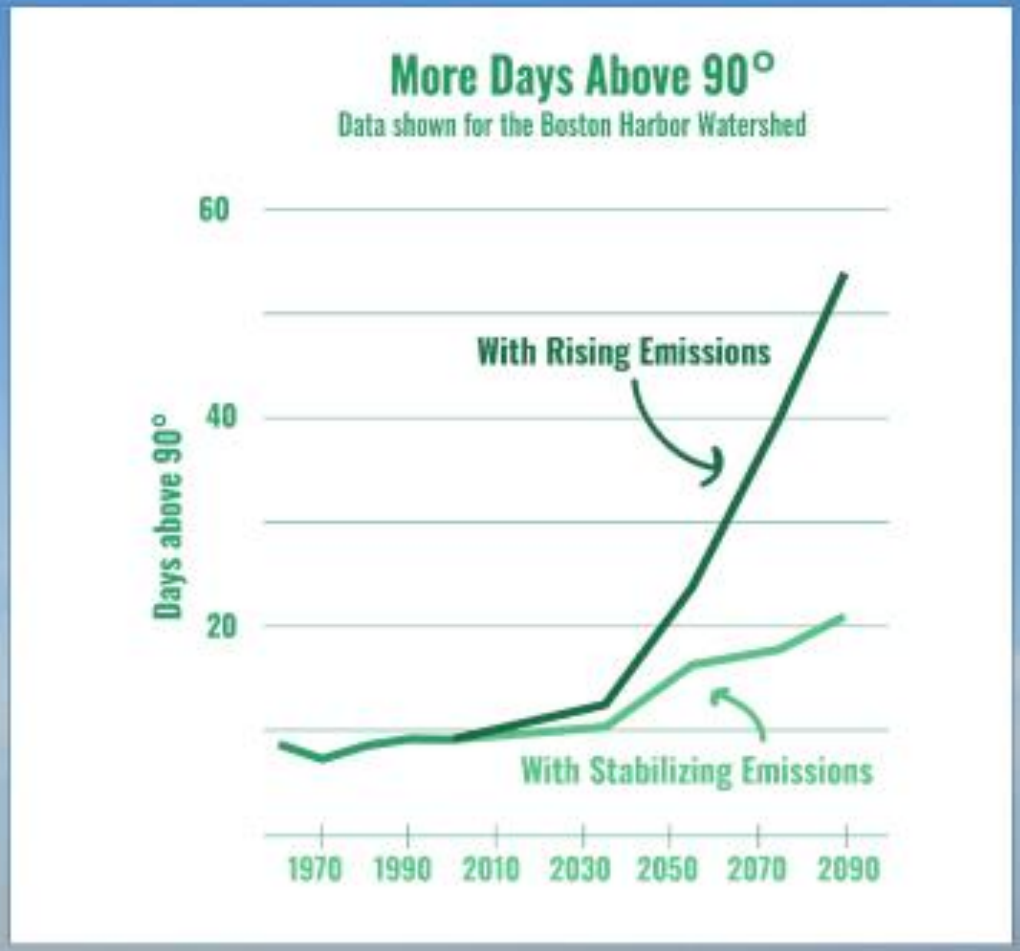
Temperature change: observed

Nearly 3˚ F since 1831



Blue Hill Observatory Annual Temperature, 1831-2018

Temperature change: projected



Source: Northeast Climate Adaptation Science Center

Precipitation change: observed

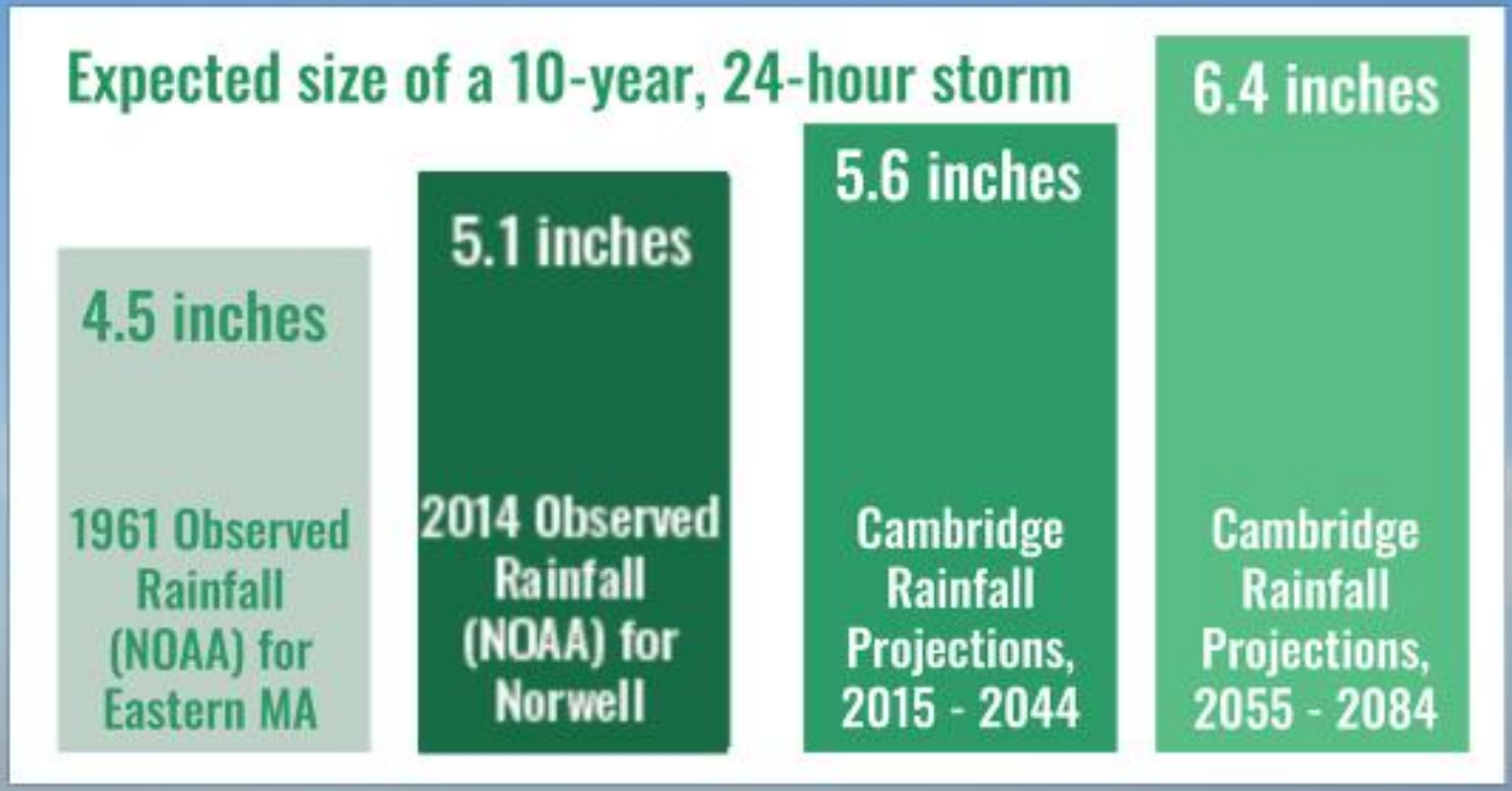
For the Northeast United States: 56% increase in the amount of rain that falls in the top 1% events from 1958 – 2016.

Source: US National Climate Assessment 2018

Source: MA Climate Change Adaptation Report 2011

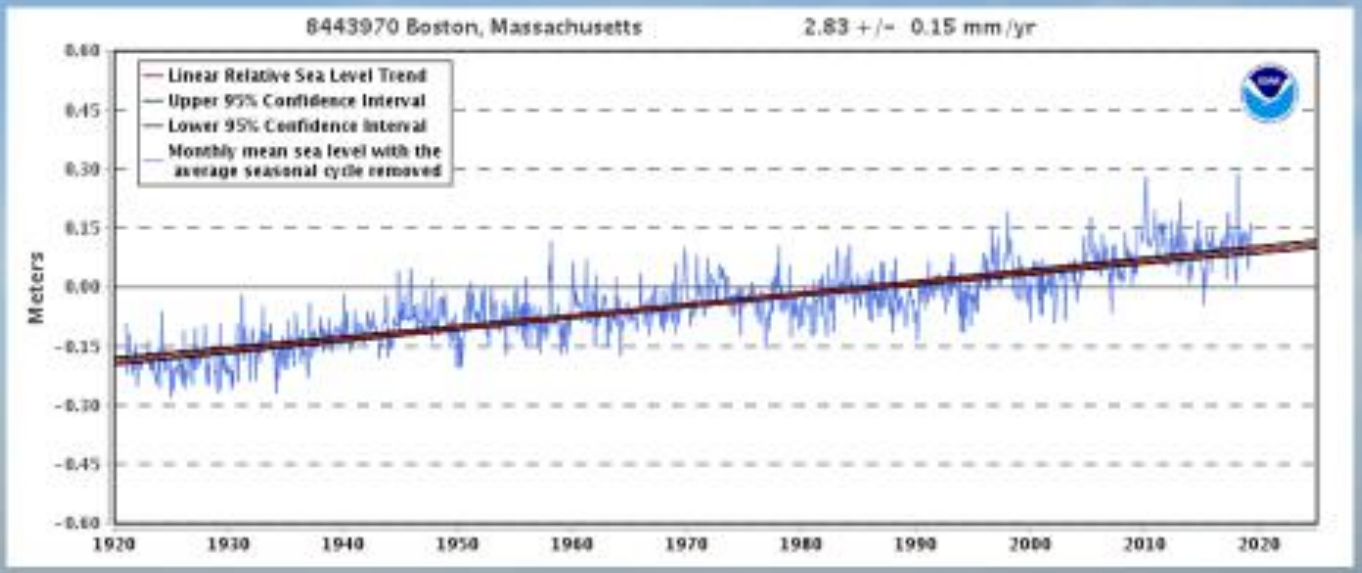
For Boston area: 10% increase over the past 50 years

Precipitation change: projected

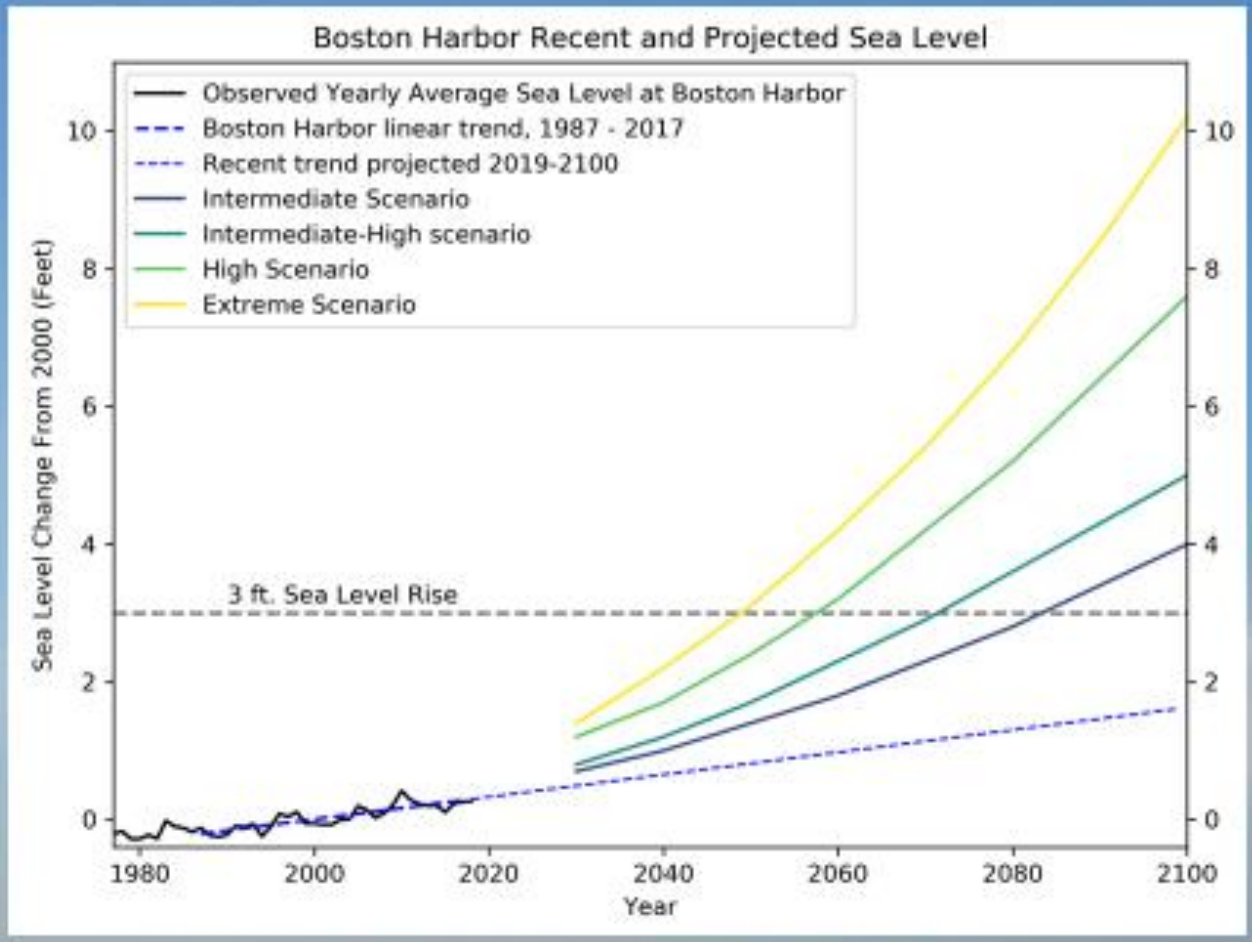


Sea level rise: observed

- Boston tide station
- Record from 1921-2018
- Equivalent to 11 inches in 100 years



Sea level rise: Projected to 2100 for Boston Harbor



Source: Northeast Climate Adaptation Science Center and MAPC

POSTERS

NORWELL

Critical Infrastructure

Infrastructure will be at risk to damage from flooding, and loss of function due to power outages. Increasing large rainfall events may subject roads, bridges, dams and buildings to more frequent or severe flooding. Areas that don't flood today may become vulnerable. FEMA flood zones reflect only current conditions, although the .2% (500-year) flood zones may indicate where future flooding will occur. FEMA flood zones also do not generally capture stormwater flooding. That is, flooding that exceeds the capacity of current stormdrains and culverts. We don't currently have models that project where future flooding from larger rain events will occur. Power outages affecting infrastructure and communications may become more frequent as result of high energy demand during heat waves. Winter outages could be caused by ice storms if warming results in temperatures hovering around freezing. The potential for more intense hurricanes could cause outages due to falling trees. Finally, buildings, roadways, and railways can be stressed by extreme heat. Heat can cause damage to expansion joints on bridges and highways, and may cause roadways to deteriorate more rapidly.

Infrastructure

- Critical Infrastructure

Other Features

- Rivers and Streams
- Water Bodies

Hazards

March 2010 Flooding

- Disaster Assistance Claims
- Flood Insurance Claims
- Emergency Calls
- Sea Level Rise (3 ft.)**
- Hot Spots*
- A: 1% Annual Chance of Flooding
- X: 0.2% Annual Chance of Flooding

Locally Identified Hazard Areas

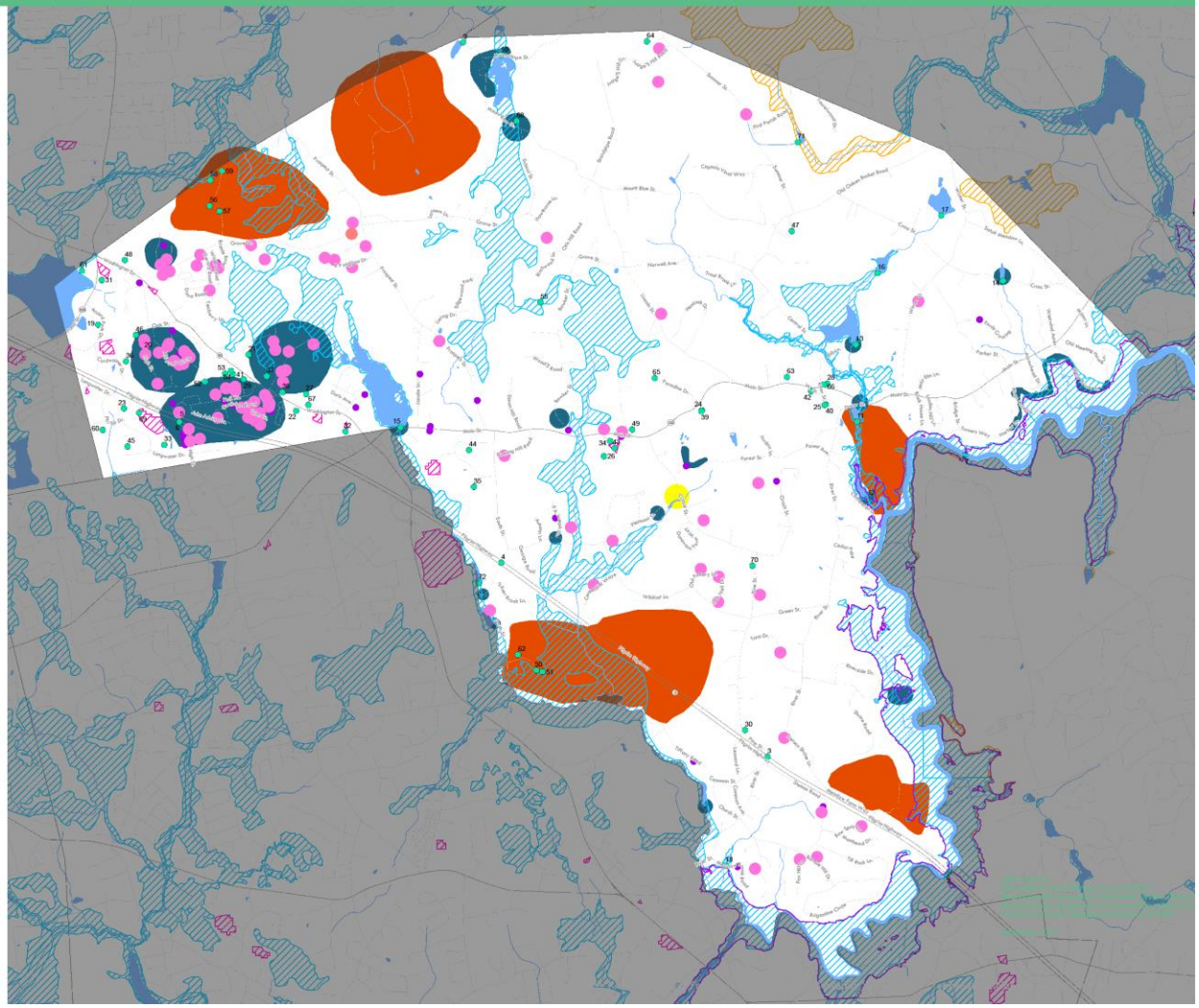
- Brush Fire
- Flooding
- Other

*Hot Spots are areas identified by MAPC as the hottest 5% of land area in the MAPC region. Data from 2016.
**Sea Level Rise here refers to the Mean Higher High Water level (MHHW) that would occur under 3 feet of sea level increase relative to sea level in the year 2000.

Label	Name
1	Rte 3 North Bound Bridge
2	Rte 3 South Bound Bridge
3	River Street Over Pass
4	South Street Overpass
5	High Street Overpass North Bound
6	High Street Overpass South Bound
7	Bridge Street Bridge
9	Boundary Pond Dam
10	Bound Brook Dam
11	Norris Pond Dam
12	Talbot Pond Dam
13	Torry Pond Dam
14	Stoney Brook Dam
15	Jacobs Pond Dam
16	Turner Pond Dam
17	Cranberry Bog Dam
18	Copeland Tannery Dam
19	Younger University Day Care
20	Ridge Hill Pre School
21	Kinder Care Day Care
22	Kinder Care Day Care
23	Bright Horizons Day Care
24	New Nursery School
25	First Parish Nursery School
26	Norwell Highway Surveyor Office
27	Norwell Gardens Elder Housing
28	Fire Station #1
29	Fire Station #2
30	Fire Station #3
31	Big Y
32	Stop and Shop
33	South Shore Medical Center
34	School Administration Building
35	Norwell Public Library
36	Southwood at Norwood Nursing Home
37	Royal Norwell Nursing and Rehab

Label	Name
37	Royal Norwell Nursing and Rehab
38	Saint Helens Church
39	UCC Church
40	First Parish Church
41	Norwell Police Station
42	State Police Barracks
43	Norwell Middle School
44	Norwell High School
45	South Shore Charter K-8
46	Grace Farrar Cole Elementary School
47	William G Vinal Elementary School
48	National Grid Substation
49	Norwell Town Hall
50	Water Pump Station #6
51	Water Pump Station #1
52	Water Pump Station #4
53	Water Pump Station #7
54	Water Pump Station #8
55	Water Pump Station #9
56	Water Pump Station #3
57	Water Pump Station #5
58	Water Pump Station #10
59	Water Pump Station #2
60	Water Storage Tank Phillip Drive
61	Hingham Water Storage Tank
62	Water Treatment Plant
63	Verizon Substation
64	Water Storage Tank
65	Water Storage Tank
66	Cushing Center
67	Rehobeth House
68	National Grid Substation
69	South Shore Charter High School
70	Council on Aging
71	Galen Pond Dam
72	Peterson Pond Dam

0 0.3 0.6 1.2 Miles



Norwell
Social Vulnerability

Social vulnerability refers to social, economic, demographic, or health factors that may make groups of people less resilient to climate change impacts. Certain vulnerabilities tend to be correlated: for example, older adults are more likely to have a disability and live alone than younger adults.

Our strategies for adapting to a changing climate should protect these populations in addition to our natural and built environment.

Who is most at risk from climate change impacts?

People who may be more susceptible to negative health effects: These can include older adults, young children, pregnant women, people with disabilities, and people with pre-existing health conditions, as they are more likely to be physically vulnerable to the health impacts of extreme heat and poor air quality caused by climate change. Individuals with physical mobility constraints, such as people with disabilities and seniors, may need additional assistance with emergency response.

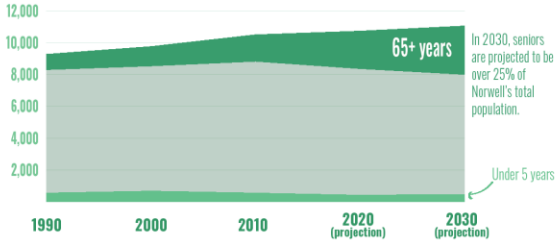
People who may have more difficulty adapting to, preparing for, or recovering from extreme weather events: Socioeconomic characteristics such as income and race can influence vulnerability to climate change. Low-income people are often more susceptible to financial shocks, which can occur after extreme weather and which can impact financial security and the ability to secure safe shelter and meet medical needs. Social isolation can also influence vulnerability, as it limits access to critical information, municipal resources, and social support systems. People at the most risk for social isolation include those living alone and people with limited English language proficiency.

People who live or work in vulnerable locations: Historic or predicted floodplain, urban flooding locations, areas prone to wildfire, heat islands, neighborhoods prone to power outages. Outdoor workers, first responders, those working in hot indoor environments.

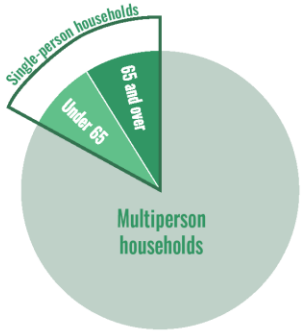
Older Adults and Young Children

Adults over 65 and children under 5 are more likely to develop health problems on very hot days or during heat waves. Older adults are also more likely to have disabilities or mobility contraints and may need additional assistance during emergencies. They are also more likely to live alone than younger adults.

Norwell Recent and Projected Population by Age



People Living Alone



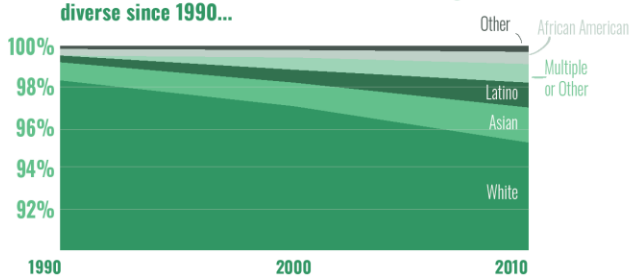
As of 2010, about 17% of Norwell households consisted of someone living alone.

Over 50% of people living alone were over 65.

Communities of Color

Particular racial or ethnic groups may also be more likely to have certain social vulnerabilities than others. For example, Black and Latino populations have a much higher rate of asthma hospitalizations than other groups. Heat waves and poor air quality can trigger asthma.

Norwell is over 95% white, but has become slightly more diverse since 1990...



Low-Income Households

27.3% ±4.2% of households in Norwell are low-income

4.2% ±1.9% of households in Norwell are below the poverty level

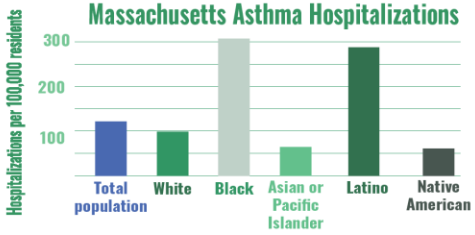
40.3% ±9% of seniors in Norwell are low-income

*A four-person household earning less than $78,150 is considered low-income; a four-person household earning less than $24,563 is below poverty level

People Who Work Outside

People who primarily work outside, such as parcel delivery people, construction workers, fishermen, or landscapers, may be at added risk from extra exposure to high heat and poor air quality.

Massachusetts Asthma Hospitalizations



Sources:
American Community Survey (ACS) 2012-2016; United States Census 1990, 2000, 2010; MAPC Projections; Massachusetts Department of Public Health Asthma Data, 2008-2012

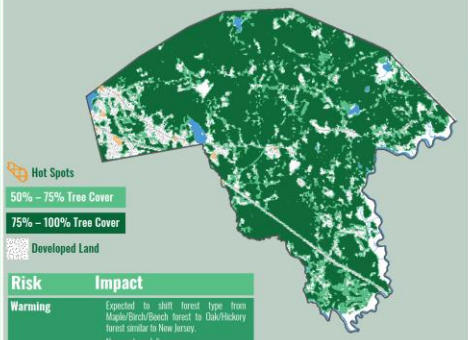
Norwell

Natural Resources

Natural Resources lessen climate impacts by absorbing and storing carbon dioxide and by serving vital protective functions. Forests, open space, wetlands, rivers, and streams protect drinking water quality and quantity, provide flood control, and give relief from extreme heat. Healthy ecosystems are more resistant to stresses from a changing climate and better able to protect against heat and flooding.

Trees

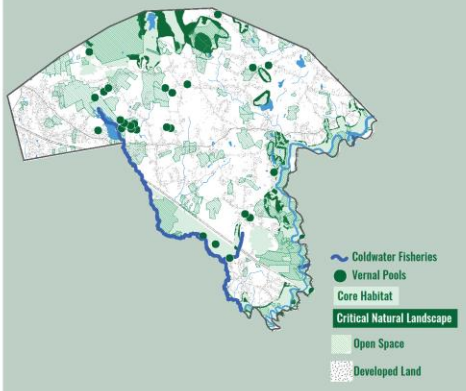
Trees are important in mitigating the impact of heat waves. According to the EPA, suburban areas with mature trees are 4-6 degrees cooler than new suburbs without trees. Shaded surfaces can be 25-40 degrees cooler than the peak temperatures of unshaded surfaces. Trees also absorb remarkable quantities of precipitation. Research has shown that a typical medium-sized tree can intercept as much as 2,380 gallons of rain per year (USDA Forest Service).



Risk	Impact
Warming	Expected to shift forest type from Maple/Birch/Beech forest to Oak/Hickory forest similar to New Jersey. New pests and diseases
Flooding, Drought, Wildfire, Ice Storms	Impaired waters, toxic exposure, contaminant leaching, weakened and damaged trees

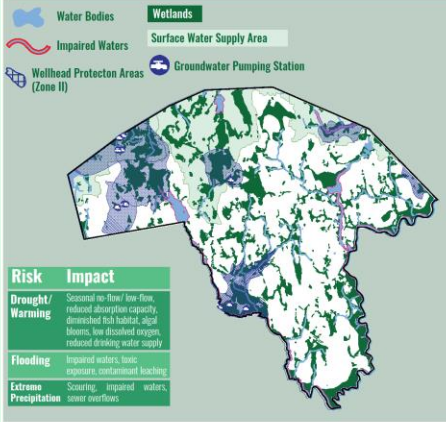
Valuable Habitat

Core Habitat and Critical Natural Landscapes are state-identified intact landscapes, or exemplary natural communities, that are better able to withstand climate stresses, and support the long-term survival of rare species and natural habitats.



Freshwater Resources

Norwell contains freshwater wetland systems that sustain critical ecosystem functions in climate change. These ecological assets protect drinking water quality and quantity, provide flood control, and maintain overall ecosystem health for climate resilience.



Risk	Impact
Drought/ Warming	Seasonal no-flow/ low-flow, reduced absorption capacity, diminished fish habitat, algal blooms, low dissolved oxygen, reduced drinking water supply
Flooding	Impaired waters, toxic exposure, contaminant leaching
Extreme Precipitation	Scouring, impaired waters, sewer overflows

Coastal Resources

Although Norwell is not located on the ocean, the tidal North River forms its southeastern boundary. Sea level rise projections extend up the length of the river into Hanover and Pembroke.

Risk	Impact
Extreme Precipitation & Flooding	Extreme storms threaten to harm salt marshes; flooding increases non-point pollution
Sea level rise	Salt marshes need to migrate upland or become submerged
Storm Surge	May erode salt marshes and shoreline
Warming	Changing ocean species, new invasives, ocean acidification

Sources
MassGIS (Bureau of Geographic Information); BioMap2: Conserving the Biodiversity of Massachusetts in a Changing World; Massachusetts Department of Fish and Game; Massachusetts Department of Environmental Protection; MassGIS (Bureau of Georgraphic Information); National Land Cover Database (NLCD)

APPENDIX B – TABLE MATRIX RESULTS

Participants were divided into small groups identified as Blue, Green, Orange, Yellow, and Red. Concerns were categorized as Environmental, Infrastructure, or Societal. Participants identified climate-related strengths and vulnerabilities for Norwell. Solutions were proposed for the vulnerabilities. Solutions were then prioritized as High, Medium, or Low. Each table was asked to identify their top four priorities. The information was recorded in a matrix for each table and is reproduced in the chart below.

Table	Topic	Strengths (S) & Vulnerabilities (V)	S/V	Solutions	Priority
Blue	Environment	Wetlands bylaw and protected areas	S	continuously update regulations to account for changing conditions	M
Blue	Environment	Properties not currently regulated cause damage (ANR's)	V	continuously update regulations to account for changing conditions	M
Blue	Environment	Rising groundwater	V	Assess impacts and potential solutions	
Blue	Environment	Tree loss/damage from heat and pests (oaks/red pine/ash)	V	Forest Mgmt. plan - do evaluation, staffing for tree management	H
Blue	Environment	Fire hazard in woodlands - many tree falls creating brush	V	forest Mgmt. plan - eliminate kindling	H
Blue	Environment	extensive tree cover	S	need to maintain it	L
Blue	Environment	ticks - Lyme disease, mosquitos - EEE	V	education and outreach, use natural controls	M
Blue	Environment	drinking water quality - high salt levels	V	MA DOT - investigate and reduce salt use, educations	H
Blue	Environment	wetland impacts from runoff - salt, potential increased rain winter events	V	education and outreach, pre-treatment, retrofit, better stormwater mgmt.	M
Blue	Environment	low stream flows, 3rd Herring Brook + low to zero flow	V	water conservation and enforcement, optimization of water withdrawals	M+
Blue	Environment	Bridge St. is subject to flooding when the North River is high in the winter	V	bridge needs to be enlarged so it doesn't back up flow	L
Blue	Environment	salt marshes are eroding, and green crabs are an invasive causing damage	V	pilot studies, - restore mosquito ditches, harvest green crabs, reduce fertilizers	M
Blue	Environment	water pollution in the North River from stormwater and septic systems	V	better stormwater and septic system management	M

Blue	Environment	inadequate flood storage for heavy rain in developed areas	V	Land preservation, Stormwater regulations, provide funding with a stormwater utility	M+
Blue	Environment	wetland and stormwater drainage affect water quality and quantity	V/S		
Blue	Environment	Bird migration is a strength, but loss of tree cover is a vulnerability	V/S	addressed in forestry management	M+
Blue	Environment	Vernal pools	S		
Blue	Environment	Restoration of river herring (2 dams removed, a 3rd on the way)	S		
Blue	Environment	town proactively protects open space using CPA	S		
Blue	Environment	Residential landscaping is rural - more natural	S		
Blue	Infrastructure	dam on 2nd Herring Brook (small, private)	V	dam removal, ensure downstream flood storage, emergency re-routing traffic, report on altered flow/levels, Dam O+M stream release plan	M
Blue	Infrastructure	several dams removed	S		
Blue	Infrastructure	septic system failure due to rising groundwater	V	Strengthen BOH regs for separation from GW, neighborhood treatment to replace failed septic, regulate new development impact on GW levels	H
Blue	Infrastructure	country drainage, culverts aging and failing	V	create town wide LID, plan for and prioritize drainage upgrades	H
Blue	Infrastructure	communications - poor cell service in some town buildings	V	install repeaters - Verizon network extender	M
Blue	Infrastructure	basement flooding (50% have electric sump pump) - COA shelter, Jacobs Farmhouse, Stetson Ford House	V		L
Blue	Infrastructure	No back up power: town hall, schools, (fire, police, COA DPW do have)	V	backup generators for all critical facilities, plan for upgrades, do a municipal buildings assessment, use renewable energy for backup power	L

Blue	Infrastructure	NHA - 7 units all electric limited generators	V	see above	L
Blue	Infrastructure	N-grid upgraded substation at Mt. Blue	S		M
Blue	Infrastructure	National Grid transmission upgrade	S		
Blue	Infrastructure	Road maintenance for storms	S	ensure funding and equipment is maintained	
Blue	Infrastructure	Telephone: copper wire is vulnerable to water	V	investigate transition to fiber, would need standby power	M
Blue	Infrastructure	Public Safety building continuous fiber loop for EOC	S		
Blue	Infrastructure	town has only 80 miles of road - manageable	S	plan for cycle of maintenance, restrict new roads	L
Blue	Infrastructure	some roads/intersections not adequate for access/evacuations	V	study traffic problems, prioritize solutions and areas needing improvement	M
Blue	Infrastructure	Judge's Hill radio tower and water tower are on limited access dirt road	V	connect SSREC to fiber, better access for maintenance	M
Blue	Infrastructure	older infrastructure needs updating	V	upgrade and maintain infrastructure (water, buildings, stormwater). Prioritize and fund	M
Blue	Infrastructure	Regional dispatch w/ Hull, Hingham, Cohasset	S	continue to seek 2 additional towns	L
Blue	Society	good network of volunteers with expertise	S		
Blue	Society	Communication with seniors who live alone	V	add seniors and med info. to reverse 911, do outreach for opt-in	H
Blue	Society	good communications - social media, but not serving elders	V/S	outreach to seniors	H
Blue	Society	not much attention paid to low-income resident - access limited to the 2 trailer parks	V	outreach, raise municipal awareness	H
Blue	Society	COA outreach	S		

Blue	Society	impact of power outages on business	V	outreach to chamber, coordination, get business involved	H
Blue	Society	strong commitment to school system	S		
Blue	Society	churches and non-profits	S		
Blue	Society	South Shore Medical Center	S		
Blue	Society	Norwell Chamber of Commerce, could help with outreach	S		
Blue	Society	no formal evacuation plan	V	review, revise, publicize, "know your zone" - MEMA	M
Blue	Society	RAVE - reverse 911	S		
Green	Environment	tree coverage	S/V	develop and fund a town-wide tree and forest management program	H
Green	Environment	groundwater resources	S		
Green	Environment	North River	S		
Green	Environment	Wetland conservation	S		
Green	Environment	Lack of brush clearing/forest maintenance	V	develop plan (see above)	H
Green	Environment	tick and mosquito breeding	V	work w/ Board of health for policies that reduce habitat, increase education and outreach	M
Green	Environment	town recycling center	S		
Green	Environment	Protected open space	S		
Green	Infrastructure	new police/fire station. Generators need to be replaced or right sized	S/V	purchase new generators	H
Green	Infrastructure	old/outdated generators - (lack integrated system)	V	ID and prioritize municipal facilities that need generators	H
Green	Infrastructure	Middle school acts as an emergency shelter	S/V	equip with new generator to support existing and future demand	H
Green	Infrastructure	high school has capacity to be a shelter, but lack infrastructure	V	equip with new generator	H
Green	Infrastructure	Route 3 is an evacuation route	S		

Green	Infrastructure	good water resources and GW protection, lack of education regarding the tier water system	S/V	education program to reduce us of automatic irrigation systems and explain tier restrictions	M
Green	Infrastructure	Town utility substations. Damage to power lines during heavy storm event	S/V	investigate establishment of local/state "right to trim" bylaw to protect power lines. Review and improve subdivision regs for tree placement and species.	M
Green	Infrastructure	Culvers and dams are old and undersized	V	obtain funding for a comprehensive assessment of aging culverts, dams, and power utilities	H
Green	Infrastructure	COA has a backup generator	S		
Green	Infrastructure	Energy Audit Program through National Grid Home Energy Assessment	S		
Green	Infrastructure	GIS mapping of town wide infrastructure and utilities	S/V	pursue funding for field assessment of town-wide infrastructure	
Green	Infrastructure	Good working relationship between town and National Grid	S		
Green	Infrastructure	Spotty cell coverage	V	pursue funding to study locations for additional cell towers	L
Green	Infrastructure	BDA infrastructure installed in schools to boost radio coverage	S		
Green	Infrastructure	Reverse 911/RAVE	S		
Green	Society	Strong Council on Aging	S		
Green	Society	Town is supportive and engaged with schools	S		
Green	Society	COA Resource/Response officer	S		
Green	Society	School Resource/Response officer	S		
Green	Society	lack of formal policy for Communication /outreach during emergency events	V	The Board of Selectmen should work with the Emergency Management Team to adopt a policy regarding public communication during storm events.	H
Green	Society	Police/COA "are you ok" check-in program	S		

Green	Society	Identifying vulnerable populations	V	ID vulnerable populations through a neighborhood watch/neighbor-to-neighbor program/foster improved communication network	M
Green	Society	Communication gaps between town and local business	V	town should establish/facilitate a partnership with local business and the Chamber for communication during emergency events	L
Red	Infrastructure	all schools have backup generators	S/V	create task force to ID shelter sites and address generator deficiencies	M
Red	Infrastructure	middle school shelter, generator not up to code	S/V	address generator deficiencies	M
Red	Infrastructure	only 2 schools have AC	V	schools should not be primary shelter - develop Cushing Center	
Red	Infrastructure	Sparrow needs new generator (can be used for pets)	S/V	conduct analysis of feasibility of sites	
Red	Infrastructure	limited shuttle services (schools and COA) not ADA accessible	V	need certified drivers, more vehicles, contract for services needed	M
Red	Infrastructure	only overnight shelter is in Weymouth, no capacity for special need	V	CERT program	L
Red	Infrastructure	COA day shelter - warming center, generator	S		
Red	Infrastructure	powerlines and trees - distribution rather than high voltage lines are the issue	V	expand hazard tree program. Coordinate with town, utility, DPU. Community outreach for privately owned tree	H
Red	Infrastructure	tree damage	V	build more sidewalks to create buffer areas for trees	H
Red	Infrastructure	police and fire need to integrate power supply (different systems)	V	feasibility study	M
Red	Infrastructure	cell tower - Judge Hill	S	do they need to be protected	
Red	Infrastructure	Water Dept. has backup generators	S		
Red	Infrastructure	in emergencies hard to get to gas stations	V		

Red	Infrastructure	infiltration system when there is high groundwater	V		
Red	Infrastructure	consequences of power outages and cold weather	V	bylaw to require developments to build in generators/ secondary power supply	H
Red	Society	no storm shelter for elderly	V		
Red	Society	senior housing/homeless shelter - limited resources, isolated	V		
Red	Society	reverse 911, social media, can easily reach 75% of population, reaching seniors can be a problem	S		
Red	Society	Weymouth shelter serves numerous towns (8)	S/V		
Red	Society	limited public safety resources - understaffed	V	provide more resources for staffing	
Red	Society	no person in charge for outreach/coordinator/ need emergency mgmt. plan,	V	Develop plan and create Hazard Mitigation Officer position	
Red	Society	Security concerns (ignoring closed roadways)	V	Do outreach, develop RACES program in schools	H
Red	Society	CERT team	S	provide support with small budget	
Red	Environment	canopy cover	S/V		
Red	Environment	groundwater protection -well protected	S/V	droughts are an issue	
Red	Environment	good wetlands bylaw	S		H
Red	Environment	no public sewer	S/V		
Red	Environment	septic systems	V	check w/ water dept. monitor groundwater levels and septic system permitting	
Red	Environment	no environmental education for the schools - resources needed	V	provide funding for hazard mitigation schools programs to develop age-specific programs (RACES)	M
Yellow	Environment	vector borne diseases - Lyme, EEE	V	education, regional county spraying	L

Yellow	Environment	health and ages of trees, mortality	V	create spatial database of public trees and conditions/asset mgmt.	H
Yellow	Environment	Highway Dept. Tree Management	S		
Yellow	Environment	National grid needs to be more proactive to minimize emergencies	V	more staff to trim trees, respond faster to proactive tree management.	
Yellow	Environment	debris management after storms	V	policy during emergency on debris location and management	L
Yellow	Environment	Stormwater bylaw threshold doesn't capture small developments, good stormwater review	S/V	feasibility of updating SW bylaw	M
Yellow	Environment	Pine Street recreation fields always flood (capped landfill)	V	at next renovation improve drainage	L
Yellow	Environment	Parks and open space	S		
Yellow	Environment	High Priority Open Space purchase Main Street fields	S		
Yellow	Environment	Town has CPA	S		
Yellow	Environment	Park and Rec could enhance connectivity, access, and public use of parks	V	increase budget to implement more programs	M
Yellow	Environment	water scarcity, drinking water protections	V	Partner with NSRWA to implement water conservation measures and regulations	H
Yellow	Environment	snow storage - contaminated snow melt entering water. Ice melt vs. hot water	V	see emergency debris management and location above	L
Yellow	Environment	Rt. 3 ice melt runoff to drinking water wells	V	determine if this is an issue - address with appropriate agency	L
Yellow	Infrastructure	Assenippi Park flooding	V	Ensure Norwell Downtown economic development plan considers flood zones, heat and historic flooding, be proactive to minimize vulnerability. Make private owners accountable if lack of maintenance causes or exacerbates flooding. Improve stormwater management as necessary. Renovate Big Y parking lot.	H
Yellow	Infrastructure	elementary school flooding	V		H
Yellow	Infrastructure	Queen Anne area flooding	V		H
Yellow	Infrastructure	Big Y parking lot flooding	V		H

Yellow	Infrastructure	Police and Fire in flooding area	V		H
Yellow	Infrastructure	Senior housing authority could flood with new development	V	consider impact of new development	L
Yellow	Infrastructure	Electric grid issues with tree loss during storms	V	tree trimming and maintenance more frequently than every 5 years	H
Yellow	Infrastructure	Transportation infrastructure during storms	V	use an online platform to communicate roads out of service	H
Yellow	Infrastructure	Housing authority loss of heating gas pilot in Community Room from high winds	V	improve backup heating system, get a generator	H
Yellow	Infrastructure	high winds and trees down cause cascading damage (wires, infra., roads)	V	interactive on-line platform for reporting, communicating and triaging emergencies	H
Yellow	Infrastructure	Town hall has no generator	V	Get a generator, especially w/ renovation	H
Yellow	Infrastructure	loss of electricity means loss of services, loss of server	V	go to cloud-based server and IP phones, business recover "go" boxes	H
Yellow	Infrastructure	COA flooding in basement	V	evaluate issue and institute proper repair	M
Yellow	Infrastructure	Middle school generator is outdated	V	replace generator for primary shelter during emergencies	H
Yellow	Infrastructure	culverts are old and lack of regular maintenance cause flooding	V	create a public asset management system and maintenance schedule	H
Yellow	Infrastructure	cell service is inconsistent, especially during emergencies	V	work with service providers on dead zones, town flexibility on siting cell towers	M
Yellow	Infrastructure	aging utility infrastructure, lack of coordination in replace. Flooding and high-water table	V	incorporate in town public asset management system	H
Yellow	Society	transportation for senior and disabled during storms	V	know where roads are closed, create an online map. Senior safe and COA visits to all seniors to ID needs and create welcome, create a phone tree,	H
Yellow	Society	homecare visits are disrupted during storms	V		H
Yellow	Society	communication between shelters and home health aides during emergency	V		
Yellow	Society	medical personnel transportation disrupted during emergencies	V		

Yellow	Society	data of people on oxygen and disabilities for emergency response	S		
Yellow	Society	COA has at risk list for seniors	S		
Yellow	Society	good multimedia communication from town during emergencies	S		
Yellow	Society	senior communication during emergencies	V	phone tree, create joint emergency plan with COA, Senior Housing, Public Housing	M
Yellow	Society	inconsistency and disorganization in communication during emergencies	V	hire consultant to create integrated communications. Implement plan	M
Yellow	Society	extraordinary effort to transport seniors and disabled even during storms	S		
Yellow	Society	Housing Authority, NSRW, MNA, COA, town staff and emergency staff are strong, dedicated group that communicates well together	S		
Yellow	Society	Big Y generator - tries to stay open during emergency, portable generators	S		
Yellow	Society	many residents have generators	S		
Yellow	Society	keeping pets safe during emergencies	V	ID resources in town for sheltering	L-M
Yellow	Society	Senior Center is warming and cooling center, has generator	S		
Yellow	Society	New library community room is warming and cooling center	S		
Yellow	Society	Housing Authority generator for warming and cooling, septic, kitchenette	S		
Yellow	Society	High Dept. and trees and grounds, proactive and responsive	S		
Yellow	Society	traffic management w/ road closures, traffic lights out	V	deployable emergency signage	H
Yellow	Society	ID vulnerable populations	V	work w/ welcome committee, multidisciplinary agencies to ID and locate vulnerable populations	M
Orange	Environment	the amount of green space in town	S		

Orange	Environment	tree coverage during windstorms and other big storms	V	need to continue to plan for and act upon.	M
Orange	Environment	trees help keep temperatures cool	S		
Orange	Environment	Brigantine Circle is particularly vulnerable to trees damage	V	more study is needed to develop strategies	M
Orange	Environment	Fire concerns - from human action	V	communicate and educate about the hazards of brush fires	M
Orange	Infrastructure	Area of projected sea level rise does not include industry	S		L
Orange	Infrastructure	Sea level rise will impact homes and values in the area.	V	communicate with local homeowners	L
Orange	Infrastructure	Green space	S		
Orange	Infrastructure	Brush fire with Fire Dept. that may not be ready	V	improve access to conservation land for Fire Dept., brush clean up, forest management plan	M
Orange	Infrastructure	Police and Fire are in a flood area, have flooded in the past	V	There is planning in place, maintain awareness for both departments	L
Orange	Infrastructure	Substation is not in a vulnerable area	S		
Orange	Infrastructure	Middle School is used as a shelter, but near flooding area	V	more data is needed on flood risk, shelter needs new generator	L
Orange	Infrastructure	45%-50% of basement in Norwell homes are finished (flood risk)	V	do communication and education	L
Orange	Infrastructure	Power lines are in heavily treed areas, that utility needs to access during storms	V	Develop plan of how to work with homeowners for trimming of trees, National Grid needs to be active partner	H
Orange	Infrastructure	Age of the power lines	V	data is needed	M
Orange	Infrastructure	Natural gas steel pipes need to be changed	V	data is needed	M
Orange	Infrastructure	Plastic gas lines are preferable for flooding issues	S	more data needed	M
Orange	Infrastructure	town generators are needed (town hall and others)	V	capital budget planning	H

Orange	Infrastructure	Middle School generator is only for school - not for shelter use	V	capital budget planning	H
Orange	Infrastructure	Main Street near Dam at Jacobs Pond is a concern/ dam is being cleaned out regularly now	S/V	more information is needed	L
Orange	Infrastructure	lack hotel and lodging for power company workers and first responders/ as well as for residents during storms	V	consider this for zoning at Town Meeting in 2020	L
Orange	Society	tension between green space and need for tax dollars	V	on-going conversation for the town	L
Orange	Society	need more information to determine right strategies	V	gather and review data	L
Orange	Society	nursing homes are in a location that has flooded previously	V	work with nursing homes to ensure proper planning	M
Orange	Society	mobile homes are subject to tree damage during storms	V	communicate with landowners to take action on maintenance	M
Orange	Society	Seniors need on ground support and communication	V	COA need to continue their good efforts	H
Orange	Society	Seniors don't use communication channels like social media, internet, cellphones that others use	V	COA build out on ground support	H
Orange	Society	distance to hospital is 12-20 minutes w/o a storm- when there is a storm ??	V	regional planning and support needed	M
Orange	Society	town wants to build on-ground emergency/hospital support for severe conditions	S	regional planning and support needed	M
Orange	Society	urgent care location is in area that has flooded in the past.	V	regional planning and support needed	M