



Marshfield's Municipal Vulnerability Preparedness (MVP) Program Workshop



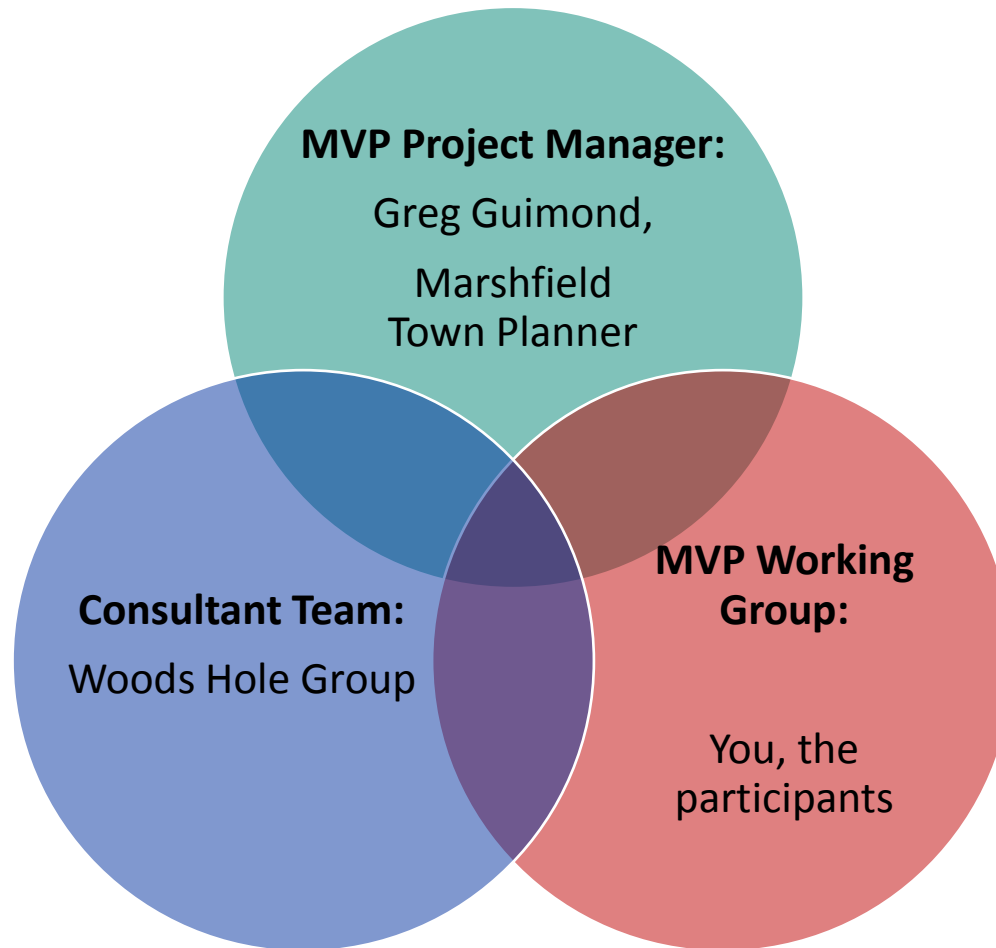
Executive Office of Energy and Environmental Affairs
Massachusetts Vulnerability Preparedness Program



February 1, 2020



Your MVP Team



Introductions - Who is here today?

Your name

Your affiliation
with the
community

One thing you
enjoy about
living/working
in Marshfield



Today's Agenda

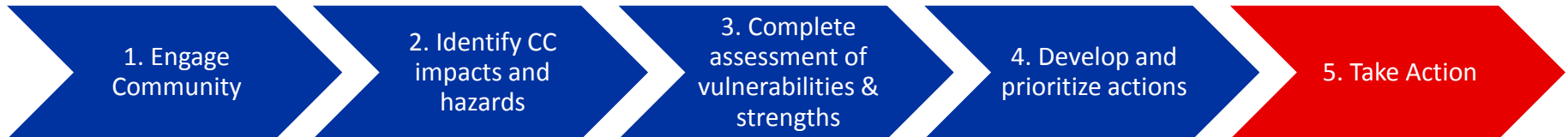


- 8:30 Registration & Breakfast
- 9:00 Welcome and Introductions
- 9:15 Large Group Discussion - Overview
- 10:00 BREAK
- 10:15 Small Group Discussion – Vulnerabilities & Strengths
- 11:45 Large Group Discussion
- 12:30 LUNCH
- 1:15 Small Group Discussion – Action Development
- 3:15 BREAK
- 3:30 Large Group Discussion & Next Steps
- 4:30 Closing Remarks

Program Overview:

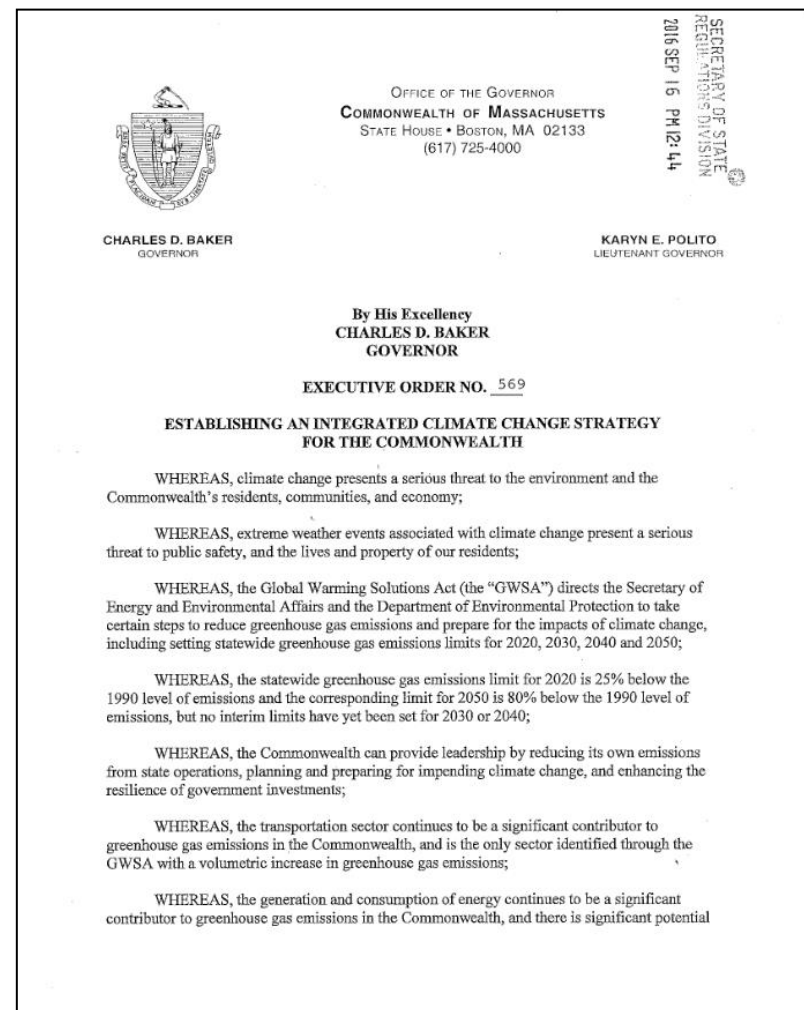
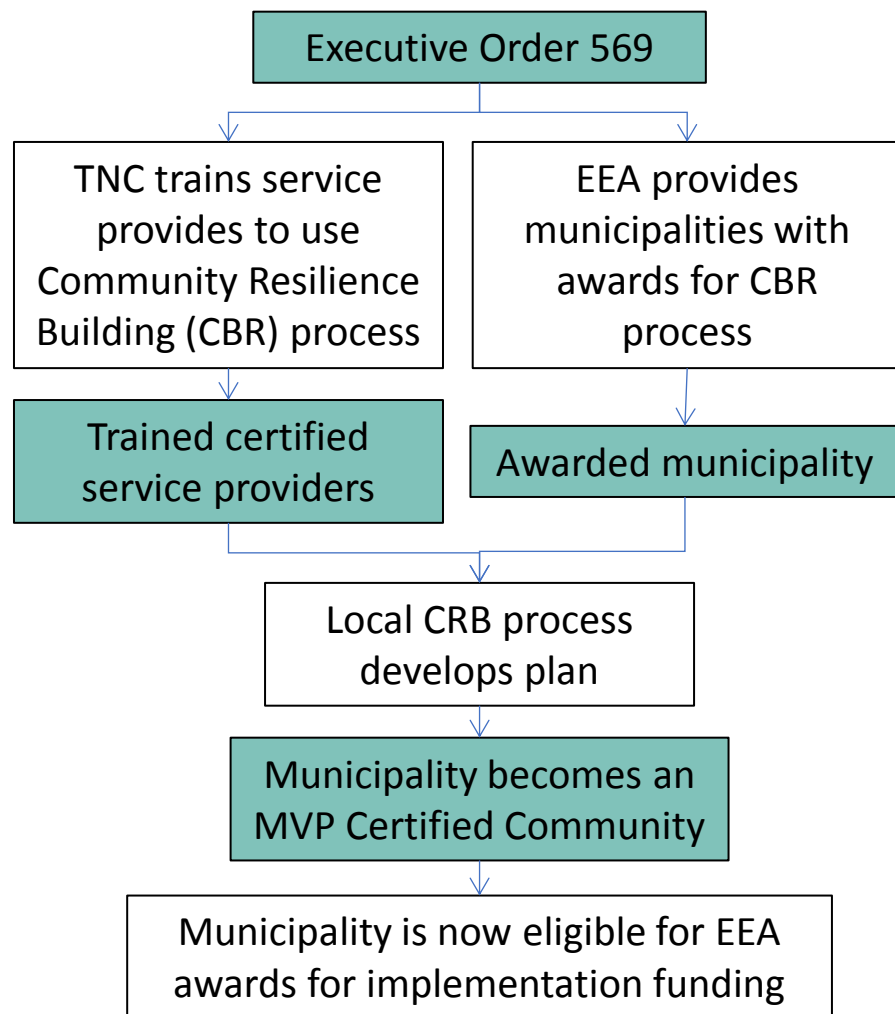
What is Municipal Vulnerability Preparedness?

State and local partnership to build resiliency to climate change



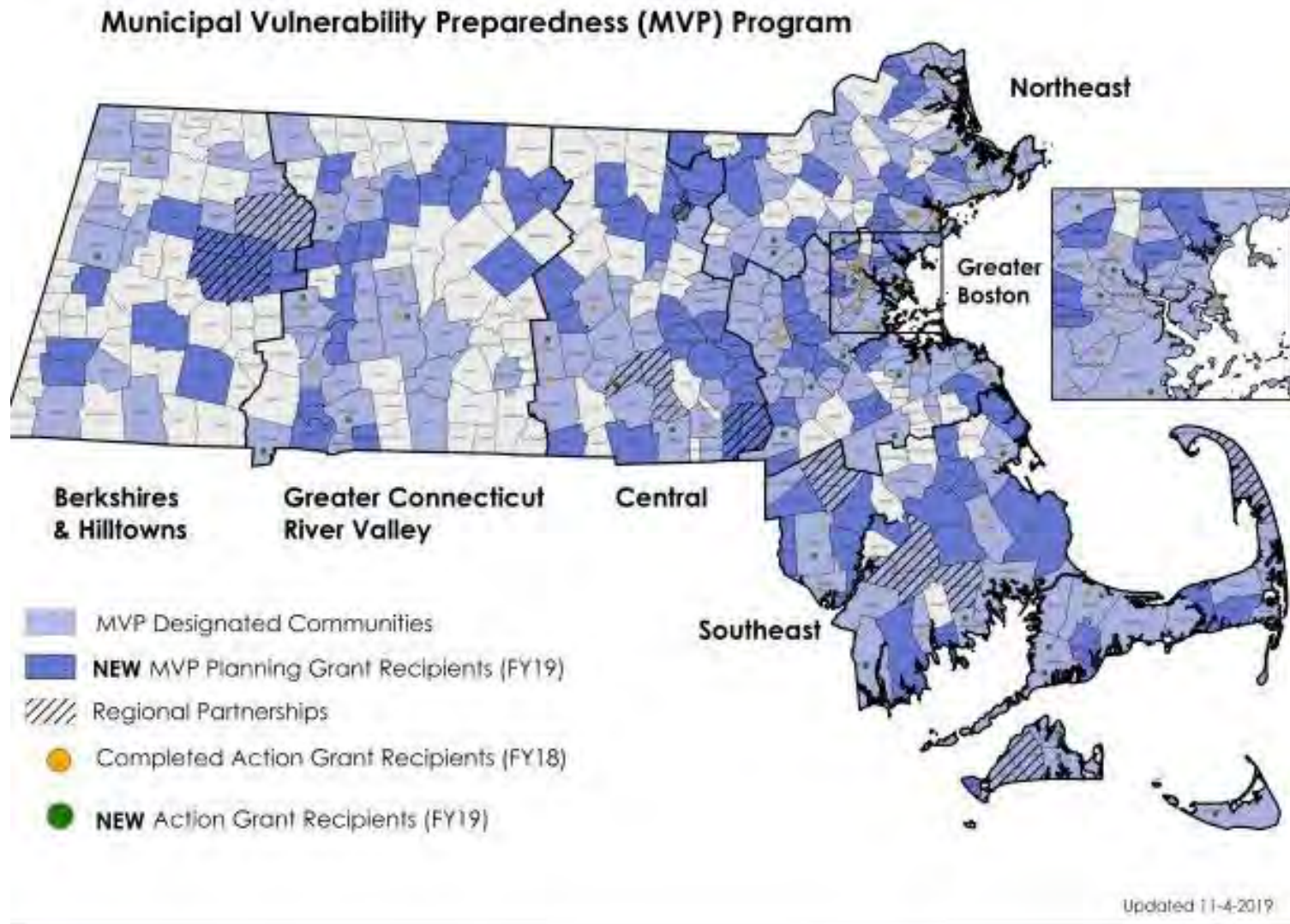
What is Municipal Vulnerability Preparedness?

Executive Order 569



What is Mmunicipal Vvulnerability Ppreparedness?

Executive Order 569



What is Municipal Vulnerability Preparedness?

Empowering Communities & Informing Statewide Action

- Community-led process
- Communities as local innovators
- Partnerships and leveraging existing efforts
- Frame coordinated statewide efforts

Goal for Today:

Work Through the Community Resilience Building (CRB) Workshop Process



CRB Workshop Process

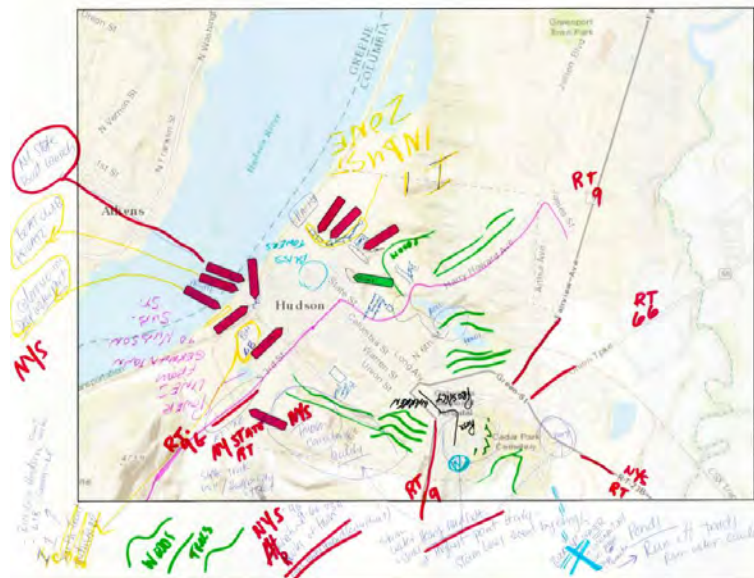
Identify Hazards

Identify Community Strengths & Vulnerabilities



Develop Community Actions

Prioritize Actions / Define Urgency and Timing








CRB Workshop Process

- CRB Workshop Structure:
 - Identify hazards
 - Identify vulnerabilities and strengths
 - Identify and prioritize community actions
- **Small groups:** Brainstorming vulnerabilities, strengths, and actions
- **Large group:** Determining hazards and prioritizing actions



CRB Workshop Process

Town of Marshfield MVP Workshop Risk Matrix		 	
Priority Level: H = High M = Medium L = Low Time : S = Short L = Long O = Ongoing		Top Priority Hazards	
		A) _____ B) _____ C) _____ D) _____	
		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 			
		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

Marshfield – Past, Present, Future



Past hazards – Flooding

Brant Rock: Jan 4, 2018



South Marshfield: Jan 5, 2018



Esplande: Jan 4, 2018

Past hazards – Nor'easters / Snow Storms

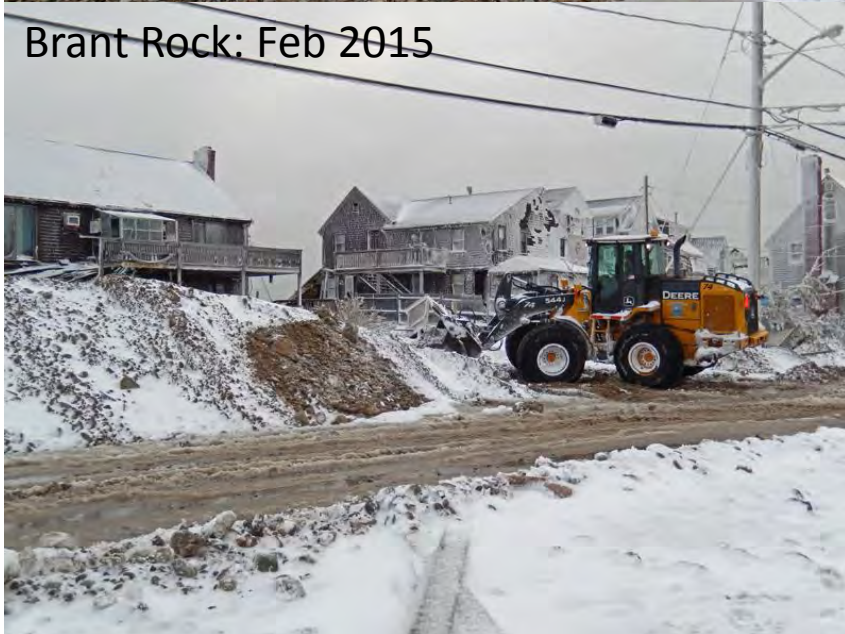
Brant Rock: Feb 2015



Jan 4, 2018



Brant Rock: Feb 2015



Jan 27, 2015



Past hazards – Coastal Erosion

Brant Rock
Feb 2015



Green Harbor Bay Ave Ramp
June 2017

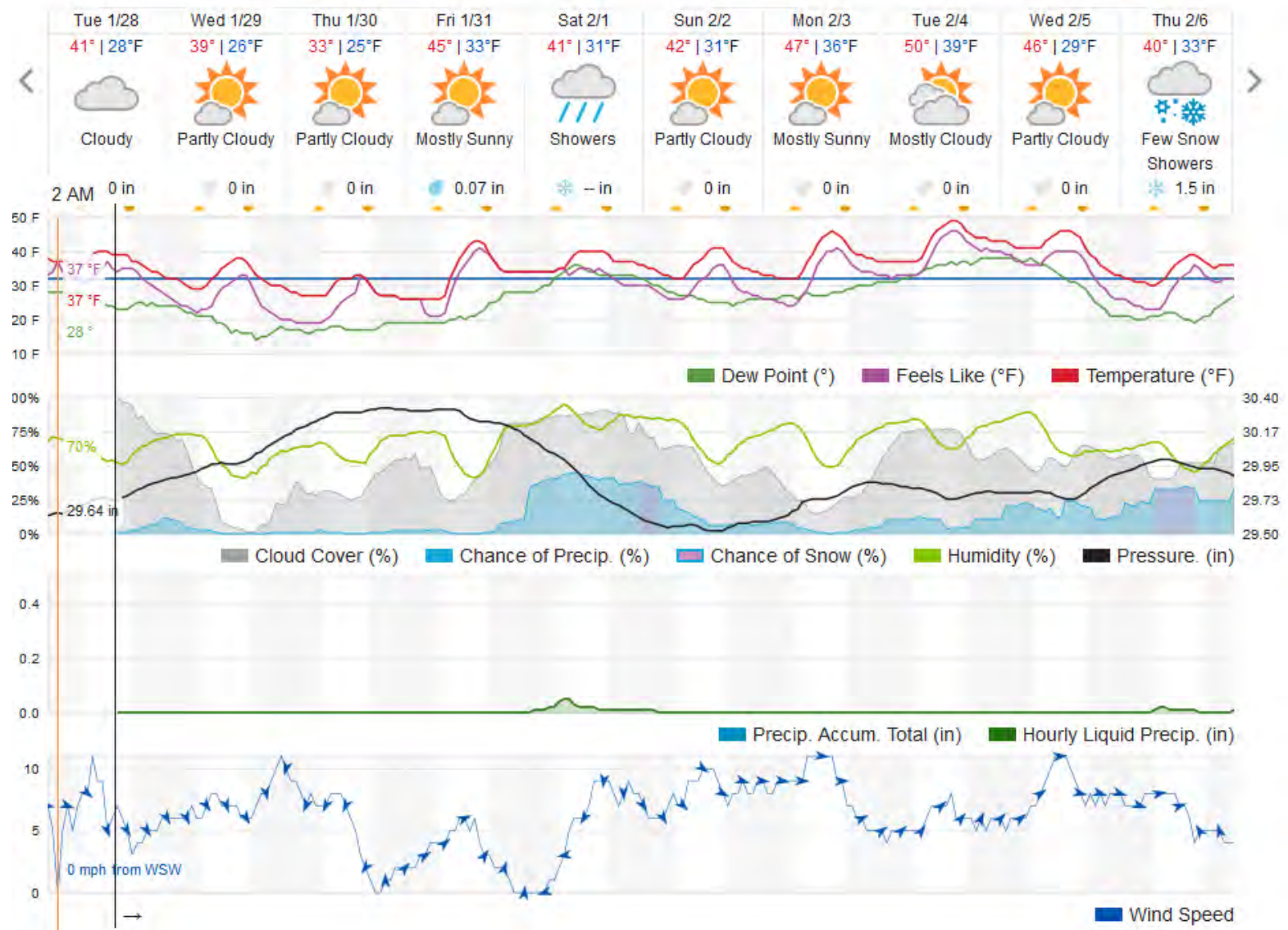
Old Rexhame
April 2017



Rexhame
Jan 2018

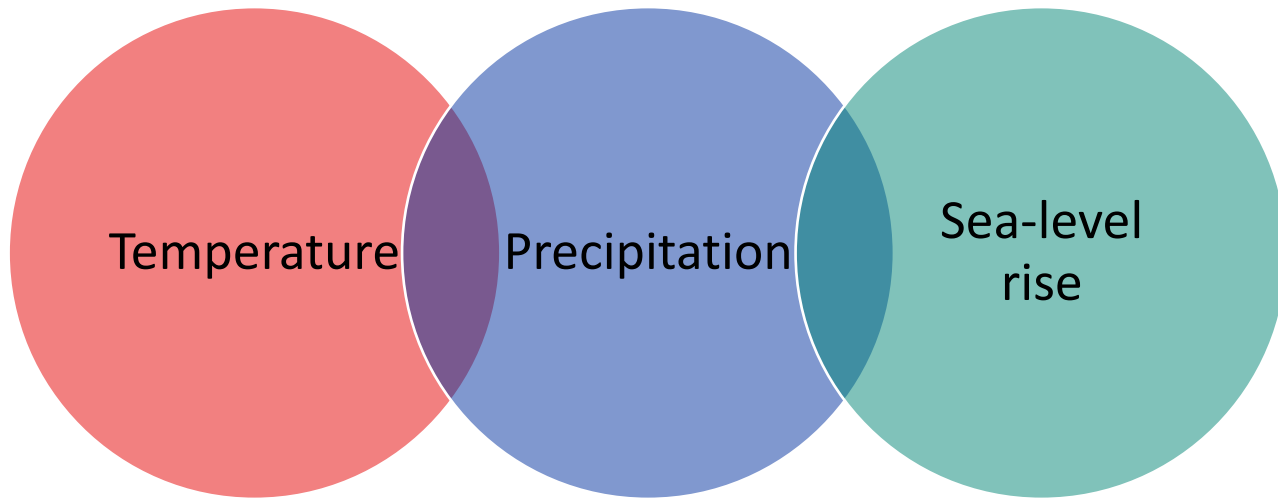


Present conditions



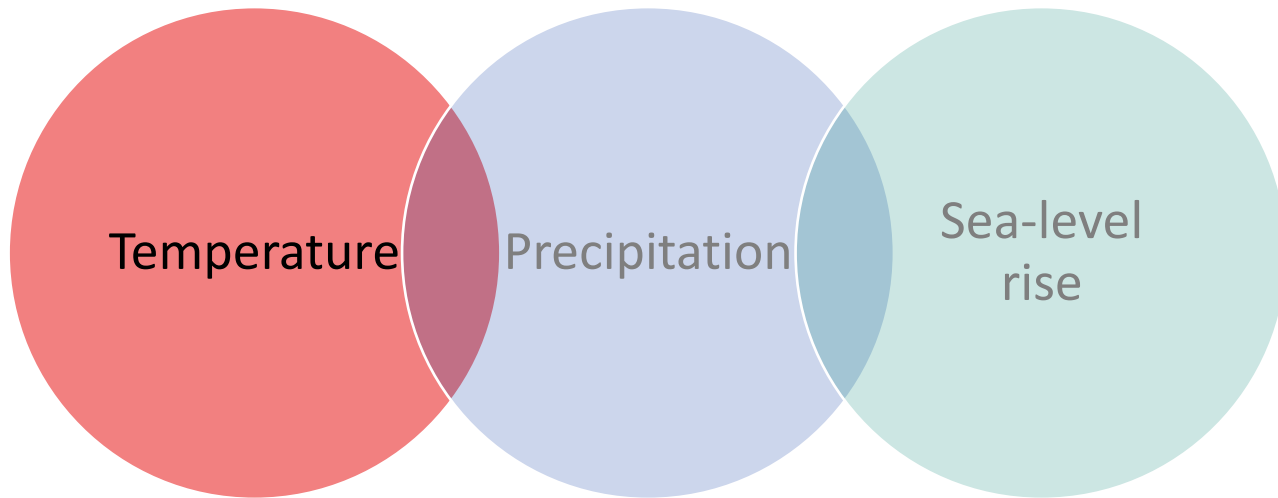
Future conditions

Projected changes in ...



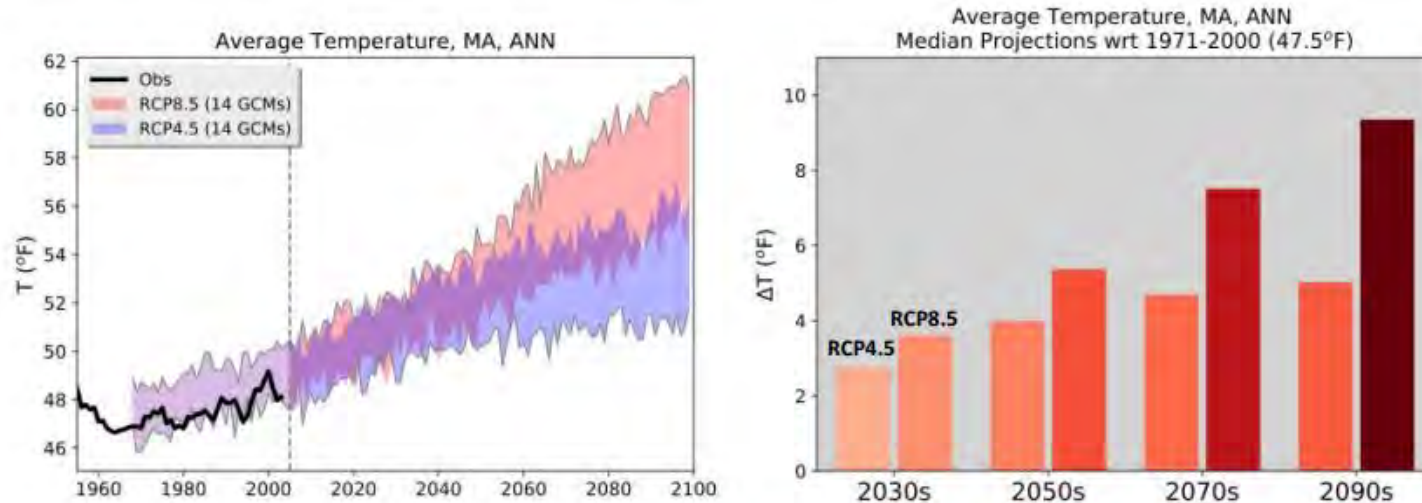
Future conditions

Projected changes in ...

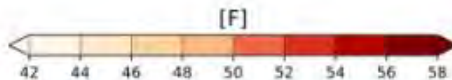
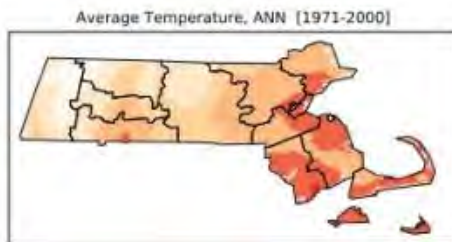


Future conditions

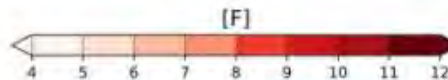
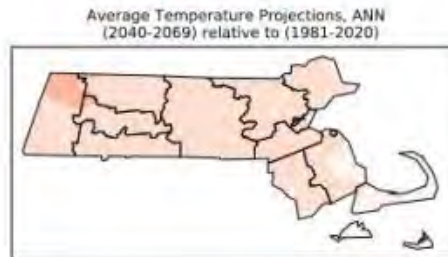
Projected changes in temperature – annual mean



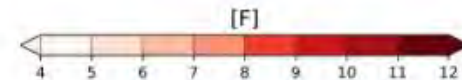
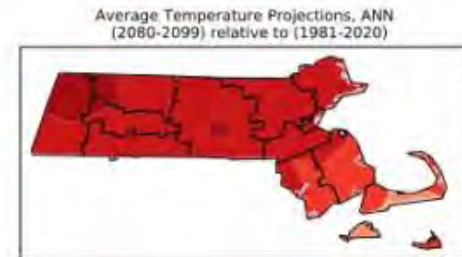
Climatology 1971-2000



Projections 2050s



Projections 2090s



Future conditions

Projected changes in temperature

South Coastal 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	49.7	+1.9 to +3.7	+2.6 to +5.8	+2.9 to +8.5	+3.2 to +10.3
	Winter	30.3	+1.9 to +4.1	+2.6 to +6.3	+3.2 to +8.3	+3.5 to +9.8
	Spring	46.7	+1.8 to +3.5	+2.4 to +5.6	+2.7 to +7.8	+3.2 to +9.5
	Summer	69.1	+1.5 to +3.7	+2.0 to +6.1	+2.6 to +9.2	+3.2 to +11.4
	Fall	52.4	+2.0 to +4.2	+3.3 to +6.2	+3.0 to +8.8	+3.6 to +10.9
Maximum Temperature	Annual	59.5	+1.8 to +3.6	+2.4 to +5.7	+2.6 to +8.5	+2.9 to +10.2
	Winter	62.2	+1.9 to +4.3	+3.1 to +6.3	+2.9 to +8.8	+3.3 to +11.0
	Spring	56.7	+1.7 to +3.4	+2.1 to +5.4	+2.6 to +7.9	+3.0 to +9.4
	Summer	79.1	+1.4 to +3.5	+1.9 to +6.0	+2.5 to +9.3	+2.9 to +11.4
	Fall	62.2	+1.9 to +4.3	+3.1 to +6.3	+2.9 to +8.8	+3.3 to +11.0
Minimum Temperature	Annual	40.0	+2.0 to +3.8	+2.8 to +5.9	+3.2 to +8.5	+3.5 to +10.5
	Winter	21.1	+2.2 to +4.4	+3.0 to +6.7	+3.7 to +9.0	+4.0 to +10.5
	Spring	36.8	+1.8 to +3.6	+2.7 to +5.8	+2.7 to +7.6	+3.3 to +9.4
	Summer	59.1	+1.6 to +3.8	+2.2 to +6.3	+2.7 to +9.1	+3.4 to +11.3
	Fall	42.6	+2.0 to +4.5	+3.4 to +6.1	+3.2 to +8.8	+3.8 to +10.9

Future conditions

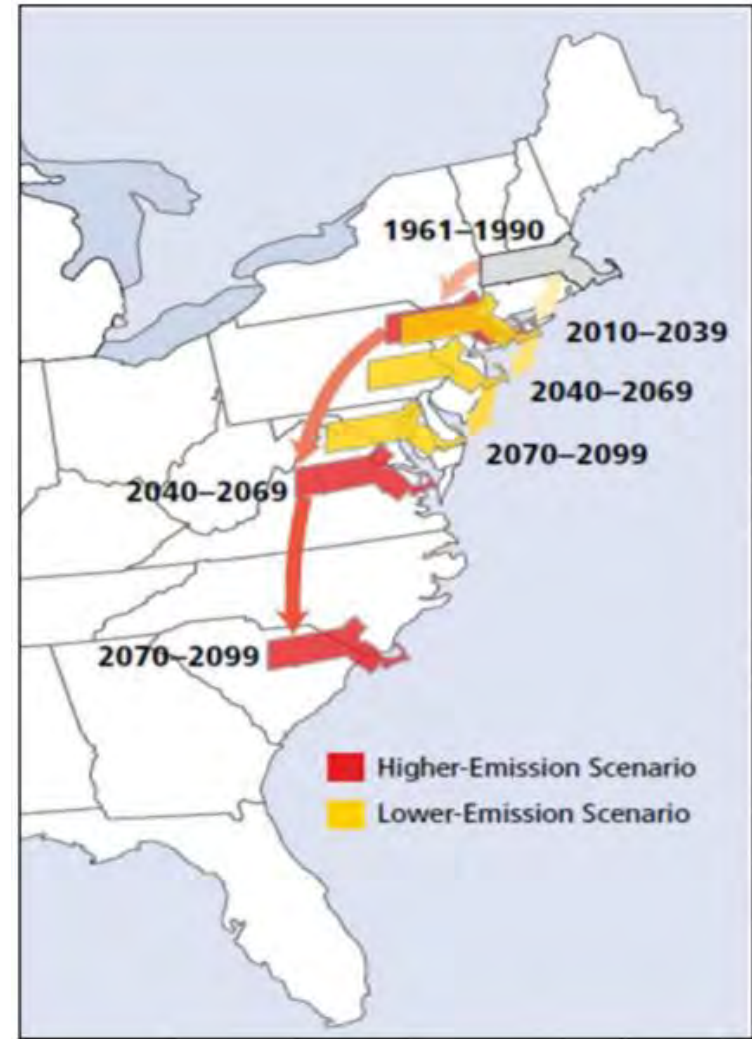
Projected changes in temperature

South Coastal 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	5	+4 to +11	+5 to +23	+7 to +41	+9 to +58
	Winter	0	+0 to +0	+0 to +0	+0 to +0	+0 to +0
	Spring	<1 ⁹⁰	+<1 ⁹⁰ to +1	+<1 ⁹⁰ to +1	+<1 ⁹⁰ to +2	+<1 ⁹⁰ to +3
	Summer	5	+3 to +10	+4 to +20	+6 to +35	+8 to +47
	Fall	<1 ⁹⁰	+<1 ⁹⁰ to +1	+1 to +3	+1 to +6	+1 to +8
Days with Maximum Temperature Over 95°F	Annual	1	+1 to +4	+1 to +9	+2 to +18	+3 to +31
	Winter	0	+0 to +0	+0 to +0	+0 to +0	+0 to +0
	Spring	0	+0 to +<1 ⁹⁰	+<1 ⁹⁰ to +<1 ⁹⁰	+<1 ⁹⁰ to +1	+<1 ⁹⁰ to +1
	Summer	1	+1 to +4	+1 to +8	+2 to +16	+3 to +27
	Fall	0	+<1 ⁹⁰ to +<1 ⁹⁰	+<1 ⁹⁰ to +1	+<1 ⁹⁰ to +2	+<1 ⁹⁰ to +3
Days with Maximum Temperature Over 100°F	Annual	<1 ⁹⁰	+<1 ⁹⁰ to +1	+<1 ⁹⁰ to +3	+<1 ⁹⁰ to +5	+<1 ⁹⁰ to +10
	Winter	0	+0 to +0	+0 to +0	+0 to +0	+0 to +0
	Spring	0	+0 to +<1 ⁹⁰	+0 to +<1 ⁹⁰	+0 to +<1 ⁹⁰	+0 to +<1 ⁹⁰
	Summer	<1 ⁹⁰	+<1 ⁹⁰ to +1	+<1 ⁹⁰ to +2	+<1 ⁹⁰ to +5	+<1 ⁹⁰ to +9
	Fall	0	+0 to +<1 ⁹⁰	+0 to +<1 ⁹⁰	+0 to +<1 ⁹⁰	+0 to +1

Future conditions

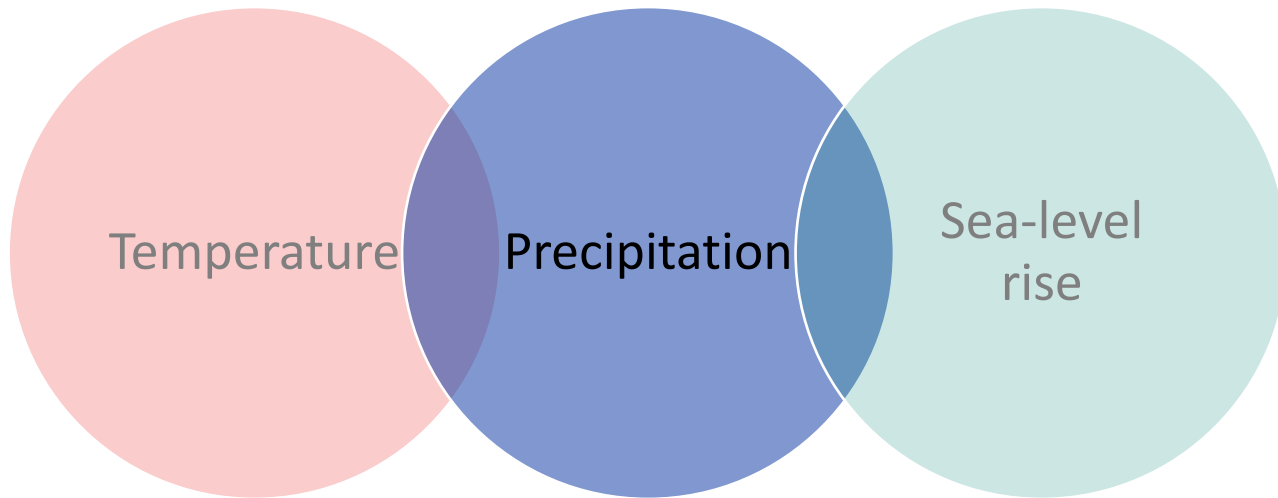
Hazards due to higher temperatures

- Heat islands
- Change in phenology: earlier flowering in some plants; earlier return of migrant birds
- Exacerbated asthma, allergies, and other respiratory conditions
- Higher cooling costs



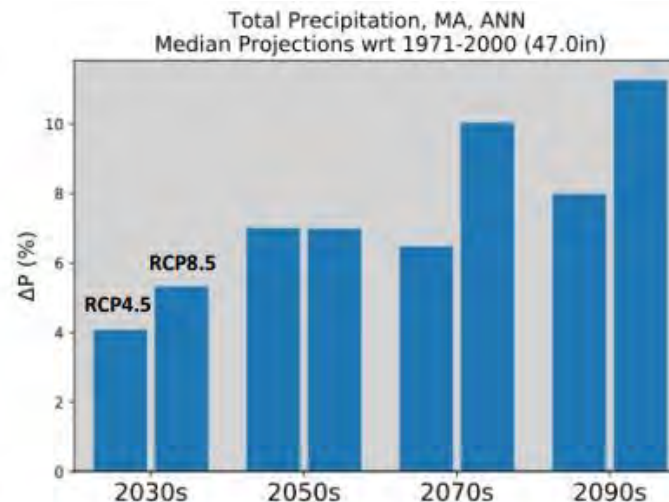
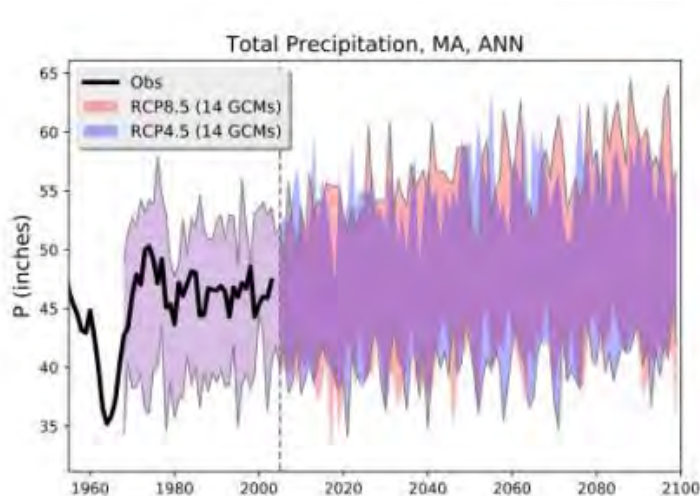
Future conditions

Projected changes in ...

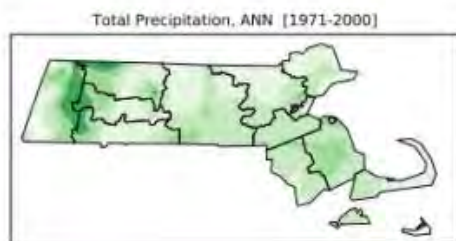


Future conditions

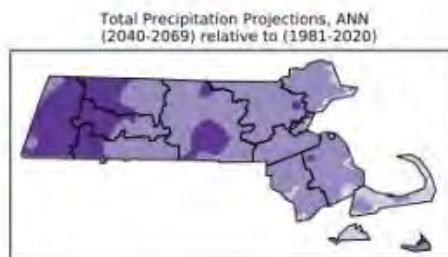
Projected changes in precipitation – annual precipitation



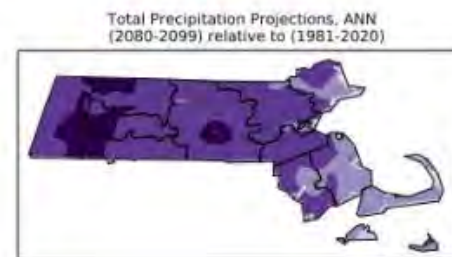
Climatology 1971-2000



Projections 2050s



Projections 2090s



Future conditions

Projected changes in precipitation

South Coastal 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	47.5	-0.2 to +3.9	+0.0 to +5.0	+0.3 to +6.2	-0.2 to +6.4
	Winter	12.5	-0.3 to +1.5	+0.1 to +1.9	+0.1 to +2.8	+0.1 to +3.7
	Spring	12.1	-0.1 to +1.8	-0.1 to +2.2	+0.1 to +2.4	+0.1 to +2.8
	Summer	10.4	-0.7 to +1.2	-0.7 to +1.8	-1.5 to +2.4	-2.1 to +2.3
	Fall	12.5	-0.9 to +1.1	-1.1 to +1.4	-1.7 to +1.7	-1.8 to +1.1

South Coastal 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	9	+<1 ⁹² to +2	+1 to +3	+1 to +3	+1 to +4
	Winter	2	-0 to +1	+<1 ⁹² to +1	+<1 ⁹² to +1	+<1 ⁹² to +2
	Spring	2	-0 to +1	+<1 ⁹² to +1	+<1 ⁹² to +1	+<1 ⁹² to +1
	Summer	2	-0 to +1	+<1 ⁹² to +1	-0 to +1	-0 to +1
	Fall	3	-0 to +1	-0 to +1	-0 to +1	-0 to +1

Future conditions

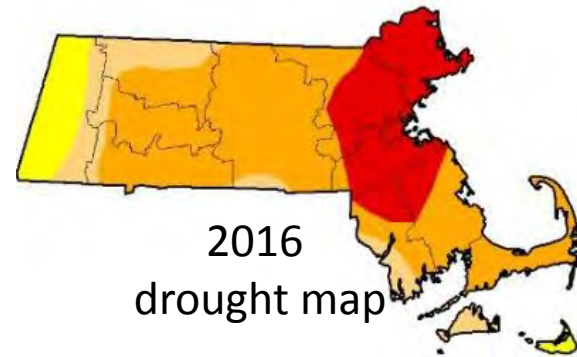
Projected changes in precipitation – dry days

South Coastal 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	17	-1 to +2	-0 to +3	-1 to +3	-0 to +4
	Winter	10	-0 to +2	-1 to +2	-1 to +2	-1 to +2
	Spring	11	-1 to +1	-1 to +1	-1 to +1	-1 to +2
	Summer	14	-1 to +2	-1 to +2	-1 to +3	-1 to +4
	Fall	13	+0 to +3	+0 to +3	-0 to +3	-0 to +3

Future conditions

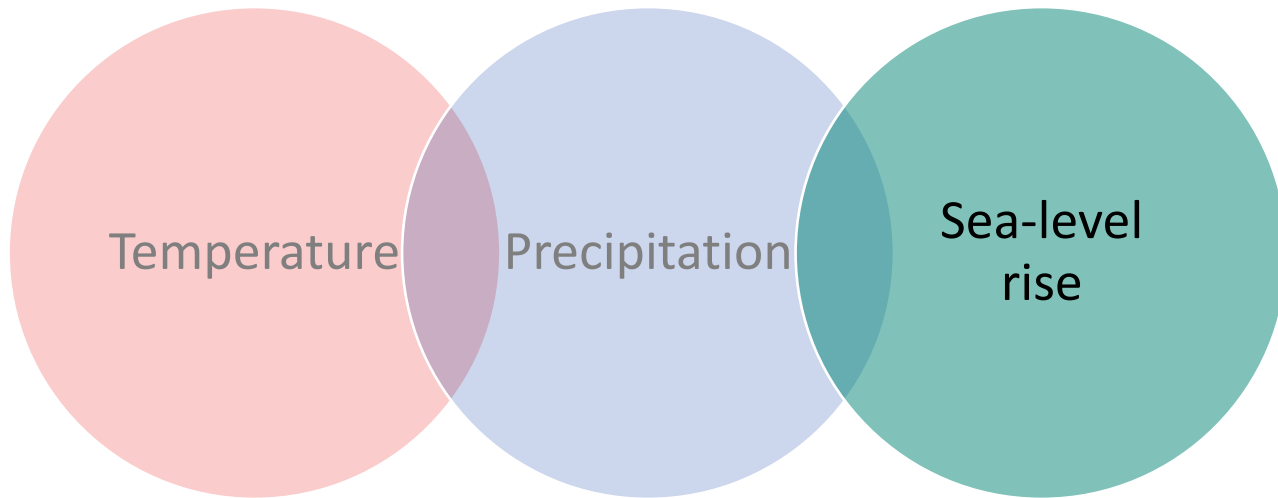
Hazards due to changes in precipitation

- Flash flooding
- Dam/culvert failure
- More frequent and intense storms – snow/ice damage
- Drought
- Greater prevalence of vector-borne disease (mosquitoes, ticks, etc)



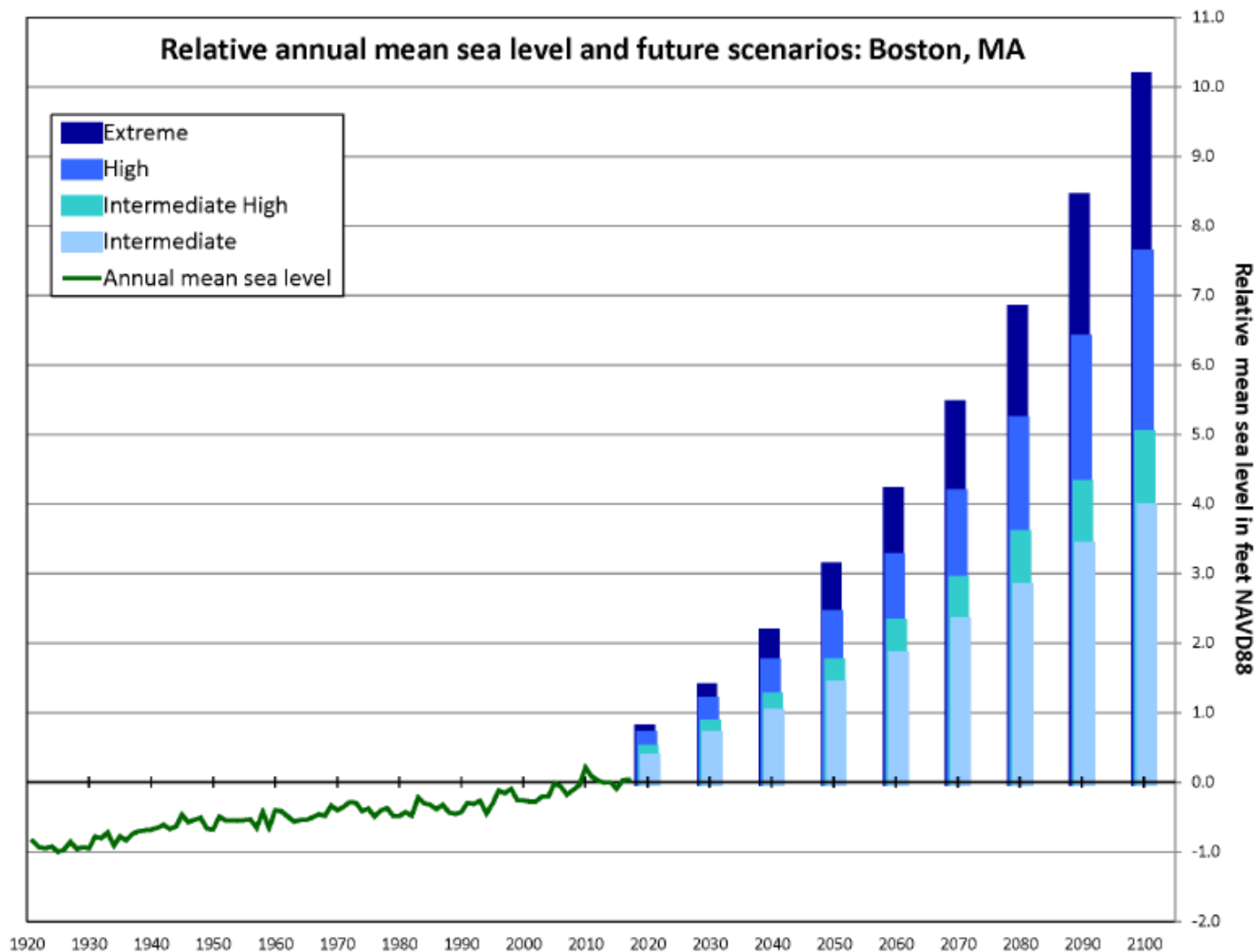
Future conditions

Projected changes in ...



Future conditions

Sea-level rise



Future conditions

Sea-level rise

Relative mean sea level (feet NAVD88) for Boston, MA					
Scenario	Cross-walked probabilistic projections	2030	2050	2070	2100
Intermediate	Unlikely to exceed (83%) under RCP8.5	0.7	1.4	2.3	4.0
	<ul style="list-style-type: none"> Extremely unlikely to exceed (95%) under RCP4.5 Unlikely to exceed (83%) under RCP4.5 About as likely as not to exceed (50%) under RCP4.5 when accounting for possible ice sheet instabilities 				
Intermediate - High	Extremely unlikely to exceed (95%) under RCP8.5	0.8	1.7	2.9	5.0
	<ul style="list-style-type: none"> Unlikely to exceed (83%) under RCP4.5 when accounting for possible ice sheet instabilities About as likely as not to exceed (50%) under RCP8.5 when accounting for possible ice sheet instabilities 				
High	Extremely unlikely to exceed (99.5%) under RCP8.5	1.2	2.4	4.2	7.6
	<ul style="list-style-type: none"> Unlikely to exceed (83%) under RCP8.5 when accounting for possible ice sheet instabilities Extremely unlikely to exceed (95%) under RCP4.5 when accounting for possible ice sheet instabilities 				
Extreme (Maximum physically plausible)	Exceptionally unlikely to exceed (99.9%) under RCP8.5	1.4	3.1	5.4	10.2
	<ul style="list-style-type: none"> Extremely unlikely to exceed (95%) under RCP8.5 when accounting for possible ice sheet instabilities 				

Statewide hydrodynamic modeling will use “High” Scenario

Hazards Overview & Survey Results



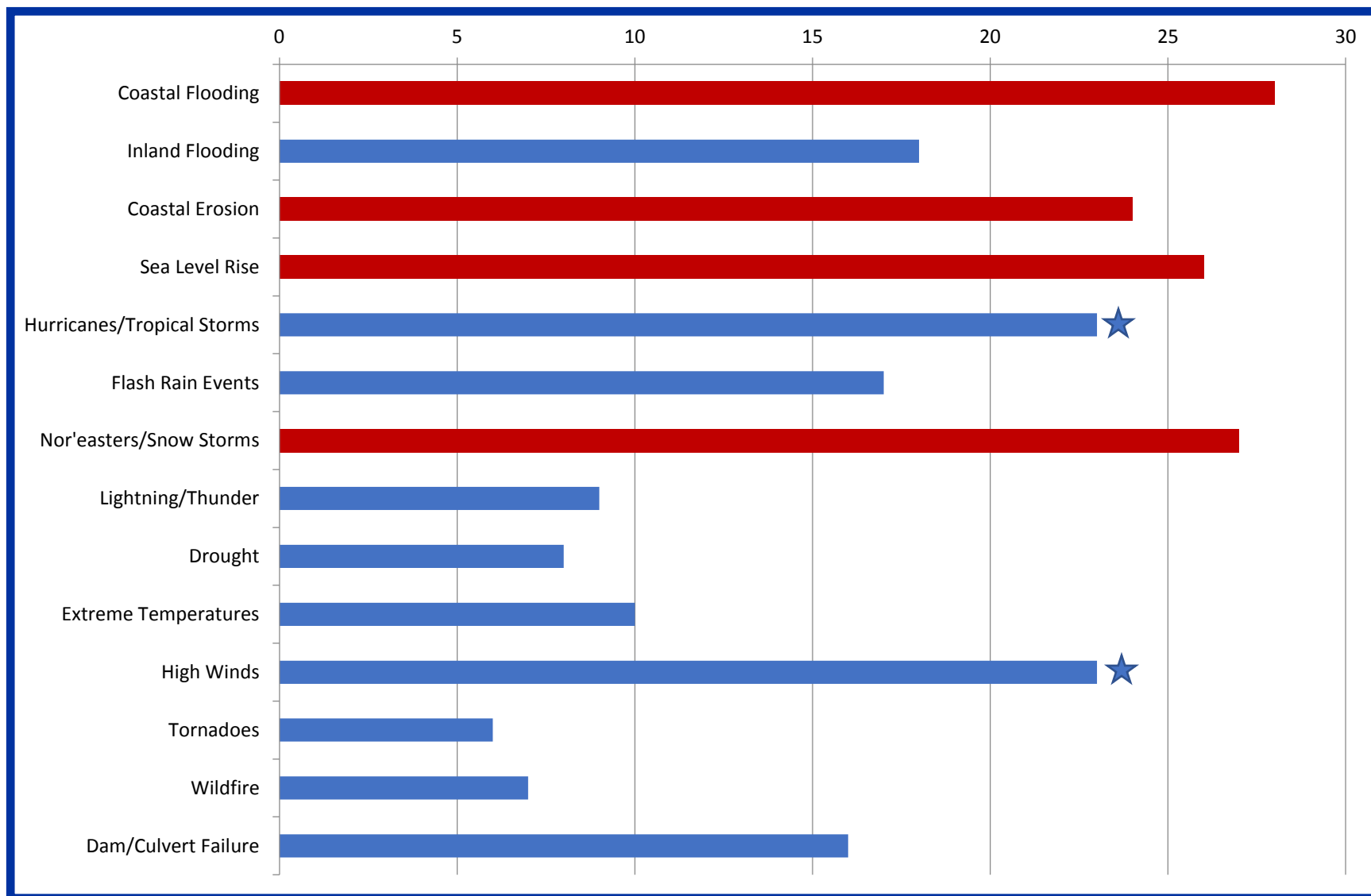
Potential Natural Hazards in Marshfield

(included in pre-workshop survey)

- Coastal Flooding
- Inland Flooding
- Coastal Erosion
- Sea-Level Rise
- Hurricane & Tropical Storms
- Flash Rain Events
- Nor'easters/Snow Storms
- Thunderstorm/Lightning
- Drought
- Extreme Temperatures
- High Winds
- Tornadoes
- Wildfires
- Dam/Culvert Failure

[illegible]

What we heard from you:



Hazards – Coastal Flooding

Brant Rock – Jan 4, 2018



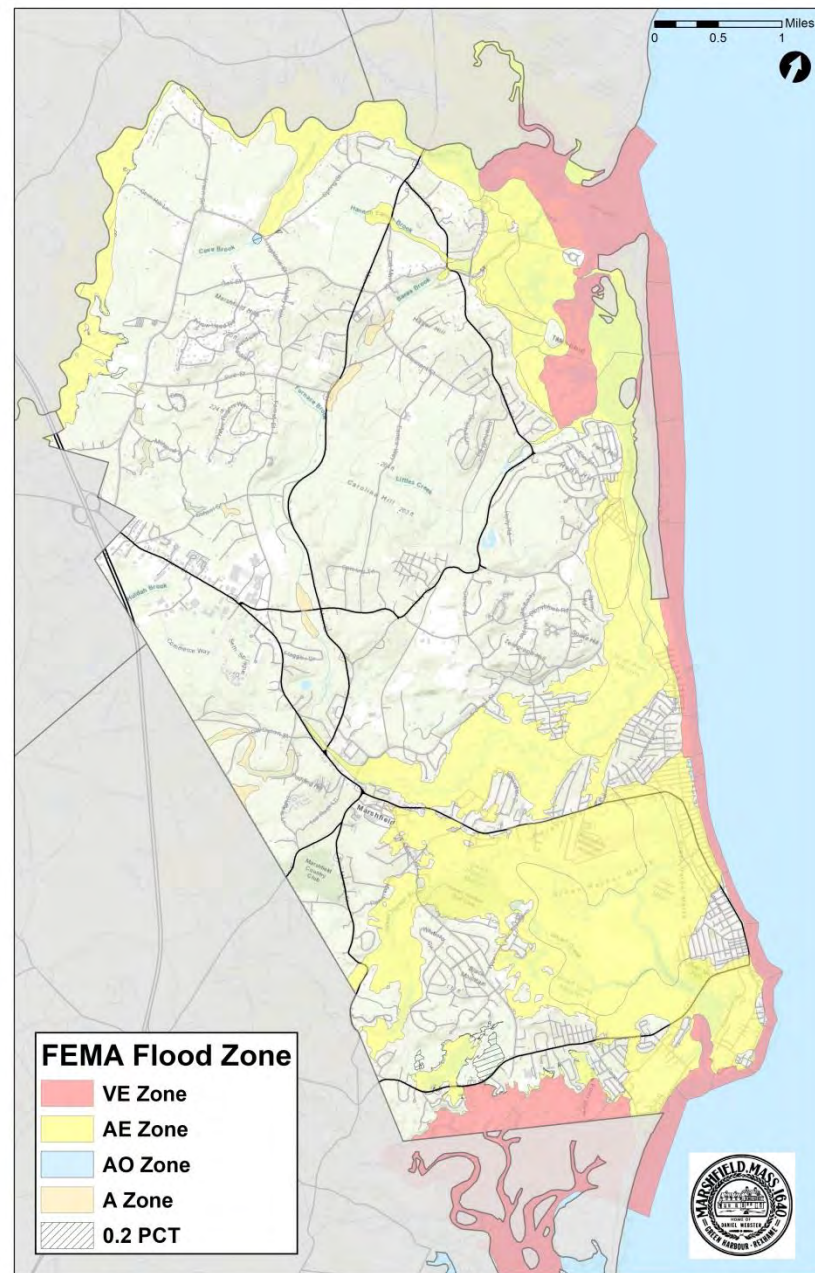
Brant Rock – Mar 5, 2018



Jan 30, 2018



Hazards – Coastal Flooding



Hazards – Nor’easters / Snow Storms

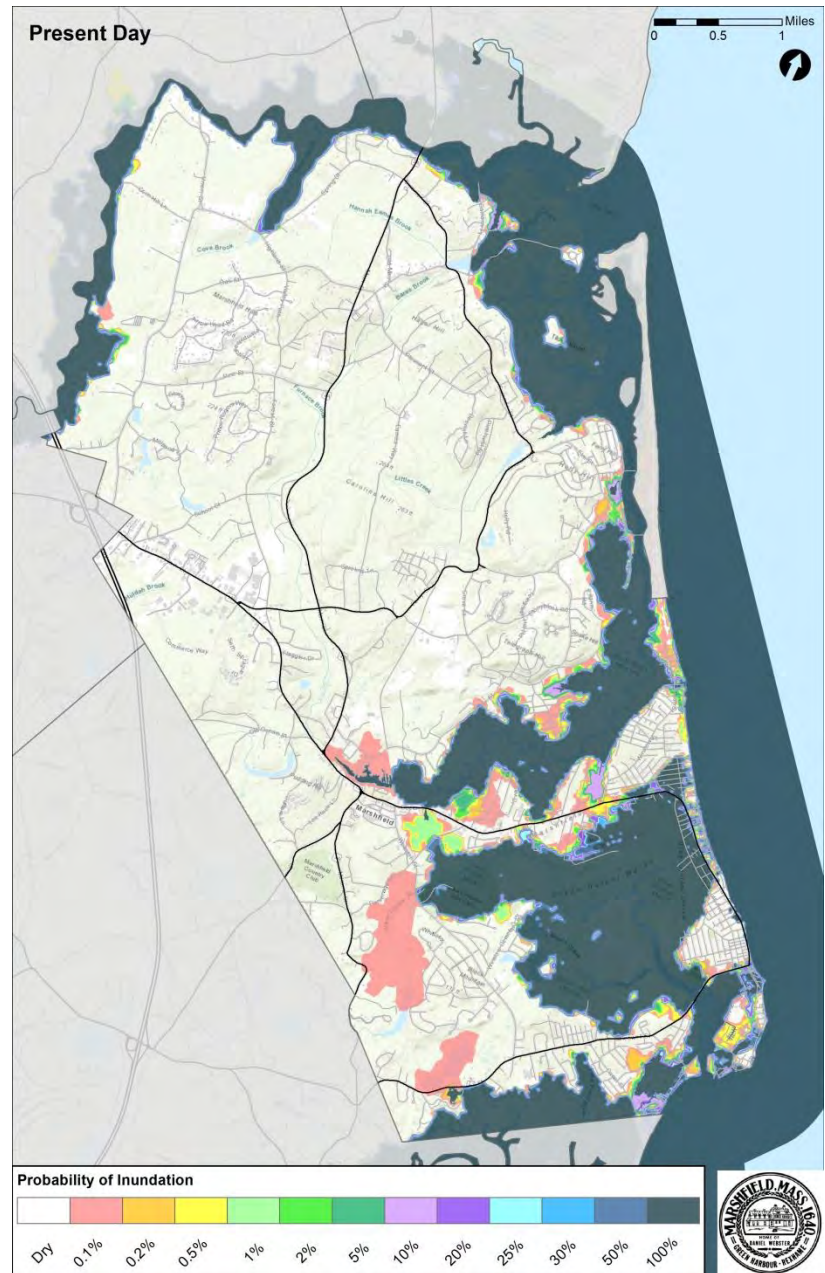
Date	Description
Jan 26, 2015	Travel ban, near blizzard conditions; 18+ inches of snow
Feb 2, 2015	5-14 inches of snow in coastal areas
Feb 8, 2015	Long duration snow storm; 8+ inches of snow
Feb 14, 2015	Near blizzard conditions; 12+ inches of snow
Mar 5, 2015	Up to 8 inches of snow
Jan 23, 2016	Heavy snow and strong, gusty winds; Up to 11 inches of snow
Feb 5, 2016	Wet heavy snow resulted in major power outages; Up to 10 inches
Feb 8, 2016	Heavy snow, gusty winds and blizzard conditions; 5-8 inches
April 3-4, 2016	4-9 inches of snow
Jan 7, 2017	13-19 inches of snow; near blizzard conditions
Feb 9, 2017	9-17 inches of snow; strong winds
Jan 4, 2018	Nor’easter brought 7-12 inches of snow, high winds, & storm surge
Jan 30, 2018	Up to 8 inches of snow
Mar 13, 2018	8-16 inches of snow; blizzard conditions
Mar 3-4, 2019	Heavy snow; 6-14 inches

Hazards

Sea-Level Rise

- Sea-level rise will increase areas flooded by daily high tides...

...but the real threat is the combination of sea-level rise and storm surge

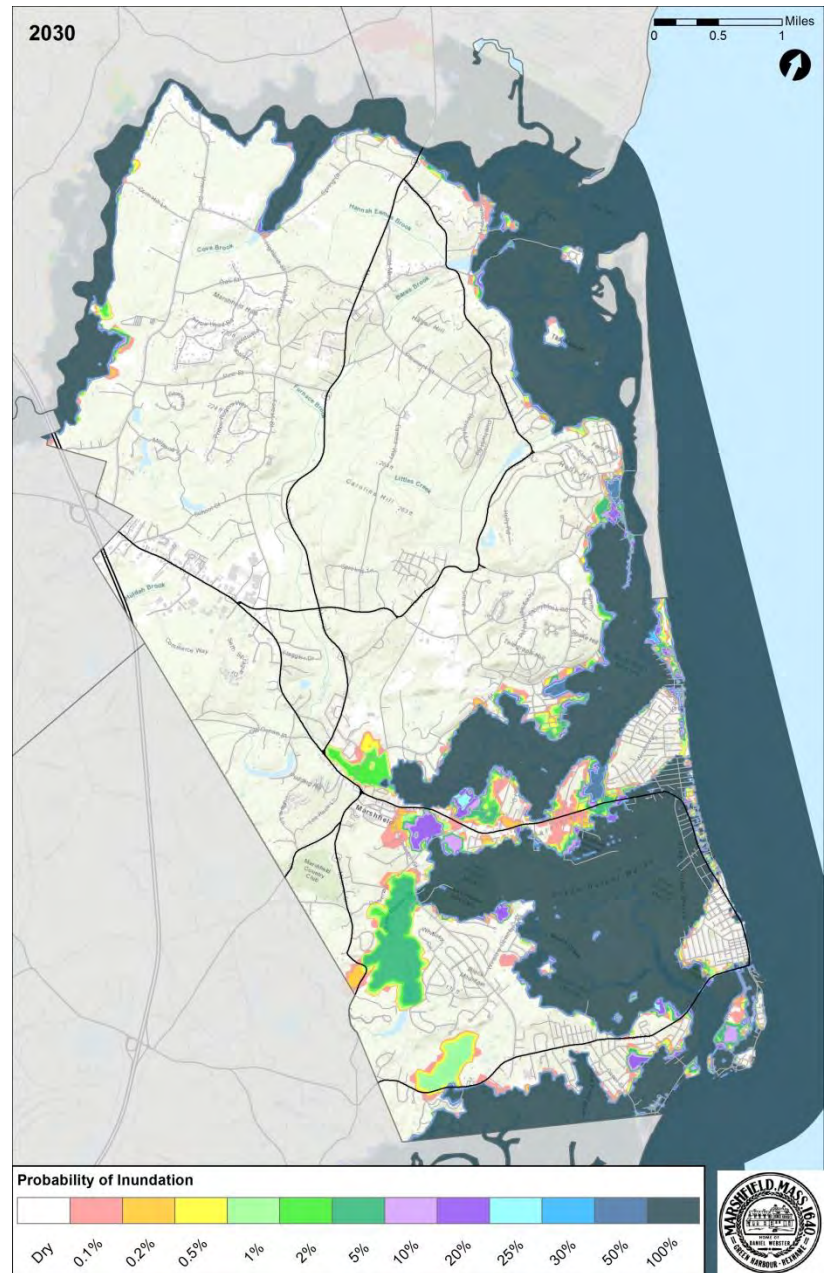


Hazards

Sea-Level Rise

- Sea-level rise will increase areas flooded by daily high tides...

...but the real threat is the combination of sea-level rise and storm surge

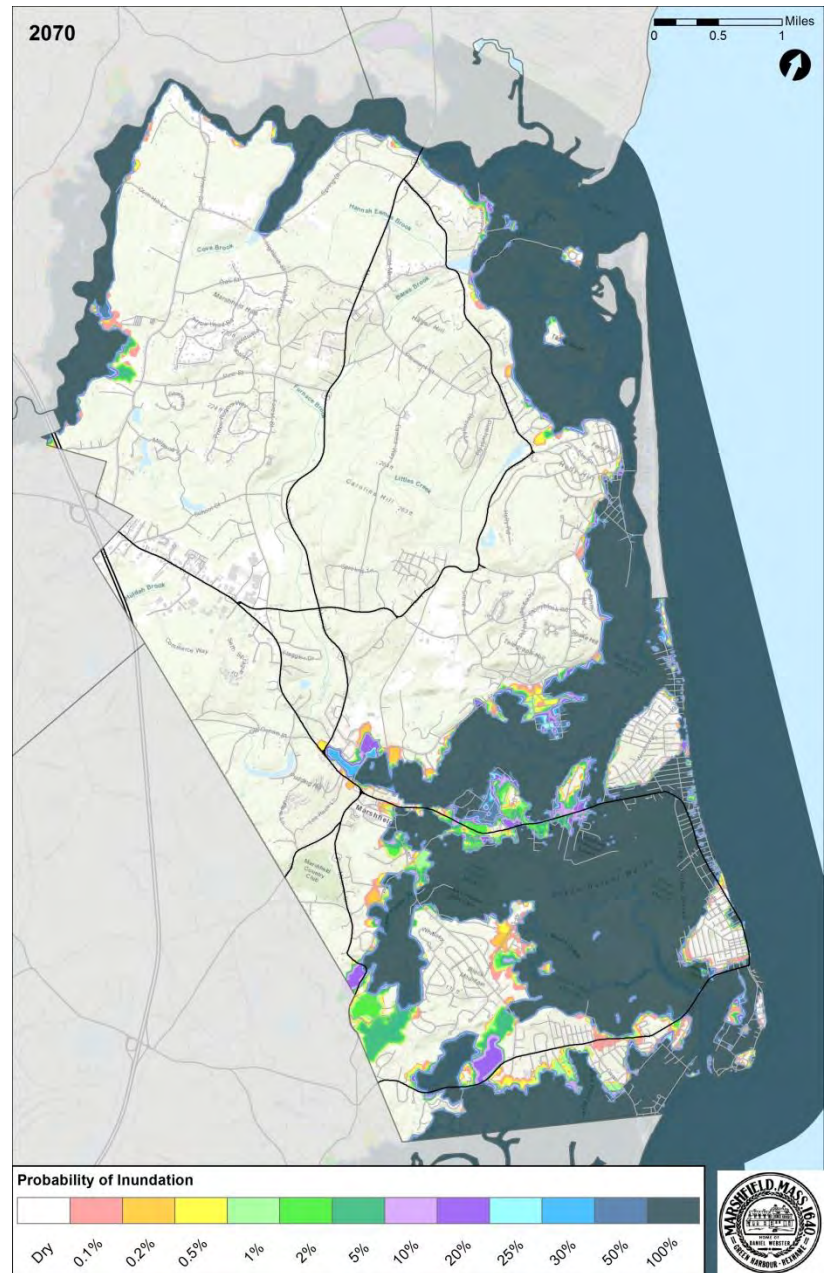


Hazards

Sea-Level Rise

- Sea-level rise will increase areas flooded by daily high tides...

...but the real threat is the combination of sea-level rise and storm surge



Hazards – Sea-Level Rise



Hazards – Coastal Erosion



Vulnerabilities & Strengths Overview



Infrastructural



Societal



Environmental

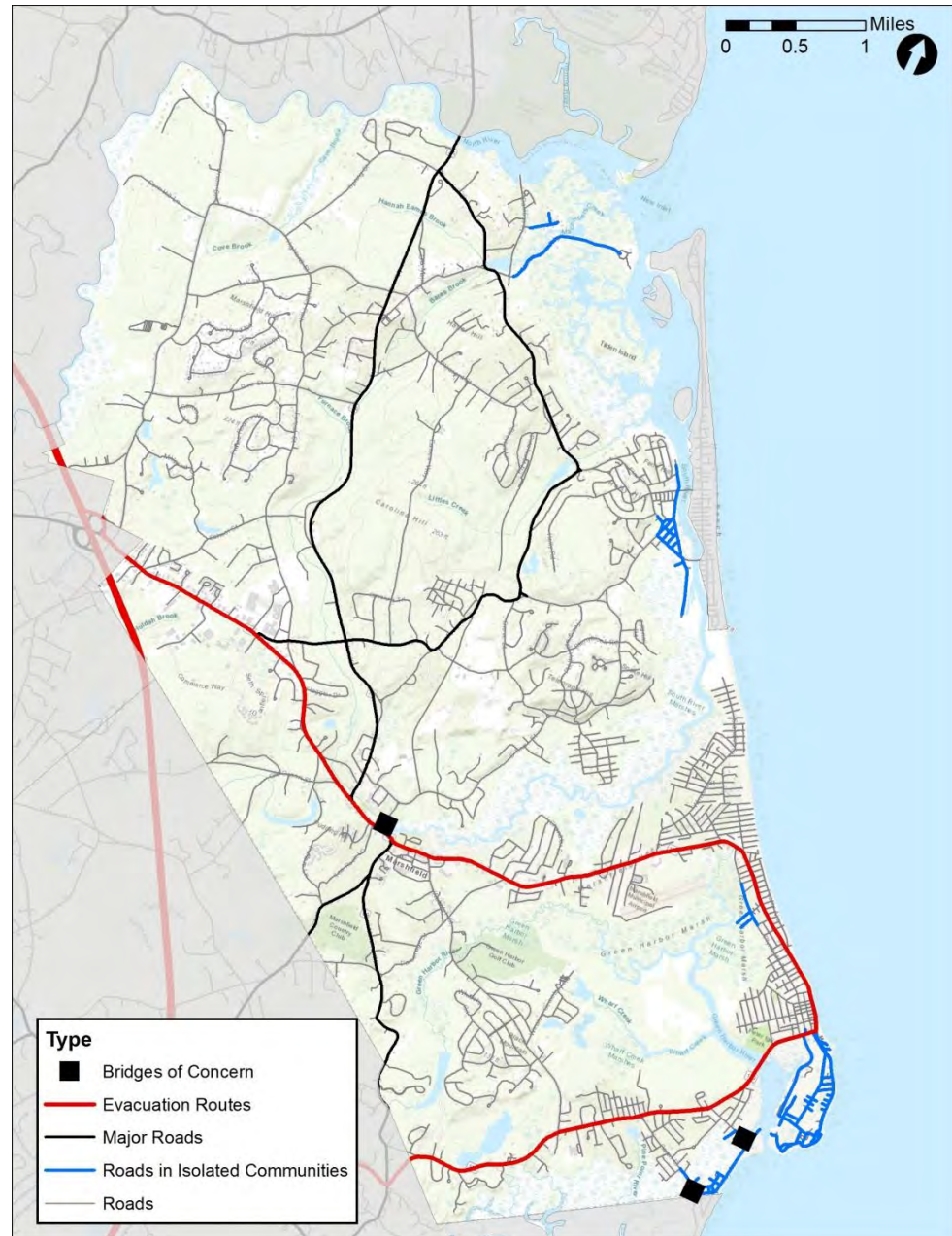
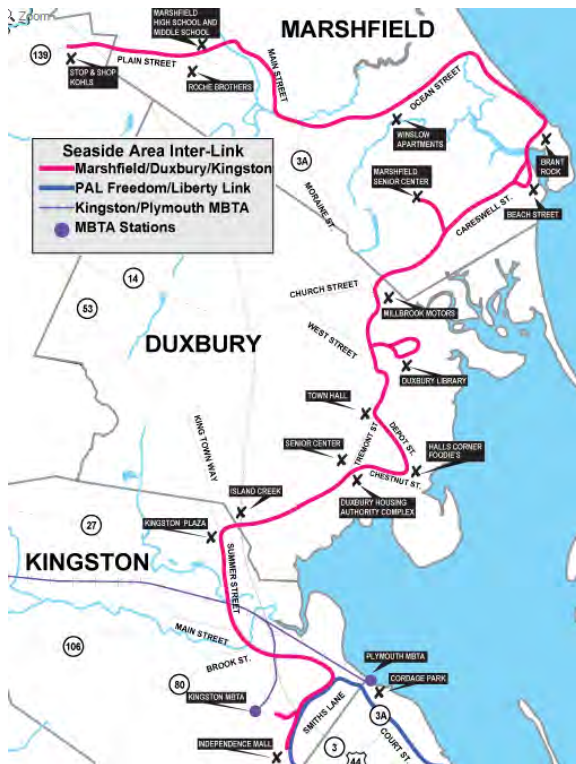
Infrastructural



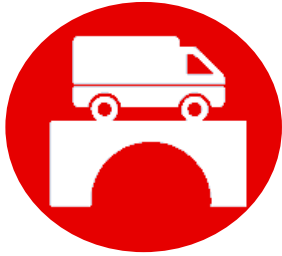
Infrastructural



Transportation

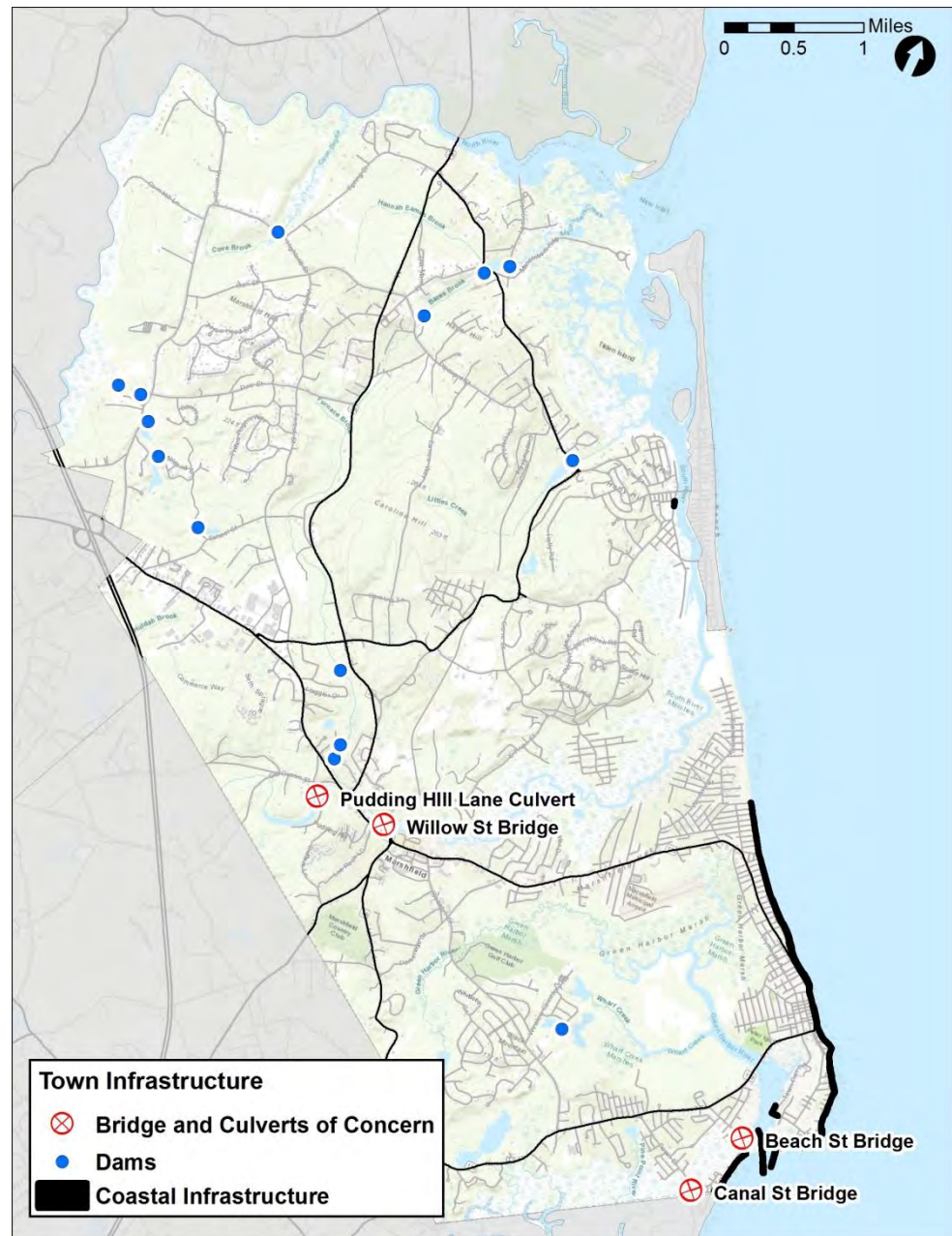
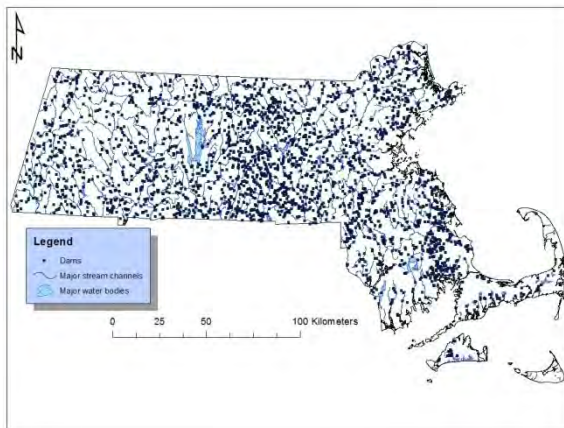


Infrastructural



Dams & Coastal Infrastructure

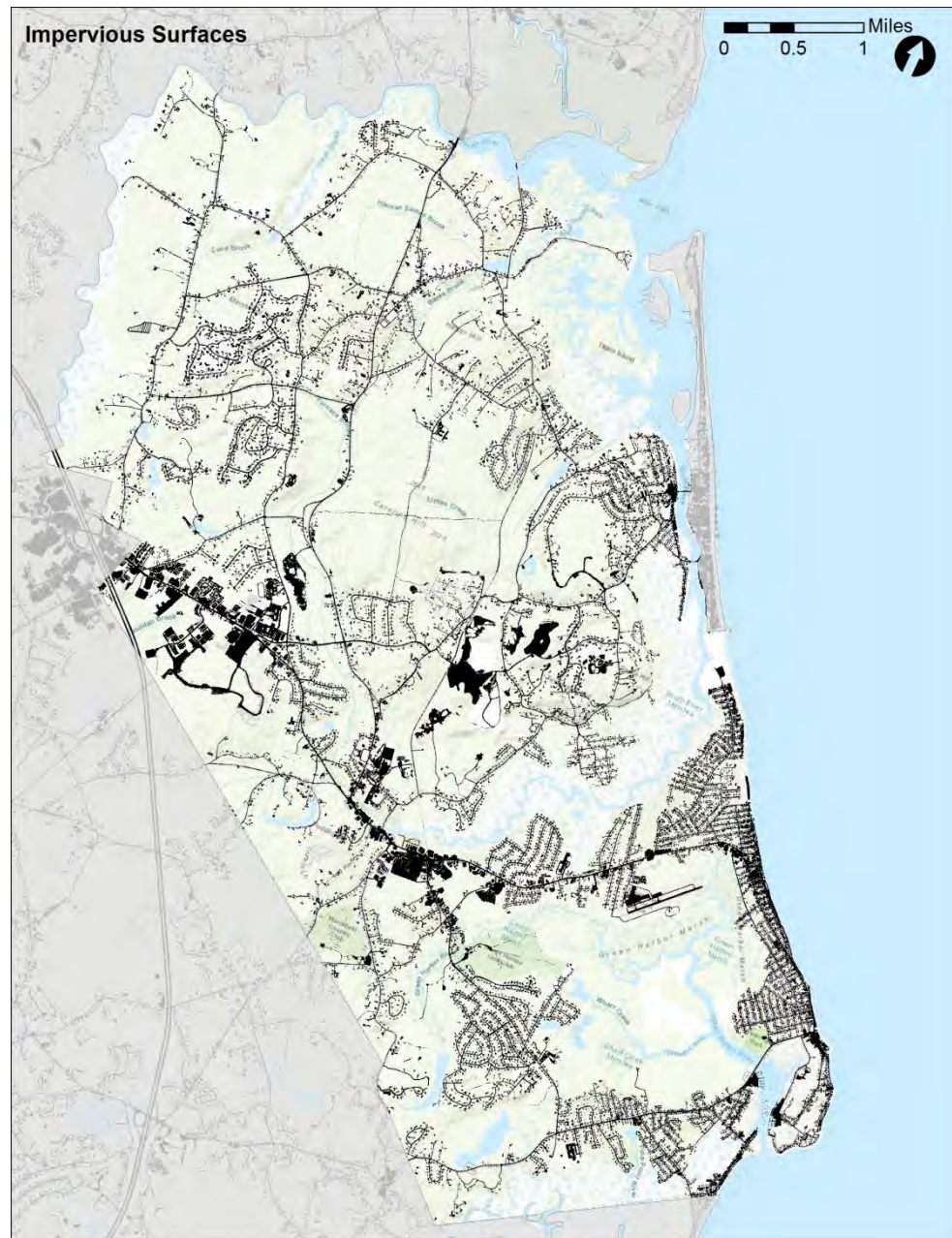
Massachusetts has more than 3000 dams.



Infrastructural



Impervious Surfaces



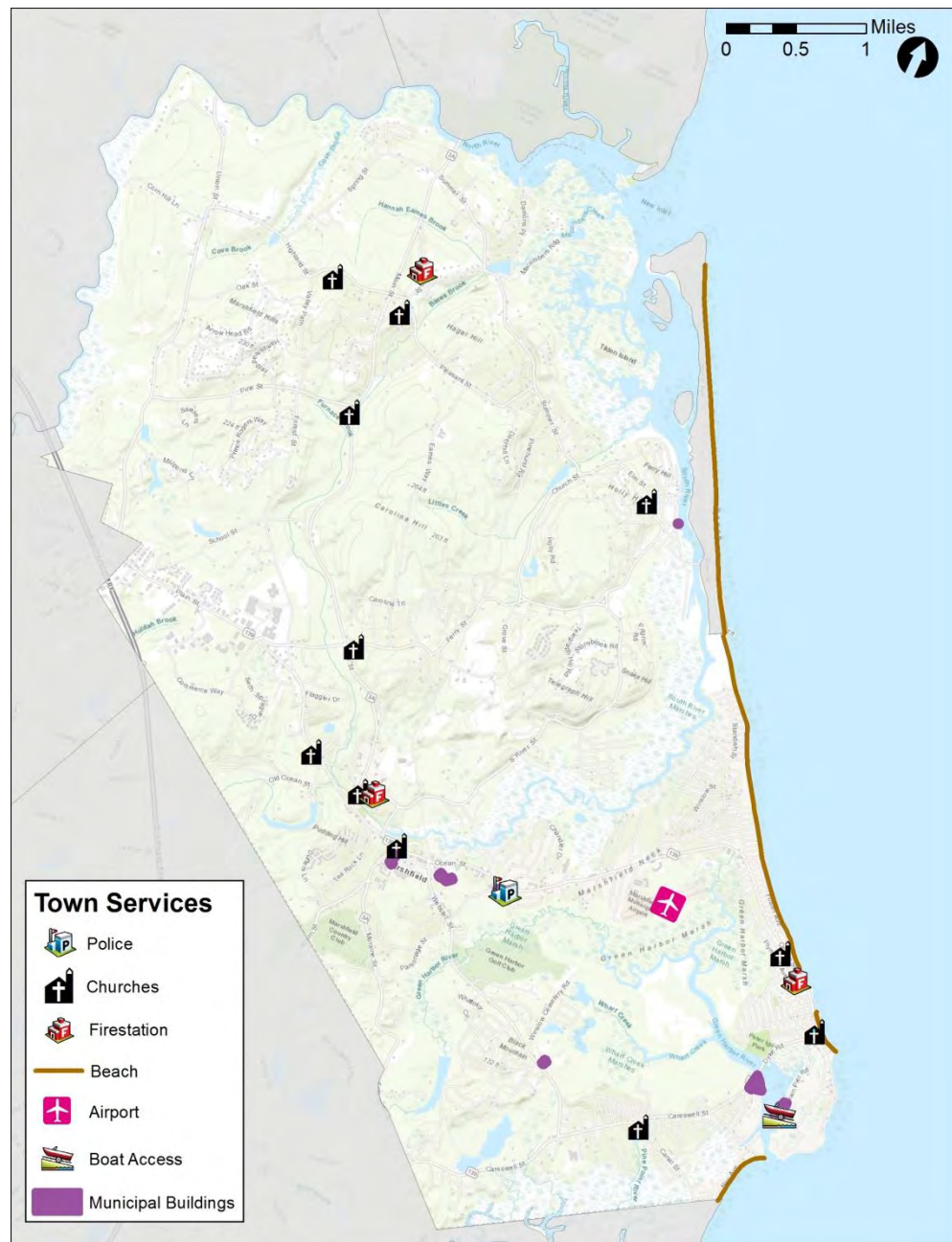
Societal



Societal



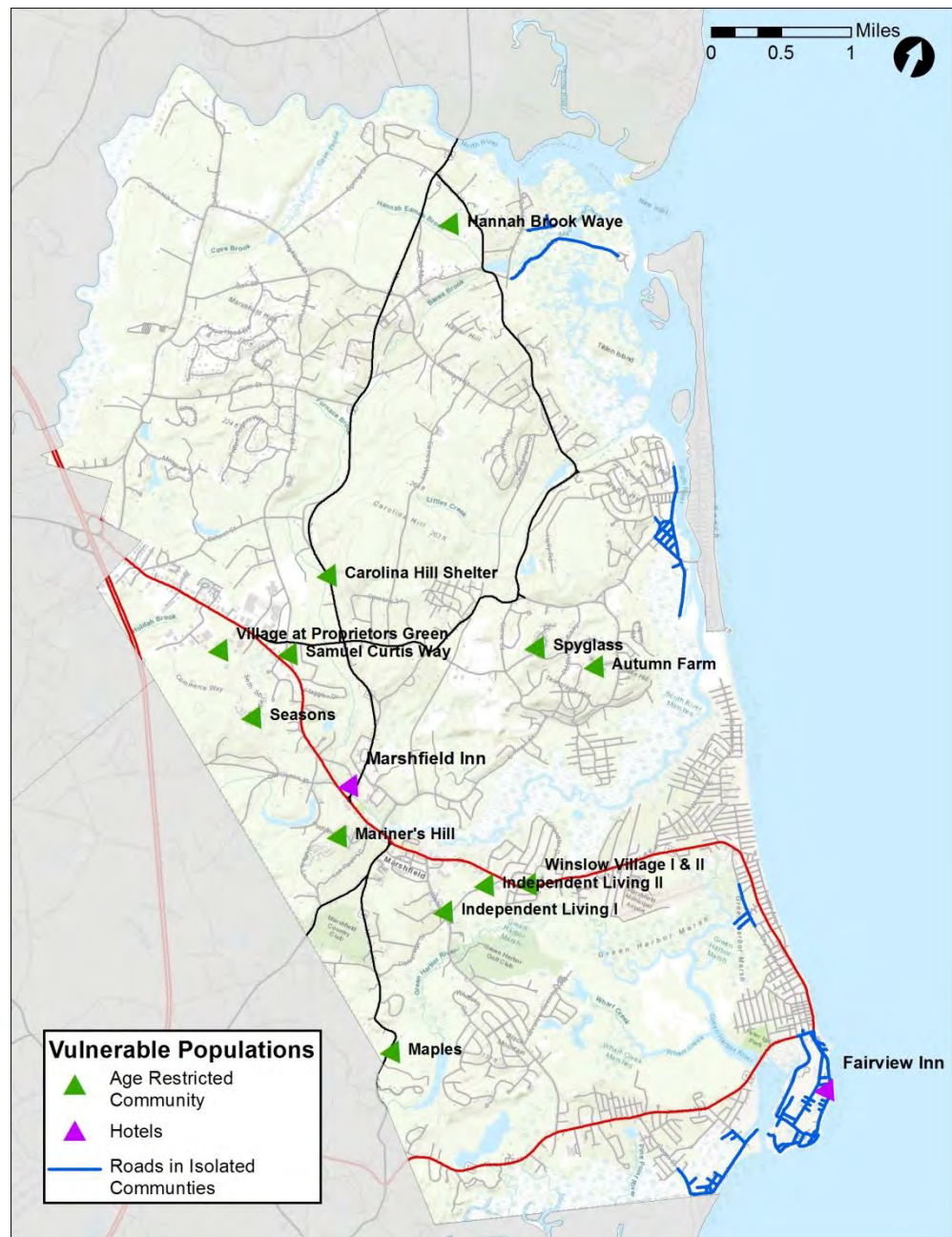
Town Services



Societal



Vulnerable Populations



Societal

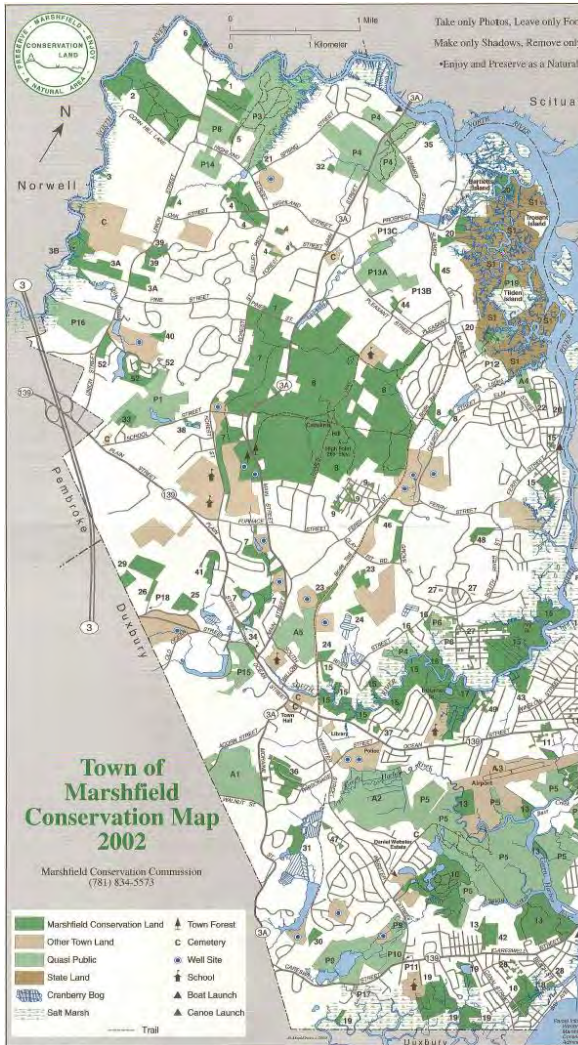


Historical Features



- **Hatch Homestead and Mill Historic District** (Union St)
- **Marshfield Hills Historic District** (Bow, Highland, Main, Old Main, Pleasant, Glen, and Prospect Sts)
- **Thomas-Webster Estate** (Webster St.)
- **Daniel Webster Law Office and Library** (Careswell and Webster Sts)
- **Issac Winslow House** (Careswell St.)

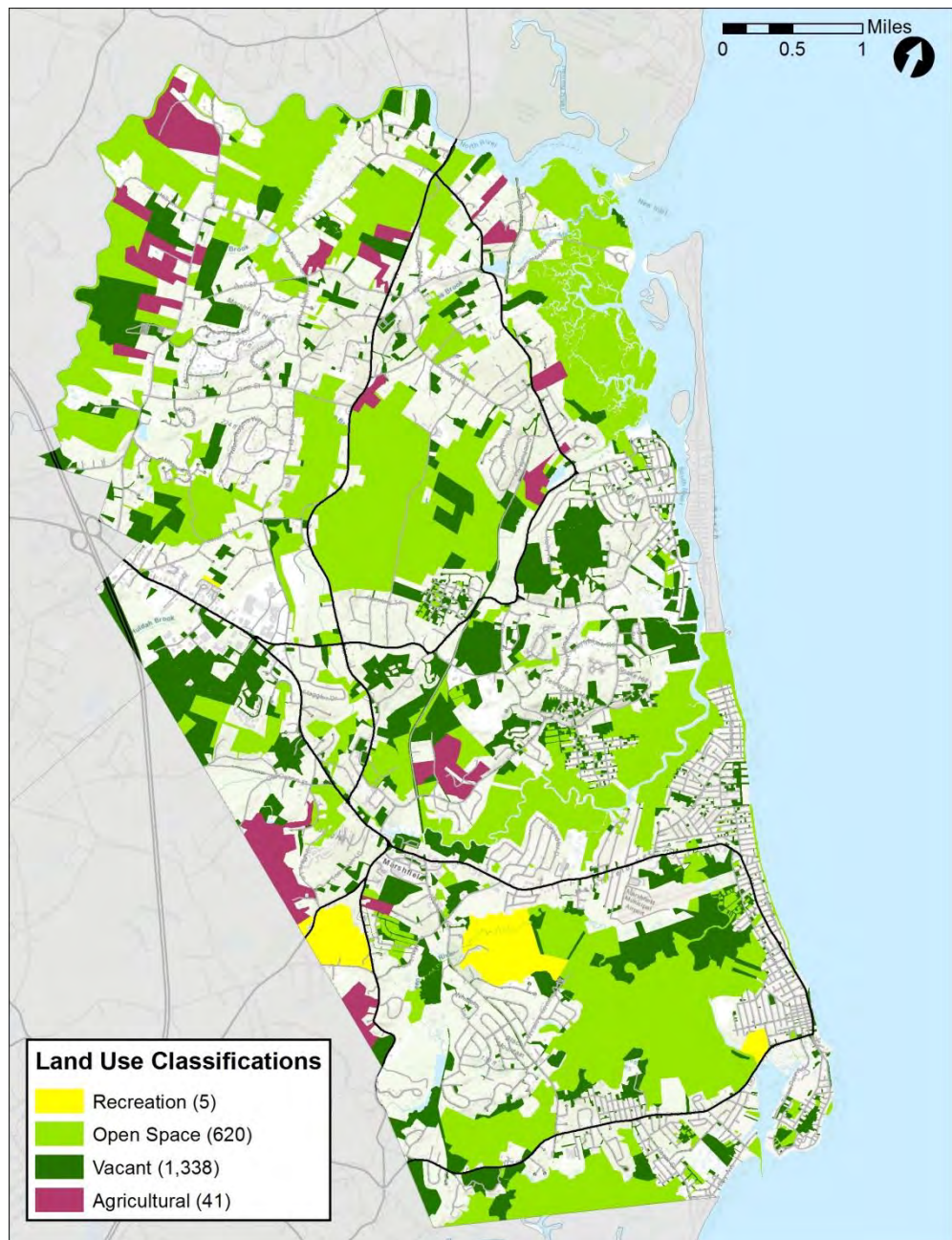
Environmental



Environmental



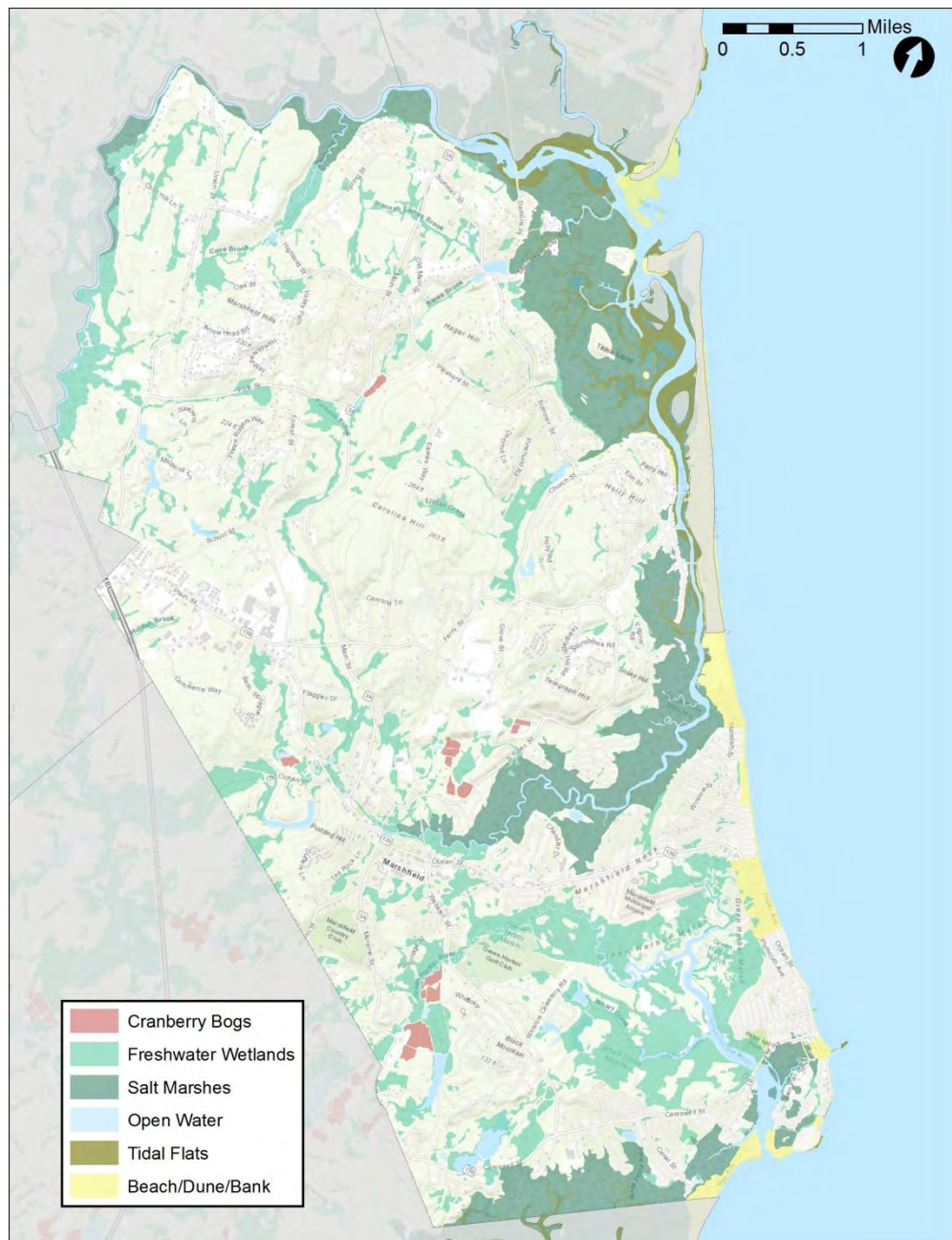
Open Space



Environmental



Wetlands



Break

**Reconvene
at Small Group Locations
at 10:15am**

