



2023 ResilientMass Plan

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2023 ResilientMass Plan: Overview and Next Steps

- Background and context
- 2023 ResilientMass Plan
 - 2022 MA Climate Assessment Top Impacts
 - Vulnerability and Risk Assessment
 - Action Strategy
- Implementation Next Steps
- Q&A

2016



EXECUTIVE ORDER 569

Institutes a comprehensive approach to GHG emissions reduction and climate change adaptation

2018



ENVIRONMENTAL BOND

Allocates \$2.4 billion with climate resiliency focus, and codifies E.O. 569, including MVP Program

2021



AN ACT CREATING A NEXT GENERATION ROADMAP FOR MA CLIMATE POLICY

Sets decarbonization goals statewide and for specific sectors, and creates Environmental Justice Council

2023



EXECUTIVE ORDER 604

Establishes role of Climate Chief, and Office of Climate Innovation and Resilience

Benefits of Hazard Mitigation Planning and Climate Adaptation Plans



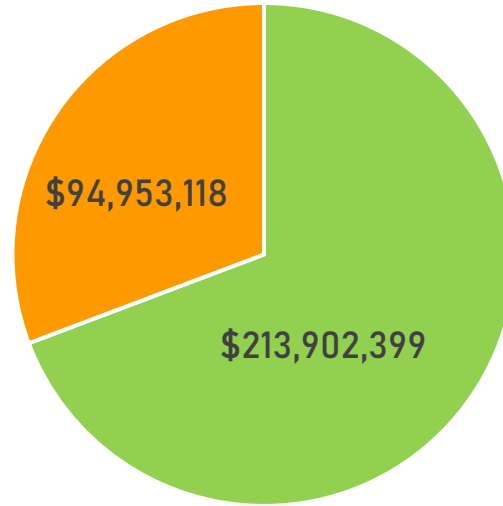
- **Limits** damage, disruption, and loss
- **Reduces** risk
- **Increases** ability to bounce back after disasters
- **Provides** a shared understanding
- **Helps** obtain funding

HMA Funding History

~ \$309M since 2010

Why do we need a state hazard mitigation and climate adaptation plan?

Total FEMA Funding Appropriated (since 2010)
\$308,855,51



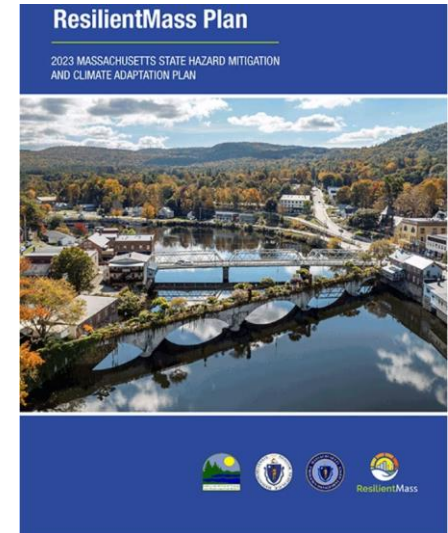
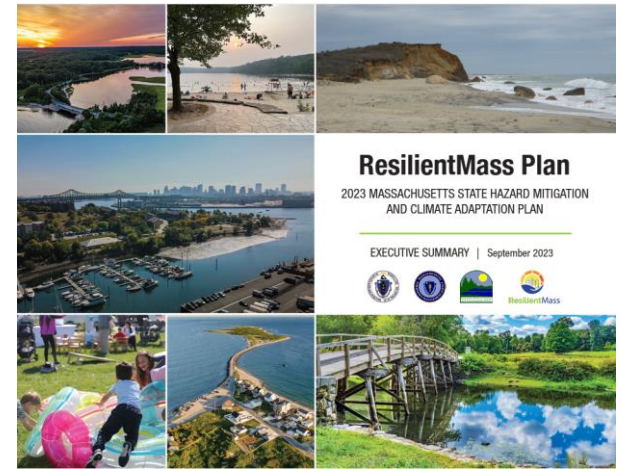
■ Under Review ■ Obligated

- Federal mandate to **maintain eligibility** for FEMA Hazard Mitigation Assistance (HMA)
- Plan must be **updated** every 5 years

What is the 2023 Resilient Mass Plan?

Read the full plan at resilient.mass.gov

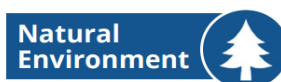
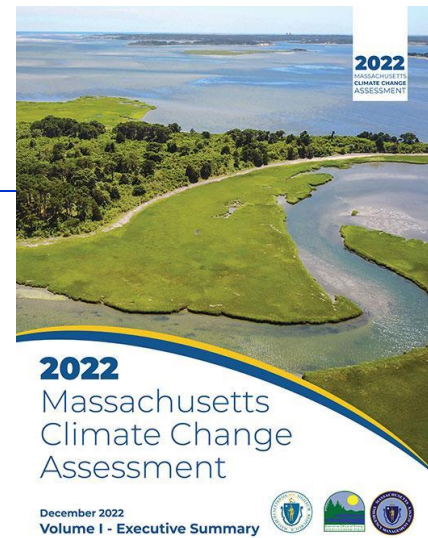
- ✓ Federally mandated update to the 2018 State Hazard Mitigation and Climate Adaptation Plan (SHMCAP)
- ✓ Identifies collaborative strategies and specific actions to increase resilience to climate change across the Commonwealth in accordance with [Executive Order 569 - Establishing an Integrated Climate Change Strategy for the Commonwealth](#).
- ✓ Prioritizes projects that reduce risks from the priority impacts and high-consequence vulnerabilities across Massachusetts.
- ✓ Establishes 142 cross-government and state agency actions to address the impacts the Commonwealth faces due to climate change



Defining statewide climate impacts and priorities: 2022 MA Climate Change Assessment

The 2022 MA Climate Change Assessment assigns **urgency rankings** to priority climate impacts across **five sectors** and **seven regions**.

MAGNITUDE OF CONSEQUENCE	+ DISPROPORTIONALITY OF EXPOSURE	+ ADAPTATION GAP	= URGENCY SCORE
Extreme	Disproportionate Exposure	Extreme	High Priority
Major		Moderate	Medium Priority
Moderate	Potential for Disproportionate Exposure	Minimal	
Minimal		Low	
Insignificant	Limited Disproportionate Exposure	Low	Lower Priority



Urgent Climate Impacts by Sector



HUMAN

Health and Cognitive Effects from Extreme Heat, including premature death and learning loss in children.

Health Effects from Degraded Air Quality, including childhood asthma cases and premature death due to the climate impact on particulate matter and ozone air quality.

Emergency Service Response Delays and Evacuation Disruptions from extreme storms, leading to injuries, loss of life, and urgent need for health, safety, and traffic first responders.

Loss of life or injury due to high-vulnerability dams, hurricanes, wildfires, extreme flooding, or extreme temperatures.

Disproportionate impacts on unhoused populations from extreme temperatures or extreme flooding.



INFRASTRUCTURE

Damage to Inland Buildings from heavy rainfall and overwhelmed drainage systems.

Damage to Electric Transmission and Utility Distribution Infrastructure associated with heat stress and extreme events.

Damage to Rails and Loss of Rail/Transit Service, including flooding and track buckling during high heat events.

Damage or loss of unreinforced masonry buildings due to earthquakes.

Damage to infrastructure, utilities, and buildings in liquefaction zones due to earthquakes.

Damage or loss to homes and critical facilities in the wildland urban interface.



NATURAL ENVIRONMENT

Freshwater Ecosystem Degradation due to warming waters, drought, and increased runoff.

Marine Ecosystem Degradation because of warming, particularly in the Gulf of Maine, and ocean acidification.

Coastal Wetland Degradation from sea level rise and storm surge.

Forest Health Degradation from warming temperatures, changing precipitation, increasing wildfire frequency, and increasing pest occurrence.

Loss of biodiversity, habitats, and native species due to climate change impacts.



GOVERNANCE

Reduction in State and Municipal Revenues, including a reduced property tax base due to coastal and inland flood risk.

Increase in Costs of Responding to Climate Migration, including planning for abrupt changes in local populations.

Increase in Demand for State and Municipal Government Services, including emergency response, food assistance, and state-sponsored health care.

Inability to carry out mission and services due to damage, disruption, or loss of state assets and services.



ECONOMY

Reduced Ability to Work, particularly for outdoor workers during extreme heat, as well as commute delays due to damaged infrastructure.

Decrease in Marine Fisheries and Aquaculture Productivity from changing ocean temperatures and acidification, which leads to decreased catch and revenues and impacts on related industries.

Reduction in the Availability of Affordably Priced Housing from direct damage (e.g. flooding) and the scarcity caused by increased demand.

Damage, disruption, or loss of coastal infrastructure such as seaports, airports, and maritime industries.



Climate Projections and Impacts in Massachusetts

RISING TEMPERATURES¹



23–29 high heat days per year expected by **2050** and annual average temperature increase of **5.9 to 7.9°F**.



Those most likely to be affected from high heat include unhoused populations, those working outdoors, the elderly, infants, individuals with chronic diseases (e.g., asthma), and environmental justice and other priority populations.

Extreme temperatures are projected to increase annual transportation infrastructure maintenance costs by over **\$140 million** by the end of the century.



CHANGES IN PRECIPITATION²



By **2070**, Massachusetts is expected to receive **12–42%** more winter precipitation.

Environmental justice and priority populations live near commercial and industrial buildings that have a **57% higher risk of flood** damage than the rest of the Commonwealth.



Annual economic flood damage is estimated to increase by **\$9.3 million** by **2030** across the Commonwealth.

COASTAL FLOODING³



Massachusetts is planning for sea level rise by up to **2.5 feet by 2050** compared to present day (2008) if global emissions are not significantly reduced. Both tidal and storm-related flooding are projected to increase.

Risks and consequences from inundation will be more significant among sensitive assets such as hospitals, schools, prisons, care facilities, and underground and at-grade living quarters.



Coastal flooding is projected to cause over **\$52 million** in damage annually to state-owned coastal properties, a **550%** increase from today.

SEVERE WEATHER⁴

Includes strong winds, tornadoes, extreme precipitation, and droughts. Precipitation amounts from the heaviest storms in the Northeast has increased by **55%** since **1958**.



High winds are of particular concern to coastal areas, where wind speeds can reach **110+ miles per hour**.



Populations living or working outdoors will be increasingly exposed to dangers of more frequent and increasingly severe weather.

Lightning was responsible for **\$20.4 million** in damage in Massachusetts between 2002 and 2022.⁵





Risk and Vulnerability Assessment

- **Hazards included** (draws from Climate Assessment vs *new analysis*):

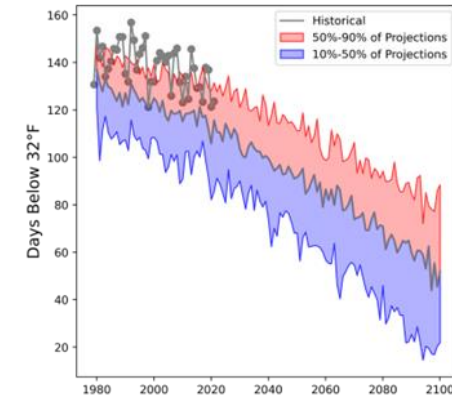
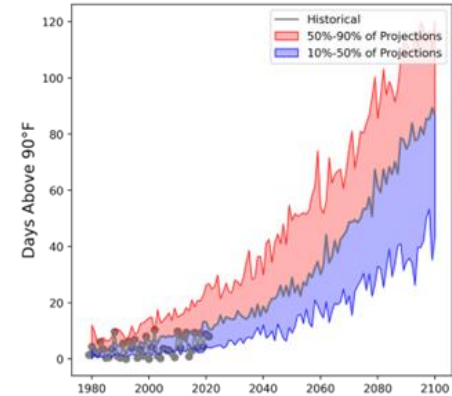
- Inland flooding
- Dam overtopping
- Drought
- Coastal flooding and storm surge
- Coastal erosion
- Average and extreme temperatures
- Wildfires
- Invasive species
- Hurricanes/tropical storms
- Winter storms/Nor'easters
- Groundwater rise
- Tsunami
- Landslides
- Tornadoes
- Other Severe Weather
- Earthquake

- **Concepts covered for each hazard:**

- **Location:** geospatial reach
- **Likelihood:** of occurrence, considering changing climate
- **Magnitude of Consequence:** of impact and ability to respond
- **Qualitative:** adaptive capacity and disproportionate impacts
- **Vulnerability** by sector

- **Example hazard: Average/Extreme Temperatures**

- Occurrences and Frequency
 - 2010-2022 had 7 of 10 warmest summers on record; 2 hottest summers on record are 2020 and 2022
 - Certainty in increase in high, low, average temperatures, and humidity
 - 2050 summer temps like MD; 2090 like GA
- Vulnerability by sector
 - **Human:** Health effects from extreme heat and degraded air quality
 - **Governance:** Increase in demand for services; adaptation coordination
 - **Infrastructure:** Damage to rails and loss of rail service; Damage to electric transmission and distribution infrastructure
 - **Natural Environment:** Freshwater and marine ecosystem degradation; Forest health degradation
 - **Economy:** Reduced ability to work

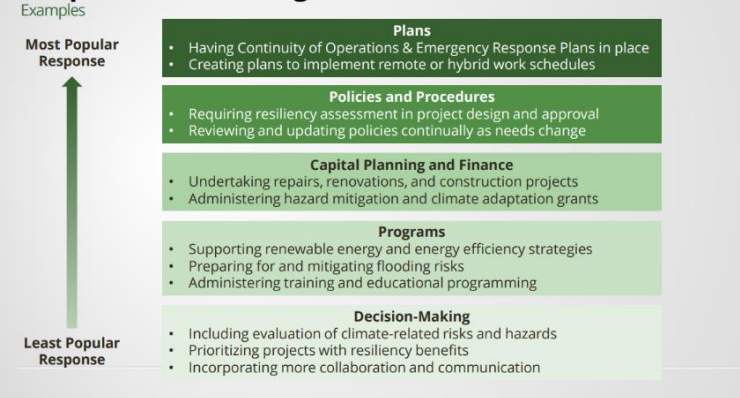




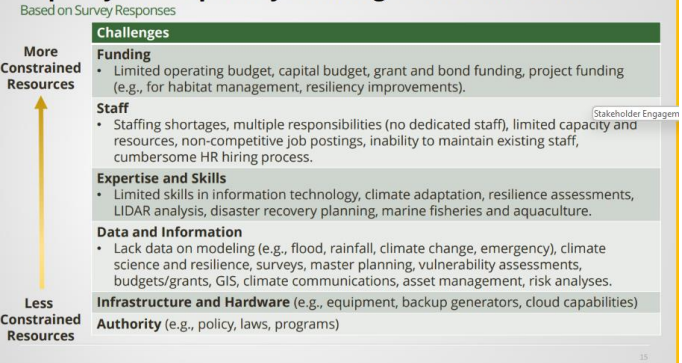
State Capability and Adaptive Capacity Analysis

- **Inventory and evaluation of the Commonwealth's existing capabilities and key challenges for agencies to implement hazard mitigation and climate adaptation actions:**
 - 81 agency survey responses (11 no responses) that identified 182 existing capabilities to reducing hazard risk and vulnerability
 - E.g. regulatory jurisdiction; coastal management programs, energy resilience initiatives; data; planning
 - and 90 new capabilities since the 2018 update, including:
 - **New coordinating structures:** RMAT launch, DOER LBE
 - **New data and tools:** Development of Climate Assessment, Drought Management Plan, and RMAT Resilience Tool
 - **New funding sources:** SHMCAP Implementation Funding, MVP expansion
- **Key opportunities to address challenges raised include:**
 - Staff capacity and subject matter expertise
 - Authority and bureaucracy
 - Data access and consistent use, filling gaps
 - Resilience standards and capital planning evaluation
 - Increased funding and metrics
 - Consistent collection and use of data
 - Increased inter-agency coordination and local capabilities

How Agencies Address Hazard Mitigation and Climate Adaptation in Existing Efforts



Capacity and Capability Challenges and Constraints



Agency Action Strategy: Bridging Hazards, Impacts, and Actions

Governance Sector: Urgent Impact #1

Reduction in State and Municipal Revenues

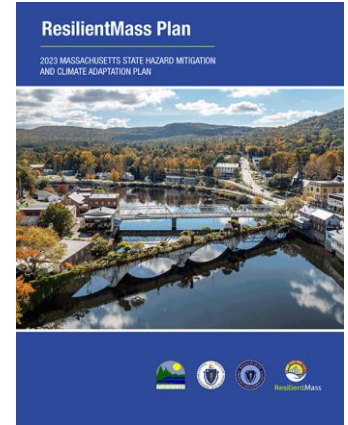
State and municipal revenue streams impacted through property tax loss following structure damage of any type, from any hazard, and income and sales tax losses associated with business interruptions or effects on industrial activities.

Major Level of Consequence	Disproportionate Exposure	Moderate Adaptation Gap
<ul style="list-style-type: none"> Massachusetts municipalities could experience \$104 million in lost revenues from a 3 ft sea level rise (1.4 percent of current property taxes in 89 coastal municipalities). 	<ul style="list-style-type: none"> Lost property tax value from coastal structures is the largest category of expected impact, and could disproportionately impact municipalities with higher proportions of population in EJ block groups. 	<ul style="list-style-type: none"> Adaptation actions focused on reducing property damage (particularly from coastal flooding) will help to mitigate this impact.

Identification of impact and magnitude in MA Climate Change Assessment



State agency actions in ResilientMass Plan



<https://resilient.mass.gov>

ACTION 1a: Acquisition/Buyout program study			
	Scale	Lead(s) & Partner(s)	Hazard(s) Addressed
<p>MEMA will hire a vendor to study other successful state buyout programs such as NJ, OH and districts in NC as well as Florida's Wind Mitigation Program to understand best practices, gaps and opportunities of improvement. The study will result in a set of recommendations that best suits Massachusetts government structure to help us identify properties and create a program that best supports coastal and riverine cities and towns making it easier for them to obtain funding.</p> <p>Acquisition/Buyout programs are one method of property acquisitions in which private lands are purchased, existing structures demolished, and the land maintained in an undeveloped state for public use in perpetuity. Acquisition of a property in a floodway is intended to reduce the risk of future flooding for the property and/or those adjacent. A voluntary property acquisition/buyout program can enable homeowners to leave high-risk areas. This can be an especially important option for EJ and other priority populations who may not have the financial means to move or to repair/rebuild after floods.</p>	Statewide, Local, Site-Specific	Lead: MEMA Partners: DCR, State Floodplain Manager, local communities	All hazards
	Goal(s) Addressed	Timeframe	1, 2, 3, 4, and 6

ResilientMass Plan Agency Actions - Example actions focused on flooding



*Actions can address multiple risks

Develop a coastal resilience strategy

Leads: EEA and CZM; Timeframe: 5+ years

Launch acquisition/buyout program study

Lead: MEMA; Timeframe: Less than 3 years

Enhance consideration of resilience in the building code

Leads: EEA and EOED; Timeframe: 5+ years

Floodplain regulatory and coordination framework

Lead: EEA; Timeframe: 5+ years

ResilientMass Plan Agency Actions - Example actions, continued

Extreme storms

- **MBTA design standards update** with new standards that include climate resilience considerations for all MBTA new construction and retrofits. (Lead: MBTA; Timeframe: Less than 3 years)
- **Statewide emergency management training needs assessment** to ensure emergency preparedness of state public safety officials to natural hazards, especially climate change-exacerbated hazards. (Lead: MEMA; Timeframe: Less than 3 years)

High heat

- **Develop and implement a new Heat Flag system** in alignment with NOAA's Heat Advisory Criteria for New England, to identify days of extreme heat and alert people to risks, particularly children and the elderly. Lead: HHS; Partners: LWD, DPH, MEMA; Timeframe: 5+ years)
- **Identify and assess opportunities to promote cooling** in residential buildings and mitigate extreme-heat risks to renters and remote workers. (Lead: EOED; Partners: HHS, HLC, LWD; Timeframe: Less than 3 years)
- **Expand DCR's Greening the Gateway Cities program into additional EJ communities and increase tree-planting efforts** across low-canopy-cover EJ neighborhoods to mitigate heat island effects, combat adverse effects of climate change, reduce energy costs, absorb and filter pollutants, and decrease water runoff. (Lead: DCR; Partners: Municipalities; Timeframe: 3-5 years)

Flooding from precipitation

- **Enhance consideration of resilience in the building code** with key partners; integrating above-code flood standards into the statewide building code could enable municipalities to voluntarily adopt more resilient standards for construction in their communities. (Leads: EEA and EOED; Partners: DCR, OPSI, DOER; Timeframe: 5+ years)
- **Farm Climate Resiliency Program expansion** will support farmers and the state agricultural system with grants including free "climate audits" for risk reduction, as well as support for climate-smart measures. (Lead: MDAR; Timeframe: Less than 3 years)
- **Protect 30 percent of land and ocean by 2030 (to align with the global 30x30 goal)**, implementing EEA's Resilient Lands Initiative, incorporating the Healthy Soils Action Plan, and taking a statewide approach to increase resilience and provide carbon sinks for GHG mitigation. (Lead: EEA and DCR, Partners: DMR, DER, DMF, DFG, MDAR; Timeframe: 5+ years)

ResilientMass Plan Action Tracker

State agencies identified over 100 initial priority actions to increase resilience and reduce the Commonwealth's risks and vulnerabilities related to natural hazards and projected climate changes. This tracker is maintained by the inter-agency [ResilientMass Action Team \(RMAT\)](#) and contains a list of actions identified through the 2023 ResilientMass planning process. All actions address at least one of the primary statewide climate change impacts identified in the [2022 Massachusetts Climate Change Assessment](#). This tracker will be updated periodically to reflect progress in implementing these actions.

Search

Clear All 

Apply filters

Executive Office

Lead Agency

Priority

Actions By Sector

Status

Completion

Category

Scale

Cross-Government Actions

Viewing 142 of 142 Actions

High

Acquisition/Buy-out Program Study

Executive Office:

EOPSS

Lead Agency:

MEMA



Category

Assessment, research, and mapping



Status

In Progress



Completion

Less than 3 years



High

Address impacts of flooding to infrastructure, natural resources and groundwater through better understanding of climate change drivers

Executive Office:

EOEEA

Lead Agencies:

EEA

DCR-OWR



Category

Assessment, research, and mapping



Status

In Development



Completion

3-5 years



Medium

Address the risk of extreme heat to building occupants

Executive Office:

A&F

Lead Agency:

DCAMM



Category

Capital planning



Status

In Progress

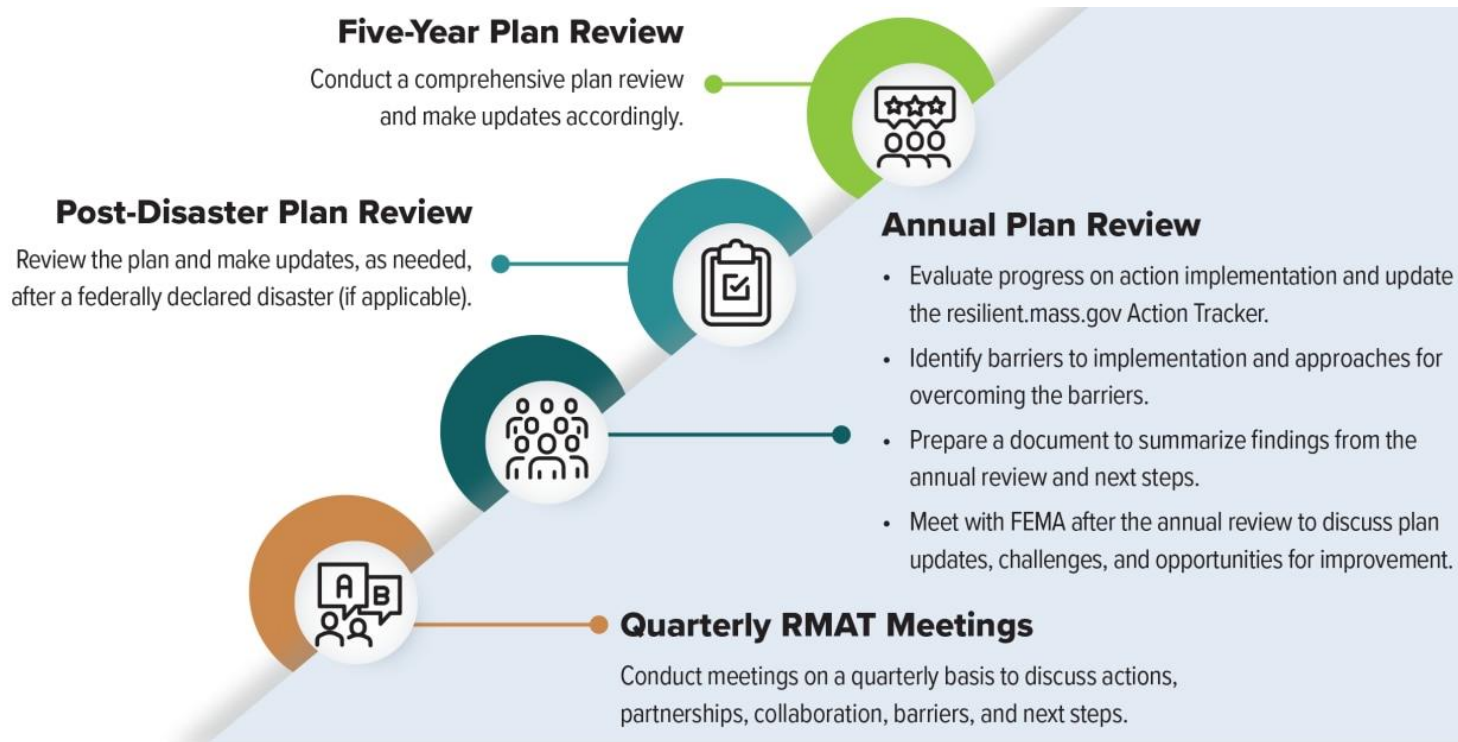


Completion

Greater than 5 years



A Living Plan



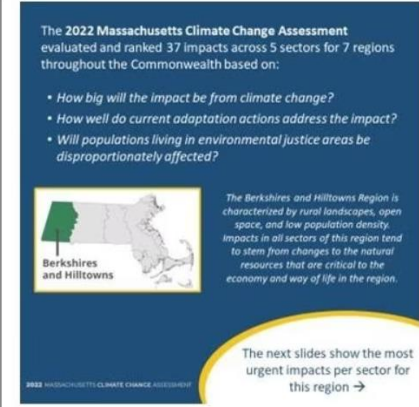
Applying the Findings: Tools and Data

- Regional findings sample slide decks and social media content: bit.ly/2022maclimate

- Summary slides and materials to help partners and organizations share findings in their own networks

- [ResilientMA.mass.gov Maps and Data Center](https://ResilientMA.mass.gov/Maps-and-Data-Center): Ongoing and growing resource for Massachusetts-specific best available climate information for users

- Local and regional planning
- Funding applications and resource prioritization
- Communication and advocacy tools



ResilientMass Climate Change Projections Dashboard

statewide climate projections for MA. Led by the Executive Office of Energy and Environmental Affairs (EEA) in partnership with Cornell University, U.S. Geological Survey and Tufts University, the Massachusetts CEA has developed new climate change projections for the Commonwealth. Select a watershed basin, target future decade and desired season to see temperature and precipitation projections. Click on the 'stacks' tab, 'IDF Sites' and select the 'Precipitation Frequency Table' to view projections of extreme precipitation for various future design storms.

Climate Change Projections Dashboard

HOW TO USE THIS DASHBOARD

Use the filter data options below to view projections of climate metrics for specified areas of interest under a future warming scenario. Select either a **Watershed** or **Town**. Next, select the **Target decade** and **Season**. Toggle between tabs to view climate metrics at the bottom of the dashboard.

Use the locator map to view projections of extreme precipitation frequency estimates across Massachusetts. Click on the layer icon (stacked squares) in the top right corner and click on "IDF Sites". Zoom with mouse to desired area or use search icon to zoom and click on blue box and then click "Select" in the pop-up box (box with plus sign). Click on the "Precipitation Frequency Table" tab at the bottom of the dashboard to view precipitation depth values (inches) for various future design storms.

FILTER DATA

Climate Projections by Watershed:
Blackstone

HOW TO USE THIS DASHBOARD

Stochastic Weather Generator outputs:

To view temperature and precipitation projections, use the filter data options in the left panel for specified areas of interest under a future warming scenario (**Representative Concentration Pathway (RCP) 8.5, a comparatively high greenhouse gas emissions scenario**). Temperature and precipitation projections for Massachusetts are provided at the watershed scale (averaged across 1000 watershed boundaries) and were developed with downscaled Global Climate Models and a **Stochastic Weather Generator** (see the **Background** to learn more).

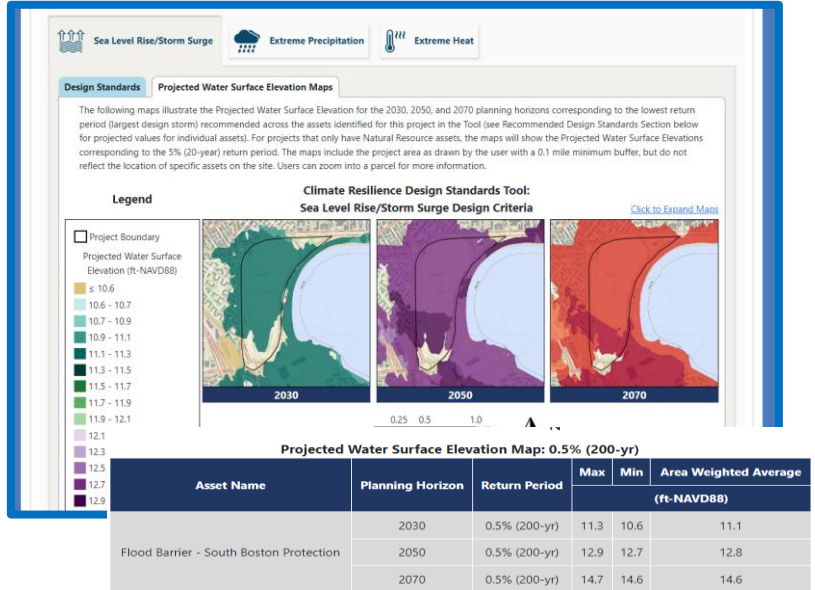
Select either a **Watershed** or **Town** from the filter menu on the left panel. For towns that span more than one watershed, users will see those watersheds listed in the drop-down menu after a town is selected, but users must choose one of the watersheds to see projections appear in the display tiles below the locator map. Alternatively, use the locator map and click to select a watershed (purple polygons), zoom and click to select a town (orange polygons), or use the search icon (🔍) to search for desired areas of interest; if using locator map to identify watershed, users must select the desired area.

[DETAILED INSTRUCTIONS](#)

Climate Metric (units)	Min temperature (degrees F)	Average duration of coldwaves (days)	Number of coldwave events (events)	Days below 0 degrees F (days)
median value (10th to 90th percentile)	3.6	-1	0	-3
baseline value	1.8 to 5.4 -3.6	-1 to -1 12	(0 to 0) 0	(-1 to -3) 9

Applying the Data: Climate Resilience Design Standards Tool

An interactive web-based tool that automates the Commonwealth's available climate change data and provides a preliminary climate exposure screening and planning recommendations for projects



Climate Resilience Design Standards Tool

This is the beta version of the Climate Resilience Design Standards Tool. Log in or register below to pilot the tool. Please submit feedback to support our piloting and improvements process by using [this form](#).

LOG-IN / REGISTER >

State Users Log-in >

Preliminary Climate Exposure Score

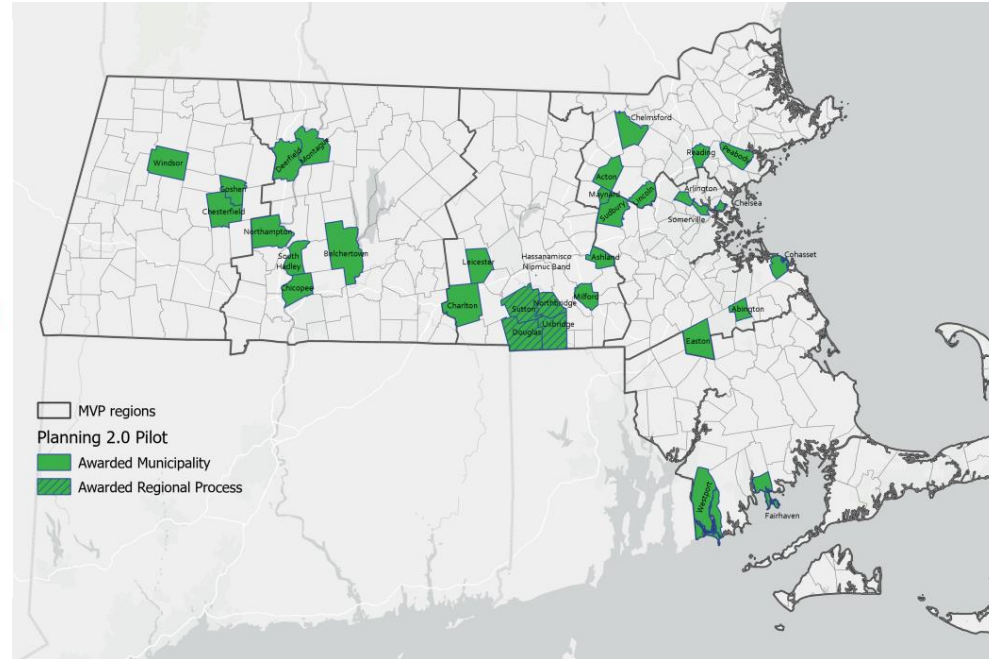
The purpose of the Exposure Score output is to provide a preliminary assessment of whether the overall project site and subsequent assets are exposed to impacts of natural hazard events and/or future impacts of climate change. For each climate parameter, the Tool will calculate one of the following exposure ratings: Not Exposed, Low Exposure, Moderate Exposure, or High Exposure. Click on the question mark to identify why your project location is receiving the exposure rating.

- Sea Level Rise/Storm Surge: High
- Extreme Precipitation - Urban Flooding: High
- Extreme Precipitation - Riverine Flooding: Moderate
- Extreme Heat: High

https://resilient.mass.gov/rmat_home/designstandards/

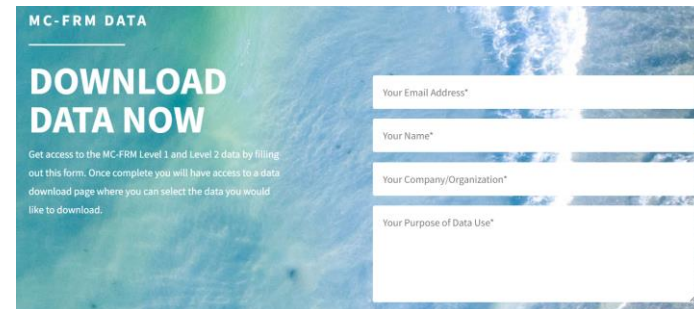
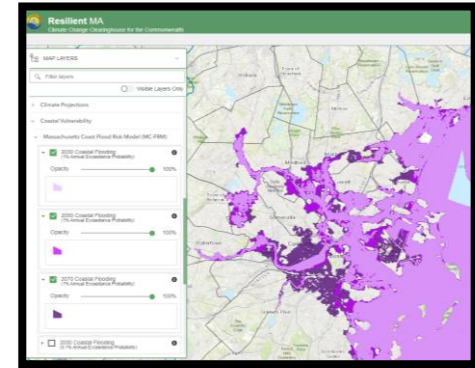
Implementing ResilientMass: MVP 2.0

For MVP communities at the 5-year mark, MVP Planning 2.0 will build on the work done to date, and will support communities with new processes, tools, and resources for inclusive and actionable climate resilience planning.



Implementing ResilientMass: Coastal Resilience

- CZM developing a coastal resilience strategy in partnership with coastal municipalities & other coastal stakeholders to guide state & local coastal resilience policy & management actions
 - Develop vision, goals and metrics for a resilient coast
 - Delineate “coastal resilience districts”
 - Identify climate resilient development standards & best practices for coastal adaptation
 - Develop recommendations for management of vulnerable areas at state & local levels
- MA Coast Flood Risk Model data available for download and on CZM and Resilient.mass.gov viewers
 - Recorded training series accessible at "MassEEA" YouTube channel

The image shows a screenshot of a web form titled 'MC-FRM DATA'. The main heading is 'DOWNLOAD DATA NOW'. Below the heading, there is a paragraph of text: 'Get access to the MC-FRM Level 1 and Level 2 data by filling out this form. Once complete you will have access to a data download page where you can select the data you would like to download.' To the right of the text is a form with four input fields: 'Your Email Address*', 'Your Name*', 'Your Company/Organization*', and 'Your Purpose of Data Use*'. The background of the form is a blue and green abstract image.

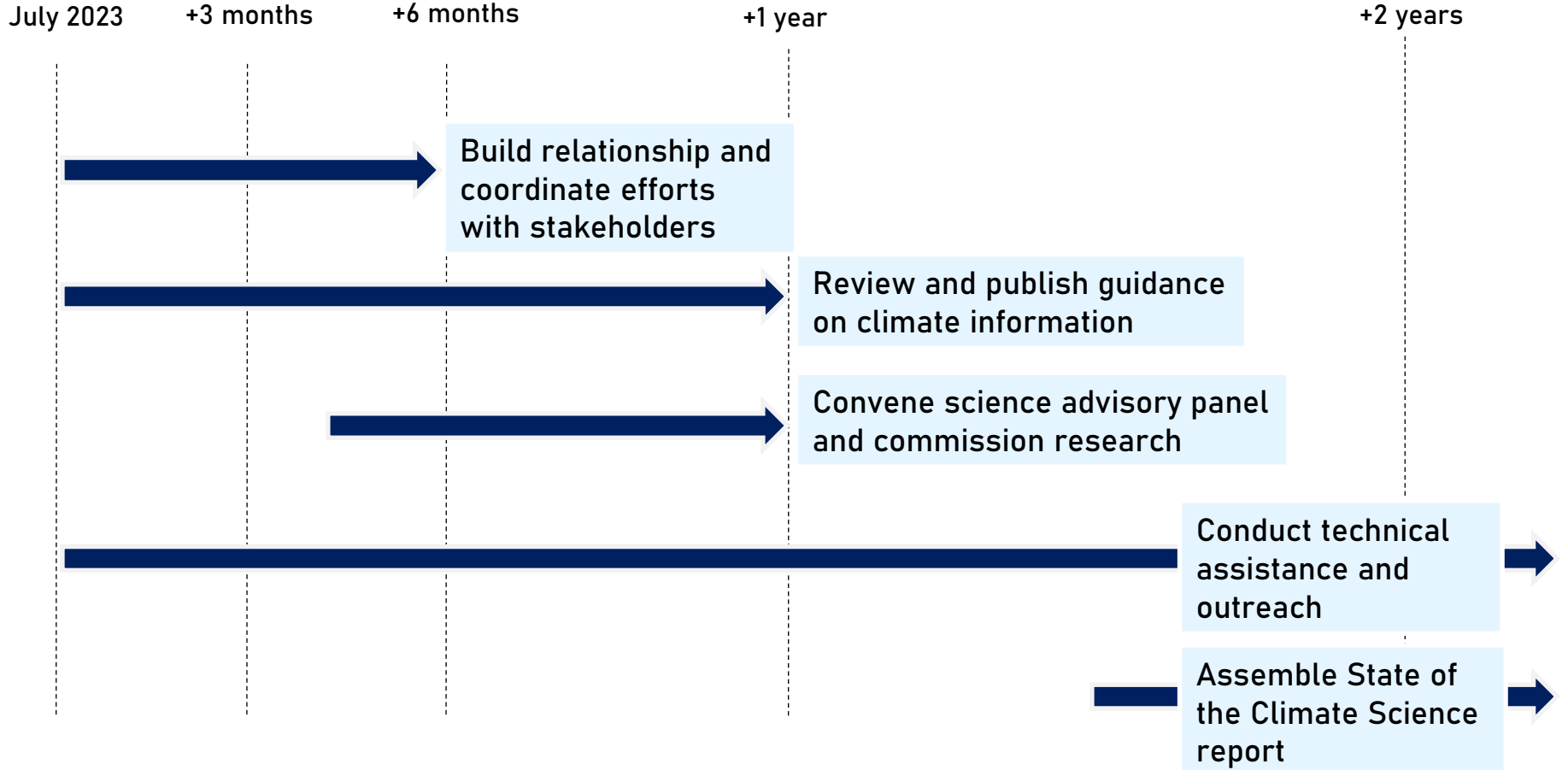


Implementing ResilientMass: EEA Office of Climate Science

- Serve as an authoritative resource, and provide subject matter experts on statewide climate data and models, and support consistent application across agencies.
- Convene the academic climate science community and identify opportunities to partner with universities on climate science needs and next steps.

climatescience@mass.gov

EEA Office of Climate Science Workplan





Thank you!

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ResilientMass