Town of Hudson

Community Resilience Building

Summary of Findings

May 2019

Downtown Hudson
Source: Marc N. Belanger

BSC GROUP

PREPARED AND PRESENTED BY

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APPENDIX

EXECUTIVE SUMMARY

In accordance with Executive Order 569, which seeks to build resilience and adapt to the impacts of climate change, the Town of Hudson, Massachusetts is pleased to submit this Summary of Findings Report. In 2018, the Town of Hudson applied for and received a Municipal Vulnerability Preparedness (MVP) program grant from the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) to complete a vulnerability assessment and action oriented resilience plan (Findings Report). This planning initiative follows the Community Resilience Building (CRB) framework developed by The Nature Conservancy. The CRB framework uses a community-driven workshop process to identify climate-related hazards, community strengths and vulnerabilities, and develop solutions to address these considerations. Completion of the CRB process enables the Town to achieve MVP community designation status from the EEA and receive eligibility for future state grant money under the MVP program or other participating funding entities.

Hudson Public Safety Complex
Source: Town of Hudson

COMMUNITY RESILIENCE BUILDING PLANNING AND WORKSHOPS

The CRB process began with the establishment of a Core Team that included community stakeholders comprised of Town Staff, Commission Members, and Hudson Light and Power Company. The Core Team held strategic planning sessions on October 3, 2018 and November 15, 2018. Core Team meetings involved developing a broad understanding of the Hazards, Vulnerabilities, and Strengths that characterize the Town of Hudson, and to identify a list of Preliminary Resilience Actions that the community may consider at the CRB Workshops. Core Team meetings were also used to identify the goals of the workshop within the context of community interests and needs. The Core Team decided that it would be beneficial to use interactive media platforms as a mechanism to engage with the community. A GIS community data viewer and an interactive demonstration of the Massachusetts Data Clearinghouse Website, resilientma.org were prepared for the community workshop.

Three Community Resilience Building Workshops were held on the following dates: December 11, 2018, February 6, 2019 and February 14, 2019. Workshop participants included a diverse set of community stakeholders from municipal departments, local businesses, non-government entities, and local interest groups. Workshop #1 involved an expanded core team working group and involved a refinement of preliminary planning efforts. Workshop #2 involved a group presentation, four engagement and education Adaptation Action Stations, and a group discussion. Information gathered during these Adaptation Action activities were integrated into previous planning efforts. Workshop #3 involved a group planning effort where participants drew upon local institutional knowledge to exchange ideas and expand upon previous CRB planning efforts. Workshop #3 concluded with a group discussion to prioritize Hazards, Vulnerabilities, Strengths, and Actions developed through the CRB engagement process.

Engagement Station at Community Workshop #2

Climate resilience planning requires an ongoing effort by community stakeholders. Workshop attendees and other interested stakeholders are encouraged to provide comments, corrections, updates, or additional information of findings transcribed in this report to Pam Helinek at phelinek@townofhudson.org. The success of climate resilience planning in Hudson is contingent upon ongoing participation of community stakeholders.

DEFINING HAZARDS

The Town of Hudson has several challenges related to establishing resilience to the effects of climate change. For example, between 1991 and 2017, Hudson experienced 17 extreme weather-related events that triggered federal or state disaster relief. Climate change is expected to increase the occurrence and intensity of natural-hazard related weather events. Identifying and preparing for the hazards most prevalent within Hudson is the first step to prepare for the effects of climate change.

During the Core Team and CRB planning efforts, stakeholders identified the top natural hazards for the Town of Hudson. Inland riverine flooding from extreme precipitation events was identified as the top hazard among most participants. Extreme temperatures, extreme snow and ice events, and drought represented the other climate exposure hazards and were highlighted as significant concerns for the Town. Collectively, it was agreed upon by the group that the Town of Hudson's top hazards present ongoing and cumulative adverse impacts on the community's most important infrastructural, societal, and environmental resources.

TOP HAZARDS WITHIN HUDSON

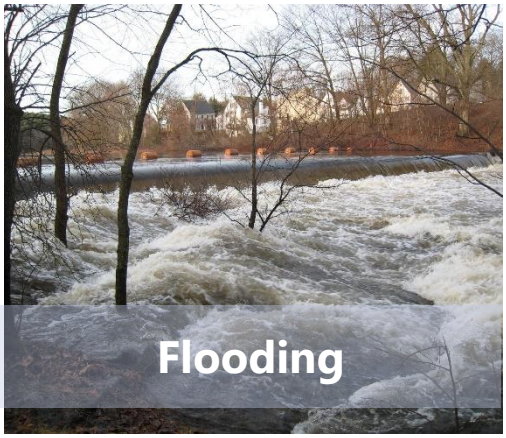


Photo Sources (clockwise from top):
David Mark
Josh Sweeny
Jonathan Wiggs
Jaime McLeod

CHARACTERIZING A CLIMATE RESILIENT HUDSON MUNICIPAL VULNERABILITIES AND STRENGTHS

The CRB process involves a robust stakeholder engagement effort and can be used to characterize the vulnerabilities and strengths unique to a given community. The Hudson CRB process revealed important characteristics that broadly represent the identity and culture of the community. Collectively, these characteristics provide a *snapshot* of the community's vulnerabilities and strengths and are an important starting point to identify community features most at risk to the effects of climate change.

The Assabet River – An Important Cultural Resource in Hudson

The Assabet River represents an important cultural feature within the community. Significant municipal attention and engaged community leadership are committed to the societal and environmental significance of the Assabet River. Water resources in the community drain predominantly to the Assabet River and therefore Hudson's water management infrastructure (e.g. bridge, culverts, dams) directly affect the river. Other important community features within Hudson are directly associated with the Assabet River for example, recreational facilities, downtown center amenities, open space, and naturalized areas. Important municipal facilities also border on the Assabet River, including the Fire Department Buildings and Hudson High School. The Assabet River provides important flood storage capacity due to its significant floodplain which also provides ecological habitat and recreational opportunity for town residents. Four dams exist along the length of the Assabet River within Hudson and represent different management and planning challenges associated with factors such as ownership or condition. Water quality of the Assabet remains an important issue for the community and river flow volumes present additional water quality challenges. Hudson remains concerned about regional Assabet River management and is interested in working with neighboring communities to develop regional solutions.

Assabet River
Source: OARS

Community Preparedness Networks – Building Upon Community Cohesion

Workshop participants identified the lack of community awareness and communication networks as among the most significant vulnerabilities in the Town of Hudson. While significant work has been done to promote civic engagement across the public, private, and non-profit sectors in Hudson, workshop participants viewed community networks as a limitation to achieving its climate resilience goals. While there are many community-centric public, private, and non-profit entities engaged in community issues, there is a recognized lack of climate change preparedness and social networks to address the challenges presented by climate change.

Emergency Preparedness and Response – Drawing Upon Established Processes as a Foundation for Climate Resilience

Emergency preparedness and response operations are managed by an established and collaborative effort between the Police Department, Fire Department, and Public Works Department. Other municipal departments such as the Health Department are also called upon to coordinate resources and expertise in an emergency circumstance. The Town of Hudson has a well-defined and established operational procedure to prepare for the effects of natural hazards and associated response. Emergency preparedness and response systems in Hudson consist of a variety of communication procedures that that have proven effective in past emergency situations. The community recognizes these systems as adequate and effective but agrees that improvements to these systems are both appropriate and necessary in the face of changing climate related hazards. Upgrades to systems such as the 3-Tiered Response Communication System was mentioned as an important first step. Proactive approaches such as moving the Municipal Information Technology and communications systems from the Town Hall to the Police Station and DPW building is occurring to take advantage of backup generation. Continuing to build upon established decision-making processes and operations is an important aspect of ongoing climate resilience efforts.

Open Space and Recreation – Opportunity for Co-Benefits

The Town of Hudson continues to promote initiatives to retain the small town, suburban character of the community. Issues such as flooding, nuisance species (i.e. invasive species), public health, and recreation are addressed within previous open space planning efforts within the community (2016 Open Space Plan, Hudson, MA). Significant achievements by the community to promote open space planning and implementation are also highlighted in this report, including the acquisition of 79 acres of new open space parcels since 2000.

Assabet River Rail Trail
Source: David Kamerman

Drawing upon concepts in the Community Preservation Act, Hudson recognizes the many co-benefits provided by comprehensive open space planning and implementation such as flood management, public health, urban heat mitigation, and nature-based ecosystem management. Similarly, Hudson is committed to drawing upon many of the goals of its Assabet River management efforts to collaboratively achieve open space management within the community. Recognizing the relationship between Hazard Mitigation Planning and Climate Change Resilience Planning, the Town of Hudson is committed to integrating Open Space and Recreation Planning into these efforts through collaborative municipal coordination and community outreach and education.

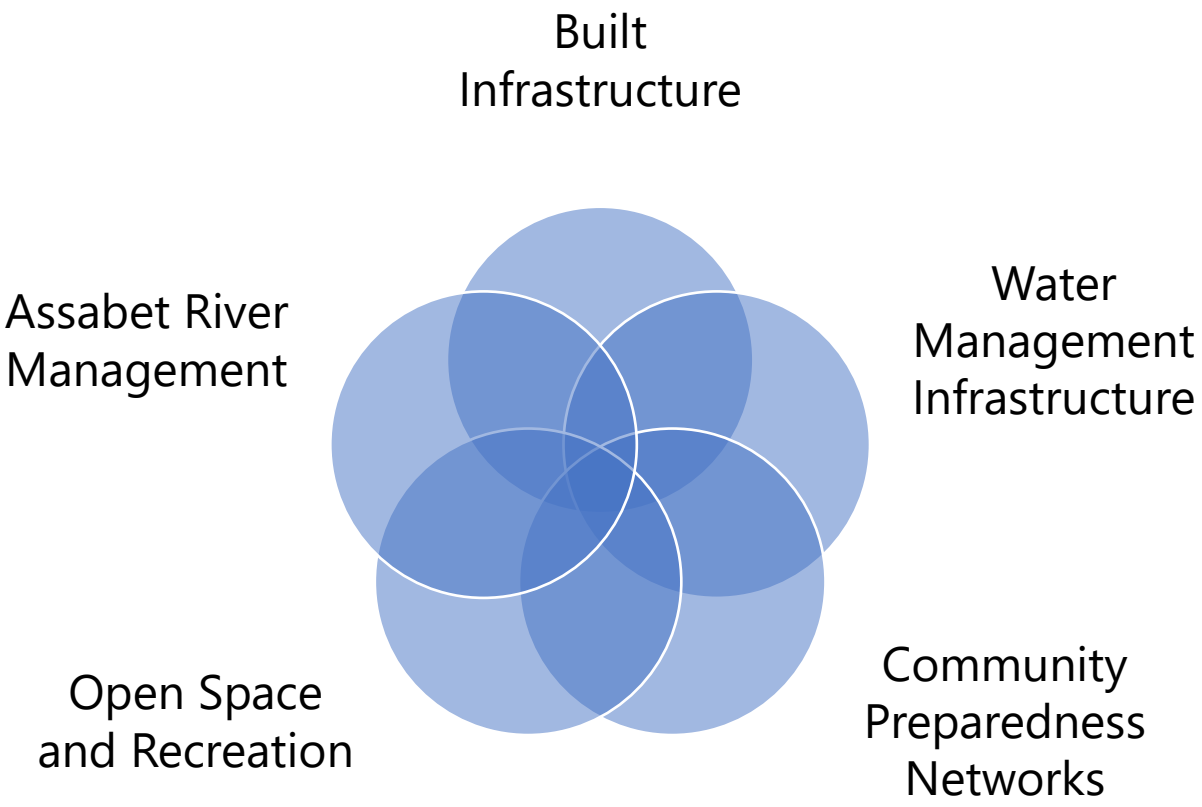
Local Business and Economic Resilience

Drawing upon lessons learned from Hazard Mitigation Planning efforts, the Town of Hudson reiterates its commitment to promoting the economic resilience of its local business. In addition to Hazard Mitigation Planning goals that promote collaborative planning between the municipality and the business community, the CRB process revealed an engaged set of stakeholders that represent local businesses eager to participate in climate resiliency planning within the community. In doing so, the business community understands its role as important stakeholder in the processes and can contribute to important climate resilient solutions. The need for additional outreach to businesses that focus on climate mitigation and adaptation was an important outcome of this process. It was also acknowledged by workshop participants that for public and private partnerships to succeed, trade-offs must exist, a challenge within the context of climate change.

Main Street, Hudson
Source: John Phelan

CATEGORIZING CONCERNS AND CHALLENGES

Workshop participants used the CRB process to collaboratively identify action oriented solutions to address the climate vulnerabilities faced by the Town of Hudson. These actions are organized into five categories based on a combination of community characteristics (i.e. strengths and vulnerabilities) and solutions identified by workshop participants. During the workshops, an emphasis was placed on the interdependence of these categories that allowed for the development of climate resilience solutions that span infrastructural, societal, and environmental features. Through this lens, overlapping solutions that provide co-benefits were identified and prioritized.



Built Infrastructure

The built infrastructure within Hudson is characterized by an interdependent network of roads, bridges, dams, municipal buildings, and privately-owned buildings. State and local roadways within Hudson are often subject to flooding, some of which are located along important emergency evacuation routes or provide access to community shelters. The dams along the Assabet River in Hudson are owned by different entities and contribute to water quality issues across the community. Privately owned buildings in the downtown business district are a source of urban heat island effect. Privately owned buildings throughout the community provide important rental properties to residents, however it was noted that the rental community may be unaware of local vulnerabilities to climate change and available resources associated with emergency preparedness. There was a great deal of support for initiatives that promote energy efficiency, renewable energy, or low-impact design to new construction building projects or building retrofits. The Town of Hudson feels strongly about improving the resilience of its community shelters which are located at the High School, Middle School, and Elementary School. Approaches identified to improve the resilience of community shelters include placing a focus on the co-benefits provided to the schools as an assembly area. Notably, the addition of community education about the shelters as a community resource and the application of technological (cellular networks) or energy (renewable sources) redundancy improves these important community resources. This category excludes the town's built infrastructure explicitly related to water management because of the unique challenges related to flooding within the community.

Built Infrastructure

Roads

Bridges

Dams

Critical Municipal Buildings

Private Buildings

Evacuation Routes

Shelters/Assembly Areas

Water Management Infrastructure

Flooding in Hudson is primarily a result of precipitation and storm water runoff overwhelming the capacity of natural and structured drainage systems to convey water. Under extreme precipitation conditions the system becomes overburdened and street and property flooding result. Workshop participants agreed that the stormwater drainage throughout the community is likely undersized and cannot meet the demands of runoff from extreme precipitation or inland flooding events. Additionally, there was concern that areas known to flood or are vulnerable to future flooding events haven't been identified where important evacuation routes or access to shelters exits. Water quality issues were a significant concern for workshop participants, notably low flows within the Assabet River which leads to nuisance species such as algal blooms and invasive species. Algal blooms present a

Water Management Infrastructure

Stormwater Drainage

Wastewater Treatment and Backup Power Generation

Drinking Water

Culverts

significant public health concern in Hudson. The Wastewater Treatment Plant in Hudson provides the primary source of surface water flows in the Assabet River. Workshop participants discussed a need to better understand what drainage capacity the river can accept from wastewater discharges during extreme high flow conditions. Additionally, the needs for backup power generation at the wastewater treatment plant was identified as an important need for the community.

Community Preparedness Networks

The Town of Hudson has a well-established emergency management plan that municipal stakeholders feel adequately address the needs of the community in an emergency. Close coordination between Police Department, Fire Department, and the Department of Public Works is evident, and emergency preparedness programs such as Swift911, evacuation routes, and backup energy redundancy at the Police Department represent important emergency preparedness response mechanisms. Workshop participants considered community outreach, education, and networks to be among the most significant vulnerability in Hudson. The town has in place various systems to notify the community of important information (e.g. town website, social media, Swift911), but participants felt these resource lack overall awareness in the community. Participants felt strongly that an informational outreach/network should be developed within the community to plan for climate change preparedness and response. Technology such as a town web-based application should be developed to convey information. Regional coordination should also occur within neighboring communities, and the Town should draw upon the capacity provided by state agencies to enhance its overall capacity to address the needs of climate preparedness.

Open Space and Recreation

The Town of Hudson has an engaged Conservation Department and Parks and Recreation Department, each committed to open space, recreation, public health, and environmental quality. The Conservation and Parks and Recreation Departments have multiple facilities (e.g. parks, trails, sports fields) that have been affected by changing climate conditions. Stakeholders conveyed the challenges of keeping up with changing climate conditions such as drought and flooding events in the context of community open space and recreation. Workshop participants were enthusiastic about the co-benefits provided with a conservation, open space, and recreation centric approach to climate

Community Preparedness Networks

Outreach

Non-Emergency Outreach

Community Networks and Education

Informational Technology (cellular applications and websites)

Regional Coordination

Coordination with State Agencies

Open Space and Recreation

Engaged Staff Members and Community Stakeholders

Observed and Persistent Challenges

Invasive Species

Cross Departmental Planning

Partnerships

Conservation

Water Quality

adaptation and resilience planning. For example, flooding issues on recreational facilities directly relates to water quality in the Assabet River, and it was agreed upon by the group that cross-departmental planning and coordination must occur to ensure co-benefits are achieved through resilience planning. Community climate resilience networks and educational opportunities were other factors identified by workshop participants that should be incorporated into open space and recreation planning.

Assabet River Management

Workshop participants were adamant that the Assabet River is among the most important community features to focus on when planning for climate resilience. The Assabet River bisects Hudson's 11 square miles and therefore remains closely aligned with most aspects of the community infrastructure, social, or environmental features. As such, stakeholders agreed that it was essential that the management of the Assabet River remains a stand-alone and central feature of climate resilience planning within the community. Most of Hudson drains to the Assabet River and therefore a combination of drainage infrastructure and natural ecological resources (e.g. wetlands or open space) must be considered when planning for flood resilience. Regional coordination with adjacent communities upstream and downstream of Hudson was prioritized. Workshop participants indicated a need to address sedimentation in the Assabet River and other water quality issues such as low flow periods during drought conditions. Participants indicated that during certain low-flow periods of the year, the only hydrologic inputs to the river in Hudson is from the wastewater treatment plant. A high priority need identified by the community was for regional coordination that includes river management initiatives that address water quality, dam removal, and low-flow conditions in the river within the context of climate change resilience planning. Nature-based solutions within the Assabet River floodplain and within known drainage paths throughout the community were recommended. Efforts to address nuisance species such as invasive species and algal blooms were also noted as important climate resilience planning features.

Assabet River Management

Bank Erosion

Water Quality

Dam Removal

Open Space Connectivity

Invasive Species/Algal Blooms

Low-Flow Conditions

Floodplain Management

Route 62 over Assabet River

Climate Resilience Actions to address these concerns were prioritized through workshop activities and coordination with Core Team leadership. These Climate Resilience Actions are organized by High Priority, Medium Priority, and Low Priority Actions.

High Priority Actions

Category	Action
Built Infrastructure	Town wide assessment of roadway flooding; Assessment of flood risk at Critical Municipal Facilities; Prioritize climate resilient solutions that present public safety issues such as evacuation routes.
	Conduct a town-wide assessment of culverts and drainage system; Consider climate related projections for precipitation when prioritizing culvert or small bridge replacement projects.
	Buried Line Assessment and Prioritization Plan (e.g. downtown area along Rt. 62 and Bike Path); Develop a better understanding of how certain areas within town are prioritized for electrical system repairs; Consider opportunities to establish alternative/renewable energy sources throughout the town. Consider opportunities to promote the application of renewable energy approaches in new development projects within the town; Coordinate with Hudson Light and Power to balance their renewable energy portfolio within the community and work with community stakeholders as partners to achieve this goal.
Water Management Infrastructure	Conduct a study to better understand the capacity of the river to accept wastewater discharges from the treatment facility during extremely high flow events. Consider options such as holding tanks or nature-based solutions (e.g. constructed wetland) to increase storage capacity of wastewater discharges; Relocate Transformers out of flood-prone areas and establish backup generation at the wastewater treatment facility.
	Integrate Dam Condition Assessment into Hazard Mitigation Plan; Develop Community Outreach Program; Initiate preliminary assessments for dam removal opportunities and funding sources; Coordinate with regional/adjacent communities on dam removal and restoration opportunities and impact assessments; Coordinate with DCR during these preliminary and ongoing efforts.
Assabet River Management	Utilize existing organizations (e.g. OARS) to increase capacity of local conservation managers to improve ecological conditions on the Assabet River; Advocate at the state level for River Management; Develop a regional approach to River Management with adjacent communities within the Assabet Watershed; Expand Water Quality Testing Program(s) for the Assabet River.

High Priority Actions (cont.)

Category	Action
Community Preparedness Networks	Develop a Community Outreach Plan to identify individuals/gatekeepers within the community that will want to lead outreach and engagement efforts to develop preparedness and response efforts to climate change hazards; Encourage a climate centric engagement effort in all projects; Design an initiative that brands Hudson as a Climate Resilient Community. Make changes to the town website to provide resources (i.e. centralized location) to promote the development of climate resilient networks. Consider the development of a web-based application to coordinate/facilitate coordination of climate resilient networks.
	Identify business/industry that may become isolated and/or disrupted from flood events; Avoid future development in flood prone areas; Engage in industry-government partnerships to provide technical assistance to businesses facing climate hazards. Enhance natural, climate control assets such as tree cover and vegetation. Apply these approaches in commercial/business districts. Engage in industry-government partnerships to provide technical assistance to businesses facing climate hazards; Engage in approaches to promote and implement renewable energy in new or existing building projects.
	Identify and map communities and critical facilities that may be cut off after extreme storm events.
	Engage in a community wide climate change education initiative. Draw upon public-private partnerships to facilitate this effort.
Open Space and Recreation	Conduct a community engagement initiative to promote the importance of recreational/open space as a public health and environmental co-benefit. Consider the use of educational signage to facilitate community engagement/education to promote the relationship between climate resilience, open space, recreation, and public health; Increase Conservation and Recreation Department capacity through interdepartmental coordination; Conduct an Climate Resilient Open Space and Recreation Plan for Hudson; Identify climate resilient management (e.g. use of new seed varieties) and develop flood management approaches for known flood locations within recreation/open space areas.

Medium Priority Actions

Category	Action
Built Infrastructure	Consider locations for pavement reduction and planting opportunities for trees, native plants, and drought tolerant plants to promote infiltration; Promote bicycle friendly roadways.
	Coordinate with Fire Department to establish an Emergency Command Center (Location and Implementation Plan); Coordinate with gas company to improve the capacity for diesel transport (e.g. identify multiple transport routes in flood events); Develop strategies to enhance the capacity for the Police and DPW building to serve as emergency management locations (e.g. electric/gas redundancy)
	Coordinate with Fire Department to establish an Emergency Command Center (Location and Implementation Plan); Coordinate with gas company to improve the capacity for diesel transport (e.g. identify multiple transport routes in flood events); Develop strategies to enhance the capacity for the Police and DPW building to serve as emergency management locations (e.g. electric/gas redundancy)
	Integrate climate planning into the existing municipal regulatory framework within Hudson; Improve interdepartmental coordination for climate change adaptation and preparedness planning; Begin identifying which climate change scenarios Hudson should be planning for; Identify funding sources to implement climate resilient initiatives; Consider the use of nature-based solutions, green infrastructure, renewable energy; The municipality should consider the employment of a municipal grant writer; Promote and advocate for renewable energy solutions for new construction projects within Hudson through regulation and advocacy mechanisms; Promote the development of south facing roofs to new development projects.
Water Management Infrastructure	No Medium Priority Action Items were identified for this category.

Medium Priority Actions (cont.)

Category	Action
Community Preparedness Networks	Develop an Emergency Recovery Plan; Update and revise local Hazard Mitigation Plans with the latest information about climate change impacts; Identify anticipated demands/resources on local public works and emergency response staff to address increased extreme weather.
	Establish a 311 network; Develop a municipal web-based application and promote opportunities to sign up for updates and messaging on a variety of subjects. Encourage businesses, real estate agencies, abutting communities, and landlords (large rental community) to promote emergency preparedness.
	Coordinate across municipal, state, regional agencies to address local vulnerability and identify resources.
	Redesign older neighborhoods using climate resilient practices; Integrate nature-based solutions and co-benefits approaches to regulatory requirements and neighborhood design; Encourage/Require the use of renewable energy standards into new construction or retrofits; Provide incentives to subsidize energy efficiency systems or upgrades to new heating systems. Consider land purchases for renewable energy projects (solar farms) and impervious surface reduction projects. Further create walkable communities to develop social cohesion among residents. Evaluate new and future (proposed) neighborhoods for flood vulnerability and consider the implications of the future flood projections on neighborhood communities as part of regulatory requirements and emergency preparedness planning.
Open Space and Recreation	Develop a management plan for ponds in Hudson to mitigate for water quality issues to address co-benefits associated with public health and natural resource quality. Coordinate with Open Space and Recreation planning as part of this effort.
Assabet River Management	Nature-Based Solutions Assessment and Erosion Control/Management Plan (including invasive sp.)
	Assess flood prone areas for locations where excess point or non-point sources of nutrient pollutants may exist. Research how low flows and higher temps will affect nutrient, sediment, and pathogen pollution.

Low Priority Actions

Category	Action
Built Infrastructure	Draw upon MassDOT to assess specific climate stressors such as heat stress or freeze thaw cycles on asphalt and other transportation infrastructure; identify locations to conduct pilot programs using resilient transportation infrastructure materials.
	Assess where hazardous material may exist within Assabet River Floodplain; Coordinate with private property owners to address potential flood hazards related to hazardous material. Coordinate with public entities to address potential flood hazards related to hazardous material.
Water Management Infrastructure	Conduct a preliminary assessment of the 400-foot Buffer Zone around drinking water wells for the identification of potential flood storage or wetland creation opportunity.
	Install Fencing to control trespassing: 1) address erosion on walking paths, 2) dog waste, 3) public information campaign to control dog waste.
Community Preparedness Networks	Coordination with Police, Fire, DPW and Ambulance to establish an Emergency Command Center (Location and Implementation Plan).
	Coordination with Police, Fire, DPW and Ambulance to maintain, upgrade, improve, replace 3-Tiered Response Communication System; Hire and Train Swift Water Rescue Team.
	Develop a Community Outreach Plan to increase the number of users within the community.
Open Space and Recreation	Open space continuity assessment (natural resource mapping and modeling) - place an emphasis on areas associated with the Assabet River floodplain.
Assabet River Management	No Low Priority Action Items were identified for this category.

Community Workshop Participants

Name	Affiliation
Brian White	Green Hudson and Hudson Land Trust
Kelli M. Calo	Hudson Board of Health
Glenn Davis	Davis Architecture
Steven C. Santos	Hudson Recreation
Ray Murphy III	Hudson Chamber of Commerce
Andy Massa	Finance Committee
Greg Opp	Hudson Land Trust
Max Kamel	Hudson DPW
Michael Burks	Hudson Police Department
Jack Hunter	Hudson Planning Department
Alison Field-Juma	OARS
Michael Parker	Hudson Fire Department
Katie Bryan	Hudson Light & Power
Richard Harris	Hudson Fire Department
Rachael Hamer	Intel
Jennifer Aiston	Intel
Tom Green	Green Hudson/Hudson Land Trust
Kristina Johnson	Hudson Planning Department
Pam Helinek	Hudson Conservation Commission Agent
Jeffrey T. Malloy	BSC Group, Inc.
Eric M. Ryder	Director of Public Works
Emilie Wilder	Hudson Conservation Commission
Jamie Eldridge	Massachusetts State Senator

MA State Senator Jamie Eldridge provides opening remarks at the CRB Workshop

Citation

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MVP Core Team Working Group

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Kelli Calo, Board of Health Director, Town of Hudson
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Jack Hunter, Planning Director, Town of Hudson
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Thank you to the community leaders within Hudson who attending the Hudson CRB Workshops. The institutional knowledge provided by workshop participants was essential to the success of this process.

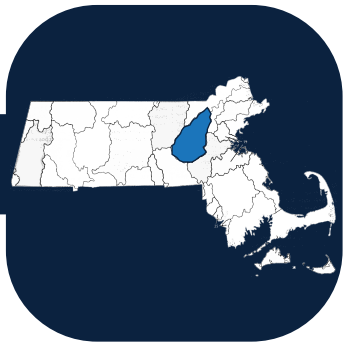
Thank you to the Metropolitan Area Planning Council (MAPC) for providing background data and community maps that were used during workshop breakout engagement activities.

CLIMATE DATA GRAPHIC

CLIMATE CHANGE

Hudson, Massachusetts
SuAsCo Watershed Basin

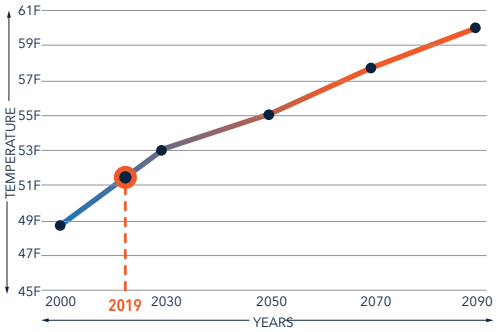
Acton, Ashland, Bedford, Berlin, Billerica, Bolton, Boxborough, Boylston, Carlisle, Chelmsford, Clinton, Concord, Framingham, Grafton, Harvard, Holliston, Hopkinton, Hudson, Lincoln, Littleton, Lowell, Marlborough, Maynard, Natick, Northborough, Sherborn, Shrewsbury, Southborough, Stow, Sudbury, Tewksbury, Upton, Wayland, Westborough, Westford, Weston



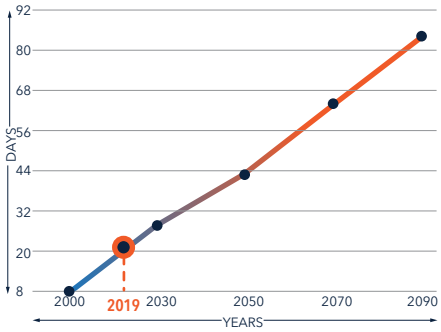
Global warming is caused by the accumulation of greenhouse gases within the atmosphere. Gases that contribute to the greenhouse effect include water vapor, carbon dioxide, methane, and nitrous oxide. On earth, human activities such as burning fossil fuels, land deforestation and wetland loss/conversion have altered the delicate balance of atmospheric conditions that regulate our climate. The effect of these changes cause global climate change that are likely to be significant and to increase over time.

EXTREME TEMPERATURES

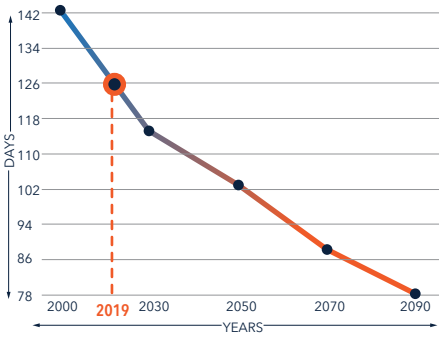
Average Temperatures



Days with Maximum Temperature over 90˚F



Fewer Days Below Freezing

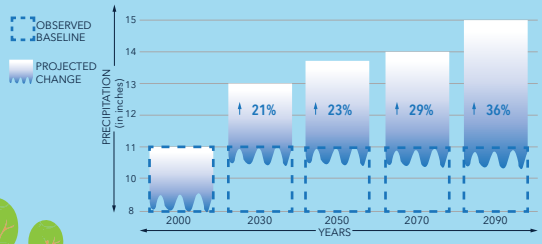


What can HUDSON expect as CLIMATE CHANGES?

Climate change has already had observable effects on the environment. Rising temperatures, changes in precipitation patterns, droughts and heat waves, sea-level rise, and extreme storm events have **altered the distribution of risk and how resources are managed.**

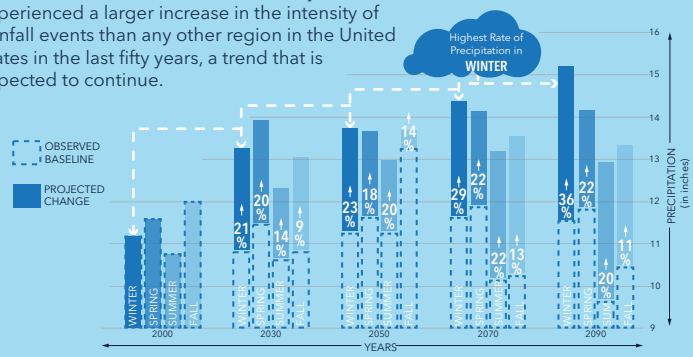
Extreme Snow And Ice Events

Total Annual Precipitation is expected to increase within the SuAsCo Basin over the remainder of the century. Most of this increase is expected to occur during winter months where precipitation will fall as either rainfall or extreme snow or ice events.



More Annual Precipitation and Inland Flooding

The Northeast United States has already experienced a larger increase in the intensity of rainfall events than any other region in the United States in the last fifty years, a trend that is expected to continue.



Blizzards, Nor'Easters and Hurricanes

Storm events fueled by higher temperatures, increased evaporation, and atmospheric moisture leads to stormy weather of increased duration and intensity.

Wind / Microbursts

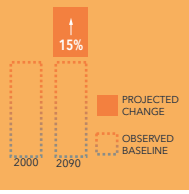
Hazardous wind conditions most commonly accompany extreme storm events. High winds and microburst conditions present unique hazards to infrastructure, public safety and important natural resources.

Heatwaves

Extreme heat events are expected to become more frequent and intense. Socially vulnerable populations are particularly vulnerable to the dangers related to extreme temperature conditions.

Drought Conditions

Due to the combined effects of higher temperatures, reduced groundwater recharge from extreme precipitation events, earlier snowmelt, summer and fall droughts may become more frequent.



Sources: Massachusetts Executive Office of Energy and Environmental Affairs; ResilientMA.org

BSC GROUP

COMMUNITY RESILIENCE BUILDING MATRIX

Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.org

H-**M**-**L** priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Flooding	Extreme Temps	Extreme Snow & Ice Events	Drought	Priority (H - M - L)	Time (Short Long Ongoing)
Infrastructural									
Transportation - (town roadways)	town-wide	Public	V	Town-wide assessment of town roadways subject to flooding. Prioritize actions to town roadways that present public safety issues (e.g. emergency evacuation routes) or resources such as fuel/water/food resources; Draw upon MassDOT to assess specific climate stressors such as heat stress or freeze thaw cycles on asphalt and other transportation infrastructure; identify locations to conduct pilot programs using resilient transportation infrastructure materials. Consider locations for pavement reducation and planting opportunities for trees, native plants, and drought tolerant plants to promote infiltration; Promote bicycle friendly roadways.				High	Ongoing
Utility Infrastructure (storm drainage system - pipes, structures, culverts)	town-wide	Public	V	Town-wide assessment of culvert system; Consider climate related projections for precipitation when prioritizing culvert or small bridge replacement projects.				High	Ongoing
Assabet River Flooding and Adjacent Infrastructure - Hazardous Materials	town-wide	Public/Private	V	Assess where hazardous material may exist within Assabet River Floodplain; Coordinate with private property owners to address potentail flood hazards related to hazardous material. Coordinate with public entities to address potential flood hazards related to hazardous materail.				Low	Ongoing
Utility Infrastructure (Wastewater Treatment Facilities)	individual-site	Public	V/S	Conduct a study to better understand the capacity of the river to accept wastewater discharges from the treatment facility during extremely high flow events. Consider options such as holding tanks or nature-based solutions (e.g. constructed wetland) to increase storage capacity of wastewater discharges; Relocate Transformers out of flood-prone areas and establish backup generation at the wastewater treatment facility.				High	Ongoing
Critical Municipal Buildings (Police Station and DPW)	individual-site	Public	V/S	Coordinate with Fire Department to establish an Emergency Command Center (Location and Implementation Plan); Coordinate with gas company to improve the capacity for diesel transport (e.g. identify multiple transport routes in flood events); Develop strategies to enhance the capacity for the Police and DPW building to serve as emergency management locations (e.g. electric/gas redundancy). Conduct an assessment of flood risk at Critical Municipal Facililities.				Medium	Ongoing
Municipal Regulatory Infrastructure: (Bylaws, Ordinances, Zoning, Business Improvement Districts, etc)	N/A	Public	V/S	Integrate climate planning into the existing municipal regulatory framework within Hudson. Improve interdepartmental coordination for climate change adaptation and preparedness planning; Begin identifying which climate change scenarios Hudson should be planning for; Identify funding sources to implement climate resilient initiatives; Consider the use of nature-based solutions, green infrastructure, renewable energy; The municipality should consider the employment of a municipal grant writer; Promote and advocate for renewable energy solutions for new construction projects within Hudson through regulation and advocacy mechanisms; Promote the development of south facing roofs to new development projects.				Medium	Ongoing
Buildings	individual-sites	Public/Private	S	Evaluate existing building codes to accommodate for changing climate exposure such as increased snow and wind loads, cooling capacity, or renewable energy generation. Evaluate for white/green roofs.				Medium	Ongoing
Shelters •Quinn Middle School (Primary Shelter) •Hudson High School (Secondary Shelter) •Farley Elementary School (Pet Friendly Shelter)	individual-sites	Public/Private	S	Consider renewable energy solutions at the schools/shelters and promote backup solar and battery solutions to increase electric power redundancy; Coordination with local power systems to ensure shelters receive prioirty utility attention during emergencies; Maintain and test backup power generation at shelters on a consistent basis; Coordinate with cellular utility companies to ensure consistent/improved service at Shelter locations including fiber optic networks or micro cells to improve cellular service in an emergency situation. Charging stations at Shelters. Communication networks at Shelters; Develop an advocacy campaign to establish knowlege of shelter resources; Retrofit schools to integrate sustainable/renewable energy design to enhance capacity of shelters.				High	Short

Dams •Washington Street Dam (owned by Hudson Power and Light) •Main Street Dam (private ownership) •Tripps Dam (town ownership) •Fort Meadow Brook Dam	individual-sites	Public	V/S	Integrate Dam Condition Assessment into Hazard Mitigation Plan; Develop Community Outreach Program; Initiate preliminary assessments for dam removal opportunities and funding sources; Coordinate with regional/adjacent communities on dam removal and restoration opportunities and impact assessments; Coordinate with DCR during these preliminary and ongoing efforts.	High	Ongoing
Electrical Distribution System Redundancy	town-wide	Hudson L&P	V/S	Buried Line Assessment and Prioritization Plan (e.g. downtown area along Rt. 62 and Bikepath); Develop a better understanding of how certain areas within town are prioritized for electrical system repairs; Consider opportunities to establish alternative/renewable energy sources throughout the town. Consider opportunities to promote the application of renewable energy approaches in new development projects within the town; Coordinate with Hudson Light and Power to balance their renewable energy portfolio within the community and work with community stakeholders as partners to achieve this goal.	High	Ongoing

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Environmental
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Features	Location	Ownership	V or S	Flooding	Extreme Temps	Extreme Snow & Ice Events	Drought	Priority H - M - L	Time Short Long Ongoing
Societal									
Emergency Preparedness - Remote Emergency Command Center	town-wide	Public	V	Coordination with Police, Fire, DPW and Ambulance to establish an Emergency Command Center (Location and Implementation Plan);				Low	Ongoing
Emergency Preparedness - Municipal Communication Systems Police, Fire, DPW, Ambulance)	town-wide	Public	S	Coordination with Police, Fire, DPW and Ambulance to maintain, upgrade, improve, replace 3-Tiered Response Communication System; Hire and Train Swift Water Rescue Team				Low	Ongoing
Emergency Preparedness - Swift911	town-wide	Public	V/S	Develop a Community Outreach Plan to increase the number of users within the community.				Low	Ongoing
Emergency Response Preparedness: Recovery Plan	town-wide	Public	V/S	Develop an Emergency Recovery Plan; Update and revise local Hazard Mitigation Plans with the latest information about climate change impacts; Identify anticipated demands/resources on local public works and emergency response staff to address increased extreme weather.				Medium	Ongoing
Non-Emergency Response and Preparedness	town-wide	Public	V/S	Establish a 311 network; Develop a municipal web-based application and promote opportunities to sign up for updates and messaging on a variety of subjects. Encourage businesses, real estate agencies, abutting communities, and landlords (large rental community) to promote emergency preparedness.				Medium	Ongoing
Coordination w/ State or Regional Planning Efforts	town-wide	Public	V	Coordinate across municipal, state, regional agencies to address local vulnerability and identify resources.				Medium	Ongoing
Vulnerable Communities and Critical Facilities	town-wide	Public/Private	V	Identify and map communities and critical facilities that may be cut off after extreme storm events				High	Short
Local Economy	town-wide	Public/Private	V/S	Identify business/industry that may become isolated and/or disrupted from flood events; Avoid future development in flood prone areas; Engage in industry-government partnerships to provide technical assistance to businesses facing climate hazards. Enhance natural, climate control assets such as tree cover and vegetation. Apply these approaches in commercial/business districts. Engage in industry-government partnerships to provide technical assistance to businesses facing climate hazards; Engage in approaches to promote and implement renewable energy in new or existing building projects.				High	Ongoing
Cultural/Community Networks	town-wide	Public/Private	V	Develop a Community Outreach Plan to identify individuals/gatekeepers within the community that will want to lead outreach and engagement efforts to develop preparedness and response efforts to climate change hazards; Encourage a climate centric engagement effort in all projects; Design an initiative that brands Hudson as a Climate Resilient Community. Make changes to the town website to provide resources (i.e. centralized location) to promote the development of climate resilient networks. Consider the development of a web-based application to coordinate/facilitate coordination of climate resilient networks.				High	Ongoing

Neighborhood Resilience	town-wide	Public/Private	V	Redesign older neighborhoods using climate resilient practices; Integrate nature-based solutions and co-benefits approaches to regulatory requirements and neighborhood design; Encourage/Require the use of renewable energy standards into new construction or retrofits; Provide incentives to subsidize energy efficiency systems or upgrades to new heating systems. Consider land purchases for renewable energy projects (solar farms) and impervious surface reduction projects. Further create walkable communities to develop social cohesion among residents. Evaluate new and future (proposed) neighborhoods for flood vulnerability and consider the implications of the future flood projections on neighborhood communities as part of regulatory requirements and emergency preparedness planning.	Medium	Ongoing
Community Education	town-wide	Public/Private	V	Engage in a community wide climate change education initiative. Draw upon public-private partnerships to facilitate this effort.	High	Ongoing

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Features	Location	Ownership	V or S	Flooding	Extreme Temps	Extreme Snow & Ice Events	Drought	Priority H - M - L	Time S hort L ong O ngoing
Environmental									
Bank Erosion (Rivers, Open Water) •Town Rivers •Fort Meadow Lake •Lake Boon •Outfall at Fowl Meadow	town-wide	Public	V/S	Nature-Based Solutions Assessment and Erosion Control/Management Plan (including invasive sp.); Evaluate open water bodies (ponds and reservoir) for water quality issues and implement long-term water quality programs that pertain to human health and natural resource quality.				Medium	Ongoing
Assabet River Management	town-wide	Public	V/S	Utilize existing organizations (e.g. OARS) to increase capacity of local conservation mangers to improve ecological conditions on the Assabet River; Advocate at the state level for River Management; Develop a regional approach to River Management with adjacent communities within the Assabet Watershed; Expand Water Quality Testing Program(s) for the Assabet River.				High	Ongoing
Water Quality (Drinking Water)	town-wide	N/A	V/S	Conduct a preliminary assessment of the 400-foot Buffer Zone around drinking water wells for the identification of potential flood storage or wetland creation opportunity.				Low	Long
Reservoir (Water Quality, Public Health, Public Safety)	town-wide	Public	V	Install Fencing to control trespassing: 1) address erosion on walking paths, 2) dog waste, 3) public information campaign to control dog waste				Low	Long
Open Space and Recreation Plan/Management	town-wide	Public	V/S	Conduct a community engagement initiative to promote the importance of recreational/open space as a public health and environmental co-benefit. Consider the use of educational signage to facilitate community engagement/education to promote the relationship between climate resilience, open space, recreation, and public health; Increase Recreation Department capacity through interdepartmental coordination; Conduct an Climate Resilient Open Space and Recreation Plan for Hudson; Identify climate resilient management (e.g. use of new seed varieties) and develop flood management approaches for known flood locations within recreation/open space areas.				High	Ongoing
Natural Resource Climate Resilience	town-wide	Public	V/S	Open space continuity assessment (natural resource mapping and modeling) - place an emphasis on areas associated with the Assabet River floodplain and the open water bodies (i.e. ponds and reservoir) throughout the community. The areas if properly manged can be an important strength within the community under changing climate conditions.				Medium	Ongoing
Nuisance Species (Algal Blooms, Invasives)	town-wide	Public	V	Assess flood prone areas for locations where excess point or non-point sources of nutrient pollutants may exist. Research how low flows and higher temps will affect nutrient, sediment, and pathogen pollution.				Medium	Ongoing

SUDBURY-ASSABET-CONCORD RIVER BASIN CLIMATE PROJECTIONS

SUDBURY-ASSABET-CONCORD (SuAsCo) BASIN

MUNICIPALITIES WITHIN SuAsCo BASIN:

Acton, Ashland, Bedford, Berlin, Billerica, Bolton, Boxborough, Boylston, Carlisle, Chelmsford, Clinton, Concord, Framingham, Grafton, Harvard, Holliston, Hopkinton, Hudson, Lincoln, Littleton, Lowell, Marlborough, Maynard, Natick, Northborough, Sherborn, Shrewsbury, Southborough, Stow, Sudbury, Tewksbury, Upton, Wayland, Westborough, Westford, and Weston

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

SuAsCo BASIN

SuAsCo 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	48.73	+2.18 to +4.37	+2.88 to +6.32	+3.47 to +9.03	+3.76 to +10.94
	Winter	27.35	+2.23 to +4.90	+2.83 to +7.25	+3.57 to +8.89	+4.01 to +10.23
	Spring	46.84	+1.67 to +3.46	+2.49 to +5.67	+2.66 to +7.92	+3.23 to +9.63
	Summer	69.51	+2.09 to +4.40	+2.74 to +6.91	+3.20 to +10.16	+3.73 to +12.69
	Fall	50.81	+2.21 to +5.02	+3.66 to +6.59	+3.47 to +9.49	+3.97 to +11.74
Maximum Temperature	Annual	59.59	+2.02 to +4.11	+2.66 to +6.28	+3.16 to +9.08	+3.42 to +10.87
	Winter	37.25	+1.85 to +4.42	+2.46 to +6.73	+2.97 to +8.13	+3.37 to +9.36
	Spring	57.9	+1.58 to +3.43	+2.26 to +5.59	+2.59 to +8.04	+3.17 to +9.71
	Summer	80.73	+1.90 to +4.46	+2.62 to +7.06	+3.10 to +10.46	+3.57 to +12.97
	Fall	62.05	+2.37 to +4.79	+3.56 to +6.83	+3.32 to +9.62	+3.81 to +12.13
Minimum Temperature	Annual	37.86	+2.27 to +4.64	+3.13 to +6.41	+3.77 to +8.96	+4.10 to +11.01
	Winter	17.45	+2.49 to +5.47	+3.25 to +7.76	+4.12 to +9.62	+4.55 to +10.91
	Spring	35.79	+1.76 to +3.71	+2.66 to +6.02	+2.81 to +7.74	+3.29 to +9.51
	Summer	58.28	+2.11 to +4.49	+2.86 to +7.18	+3.30 to +9.86	+3.91 to +12.40
	Fall	39.56	+2.11 to +5.16	+3.60 to +6.56	+3.62 to +9.26	+4.14 to +11.62

- The SuAsCo basin is expected to experience increased average temperatures throughout the 21st century. Maximum and minimum temperatures are also expected to increase throughout the end of the century. These increased temperature trends are expected for annual and seasonal projections.
- Seasonally, maximum summer and fall temperatures are expected to see the highest projected increase throughout the 21st century.
    - Summer mid-century increase of 2.6 °F to 7.1 °F (3-9% increase); end of century increase of 3.6 °F to 13 °F (4-16% increase).
    - Fall mid-century increase of 3.6 °F to 6.8 °F (6-11% increase); end of century increase by and 3.8 °F to 12.1 °F (6-20% increase).
- Seasonally, minimum winter and fall temperatures are expected to see increases throughout the 21st century.
    - Winter mid-century increase of 3.3 °F to 7.8 °F (19-44% increase); end of century increase by 4.6 °F to 10.9 °F (26-63% increase).
    - Fall mid-century of 3.6 °F to 6.6 °F (9-17% increase); end of century increase of 4.1°F to 11.6 °F (10-29% increase).

SuAsCo BASIN

SuAsCo 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	8.07	+7.24 to +20.03	+10.13 to +35.14	+12.20 to +56.37	+14.48 to +76.25
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.5	+0.05 to +0.77	+0.28 to +1.74	+0.35 to +2.97	+0.23 to +5.00
	Summer	7.21	+6.54 to +17.38	+8.50 to +29.80	+10.77 to +45.90	+12.66 to +59.87
	Fall	0.36	+0.42 to +2.15	+0.79 to +4.79	+0.58 to +8.98	+1.10 to +12.13
Days with Maximum Temperature Over 95°F	Annual	0.75	+2.02 to +8.21	+3.06 to +16.75	+3.91 to +31.59	+5.51 to +48.44
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.03	+0.03 to +0.24	+0.02 to +0.47	+0.05 to +1.08	+0.06 to +1.95
	Summer	0.71	+1.86 to +7.70	+2.75 to +15.30	+3.44 to +28.30	+5.16 to +42.21
	Fall	0.01	+0.07 to +0.61	+0.09 to +1.24	+0.14 to +3.25	+0.24 to +4.72
Days with Maximum Temperature Over 100°F	Annual	0.02	+0.20 to +2.03	+0.32 to +4.87	+0.58 to +11.71	+0.60 to +21.91
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.00 to +0.02	+0.00 to +0.04	+0.00 to +0.20	+0.00 to +0.45
	Summer	0.02	+0.21 to +1.91	+0.29 to +4.70	+0.52 to +10.99	+0.60 to +20.34
	Fall	0.00	+0.00 to +0.08	+0.00 to +0.21	+0.00 to +0.55	+0.00 to +1.01

- Due to projected increases in average and maximum temperatures throughout the end of the century, the SuAsCo basin is also expected to experience an increase in days with daily maximum temperatures over 90 °F, 95 °F, and 100 °F.
    - Annually, the SuAsCo basin is expected to see days with daily maximum temperatures over 90 °F increase by 10 to 35 more days by mid-century, and 14 to 76 more days by the end of the century.
    - Seasonally, summer is expected to see an increase of 9 to 30 more days with daily maximums over 90 °F by mid-century.
    - By end of century, the SuAsCo basin is expected to have 13 to 60 more days.

SuAsCo BASIN

SuAsCo Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Days with Minimum Temperature Below 0°F	Annual	5.96	-1.61 to -3.54	-2.03 to -4.25	-2.23 to -4.57	-2.25 to -4.73
	Winter	5.93	-1.63 to -3.34	-2.00 to -4.05	-2.22 to -4.42	-2.23 to -4.57
	Spring	0.03	-0.26 to +0.03	-0.01 to -0.27	-0.01 to -0.32	-0.01 to -0.29
	Summer	0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00
	Fall	0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00
Days with Minimum Temperature Below 32°F	Annual	143.36	-11.90 to -27.94	-19.26 to -39.80	-22.36 to -55.02	-24.35 to -64.94
	Winter	83.01	-2.19 to -6.66	-3.27 to -11.19	-4.93 to -19.68	-5.77 to -24.53
	Spring	33.93	-3.32 to -11.44	-6.76 to -14.98	-8.06 to -19.33	-8.67 to -20.34
	Summer	0.00	-0.04 to -0.00	-0.04 to -0.00	-0.05 to -0.00	-0.05 to -0.00
	Fall	26.38	-5.23 to -11.1	-8.40 to -13.61	-8.58 to -17.66	-8.19 to -19.77

- Due to projected increases in average and minimum temperatures throughout the end of the century, the SuAsCo basin is expected to experience a decrease in days with daily minimum temperatures below 32 °F and 0 °F.
- Seasonally, winter, spring and fall are expected to see the largest decreases in days with daily minimum temperatures below 32 °F.
    - Winter is expected to have 3 to 11 fewer days by mid-century, and 6 to 25 fewer days by end of century.
    - Spring is expected to have 7 to 15 fewer days by mid-century, and 9 to 20 fewer days by end of century.
    - Fall is expected to have 8 to 14 fewer days by mid-century, and 8 to 20 fewer days by end of century.

SuAsCo BASIN

SuAsCo Basin		Observed Baseline 1971-2000 (Degree-Days)	Projected Change in 2030s (Degree-Days)	Mid-Century Projected Change in 2050s (Degree-Days)	Projected Change in 2070s (Degree-Days)	End of Century Projected Change in 2090s (Degree-Days)
Heating Degree-Days (Base 65°F)	Annual	6534.66	-543.72 to -1137.18	-749.60 to -1586.93	-872.65 to -2093.75	-983.52 to -2459.88
	Winter	3406.17	-193.54 to -454.48	-250.62 to -669.31	-316.34 to -807.48	-368.77 to -941.56
	Spring	1694.75	-136.54 to -293.20	-206.58 to -473.07	-225.41 to -619.25	-284.35 to -726.21
	Summer	90.35	-29.17 to -55.74	-40.30 to -72.21	-47.07 to -80.96	-48.42 to -83.98
	Fall	1340.41	-166.26 to -374.01	-279.18 to -460.66	-262.08 to -639.19	-276.44 to -731.23
Cooling Degree-Days (Base 65°F)	Annual	585.03	+216.39 to +456.32	+284.68 to +771.17	+342.54 to +1196.87	+397.57 to +1581.57
	Winter	nan	-0.64 to +2.13	+0.04 to +2.24	+0.81 to +3.49	+1.52 to +3.80
	Spring	25.38	+12.29 to +31.14	+20.23 to +61.91	+23.71 to +105.36	+22.14 to +143.39
	Summer	505.04	+158.00 to +349.52	+197.02 to +569.20	+238.23 to +859.80	+281.63 to +1086.27
	Fall	49.33	+29.98 to +95.36	+43.76 to +159.37	+51.78 to +253.82	+77.28 to +341.21
Growing Degree-Days (Base 50°F)	Annual	2592.31	+407.83 to +821.76	+546.41 to +1274.32	+642.32 to +1976.40	+729.06 to +2475.28
	Winter	6.27	-0.58 to +10.51	+0.41 to +14.62	+4.00 to +22.78	+3.32 to +28.60
	Spring	314.11	+66.08 to +145.31	+91.86 to +251.45	+108.38 to +398.05	+120.48 to +500.08
	Summer	1794.81	+192.32 to +404.30	+251.12 to +635.57	+293.25 to +934.43	+342.08 to +1166.70
	Fall	469.32	+113.10 to +302.42	+180.27 to +412.20	+170.27 to +621.20	+217.49 to +791.63

- Due to projected increases in average, maximum, and minimum temperatures throughout the end of the century, the SuAsCo basin is expected to experience a decrease in heating degree-days, and increases in both cooling degree-days and growing degree-days.
- Seasonally, winter historically exhibits the highest number of heating degree-days and is expected to see the largest decrease of any season, but spring and fall are also expected to see significant change.
    - The winter season is expected to see a decrease of 7-20% (251 -669 degree-days) by mid-century, and a decrease of 11-28% (369 -942 degree-days) by the end of century.
    - The spring season is expected to decrease in heating degree-days by 12-28% (207 -473 degree-days) by mid-century, and by 17-43% (284 -726 degree-days) by the end of century.
    - The fall season is expected to decreases in heating degree-days by 21-34% (279 -461 degree-days) by mid-century, and by 21-55% (276 -731 degree-days) by the end of century.
- Conversely, due to projected increasing temperatures, summer cooling degree-days are expected to increase by 39-113% (197 -569 degree-days) by mid-century, and by 56-215% (282 -1086 degree-days) by end of century.
- Seasonally, summer historically exhibits the highest number of growing degree-days and is expected to see the largest decrease of any season, but the shoulder seasons of spring and fall are also expected to see an increase in growing degree-days.

- The summer season is projected to increase by 14-35% (251 -636 degree-days) by mid-century, and by 19-65% (342 -1167 degree-days) by end of century.
- Spring is expected to see an increase by 29-80% (92 -251 degree-days) by mid-century and 38-159% (120 -500 degree-days) by end of century.
- Fall is expected to see an increase by 38-88% (180 -412 degree-days) by mid-century and 46-169% (217 -792 degree-days) by end of century.

SuAsCo BASIN

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Days with Precipitation Over 1"	Annual	6.84	+0.23 to +1.99	+0.64 to +3.35	+1.29 to +2.88	+1.15 to +4.16
	Winter	1.55	-0.08 to +0.85	+0.19 to +1.18	+0.30 to +1.53	+0.40 to +1.83
	Spring	1.49	-0.08 to +0.72	-0.03 to +0.95	+0.11 to +1.17	+0.13 to +1.33
	Summer	1.59	-0.13 to +0.56	-0.02 to +0.92	-0.10 to +0.79	-0.20 to +0.71
	Fall	2.22	-0.25 to +0.76	-0.13 to +0.96	-0.27 to +0.78	-0.38 to +0.96
Days with Precipitation Over 2"	Annual	0.61	-0.05 to +0.41	+0.07 to +0.52	+0.04 to +0.49	+0.09 to +0.64
	Winter	0.05	-0.02 to +0.07	-0.02 to +0.08	-0.01 to +0.09	-0.01 to +0.13
	Spring	0.04	-0.02 to +0.12	+0.01 to +0.15	-0.02 to +0.17	-0.01 to +0.29
	Summer	0.27	-0.08 to +0.15	-0.03 to +0.22	-0.08 to +0.17	-0.06 to +0.22
	Fall	0.25	-0.09 to +0.27	-0.07 to +0.26	-0.04 to +0.21	-0.10 to +0.24
Days with Precipitation Over 4"	Annual	0.04	-0.03 to +0.07	-0.02 to +0.07	-0.04 to +0.07	-0.04 to +0.15
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.00 to +0.00	+0.00 to +0.01	+0.00 to +0.00	+0.00 to +0.01
	Summer	0.01	-0.02 to +0.04	-0.01 to +0.04	-0.01 to +0.05	-0.02 to +0.06
	Fall	0.02	-0.03 to +0.07	-0.03 to +0.05	-0.03 to +0.05	-0.03 to +0.09

- The projections for expected number of days receiving precipitation over one inch are variable for the SuAsCo basin, fluctuating between loss and gain of days.
  - Seasonally, the winter season is generally expected to see the highest projected increase.
  - The winter season is expected to see an increase in days with precipitation over one inch of 0-1 days by mid-century, and an increase of 0-2 days by the end of century.
  - The spring season is expected to see an increase in days with precipitation over one inch of -0-1 days by mid-century, and of an increase of 0-1 days by the end of century.

SuAsCo BASIN

SuAsCo 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	45.44	+0.16 to +4.84	+0.56 to +6.06	+1.53 to +7.79	+1.23 to +8.01
	Winter	11.15	-0.38 to +2.08	+0.07 to +2.56	+0.45 to +3.20	+0.38 to +4.05
	Spring	11.57	-0.14 to +2.36	+0.02 to +2.08	+0.28 to +2.58	+0.22 to +2.55
	Summer	10.76	-0.18 to +1.53	-0.47 to +2.20	-0.64 to +2.40	-1.13 to +2.15
	Fall	11.97	-1.19 to +1.08	-1.27 to +1.70	-1.78 to +1.57	-1.54 to +1.35

- Similar to projections for number of days receiving precipitation over a specified threshold, seasonal projections for total precipitation are also variable for the SuAsCo basin.
    - The winter season is expected to experience the greatest change with an increase of 1-23% by mid-century, and of 3-36% by end of century.
    - Projections for the summer and fall seasons are more variable, and could see either a drop or increase in total precipitation throughout the 21st century.
        - The summer season projections for the SuAsCo or basin could see a decrease of 0.5 to an increase of 2.2 inches by mid-century (decrease of 4 to increase of 20%) and a decrease of 1.1 to an increase of 2.2 inches by the end of the century (decrease of 11% to increase of 20%).
        - The fall season projections for the SuAsCo basin could see a decrease of 1.3 to an increase of 1.7 inches by mid-century (decrease of 11% to increase of 14%) and a decrease of 1.5 to an increase of 1.4 inches by the end of the century (decrease of 13% to increase of 11%).

SuAsCo 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	16.83	-0.55 to +1.41	-0.40 to +1.98	-0.88 to +2.26	-0.72 to +2.5
	Winter	11.64	-0.90 to +1.21	-0.74 to +1.39	-1.05 to +1.70	-1.13 to +1.70
	Spring	11.04	-1.16 to +0.81	-1.20 to +0.96	-1.46 to +1.09	-1.17 to +0.83
	Summer	12.34	-0.81 to +1.60	-0.74 to +2.42	-1.26 to +2.73	-0.99 to +2.06
	Fall	12.22	-0.01 to +1.94	-0.19 to +2.65	-0.27 to +3.05	-0.03 to +3.13

- Annual and seasonal projections for consecutive dry days, or for a given period, the largest number of consecutive days with precipitation less than 1 mm (~0.04 inches), are variable throughout the 21st century.
    - For all the temporal parameters, the SuAsCo basin is expected to see a slight decrease to an increase in consecutive dry days throughout this century.
    - Seasonally, the fall and summer seasons are expected to continue to experience the highest number of consecutive dry days.
        - The fall season is expected to an increase of 0-3 days in consecutive dry days by the end of the century.

PUBLIC LISTENING SESSION - FEEDBACK

The Town of Hudson has received a Municipal Vulnerability Preparedness (MVP) Planning Grant from the Commonwealth of Massachusetts. This grant enabled Hudson to identify and analyze our risks and strengths in the face of climate change. Certification as an MVP Community will make us eligible for grant money to address these issues.

We are hosting a Public Listening Session to report and discuss our findings with the Hudson community. Please join us and invite your friends and neighbors.

Climate Change Vulnerabilities in Hudson

Public Listening Session

Tuesday May 14

6:00PM-7:00PM

Police/DPW Building, 1 Municipal Drive

State and local partnership grant to build resiliency to climate change

Comment No.	Participant Comment or Question (summarized for clarity)
Comment 1	Extreme Temps should include both heat and cold events and should also account for extended weather patterns. Extreme heat is an important vulnerability for Hudson.
Comment 2	Has an explicit action item (solution) to identified vulnerabilities been identified in this process that ranks as a top priority – an immediate action that should be taken by our community to avoid catastrophic climate impacts? Response – No, this process has identified a broad set of actions that can be taken to address a broad set of vulnerabilities that exist across your community. Many of these action cross categorical issue areas and provide co-benefits when implemented.
Comment 3	Climate mitigation – carbon reduction - efforts should be included in future resilience planning and implementation actions in Hudson.
Comment 4	Communication networks are an important aspect of social resilience to climate change.
Comment 5	Drought is something we should be thinking about. It is common to see water conservation signs throughout the community during periods of drought. Understanding the relationship between drought and climate change is important for the community to understand.
Comment 6	The Assabet River appears to be a central feature of this planning effort. The Assabet River is influenced by upstream and downstream activities in other communities. Regional efforts and partnerships is an important component of successful river corridor management. Regional partnerships should be prioritized in future implementation efforts.