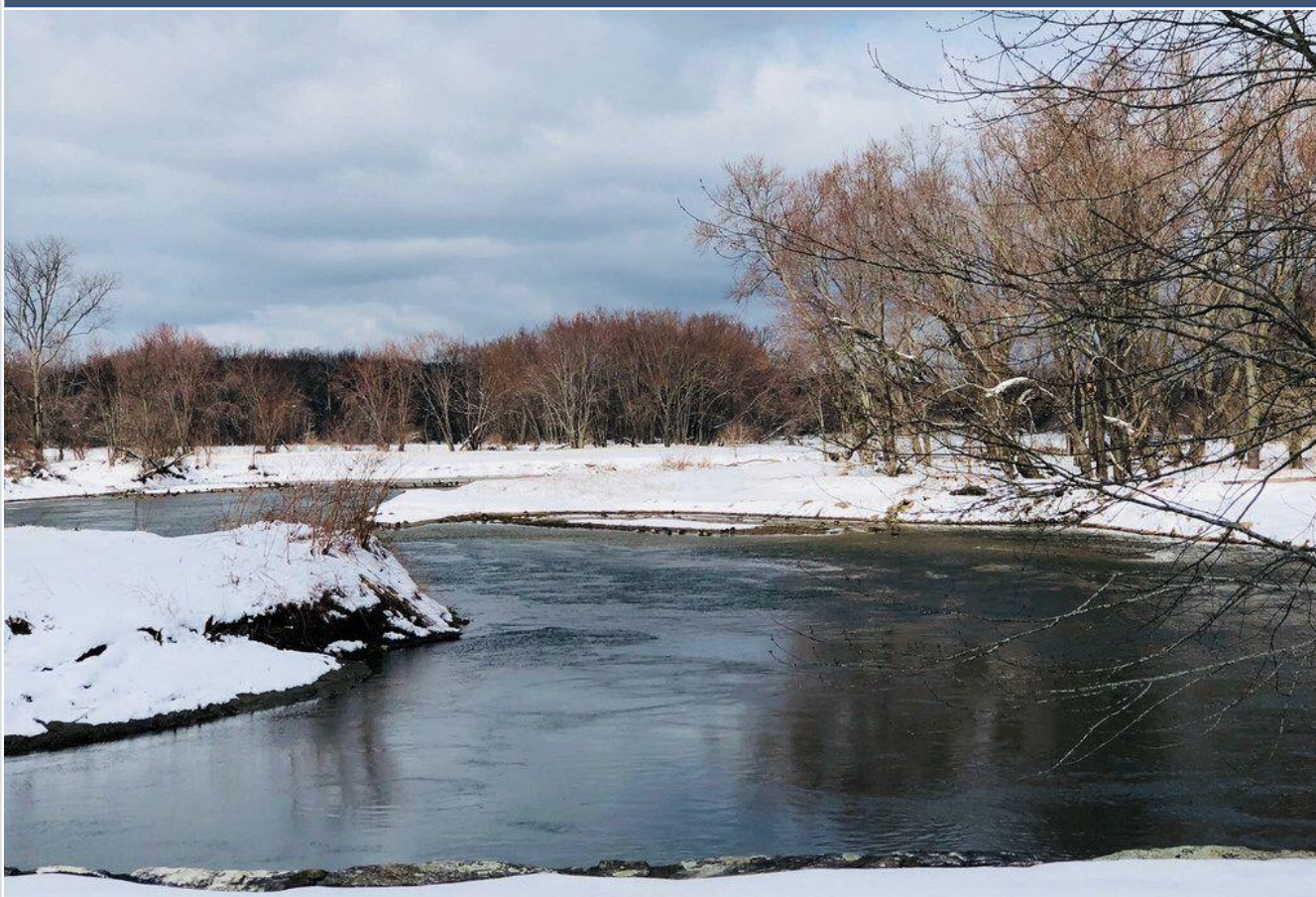
Town of Sheffield

Community Resilience Building

Summary of Findings

May 2019



Housatonic River in Winter
Source: Paul Chandler

BSC GROUP

PREPARED AND PRESENTED BY

Jeffrey T. Malloy, BSC Group, Inc.

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ATTACHMENTS

EXECUTIVE SUMMARY

In accordance with Executive Order 569, which seeks to build resilience and adapt to the impacts of climate change, the Town of Sheffield, Massachusetts is pleased to submit this Summary of Findings Report. In 2018, the Town of Sheffield applied for and received a Municipal Vulnerability Preparedness (MVP) Planning 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 followed the Community Resilience Building (CRB) framework developed by The Nature Conservancy to apply 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 preference for future state grants under the MVP program or other participating funding entities.

Dewey Memorial Hall
Source: Berkshire Edge

COMMUNITY RESILIENCE BUILDING PLANNING AND WORKSHOPS

The CRB process began with the establishment of a Core Team that included community stakeholders comprised of Municipal Town Staff. The Core Team held a strategic planning session on November 6, 2018. This Core Team meeting involved developing a broad understanding of the Hazards, Vulnerabilities, and Strengths that characterize the Town of Sheffield, and to identify a list of Preliminary Resilience Actions that the community may consider at the CRB Workshop. The Core Team meeting was also used to identify the goals of the workshop within the context of community interests and needs. The Core Team decided that it was important to use the workshops as a mechanism to engage with the community using interactive media platforms for example a GIS community data viewer prepared specifically for the workshop and an interactive demonstration of the Massachusetts Climate Change Clearinghouse Website, resilientma.org.

The Community Resilience Building Workshop was held on March 21, 2019. Workshop participants included a diverse set of community stakeholders from municipal departments, local businesses, non-government entities, and local interest groups. The CRB Workshop involved a refinement of preliminary planning efforts that drew upon Hazard Mitigation Planning efforts completed in December 2018. The Workshop involved a group presentation, two engagement and education Adaptation Action Stations, and workshop breakout groups. Information gathered during these Adaptation Action activities were integrated into previous planning efforts. Additionally, solutions derived from the breakout groups were integrated in the CRB Planning Matrix. The Workshop concluded with a group discussion to prioritize Hazards, Vulnerabilities, Strengths, and Actions developed through the CRB engagement process.

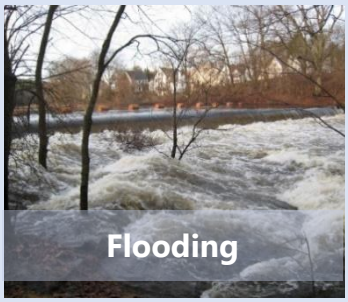
Climate resilience planning requires an ongoing effort by community stakeholders. Workshop attendees and other interested stakeholders are encouraged to provide comments, corrections, updates, or additional information of findings transcribed in this report to Jill Hughes at **jhughes@sheffieldma.gov**. The success of climate resilience planning in Sheffield is contingent upon ongoing participation of community stakeholders.

DEFINING HAZARDS

The Town of Sheffield has several challenges related to establishing resilience to the effects of climate change. Climate change is expected to increase the occurrence and intensity of natural-hazard related weather events. For example, the observed amount of precipitation falling in extreme events has increased by 71% in the Northeast from 1958-2012. In Berkshire County, of the 63 severe storm events that have resulted in property damage since 1955, 15% of them have occurred since 2014. Identifying and preparing for the hazards most prevalent within Sheffield is the first step to prepare for the effects of climate change. Understanding that climate change challenges how community resources are managed and that the distribution of risk for decision-makers is gradually changing, it is essential to establish planning efforts that prioritize explicit needs of the community.

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

TOP HAZARDS WITHIN SHEFFIELD



*I believe the wetlands in Sheffield will help **reduce the hazards** associated with climate change by mitigating pollution and flooding.*

*With the many dirt roads, **Sheffield needs to address water on the roads and crossing them**. This may entail hardening of some roadways, and using green design and nature based solutions to support the roads in other locations. culverts and bridges should be sized and designed to meet increased stormflow following higher intensity and frequency of storms (rain, ice).*

*The **more trees**, the better.*

*Elderly populations are vulnerable not only during flooding, but also during **snow and ice events**, as heart attacks are common for the health-compromised who try to shovel/plow themselves.*

***Riparian buffers** along rivers to slow erosion are valuable natural resources.*

***Open space preservation** should be prioritized.*

SURVEY SAYS...

As part of the Community Resilience Building engagement process, a survey was placed on the town website. Sheffield residents commented on their concerns and priorities related to climate change in the Town of Sheffield. The quotes on this page paraphrase the 31 responses received from the survey.

***Small changes** add up at all levels.*

*The focus of climate change planning should be one which is **long-term and forward-thinking.***

*The poor, especially the disabled, elderly, and children, are **vulnerable groups in our community**, and will require additional assistance during emergency events.*

Preparation** should be underscored with **prevention

*Green infrastructure and **nature-based solutions** can help mitigate the effects of our built environment.*

*Transportation and **infrastructure resilience** should be prioritized as these hold the community together.*

*The town should provide **education** to help the public realize the role they play in emergency preparedness.*

*The town should prioritize incentives to reduce carbon emissions and increase **renewable energy** resources.*

CHARACTERIZING A CLIMATE RESILIENT SHEFFIELD MUNICIPAL VULNERABILITIES AND STRENGTHS

The CRB process involves a robust stakeholder engagement effort and is used to characterize the vulnerabilities and strengths unique to a given community. The Sheffield 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 is an important starting point to identify community features most at risk to the effects of climate change.

Route 7 (Main Street) Corridor

Route 7 (Main Street) represents the major transportation route through Sheffield. Main Street is a state-owned roadway that is situated parallel and adjacent to the Housatonic River. More than 33% of Sheffield's total property value is located within the 100-year floodplain along Main Street. Most of Sheffield's retail, food services, community, and government services are located along Main Street. Rt. 7 provides important emergency access routes within Sheffield while also serving as the main travel corridor for tourists traveling to destinations within Sheffield or the surrounding region. The community recognizes the vulnerability of this important travel and economic corridor to the effects of flooding and are eager to engage with a broad set of municipal, state, and local business leaders to identify solutions to increase the climate resilience of Route 7 and the adjacent Housatonic River ecosystem.

Route 7 bridge, north of Sheffield Center
Source: Berkshire Eagle

Local Agriculture

Local agriculture is an important social, economic, and cultural feature within Sheffield. For example, Sheffield has one of the largest dairy farms in the state. Approximately 18% (5,644 acres) of land area within Sheffield is used for Agriculture. Of this land area, approximately 30% of Sheffield's agricultural land is within the floodplain along the Housatonic River and other smaller river tributaries. Agricultural land provides important floodplain storage and natural resources, but also presents unique hazards to the farming community livestock becomes trapped, or agricultural/dairy farmland is lost due to flooding or riverbank erosion. Workshop stakeholders also acknowledged the establishment of the marijuana industry within Sheffield as an important agricultural strength that may serve as a mechanism to promote renewable energy, vehicle electrification, and green infrastructure initiatives within the community.

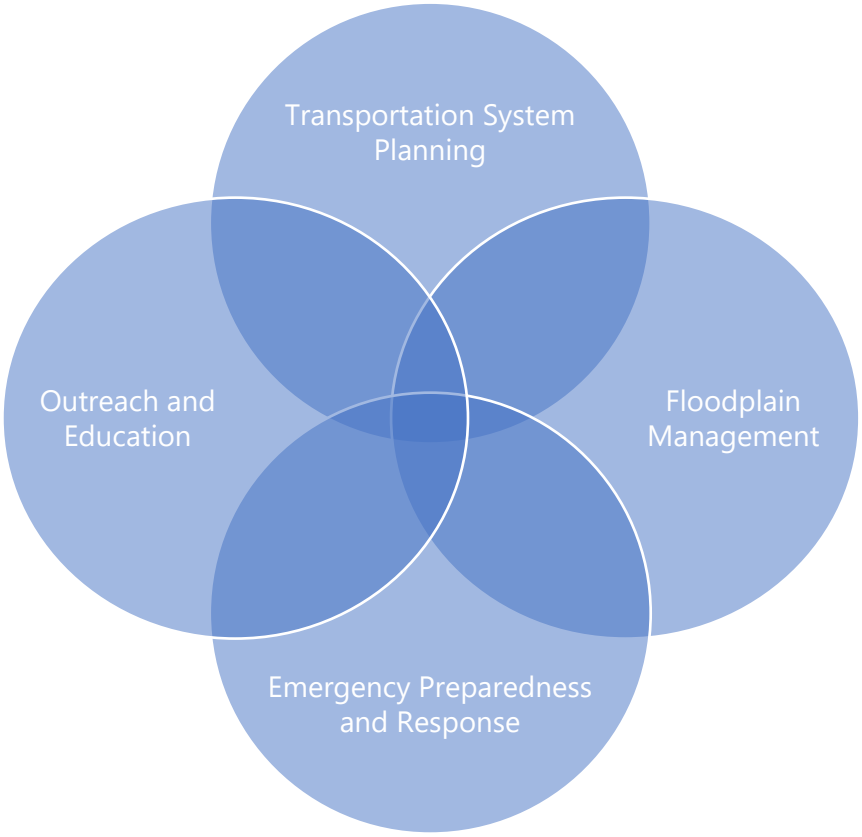
Housatonic River and Floodplains

Approximately 23% of the Town of Sheffield is located within the 100-year floodplain. Over 9 miles of roadway in Sheffield is located within the 100-year floodplain, which include state owned Rt. 7 and 7A and locally owned paved and unpaved roadways. Notably, more than 33% of Sheffield's total property value is located within the 100-year floodplain of the Housatonic River adjacent to Main Street/Route 7. Sheffield recognizes that many important community assets and resources are located within the floodplain such as local businesses and agricultural land, while the ecological resources along the Housatonic provide important tourism or recreational resources to the region. Workshop participants acknowledged that important floodplain management planning was essential for the long-term sustainability of the community and surrounding region. An emphasis was placed on the importance of establishing more awareness within the community of vulnerable assets that exist within the 100-year floodplain and how future climate related flood conditions may affect existing or future community assets.

Housatonic River and Floodplain
Source: mass.gov

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 Sheffield. These actions are organized into four 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 to allow for the development of climate resilient solutions that span infrastructural, societal, and environmental features. Through this lens, overlapping solutions that provide co-benefits were identified and prioritized.



Floodplain Management

Flooding in Sheffield is primarily a result of local topography characterized by hilly terrain and shallow soil that support headwater streams that ultimately flow to the Housatonic River. Streams such as Ironwork Brook, Dry Brook, Schenob Brook, and Willard Brook have expansive floodplains throughout the community. The Housatonic River floodplain is located along Route 7, Sheffield's primary transportation corridor. Following heavy rainfall events or extended periods of snow melt, stream and river channels, bridge and culverts spans, and drainage channels are unable to contain the volume of water flowing through the natural and built environment. Under extreme precipitation conditions stream and rivers overtop their banks and significant flooding results. State and local roadways within Sheffield are often subject to flooding, some of which are located along important emergency evacuation routes, bus routes, or along access routes to community shelters. Local businesses along Route 7, agricultural fields, and other community resources such as recreational open space remain situated within Sheffield's floodplain. Town-wide flooding issues is recognized by workshop participants as an urgent matter and it was agreed that a better understanding of the vulnerabilities and risks associated with climate related increases in flooding is needed. A specific focus was placed on the importance of conducting a roadway inventory in conjunction with a bridge and culvert assessment, that may be used to identify and prioritize roadway and drainage infrastructure that is currently vulnerable to flooding or may become so under future climate change scenarios. An inherent connection between Housatonic River Management and Floodplain Management was acknowledged by the community. A better understanding of flood dynamics in the Housatonic River floodplain was identified. Addressing bank erosion issues was also identified. Participants agreed that drawing upon local capacity such as the Conservation Commission or local businesses along the Route 7/Main Street corridor was essential to develop effective floodplain management solutions. Finally, workshop participants identified a great deal of support for initiatives that promote the use of regulatory mechanisms, green infrastructure, low-impact design, or nature-based solutions throughout the built environment to improve flooding conditions.

Floodplain Management

Roadway Inventory

Drainage Infrastructure Inventory

Evacuation Routes

Critical Buildings

Shelters/Assembly Areas

Housatonic River Management

Regulatory Mechanisms

Flood Resilient Transportation Planning

A key planning feature identified by Workshop participants is the interdependent sources of vulnerability that exist within Sheffield's transportation roadway infrastructure. Route 7 (Main Street) and 7A are state owned roadways with documented vulnerabilities to flooding. Many locally owned paved and dirt roadways are also subject to frequent flooding and washouts, especially those adjacent to steep slopes. Many of these roadways provide important emergency access and bus routes, for example Berkshire School Road near Mt. Everett High School which serves as the town's primary emergency shelter. Workshop participants emphasized the need to coordinate with state agencies (e.g. MassDOT) and grant funding

agencies to finance flood resilience projects while maintaining a focus on climate mitigation and adaptation efforts. Community engagement and outreach efforts were also noted as an important aspect of this initiative to address the lack of awareness by full time and second-home residents that may not be aware of existing vulnerabilities or evacuation procedures. Workshop participants agreed that an important first step is to conduct a roadway inventory that will identify and prioritize roadway infrastructure that is currently vulnerable to flooding or may become so under changing climate scenarios. This assessment should also include private driveways situated along steep slopes where roadway washouts present hazards to public infrastructure and safety. Efforts to establish regulatory mechanisms to promote the use of flood management strategies was also encouraged by most workshop participants

Culvert on County Road

Emergency Response Preparedness and Recovery Planning:

The Town of Sheffield has an established emergency management plan that municipal stakeholders feel adequately addresses the needs of the community in an emergency. Implementation of emergency management and preparedness for the community occurs through close coordination between municipal departments. Current emergency management procedures include preparation, mitigation, response, recovery actions, and activation and operation of shelters. Workshop participants agreed that increased capacity for emergency preparedness is an important action item the town can implement to improve resilience to the effects of a changing climate. Stakeholders indicated a need for local education initiatives as necessary to improve the town's capacity for effective emergency preparedness operations. The town has in place various systems to notify the community of important information (e.g. Town Website, Reverse911), but participants felt these

Flood Resilient Transportation Planning

Roadway Inventory

Drainage Infrastructure Inventory

Evacuation Routes

Critical Buildings

Emergency Response Preparedness

Community Outreach

Community Networks and Education

Evacuation Routes

Regional Coordination

Coordination with State Agencies

Municipal Communication Networks

Second-Home Residents

Emergency Shelter/Assembly Areas

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. Adding new users to the system to include cell phone numbers was prioritized. 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. The need to improve the capacity of existing shelters/cooling centers to function during a storm event was also acknowledged. Increasing the number of shelters within the community was also emphasized and participants expressed a need to increase the awareness of these resources at a town-wide scale. Understanding the needs and limitations of socially vulnerable populations (e.g. elderly population) should also be explicitly addressed within future planning efforts. Among the most important actions that workshop participants identified was to begin the process of developing an emergency response and recovery plan.

Outreach and Education

Community Networks and Education

Evacuation Routes

Nuisance Species and Vector Borne Disease

Shelter-In-Place

Second-Home Residents

Emergency Shelter/Assembly Areas

Outreach and Education

The need to conduct community outreach, education, and engagement concurrent with many of the other action items identified during the CRB Workshop was a predominant outcome of this process. Participants agreed that while Sheffield is a neighborly community, there are opportuntieis to increase the capcity of the community to deal with the effects of climate change through expanded community outreach and education efforts. Improving emergency preparedness policies and programs that increase the notification and communication needs of town residents was identified as a top priority. Engaging with business leaders and farmers along the Route 7 corridor and Housatonic River floodplain was identified as a priority among participants. Similarly, it was identified that increasing the overall understanding of sheltering resources in Sheffield was important as awareness of these important and established resources is lacking. Participants agreed that many of the efforts related to flood management and Housatonic River management were directly associated with increased awareness throughout the community and should focus on the importance of natural resources and emergency preparedness to enhance climate resilience. Signage, educational programs with the local school system, and efforts to educate residents or tourists of the risks associated with nuisance species such as mosquitos or ticks that carry vector borne diseases was also identified as important. Efforts to identify socially vulnerable populations (e.g. elderly groups) was encouraged while establishing shelter-in-place resources for individuals or groups that may not have the capacity to get to emergency shelters was recommended. Additionally, it was identified that there is a general lack of awareness by second-home residents of the resources made available by the community and that an important step to improve the resilience of the community was to promote an engagement initiative to these residents.

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
Flood Management	Approximately 18% (5,644 acres) of the land area within Sheffield is used for agriculture. Of this land area, approximately 30% of Sheffield's agricultural land is within the floodplain making these areas subject to agricultural loss or dairy farm loss. Most of this agricultural land is in the floodplain of the Housatonic River. Riverbank erosion should be addresses through nature-based solutions where possible. River management efforts should include farmers as central decision-makers in these efforts, including education and outreach programs. Assess practices that may reduce vulnerability of corn to extreme heat and fire events.
	Approximately 23% of the town is located within the 100-year floodplain. Develop a flood preparedness community awareness and education initiative. Focus on areas where flooding is a known concern for example in residential communities with socially vulnerable populations (Elderly residents at the Root Lane and Main Street neighborhood) or where local businesses are situated (Main Street/Route 7). Establish protocols for emergency response along Route 7 where flood events may delay response or sheltering efforts.
	Approximately 23% of the town is located within the 100-year floodplain. Continue to promote regulatory/conservation protections to important floodplain resources within the community.; Identify locations for future acquisition for conservation land to be used for flood storage. Apply nature based solutions where appropriate. Coordinate closely with local boards/commissions/interest groups to increase the capacity of these efforts. Develop community outreach programs for the community to better understand the importance and risks associated with floodplains in a changing climate. Improve flood mapping within the community to account for future climate risks, how green infrastructure or nature based solutions may improve floodplain capacity.

Flood Management (cont.)	Utilize existing organizations or local institutional capacity (e.g. Conservation Commission) to increase the capacity for Housatonic River Management. Advocate state level capacity (e.g. DEP) to finance and implement River Management efforts. Engage with the local agricultural industry to address riverbank erosion. Expand water quality testing programs in the Housatonic River. Promote the Housatonic as a recreational and cultural asset within the community that must be protected from the effects of climate change. Coordinate closely with local business/property owners along the Route 7 corridor subject to flooding associated with the Housatonic River. Establish more appropriate stream gage stations along the Housatonic River to better plan for flood events. Establish a community awareness/engagement program associated with gage installation and flood planning efforts. Conduct riverbank management efforts to minimize flood hazards (fallen trees) during storm events.
	The beaver population within Sheffield has grown to a point where this species is increasing the flood prevalence within the community.
Transportation System Planning	9.08 miles of roadway within Sheffield are located within the 100-year floodplain. Conduct road inventory to identify and prioritize roadways that are located within areas subject to flood vulnerability. Immediately prioritize roadways that are currently vulnerable to flooding. Assess locations where projected impacts of climate change may place additional roadways within vulnerable locations over time. Conduct a feasibility study to identify appropriate engineering, BMP design, or green infrastructure solutions. Coordinate with MassDOT to assess specific climate stressors such as heat stress, freeze thaw cycles, or salt application to roadway infrastructure; Identify locations to conduct pilot programs using resilient transportation infrastructure materials to address vulnerabilities associated with these stressors.
	More than 33% of Sheffield's total property value is located within the 100-year floodplain along Main Street/Route 7. Coordinate w/ MassDOT to assess and mitigate flooding on Route 7; Work with Mountain Water Systems in these efforts. Identify locations where pilot programs may be implemented that use resilient transportation infrastructure materials to address climate stressors or responses such as heat stress, freeze thaw cycles, or salt application. Coordinate these efforts with Housatonic River Flood Management efforts. Consider regulatory updates along Main Street corridor.
	Impacts to tourism within Sheffield are affected by extreme climate events and incrementally changing climate conditions such as the introduction of nuisance species. Route 7 serves as the main travel corridor for tourists either within Sheffield or those traveling through Sheffield to other destinations. Assess the effects of climate change on tourism and the local economy. Integrate these considerations into regulatory changes or municipal planning documents. Coordinate closely with transportation assessments and flood resilience projects along Route 7.

Transportation System Planning (cont.)	Sheffield has 30 bridges that cross water bodies (this number does not include c culverts and smaller crossings). Undersized bridges or culverts may constrict stream or river flow and cause flooding during extreme storm events. Develop an inventory of Town Bridges and Culverts with an assessment of climate change effects. Coordinate closely with steep slope inventory to identify locations where landslide debris flows could directly impact bridges.
	Expand upon culvert assessment; implement actions to replace prioritized culverts; coordinate closely with town roadway assessment. Coordinate closely with steep slope inventory to identify locations where landslide debris flows could directly impact culverts.
	Assess impacts on town roads and private driveways where moderate to steep slopes exist. Evaluate steep slopes, notably undeveloped forested steep slopes, for subsurface/geologic conditions that are susceptible to landslides. Coordinate closely with town roadway assessments and bridge and culvert assessments. Assess these areas for changes in plant species community changes or evidence of invasive species (plant or insect) that may increase the vulnerability of steep slopes to landslides. Consider the use of regulatory mechanisms or incentives (BMPs) or engineered solutions to address this issue where steep slopes and driveways cause washouts.
Emergency Preparedness and Response	Develop a flood mitigation plan for Berkshire School Road in the vicinity of Mt. Everett High School. Flooding of this road prevents issues evacuating students in extreme circumstances and limits access to Mt. Everett High School as the town's primary shelter without accessing it from Route 41.
	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. Evaluate recovery options for flooding events along Route 7.
Community Education and Outreach	Coordinate with local, regional, and state partners to evaluate the effects of climate change on public health. Establish a community outreach program to raise awareness of public health risks related to a changing climate and vector borne disease.
	Clearly display home and business address numbers where clearly visible to emergency responders.
	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, public health. Coordinate closely with community assessments focused on nuisance pests/invasive species, vector borne diseases, and natural resource management. Place an emphasis on locations associated with the Housatonic River floodplain.

Community Outreach and Education (cont.)	Draw upon local capacity (e.g. Sheffield Agricultural Commission) to establish practices for sustainable and climate resilient agriculture in Sheffield. Apply nature based solutions to diminish the effects of flooding, drought, or extreme weather events to Sheffield's agricultural land. Coordinate closely with the Conservation Commission to apply conservation and landscape appropriate resilient solutions within floodplain areas. Consider the use of Nature-based Solutions to address climate resilience.

The Berkshire School
Source: Berkshire School

Medium Priority Actions

Category	Action
Flood Management	Six dams are located in Sheffield. Town Hall, Fire Station, Residential Properties, Route 7, and Local Roadways at risk due to Mill Pond Dam failure. Draw upon Hazard Mitigation Plan and specifically the section related to Climate Change Impacts to evaluate freeboard conditions at Sheffield's dams. Evaluate how spillway or controlled discharges from dams will impact downstream flooding. Access available dam safety information/data to facilitate future dam safety planning initiatives.
	Livestock is subject to vulnerability during flooding events where they may become trapped or isolated, during extreme heat conditions, or during extreme snow and ice events where unprotected livestock may become isolated or lost. Develop a livestock management plan to account for the effects of a changing climate.
	Integrate flood impacts, causes, and avoidance into site plan review.
Transportation System Planning	No Medium Priority Actions Identified for this Category.
Emergency Preparedness and Response	Community engagement effort to add new users to system most notably cell phone users and second-home residents; Conduct an engagement effort with local businesses to participate in Reverse 911 improve existing system through testing. Conduct a community outreach effort to better understand the emergency preparedness, notification, and communication needs of the community.
	Develop protocols for local shelters and cooling stations; Engage in community outreach/education efforts to increase awareness of shelter/cooling shelter resources. Develop a shelter-in-place plan for residents that may choose to remain in their residence during a hazardous event. Conduct an extensive outreach and education program to ensure residents are aware of how to properly and safely shelter in place. Establish backup generation at shelters. Establish a plan that provides food and water storage at shelters. Coordinate with regional shelters (Bard College at Simons Rock, Great Barrington) to increase capacity and awareness of resources.
	Develop incentive programs for the marijuana industry. This includes renewable energy incentives for farmers or distributors. Leverage financial opportunities or partnerships to implement climate change resilience goals within the community. Develop plans for increased tourism within the community and address vulnerabilities through the development of the marijuana industry.

Community Outreach and Education	Identify locations where nuisance species are prevalent or will likely increase the vulnerability of the community with respect to public health and safety, the local economy (tourism), or natural resources. Map these areas and develop a planning approach that may include conservation or nature based solutions to address nuisance species. Develop a community outreach initiative to educate the public on the risks of nuisance species.

Low Priority Actions

Category	Action
Flood Management	Evaluate options to increase the size of the existing culvert that passes beneath the railroad tracks based on anticipated extreme precipitation/flood events.
	Evaluate areas throughout the community for the application of Green Infrastructure projects. Encourage the use of Green Infrastructure through regulatory changes or incentive programs.
Transportation System Planning	No Low Priority Action Items Identified
Emergency Preparedness and Response	Approximately 500 households including Town Buildings and businesses get their water from Mountain Water Systems. Mountain Water Systems also serves many water hydrants along Route 7. Coordinate the establishment of an emergency dispensing center in the event of an emergency. Partner with state departments such as MassDEP or Department of Energy Resources to develop water conservation management/engagement programs within the community. Assess drinking water wells within 100-year floodplain (e.g. Maple Avenue) or anticipated future floodplains for vulnerability.
	Update and reaffirm MOU with participating stakeholders; include new stakeholders; Integrate climate change vulnerabilities/risks into these agreements.
	Finalize CEMP. Integrate Climate Change Resilience into CEMP.
Community Outreach and Education	Conduct a survey of historic resources within the community subject to flooding and more specifically the effects of a climate change related flooding. Share this information with the community by incorporating the findings into the town's Open Space and Recreation Plan.

Workshop Participant List

Eric Carlson, Chairman – Zoning Board of Appeals
Jim Collingwood, Chairman – Planning Board
Dennis Sears, Chairman – Historical Commission
Tony Carlotto, Chairman – Historical Society
Sarah Gulotta, Chairman – Board of Health
Tim Fulco, Berkshire School
Nadine Hawver, Board of Selectmen
Rene Wood, Board of Selectmen
Kathy Orlando, Agricultural Commission
Kathie Loring, Executive Director – Council on Aging
Rhonda LaBombard, Town Administrator
Jill Hughes, Assistant to Town Administrator
Ed Pickert, Highway Superintendent
Renee LeClair, Town Hall Clerical Staff
Charles Lockenwitz, Facilities Manager
Jim Kelly, Agricultural Commission

Citation

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MVP Core Team Working Group

Jill Hughes, Assistant to Town Administrator
Rhonda LaBombard, Town Administrator
Renee LeClair, Board of Health Clerk
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Workshop Facilitators

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Acknowledgements

This project was made possible through funding from the Massachusetts Executive Office of Energy and Environmental Affairs' Municipal Vulnerability Preparedness (MVP) Grant Program. Thank you for providing the leadership and funds to support this process. The Town of Sheffield values your partnership.

Thank you to the community leaders within Sheffield who attended the Sheffield CRB Workshops. The institutional knowledge provided by workshop participants was essential to the success of this process.

Thank you to the Berkshire Regional Planning Commission for providing background data and community maps that were used during workshop breakout engagement activities.

CLIMATE CHANGE GRAPHIC

CLIMATE CHANGE

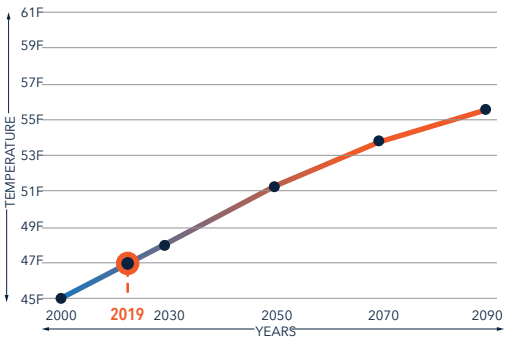
Sheffield, Massachusetts
Housatonic Watershed Basin

Alford, Becket, Cheshire, Dalton, Egremont, Great Barrington, Hancock, Hinsdale, Lanesborough, Lee, Lenox, Monterey, Mount Washington, New Ashford, New Marlborough, Otis, Peru, Pittsfield, Richmond, Sandisfield, Sheffield, Stockbridge, Tyringham, Washington, West Stockbridge, and Windsor

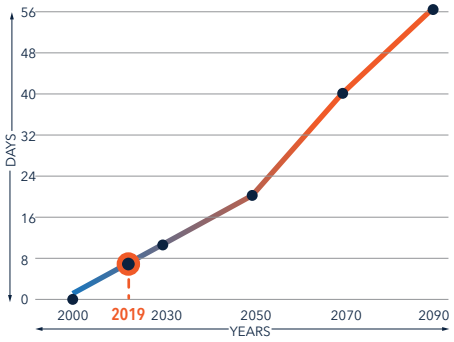
Global warming is caused by the accumulation of greenhouse gases within the atmosphere. Gases that contribute to the greenhouse effect include water vapor, carbon dioxide, methane, and nitrous oxide. On earth, human activities such as burning fossil fuels, land deforestation and wetland loss/conversion 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

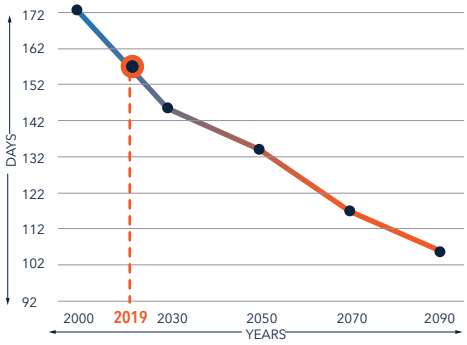
Average Temperatures



Days with Maximum Temperature over 90°F



Fewer Days Below Freezing

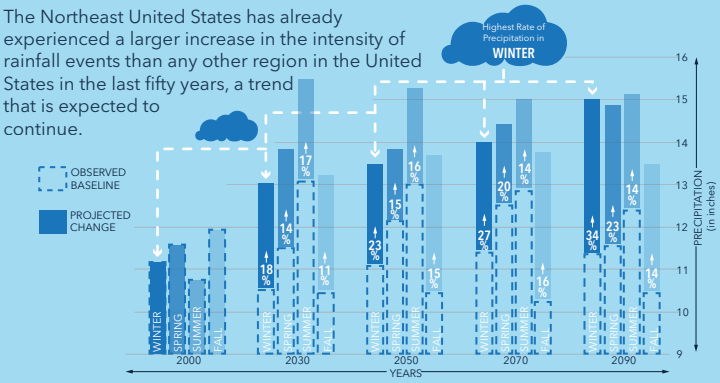


What can SHEFFIELD expect as CLIMATE CHANGES?

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.**

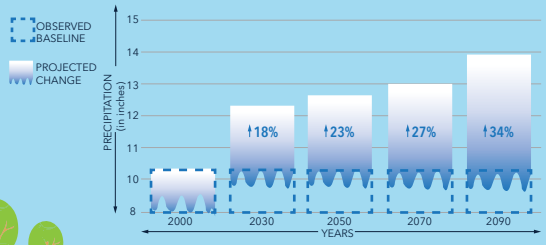
More Annual Precipitation and Inland Flooding

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.



Extreme Snow And Ice Events

Total Annual Precipitation is expected to increase within the Housatonic 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.



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

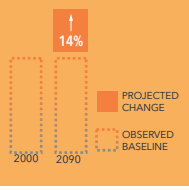
Hazardous wind conditions most commonly accompany extreme storm events. High winds and microburst conditions present unique hazards to infrastructure, public safety and important natural resources.

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

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

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

Features	Location	Ownership	V or S	Flooding	Extreme Precipitation	Extreme Heat	High Velocity Wind	Priority H - M - L	Time Short Long Ongoing
Infrastructural									
Town Roadways •Lime Kiln Road •Cross Road •Weatogue Road •Rannapo Road •County Road •Berkshire School Road •Dirt Roads •Kellogg Road	town-wide	public-private	V	9.08 miles of roadway within Sheffield are located within the 100-year floodplain. Conduct road inventory to identify and prioritize roadways that are located within areas subject to flood vulnerability. Immediately prioritize roadways that are currently vulnerable to flooding. Assess locations where projected impacts of climate change may place additional roadways within vulnerable locations over time. Conduct a feasibility study to identify appropriate engineering, BMP design, or green infrastructure solutions. Coordinate with MassDOT to assess specific climate stressors such as heat stress, freeze thaw cycles, or salt application to roadway infrastructure; Identify locations to conduct pilot programs using resilient transportation infrastructure materials to address vulnerabilities associated with these stressors.				H	O
State Roadways •Route 7 •Route 7A	road-specific	MassDOT/ public	V	More than 33% of Sheffield's total property value is located within the 100-year floodplain along Main Street/Route 7. Coordinate w/ MassDOT to assess and mitigate flooding on Route 7; Work with Mountain Water Systems in these efforts. Identify locations where pilot programs may be implemented that use resilient transportation infrastructure materials to address climate stressors or responses such as heat stress, freeze thaw cycles, or salt application. Coordinate these efforts with Housatonic River Flood Management efforts. Consider regulatory updates along Main Street corridor.				H	O
Dams •Willard Brook Dam •Mill Pond Dam •Schenob Brook Dam	specific location	public/private	V	Six dams are located in Sheffield. Town Hall, Fire Station, Residential Properties, Route 7, and Local Roadways at risk due to Mill Pond Dam failure. Draw upon Hazard Mitigation Plan and specifically the section related to Climate Change Impacts to evaluate freeboard conditions at Sheffield's dams. Evaluate how spillway or controlled discharges from dams will impact downstream flooding. Access available dam safety information/data to facilitate future dam safety planning initiatives.				M	O
Small Bridges	specific location	public	V	Sheffield has 30 bridges that cross water bodies (this number does not include c culverts and smaller crossings). Undersized bridges or culverts may constrict stream or river flow and cause flooding during extreme storm events. Develop an inventory of Town Bridges and Culverts with an assessment of climate change effects. Coordinate closely with steep slope inventory to identify locations where landslide debris flows could directly impact bridges.				H	O
Culverts	town-wide	MassDOT/ public	V	Expand upon culvert assessment; implement actions to replace prioritized culverts; coordinate closely with town roadway assessment. Coordinate closely with steep slope inventory to identify locations where landslide debris flows could directly impact culverts.				H	O

Community Resilience Building Risk Matrix									www.CommunityResilienceBuilding.org
				Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)					
H-**M**-**L** priority for action over the **S**hort or **L**ong term (and **O**ngoing) **V** = Vulnerability **S** = Strength				Flooding	Extreme Precipitation	Extreme Heat	High Velocity Wind	**Priority** **H** - **M** - **L**	**Time** **S**hort **L**ong **O**ngoing
Features	**Location**	**Ownership**	**V or S**						
Infrastructural									
Mountain Water System	Rt. 7	private	V/S	Approximately 500 households including Town Buildings and businesses get their water from Mountain Water Systems. Mountain Water Systems also serves many water hydrants along Route 7. Coordinate the establishment of an emergency dispensing center in the event of an emergency. Partner with state departments such as MassDEP or Department of Energy Resources to develop water conservation management/engagement programs within the community. Assess drinking water wells within 100-year floodplain (e.g. Maple Avenue) or anticipated future floodplains for vulnerability.				L	L
Emergency Notification Systems (Code Red/Reverse 911, Blackboard Connect)	town-wide	public	V/S	Community engagement effort to add new users to system most notably cell phone users and second-home residents; Conduct an engagement effort with local businesses to participate in Reverse 911 improve existing system through testing. Conduct a community outreach effort to better understand the emergency preparedness, notification, and communication needs of the community.				M/L	O
Mutual Aid Agreements	regional	N/A	S	Update and reaffirm MOU with participating stakeholders; include new stakeholders; Integrate climate change vulnerabilities/risks into these agreements.				L	O
Emergency Shelters •Mt. Everett High School Cooling Centers •Sheffield Senior Center and Bushnell Sage Library	specific location	public	V/S	Develop protocols for local shelters and cooling stations; Engage in community outreach/education efforts to increase awareness of shelter/cooling shelter resources. Develop a shelter-in-place plan for residents that may choose to remain in their residence during a hazardous event. Conduct an extensive outreach and education program to ensure residents are aware of how to properly and safely shelter in place. Establish backup generation at shelters. Establish a plan that provides food and water storage at shelters. Coordinate with regional shelters (Bard College at Simons Rock, Great Barrington) to increase capacity and awareness of resources.				M	O
Emergency Shelter Accessibility (Berkshire School Road)	specific location	public	V	Develop a flood mitigation plan for Berkshire School Road in the vicinity of Mt. Everett High School. Flooding of this road prevents issues evacuating students in extreme circumstances and limits access to Mt. Everett High School as the town's primary shelter without accessing it from Route 41.				H	S
Railroad Tracks @ Ranapo Road and Ashley Falls Bridge	specific location	public/private	V	Evaluate options to increase the size of the existing culvert that passes beneath the railroad tracks based on anticipated extreme precipitation/flood events.				L	L
Lack of Green Infrastructure	town-wide	N/A	V	Evaluate areas throughout the community for the application of Green Infrastructure projects. Encourage the use of Green Infrastructure through regulatory changes or incentive programs.				L	L

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

Features	Location	Ownership	V or S	Flooding	Extreme Precipitation	Extreme Heat	High Velocity Wind	Priority H - M - L	Time S Long O ngoing
Societal									
Vector Borne Disease (Mosquitos, Ticks)	town-wide	N/A	V	Coordinate with local, regional, and state partners to evaluate the effects of climate change on public health. Establish a community outreach program to raise awareness of public health risks related to a changing climate and vector borne disease.				H	O
Tourism •Impact from Mosquitos •Impact from Water Levels in Housatonic •Impacts from Flooding on Route 7	specific location	private	V	Impacts to tourism within Sheffield are affected by extreme climate events and incrementally changing climate conditions such as the introduction of nuisance species. Route 7 serves as the main travel corridor for tourists either within Sheffield or those traveling through Sheffield to other destinations. Assess the effects of climate change on tourism and the local economy. Integrate these considerations into regulatory changes or municipal planning documents. Coordinate closely with transportation assessments and flood resilience projects along Route 7.				H	O
Agricultural Land •Trapped Livestock	town-wide	private	V	Livestock is subject to vulnerability during flooding events where they may become trapped or isolated, during extreme heat conditions, or during extreme snow and ice events where unprotected livestock may become isolated or lost. Develop a livestock management plan to account for the effects of a changing climate.				M	L
Agricultural Land •Loss of Productive Ag. Land on Housatonic River	town-wide	private	V	Approximately 18% (5,644 acres) of the land area within Sheffield is used for agriculture. Of this land area, approximately 30% of Sheffield's agricultural land is within the floodplain making these areas subject to agricultural loss or dairy farm loss. Most of this agricultural land is in the floodplain of the Housatonic River. Riverbank erosion should be addresses through nature-based solutions where possible. River management efforts should include farmers as central decision-makers in these efforts, including education and outreach programs. Assess practices that may reduce vulnerability of corn to extreme heat and fire events.				H	O
Regulatory Structure	N/A	public	V/S	Integrate flood impacts, causes, and avoidance into site plan review.				M	L
Comprehensive Emergency Management Plan (CEMP)	town-wide	public	V/S	Finalize CEMP. Integrate Climate Change Resilience into CEMP.				L	L
Flood Preparedness w/in Community	town-wide	public/private	V	Approximately 23% of the town is located within the 100-year floodplain. Develop a flood preparedness community awareness and education initiative. Focus on areas where flooding is a known concern for example in residential communities with socially vulnerable populations (Elderly residents at the Root Lane and Main Street neighborhood) or where local businesses are situated (Main Street/Route 7). Establish protocols for emergency response along Route 7 where flood events may delay response or sheltering efforts.				H	O
Historic/Cultural Resources	town-wide	public/private	V	Conduct a survey of historic resources within the community subject to flooding and more specifically the effects of a climate change related flooding. Share this information with the community by incorporating the findings into the town's Open Space and Recreation Plan.				L	L
Emergency Preparedness - Home and Business address visibility	town-wide	public	V	Clearly display home and business address numbers where clearly visible to emergency responders.				H	S
Emergency Preparedness - Shelter-In-Place	town-wide	private	V/S	Develop, distribute and widely promote Sheltering in Place and Disaster Preparedness materials.				L	O

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Features	Location	Ownership	V or S	Flooding	Extreme Precipitation	Extreme Heat	High Velocity Wind	Priority H - M - L	Time S hort L ong O ngoing
Societal									
Agriculture - Marijuana Industry	town-wide	public/private	S	Develop incentive programs for the marijuana industry. This includes renewable energy incentives for farmers or distributors. Leverage financial opportunities or partnerships to implement climate change resilience goals within the community. Develop plans for increased tourism within the community and address vulnerabilities through the development of the marijuana industry.				M	O
Emergency Response Preparedness: Recovery Plan	town-wide	public	V	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. Evaluate recovery options for flooding events along Route 7.				H	O

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Features	Location	Ownership	V or S	Flooding	Extreme Precipitation	Extreme Heat	High Velocity Wind	Priority **H** - **M** - **L**	Time **S**hort **L**ong **O**ngoing
Environmental									
Nuisance Pests/Invasive Plant Species •Mosquitos •Ticks •Poison Ivy	town-wide	N/A	V	Identify locations where nuisance species are prevalent or will likely increase the vulnerability of the community with respect to public health and safety, the local economy (tourism), or natural resources. Map these areas and develop a planning approach that may include conservation or nature based solutions to address nuisance species. Develop a community outreach initiative to educate the public on the risks of nuisance species.				M	O
Open Space	location-specific	state	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, public health. Coordinate closely with community assessments focused on nuisance pests/invasive species, vector borne diseases, and natural resource management. Place an emphasis on locations associated with the Housatonic River floodplain.				H	O
Floodplains •Housatonic River Floodplain •Willard Brook Floodplain •Schenob Brook Floodplain •Dry Brook Floodplain •Ironwork Brook	town-wide	public	S	Approximately 23% of the town is located within the 100-year floodplain. Continue to promote regulatory/conservation protections to important floodplain resources within the community.; Identify locations for future acquisition for conservation land to be used for flood storage. Apply nature based solutions where appropriate. Coordinate closely with local boards/commissions/interest groups to increase the capacity of these efforts. Develop community outreach programs for the community to better understand the importance and risks associated with floodplains in a changing climate. Improve flood mapping within the community to account for future climate risks, how green infrastructure or nature based solutions may improve floodplain capacity.				H	O
Steep Slopes >15%	town-wide	public/private	V	Assess impacts on town roads and private driveways where moderate to steep slopes exist. Evaluate steep slopes, notably undeveloped forested steep slopes, for subsurface/geologic conditions that are susceptible to landslides. Coordinate closely with town roadway assessments and bridge and culvert assessments. Assess these areas for changes in plant species community changes or evidence of invasive species (plant or insect) that may increase the vulnerability of steep slopes to landslides. Consider the use of regulatory mechanisms or incentives (BMP's) or engineered solutions to address this issue where steep slopes and driveways cause washouts.				H	O
Housatonic River Management	town-wide	public/private	V/S	Utilize existing organizations or local institutional capacity (e.g. Conservation Commission) to increase the capacity for Housatonic River Management. Advocate state level capacity (e.g. DEP) to finance and implement River Management efforts. Engage with the local agricultural industry to address riverbank erosion. Expand water quality testing programs in the Housatonic River. Promote the Housatonic as a recreational and cultural asset within the community that must be protected from the effects of climate change. Coordinate closely with local business/property owners along the Route 7 corridor subject to flooding associated with the Housatonic River. Establish more appropriate stream gage stations along the Housatonic River to better plan for flood events. Establish a community awareness/engagement program associated with gage installation and flood planning efforts. Conduct riverbank management efforts to minimize flood hazards (fallen trees) during storm events.				H	S

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

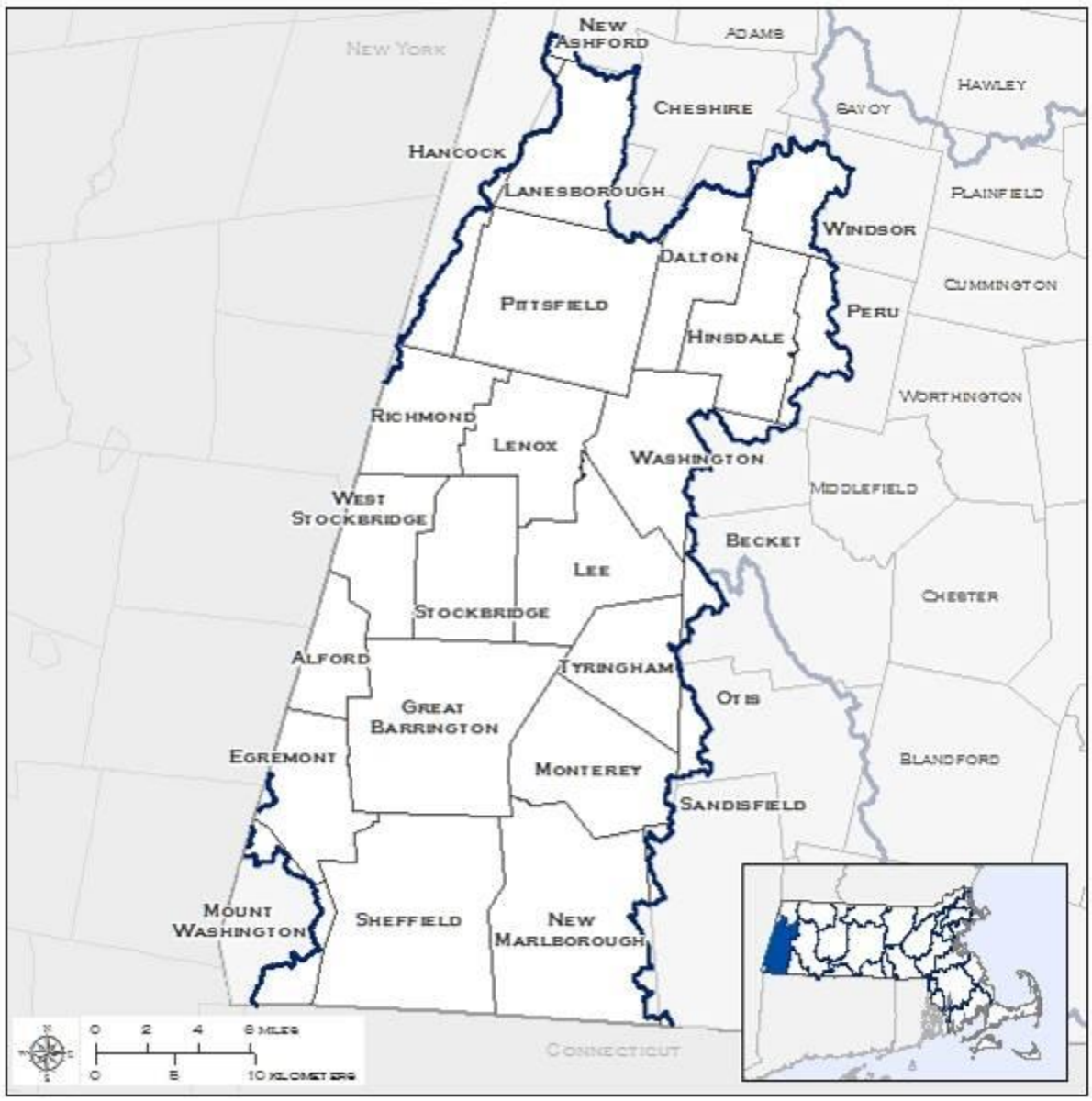
Features	Location	Ownership	V or S	Flooding	Extreme Precipitation	Extreme Heat	High Velocity Wind	Priority **H** - **M** - **L**	Time **S**hort **L**ong **O**ngoing
Environmental									
Sustainable and Resilient Agriculture	town-wide	public/private	V/S	Draw upon local capacity (e.g. Sheffield Agricultural Commission) to establish practices for sustainable and climate resilient agriculture in Sheffield. Apply nature based solutions to diminish the effects of flooding, drought, or extreme weather events to Sheffield's agricultural land. Coordinate closely with the Conservation Commission to apply conservation and landscape appropriate resilient solutions within floodplain areas. Consider the use of Nature-based Solutions to address climate resilience.				H	O
Beaver/Flood Management	town-wide	public/private	V	The beaver population within Sheffield has grown to a point where this species is increasing the flood prevalence within the community.				H	O

HOUSATONIC BASIN CLIMATE PROJECTIONS

HOUSATONIC BASIN

MUNICIPALITIES WITHIN HOUSATONIC BASIN:

Alford, Becket, Cheshire, Dalton, Egremont, Great Barrington, Hancock, Hinsdale, Lanesborough, Lee, Lenox, Monterey, Mount Washington, New Ashford, New Marlborough, Otis, Peru, Pittsfield, Richmond, Sandisfield, Sheffield, Stockbridge, Tyringham, Washington, West Stockbridge, and Windsor



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.

HOUSATONIC BASIN

Housatonic 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	44.32	+2.24 to +4.61	+3.09 to +6.72	+3.69 to +9.29	+4.28 to +11.30
	Winter	22.46	+2.56 to +5.86	+3.29 to +8.82	+4.39 to +10.49	+4.74 to +11.97
	Spring	42.73	+1.77 to +3.42	+2.43 to +5.55	+2.98 to +7.69	+3.54 to +9.50
	Summer	65.08	+2.33 to +4.44	+3.03 to +6.93	+3.53 to +10.02	+4.14 to +12.27
	Fall	46.64	+2.35 to +5.29	+3.81 to +6.94	+3.84 to +9.75	+4.12 to +12.02
Maximum Temperature	Annual	55.41	+2.01 to +4.42	+2.74 to +6.89	+3.27 to +9.52	+3.87 to +11.42
	Winter	32.29	+2.08 to +5.13	+2.82 to +7.86	+3.61 to +9.41	+3.94 to +10.88
	Spring	54.24	+1.53 to +3.43	+2.27 to +5.56	+2.82 to +7.98	+3.47 to +9.59
	Summer	77.04	+2.13 to +4.58	+2.67 to +7.27	+3.37 to +10.49	+3.95 to +12.78
	Fall	57.67	+2.53 to +5.19	+3.51 to +7.38	+3.64 to +10.13	+4.20 to +12.39
Minimum Temperature	Annual	33.23	+2.41 to +4.91	+3.50 to +6.93	+4.15 to +9.13	+4.53 to +11.28
	Winter	12.62	+2.82 to +6.62	+3.87 to +9.59	+5.22 to +11.53	+5.47 to +13.11
	Spring	31.21	+1.91 to +3.71	+2.54 to +6.00	+3.25 to +7.54	+3.70 to +9.22
	Summer	53.11	+2.45 to +4.64	+3.30 to +7.08	+3.75 to +9.69	+4.15 to +11.83
	Fall	35.62	+2.10 to +5.28	+3.58 to +6.77	+3.87 to +9.38	+4.04 to +11.59

- The Housatonic 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 2.7 °F to 7.3 °F (3-9% increase); end of century increase of 4 °F to 12.8 °F (5-17% increase).
    - Fall mid-century increase of 3.5 °F to 7.4°F (6-13% increase); end of century increase by and 4.2 °F to 12.4 °F (7-21% increase).
- Seasonally, minimum winter and fall temperatures are expected to see increases throughout the 21st century.
    - Winter mid-century increase of 3.9 °F to 9.6 °F (31-76% increase); end of century increase by 5.5 °F to 13.1 °F (43-104% increase).
    - Fall mid-century of 3.6 °F to 6.8 °F (10-19% increase); end of century increase of 4.0°F to 11.6 °F (11-33% increase).

HOUSATONIC BASIN

Housatonic 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	1.33	+2.89 to +10.27	+4.43 to +20.21	+5.59 to +38.75	+7.19 to +56.83
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.04	+0.07 to +0.42	+0.11 to +0.83	+0.19 to +1.82	+0.14 to +3.21
	Summer	1.27	+2.74 to +9.06	+3.83 to +18.05	+4.81 to +32.71	+6.55 to +46.77
	Fall	0.02	+0.16 to +0.91	+0.21 to +1.86	+0.22 to +4.73	+0.24 to +6.84
Days with Maximum Temperature Over 95°F	Annual	0.07	+0.29 to +2.77	+0.49 to +6.45	+0.74 to +14.71	+1.06 to +27.38
	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 +0.04	+0.00 to +0.06	+0.00 to +0.34	+0.00 to +0.94
	Summer	0.07	+0.26 to +2.60	+0.45 to +6.16	+0.71 to +13.51	+0.96 to +24.96
	Fall	0.00	+0.00 to +0.23	+0.02 to +0.48	+0.03 to +0.95	+0.00 to +1.62
Days with Maximum Temperature Over 100°F	Annual	0.00	+0.00 to +0.26	+0.01 to +1.03	+0.03 to +3.11	+0.02 to +7.35
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.04	+0.00 to +0.08
	Summer	0.00	+0.00 to +0.23	+0.01 to +1.01	+0.03 to +2.92	+0.02 to +7.10
	Fall	0.00	+0.00 to +0.01	+0.00 to +0.06	+0.00 to +0.19	+0.00 to +0.36

- Due to projected increases in average and maximum temperatures throughout the end of the century, the Housatonic basin is also expected to experience an increase in days with daily maximum temperatures over 90 °F, 95 °F, and 100 °F.
    - Annually, the Housatonic basin is expected to see days with daily maximum temperatures over 90 °F increase by 4 to 20 more days by mid-century, and 7 to 57 more days by the end of the century.
    - Seasonally, summer is expected to see an increase of 4 to 18 more days with daily maximums over 90 °F by mid-century.
    - By end of century, the Housatonic basin is expected to have 7 to 47 more days.

HOUSATONIC BASIN

Housatonic 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	15.92	-5.49 to -10.12	-7.21 to -11.96	-8.19 to -12.68	-8.52 to -13.56
	Winter	15.01	-5.17 to -9.62	-6.83 to -11.36	-7.67 to -11.98	-7.91 to -12.71
	Spring	0.93	-0.23 to -0.79	-0.27 to -0.78	-0.35 to -0.87	-0.38 to -0.90
	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	-0.04 to -0.00	-0.04 to -0.00	-0.04 to -0.00	-0.04 to -0.00
Days with Minimum Temperature Below 32°F	Annual	172.97	-10.88 to -28.16	-19.40 to -38.83	-22.42 to -53.75	-23.77 to -63.13
	Winter	86.9	-0.80 to -6.06	-1.84 to -8.83	-2.92 to -16.06	-3.53 to -19.72
	Spring	48.58	-4.49 to -9.51	-6.03 to -14.89	-7.46 to -19.46	-9.46 to -21.18
	Summer	0.13	-0.02 to -0.21	-0.02 to -0.35	-0.02 to -0.31	-0.02 to -0.31
	Fall	37.34	-4.68 to -13.01	-9.26 to -16.13	-9.18 to -21.42	-9.42 to -24.72

- Due to projected increases in average and minimum temperatures throughout the end of the century, the Housatonic 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 2 to 9 fewer days by mid-century, and 4 to 20 fewer days by end of century.
    - Spring is expected to have 6 to 15 fewer days by mid-century, and 9 to 21 fewer days by end of century.
    - Fall is expected to have 9 to 16 fewer days by mid-century, and 9 to 25 fewer days by end of century.

HOUSATONIC BASIN

Housatonic 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	7822.03	-670.10 to -1372.30	-900.56 to -1924.44	-1057.85 to -2516.06	-1213.52 to -2905.02
	Winter	3849.68	-214.60 to -542.71	-290.64 to -807.49	-388.93 to -951.53	-436.61 to -1099.08
	Spring	2059.3	-149.28 to -297.95	-209.42 to -480.77	-257.38 to -639.14	-309.62 to -765.07
	Summer	223.89	-75.13 to -127.09	-99.65 to -163.79	-120.06 to -192.72	-129.86 to -202.21
	Fall	1689.59	-193.19 to -432.12	-311.38 to -537.87	-309.15 to -743.70	-325.05 to -863.11
Cooling Degree-Days (Base 65°F)	Annual	261.29	+160.30 to +347.99	+222.51 to +603.30	+263.27 to +940.20	+310.17 to +1262.07
	Winter	nan	nan to nan	+0.86 to +4.31	+1.57 to +1.57	+2.35 to +10.65
	Spring	12.03	+6.43 to +18.90	+11.04 to +36.74	+13.95 to +62.62	+12.37 to +97.39
	Summer	231.11	+126.85 to +280.97	+169.14 to +472.65	+199.51 to +730.12	+239.39 to +931.12
	Fall	18.38	+18.32 to +60.49	+28.08 to +98.50	+35.42 to +176.56	+41.87 to +235.21
Growing Degree-Days (Base 50°F)	Annual	1899.77	+386.61 to +743.64	+528.03 to +1186.76	+626.85 to +1776.20	+713.76 to +2238.16
	Winter	3.09	+0.02 to +7.78	+0.88 to +8.08	+0.19 to +14.19	+2.04 to +19.93
	Spring	207.26	+51.95 to +117.64	+83.17 to +202.54	+103.91 to +307.63	+109.22 to +407.29
	Summer	1389.48	+212.76 to +406.04	+276.17 to +635.70	+321.76 to +919.82	+376.08 to +1126.63
	Fall	293.17	+100.86 to +258.98	+154.03 to +362.52	+158.26 to +550.34	+201.11 to +688.38

- Due to projected increases in average, maximum, and minimum temperatures throughout the end of the century, the Housatonic 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 8-21% (291-807 degree-days) by mid-century, and a decrease of 11-29% (437 -1099 degree-days) by the end of century.
    - The spring season is expected to decrease in heating degree-days by 10-23% (209-481 degree-days) by mid-century, and by 15-37% (310 -765 degree-days) by the end of century.
    - The fall season is expected to decreases in heating degree-days by 18-32% (311 -538 degree-days) by mid-century, and by 19-51% (325 -863 degree-days) by the end of century.
- Conversely, due to projected increasing temperatures, summer cooling degree-days are expected to increase by 73-205% (169 -473 degree-days) by mid-century, and by 104-403% (239-931 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 20-46% (276 -636 degree-days) by mid-century, and by 27-81% (376 -1127 degree-days) by end of century.
- Spring is expected to see an increase by 40-98% (83-203 degree-days) by mid-century and 53-197% (109-407 degree-days) by end of century.
- Fall is expected to see an increase by 53-124% (154-362 degree-days) by mid-century and 69-235% (201-688 degree-days) by end of century.

HOUSATONIC BASIN

Housatonic Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Days with Precipitation Over 1"	Annual	6.02	-0.24 to +2.10	+0.37 to +2.84	+0.58 to +2.84	+0.35 to +3.97
	Winter	0.92	-0.04 to +0.53	+0.01 to +0.87	+0.02 to +1.05	+0.11 to +1.19
	Spring	1.35	-0.08 to +0.45	-0.05 to +0.57	-0.02 to +0.93	+0.06 to +1.38
	Summer	2.1	-0.19 to +0.68	-0.20 to +0.93	-0.33 to +0.85	-0.24 to +0.76
	Fall	1.62	-0.36 to +0.78	-0.34 to +0.85	-0.25 to +1.07	-0.26 to +1.22
Days with Precipitation Over 2"	Annual	0.57	-0.16 to +0.37	-0.12 to +0.42	+0.01 to +0.57	+0.04 to +0.73
	Winter	0.02	-0.03 to +0.03	-0.03 to +0.07	-0.02 to +0.08	-0.02 to +0.09
	Spring	0.1	+0.00 to +0.08	-0.01 to +0.11	+0.00 to +0.21	+0.00 to +0.26
	Summer	0.35	-0.10 to +0.19	-0.06 to +0.19	-0.10 to +0.19	-0.11 to +0.23
	Fall	0.1	-0.11 to +0.17	-0.04 to +0.19	-0.03 to +0.20	-0.05 to +0.19
Days with Precipitation Over 4"	Annual	0.01	-0.02 to +0.06	-0.01 to +0.06	-0.01 to +0.09	-0.02 to +0.12
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.01
	Summer	0.00	-0.02 to +0.04	-0.02 to +0.03	-0.01 to +0.04	-0.02 to +0.05
	Fall	0.00	-0.02 to +0.05	-0.02 to +0.05	-0.02 to +0.05	-0.02 to +0.05

- The projections for expected number of days receiving precipitation over one inch are variable for the Housatonic 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 of 0-1 days by the end of century.
    - The spring season is expected to see an increase in days with precipitation over one inch of 0-1 days by mid-century, and an increase of 0-1 days by the end of century.

HOUSATONIC BASIN

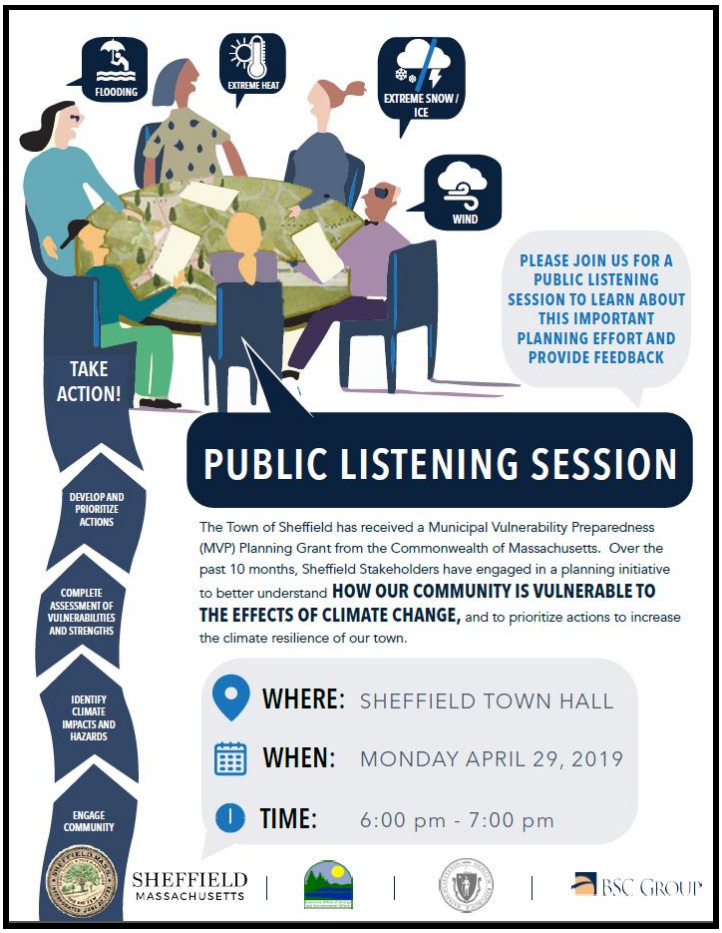
Housatonic Basin		Observed Baseline 1971-2000 (Inches)	Projected Change in 2030s (Inches)	Mid-Century Projected Change in 2050s (Inches)	Projected Change in 2070s (Inches)	End of Century Projected Change in 2090s (Inches)
Total Precipitation	Annual	47.43	+0.21 to +4.41	+1.09 to +6.42	+1.57 to +6.85	+1.56 to +7.66
	Winter	10.22	-0.50 to +1.81	+0.09 to +2.35	+0.21 to +2.77	+0.81 to +3.51
	Spring	12.07	-0.05 to +1.74	+0.20 to +1.78	+0.38 to +2.41	+0.48 to +2.77
	Summer	13.23	-0.15 to +2.20	-0.13 to +2.15	-0.35 to +1.85	-0.79 to +1.91
	Fall	11.86	-1.35 to +1.40	-1.32 to +1.83	-1.41 to +1.84	-1.69 to +1.67

- Similar to projections for number of days receiving precipitation over a specified threshold, seasonal projections for total precipitation are also variable for the Housatonic basin.
    - The winter season is expected to experience the greatest change with an increase of 1-23% by mid-century, and of 8-34% 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 Housatonic or basin could see a decrease of 0.1 to an increase of 2.2 inches by mid-century (decrease of 1% to increase of 16%), and a decrease of 0.8 to an increase of 1.9 inches by the end of the century (decrease of 6% to increase of 14%).
        - The fall season projections for the Housatonic basin could see a decrease of 1.3 to an increase of 1.8 inches by mid-century (decrease of 11% to increase of 15% and a decrease of 1.7 to an increase of 1.7 inches by the end of the century (decrease of 14% to increase of 14%).

Housatonic 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	15.98	-0.07 to +1.00	-0.06 to +1.94	-0.19 to +1.89	-0.08 to +2.26
	Winter	11.32	-1.03 to +0.67	-0.53 to +0.83	-0.95 to +0.95	-1.23 to +1.25
	Spring	10.84	-1.18 to +0.92	-1.13 to +1.31	-1.42 to +0.94	-1.49 to +0.95
	Summer	10.64	-0.83 to +1.19	-0.46 to +1.04	-0.73 to +1.51	-0.86 to +2.42
	Fall	11.27	-0.07 to +1.78	+0.14 to +2.80	+0.06 to +3.04	+0.19 to +2.79

- 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 Housatonic 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 experience an increase of 0-3 days in consecutive dry days by the end of the century.

PUBLIC LISTENING SESSION - FEEDBACK



Comment No.	Participant Comment (summarized for clarity)
Comment 1	100-year floodplain depicted on FEMA Maps can no longer be trusted as accurately reflecting the floodplain. Critical areas in town should be reviewed in relation to accurate flood vulnerability.
Comment 2	Extreme snow and ice should be reflected as extreme precipitation on the matrix and within the Findings Report.
Comment 3	Sheffield should be paying close attention to carbon reduction/mitigation strategies.
Comment 4	The schools within the community should be more actively involved in climate adaptation planning processes.
Comment 5	Sheffield needs to find new/innovative mechanisms to reach the public (e.g. social media platforms, newspapers, senior center postings, mailings, etc.) “people need to know about what is going on and how they can help”
Comment 6	Sheffield needs to work closely with MassDOT.
Comment 7	The schools are taking proactive approaches to implement renewable energy solutions and green infrastructure/nature-based solutions into its operations. Use these examples to educate the broader community.
Comment 8	Participants wanted to better understand if they could prepare their own grant applications and request municipal approval for submission to the state as part of this (and other) grant funding programs.