Town of Dracut
MASSACHUSETTS

MUNICIPAL VULNERABILITY PREPAREDNESS (MVP) PLAN

Community Resilience Building Workshop

Summary of Findings

Submitted by

GREEN INTERNATIONAL AFFILIATES, INC.

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Building Strong Client Relationships Through Engineering Excellence

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EXECUTIVE SUMMARY AND OVERVIEW

The Municipal Vulnerability Preparedness (MVP) grant program was initiated by the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) in 2017 following the issuance of the Governor Baker's Executive Order 565 as well as other administration-led state and local partnerships to provide support for cities and towns in Massachusetts in planning for climate change resiliency and implementing priority projects and key climate change adaptation actions. EO 569 was codified under the Environmental Bond Bill in 2018. The EOEEA grants require that MVP Plans be developed under the guidance of MVP certified providers who are trained to provide technical assistance to communities using the Community Resilience Building Framework.

EXECUTIVE ORDER 569

In September 2016, Governor Baker issued Executive Order No. 569 (EO 569), Establishing an Integrated Climate Change Strategy for the Commonwealth. The executive order is based on the following Administration's findings:

- Climate change and extreme weather events present a serious threat to the environment, residents, communities, public safety, property, and the Commonwealth's economy.
- The Global Warming Solutions Act (GWSA) calls for certain steps to reduce greenhouse gas (GHG) emissions limits and prepare for the impacts of climate change for 2020 and 2050, but no interim limits for 2030 and 2040.
- The Commonwealth can provide leadership by reducing its own emissions from state operations, planning and preparing for impending climate change, and enhancing the resiliency.
- The transportation sector continues to be a significant contributor to GHG emissions and is the only sector identified in the GWSA with a volumetric increase in GHG emissions.
- The generation and consumption of energy continues to be a significant contributor to GHG emissions in the Commonwealth, and there is significant potential for reducing emissions through continued diversification of our energy supply and adoption of a comprehensive energy plan.
- State agencies and authorities, as well as cities and towns, must prepare for the impacts of climate change by assessing vulnerability and adopting strategies to increase the adaptive capacity and resiliency of infrastructure and other assets.
- The Executive Office of Public Safety and Security and its constituent agencies, including the Massachusetts Emergency Management Agency, have deep institutional expertise in preparing for, responding to, and mitigating damage from natural hazards.
- Only through an integrated strategy bringing together all parts of state and local government will Massachusetts be able to address these threats effectively.

EO 569 was made law in 2018 as part of the Environmental Bond Bill.

I. MUNICIPAL VULNERABILITY PREPAREDNESS (MVP) GRANT PROGRAM

The Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA - https://www.mass.gov/orgs/executive-office-of-energy-and-environmental-affairs) created the position of Assistant Secretary of Climate Change and appointed Katie Theoharides as Assistant Secretary. Under Katie's leadership, EOEEA also created the Municipal Vulnerability Preparedness (MVP) grant program. The following excerpt taken from the EOEEA website (https://www.mass.gov/service-details/mvp-program-information) describes the purpose of the MVP grant program:

The Municipal Vulnerability Preparedness grant program (MVP) provides support for cities and towns in Massachusetts to plan for resiliency and implement key climate change adaptation actions for resiliency. The state awards communities with funding to complete vulnerability assessments and develop action-oriented resiliency plans. The program helps communities to:

- Define extreme weather and natural and climate related hazards
- Understand how their community may be impacted by climate change with a Massachusetts specific climate change clearinghouse with the latest science and data: link to http://www.resilientma.org/
- Identify existing and future vulnerabilities and strengths
- Develop and prioritize actions for the community
- Identify opportunities to take action to reduce risk and build resilience
- Implement key actions identified through the planning process

MVP certified providers are trained in workshops across the state to provide technical assistance to communities in completing the assessment and resiliency plan using the Community Resilience Building Framework. Towns and cities will then be able to choose the provider of their choice from a list of certified providers. Communities who complete the MVP program become certified as an MVP community and are eligible for MVP Action grant funding and other opportunities.

Community Resilience Building Framework

Under the MVP Program, Massachusetts communities will prepare MVP Plans for their community using a proven, workshop-based model developed by The Nature Conservancy (TNC), called the Community Resilience Building Framework (https://www.communityresiliencebuilding.com/). Under the MVP Grant program, the MVP Plan development must be led by a certified MVP Provider. Dracut retained the services of Green International Affiliates, Inc., whose Stormwater and Permitting Group Leader, Danielle Spicer, P.E., is a certified MVP Provider. Ms. Spicer served as the lead facilitator for the project.

Other Recent Mitigation Developments

In 2005, the National Institute of Building Sciences (NIBS) Multi-hazard Mitigation Council released a study, entitled Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities, which determined that for every $1 of natural hazard mitigation funded by the Federal Emergency Management Agency (FEMA) between 1993 and 2003, the country avoided $4 in future losses from natural disasters. Towards the end of last year, the NIBS released a 2017 Interim Report that shows that investing in mitigation has resulted in an even greater benefit than was previously determined in the 2005 study. The 2017 interim report found that for Federal Mitigation Grants, there is a $6 benefit or savings for every $1 spent.

The 2017 study also found that where more stringent codes are used, there is a $4 benefit or savings for every $1 spent. The 2017 NIBS Interim report looked at number of disaster types, including floods, wind,

earthquakes and wildfires, and all of them have a positive benefit cost ratio for mitigation investment. In particular, flood mitigation had the highest benefit cost ratio (7:1). The full 2017 NIBS study can be found at https://www.nibs.org/page/mitigationsaves.

Since the 2005 NIBS report was released, the US has experienced several devastating disasters, including major hurricanes (i.e. Katrina, Sandy, Harvey, Irma, and Maria) and the extensive wildfires in California. Funding for mitigation projects has decreased even though the benefits of mitigation have been clearly known for some time. As a result of not being more proactive, the United States is now looking at some of the highest collective losses from natural disasters in our nation's history.

While Massachusetts evaluates its vulnerability to climate change through the Governor's EO 569 - Establishing an Integrated Climate Change Strategy for the Commonwealth, increased investment in flood mitigation would be an obvious cost-effective strategy, especially when considering the new B/C ratio of 7:1 from the NIBS 2017 study.

Multiplying Probability by Consequences is a simple way to estimate Risk. New 2018 climate change data from the Northeast Climate Science Center at the University of Massachusetts indicates an increase in the probability of more extreme weather events that will cause more flooding. Town of Dracut should consider its vulnerability (i.e. Risk) relative to future flooding probabilities. Considering the residential/commercial development occurring in future flood-prone areas (i.e. increased consequences), Dracut is likely increasing its risk unless it offsets these two risk factors with more proactive mitigation efforts.

Previous Sustainability and Resiliency Efforts in the Town of Dracut

When the Town became aware of the MVP Program, developing an MVP Plan was the next reasonable step in Dracut's planning efforts, and as such, the Town applied for and received a grant from the Commonwealth to develop an MVP Plan.

The Town of Dracut recognizes its potential vulnerability to climate change related hazards and the importance of developing climate change preparedness plans and building resilience against these risks and hazards. In addition, the Town recognizes the need to develop its own local Hazard Mitigation Plan (HMP) to build resilience and develop strategies against other natural hazards. Dracut is included in the latest update of the Hazard Mitigation Plan for the Northern Middlesex Region (approved by FEMA in August 2015) as part of the 9 active communities within the region. The regional Multiple Hazard Community Planning Team (MHCPT) collected and analyzed natural hazard data from local officials, such as emergency managers, planners, public work personnel, police and fire departments, building inspector and health agents. The Goals and Actions within this plan were developed as local vulnerabilities to natural and non-natural hazards were identified and concerns were being raised by emergency responders and local officials. The purpose of the regional HMP is to identify vulnerabilities to future disasters and formulate mitigation strategies to avoid or minimize losses by providing "…data and information that can be utilized to increase public awareness and promote improved mitigation planning at the local, regional, and state levels of government. Developing a mitigation plan before disaster strikes will result in the most efficient and effective means for reducing loss of life and property."

Since the plan must be updated every five years for the communities to continue being eligible for Federal grant funding for hazard mitigation projects, the Town is required to develop the HMP and submit it for the State and Federal approval. Therefore, the Town of Dracut opted to develop its own local HMP in conjunction with the MVP process.

Town of Dracut has taken steps towards preserving it's natural open space by accepting and implementing the Community Preservation Act as a mechanism to decrease developmental pressures on the agricultural

and semi-rural character in the eastern portion of the Town and preserving its open space. The Dracut's first Open Space and Recreation Plan (OSRP) was completed in 1996, and updated in 2009 by the Community Preservation Committee with technical assistance from the Northern Middlesex Council of Governments (NMCOG). The OSRP is focused on the improvements to greenways and trails, public awareness and stewardship of open space resources, and public access to water resources. According to the recently updated Master Plan, protecting farmland has been the focus of many land protection projects within Dracut, and will continue into the future.

A local land trust was recently formed, which is a non-profit organization dedicated to protecting and preserving open space and farmland. Currently the Trust owns the 34-acre Ogonowski Memorial Field and the 35-acre Smith-Healy Farm in addition to holding the Conservation Restriction (CR) on the George B. Richardson Hay Field. The adoption of a Right to Farm Bylaw is another Town's effort to mitigate developmental fragmentation and preserve the Town's historical character. The open space and recreation plan is in the process of being developed by a five member committee, two staff people and NMCOG. It is anticipated to be completed by May 2021.

The Town has also been extensively involved in energy preservation and energy use reduction initiatives through a variety of programs:

- Dracut is a designated Green Community, which received its designation through the state funded Green Community Designation and Grant Program by pledging to cut municipal energy use by 20 percent over 5 years and that met other criteria established in the Green Communities Act.
- Dracut has received a gold-level designation through SolSmart program, which provides technical assistance for local governments in their solar programs and efforts.
- Dracut along with several other communities launched a community electricity aggregation (CEA) program designed to provide residents and businesses with competitive choice, long-term price stability, and reduced electricity rates. The program is estimated to save the residents an average of $150 in electric expenses.
- Dracut converted all of its streetlights acquired from National Grid through the Metropolitan Area Planning Council (MAPC) grant program into high efficiency LEDs, which reduced the energy use as well as energy cost for the town, while improving the lighting efficiency.

In addition to the above conservation and energy reduction efforts, the Town participates in household waste reduction and recycling programs and initiatives, such as Recycle Smart and the Recycling Dividends Program (RDP). Dracut also holds annual Household Hazardous Waste Collection Days twice a year in coordination with Methuen, while the Board of Health runs a no-charge mercury collection program throughout the year.

II. TOWN PROFILE

Geography and History of Land Use

(Information in this section has been adapted from the Town of Dracut Open Space and Recreation Plan 2009 and Town of Dracut Master Plan 2020)

The Town of Dracut is a nearly 21.5 square mile residential suburban community located approximately 40 miles northwest of Boston in the Middlesex County of Massachusetts. It is bordered by the New Hampshire state from the north, the Town of Tyngsborough from the west, the City of Methuen from the east. The City of Lowell, the Town of Tewksbury, and the Town of Andover are bordering the Town from the south across the Merrimack River which forms the southeastern Town boundary. The population of Dracut was a total of 29,457 as of April 1, 2010, according to the US Census Bureau.

Historically, the area where the Town of Dracut is presently located was inhabited by the Native Americans and it was an important settlement due to its location on the Merrimack River with abundant fishing areas along Merrimack River and Beaver Brook. When European settlers arrived in 1660's, they used the existing Indian pathways to transport their farming goods. Dracut was part of Chelmsford until 1701 and was incorporated as a Town on February 26, 1701.

The Town's location near the Merrimack River also played an important role in Dracut's economic development, since the river ferries were used to cross the first settlers' farming goods across the river and moving them to and from the Boston market.

By 1760s Dracut continued to grow with the development of many paper and fulling mills. One of the largest contributions to the area's development at this time was construction of the Middlesex Merrimack (Pawtucket) Bridge in 1792, which was the first structure to cross the Merrimack River.

Transportation development and improvements, such as opening of the Middlesex Canal and the Middlesex Turnpike, drove the Town's economic development into the nineteenth century, providing better connections of the area to Boston and stimulating the growth of manufacturing in Dracut. In early 1800's, the area's connection to other regional economies was improved by the operation of steamboats that began navigating the river, and even further improved with the opening of the Boston and Lowell Railroad in 1835. By the middle of 1800's, Dracut lost the majority of its manufacturing base along the Merrimack River to the industrially developed neighboring Lowell, which drove Dracut's residential development, providing housing for Lowell's mill workers and working class, while the agriculture continued to be an important economic activity in Town.

In addition to the existing agricultural and small manufacturing economies, the Town emerged as a popular tourism and entertainment destination when Harry Kittredge built Lakeview Park, a summer resort with events and activities on Lake Mascuppic, in 1908. The eastern part of Dracut remained mainly undeveloped due to the presence of many farms in that area. Transportation improvement of the twentieth century resulted in construction of I-93, I-495 and Route 3, the major highways providing connection to many employment centers, which established today's Dracut as a predominantly residential, with limited industrial, commercial, and agricultural community. As Dracut continued its unique economic development though 1900's as a suburban neighbor to major employment centers, the western portion of Town became densely developed, while the eastern portion continued to host numerous farms and preserved its semi-rural character. In order to preserve the agricultural and semi-rural areas of East Dracut and to relieve the development pressures, the Community Preservation Act was adopted in 2003 and the Town of Dracut Open Space and Recreation Plan was completed.

Although a significant amount of agricultural and open space land in East Dracut contributes to its rural character, it is, however, not protected from being converted into residential, commercial or industrial uses, because it is presently zoned as Residential 1 (R-1), with a minimum lot size of 40,000 square feet. According to the Towns Master Plan recently updated in 2020, Dracut's population increased by 115.42% from 1960 to 2010, while the regional population grew by 69.4% during the same time period. Therefore, the Town's remaining rural character may gradually disappear without additional efforts to protect open space, update land use policy, and control population trend**s.**

Rivers, Waterbodies and Wetlands

(Information in this section has been adapted from the Town of Dracut Open Space and Recreation Plan 2009 and Town of Dracut Master Plan 2020, Merrimack River Watershed Council http://merrimack.org/about/ and EPA https://www.epa.gov/merrimackriver/about-merrimack)

Dracut's location entirely within the Merrimack River drainage basin has been crucial in historic development and the land use of the Town. The width of the Merrimack River within its course along the southern border of Dracut is between 300 and 500 feet All rivers and brooks within the Town are tributaries to Merrimack River on the south border of the municipality. Over 300 acres of the Town's area is covered by surface water bodies.

The Merrimack River originates at the confluence of the Pemigewasset and Winnipesaukee Rivers in central New Hampshire and flows south for approximately 117 miles to the Atlantic Ocean, where it empties into the Gulf of Maine in Newburyport, Massachusetts. The Merrimack River watershed is the fourth larges watershed in New England, home to over 200 communities with over 2.5 million people, providing drinking water to over 600,000 people and draining a watershed of approximately 5,000 square miles. It also provides important recreational opportunities and wildlife habitat.

The major tributaries to the Merrimack River in Dracut are Beaver Brook, Peppermint Brook and Richardson Brook and their tributaries.

Other Dracut's water resources include Long Pond, a small portion of the Lake Mascuppic, shared with neighboring communities, Peters Pond and multiple smaller tributaries to the Merrimack River, Beaver Brook and Peppermint Brook with the surrounding wetlands.

There are floodplains associated with major watercourses in Dracut. The latest Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) countrywide study of July 6, 2016 covers the geographic area of Middlesex County, Massachusetts, including Dracut. According to the latest updated FIS, the hydrologic and hydraulic analyses used for the updated FIS report was original prepared for FEMA FIS report dated June 5, 1989 by the New England Division of the USACE, where the study was completed in July 1986, and for FEMA FIS dated June 2, 1980 by the New England Division of the USACE, where the study was completed in May 1978.

The areas studied by detailed method included Merrimack River on the southeastern side of Town, Beaver Brook 3 to its confluence with Merrimack River in Lowell, portion of Tributary to Beaver Brook 3 from approximately 950 feet upstream of the Lakeview Avenue crossing to its confluence with Beaver Brook, portion of Peppermint Brook from Hildred Street to its confluence with Beaver Brook 3 in Dracut, Trout Brook to its confluence with Richardson Brook, and Richardson Brook to its confluence with Merrimack River. The remaining water bodies, including Bartlett Brook, were studied by approximate methods, with no base flood elevation determined.

The Town of Dracut has a wetlands bylaw that extends local jurisdiction beyond state and federal wetland regulations and further restricts development in protected wetland areas. Protecting wetlands is an

essential component to mitigating flood risk. Wetlands provide a habitat for wildlife and they also serve as a space to absorb surface water. Impacting wetlands with development can negatively impact the groundwater level.

Government

(Information in this section has been adapted from the Town of Dracut Master Plan 2020)

An Open Town Meeting led by the five-member Board of Selectmen and a Town Manager, is the form of Government in the Town of Dracut. The voters elect the Board of Selectmen, School Committee, the Town Moderator, Library Trustees, and some members of the housing authority. In addition, the residents of the Water Supply District also elect a district moderator and water commissioners. The Board of Selectmen, School Committee, and Library Trustees appoint a Town Manager, Superintendent of Schools, and a Library Director respectively. Ann M. Vandal is the present Town Manager, and she currently oversees and coordinates Dracut's daily operations with the assistance of the town accountant, tax collector/treasurer, and assessor.

Water Supply

(Information in this section has been adapted from the Town of Dracut Master Plan 2020)

There are two water supply districts serving Dracut. The majority of the Town's population is being served by the privately-owned Dracut Water Supply District while the eastern portion of the town is being served by the Kenwood Water Department, which is owned by the Town. Small portion of Dracut is also being supplied by private wells.

The Dracut Water Supply District provides water to over 23,000 people located in Dracut Center, neighborhoods of Collinsville and the Navy Yard. The two wells supplying water for this District are located off Hildreth Street in the New Boston Well Field in Dracut and five wells are located off Frost Road in the Town of Tyngsborough Well Field along Merrimack River. In addition, the District purchases some water from the City of Lowell through the interconnection with the Lowell Regional Water Utility (LRWU) at the Pleasant Street Pump Station. There is a second interconnection with the Kenwood Water District being constructed, which would allow the District to receive water from Methuen.

The Kenwood Water Supply District, serving the eastern portion of Dracut, is currently not connected to the Dracut District and it presently operates as a distribution system only, purchasing its water from the Lowell and Methuen Water Departments, both of which draw their water from the Merrimack River. The Kenwood District continues to expand and upgrade the distribution system with continued development in the eastern section of Dracut.

The Dracut Water Supply has three water storage facilities with a total capacity of 6.3 million gallons, while supplying water for approximately 9,000 households, 1,000 of which are located in Tyngsborough. The Kenwood Water District supplies water to almost 2,000 accounts. According to the Master Plan, the Town's present average demand is approximately 1.5 million gallons of water per day.

Sewer System

(Information in this section has been adapted from the Town of Dracut Master Plan 2020)

Most of the Dracut's population (approximately 95%) are being served by the Municipal Sewer System. Only 5% of the Town's population, located on the northeastern side of Town around Jones Avenue, Methuen Road, Island Pond Road and Marsh Hill Road, are being served by the on-site septic systems. The sewage is being sent to the Lowell Regional Wastewater Utility (LRWWU), where Dracut owns approximately 11% of the LRWWU facility, or 3.6 million gallons per day of capacity, and Greater Lawrence Sanitary District (GLSD).

According to the Master Plan, the Town's present average utilization of its allocation from the LRWWU is approximately 1.4 million gallons per day.

Dracut has an extensive sewer expansion program, that has proven to be successful over the past twenty years, when the Town was able to sewer the majority of its residences in this timeframe.

Historical Properties

(Information in this section has been adapted from the Town of Dracut Master Plan 2020 and the Massachusetts Cultural Resource Information System (MACRIS) database)

Dracut currently has 164 historic resources documented at the MA Cultural Resource Information System database, none of which are included on the National Register of Historic Places. These resources include districts/areas, building, burial ground, objects, and structures. Six buildings in Dracut were constructed in the 18th century, with the oldest one, Coburn-Solomon Osgood-Cutter house, located at 710 Mammoth Road, constructed in 1700. One historic structure is listed on the MACRIS - the Stone Arch Bridge over Beaver Brook; it was constructed in 1857 and was last rehabilitated in 1921. A few historic objects listed in the database for Dracut that date back to the late 19th – early 20th century, however several more are recommended to be inventoried and included by the Town's recently updated Master Plan 2020, in order to preserve the Town's history and cultural character going back to almost three centuries. The Historic Preservation Plan was developed for Dracut in 2012 by Fisher Larson Associates showing many significant structures in a nearly non-altered or minimally altered condition and should be considered for inventory and preservation.

Since agriculture played an important role in the Town's history and economy, continuing efforts to inventory farmstead structures, farm buildings and barns is beneficial to the Town's effort to preserve the remaining agricultural character and history.

Parks, Recreation and Open Space

(Information in this section has been adapted from the Town of Dracut Open Space and Recreation Plan 2009 and Town of Dracut Master Plan 2020)

The Town of Dracut is involved in preserving open space and providing passive and active recreational opportunities for the Town's residents and visitors. Conservation restrictions (held by state, local and non-profit organizations) cover many of the Town's open spaces especially along the Merrimack River on the south and the State Forest on the west side of the Town.

The newly updated Town's Master Plan includes land conservation and land use factors as important in the communities' economic development. Dracut has several recreation facilities and open spaces which are spread throughout the Town, highly valued by the residents, which are suitable for hiking, biking, and other activities, as well as swimming, fishing, and boating. The conserved open space parcels in Dracut account for nearly 5% of the Town's land. The following list represents some of these assets:

- Dracut-Lowell-Tyngsborough State Forest, owned and managed by the State Department of Conservation and Recreation, which includes 527 acres in the southwest corner of Dracut. The State Forrest plays an important recreational, cultural and environmental role in Dracut. It provides many activities including hiking, biking, horseback riding, cross-country skiing, as well as hunting.
- Merrimack River on the southern border of Dracut is a recreational resource itself, offering aesthetic values and recreational opportunities including jogging or walking on a nearby Riverwalk, or an informal boat launch. Due to the river being polluted with Phosphorus, and PCBs and Mercury in Fish, the river is not recommended to be used for fishing.

- Mascuppic Lake, Long Pond, Peter's Pond, and Cedar Pond, as well as Beaver Brook are used for boating and fishing in Dracut. There is also a canoe/kayak launch on Long Pond.
- There are multiple trails in Town dedicated for recreational activities including walking, jogging and hiking, some of which are also great for bird watching: Long Pond Trail, Dunlap Sanctuary Trail, East Richardson Preserve Trail, Nickel Mine Conservation Trail, Dracut Land Trust Trail.
- Other recreational lands including golf and other recreational properties participating in Massachusetts' Chapter 61B program.
- Agricultural land under the Massachusetts Chapter 61 and 61A program.

Dracut's Open Space and Recreation Plan is currently being revised and updated to ensure continuing preservation of open space, protection of Town's water supply and improving the Town's recreational resources. The revision of Zoning Bylaw has also been recommended in the most recent update of the Dracut Master Plan to ensure that further development in Town is not negatively affecting the open space, quality of life and historic land use established in Town over the history of over three centuries.

III. COMMUNITY RESILIENCE BUILDING PROCESS IN DRACUT

Town of Dracut was awarded an MVP Grant to develop a resiliency plan and retained the services of Green International Affiliates, Inc. and Green's Stormwater and Permitting Group Leader, Certified MVP Provider, Danielle Spicer, P.E., LEED AP, ENV SP who served as the lead facilitator at the required workshops. Communities who complete the MVP program become certified as an MVP community and are eligible for MVP Action grant funding and other opportunities.

As part of the MVP process, municipalities follow the Community Resilience Building (CRB) Workshop Guide, developed by the Nature Conservancy, NOAA's Office for Coastal Management, and other partners, to identify community's key climate-related hazards, vulnerabilities and strengths, develop and prioritize adaptation actions in coordination with the existing local plans, policies and municipalities vision. The Town assembled the joint MVP/HMP Core Team, which consists of community stakeholders who will develop goals, planning strategies, and will eventually implementation of priority actions.

MVP/HMP Core Team

- Ann Vandal – Dracut Town Manager
- Ed Patenaude – Dracut Director of Public Works
- Mark Hamel – Dracut Town Engineer
- Lori Cahill – Dracut Conservation Agent/Parks and Recreation
- Dan MacLaughlin – Dracut Building Inspector
- Richard Patterson – Dracut Deputy Fire Chief/Emergency Manager
- Betsy Ware – Dracut Community Development
- Bethany Loveless – Dracut Council on Aging
- Tina Douk – Dracut Stormwater Manager (DPW)

Due to the COVID-19 precautions, two joint MVP/HMP Kick-off Meetings were held remotely on June 6, 2020 and August 13. 2020. At the Kick-off meeting, the Core Team established initial MVP Plan goals. Following the CRB Guidelines, the Town held two (2) ½-day, 4-hour hybrid remote/in-person workshops, for the development of the plan. The two (2) ½-day workshops were held on September 29, 2020 and October 6, 2020, respectively.

Town of Dracut MVP Plan Goals

The following Goals for the MVP Plan were developed by the Core Team during the first Kick-Off Meeting:

1. Successful completion of the CRB process to become designated as a "Municipal Vulnerability Preparedness Program Climate Community," or "MVP Climate Community", which may lead to increased standing in future funding and follow-on opportunities;

2. Develop a Hazard Mitigation Plan (HMP) in conjunction with the MVP Plan;

3. Eligibility for an Action Grant to acquire funding for the Town dams to be removed or substantially repaired using MVP grants;

4. Building resilience for future unexpected events due to natural hazards and climate change, such as COVID-19 and other unexpected emergencies

5. Evaluate municipal shelter buildings and ensure the future plans include the expanse of the shelter infrastructure in the community

6. Develop municipal programs or update regulations to build options for future vulnerabilities

7. Develop and prioritize community actions which will help build the Town's resiliency to climate change related hazards.

Top Four Natural Hazards as a Result of Climate Change

The first Core Team meeting also focused on identifying the Town's top four hazards potentially resulting from climate change:

- Snowstorms/Extreme Cold
- Flooding
- Wind Damage/High Winds
- Extreme Temperatures

Workshop Participants

Workshop Number 1 – September29, 2020	**Workshop Number 2 – October 6, 2020**
MVP Provider & Lead facilitator: Danielle Spicer MVP Provider & Workshop facilitator: Peter Richardson MVP Workshop facilitator: Oxana Fartushnaya Mitigation Planning Lead: Jamie Caplan of Jamie Caplan Consulting LLC, Certified MVP Provider Town Manager: Ann Vandal Stormwater Manager: Tina Douk Town Engineer: Mark Hamel DPW Director: Ed Patenaude Stormwater Department: Leo Caron Water Supply District Superintendent: Michael Sheu Sewer and Kenwood Water Superintendent: Jay Reynolds Agricultural Commission & Permanent Building Committee: Ellis Neofotistos Buildings and Grounds Supervisor: Andrew Graham Northern Middlesex Council of Government, Executive Director: Beverly Woods Zoning Board of Appeals: John Crowley Building Inspector: Dan McLaughlin MA DER, Senior Ecological Restoration Engineer: Kris Houle Veterans Service Officer: Jeffrey Hollett Community Development Coordinator: Betsy Ware MVP Northeast Regional Coordinator: Michelle Rowden (EEA)	MVP Provider & Lead facilitator: Danielle Spicer MVP Provider & Workshop facilitator: Peter Richardson MVP Workshop facilitator: Oxana Fartushnaya Mitigation Planning Lead: Jamie Caplan of Jamie Caplan Consulting LLC, Certified MVP Provider Town Manager: Ann Vandal Stormwater Manager: Tina Douk Town Engineer: Mark Hamel DPW Director: Ed Patenaude Stormwater Department: Leo Caron Water Supply District Superintendent: Michael Sheu Fire Department /EMD: Richard Patterson Public Schools Business Administrator: Thomas Lafleur Buildings and Grounds Supervisor: Andrew Graham

Report Citation and Acknowledgements

Town of Dracut Municipal Vulnerability Preparedness (MVP) Plan and Summary of Findings, prepared by Danielle Spicer, P.E., LEED AP, ENV SP, Stormwater and Permitting Group Leader, of Green International Affiliates, Inc.

IV. SUMMARY OF FINDINGS

Following the CRB Framework, The MVP Core Team also developed a list of potential workshop participants during the initial Kick-off Meetings and determined materials necessary for successful workshops. Refer to Appendix A for list of workshop attendees, meeting notes, presentations and copies of matrices and work maps.

Workshops Overview

The first workshop focused on identifying the vulnerable areas in Town and the Town's strengths (and assets) under three categories, infrastructural, societal and environmental in light of climate change.

Based on the results of the first workshop, participants focused on developing action steps that the Town should take to become more resilient to projected climate change conditions. The workshop participants developed specific community action steps and prioritized the most vulnerable locations in Town to include them in the MVP plan. A list of Prioritized Action Steps is included in Section VIII of this report.

The workshop participants worked diligently to identify multiple areas of concern related to climate change and its possible effects on the Town of Dracut, from the state of current critical infrastructure, regulations and ordinances, to energy sources and communication and education issues, related to climate change and building the Town's resilience. Once the Town's MVP Plan is approved by EOEEA, Town of Dracut will be eligible for future MVP grants.

Top Hazards and vulnerable areas for Dracut

The first workshop on September 29, 2020 opened with a presentation explaining the MVP Process. The participants were asked to identify and discuss the Town's previous mitigation efforts, if any. Climate change projections developed by Northeast Climate Science Center at the University of Massachusetts Amherst were also presented. These primarily focused on increase in snowstorms and extreme cold days, flooding, wind damage and increased duration of extreme hot temperatures. GIS mapping based on TNC's CRB process and templates graphically presented the UMass climate change projections, Workshop participants were then separated into two groups to review and discuss the information. The groups were instructed to determine which areas in Town can be considered vulnerable to the selected four natural hazards as a result of climate change projections listed below:

1. **Snowstorms/Extreme Cold:** Damage to infrastructure and Town's budget was noted to result from severe winter storms and extreme cold temperatures in Dracut. Given the climate change scenarios provided during the workshop, the participants concluded winter storms with heavy wet snow and winds have an increasing potential to take down trees and utility wires. The participants noted more frequent extreme cold temperatures raised concerns regarding potential loss of power or other damage to natural resources and infrastructure in Dracut.

2. **Flooding:** Though Dracut is not located within a lot of flooding sources, there is an intense development of the riverine zones of Beaver Brook and Peppermint Brook, causing concerns about future potential flooding of these highly populated areas and due to previous flooding incidents on the Beaver Brook Dam. In addition, a few low point areas and areas with poor drainage issues which get flooded during the intense rain events were pointed out by the workshop participants. Therefore, this natural hazard is considered important in considering mitigation measures in building Town's resilience to increased precipitation.

3. **Wind Damage/High Winds:** The workshop participants agreed that the Town of Dracut is susceptible to destructive effects of strong winds, with a potential of more rare but severe events

such as tornados, hurricanes and nor'easters. It was discussed that wind-related events including those during winter season have caused power outages and fallen tree damage previously and anticipated these hazards becoming more extreme in the future with climate change.

4. **Extreme Temperatures:** The Town has experienced issues with heat and drought in the past especially during this Summer of 2020 when the entire Massachusetts was suffering from severe draughts conditions. It was concluded that with climate change, extreme temperatures in both directions will become more common, and with warmer temperatures, the potential for droughts will increase.

V. CURRENT CONCERNS AND CHALLENGES PRESENTED BY HAZARDS

After reviewing the workshop materials with regards to the top four hazards, the participants identified vulnerable areas using the GIS maps depicting the Town's resource areas, including wetlands, waterbodies, flood plains and open space. The participants used the CRB matrix template and their local knowledge of the Town to develop a list of vulnerabilities. Each group considered the Town's vulnerabilities as they relate to three categories: Infrastructural, Societal, and Environmental. Note that a number of items identified as vulnerabilities based on certain attributes were also considered strengths in other attributes. The vulnerability and strength attributes will be discussed in Sections V and VI respectively.

After the group held a discussion and reached the consensus, they developed a consolidated list of vulnerabilities for each category as summarized in Table 1 below:

Table 1: Vulnerable Areas and Attributes for Dracut based on Climate Change Projections

INFRASTRUCTURAL	SOCIETAL	ENVIRONMENTAL
• *Water Booster Pump Station* • *Area with no Municipal Water/Sewer* • *Booster Station - Interconnection* • *Tyngsborough Transmission* • *Asbestos-cement (AC) Water Mains* • *Sewer Pump Stations* • *Bridges over Beaver Brook* • *Structurally Failing Culverts* • *Dams* • *Road Management* • *Stormwater Drainage Issues* • *Impervious Surfaces* • *Overhead Powerlines*	• *EJ Communities* • *Code Red - "Mass Notification System" (Reverse 911)* • *City of Lowell Emergency Evacuation Route Traffic Flow* • *Assisted Living Facilities & Adult Daycare Facility* • *Council on Aging & Elderly housing* • *Group Homes for People with Special Needs*	• *Open Space* • *No Forest Management Plan for open spaces* • *Densely Developed Riparian Buffers* • *Bridge Street FEMA Projections* • *Untreated Discharges from Old and Undersized Drainage Systems* • *Impaired Waterbodies in Town with no TMDL* • *Water Supply Land (North)* • *Dam Removal/Substantial Repair Issues* • *Stormwater Bylaw* • *Zoning Bylaw*

Certain Infrastructural, Societal, and Environmental items the workshop participants identified as vulnerabilities on the one hand, were also identified as strengths and assets to the Town in different aspects. Therefore, a number of the Town's vulnerabilities and challenges presented below are also discussed in Section V relative to different attributes that the participants recognized as strengths.

Infrastructural

1. *Water Booster Pump Station*

There is a concern among the participants about the condition of the Water Booster Pump Station located on Methuen Street in Dracut. The station was originally built in 1965 and has never been upgraded. There are issues with confined space and outdated infrastructure.

2. *Area with no Municipal Water/Sewer*

The northeastern side of Dracut in the vicinity of Bartlett Brook has an area with no municipal water and sewer system. It is located near the Kenwood Water Supply District and this area that accounts for almost 5% of the Town territory is being served by municipal and private wells and septic systems. Though the Town achieved a great level of success in providing municipal sewer to 95% of Dracut, this area needs to be monitored and studied more for potential vulnerabilities of the wells to climate change with regards to water levels and come up with additional water conservation efforts. Drainage discharges within this area also need to be studied in order to come up with actions to increase this areas resiliency in the future.

3. *Booster Station - Interconnection/Partial Built*

The Booster Station located on Broadway Street is partially built and has not been completed. Though it is partially built, once completed it will provide an emergency water service to the neighborhoods in the vicinity of Jones Avenue/Methuen Road on the north side of Dracut. Installing a 40-foot water line would complete this interconnection and make the Town's water system more reliable and resilient in the event of failures within the main water system.

4. *Tyngsborough Transmission*

Located on Tyngsborough Road, the Tyngsborough transmission is a very important connection for the Town's water distribution system. In order to increase the Town's resiliency to the climate change related hazards such as flooding and extreme temperatures, it may be necessary to provide flood proofing around the existing well heads, perform transmission main upgrade to build new wellheads up above the 100-year floodplain.

5. *Asbestos-cement (AC) Water Mains*

Built in 1960s, the thirty five (35) AC water mains town wide are nearing the end of their useful service life, therefore, the AC pipe condition assessment and strategic replacement planning will be necessary in the coming decade to ensure the system functions reliably, especially in the events of extreme temperatures.

6. *Sewer Pump Stations*

Dracut has 26 pump stations located throughout Town that need to be investigated for potential solutions to improve the stations and their resiliency to climate related hazards. There are 17 municipal and 9 private sewer pump stations, and the proper maintenance plan for the private ones is necessary to coordinate resiliency of this infrastructure in the future. Also, the backups and capacity issues were noted by the workshop participants, which need to be addressed to ensure the sewer system will operate as intended especially in the events of emergency caused by potential climate-related hazards, especially with future population growth.

7. Bridges over Beaver Brook

There are four bridges in Dracut, providing crossings over Beaver Brook, which is the Town's main watercourse: Lakeview Avenue, Parker Avenue, Pleasant Street and Phineas Street. In addition, there is another bridge west of the Lakeview Avenue Bridge, carrying Lakeview Ave over Power Canal, associated with Beaver Brook. There are some concerns in Dracut about the capacity and current condition of two bridges to operate during peak flood events as they are currently under pressure during intense storm events, the participants agreed that it is important to evaluate the bridges capacity using projected increased precipitation rates. Two of these municipal bridges are box culverts (Lakeview Avenue and Parker Avenue), and a state-owned Pleasant Street bridge is a stone arch.

8. Structurally Failing Culverts

There are four culverts in Dracut that are currently structurally failing. Two town-owned culverts conveying Peppermint Brook, located on Sladen Street and Lakeview Avenue. There are also two privately-owned culverts, located on Sawmill Drive and conveying Bartlett Brook under the roadway. The municipal culverts are currently on schedule to be replaced, however the participants mentioned that they can be investigated more for potentially incorporating the projected increased precipitation rates for the proposed culvert replacements considering the ROW constraints and improving wildlife passage.

For private culverts on Sawmill Drive, the participants discussed the need to research and study options to replace these culverts to meet the stream crossing standards without increasing downstream flooding. These culverts were mentioned to concern the participant, since their potential collapse will result in a public safety issue as it will isolate people living in this area.

9. Dams

There are two privately-owned Significant hazard dams in Dracut located on Beaver Brook, and one Unnamed Dam in the vicinity of Victory Lane, which is not listed in the Department of Conservation and Recreation (DCR) inventory. The Jurisdictional determination review for this dam was completed by GZA GeoEnvironmental, Inc. in June 2020 and recommended the Unnamed Dam on Beaver Brook to be considered a Jurisdictional dam based on the estimated height and storage volume. The condition of the dam has not been evaluated as part of the Jurisdictional Determination, however, based on the GZA's observation, the dam has certain deficiencies and can be considered Unsafe. It was also GZA's opinion that considering "the potential for a domino failure of the Beaver Brook Dam located approximately one-half mile downstream, a Significant hazard classification is likely appropriate for the Dam".

The Beaver Brook Dam on the south side and Collinsville Dam on the north side of Beaver Brook within Dracut were previously studied and the State recommends the Town to consider these dams for potential removal. The participants agreed that these studies can be incorporated for the potential removal of these dams, however, they need to be investigated more to demonstrate that removal would not result in downstream flooding and will not result in harmful effects to any of the Town's assets. The community seems to have divided opinions about the removal of these dams, depending on whether they live upstream or downstream, therefore public outreach and participation will be required to coordinate the available information about potential effects of the removal of these dams. Since the condition of the Unnamed dam in the vicinity of Victory Lane has not been assessed by DCR yet, it is necessary to conduct a study to evaluate this dam for potential removal. Beaver Brook Dam has been previously flooded in 2006 which also caused flooding of Lakeview Avenue bridge. It is necessary to develop a full picture of what would be beneficial for Dracut to either remove all or some of these dams, or substantially repair them as part of building the Town's

resilience to climate change. All of these dams do not currently serve any specific purpose and they obstruct natural fish passage on the way to Merrimack River.

Since the FEMA flood study for Beaver Brook watershed within Dracut is based on a hydrologic analysis performed in 1978 for the FIS 1980, the future flood risk to the dams and bridges should be re-evaluated by performing a new H&H analysis for this watershed and by using EOEEA climate change projection data.

10. Road Management

The roads townwide have no formal road management plan. There is a traffic control plan for evacuation and flow through plan for north/south movement, however the formal road management plan would be beneficial in building the Town's resiliency to various natural hazards and emergency events.

11. Stormwater Drainage Issues

There are four areas in Dracut identified by the workshop participants that encounter flooding issues at low points on the roadways (area south of Mammoth Road/Pine Valley Drive to Lakeview Ave; area around Tennis Plaza Road/Wimbledon Crossing; area around Arlington Street/Cricket Lane; and area around Montaup Avenue/Fox Avenue). Participants discussed the need to research options for addressing undersized drainage systems, while incorporating potential Best Management Practices (BMPs) and Low Impact Development (LID) concept to improve quality of the stormwater runoff in Dracut. It was discussed that reviewing and revising present regulations in light of projected increased precipitation rates may be necessary in order to make regulatory changes that would benefit the quality of surface and groundwater in Town through stormwater improvements and new projects.

12. Impervious Surfaces

As mentioned in the Towns newly updated Master Plan, there is an increased amount of impervious areas in Dracut, according to the study that was conducted by CDM Smith in 2018. A lot of these impervious areas are concentrated in densely developed areas in the vicinity of Beaver Brook and Peppermint Brook, contributing to the impairment of these waterbodies. The workshop participants agreed that it is important to improve the quality of the stormwater runoff from these impervious areas and to ensure the new projects and redevelopment projects incorporate nature-based solutions to improve the quality of stormwater discharging to already impaired waterbodies.

13. Overhead Powerlines

Dracut's electricity and some other utilities are being distributed via overhead wires on utility poles. These wires and poles are often susceptible to wind damage, fallen trees caused by severe winter storms, ice storms and thunderstorms. The workshop participants noted that this vulnerability, though common throughout Massachusetts communities, need to be evaluated more closely for potential mitigation measures that would make the distribution of electricity more reliable and resilient to the climate change hazards. Tree Maintenance is a part of the Public Works Department numerous functions to support the upkeep of the towns' public grounds and public ways. The Department has the ability to oversee utilities and work with them on regular maintenance and pruning of street trees. As part of performing the tree maintenance, tree commissioner can request a plan from the utility companies and hold a public hearing to address reasonable work within the street rights of way.

Societal

1. Environmental Justice *(EJ) Communities*

The southwest side of Dracut between Mammoth Road and Donahue Road is home to an EJ community based on income. The workshop participant discussed the needs for conducting public education and outreach programs to ensure this community has access to valuable information about the location of the emergency shelters and where help can be sought during various emergency events.

2. *Code Red - "Mass Notification System" (Reverse 911)*

Only 20% of Dracut's population has landlines and combined with multiple dead zones caused by bad cellular coverage of all providers, this issue was identified by the workshop participates as important in the events of emergency cause by potential climate related hazards. Therefore, the need for a study to evaluate options to provide improved cellular services within dead zones and additional public education on how to keep informed in cases of emergency events and disasters was raised by the workshop participants.

3. *City of Lowell Emergency Evacuation Route Traffic Flow*

Dracut has developed an Emergency Evacuation Plan with the assistance from the Northern Middlesex Council of Governments. The evacuation plan and traffic control plan were developed for the evacuation of Dracut and the flow through from adjacent communities, Including New Hampshire moving south. However, the plan for Mass Care Shelter is still being developed. There are some issues in the emergency evacuation plan mentioned by the workshop participants, resulting in influx of traffic in case of emergency, when many people will be traveling to the City of Lowell.

4. *Assisted Living Facilities and Adult Daycare Facility*

There are two assisted living facilities in Dracut located around Broadway/Loon Hill Road and Bridge Street/Avis Avenue. There is also one adult daycare facility on Darren Road. These facilities house and/or providing programs for elderly population were discussed by the workshop participants as being vulnerable societal features in Town. Elderly residents may require special care and assistance during extreme weather events, especially with any loss of basic utility services, such as electric service or events that may require their temporary relocation. Therefore, the workshop participants agreed that coordination with these facilities for planning for these events is an important acting that needs to be considered in Dracut's efforts to build resiliency to climate change hazards.

5. *Council on Aging*

The Council on Aging building located at 951 Mammoth Road provides many important programs and assistance for vulnerable populations including elderly community and people with disabilities. Many people attend the facility for various reasons, including when they experience difficulties. More importantly, it provides heating/cooling stations for all public during extreme temperatures. Through the building is generally in a good shape, there is still no generator in it. Therefore, in the event of power outage cause by potential severe storms and associated wind damage, the Council on Aging will be left with no power for an unknow period of time. The Town's new Hazard Mitigation Plan that is being developed simultaneously with this MVP plan will allow to address the generator issue through FEMA grant. However, an expansion of the public outreach about the availability of the heating and cooling station for the days when extreme temperatures hit the Town is necessary in planning for the Town's resilient future.

6. *Group Homes for People with Special Needs*

There are twenty-eight (28) group homes for people with disabilities and/or special needs in Dracut. Workshop participants agreed that people with disabilities and special needs may require special care and assistance during extreme weather events, especially considering that some of this population cannot be evacuated to the same shelters as the general population. The need to continue coordination with emergency centers and to establish evacuation location to shelters separate from a general population shelters was discussed as necessary in building the Town's resilience to the potential emergency situations causes by climate-related threats.

Environmental

1. *Open Space*

The Dracut Open Space and Recreation Plan (OSRP) was first completed in 1996 as a result of residents becoming concerned about development pressures on the agricultural and semi-rural character of East Dracut. Last updated in 2009, the OSRP focused on preserving the Town's agricultural assets, access of residents to various recreational activities, improving and increasing the community's recreation space, facilities and land management, and improving community' environmental health and water quality. Over the course of this decade, many land protection projects have been focused on protecting farmland as an important historical element in Dracut. However, the remaining rural land in Dracut is threatened by the incremental loss of open space land to development due to the increasing value of land driven by the strong real estate market. In addition, according to the recently updated Master Plan, the OSRP does not protect its open space parcels under Article 97 of the State Constitution. There are limitations on the size of allowed development within these parcels in the zoning regulations as well as a continued effort to put formal restrictions on all CPA acquired land.

In order to assess the Town's performance in the past decade, the participants agreed that it is important to complete the update of the OSRP to reflect the changes in the community and in coordination with the Master Plan and other disciplines and departments. It is also important to establish on-going maintenance of the OSRP to be able to evaluate the Town's performance in its efforts to preserve and increase open space and improve the quality of natural resources as well as maintain Town's eligibility for certain state grant programs. These need to be addressed in the Dracut MVP plan. The participants also noted that the Town should incorporate nature-based solutions in the revised OSRP.

2. *No Forest Management Plan for Open Spaces*

The present outdated Open Space and Recreation Plan (OSRP) does not address the forest management. The workshop participants discussed the importance to create a forest management plan for open spaces in the Town's efforts to build resiliency to changing climate, as the forest plays a crucial role in system's ability to self-stabilize and quality of the environment. The OSRP update, which is currently in the process of being developed and anticipated to be completed by May 2021, includes efforts to address this issue.

3. *Densely Developed Riparian Buffers*

The areas of Dracut surrounding the Merrimack River, Beaver Brook and Peppermint Brook are very densely developed with high percentage of impervious surfaces, which contributes to various potential hazards discussed in this report. These need to be addressed in the Dracut MVP plan, as noted during the workshop. The townwide water quality sampling at the outfalls can be an important start in studying the sources of pollution and evaluating these areas for the projected increase in precipitations events in order to develop

mitigation actions and projects to improve water quality in the future. Since the Town's Stormwater Bylaw was recently updated in 2020, it is also important to update the Wetlands Bylaw in coordination with it.

4. *Bridge Street FEMA Projections*

Portions of Bridge Street in the vicinity of Peppermint Brook are shown to be located within FEMA Zone A with 1% annual chance of flooding and no base flood elevation established for this area, which means this area is vulnerable to the potential increase in precipitation and flooding, as it is projected to overtop. The workshop participants discussed the need to study this area using the FEMA Flood Insurance Study dated 2016, to see what data the study was based on, which methods were used in this determination, the age of the H&H analyses and other factors that may affect the actions needed to be taken in building this areas resilience to the climate-related hazards.

5. *Untreated Discharges from Old and Undersized Drainage Systems*

There is an inventory of the storm drainage systems in Dracut developed as part of MS4 permit with known locations of some old and undersized drainage systems discharging into receiving regulated waterbodies (General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) areas). The workshop participants discussed the need to research options for addressing undersized drainage systems throughout the community and potentially looking into updating regulations for climate change projections with regards to peak volume, rainfall data, and research other options to improve quality of the stormwater runoff in Dracut.

6. *Impaired Waterbodies in Town with no TMDL*

There are seven (7) impaired waterbodies in the Town of Dracut, which do not have a completed TMDL established for them.

- **Bartlett Brook** from New Hampshire/Dracut line to Mill Pond in Methuen is a Category 5 waterbody requiring a TMDL, and listed as impaired with *Escherichia coli* (*E. coli*)
- **Beaver Brook** from New Hampshire/Dracut line to Merrimack River is a Category 5 waterbody requiring a TMDL, and listed as impaired with debris, floatables, trash; physical substrate habitat alterations; aquatic macroinvertebrate bioassessments; *E. coli*; taste and odor; and turbidity
- **Merrimack River** from Lowell Wastewater Utility outfall to the Essex Dam in Lawrence is a Category 5 waterbody requiring a TMDL, and listed as impaired with *E. coli;* PCB in fish tissue; phosphorus
- **Peppermint Brook** from the headwaters east of Route 38 to the confluence with Beaver Brook is a Category 5 waterbody requiring TMDL, and listed as impaired with debris, floatables, trash and *E. coli*
- **Richardson Brook** from the headwaters to the confluence with the Merrimack River is a Category 5 waterbody requiring a TMDL, and listed as impaired with *E. coli*
- **Trout Brook** from the Dracut headwaters to Richardson Brook is a Category 5 waterbody requiring a TMDL, and listed as impaired with *E. coli*
- **Long Pond** is a Category 5 waterbody requiring a TMDL, and listed as impaired with non-native aquatic plants, harmful algal bloom, and mercury in fish tissue

This is an important hazard in the environmental category, since it is directly linked to the quality of the environment and public health. The waterbodies in Dracut are already affected by the excessive precipitation events when untreated overflow gets discharged into these already impaired waterbodies. Therefore, the efforts to address this issue are important in building the Town's climate resiliency. There is

an undergoing initiative to perform testing at outfalls and trace the pollutants back to the source in Dracut, which required time and funding. After completion of the study, Dracut will be able to identify potential actions based on its outcomes.

7. Dracut Water Supply Land (North)

One of Dracut's water supply lands located west of Hildreth Street in the northern part of Dracut is not being used due to high concentration of Manganese. The workshop participants discussed the need to develop a treatment system so that this land can be used for water supply.

8. Dam Removal/Substantial Repair Issues

As mentioned under Infrastructure Item 9, there are two significant hazard dams in Dracut located on Beaver Brook, which are recommended by the State to be evaluated by the Town for potential removal. There is another Unnamed Dam near Victory Lane, which is not listed in the DCR inventory, however, was observed by GZA GeoEnvironmental, Inc. as part of Jurisdictional Determination and, based on the GZA's observation, to likely to be rated Significant Hazard as well. Additional research and public coordination on whether to remove or substantially repair the dams was noted necessary by the workshop participants in the Town's efforts to build resilience to climate change factors. The dams, whether removed or substantially repaired, will require sediment substrate testing upstream and along Beaver Brook to ensure no contamination will impact the water quality from either of the options. The detailed hydrologic and hydraulic (H&H) analysis of Beaver Brook is necessary for the dam removal studies and final decision to be made.

9. Stormwater Bylaw

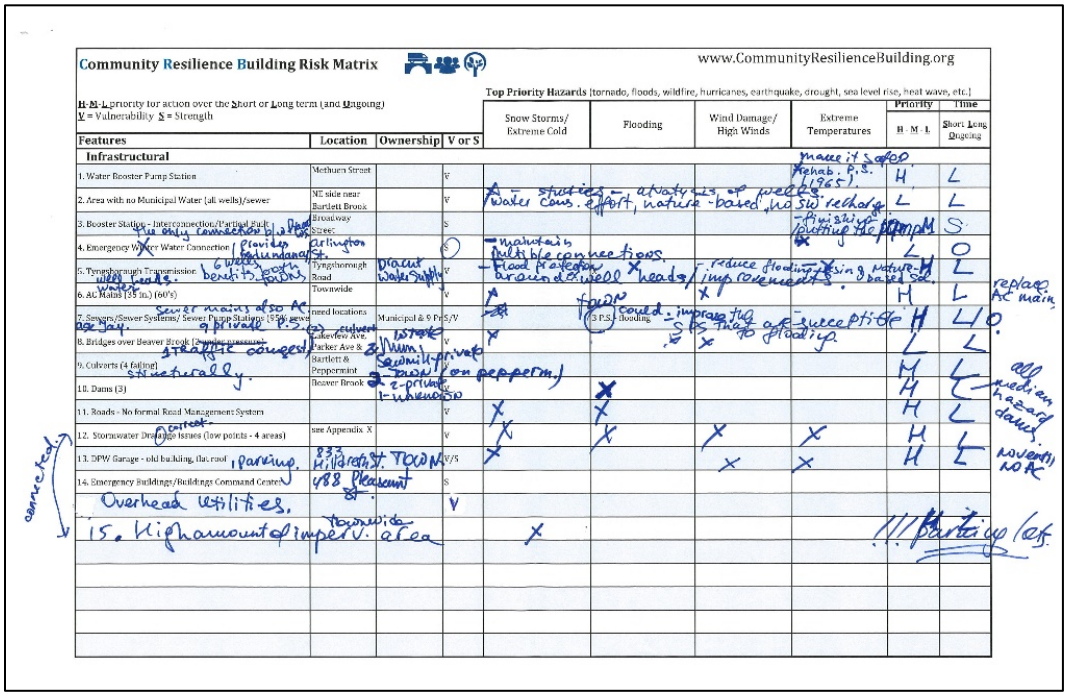
The Town of Dracut Stormwater Bylaw (Chapter 24 and 25 of the Town of Dracut General Bylaws) recognizes that "increased and contaminated storm water runoff is a major cause of impairment of water quality and flow in lakes, ponds, streams, rivers, wetlands and groundwater; contamination of drinking water supplies; alteration or destruction of aquatic and wildlife habitat; and flooding." Therefore, in order to protect the Town's waterbodies, groundwater and the environment as well as the public health, safety and welfare, the Town recently updated its Stormwater Bylaw and Illicit Discharge Bylaw in 2018, which is mostly considered as a strength in Dracut. However, the participants discussed the possibility to add an update for peak volume and rainfall events using Climate Change Projections data. The stormwater bylaw addresses development in Dracut with regards to peak volumes, discharges and water quality. However, additional efforts could be added to address development in specific vulnerable areas of Dracut in the future.

10. Zoning Bylaw

The fragments of Dracut's Zoning bylaw have been partially updated seventy-five times over the past three decades since the 1980s, when the Town's bylaw was approved by the Attorney General, however no cumulative update was performed. The existing zoning bylaw addresses development in some vulnerable areas, however additional measures need to be added with regards to protecting open space. It has been recommended in the most recent update of the Town's Master Plan that the zoning regulations should be updated to improve open space regulations to better protect natural resources and to increase land requirement for cluster development, as well as provide clarity and consistency in many of the standards, definitions and procedural requirements. Additional measures can also be taken to address new development in other vulnerable areas considering the projected climate change effects.

Participants identify vulnerabilities using the CRB Workshop guidelines and map at the first workshop

Participants work on prioritizing actions using the CRB Workshop guidelines and maps at the second workshop



Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

H-M-L priority for action over the Short or Long term (and Ongoing)
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	Snow Storms/ Extreme Cold	Flooding	Wind Damage/ High Winds	Extreme Temperatures	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
1. Water Booster Pump Station	Methuen Street		V					H	L
2. Area with no Municipal Water (all wells)/sewer	NE side near Bartlett Brook		V					L	L
3. Booster Station - Interconnection/Partial Built	Broadway Essex		S					M	S
4. Emergency Water Connection	Carlington		S					L	O
5. Tyngsborough Transmission	Tyngsborough Road	Dracut Water Supply	V					H	L
6. AC Mains (35 in.) (60's)	Townwide		V					H	L
7. Sewers/Sewer Systems/ Sewer Pump Stations (95% sewer)	Mixed locations	Municipal & 9 Pvt.S/V						H	L
8. Bridges over Beaver Brook	Lakeview Ave.		V					L	L
9. Culverts (4 failing)	Parker Ave & Bartlett & Peppermint		V					M	L
10. Dams (3)	Beaver Brook		V					M	L
11. Roads - No formal Road Management System			V					H	L
12. Stormwater Drainage Issues (low points - 4 areas)	see Appendix X		V					H	
13. DPW Garage - old building, flat roof	833 Hildreth St.	TOWN	V/S					H	L
14. Emergency Buildings/Buildings Command Center	488 Pleasant St.		S						
Overhead Utilities.			V						
15. High amount of Imperv. area									

Figure 1: Typical Risk Matrix used by participants during workshops

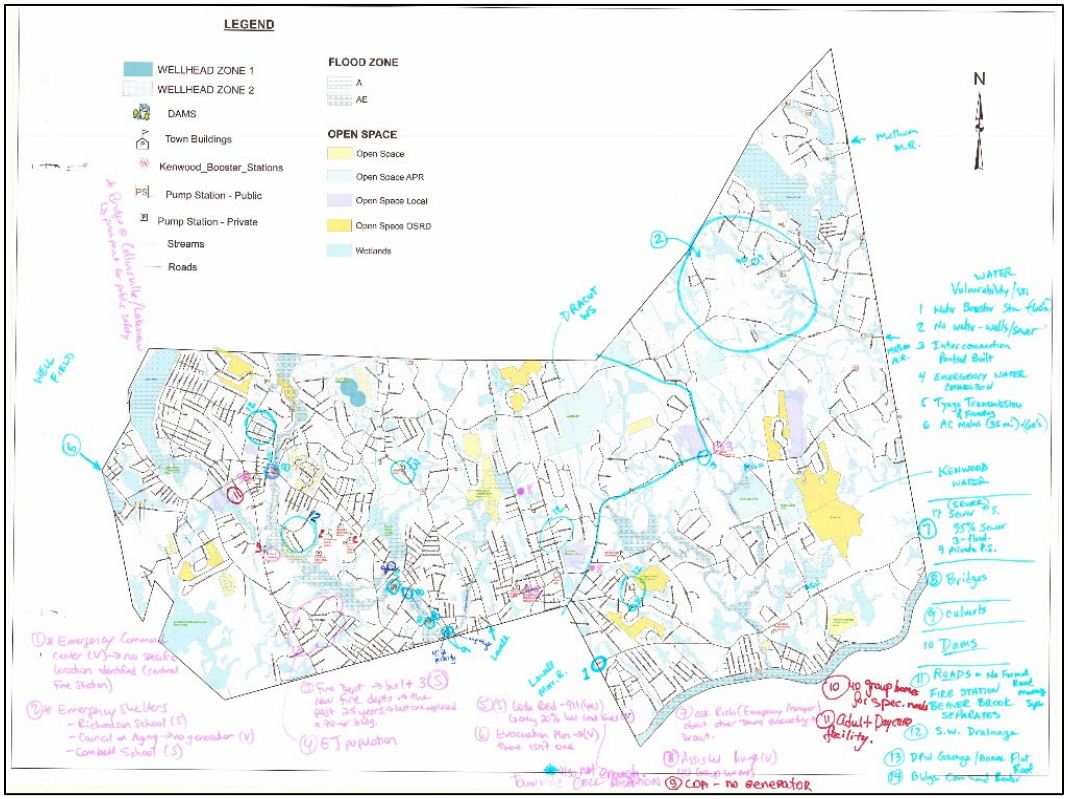


Figure 2: Town wide Map identifying specific vulnerable areas

VI. CURRENT STRENGTHS AND ASSETS IN DRACUT

Certain Infrastructural, Societal, and Environmental items the workshop participants identified as vulnerabilities on the one hand, were also identified as strengths and assets to the Town in different aspects. Therefore, a number of the Town's strengths and assets presented below were discussed previously relative to different attributes that the participants recognized as vulnerabilities.

Table 2: Current Strengths and Assets in Dracut related to Climate Change Resiliency

INFRASTRUCTURAL	SOCIETAL	ENVIRONMENTAL
• *Water Booster Pump Station* • *Emergency Water Connection* • *Municipal Sewer System* • *Bridges over Beaver Brook* • *DPW Garage* • *Emergency Buildings/Buildings Command Center*	• Emergency Command Center & Fire Department Buildings • *Emergency Shelters* • *Code Red - "Mass Notification System" (Reverse 911)* • *Dracut Evacuation Plan* • *Assisted Living Facilities and Adult Daycare Facilities*	• *Open Space* • *Municipal Separate Storm Sewer Systems (MS4)* • *State Forest* • *Stormwater Bylaw*

Infrastructural

1. *Water Booster Pump Station*

Though there is a concern among the participants about the condition of the Water Booster Pump Station located on Methuen Street in Dracut, its presence is also considered a strength in Dracut, because it provides an important interconnection for the water supply for the southeastern neighborhoods of Town.

2. *Emergency Water Connection*

There is an emergency water connection on Arlington Street on the southern side of Dracut. The workshop participants agreed that this is a strength for the Town to be able to maintain multiple connections, providing reliable service in the events of emergency and failure of other connections due to events caused by all four top hazards potentially caused by the projected climate change effects.

3. *Municipal Sewer System*

Dracut achieved a great level of success in providing municipal sewer to 95% of the Town, as part of the Municipal Small Separate Sewer System (MS4) permit. On-going efforts are continuing to improve its functions to provide reliable sewer service to the community, therefore, contributing to building its resiliency to the future projected climate-related hazards.

4. *Bridges over Beaver Brook*

Dracut's four main bridges provide crossing over Beaver Brook in a densely populated area of Town. The bridges are generally well maintained and considered by the workshop participants as important assets for the community.

5. *DPW Garage*

The DPW garage is located in the central part of Town with convenient transportation connection and outside of areas susceptible to any flood hazards, which means that in case of weather-related emergency the Department will be able to continue to operate.

6. *Emergency Buildings/Buildings Command Center*

Dracut's Fire Department Headquarters located at 488 Pleasant Street serves as the Town's emergency and buildings command center and is considered a strength in the community. The building underwent major renovation in the past 25 years and the participants agreed that continuing its maintenance is important in building the Towns resiliency to the projected events caused by the climate-related hazards.

Societal

1. *Emergency Command Center and Fire Department Buildings*

Dracut Fire Department Headquarters and two additional Fire Station located strategically in different areas of Town are major strengths recognized by the workshop participants, available for emergency situations 24/7 throughout Town. All three buildings have been replaced in the past 25 years and are well maintained.

2. *Emergency Shelters*

The Dracut Senior High School and Richardson Middle School are designated as emergency shelter buildings in Dracut. Both located in the area east of Lakeview Avenue in the western side of Dracut, the buildings are well maintained and have enough capacity to accommodate the Town's population during emergency events. Continuing to maintain both as primary shelters is important in building Town's preparedness for any hazards caused by projected climate change effects. The workshop participants also noted that that Town is considering adding the Campbell Elementary School to shelter buildings to be used in the opposite side of the Town to provide additional capacity and convenience for residents of East Dracut.

3. *Code Red - "Mass Notification System" (Reverse 911)*

The Reverse 911 system in place in Dracut provides emergency messages to residents when necessary, therefore it was noted by the workshop participant as a strong asset in the Town's preparedness to future climate-related emergencies.

4. *Dracut Evacuation Plan*

Completed in 2011 with the assistance from the Northern Middlesex Council of Governments, Dracut considers the Evacuation Plan an important community's asset in building the Town's resiliency and preparedness to any hazard.

5. *Assisted Living Facilities and Adult Daycare Facilities*

Though considering these facilities a vulnerability for providing housing and assistance to vulnerable elderly population in Dracut as described in section V above, these are two assisted living facilities and one adult daycare facility are also considered strength in the community due to being able to provide evacuation coordination, education, public outreach and other important programs for elderly population in the events of emergency, including climate-related hazards.

Environmental

1. *Open Space*

The Town of Dracut recognizes the importance of Open Space for its growth and development, environmental health and public health and safety, therefore, it has been involved it preserving an open space for over a two decades now. Workshop participants also recognize the importance of open space containing water bodies in mitigating flood risks and improving water quality.

Though the Town's 2009 Open Space and Recreation Plan is due for an update and is currently being developed, the outdated OSRP puts a lot of effort on protection and expansion of existing open space such as parks, recreational fields, conservation restriction land and forest land. In addition, the Town participates in the State Chapter 61 program (Chapters 61 for forestlands, 61A for agriculture land and 61B for recreational land) that give certain tax abatements to eligible landowners who maintain their property in its current use as open space for forest, agriculture, recreation or open space.

Since farming has played a significant role in Dracut's history and is still a big part of the community's development, a specific stress of the Town's OSRP is dedicated to 61A lands in the efforts to preserve the rural character of the eastern portion of Town. There are presently approximately 1,021 acres of private agricultural land currently enrolled in the state Chapter 61A program. In addition, there are approximately 41 acres enrolled in Chapter 61 as forest land, and approximately 335 acres enrolled in Chapter 61B as recreational/open space land.

Updating the OSRP with new goals, stricter regulations of open space land development and in conjunction with the most recent 2020 Master Plan and other more recent municipal regulations is very important in building Dracut's resiliency to climate-related hazards and in order to maintain Dracut's eligibility for certain state grant programs, including MVP grants.

2. *Municipal Separate Storm Sewer Systems (MS4)*

Dracut achieved a great level of success in providing municipal sewer to 95% of the Town, as part of the Municipal Small Separate Sewer System (MS4) permit. As a result, a lot of the stormwater runoff is now being treated and there are also many on-going efforts and initiatives in Dracut aiming to improve water quality, that would benefit from the State's assistance to the MVP communities.

3. *State Forest*

The workshop participants identified having a Dracut-Lowell-Tyngsborough State Forest, owned and managed by the State Department of Conservation and Recreation, as an important recreational, cultural and environmental role in Dracut. It provides wildlife habitat and multiple environmental benefits to the community due to its large area of 527 acres, while providing many recreational activities.

4. *Stormwater Bylaw*

Significant steps were undertaken by Dracut to comply with the new National Pollutant Discharge Elimination System (NPDES) Small Municipal Separate Storm Sewer System (MS4) Permit for Massachusetts by the Town of Dracut, which included hiring of a stormwater manager, establishing a stormwater enterprise fund and a stormwater permitting authority. These is a stormwater bylaw in Town, serving a purpose of protecting, maintaining and enhancing "…the public health, safety, environment and general welfare of the Town by establishing minimum requirements and procedures to control the adverse effects of soil erosion

and sedimentation, construction site runoff, increased post-development stormwater runoff and nonpoint source pollution associated with new development and redevelopment."

Since stormwater bylaw was updated recently in 2018, it is mostly considered as a strength in Dracut, however the participants discussed the possibility to add an update for peak volume and rainfall events using climate change projections data from Umass Amherst for the Merrimack River watershed for the 2050's and 2090's.

5. *Zoning Bylaw*

As mentioned above in Section V of this report, Dracut's Zoning has a zoning bylaw since the 1980s, that has been updated multiple times in fragments to address the Town's development over the decades. Though, no cumulative update was performed to coordinate various sections of the bylaw, the existing zoning bylaw made many efforts in improving the Town's regulations in vulnerable areas such as flood plains, wetlands and wellhead protection areas.

The Town has the Flood Plain and Floodway Overlay District Bylaw regulating land use in flood prone areas designated as zones A, A1-30, AE, AH, and A99 on the Flood Insurance Rate Maps (FIRM). Any new construction and earthmoving is prohibited in this district, with the exception of conservation uses, agriculture, repairs to existing structures and new structures that are proven to not be subject to flooding in order to protect persons and property against the flood hazards and to maintain the flood storage capacity of floodplains.

According to the recently updated Master Plan, Dracut has also established a Wetland and Water Conservancy District in order to protect the Town's wetlands, water bodies and adjoining lands, mitigate flood hazards, and promote the usefulness of wetlands for recreation and habitat, as well as a Wellhead Protection District in order to preserve and protect existing and potential sources of drinking water supplies, therefore recognizing the importance of these vulnerable areas in the community's growth and development. These bylaws are prohibiting uses in the underlying zoning districts as well as prohibiting other activities outlined in the regulations, while requiring a special permit for selected activities.

VII. SPECIFIC CATEGORIES OF CONCERNS AND CHALLENGES

As can be seen from the results of the workshops described above, there are concerns and challenges in Dracut when it comes to preparing the Town for climate change projections. As a result of the workshops, the snow storms/extreme cold was considered the most important hazards for Dracut, immediately followed by flooding, wind damage and extreme temperatures.

The categories below summarize the specific concerns and challenges that Dracut faces in its efforts to become more resilient to climate-related hazards:

Infrastructural

The specific water and sewer infrastructure vulnerable to climate change related hazards mentioned by the workshop participants are:

- Water Booster Pump Station on Methuen Street
- Booster Station on Broadway
- Emergency Water Connection on Arlington Street
- Tyngsborough Transmission on Tyngsborough Road
- Sewer Pump Stations
- Asbestos-cement (AC) Water Mains townwide
- Area with no municipal water/sewer (Northeastern side of Dracut near Bartlett Brook)

The workshop participants identified a number of water and sewer system components as vulnerable areas to flooding, snowstorms and extreme cold, as well as extreme heat hazards in some instances. In order for Dracut to ensure enough capacity and reliable operation of these systems in the events of flooding, the real risk of flooding at the existing infrastructure locations is unknown until a model is run with climate change projections. Reliable operation of water and sewer systems in the events of emergency caused by extreme heat and extreme cold is crucial. The AC water mains townwide are nearing the end of their useful service life, therefore, the AC pipe condition assessment and strategic replacement will be required in the near future to ensure the system's resiliency to climate change factors, especially in the events of extreme temperatures.

The area with no municipal sewer and water, located in the northeastern side of Town in the vicinity of Bartlett Brook, is also considered a critical area which can be affected by the projected increase in precipitation and extreme weather events. This area serves 5% of the Dracut's population, and needs additional efforts in identifying vulnerable areas where the water levels in wells are susceptible to climate change hazards, including flooding and extreme temperatures. During the periods of draught, the capacity of wells to produce enough water supply for the population in this area of Town needs to be assessed in order to identify possible mitigation measures for this hazard. Drainage discharges within this area also need to be evaluated with the climate change projections in mind. Same as for the flooding hazards, the real risk of extreme temperatures and draught to the capacity of the current town wells to provide enough water for this area is unknown until a model is run with climate change projections. Evaluation of the Town's water system capacity to provide enough storage during increased periods of draughts and population growth as well as continuing to maintain multiple connections and implementing water conservation measures are also important actions in building Dracut's resiliency to the potential effects of climate change.

The specific areas with flooding issues caused by low spots and/or undersized drainage systems in Dracut that were mentioned by the workshop participants are:

- Arlington Street/Cricket Lane area – low spot, flooding issues;
- Montaup Avenue/Fox Avenue area – low spot, flooding issues;
- Tennis Plaza Road/Wimbledon Crossing area – low spot, flooding issues;
- Mammoth Road/Jackson Avenue area – low spot, flooding issues;
- Sladen Street – undersized culvert (Peppermint Brook);
- Lakeview Avenue – undersized culvert (Peppermint Brook);
- Sawmill Drive – two private undersized culverts (Bartlett Brook);

These above areas in Dracut encounter flooding issues at low points on the roadways and at the specific locations with structurally failing culverts. Addressing the issues in these areas is important in building the Town's resiliency to potential increased precipitation and flooding in the next decades. The undersized drainage systems and structurally failing culverts can also potentially impound flood waters. In order to assess address the risks related to climate change, however, additional analyses using the climate change projection for these areas are needed. The Town may benefit from a town-wide stormwater computer model of its drainage systems or individual hydraulic grade line analyses of each system to better understand system capacities/deficiencies and prioritize which systems have the most critical need for upgrade. Increased precipitation in the future will cause local street flooding where drainage systems are undersized, which could impact adjacent homes and businesses. In addition, the high amount of impervious area in Town contributing to excessive stormwater runoff and affecting water quality. Therefore, incorporating "Green Infrastructure" components, LID techniques and BMPs in future projects will help mitigate potential excessive stormwater runoff impacts resulting in increased peak flows, degrading water quality, and heat island effects.

There is no formal road management system in Dracut, therefore other areas may be susceptible to flooding, extreme temperatures as well as wind damage and snowstorms, which will create an instant hazard for the surrounding residences and businesses.

Another infrastructure item that was mentioned by the workshop participants as a vulnerability is Overhead Powerlines, since the overhead wires and poles are often susceptible to wind damage and fallen trees caused by severe snowstorms, ice storms and thunderstorms. Therefore, in order to mitigate the risks associated with this hazard and make the distribution system more reliable and resilient to wind damage, it is necessary to evaluate the existing wires and poles for potential mitigation measures. Though, potential for relocating critical portions of the electrical distribution system underground would reduce the risk of outages from high winds during winter and summer storms, they may not be cost effective and accepted by the utility companies and taxpayers. Another less costly option to mitigate this risk could be to increase tree maintenance in order to keep them clear of wires, evaluation of hazard trees within Dracut and preparation of the tree removal and re-planting.

The specific bridges in Town that were mentioned by the workshop participants are:

- Lakeview Avenue over Beaver Brook
- Parker Avenue over Beaver Brook
- Pleasant Street over Beaver Brook
- Phineas Street over Beaver Brook
- Lakeview Avenue Bridge, carrying Lakeview Ave over Power Canal

To prepare these bridges for increased precipitation and protect this important infrastructure from flooding, the concerns regarding the capacity and current condition of the bridges to operate during peak flood events need to be addressed using projected increased precipitation rates as some of the bridges are currently under pressure during intense storm events.

The Town of Dracut has three (3) dams located on Beaver Brook that formed the existing landscape and influenced the development of Town historically:

- Beaver Brook Dam (Pleasant Street)
- Collinsville Dam (Lakeview Avenue)
- Unnamed Dam (Victory Lane)

These dams present concerns with regards to Dracut's efforts to prepare for potential increase in precipitation and flooding. Rated as "significant hazard" by the MA Office of Dam Safety, the Beaver Brook Dam and Collinsville Dam are not being used for any specific purpose at the moment. The studies for potential removal of these dams need to be evaluated by the Town to make a decision on either proceeding with the removal or considering the substantial repair and reuse options. The Unnamed Dam near Victory Lane, which has not been inventoried or studied by DCR yet, has also raised concerns among the workshop participants, as this structure could have unknown potential infrastructural or environmental vulnerabilities associated with it.

Another infrastructural issue identified at the workshop is the high amount of impervious areas in the Town of Dracut, contributing to the water quality problem. Stormwater runoff from the densely developed areas surrounding Beaver Brook and Peppermint Brook as well as multiple parking lots contribute to the impairment of the Town's waterbodies. The fifty years old High School parking lot also requires upgrading.

In order to address the issue of high amount of impervious surfaces and the stormwater runoff from these areas in Dracut, the municipal parking lots as well as any other existing impervious areas identified in the future for repair or upgrade should consider implementing Best Management Practices (BMPs) and Nature-based Solutions (NbS) to improve recharge, water quality and mitigate additional stormwater runoff from projected increase in precipitation.

In order for Dracut to truly understand and prepare its infrastructure for the projected increase in precipitation including snowstorms and flooding events, it is important to conduct a study and run the model for the area susceptible to flooding with the climate-change projections for 2050s and 2090s, specifically for the densely populated areas surrounding Beaver Brook and Peppermint Brook. The latest Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) countrywide study of July 6, 2016 covers the geographic area of Middlesex County, Massachusetts, including Dracut. However, the watersheds in Dracut were last studied by USACOE for FEMA FIS in 1978. The further FIS updates did not restudy any of the areas in Dracut and the original Dracut study data was adopted, therefore, the data is severely outdated, and doesn't accurately depict current flood risks and the future risks based on climate change predictions. In addition, not all waterbodies in Dracut were studied by the detailed methods in the original study as described in Section II, Rivers, Waterbodies and Wetlands, of this report, therefore there is no base flood elevation determined for them.

Consequently, Dracut would benefit from a completely new hydrologic analysis using Log Pearson Type III gage analysis and USACE HEC-RAS hydraulic computer model. The Log Pearson Type III gage analysis was used in the original H&H studies from 1978 for the Merrimack River, Richardson Brook and adapted to Trout Brook, a tributary to Richardson Brook. For other major Dracut's watercourses, including Beaver

Brook and Peppermint Brook, which were studies by detailed methods, the empirical regression equations developed for Massachusetts by the USGS (U.S. Department of the Interior, 1977) was used.

From the available FEMA data, it is apparent that the Town does not have an updated information to assess vulnerabilities and future risks related to climate change and the actual flood risk associated with certain watercourses, low point areas and critical infrastructure facilities may be underestimated by the current FEMA flood studies. To understand and estimate the Town's true vulnerability and risks related to increased precipitation and flooding for the next 50-100 years relative to infrastructure, hydrologic and hydraulic analyses based on EOEEA's climate change projection data for the entire Merrimack River watershed in Dracut are needed. Town of Dracut's climate change resiliency efforts would benefit from updated H&H, as the existing FEMA flood maps may not depict the current flood risk for the Beaver Brook's, Peppermint Brook's and other important watercourses' floodplains, let alone future conditions.

See Appendix B for a Map of Dracut's Infrastructural, Societal and Environmental Features.

Societal

The specific societal facilities and areas vulnerable to climate-related hazards mentioned by the workshop participants are:

- Two Assisted Living Facilities
- One Adult Daycare facility
- One Environmental Justice (EJ) Community
- Council on Aging and the
- Group Homes for People with Special Needs

Described in more details in Section V of this report, these areas vulnerable to most of the identified hazards, as elderly residents, EJ population and people with special needs may require special care and assistance during extreme weather events and potential evacuation/relocation caused by them. It was agreed between the workshop participants that in order to address this vulnerability, additional public education and outreach programs need to be provided for these communities and facilities regarding specific evacuation programs, protocols and assistance, as well as providing proper emergency shelters for each group depending on their needs, capabilities and/or special requirements. Coordination with these facilities for planning for these events is an important action that needs to be considered in Dracut's efforts to prepare for projected increase in extreme weather events.

Back-up generator for Senior Center is another item needed to build resiliency of this facility in cases of power outages cause by wind damage and snowstorms as mentioned during the workshops. Options to address this issue include using a FEMA grant funding available to communities with updated Hazard Mitigation Plans (HMPs), which Dracut is currently in a process of generating.

Evaluating options to improve the Code Red - "Mass Notification System" (Reverse 911), to provide additional public outreach on proper ways of keeping informed during emergencies caused by climate-related hazards is also very important step in building Dracut's preparedness for the future.

Finding solutions and updating plans to manage traffic flow and avoid the traffic congestions on Dracut's established evacuation routes is another recommended step for building the Town's resilience to climate change and considering population growth.

Dracut is also recommended to continue maintaining its Emergency Command Center at the Fire Department Headquarters, the additional Fire Stations # 2 and 3, and the Town's primary Emergency

Shelters (Richardson Middle School and Dracut High School) while considering adding another buildings to the Shelters list on the other side of Town considering the population growth and preventing traffic congestions during evacuation of the residents townwide to the same shelter area.

Environmental

The following environmental vulnerable features related to climate change hazards identified by the workshop participants are:

- Open Space

The Town of Dracut recognized the importance of open space in building a resilient future and has been involved in protecting and preserving its Open Space for over two decades now as discussed in more detail in Section V of this report. The challenge in Dracut is presented by the outdated 2009 Open Space and Recreation Plan (OSRP), which makes the town ineligible for certain state grants assisting municipalities in land projects preserving and improving its open space. Another challenge is presented by the incremental loss of open space land to development due to the increasing value of land driven by the strong real estate market and the zoning regulations allowing limited development of the municipal open space parcels due to not being protected under Article 97. Also, protecting farmland has been the focus of many land protection projects within Dracut, according to the updated Master Plan, and the efforts should continue into the future and be reflected in the updated OSRP.

The update of the outdated OSRP is estimated to be completed in May 2021, which includes coordination with other departments and disciplines, including recently updated Master Plan, Zoning Bylaw, Stormwater Bylaw, Illicit Discharge Bylaw and other updated regulations. This update will help evaluate the Town's performance in the past decade and set new goals and new projects to pursue. It may be beneficial to evaluate vulnerabilities of parks and recreational fields for future use with regards to climate-related hazards, such as flood, wind damage and extreme heat in the upcoming OSRP update. The revised OSRP would also benefit from incorporating Nature-based Solutions, as discussed at the workshops.

Another issue that should be addressed in the updated OSRP is that there is no formal forest management plan for open spaces. The forest management plan, if adopted, will ensure a better environmental health in Dracut, as well as will benefit the Town's climate change resiliency efforts. Establishing an on-going OSRP maintenance plan will also be beneficial for the Town's resilient future, as it will allow it to perform the necessary updates in a timely manner to reflect the changes in the community caused by development and climate-related hazards.

- The Riparian Buffers are very developed

The high percentage of impervious surfaces and highly developed riparian buffers discussed in detail in Section V of this report is recommended to be addressed in the Town's mitigation efforts related to climate change projections. The townwide water quality sampling at the outfalls can be an important start in studying the sources of pollution and evaluating these areas for the projected increase in precipitations events in order to develop mitigation actions and projects to improve water quality in the future. Since the Town's Stormwater Bylaw was recently updated in 2020, it is also important to update the Wetlands Bylaw in coordination with it.

- Bridge Street FEMA Projections

Since portions of the Bridge Street in the vicinity of Peppermint Brook, which is also a densely populated area in Dracut, are projected to overtop during 100-year flood events, it is important to study this area in more detail using available data from FEMA and run the model with the climate change projections for 2050s and 2090s. A new H&H analysis is also recommended since Beaver Brook was last studied by detailed

methods in 1986 by USACE. In addition, the discharges were developed by statistical analysis of available flow data from two representative gaging stations in the region, since there are no stream flow gaging stations on Beaver Brook, and by the use of empirical regression equations developed for Massachusetts by the USGS. With projected increase in precipitation in the future, the population living within or near flood plains can be affected and will demand actions. Many structures, if built too low in flood plains before the NFIP and FEMA flood maps existed, can be negatively affected by climate change related hazards.

- Old and Undersized Drainage System & Impaired Waterbodies with no TMDL

This environmental item was identified during the workshop as a vulnerability to flooding, snowstorms, extreme cold and extreme heat. As discussed above in Section V of this report, 95% of Dracut has a municipal storm and sewer system and a part of the MS4 permit. However, this old and undersized drainage system network is discharging into the regulated impaired waterbodies with no TMDL established, which affects the water quality in Dracut. Projected increase in precipitation events, including severe snowstorms, will add pressure to the drainage network and, therefore, this issue needs to be investigated more for potential solutions.

- Dracut Water Supply Land (North)

Since this water supply land in the northern part of Dracut is not currently being used due to high concentration of Manganese, it is important for the Town's climate change preparedness to develop a treatment system so that this land can be used as intended in the events of draughts and water scarcity due to other potential hazards and population growth.

- Beaver Brook Dams Removal/Substantial Repair Issues

There are three dams on Beaver Brook in Dracut, with two rated a "significant hazard" and one dam is also likely to be rated as "significant hazard" according to observations made by GZA GeoEnvironmental, Inc. while conducting Jurisdictional Determination for the dam, as described in detail in Section V of this report. There are still many factors that need to be researched, assessed and considered in order to make a decision whether to pursue the removal or substantial repair of the Beaver Brook dams. These dams restrict fish and wildlife passage. The extent of alteration of the current ecosystems and potential impacts on the existing infrastructure surrounding each dam, potential flooding issues, storm water management issues, fishery management, historical preservation and deteriorating of already unstable dams needs to be taken into consideration when making a decision about each dam.

Potential regulatory actions were also discussed at the workshop as part of adapting the Town to climate change effects:

- Stormwater Bylaw

The recently adopted Stormwater Bylaw could benefit from additional updates to address the projected effects of climate change and increased peak flow rates using Climate Change projections data in the efforts to build the Town's resilience.

- Zoning Bylaw

Zoning Bylaw in Dracut is currently addressing the issue of new development in some vulnerable areas. However, a review and a cumulative update of the present zoning regulations is necessary to make sure various districts and overlays vulnerable to the projected climate change effects area protected and the regulations are enhancing the Town's resiliency. The Town is about to start a two-year process of a cumulative re-write of its zoning bylaw in the near future.

VIII. TOP RECOMMENDATIONS TO IMPROVE RESILIENCE TO HAZARDS

At the second workshop, participants reviewed the top four hazards (namely: Snowstorms/Extreme Cold; Flooding; Wind Damage; Extreme Temperatures), in conjunction with the vulnerabilities and strengths they had identified and came up with action steps for the Town to take to become more resilient to the potential effects of climate change. Table 3 below lists the recommended action steps the Town should take going forward to become more resilient to climate change and sustainable to extreme weather and geological events.

Workshop's Highest Priority Recommendations for Dracut

The highest priority recommendations to come out of the workshops are the dam removal projects, culvert replacements that can meet the stream crossing standards, regulations and bylaw revisions, overhead powerline and well heads improvements as well as the drainage improvements that can be done using LID and Nature-based Solutions (NbS). Some of the above priority recommendations would require updated H&H analyses for Beaver Brook, Peppermint Brook and Bartlett Brook using climate change projection data.

Other important priorities mentioned by the workshop participants include specific water, sewer and stormwater infrastructure action items, which would make them more resilient to future climate-related hazards.

Developing proper education and public outreach programs, especially with vulnerable population groups, is also an important effort in building Dracut's resilient future. As a result of the Community Building Resilience workshops for Dracut, the action steps were reviewed and developed.

The action steps have been prioritized in Table 3 below as follows:

High MVP Priority
Medium MVP Priority
Low MVP Priority

The estimated cost for the projects was determined as follows:

- High – over $100,000
- Medium – $25,000 - $100,000
- Low – under $25,000

Table 3: Recommended Action Steps to Improve Resiliency to Climate Change in Dracut

Project No.	Mitigation Action	Timeframe	Responsible Organization	Potential Funding Source	Estimated Cost
1	**Lakeview Avenue Culvert Replacement** Replacement of the town-owned structurally failing culvert conveying Peppermint Brook under Lakeview Ave to meet Stream Crossing Standards, considering ROW constraints; include a Hydrologic and Hydraulic (H&H) model for change in flow using projected climate change data	2021-2023	DPW	MVP Grant	High ~ upwards of $1,000,000
2	**Victory Lane Dam Removal** Include information demonstrating that removal would not result in downstream flooding. Study will include public outreach with upstream and downstream communities about the effects of removal of these dams	2021-2030	DPW	State & MVP Grant	High
3	**Beaver Brook Dam Removal** Design of Removal of Beaver Brook Dam based on the results of Study; Design shall include test sediment substrate upstream and along the brook, study of sediment upstream of dams (make sure there is no contamination), and the H&H study for the dam removal. FEMA will require map revisions (LOMR)	2021-2030	DPW	State & MVP Action Grant	High
4	**Collinsville Dam Removal** Design of Removal of Collinsville Dam based on the results of Study; Design shall include test sediment substrate upstream and along the brook, study of sediment upstream of dams (make sure there is no contamination), and the H&H study for the dam removal. FEMA will require map revisions (LOMR)	2021-2030	DPW	State & MVP Action Grant	High
5	**Well Heads Improvements** Flood proof existing well heads and provide transmission main upgrades by building new well heads up above 100-year floodplain (Tyngsborough Transmission)	2021-2023	Dracut Water District	MVP Grant	High ~ Approx. $600,000

6	**Overhead Powerlines Improvements** Coordinate with the Power company to remove hazard trees Town wide near overhead wires.	2021-2025	DPW/Tree Division	Town	Low
7	**Update Regulations & Bylaws** Update Zoning Bylaw using Climate Change projection data to comply with applicable local, State and Federal regulations	2021-2025	Zoning Board	Town	Medium
8	**Update Regulations & Bylaws** Update Wetlands Bylaw using Climate Change projection data to comply with applicable local, State and Federal regulations	2021-2025	Conservation	Town	Medium
9	**NFIP Compliance** Expand compliance with NFIP and certify a floodplain manager.	2021-2025	Building	FEMA BRIC	Medium
10	**LID Drainage Improvements** Rehabilitate or retrofit the undersized drainage system using LID and Green Infrastructure techniques in the following neighborhoods: • south of Mammoth Rd/ Pine Valley Dr to Lakeview Ave • Tennis Plaza Rd/ Wimbledon Crossing • Arlington St/ Cricket Ln • Montaup Ave/Fox Ave	2021-2030	DPW	MVP Grant	High ~ approx. $300,000
11	**Bartlett Brook Culvert Replacements under Sawmill Drive** Research options to replace 2 private failing culverts conveying Bartlett Brook under Sawmill Drive to meet Stream Crossing Standards without increasing downstream flooding (open bottom, higher capacity); include a Hydrologic and Hydraulic (H&H) model for change in flow using projected climate change data	2021-2025	DPW	MVP Grant	High ~ approx. $400,000-$500,000
12	**Water System Improvements** • Rehabilitate the Water Booster Pump Station on Methuen Street and address safety and confined space issues	2021-2025	Kenwood Water (Town)	Town/Grant Funded	High ~ approx. $400,000

	• Replace old AC water main pipes townwide				High ~ approx. $5,000,000
13	**Water System Improvements** • Rehabilitate the Water Booster Pump Station and address safety and confined space issues • Replace old AC water main pipes townwide	2021-2025	Dracut Water District (Private)	Town	High ~ approx. $12,500,000
14	**Sewer System Improvements** • Sewer line rehabilitation • Oversight of private pump stations	2021-2025	DPW	Town	High ~ approx. $5,000,000 $0
15	**Road System Management Planning** • Formalize a plan for road management system • Coordinate with City of Lowell to mitigate Emergency Evacuation Route Traffic Impacts	2021-2023	DPW & Emergency Management	Ch.90	High ~ approx. $100,000
16	**Generator at Council of Aging** Purchase and Install an emergency generator at the Council on Aging	2021-2023	Emergency Management	FEMA Grant	TBD
17	**Snow Accumulations** Determine snow load capacity for town buildings.	2022-2025	Building	FEMA BRIC	Low
18	**Open Space Improvements** • Update & Revise OSRP 2009 in coordination with the Master Plan 2020 and with other disciplines, departments and permitting changes • Incorporate Nature-based Solution options into revised OSRP • Develop & Coordinate Maintenance Plan for OSRP and Forest Management Plan for Open Spaces	2021-2023	Planning and Conservation	Town	TBD

19	**Water Supply & Water Quality Improvements in the area with no municipal water** • Study water level within wells and drainage discharges • Implement water conservation efforts depending on the results of the study	2022-2025	Kenwood Water	Town	Medium /High ~ approx. $50,000 – $100,000 for study
20	**Public Education & Outreach Planning** • Develop public education and outreach programs for vulnerable populations (EJ population, elderly housing and facilities and group homes for special needs population) relative to climate change and availability of helpful municipal resources • Develop specific evacuation procedures and location for various groups of vulnerable populations	2021-2025	Planning and Emergency Management	Town	Low

* MVP Action Grants typically include a Town cost share commitment of 25%

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APPENDIX A – COMPLETED RISK 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	Snow Storms/ Extreme Cold	Flooding	Wind Damage/ High Winds	Extreme Temperatures	Priority H - M - L	Time Short Long Ongoing	Notes Action Items
Infrastructural										
Water Booster Pump Station	Methuen Street	Town	V	X	X	X	X	H	L	1. Rehabilitate the pump station (originally built 1965); 2. Address safety issue and confined space issue
Area with no Municipal Water (all wells)/Sewer	NE side near Bartlett Brook	Private	V	X	X	X	X	L	L	1. Study to look at water levels within wells, since sewer is municipal, as well as look at drainage discharge within this area; 2. Implement water conservation efforts
Booster Station - Interconnection/Partial Built	Broadway Street	Town	S/V	X	X			M	S	1. Install 40-foot pump; complete the inteconnection
Emergency Water Connection	Arlington Street	Town	S	X	X	X	X	L	O	1. Maintain multiple connections
Tyngsborough Transmission	Tyngsborough Road	Dracut Water Supply	V		X		X	H	L	1. Flood proofing around the existing well heads, transmission main upgrade (build wellheads up above the 100-year floodplain)
AC Water Mains (35) (build in 1960's)	Townwide	Town	V	X			X	H	L	1. Replace the AC pipes w/ appropiate contractor
Municipal Sewer Systems (95% of Town has municipal sewer)	Townwide	Town	S						L/O	1. Improve 3 pump stations; 2. Continue proper maintenance plan for 9 private pump stations; 3. Find solution for backups/not enough capacity.
Sewer Pump Stations	Townwide	Town	V		X			H	L/O	
Bridges over Beaver Brook (1 succeptible to traffic congestion)	Lakeview Ave, Parker Ave & Pleasant St	2 -Town 1-State (Pleasant St)	V/S	X	X	X		L	L	Lakeview Ave is a Culvert, and other one conveys the Beaver Brook (stone arch, and concrete box culvert).
Structurally Failing Municipal Culverts (2)	Peppermint Brook: Sladen St & Lakeview	Town	V		X			H	L	1. Finish replacement of the town-owned culvert to meet stream crossing standards; 2. Research and study options to replace Lakeview Ave culvert (high priority) considering ROW constraints and Stream Crossing Standards
Structurally Failing Private Culverts (2)	Bartlett Brook: Sawmill Drive	Private	V		X			H	L	Research and study options to replace culverts to meet the stream crossing standards without increasing downstream flooding (open bottom, higher capacity) - if collapses, it is a public safety issue as it will isolate the people, there are utilities located beneath the culverts
Dams (3)	Beaver Brook	3 - private	V		X			H	L	1. Study removal of Victory Lane dam; 2. Incorporate the 2 completed studies for the potential removal of the northern most and southern most dams to demonstrate that removal would not result in downstream flooding. 3. Public outreach with upstream and downstream communities about the effects of removal of these dams
Roads - No Formal Road Management System	Townwide	Town	V	X	X	X		H	L	1. Formalize a plan for road management system, there is a traffic control plan for evacuation and a flow through plan for north/south
Stormwater Drainage issues (flooding at low points - 4 areas)	see Appendix X for locations	Town	V	X	X	X	X	H	L	1. Research options for addressing undersized drainage systems; 2. Look at updating reg's for climate change (peak volume, rainfall data (NOAA Atlas 14)?); 3. Consider LID projects within the watershed; 4. Consider adding BMPs
High amount of impervious area in Town	Townwide	Town	V		X			H	L	Research options to incorporate nature-based solutions in school parking lots upgrade
Emergency Buildings/Buildings Command Center	488 Pleasant St	Town	S							1. Continue maintaining emergency buildings and command center
Overhead Powerlines	Townwide	Town	V	X		X				Evaluate powerlines and poles to come up with proper mitigation actions

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	Snow Storms/ Extreme Cold	Flooding	Wind Damage/ High Winds	Extreme Temperatures	Priority H - M - L	Time Short Long Ongoing	Notes Action Items
Societal										
Emergency Command Center	488 Pleasant St	Town	S	X	X	X	X			Continue maintaining emergency command center
Emergency Shelters	HS/Richardson	Town	S	X	X	X	X			1. Continue maintaining the HS and Richardson Middle School as primary shelters; 2. Consider adding Campbell School to shelter buildings to be used in the opposite side of the Town.
Fire Department/Stations (3 building replaced in the past 25 years)	see Appendix X	Town	S	X	X	X	X			see item 1.
EJ Communities	SW side - b/w Mammoth & Donahue Rd		V	X	X	X	X	L	O	1. Conduct public education/outreach to educate about the location of the shelters and where help can be sought during various emergency events
Code Red - "Mass Notification System" (Reverse 911)	Townwide	Town	S/V	X	X	X	X	L	L	1. Study to evaluate how to provide improved cellular services within dead zones (only 20% of population has landlines/Not enough town wide cell reception, multiple dead zones withing the Town); 2. Public education on how to keep informed in cases of emergency events/disasters
Evacuation Plan	Townwide	Town	S	X	X	X	X			
City of Lowell Emergency Evacuation Route Traffic Flow	Townwide	Town	S/V	X	X	X	X	H	O	Route is developed, but final plan for Mass Care Shelter is being developed, result in influx of traffic.
Assisted Living Facilities (2) & Adult Daycare facility (1)	Broadway/Loon Hill Rd; Bridge St/Avis Ave & Darren	Private	V/S	X		X	X	L	O	Bridge St is a new facility, density may be a concern as well (120 units) - concerns w/ evacuation of such a large facility (continue coordination w/ emergency management), low frequency high impact facilities
Council on Aging & Elderly housing (COA no generator)	951 Mammoth R	Town	V	X		X	X	H	S	1. Public Outreach for how to access heating/cooling stations (new generator - FEMA grant)
Group Homes for People with Special Needs (28)	Townwide		V	X		X	X	L	O	1. Continue coordination w/ emergency centers; 2. Establish evacuation location to shelters separate from a general population shelters.

Community Resilience Building Risk Matrix

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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	Snow Storms/ Extreme Cold	Flooding	Wind Damage/ High Winds	Extreme Temperatures	Priority H - M - L	Time Short Long Ongoing	Notes Action Items
Environmental										
Open Space	Townwide	Town	V/S		X		X	M	L	1. Complete/Revise outdated OSRP in coordination with the Master Plan 2020 and with other disciplines/departments (permitting); 2. Coordinate and establish on-going maintenance for OSRP; 3. Incorporate Nature-Based solutions into revised OSRP; 4. Study to see what new parcels can be included in the updated OSRP
No Forest Management Plan for open spaces	Townwide	Town	V		X	X	X			1. Create a forest management plan for open spaces
61A Land - a lot of farming	Townwide	Private/State	S							
The Riparian Buffers are very developed	Beaver Brook/Peppermint Brook	Town/Private	V		X		X	H	S/L	1. Conduct town wide water quality sampling at the outfalls 2. Update Wetlands bylaw in coordination with SW bylaw
Bridge St (FEMA projections - shows overtopping)		Town	V		X			L	L	1. Check on age of H&H analysis, make sure FEMA study for Dracut (2010) has been updated (see what the study was based on/methods)
MS4 - Old & Undersized Drainage systems discharging into receiving regulated waterbodies (MS4)			S/V	X	X	X	X	H	L	1. Research options for addressing undersized drainage systems; 2. Look at updating reg's for climate change (peak volume, rainfall data (NOAA Atlas 14 or more stringent climate change projection data)?)
Impaired Waterbodies (5) in Town with no TMDL		Town	V		X		X	H	S	1. Perform testing at outfalls, trace the pollutants back to identify potential actions based on outcome of study
State Park (1 in Town)		State	S							
Water Supply Land (North) is not being used due to high Mn		Legislative district (regional	V				X	M	L	1. Continue the process to develop a treatment system
Dam Removal/Substantial Repair (3 dams) issues	Beaver Brook	2 private - 1 unk	V		X			H	L	Test sediment substrate upstream and along the brook, study of sediment upstream of dams (make sure there is no contamination), do the H&H study for the dam removal, (coord w. No 10 under Infra)
Recently Updated Stormwater Bylaw 2018	Townwide	Town	S/V		X		X	H	S	1. Update for peak volume and rainfall events (using NOAA Atlas 14 or more stringent climate change projection data)

APPENDIX B – MAP OF DRACUT INFRASTRUCTURAL, SOCIETAL AND ENVIRONMENTAL FEATURES

MAP OF DRACUT INFRASTRUCTURAL, SOCIETAL AND ENVIRONMETAL FEATURES

2-8-2021

Legend

Vulnerability Point

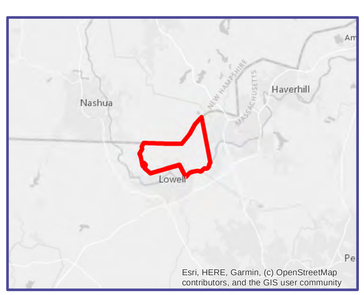
Vulnerability Type

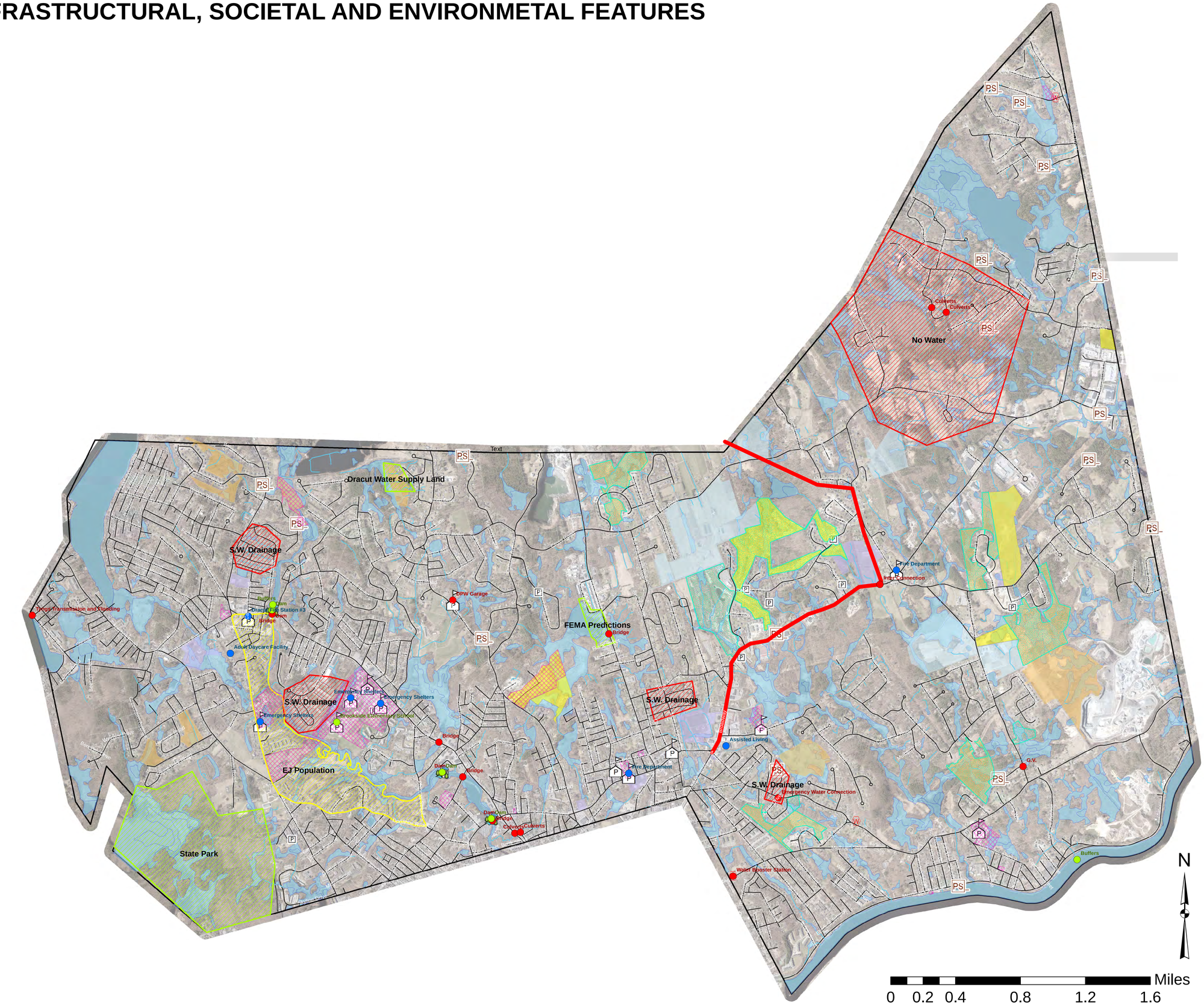
- Environmental
- Infrastructural
- Societal
- Vulnerability Line
- Town-Owned Parcels
- Open Spaces

Vulnerability Polygon

Vulnerabiity Type

- Environmental
- Infrastructural
- Societal
- Dams
- Town Buildings
- Kenwood Booster Stations
- Pump Station Public
- Code 61 Parcels
- Pump Station Private
- Streams
- Roads
- Open Space APR
- Open Space Local
- Open Space OSRD
- Wetlands
- Parcel Poly





APPENDIX C – WORKSHOP MATERIALS

MASSACHUSETTS CLIMATE CHANGE PROJECTIONS FOR MERRIMACK BASIN

MERRIMACK BASIN

MUNICIPALITIES WITHIN MERRIMACK BASIN:

Amesbury, Andover, Ashburnham, Ashby, Ayer, Boxborough, Boxford, Chelmsford, Dracut, Dunstable, Georgetown, Groton, Groveland, Harvard, Haverhill, Lawrence, Littleton, Lowell, Merrimac, Methuen, Newbury, Newburyport, North Andover, Salisbury, Tewksbury, West Newbury, and Westford

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.

MERRIMACK BASIN

Merrimack 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	48.1	+2.2 to +4.4	+3.0 to +6.4	+3.6 to +9.1	+3.9 to +10.9
	Winter	26.8	+2.5 to +5.3	+3.2 to +7.8	+4.0 to +9.5	+4.3 to +10.8
	Spring	46.1	+1.7 to +3.5	+2.6 to +5.4	+2.7 to +7.7	+3.3 to +9.4
	Summer	68.8	+2.1 to +4.3	+2.8 to +6.7	+3.2 to +9.9	+3.8 to +12.5
	Fall	50.3	+2.3 to +5.0	+3.3 to +6.7	+3.5 to +9.6	+4.0 to +11.8
Maximum Temperature	Annual	59.1	+2.1 to +4.2	+2.7 to +6.3	+3.3 to +9.1	+3.6 to +10.9
	Winter	36.7	+2.1 to +4.8	+2.8 to +7.3	+3.4 to +8.8	+3.8 to +10.0
	Spring	57.5	+1.6 to +3.4	+2.2 to +5.5	+2.6 to +7.9	+3.2 to +9.4
	Summer	80.5	+1.9 to +4.4	+2.7 to +6.7	+3.1 to +10.2	+3.6 to +12.8
	Fall	61.5	+2.4 to +4.9	+3.5 to +6.9	+3.4 to +9.9	+3.9 to +12.2
Minimum Temperature	Annual	37.0	+2.3 to +4.8	+3.2 to +6.5	+3.9 to +9.1	+4.2 to +11.0
	Winter	16.9	+2.7 to +5.8	+3.6 to +8.3	+4.6 to +10.2	+4.8 to +11.6
	Spring	34.7	+1.9 to +3.8	+2.7 to +5.7	+2.9 to +7.5	+3.4 to +9.3
	Summer	57.1	+2.2 to +4.5	+3.0 to +7.1	+3.4 to +9.7	+4.0 to +12.2
	Fall	39.1	+2.2 to +5.2	+3.5 to +6.6	+3.6 to +9.4	+4.1 to +11.6

- The Merrimack 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 6.7 °F (3-8% increase); end of century increase of 3.6 °F to 12.8 °F (4-16% increase).
    - Fall mid-century increase of 3.5 °F to 6.9°F (6-11% increase); end of century increase by and 3.9 °F to 12.2 °F (6-20% increase).
- Seasonally, minimum winter and fall temperatures are expected to see increases throughout the 21st century.
    - Winter mid-century increase of 3.6 °F to 8.3 °F (21-49% increase); end of century increase by 4.8 °F to 11.6 °F (28-68% increase).
    - Fall mid-century of 3.5 °F to 6.6 °F (9-17% increase); end of century increase of 4.1°F to 11.6 °F (11-30% increase).

MERRIMACK BASIN

Merrimack 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	7	+7 to +20	+11 to +33	+13 to +55	+15 to +74
	Winter	0	+0 to +0	+0 to +0	+0 to +0	+0 to +0
	Spring	<1[63]	+<1[63] to +1	+<1[63] to +2	+<1[63] to +3	+<1[63] to +5
	Summer	7	+6 to +17	+9 to +28	+11 to +44	+13 to +58
	Fall	<1[63]	+1 to +3	+1 to +5	+1 to +9	+1 to +13
Days with Maximum Temperature Over 95°F	Annual	1	+2 to +8	+3 to +16	+4 to +31	+6 to +49
	Winter	0	+0 to +0	+0 to +0	+0 to +0	+0 to +0
	Spring	0	+<1[63] to +<1[63]	+<1[63] to +<1[63]	+<1[63] to +1	+<1[63] to +2
	Summer	1	+2 to +8	+3 to +14	+4 to +27	+5 to +42
	Fall	0	+<1[63] to +1	+<1[63] to +2	+<1[63] to +4	+<1[63] to +6
Days with Maximum Temperature Over 100°F	Annual	<1[63]	+<1[63] to +2	+<1[63] to +5	+1 to +11	+1 to +22
	Winter	0	+0 to +0	+0 to +0	+0 to +0	+0 to +0
	Spring	0	+0 to +<1[63]	+0 to +<1[63]	+0 to +<1[63]	+0 to +1
	Summer	<1[63]	+<1[63] to +2	+<1[63] to +5	+1 to +10	+1 to +20
	Fall	0	+0 to +<1[63]	+<1[63] to +<1[63]	+0 to +1	+0 to +2

- Due to projected increases in average and maximum temperatures throughout the end of the century, the Merrimack basin is also expected to experience an increase in days with daily maximum temperatures over 90 °F, 95 °F, and 100 °F.
    - Annually, the Merrimack basin is expected to see days with daily maximum temperatures over 90 °F increase by 11 to 33 more days by mid-century, and 15 to 74 more days by the end of the century.
    - Seasonally, summer is expected to see an increase of 9 to 28 more days with daily maximums over 90 °F by mid-century.
    - By end of century, the Merrimack basin is expected to have 13 to 58 more days.

[63] Over the observed period, there were some years with at least 1 day with seasonal Tmax over a certain threshold while in all the other years that threshold wasn't crossed seasonally at all.

MERRIMACK BASIN

Merrimack 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	7	-2 to -4	-2 to -5	-3 to -5	-3 to -5
	Winter	7	-2 to -4	-2 to -4	-2 to -5	-2 to -5
	Spring	<1[64]	-0 to +<1[64]	-0 to -0	-0 to -0	-0 to -0
	Summer	0	-0 to -0	-0 to -0	-0 to -0	-0 to -0
	Fall	<1[64]	-0 to -0	-0 to -0	-0 to -0	-0 to -0
Days with Minimum Temperature Below 32°F	Annual	148	-12 to -30	-19 to -43	-23 to -56	-25 to -66
	Winter	83	-2 to -7	-3 to -12	-5 to -20	-6 to -25
	Spring	37	-4 to -12	-7 to -15	-8 to -19	-9 to -21
	Summer	0	-0 to -0	-0 to -0	-0 to -0	-0 to -0
	Fall	27	-5 to -11	-9 to -15	-9 to -18	-9 to -20

- Due to projected increases in average and minimum temperatures throughout the end of the century, the Merrimack 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 12 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 21 fewer by end of century.
    - Fall is expected to have 9 to 15 fewer days by mid-century, and 9 to 20 fewer days by end of century.

[64] Over the observed period, there were some years with at least 1 day with seasonal Tmin under a certain threshold while in all the other years that threshold wasn't crossed seasonally at all.

MERRIMACK BASIN

Merrimack 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	6693	-572 to -1185	-769 to -1621	-914 to -2135	-1032 to -2503
	Winter	3450	-217 to -492	-282 to -714	-353 to -865	-395 to -997
	Spring	1762	-144 to -291	-213 to -449	-225 to -613	-290 to -720
	Summer	106	-34 to -62	-43 to -79	-54 to -90	-54 to -92
	Fall	1381	-160 to -374	-279 to -463	-266 to -649	-285 to -735
Cooling Degree-Days (Base 65°F)	Annual	526	+209 to +444	+283 to +737	+341 to +1154	+399 to +1518
	Winter	0	+1 to +2	+0 to +4	+1 to +4	+2 to +3
	Spring	20	+10 to +30	+19 to +51	+20 to +90	+16 to +126
	Summer	455	+156 to +337	+199 to +542	+236 to +828	+278 to +1057
	Fall	43	+31 to +94	+48 to +167	+55 to +258	+78 to +335
Growing Degree-Days (Base 50°F)	Annual	2466	+406 to +812	+549 to +1226	+641 to +1923	+730 to +2413
	Winter	6	-1 to +11	+2 to +15	+5 to +24	+3 to +32
	Spring	276	+63 to +136	+89 to +239	+110 to +362	+116 to +471
	Summer	1729	+191 to +398	+258 to +614	+297 to +912	+344 to +1147
	Fall	442	+109 to +296	+179 to +416	+169 to +622	+214 to +779

- Due to projected increases in average, maximum, and minimum temperatures throughout the end of the century, the Merrimack 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% (282 -714 degree-days) by mid-century, and a decrease of 11-29% (395 -997 degree-days) by the end of century.
    - The spring season is expected to decrease in heating degree-days by 12-25% (213-449 degree-days) by mid-century, and by 16-41% (290 -720 degree-days) by the end of century.
    - The fall season is expected to decreases in heating degree-days by 20-34% (279 -463 degree-days) by mid-century, and by 21-53% (285 -1518 degree-days) by the end of century.
- Conversely, due to projected increasing temperatures, summer cooling degree-days are expected to increase by 44-119% (199 -542 degree-days) by mid-century, and by 61-233% (278-1027 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 15-36% (258 -614 degree-days) by mid-century, and by 20-66% (344 -1147 degree-days) by end of century.
    - Spring is expected to see an increase by 32-86% (89 -239 degree-days) by mid-century and 42-171% (116 -471 degree-days) by end of century.
    - Fall is expected to see an increase by 41-94% (179 -415 degree-days) by mid-century and 49-176% (214 -779 degree-days) by end of century.

MERRIMACK BASIN

Merrimack 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	7	+<1[65] to +2	+<1[65] to +3	+1 to +3	+1 to +4
	Winter	2	-0 to +1	+<1[65] to +1	+<1[65] to +1	+<1[65] to +2
	Spring	2	-0 to +1	-0 to +1	+<1[65] to +1	+<1[65] to +1
	Summer	1	-0 to +<1[65]	-0 to +1	-0 to +1	+0 to +1
	Fall	2	-0 to +1	-0 to +1	-0 to +1	+0 to +1
Days with Precipitation Over 2"	Annual	1	+<1[65] to +<1[65]	+0 to +1	+<1[65] to +1	+<1[65] to +1
	Winter	<1[65]	-0 to +<1[65]	-0 to +1	-0 to +<1[65]	+0 to +<1[65]
	Spring	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Summer	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Fall	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
Days with Precipitation Over 4"	Annual	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Winter	0	+0 to +0	+0 to +0	+0 to +0	+0 to +<1[65]
	Spring	0	-0 to +<1[65]	+0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Summer	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Fall	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]

- The projections for expected number of days receiving precipitation over one inch are variable for the Merrimack 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 0-2 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.

[65] Over the observed period, there were some years with at least 1 day with seasonal precipitation over a certain threshold while in all the other years that threshold wasn't crossed seasonally at all.

MERRIMACK BASIN

Merrimack 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	44.2	+0.1 to +4.5	-0.0 to +5.8	+0.9 to +6.9	+0.9 to +7.6
	Winter	10.8	-0.5 to +1.9	-0.0 to +2.4	+0.4 to +3.0	+0.4 to +3.8
	Spring	11.3	-0.1 to +2.2	-0.1 to +2.1	+0.1 to +2.6	+0.2 to +2.5
	Summer	10.3	-0.2 to +1.3	-0.6 to +2.0	-0.8 to +1.8	-1.1 to +1.8
	Fall	11.9	-1.1 to +1.1	-1.1 to +1.5	-1.6 to +1.4	-1.4 to +1.3

- Similar to projections for number of days receiving precipitation over a specified threshold, seasonal projections for total precipitation are also variable for the Merrimack basin.
    - The winter season is expected to experience the greatest change with an increase of 0-22% by mid-century, and of 4-35% 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 Merrimack or basin could see a decrease of 0.6 to an increase of 2.0 inches by mid-century (decrease of 6% to increase of 20%) and a decrease of 1.1 to an increase of 1.8 inches by the end of the century (decrease of 10% to increase of 17%).
        - The fall season projections for the Merrimack basin could see a decrease of 1.1 to an increase of 1.5 inches by mid-century (decrease of 10% to increase of 13% and a decrease of 1.4 to an increase of 1.3 inches by the end of the century (decrease of 12% to increase of 11%).

Merrimack Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Consecutive Dry Days	Annual	17	-1 to +1	-0 to +2	-1 to +2	-0 to +3
	Winter	12	-1 to +1	-1 to +2	-1 to +2	-1 to +2
	Spring	12	-1 to +1	-1 to +1	-2 to +1	-1 to +1
	Summer	13	-1 to +1	-1 to +2	-1 to +2	-1 to +2
	Fall	12	-0 to +2	-0 to +2	-0 to +3	-0 to +3

- 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 Merrimack 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 summer season is expected to experience a decrease of 1 day to an increase of 2 days in consecutive dry days by the end of the century.

MVP CORE TEAM KICK OFF MEETING

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MEETING MINUTES

Project Name:	MVP/HMP Plan for Dracut
Subject:	MVP/HMP Core Team Kick Off Meeting
Date / Time:	June 25, 2020 at 10:00am
Location:	Virtual (Teams Meeting)
Prepared By:	Danielle Spicer, P.E.
Attendees:	See Attached Attendance Sheet

The following is a summary of items discussed at the kick off meeting for the MVP/HMP Planning process for the Town of Dracut. Action items are noted in bold below.

1. Introductions: The virtual MVP/HMP kick-off meeting was held via Microsoft Teams to present an upcoming MVP/HMP process for the Town of Dracut. Danielle Spicer with Green International Affiliates, Inc. (Green) and Jamie Caplan with Jamie Caplan Consulting LLC, both State Certifies MVP Providers, presented the project to the Core Team selected by the Town of Dracut followed by the questioning session in the end of the presentation. (see attached attendance list for who attend the meeting virtually).

2. Overview of MVP Program:
    a. Danielle Spicer and Jamie Caplan gave a brief overview of the MVP/HMP grant program and explained its two-fold purpose, which is to make the Town more resilient to climate change and to make the Town eligible for MVP Action grants and FEMA grants.

    b. Jamie Caplan discussed with the Core Team the need to evaluate the performance on the 21 Dracut-specific mitigation actions from the previous Regional HMP 2015. She was hoping to start the process of evaluating the Town's 5-year performance early in order to be able to add the new actions and expand/revise/adapt the old ones for the upcoming 5 years.

    c. The main concern that the MVP plan will address are how to deal with increased temperatures and increased precipitation based on UMass climate change projections. How to deal with climate change and preserve the natural habitat.

    d. First Step will be to identify the vulnerabilities within the Town. What are the Town's strengths and weaknesses? We will need to show these on some maps. During the Workshops, we can brainstorm for solutions.

3. Schedule Workshops & Invitation Process:
    a. We recommend having one more Core Team meeting in early August to discuss the major hazards before the workshop begins.
    b. There are two possible formats for the workshops (1 – 8 hr day or 2 – 4 hr days). The Town would prefer 2 – 4 hr days, which will be held virtually.
    c. 1st will identify the vulnerabilities within the Town
    d. 2nd will brainstorm on projects to reduce vulnerabilities

e. **An article for when the workshops will be held (in September) will need to be drafted**. The article will be posted in the local paper for advertisement about the workshops.

4. Preparation of Materials needed for workshops:
    a. Map of Town
    b. Vendor for the Town GIS
    c. Need to add resource areas to Town Maps (i.e. Floodplain, open space)
    d. Identify problem areas within town (weather related)

5. Questions and Answers:
    a. Danielle and Jamie discussed the Town's GIS capabilities to be used in the MVP/HMP process. They explained that from their experience both HMP and MVP plans will be stronger and more presentable if we are able to use the Town's GIS client to create the locus maps with boundaries of flooding, environmentally sensitive areas, wetlands, etc. and use these maps in the process to identify and map critical facilities, vulnerable populations, and other key items that will be included in the HMP and MVP plans.

    b. Mark Hamel, Dracut, Town Engineer, also raised a question about a possibility to study the 2 town dams in order to include them in the potential mitigation items. He mentioned that one of the dams has been studied by FWS in the past and that the Town can take this opportunity to study the dams more and evaluate potential solutions as part of the MVP and HMP planning process. Rich Patterson, Dracut Deputy Fire Chief/ Emergency Management, added that the dams are privately owned, which makes it difficult to include them in the Town's plans.

The preceding meeting notes represent our understanding of the information exchanged. Please notify us of any misunderstandings or required interpretations, within five days, as we will proceed on the basis that these items are agreed to by all parties.

Enclosures:

a. Sign-In sheet

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ATTENDANCE SHEET
Project: **Dracut MVP Kick-off Meeting**
Location: **Virtual Teams Meeting**
Date: **Thursday, June 25, 2019 at 10:00am**

Name	Representing	Phone	Email
1. Danielle Spicer	Green International Affiliates, Inc., State Certified MVP Provider, P.E., CFM, LEED AP, ENV SP	978-923-0400	dspicer@greenintl.com
2. Peter Richardson	Green International Affiliates, Inc., State Certified MVP Providers, P.E.,LEED AP, ENV SP	978-923-0400	prichardson@greenintl.com
3. Oxana Fartushnaya	Green International Affiliates, Inc., Environmental Scientist	978-923-0400	ofartushnaya@greenintl.com
4. Jamie Caplan	Jamie Caplan Consulting LLC, State Certified MVP Provider, Mitigation Planning Lead	p: 413-586-0867 c: 413-218-7310	jamie@jamiecaplan.com
5. Ann Vandal	Dracut, Town Manager	978-452-1227	Avandal@dracutma.gov
6. Tina Douk	Dracut, Stormwater Manager	978-957-1497	tdouk@dracutma.gov
7. Mark Hamel	Dracut, Town Engineer	978-454-2594	Mhamel@dracutma.gov
8. Ed Patenuade	Dracut, DPW Director	978-957-0411	Epatenaude@dracutma.gov
9. Bethany Loveless	Dracut, Council on Aging Director	978-957-2611	Bloveless@dracutma.gov
10. Rich Patterson	Dracut, Deputy Fire Chief/ Emergency Management	978-454-2113	rpatterson@dracutma.gov
11.			
12.			
13.			
14.			

Dracut Municipal Vulnerability Preparedness (MVP) Plan & Hazard Mitigation Plan (HMP)

Danielle Spicer, P.E., LEED AP, ENV SP from
Green International Affiliates, Inc
Jamie Caplan, from Jamie Caplan Consulting LLC
(State Certified MVP Providers)

June 25, 2020

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Building Strong Client Relationships Through Engineering Excellence

Agenda

1. Introductions – MVP/HMP Core Team
2. Overview of MVP/HMP Program
3. Previous Related Mitigation Planning Efforts
4. Defining and Setting Goals for the Town's MVP Plan
5. Schedule Workshops and Invitation Process
6. Preparation of Materials for Workshops
7. Questions/Discussion
8. Adjourn

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MVP/HMP Plans Previously Done

History of success in MA

- Commonwealth of MA (State Plan)
- Town of Becket (MVP/HMP)
- Town of Bridgewater (MVP)
- Town of Blandford (HMP)
- Town of Dighton (MVP/HMP)
- Town of Fairhaven (MVP/HMP)
- Town of Lexington (MVP/HMP)
- Town of Ludlow (HMP)
- Town of North Reading (HMP/MVP)
- City of Pittsfield (MVP/HMP)
- Town of South Hadley (HMP)
- UMASS Amherst (HMP)

Nationwide experience

- Territory of American Samoa
- County of Maui
- American Indian Tribes
- South Central Region of Connecticut

MVP/HMP Core Team - Dracut

- Ann Vandal – Town Manager
- Ed Patenaude – Director of Public Works
- Mark Hamel – Town Engineer
- Lori Cahill – Conservation Agent/Parks and Recreation
- Dan MacLaughlin – Building Inspector
- Richard Patterson – Deputy Fire chief/emergency response
- Betsy Ware – Community Development
- Bethany Loveless – Council on Aging
- Tina Douk - Stormwater Manager (DPW)

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Outcomes of this Process

- MVP Community Designation
- Eligibility and ideas for “Action Grants”
- Updated Hazard Mitigation Plan
- Eligibility for FEMA grant funding
- Public education and awareness
- Baseline information for future planning and implementation efforts
- Best Management Practices for Resiliency

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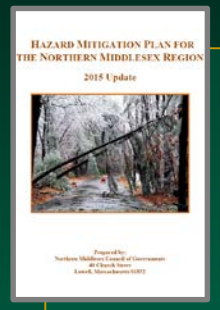
FEMA's Pre-Disaster Mitigation Funding

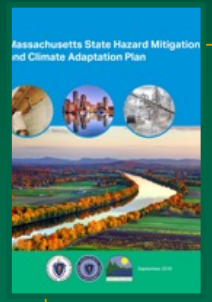
A FEMA-approved Hazard Mitigation Plan is required to receive Federal Grant Funds for Hazard Mitigation Projects

- Pre-Disaster Mitigation (PDM)
  - Building Resilient Infrastructure and Communities (BRIC)
- Flood Mitigation Assistance (FMA)
- Hazard Mitigation Grant Program (HMGP)
  - Only available after a Presidential Disaster Declaration

Mitigation Plan Development



Hazard Mitigation Plan for the Northern Middlesex Region (2015)



State Hazard Mitigation and Climate Adaptation Plan 2018

Municipal Vulnerability Preparedness Program (MVP)

Town of Dracut MASSACHUSETTS

Town of Dracut Hazard Mitigation Plan 2020

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Mitigation Defined

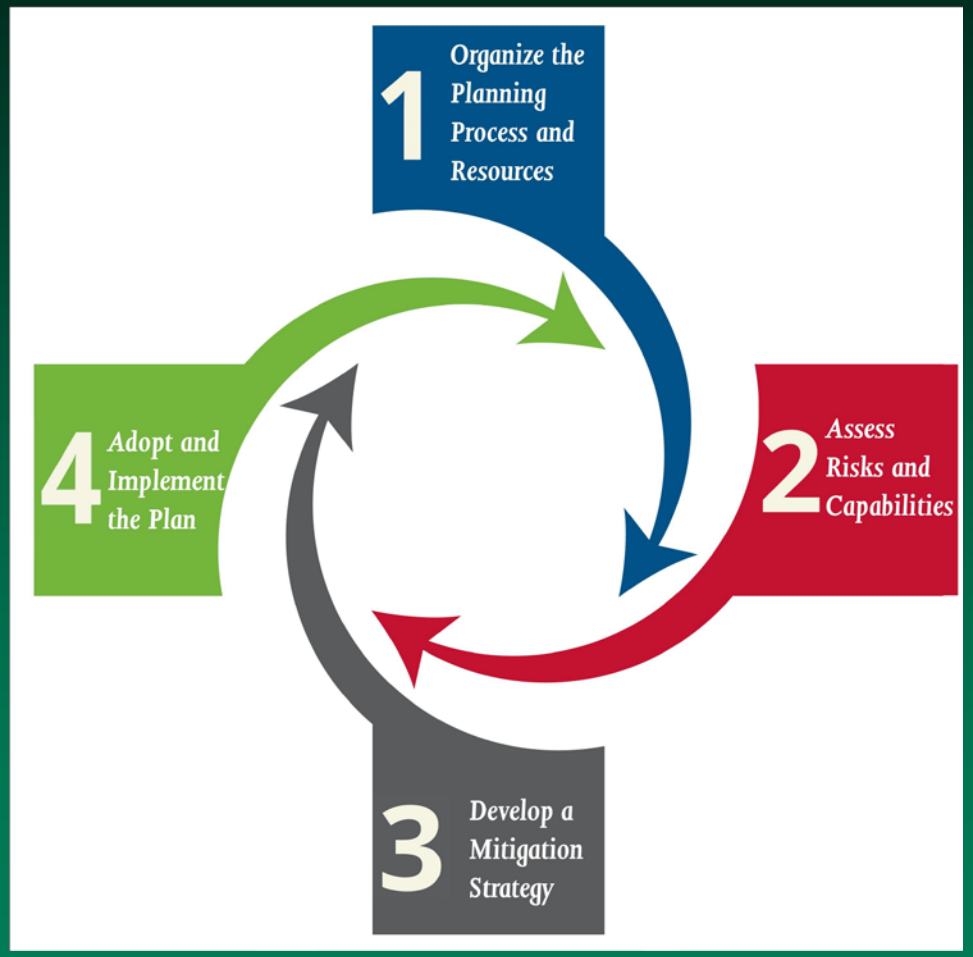
- Any sustained actions taken to reduce or eliminate long term risk to people and property from hazards and their effects.

Possible Mitigation Actions – Eligible for Funding

- Property acquisition
- Structure elevation
- Flood risk reduction (culverts, drainage upgrades)
- Retrofitting buildings
- Soil stabilization
- Generators (FEMA only)

- Nature-based solutions and low-impact development prioritized!

Hazard Mitigation Plan



- Core Team Meetings
- CRB Workshop
- Stakeholder Interviews
- Public Meetings, Listening Session
- Survey
- Draft Plan Review

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Core Team

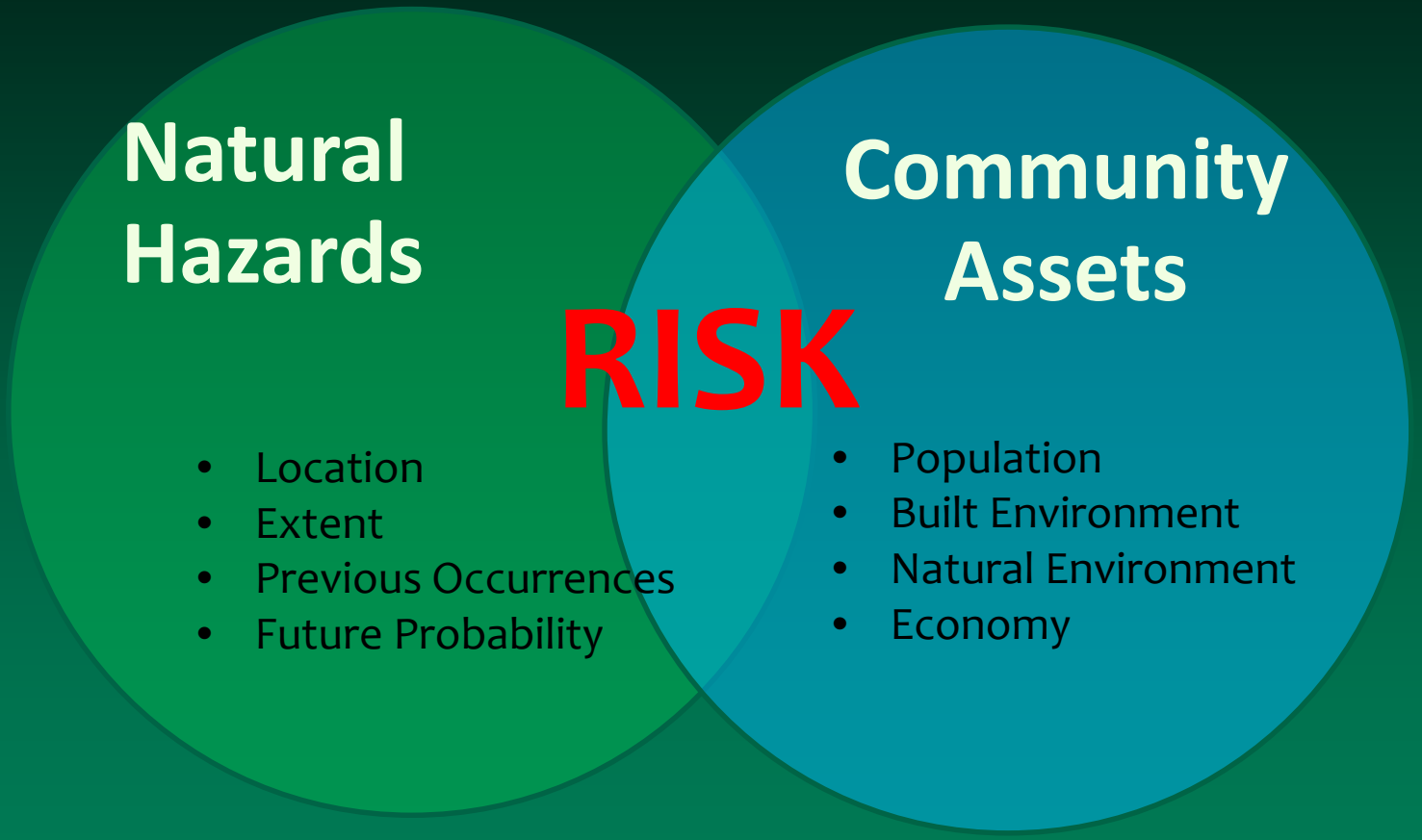
Provide supporting data or information.

Assist in the identification and prioritization of mitigation actions.

Review and comment on draft plan deliverables.

Approve final draft plan prior to submission to MEMA and FEMA.

Defining Risk



Natural Hazards

Primary Climate Change Interactions	Natural Hazards
Changes in Precipitation	• Flooding • Drought • Landslide
Sea Level Rise	• Coastal Flooding • Coastal Erosion • Tsunami
Rising Temperatures	• Average/Extreme Temperatures • Wildfires • Invasive Species
Extreme Weather	• Hurricanes/Tropical Storms • Severe Winter Storm/Nor'easter • Tornadoes • Severe Weather (strong winds/extreme precipitation)
Non-Climate Influenced Hazards	• Earthquake

High Hazard Areas

- Lowell/Dracut/Tyngsborough Forest (fire, truck volume)
- Flooding Concern
  - Peter's Pond and Cedar Pond Shorelines
  - Bartlett Brook
  - Richardson Brook
  - Trout Brook
  - Double Brook
  - Shore of Lake Mascuppic
  - Beaver Brook
- Four Dams

Critical Facilities

- Fire Stations
- Police Department
- Dracut Junior High School
- Campbell School
- Dracut Middle School
- Shelter in place buildings?

Mitigation Actions

- Local Plans and Regulations
- Structure and Infrastructure
- Natural System Protection
- Education and Awareness Programs

National Benefit-Cost Ratio (BCR) Per Peril *BCR numbers in this study have been rounded	Beyond Code Requirements	Federally Funded
Overall Hazard Benefit-Cost Ratio	$4:1	$6:1
Riverine Flood	$5:1	$7:1
Hurricane Surge	$7:1	Too few grants
Wind	$5:1	$5:1
Earthquake	$4:1	$3:1
Wildland-Urban Interface Fire	$4:1	$3:1

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Dracut Mitigation Actions

Current Status for FEMA

- Completed
- Partially Completed
- Delayed
- Cancelled

Keep for Update?

Develop New Actions

Plan Adoption And Implementation

Write and Review Plan

Plan Adoption and Implementation

FEMA Approval every 5 years

Mitigation Planning

Next Steps

Stakeholder Engagement Meetings

Core Team Meetings

Public Meetings/Listening Session

Overview of MVP Program

Community Resilience Building

WORKSHOP GUIDE

www.CommunityResilienceBuilding.org

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Overview of MVP Program

Overview of the Process (Steps & Tasks)

DURING WORKSHOP

A Prepare for the Workshop
1. Establish a core team with goals.
2. Engage stakeholders.
3. Prepare materials for workshop.
4. Decide on participant arrangements.

B Characterize Hazards
1. Identify past, current, and future impacts.
2. Determine the highest-priority hazards.

C Identify Community Vulnerabilities and Strengths
1. Identify infrastructural vulnerabilities and strengths.
2. Identify societal vulnerabilities and strengths.
3. Identify environmental vulnerabilities and strengths.

D Identify and Prioritize Community Actions
1. Identify and prioritize infrastructural actions.
2. Identify and prioritize societal actions.
3. Identify and prioritize environmental actions.

E Determine the Overall Priority Actions
1. Identify highest-priority actions.
2. Further define urgency and timing.

F Put It All Together
1. Generate final workshop products.

G Move Forward
1. Continue community outreach and engagement.
2. Secure additional data and information.
3. Inform existing planning and project activities.

Community Components

Infrastructural

Societal

Environmental

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Climate Change Projections

- UMASS Climate Research Center Report
- Climate Change Projections from EOEA for Development of MVP Plans

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Overview of MVP Program

MERRIMACK BASIN

MUNICIPALITIES WITHIN MERRIMACK BASIN:

Amesbury, Andover, Ashburnham, Ashby, Ayer, Boxborough, Boxford, Chelmsford, Dracut, Dunstable, Georgetown, Groton, Groveland, Harvard, Haverhill, Lawrence, Littleton, Lowell, Merrimac, Methuen, Newbury, Newburyport, North Andover, Salisbury, Tewksbury, West Newbury, and Westford

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.

MERRIMACK BASIN

Merrimack 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	48.1	+2.2 to +4.4	+3.0 to +6.4	+3.6 to +9.1	+3.9 to +10.9
	Winter	26.8	+2.5 to +5.3	+3.2 to +7.8	+4.0 to +9.5	+4.3 to +10.8
	Spring	46.1	+1.7 to +3.5	+2.6 to +5.4	+2.7 to +7.7	+3.3 to +9.4
	Summer	68.8	+2.1 to +4.3	+2.8 to +6.7	+3.2 to +9.9	+3.8 to +12.5
	Fall	50.3	+2.3 to +5.0	+3.3 to +6.7	+3.5 to +9.6	+4.0 to +11.8
Maximum Temperature	Annual	59.1	+2.1 to +4.2	+2.7 to +6.3	+3.3 to +9.1	+3.6 to +10.9
	Winter	36.7	+2.1 to +4.8	+2.8 to +7.3	+3.4 to +8.8	+3.8 to +10.0
	Spring	57.5	+1.6 to +3.4	+2.2 to +5.5	+2.6 to +7.9	+3.2 to +9.4
	Summer	80.5	+1.9 to +4.4	+2.7 to +6.7	+3.1 to +10.2	+3.6 to +12.8
	Fall	61.5	+2.4 to +4.9	+3.5 to +6.9	+3.4 to +9.9	+3.9 to +12.2
Minimum Temperature	Annual	37.0	+2.3 to +4.8	+3.2 to +6.5	+3.9 to +9.1	+4.2 to +11.0
	Winter	16.9	+2.7 to +5.8	+3.6 to +8.3	+4.6 to +10.2	+4.8 to +11.6
	Spring	34.7	+1.9 to +3.8	+2.7 to +5.7	+2.9 to +7.5	+3.4 to +9.3
	Summer	57.1	+2.2 to +4.5	+3.0 to +7.1	+3.4 to +9.7	+4.0 to +12.2
	Fall	39.1	+2.2 to +5.2	+3.5 to +6.6	+3.6 to +9.4	+4.1 to +11.6

- The Merrimack 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 6.7 °F (3-8% increase); end of century increase of 3.6 °F to 12.8 °F (4-16% increase).
  - Fall mid-century increase of 3.5 °F to 6.9°F (6-11% increase); end of century increase by and 3.9 °F to 12.2 °F (6-20% increase).
- Seasonally, minimum winter and fall temperatures are expected to see increases throughout the 21st century.
  - Winter mid-century increase of 3.6 °F to 8.3 °F (21-49% increase); end of century increase by 4.8 °F to 11.6 °F (28-68% increase).
  - Fall mid-century of 3.5 °F to 6.6 °F (9-17% increase); end of century increase of 4.1°F to 11.6 °F (11-30% increase).

Scope of Work

1. Support the municipal core team to prepare for the workshop(s):
2. Conduct (1) 8 hour workshop or (2) 4 hour works and provide lead facilitation and small group facilitation
3. Package workshop outcomes and generate the final report:
4. Help the community plan for next steps

   - Hold a public listening session

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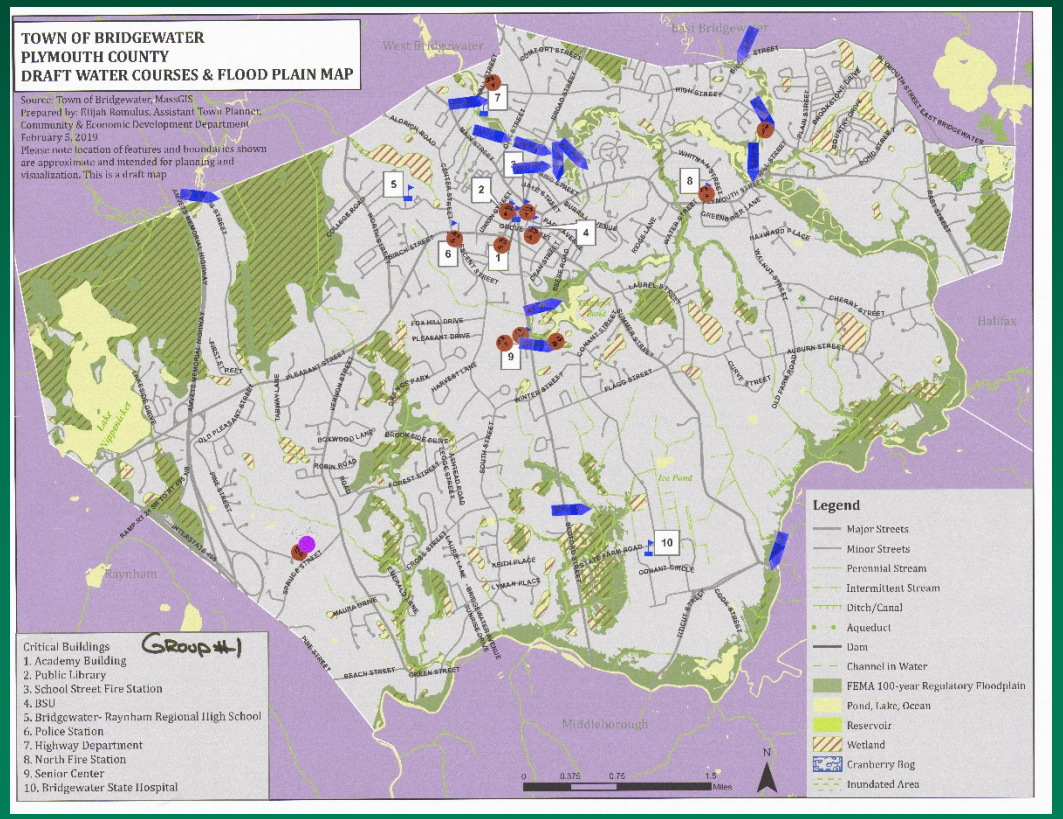
Workshops – Bridgewater, MA



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Defining and Setting Goals for the Town's MVP Plan

Upon successful completion of the CRB process and clearly defined efforts to begin implementation (including conducting at least 1 public session), municipalities will be designated as a **"Municipal Vulnerability Preparedness Program Climate Community,"** or **"MVP Climate Community"** which may lead to increased standing in future funding opportunities and follow-on opportunities.

Schedule Workshops and Invitation Process

When, Where and Who's Invited?

- Workshop No 1 (4-hours) - Assess vulnerabilities
- Workshop No. 2 (4-hours) – Develop Actions

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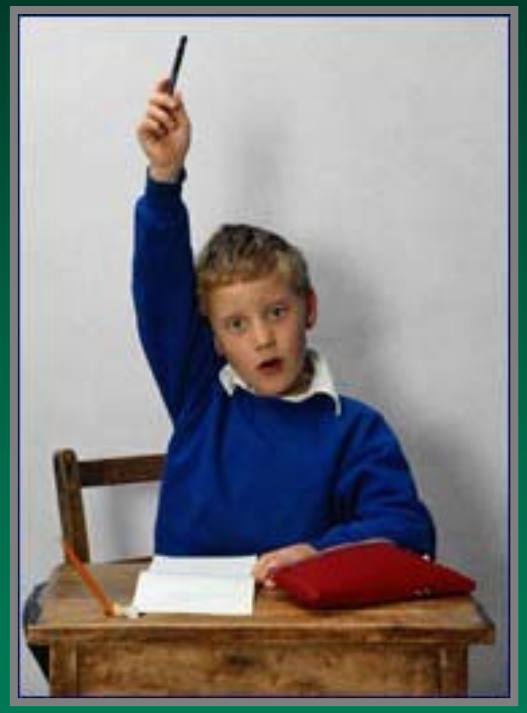
Preparation of Materials for Workshops

1. Room with tables and ability to break into groups (will now be virtual)
2. GIS Maps with Critical Facilities and known Hazards
3. Previous Mitigation Action Items
4. Set Ground Rules
    1. Extra Core Team meeting right before Workshops to identify high hazards

Schedule

- June 25 – 1st Core Team Meeting (MVP/HMP)
- Late July/Early August – 2nd Core Meeting (MVP/HMP)
- Week of 9/14 – 9/21 – Two 4 hour Workshops(MVP/HMP)
- Week of 10/12 – 3rd Core Meeting (HMP only)
- Week of 10/26 – 1st Listening Session (HMP only)
- Week of 11/9 – 2nd Listening Session (MVP/HMP)
- Week of 12/14 – Submit MVP to EOEEA
- Week of 1/11/2021 – Submit HMP to FEMA

Questions



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WORKSHOP NO. 1

The Municipal Vulnerability Preparedness grant program (MVP) provides support for cities and towns in Massachusetts to begin the process of planning for climate change resiliency and implementing priority projects. The state awards communities with funding to complete vulnerability assessments and develop action-oriented resiliency plans. Communities who complete the MVP program become certified as an MVP community and are eligible for MVP Action grant funding and other opportunities.

Goals of the Workshops:

- Stakeholder based vulnerability and strength identification process
- Participants identify opportunities to increase resilience, develop solutions, and prioritize actions
- Prioritized action plans are developed including time horizon information

Why You should care:

- MVP certified plans will be crossed walked into Town's Open Space Plans, Master Plans, and Hazard Mitigation Plans
- Incorporate into comprehensive planning process to ensure resilience is community priority
- MVP certified communities will be priority status for some state grant opportunities

Dracut's MVP Workshop Dates

- September 29th from 3-7pm
- October 6th from 3-7pm

Dracut's MVP Workshop Dates

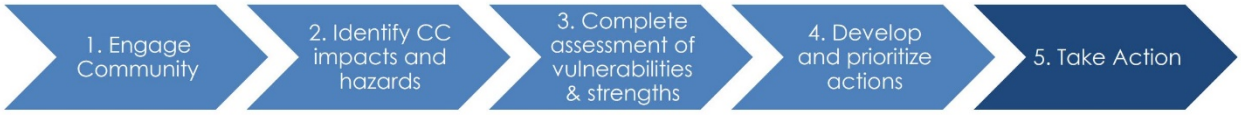
- September 29th from 3-7pm
- October 6th from 3-7pm

Town of Dracut
MASSACHUSETTS

Agenda (Workshop No. 1 on 9/29/2020):

- 3:00 – 3:10 Introductions
- 3:10 – 3:20 MVP/HMP Program Overview
- 3:20 – 3:30 Review Goals for MVP/HMP Plan & Top Four Hazards for Town of Dracut
- 3:30 – 4:00 Nature Based Solutions
- 4:00 – 4:20 Infrastructure – Identify Vulnerabilities
- 4:20 – 4:40 Infrastructure – Identify Strengths
- 4:40 – 5:00 Societal – Identify Vulnerabilities
- 5:00 – 5:30 Break
- 5:30 – 5:50 Societal – Identify Strengths
- 5:50 – 6:10 Environmental – Identify Vulnerabilities
- 6:10 – 6:30 Environmental – Identify Strengths
- 6:30 – 7:00 Questions/Discussion/Next Steps

State and local partnership to build resiliency to climate change



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ATTENDANCE SHEET
Project: **Dracut MVP Workshop No. 1**
Location: **In-person – Harvey J. Gagnon Harmony Hall: 1660 Lakeview Ave, Dracut, MA**
Virtual – Microsoft Teams Meeting
Date: **Tuesday, September 29, 2020**
Time: **3 pm-7 pm**

Name	Representing	Phone	Email	In-person or Virtual
1. Danielle Spicer	Green International Affiliates, Inc., State Certified MVP Provider, P.E., CFM, LEED AP, ENV SP	978-923-0400	dspicer@greenintl.com	In-person
2. Peter Richardson	Green International Affiliates, Inc., State Certified MVP Providers, P.E.,LEED AP, ENV SP	978-923-0400	prichardson@greenintl.com	In-person
3. Oxana Fartushnaya	Green International Affiliates, Inc., Environmental Scientist	978-923-0400	ofartushnaya@greenintl.com	In-person
4. Jamie Caplan	Jamie Caplan Consulting LLC, State Certified MVP Provider, Mitigation Planning Lead	413-586-0867	jamie@jamiecaplan.com	Virtual
5. Tina Douk	Dracut, Stormwater Manager	978-957-1497	tdouk@dracutma.gov	In-person
6. Leo Caron	Dracut, Stormwater	978-957-1497	N/A	In-person
7. David Sutherland	Dracut, Open Space Committee & Conservation Commission	978-987-7857	sutherland.david@comcast.net	In-person
8. Michael Sheu	Dracut, Water Supply District superintendent	978-957-0441	michael.sheu@dracutwater.com	In-person
9. Jay Reynolds	Dracut, Sewer and Kenwood Water Superintendent	978-957-0371	Jreynolds@dracutma.gov	In-person
10. Mark Hamel	Dracut, Town Engineer	978-454-2594	Mhamel@dracutma.gov	In-person

11. Ed Patenaude	Dracut, DPW Director	978-957-0411	Epatenaude@dracutma.gov	In-person
12. Ellis Neofotistos	Dracut, Agricultural Commission & Permanent Building Committee	978-957-1983	srowe@dracutma.gov	In-person
13. Andrew Graham	Dracut, Supervisor of buildings & grounds		agraham@dracutps.org	Virtual
14. Beverly Woods	Northern Middlesex Council of Government, Executive Director		bwoods@nmcog.org	Virtual
15. John Crowley	Dracut, Zoning Board of Appeals, Chair	978-454-0603	jcrow24844@aol.com	Virtual
16. Dan McLaughlin	Dracut, Building Inspector		Dmclaughlin@dracutma.gov	Virtual
17. Ann Vandal	Dracut, Town Manager	978-452-1227	Avandal@dracutma.gov	Virtual
18. Kris Houle	MA DER, Senior Ecological Restoration Engineer		kris.houle@state.ma.us	Virtual
19. Jeffrey Hollett	Dracut, Veterans Service Officer		jhollett@dracutma.gov	Virtual
20. Betsy Ware	Dracut, Community Development Coordinator	978-453-4557	eware@dracutma.gov	Virtual
21. Michelle Rowden (EEA)	MVP Northeast Regional Coordinator		michelle.rowden@state.ma.us	Virtual
22.				
23.				
24.				
25.				
26.				

Dracut
Municipal Vulnerability Preparedness (MVP) Plan – Workshop No. 1

Danielle Spicer, P.E., LEED AP, ENV SP from
Green International Affiliates, Inc
(State Certified MVP Provider)

September 29, 2020

Town of Dracut
MASSACHUSETTS

GREEN INTERNATIONAL AFFILIATES, INC.

Building Strong Client Relationships Through Engineering Excellence

Agenda

3:00 – 3:10	Introductions – MVP/HMP Core Team
3:10 – 3:20	MVP/HMP Program Overview
3:20 – 3:30	Review MVP Plan Goals & Top Four Hazards
3:30 – 4:00	Nature Based Solutions
4:00 – 4:20	Infrastructure – Identify Vulnerabilities
4:20 – 4:40	Infrastructure – Identify Strengths
4:40 – 5:00	Societal –Identify Vulnerabilities
5:00 – 5:30	Break
5:30 – 5:50	Societal – Identify Strengths
5:50 – 6:10	Environmental –Identify Vulnerabilities
6:10 – 6:30	Environmental –Identify Strengths
6:30 – 7:00	Questions/Discussion/Next Steps

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Introductions

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Civil and Structural Engineers

Overview of MVP/HMP Program

Community Resilience Building Workshop Guide

www.CommunityResilienceBuilding.com

UMASS Climate Change Projections

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MVP/HMP Core Team - Dracut

- Ann Vandal – Town Manager
- Ed Patenaude – Director of Public Works
- Mark Hamel – Town Engineer
- Lori Cahill – Conservation Agent/Parks and Recreation
- Dan MacLaughlin – Building Inspector
- Richard Patterson – Deputy Fire chief/emergency response
- Betsy Ware – Community Development
- Bethany Loveless – Council on Aging
- Tina Douk - Stormwater Manager (DPW)

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Jamie Caplan Consulting LLC

History of success in MA

- Commonwealth of MA (State Plan)
- Town of Becket (MVP/HMP)
- Town of Blandford (HMP)
- Town of Dighton (HMP/MVP)
- Town of Fairhaven (MVP/HMP)
- Town of Lexington (MVP/HMP)
- Town of Ludlow (HMP)
- Town of North Reading (HMP)
- City of Pittsfield (MVP/HMP)
- Town of South Hadley (HMP)
- UMASS Amherst (HMP)

Nationwide experience

- Territory of American Samoa
- County of Maui
- American Indian Tribes
- South Central Region of Connecticut

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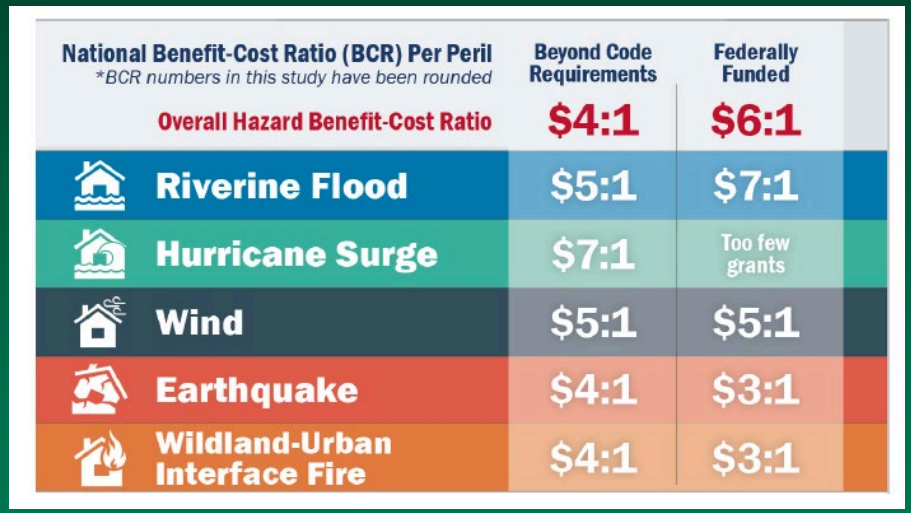
FEMA's Pre-Disaster Mitigation Funding

A FEMA-approved Hazard Mitigation Plan is required to receive Federal Grant Funds for Hazard Mitigation Projects

- Building Resilient Infrastructure and Communities (BRIC)
  - Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- Hazard Mitigation Grant Program (HMGP)
  - Only available after a Presidential Disaster Declaration



National Benefit-Cost Ratio (BCR) Per Peril *BCR numbers in this study have been rounded	Beyond Code Requirements	Federally Funded
Overall Hazard Benefit-Cost Ratio	$4:1	$6:1
Riverine Flood	$5:1	$7:1
Hurricane Surge	$7:1	Too few grants
Wind	$5:1	$5:1
Earthquake	$4:1	$3:1
Wildland-Urban Interface Fire	$4:1	$3:1

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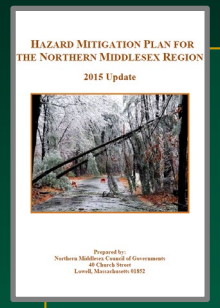
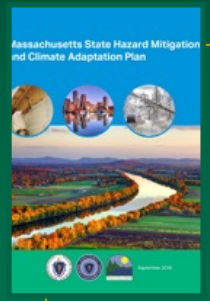
Mitigation Plan Development



Hazard Mitigation Plan for the Northern Middlesex Region (2015)



State Hazard Mitigation and Climate Adaptation Plan 2018

Municipal Vulnerability Preparedness Program (MVP)

Town of Dracut MASSACHUSETTS

Town of Dracut Hazard Mitigation Plan 2020

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Mitigation Defined

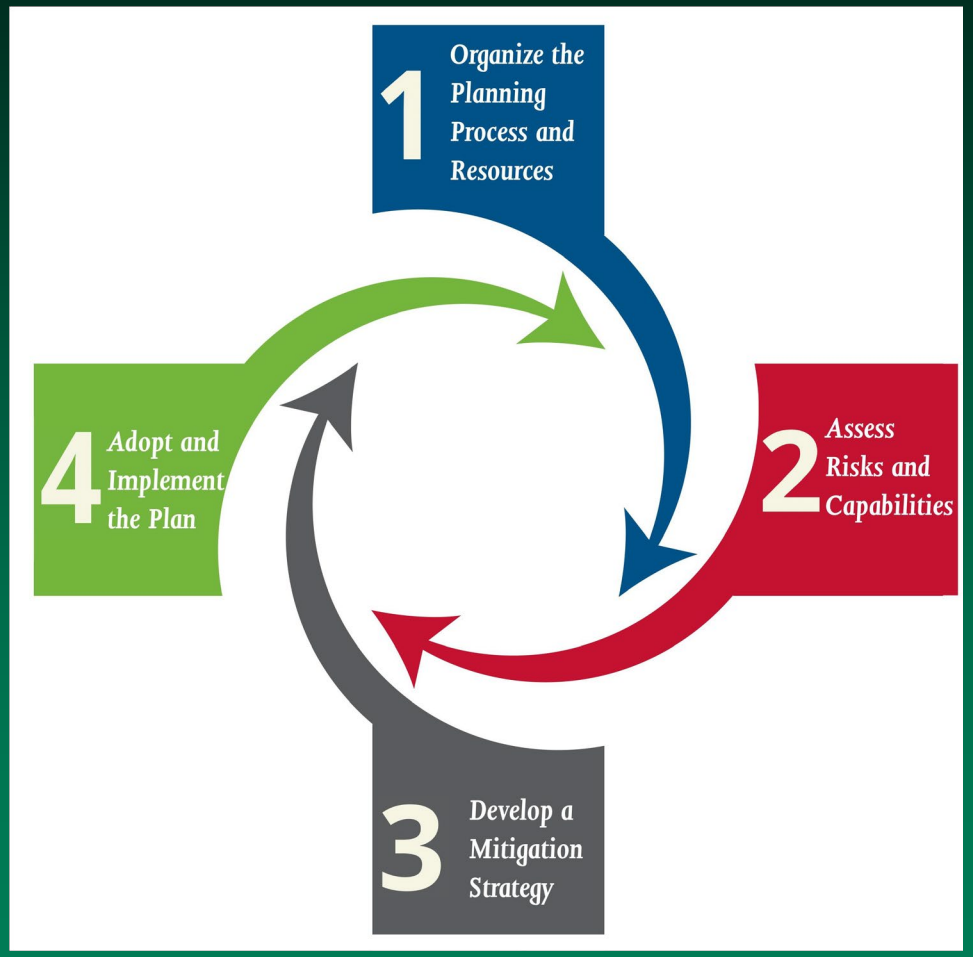
- Any sustained actions taken to reduce or eliminate long term risk to people and property from hazards and their effects.

Possible Mitigation Actions Eligible for Funding

- Property acquisition
- Structure elevation
- Flood risk reduction (culverts, drainage upgrades)
- Retrofitting buildings
- Soil stabilization
- Generators (FEMA only)

- Nature-based solutions and low-impact development prioritized!

Hazard Mitigation Plan



- Core Team Meetings
- CRB Workshop
- Stakeholder Interviews
- Public Meetings, Listening Session
- Draft Plan Review

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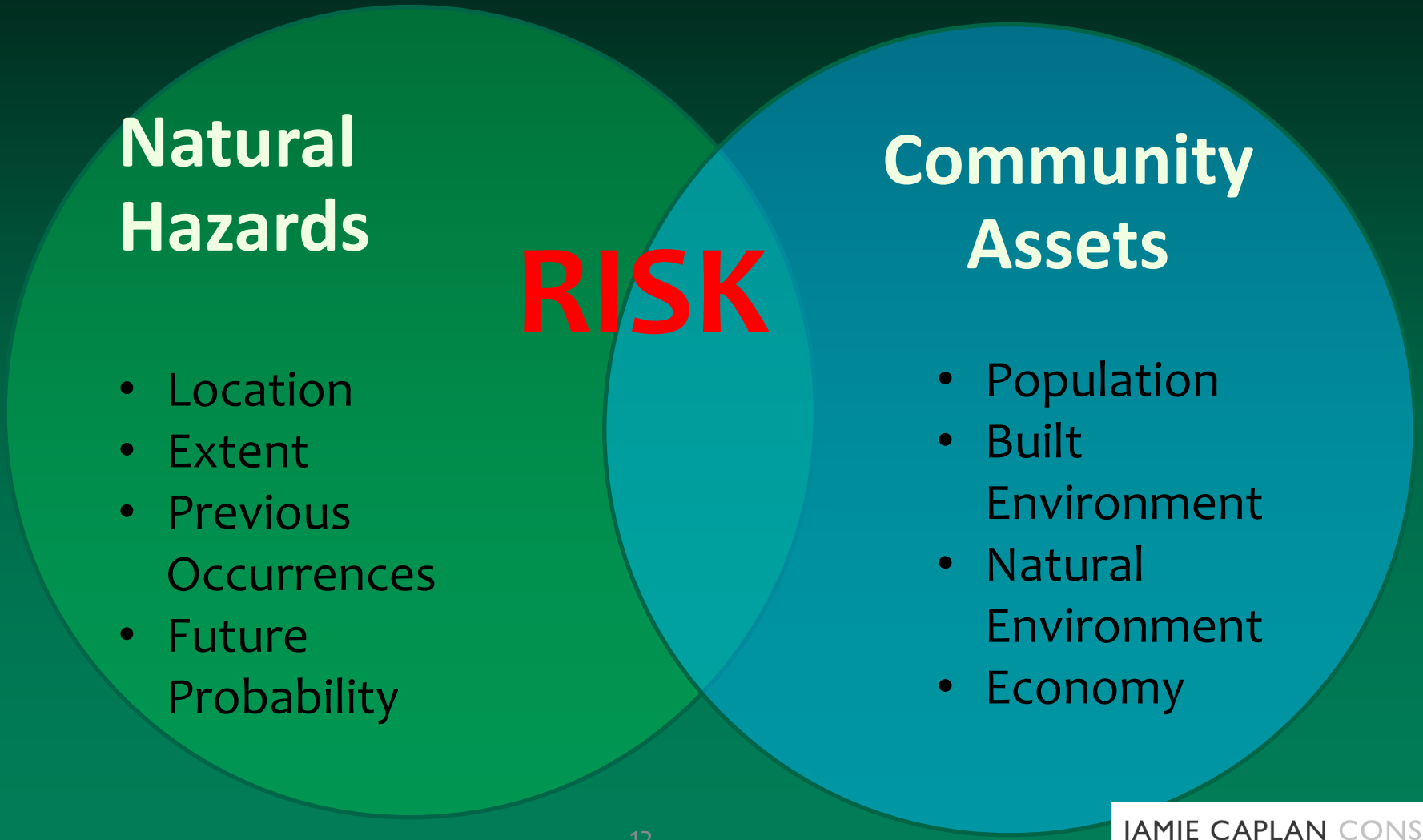
Defining Risk



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Hazard Mitigation Plan Hazards

Primary Climate Change Interactions	Natural Hazards
Changes in Precipitation	• Flooding • Drought • Landslide
Sea Level Rise	• Coastal Flooding • Coastal Erosion • Tsunami
Rising Temperatures	• Average/Extreme Temperatures • Wildfires • Invasive Species
Extreme Weather	• Hurricanes/Tropical Storms • Severe Winter Storm/Nor'easter • Tornadoes • Severe Weather (strong winds/extreme precipitation)
Non-Climate Influenced Hazards	• Earthquake

Critical Facilities in Hazard Mitigation Plan

- Fire Stations
- Police Station
- Schools
- Town Hall
- Public Works
- Council on Aging
- Library

- Future Development
  - Buildings
  - Infrastructure

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Mitigation Actions

1. Local Plans and Regulations
2. Structure and Infrastructure
3. Natural System Protection
4. Education and Awareness Programs

Plan Adoption And Implementation

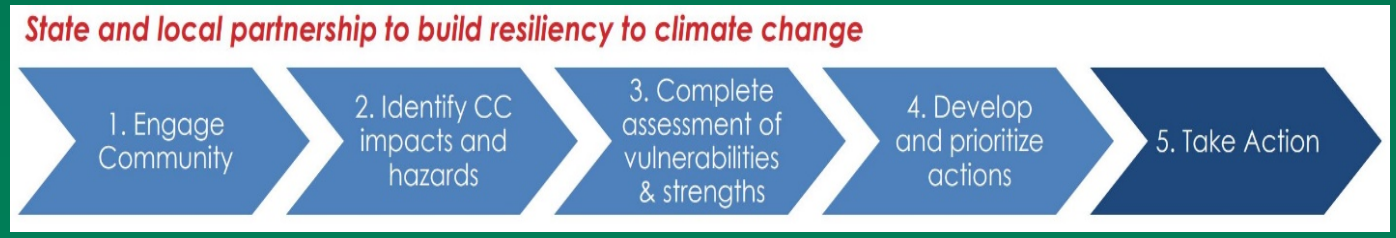
Scheduled for review in January 2021 by MEMA and then FEMA

Plan Adoption and Implementation

FEMA Approval every 5 years

Municipal Vulnerability Preparedness (MVP) Plan Overview

- provides support for cities and towns in Massachusetts to begin the process of planning for climate change resiliency and implementing priority projects.
- The state awards communities with funding to complete vulnerability assessments and develop action-oriented resiliency plans.
- Communities who complete the MVP program become certified as an MVP community and are eligible for MVP Action grant funding and other opportunities.



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Overview of MVP Program

Community Resilience Building

WORKSHOP GUIDE

www.CommunityResilienceBuilding.org

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Overview of MVP Program

Overview of the Process (Steps & Tasks)

DURING WORKSHOP

A Prepare for the Workshop
1. Establish a core team with goals.
2. Engage stakeholders.
3. Prepare materials for workshop.
4. Decide on participant arrangements.

B Characterize Hazards
1. Identify past, current, and future impacts.
2. Determine the highest-priority hazards.

C Identify Community Vulnerabilities and Strengths
1. Identify infrastructural vulnerabilities and strengths.
2. Identify societal vulnerabilities and strengths.
3. Identify environmental vulnerabilities and strengths.

D Identify and Prioritize Community Actions
1. Identify and prioritize infrastructural actions.
2. Identify and prioritize societal actions.
3. Identify and prioritize environmental actions.

E Determine the Overall Priority Actions
1. Identify highest-priority actions.
2. Further define urgency and timing.

F Put It All Together
1. Generate final workshop products.

G Move Forward
1. Continue community outreach and engagement.
2. Secure additional data and information.
3. Inform existing planning and project activities.

Community Components

Infrastructural

Societal

Environmental

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Overview of MVP Program

March 2018

MERRIMACK BASIN

MUNICIPALITIES WITHIN MERRIMACK BASIN:

Amesbury, Andover, Ashburnham, Ashby, Ayer, Boxborough, Boxford, Chelmsford, Dracut, Dunstable, Georgetown, Groton, Groveland, Harvard, Haverhill, Lawrence, Littleton, Lowell, Merrimac, Methuen, Newbury, Newburyport, North Andover, Salisbury, Tewksbury, West Newbury, and Westford

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.

March 2018

MERRIMACK BASIN

Merrimack 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	48.1	+2.2 to +4.4	+3.0 to +6.4	+3.6 to +9.1	+3.9 to +10.9
	Winter	26.8	+2.5 to +5.3	+3.2 to +7.8	+4.0 to +9.5	+4.3 to +10.8
	Spring	46.1	+1.7 to +3.5	+2.6 to +5.4	+2.7 to +7.7	+3.3 to +9.4
	Summer	68.8	+2.1 to +4.3	+2.8 to +6.7	+3.2 to +9.9	+3.8 to +12.5
	Fall	50.3	+2.3 to +5.0	+3.3 to +6.7	+3.5 to +9.6	+4.0 to +11.8
Maximum Temperature	Annual	59.1	+2.1 to +4.2	+2.7 to +6.3	+3.3 to +9.1	+3.6 to +10.9
	Winter	36.7	+2.1 to +4.8	+2.8 to +7.3	+3.4 to +8.8	+3.8 to +10.0
	Spring	57.5	+1.6 to +3.4	+2.2 to +5.5	+2.6 to +7.9	+3.2 to +9.4
	Summer	80.5	+1.9 to +4.4	+2.7 to +6.7	+3.1 to +10.2	+3.6 to +12.8
	Fall	61.5	+2.4 to +4.9	+3.5 to +6.9	+3.4 to +9.9	+3.9 to +12.2
Minimum Temperature	Annual	37.0	+2.3 to +4.8	+3.2 to +6.5	+3.9 to +9.1	+4.2 to +11.0
	Winter	16.9	+2.7 to +5.8	+3.6 to +8.3	+4.6 to +10.2	+4.8 to +11.6
	Spring	34.7	+1.9 to +3.8	+2.7 to +5.7	+2.9 to +7.5	+3.4 to +9.3
	Summer	57.1	+2.2 to +4.5	+3.0 to +7.1	+3.4 to +9.7	+4.0 to +12.2
	Fall	39.1	+2.2 to +5.2	+3.5 to +6.6	+3.6 to +9.4	+4.1 to +11.6

- The Merrimack 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 6.7 °F (3-8% increase); end of century increase of 3.6 °F to 12.8 °F (4-16% increase).
  - Fall mid-century increase of 3.5 °F to 6.9°F (6-11% increase); end of century increase by and 3.9 °F to 12.2 °F (6-20% increase).
- Seasonally, minimum winter and fall temperatures are expected to see increases throughout the 21st century.
  - Winter mid-century increase of 3.6 °F to 8.3 °F (21-49% increase); end of century increase by 4.8 °F to 11.6 °F (28-68% increase).
  - Fall mid-century of 3.5 °F to 6.6 °F (9-17% increase); end of century increase of 4.1°F to 11.6 °F (11-30% increase).

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Overview of MVP Program

- 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 15-36% (258 -614 degree-days) by mid-century, and by 20-66% (344 -1147 degree-days) by end of century.
  - Spring is expected to see an increase by 32-86% (89 -239 degree-days) by mid-century and 42-171% (116 -471 degree-days) by end of century.
  - Fall is expected to see an increase by 41-94% (179 -415 degree-days) by mid-century and 49-176% (214 -779 degree-days) by end of century.

MERRIMACK BASIN

Merrimack 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	7	+<1[65] to +2	+<1[65] to +3	+1 to +3	+1 to +4
	Winter	2	-0 to +1	+<1[65] to +1	+<1[65] to +1	+<1[65] to +2
	Spring	2	-0 to +1	-0 to +1	+<1[65] to +1	+<1[65] to +1
	Summer	1	-0 to +<1[65]	-0 to +1	-0 to +1	+0 to +1
	Fall	2	-0 to +1	-0 to +1	-0 to +1	+0 to +1
Days with Precipitation Over 2"	Annual	1	+<1[65] to +<1[65]	+0 to +1	+<1[65] to +1	+<1[65] to +1
	Winter	<1[65]	-0 to +<1[65]	-0 to +1	-0 to +<1[65]	+0 to +<1[65]
	Spring	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Summer	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Fall	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
Days with Precipitation Over 4"	Annual	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Winter	0	+0 to +0	+0 to +0	+0 to +0	+0 to +<1[65]
	Spring	0	-0 to +<1[65]	+0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Summer	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Fall	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]

- The projections for expected number of days receiving precipitation over one inch are variable for the Merrimack 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 0-2 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.

[65] Over the observed period, there were some years with at least 1 day with seasonal precipitation over a certain threshold while in all the other years that threshold wasn't crossed seasonally at all.

MERRIMACK BASIN

Merrimack 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	44.2	+0.1 to +4.5	-0.0 to +5.8	+0.9 to +6.9	+0.9 to +7.6
	Winter	10.8	-0.5 to +1.9	-0.0 to +2.4	+0.4 to +3.0	+0.4 to +3.8
	Spring	11.3	-0.1 to +2.2	-0.1 to +2.1	+0.1 to +2.6	+0.2 to +2.5
	Summer	10.3	-0.2 to +1.3	-0.6 to +2.0	-0.8 to +1.8	-1.1 to +1.8
	Fall	11.9	-1.1 to +1.1	-1.1 to +1.5	-1.6 to +1.4	-1.4 to +1.3

- Similar to projections for number of days receiving precipitation over a specified threshold, seasonal projections for total precipitation are also variable for the Merrimack basin.
  - The winter season is expected to experience the greatest change with an increase of 0-22% by mid-century, and of 4-35% 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 Merrimack or basin could see a decrease of 0.6 to an increase of 2.0 inches by mid-century (decrease of 6% to increase of 20%) and a decrease of 1.1 to an increase of 1.8 inches by the end of the century (decrease of 10% to increase of 17%).
    - The fall season projections for the Merrimack basin could see a decrease of 1.1 to an increase of 1.5 inches by mid-century (decrease of 10% to increase of 13% and a decrease of 1.4 to an increase of 1.3 inches by the end of the century (decrease of 12% to increase of 11%).

Merrimack Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Consecutive Dry Days	Annual	17	-1 to +1	-0 to +2	-1 to +2	-0 to +3
	Winter	12	-1 to +1	-1 to +2	-1 to +2	-1 to +2
	Spring	12	-1 to +1	-1 to +1	-2 to +1	-1 to +1
	Summer	13	-1 to +1	-1 to +2	-1 to +2	-1 to +2
	Fall	12	-0 to +2	-0 to +2	-0 to +3	-0 to +3

- 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 Merrimack 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 summer season is expected to experience a decrease of 1 day to an increase of 2 days in consecutive dry days by the end of the century.

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Outcome of the MVP Process

- MVP Community Designation
- Eligibility and Ideas for “Action Grants”
- Increased competitiveness for other grant funding
- Public education and awareness
- Baseline information for future planning and implementation efforts
- Best Management practices for resiliency (nature based solutions)

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Goals for the MVP Plan

What are the Goals for The Town's MVP Plan?

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Goals for the Town's MVP Plan

1. *Successful completion of the CRB process to become designated as a **"Municipal Vulnerability Preparedness Program Climate Community,"** or **"MVP Climate Community"** which may lead to increased standing in future funding opportunities and follow-on opportunities.*
2. *Develop a HMP plan in conjunction with the MVP plan*
3. *Eligibility for an Action Grant to acquire Funding for 3 dams to be removed or substantially repaired using MVP grants*
4. *Building resilience for future unexpected events due to natural hazards and climate change, such as COVID-19 and other unexpected emergencies*
5. *Evaluate municipal shelter buildings and ensure the future plans include the expanse of the shelter infrastructure in the community*
6. *Develop municipal programs or update regulations to build options for future vulnerabilities*

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Characterize Hazards

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Climate Related Hazards (MVP)

Types of Natural Hazards for Inland Communities

- Deep Freeze (Extreme cold)
- Drought
- Floods
  - Excessive rainfall
  - Heavy rain on frozen ground,
  - Rain combined with snow melt
  - Tidal Backwater (SLR)
  - Beaver Dams
- Geological Events
  - Earthquake
  - Erosion
  - Landslides
- Heat Wave
- Hurricanes (Flooding and Wind Damage)
- Microbursts/Tornadoes
- Thunderstorms/Lightning
- Wildfires
- Wind
- Winter Storms
  - Nor'Easter
  - Blizzards
  - Rain/snow mix
  - Ice storm

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Dracut's Top Four Natural Hazards as a Result of Climate Change

1. Snow Storms/Extreme Cold
2. Flooding
3. Wind Damage/High Winds
4. Extreme Temperatures

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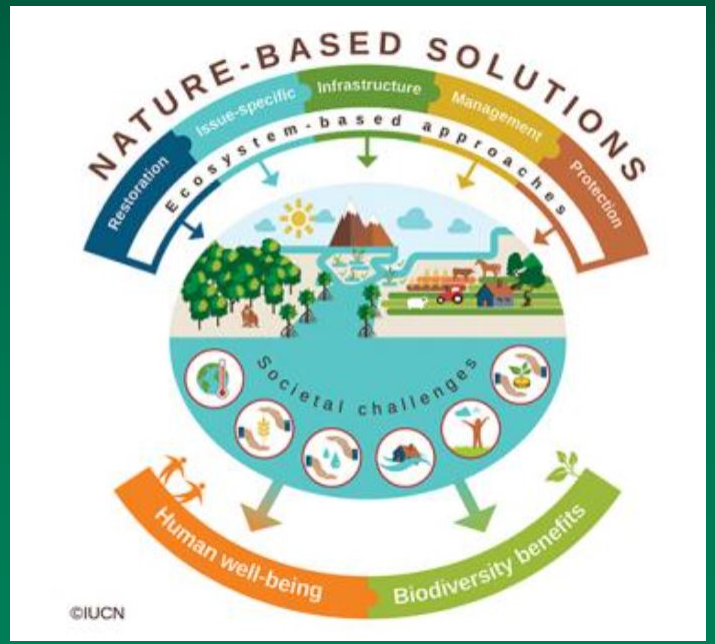
Nature Based Solutions

- "Actions that work with and enhance nature so as to help people adapt to change or disasters"
- "Inspired and supported by nature…provide benefits and help build resilience"



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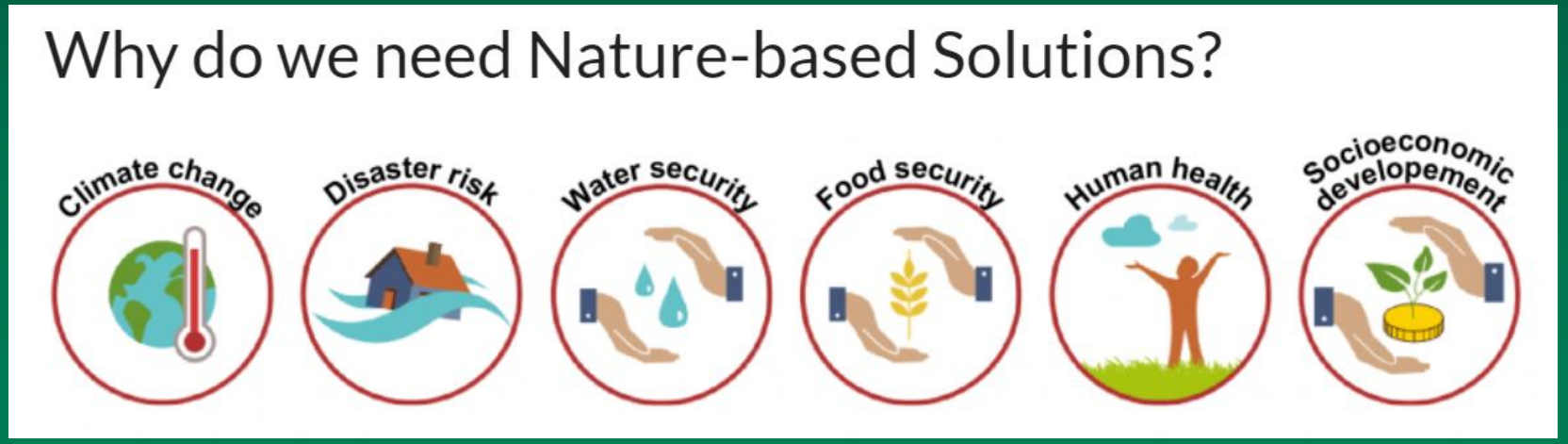
Nature Based Solutions

"actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits".

– International Union for Conservation of Nature (IUCN)



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Nature Based Solutions

- Floodplain & Wetland Restoration
- Reforestation
- Stormwater Wetlands/Rain Gardens
- Conservation Land
- Riparian Buffers & Restoration
- Dam Removal!!
- Open Space

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Green Infrastructure

Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage and water treatment systems—is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits.

– Environmental Protection Agency (EPA)

Green Infrastructure includes **natural** systems as well as practices that are **engineered** to mimic natural systems.

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Engineered Solutions

- Green Roofs
- Permeable Paving
- Downspout Disconnect
- Renewable Energy
- Wildlife Corridors
- Fish Ladder

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Identify Community Vulnerabilities & Strengths

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Identify Community Vulnerabilities & Strengths

- Infrastructural
  - Built Infrastructure
    - Roads
    - Bridges
    - Dams
    - Critical Municipal Buildings
  - Water Management Infrastructure
    - Storm Drainage
    - Wastewater Treatment
    - Drinking Water

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Civil and Structural Engineers

Identify Community Vulnerabilities & Strengths

- Societal
  - Emergency Preparedness and Response
    - Assembly Areas
    - Remote Emergency Command Center
    - Emergency Communication Systems
    - Vulnerable Assets and Populations

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Civil and Structural Engineers

Identify Community Vulnerabilities & Strengths

- Environmental
  - Open Space and Natural Resources
    - Wetlands and Flood Storage
    - Water Quality and Water Supply
    - Bank Erosion
    - Trees and Shade

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Civil and Structural Engineers

Why we are here!
Workshop Risk Matrix

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.com

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					Priority H - M - L	Time S Long O
Infrastructural									
Societal									
Environmental									

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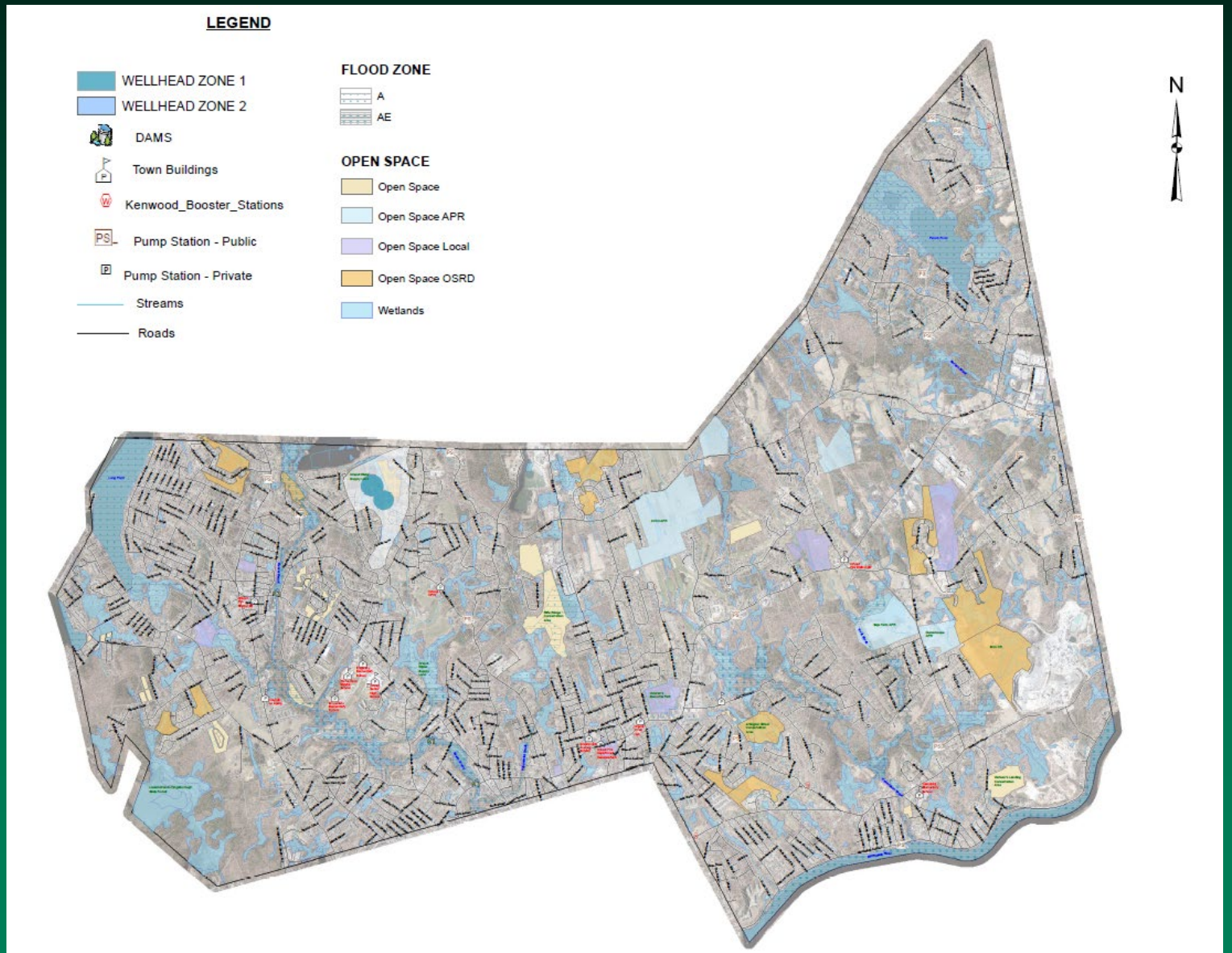
Identify Community Vulnerabilities & Strengths



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Questions/Discussion/Next Steps

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(V) Incoming water booster station - very old
Community Resilience Building Risk Matrix

WORKSHOP NO. 2

Dracut's MVP Workshop Dates

- September 29th from 3-7pm
- October 6th from 3-7pm

Town of Dracut
MASSACHUSETTS

Agenda (Workshop No. 2 on 10/06/2020):

- 3:00 – 3:10 Introductions/Recap of CRB Process
- 3:10 – 3:20 Review of Goals & Hazards
- 3:20 – 3:30 Review of Natural Base Solutions
- 3:30 – 4:00 Finalize Risk Matrix
- 4:00 – 5:00 Infrastructure Action Items
- 5:00 – 5:30 Break
- 5:30 – 6:00 Societal Action Items
- 6:00 – 6:30 Environmental Action Items
- 6:30 – 7:00 Questions/Discussion/Next Steps

GREEN INTERNATIONAL AFFILIATES, INC.
239 LITTLETON ROAD, SUITE 3 WESTFORD, MA 01886
T: (978) 923-0400 | F: (978) 399-0033 | WWW.GREENINTL.COM

ATTENDANCE SHEET

Project: **Dracut MVP Workshop No. 2**
Location: **In-person – Dracut Fire Department Conference Room: 488 Pleasant Street, Dracut, MA**
Virtual – Microsoft Teams Meeting
Date: **Tuesday, October 6, 2020**
Time: **3 pm-7 pm**

Name	Representing	Phone	Email	In-person or Virtual
1. Danielle Spicer	Green International Affiliates, Inc., State Certified MVP Provider, P.E., CFM, LEED AP, ENV SP	978-923-0400	dspicer@greenintl.com	In-person
2. Peter Richardson	Green International Affiliates, Inc., State Certified MVP Providers, P.E.,LEED AP, ENV SP	978-923-0400	prichardson@greenintl.com	In-person
3. Oxana Fartushnaya	Green International Affiliates, Inc., Environmental Scientist	978-923-0400	ofartushnaya@greenintl.com	In-person
4. Jamie Caplan	Jamie Caplan Consulting LLC, State Certified MVP Provider, Mitigation Planning Lead	413-586-0867	jamie@jamiecaplan.com	Virtual
5. Tina Douk	Dracut, Stormwater Manager	978-957-1497	tdouk@dracutma.gov	In-person
6. Mark Hamel	Dracut, Town Engineer	978-454-2594	Mhamel@dracutma.gov	In-person
7. Michael Sheu	Dracut, Water Supply District superintendent	978-957-0441	michael.sheu@dracutwater.com	In-person
8. Richard Patterson	Deputy Fire Chief/EMD	978-479-3786	Rpatterson@dracutma.gov	In-person
9. Ed Patenaude	Dracut, DPW Director	978-957-0411	Epatenaude@dracutma.gov	In-person
10. Leo Caron	Dracut, Stormwater	978-957-1497	N/A	In-person
11. Ann Vandal	Dracut, Town Manager	978-452-1227	Avandal@dracutma.gov	Virtual

12. Tom Lafleur	Dracut, School Business Administrator	978-957-5583	tlafleur@dracutps.org	Virtual
13. Andrew Graham	Dracut, Supervisor of buildings & grounds	978-957-9704	agraham@dracutps.org	Virtual
14.				
15.				
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Dracut
Municipal Vulnerability Preparedness (MVP) Plan – Workshop No. 2

Danielle Spicer, P.E., LEED AP, ENV SP from
Green International Affiliates, Inc
(State Certified MVP Provider)

October 6, 2020

Town of Dracut
MASSACHUSETTS

GREEN INTERNATIONAL AFFILIATES, INC.

Building Strong Client Relationships Through Engineering Excellence

Agenda

3:00 – 3:10	Recap of CRB Process
3:10 – 3:20	Review of Goals & Hazards
3:30 – 3:30	Review of Natural Base Solutions
3:30 – 4:00	Finalize Risk Matrix
4:00 – 5:00	Infrastructure Action Items
5:00 – 5:30	Break
5:30 – 6:00	Societal Action Items
6:00 – 6:30	Environmental Action Items
6:30 – 7:00	Questions/Discussion/Next Steps

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Introductions

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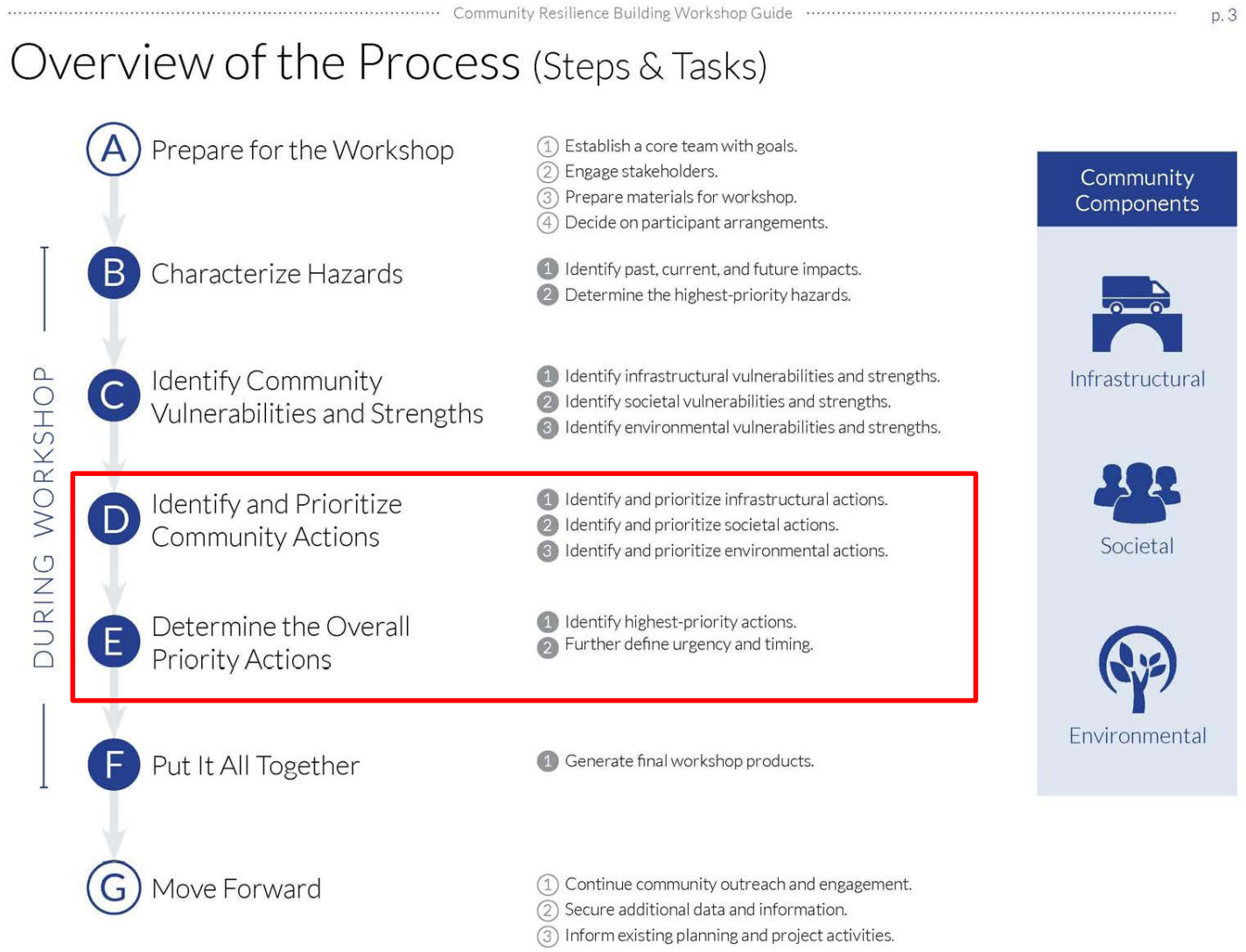
MVP Program – CRB Process

Workshop No. 1:

Finalize Step B & Work on Step C

Workshop No. 2:

Finalize Steps C, D & E



Overview of the Process (Steps & Tasks)

DURING WORKSHOP

A	Prepare for the Workshop	1 Establish a core team with goals. 2 Engage stakeholders. 3 Prepare materials for workshop. 4 Decide on participant arrangements.
B	Characterize Hazards	1 Identify past, current, and future impacts. 2 Determine the highest-priority hazards.
C	Identify Community Vulnerabilities and Strengths	1 Identify infrastructural vulnerabilities and strengths. 2 Identify societal vulnerabilities and strengths. 3 Identify environmental vulnerabilities and strengths.
D	Identify and Prioritize Community Actions	1 Identify and prioritize infrastructural actions. 2 Identify and prioritize societal actions. 3 Identify and prioritize environmental actions.
E	Determine the Overall Priority Actions	1 Identify highest-priority actions. 2 Further define urgency and timing.
F	Put It All Together	1 Generate final workshop products.
G	Move Forward	1 Continue community outreach and engagement. 2 Secure additional data and information. 3 Inform existing planning and project activities.

Community Components

Infrastructural

Societal

Environmental

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Goals for the MVP Plan

What are the Goals for The Town's MVP Plan?

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Goals for the Town's MVP Plan

1. *Successful completion of the CRB process to become designated as a **"Municipal Vulnerability Preparedness Program Climate Community,"** or **"MVP Climate Community"** which may lead to increased standing in future funding opportunities and follow-on opportunities.*
2. *Develop a HMP plan in conjunction with the MVP plan*
3. *Eligibility for an Action Grant to acquire Funding for 3 dams to be removed or substantially repaired using MVP grants*
4. *Building resilience for future unexpected events due to natural hazards and climate change, such as COVID-19 and other unexpected emergencies*
5. *Evaluate municipal shelter buildings and ensure the future plans include the expanse of the shelter infrastructure in the community*
6. *Develop municipal programs or update regulations to build options for future vulnerabilities*

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Characterize Hazards

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Dracut's Top Four Natural Hazards as a Result of Climate Change

1. Snow Storms/Extreme Cold
2. Flooding
3. Wind Damage/High Winds
4. Extreme Temperatures

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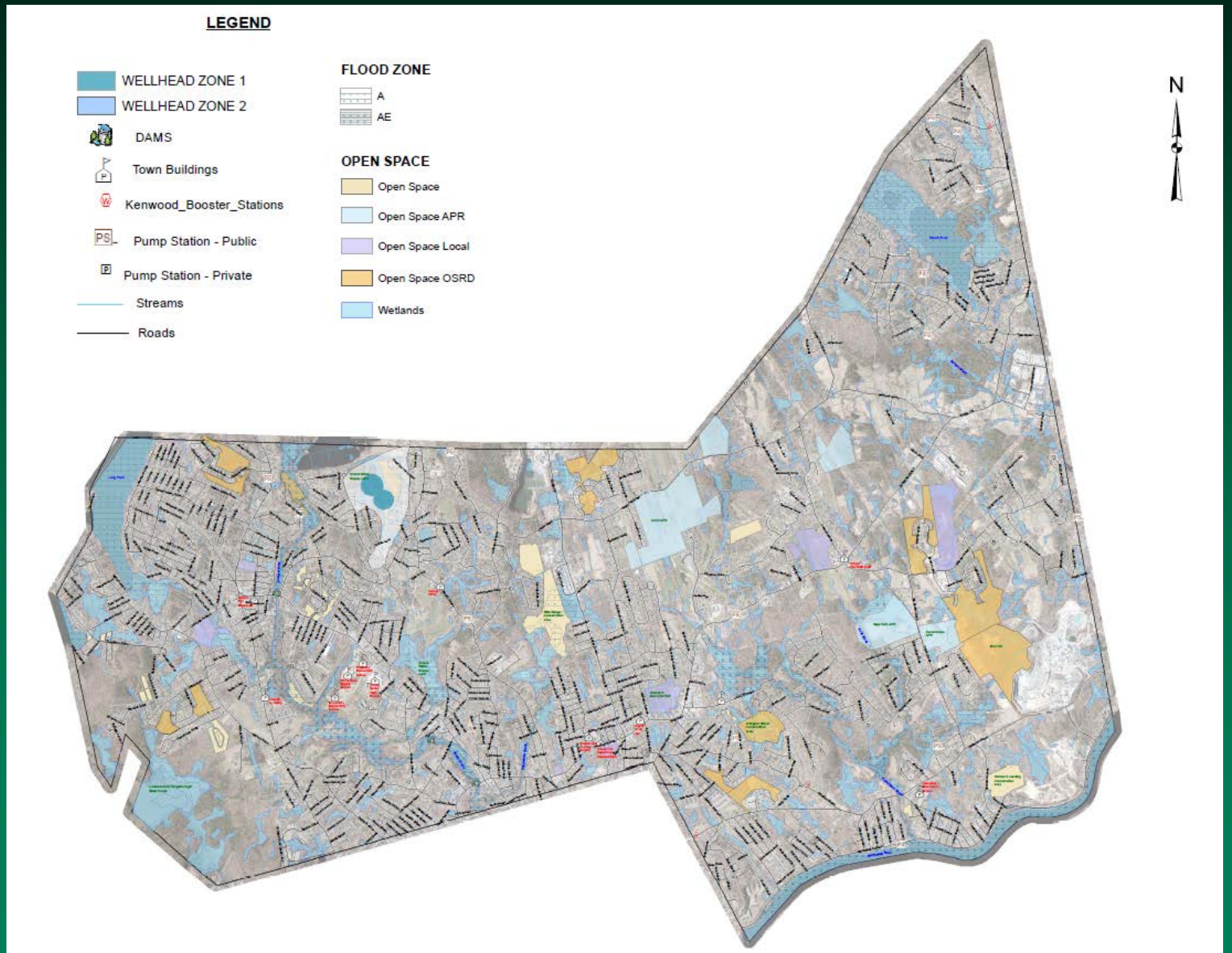
Identify & Prioritize Community Actions



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Mitigation Defined

- Any sustained actions taken to reduce or eliminate long term risk to people and property from hazards and their effects.

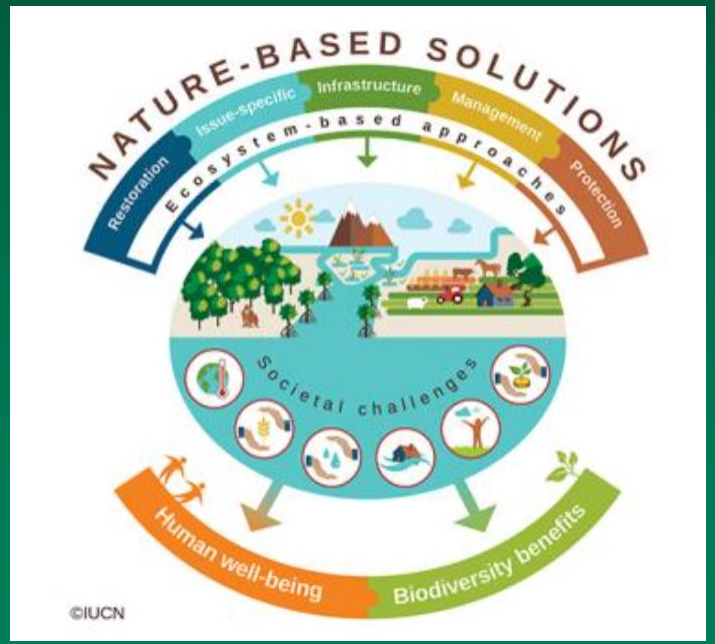
Possible Mitigation Actions Eligible for Funding

- Property acquisition
- Structure elevation
- Flood risk reduction (culverts, drainage upgrades)
- Retrofitting buildings
- Soil stabilization
- Generators (FEMA only)

- Nature-based solutions and low-impact development prioritized!

Nature Based Solutions

- "Actions that work with and enhance nature so as to help people adapt to change or disasters"
- "Inspired and supported by nature…provide benefits and help build resilience"



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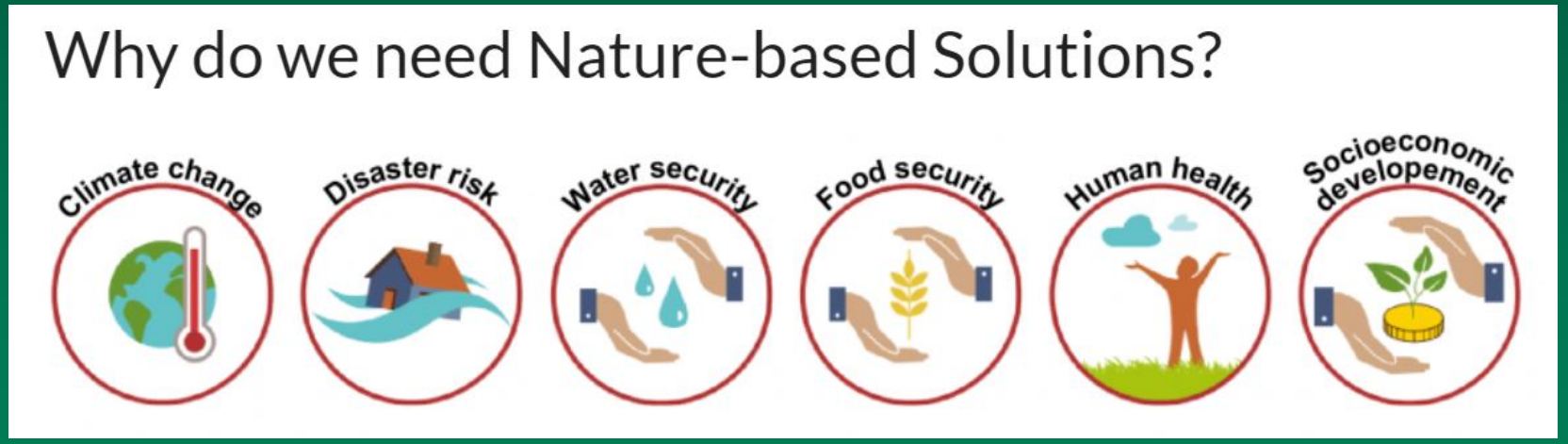
Nature Based Solutions

"actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits".

– International Union for Conservation of Nature (IUCN)



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Nature Based Solutions

- Floodplain & Wetland Restoration
- Reforestation
- Stormwater Wetlands/Rain Gardens
- Conservation Land
- Riparian Buffers & Restoration
- Dam Removal!!
- Open Space

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Green Infrastructure

Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage and water treatment systems—is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits.

– Environmental Protection Agency (EPA)

Green Infrastructure includes **natural** systems as well as practices that are **engineered** to mimic natural systems.

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Engineered Solutions

- Green Roofs
- Permeable Paving
- Downspout Disconnect
- Renewable Energy
- Wildlife Corridors
- Fish Ladder

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Why we are here!
Workshop Risk Matrix

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.com

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					Priority H - M - L	Time Short Long Ongoing
Infrastructural									
Societal									
Environmental									

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Why we are here!
Workshop Risk Matrix

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

H-M-L priority for action over the Short or Long term (and Ongoing)
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	Snow Storms/ Extreme Cold	Flooding	Wind Damage/ High Winds	Extreme Temperatures	Priority H - M - L	Time Short Long Ongoing
Infrastructural									
1. Water Booster Pump Station	Methuen Street		V						
2. Area with no Municipal Water (all wells)/sewer	NE side near Bartlett Brook		V						
3. Booster Station - Interconnection/Partical Built	Broadway Street		S						
4. Emergency Winter Water Connection			S						
5. Tyngsborough Transmission	Tyngsborough Road		V		X				
6. AC Mains (35 in.) (60's)	Townwide		V						
7. Sewers/Sewer Systems/ Sewer Pump Stations (95% sewe	need locations	Municipal & 9 Private	S/V		3 P.S. - flooding				
8. Bridges over Beaver Brook (2 under pressure)	Lakeview Ave, Parker Ave &		V		2 under pressure				
9. Culverts (4 failing)	Bartlett & Peppermint		V						
10. Dams (3)	Beaver Brook		V						
11. Roads - No formal Road Management System			V						
12. Stormwater Draiange issues (low points - 4 areas)	see Appendix X		V						
13. DPW Garage - old building, flat roof			V/S						
14. Emergency Buildings/Buildings Command Center			S						
Societal									
1. No Emergency Command Center			V						
2. Emergency Shelters (all but Council on Aging have generators)			S/V						
3. Fire Department/Stations (3 building replaced in the past 25 years)	see Appendix X		S						
4. EJ Communities	SW side - b/w Mammoth &		V						
5. Code red - 911/ But only 20% of population has landlines/Not enough townwide cell reception	Townwide		S/V						
6. No Evacuation Plan - ask Rich Patterson			?						

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Why we are here!
Workshop Risk Matrix

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

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Features	Location	Ownership	V or S	Snow Storms/ Extreme Cold	Flooding	Wind Damage/ High Winds	Extreme Temperatures	Priority H - M - L	Time Short Long Ongoing
Infrastructural									
7. Neighbor Towns evacuating to Dracut - ask Rich Patterson			V						
8. Assisted Living Facilities/Group Homes	Broadway/Loon Hill Rd; Bridge		V						
Environmental									
1. Open Space -Need to add additional info - look at Master Plan			V						
2. 61A Land - a lot of farming			S						
3. No Open Space over arching organization			V						
4. The riparian buffers are very developed			V						
5. FEMA projections			V						
6. Basement of Brookside Elementary School is very close to 100-year floodplain			V						
5. FEMA projections - Overtopping of Rt 38 (Peppermint Brook)			V						
6. MS4 in Town/Old & Undersized Drainage systems discharging into receiving regulated waterbodies (MS4)			S/V						
7. Drainage System Old/Undersized			V						
8. Impaired Waterbodies (5) in Town with no TMDL			V						
9. State Park (1 in Town)			S						
10. Water Supply Land (North) is not being used due to high Mn			V						
11. Dam Removal/Substantial Repair (3 dams) issues			V						
. Recently Updated Stormwater Bylaw 2018			S						

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Questions/Discussion/Next Steps

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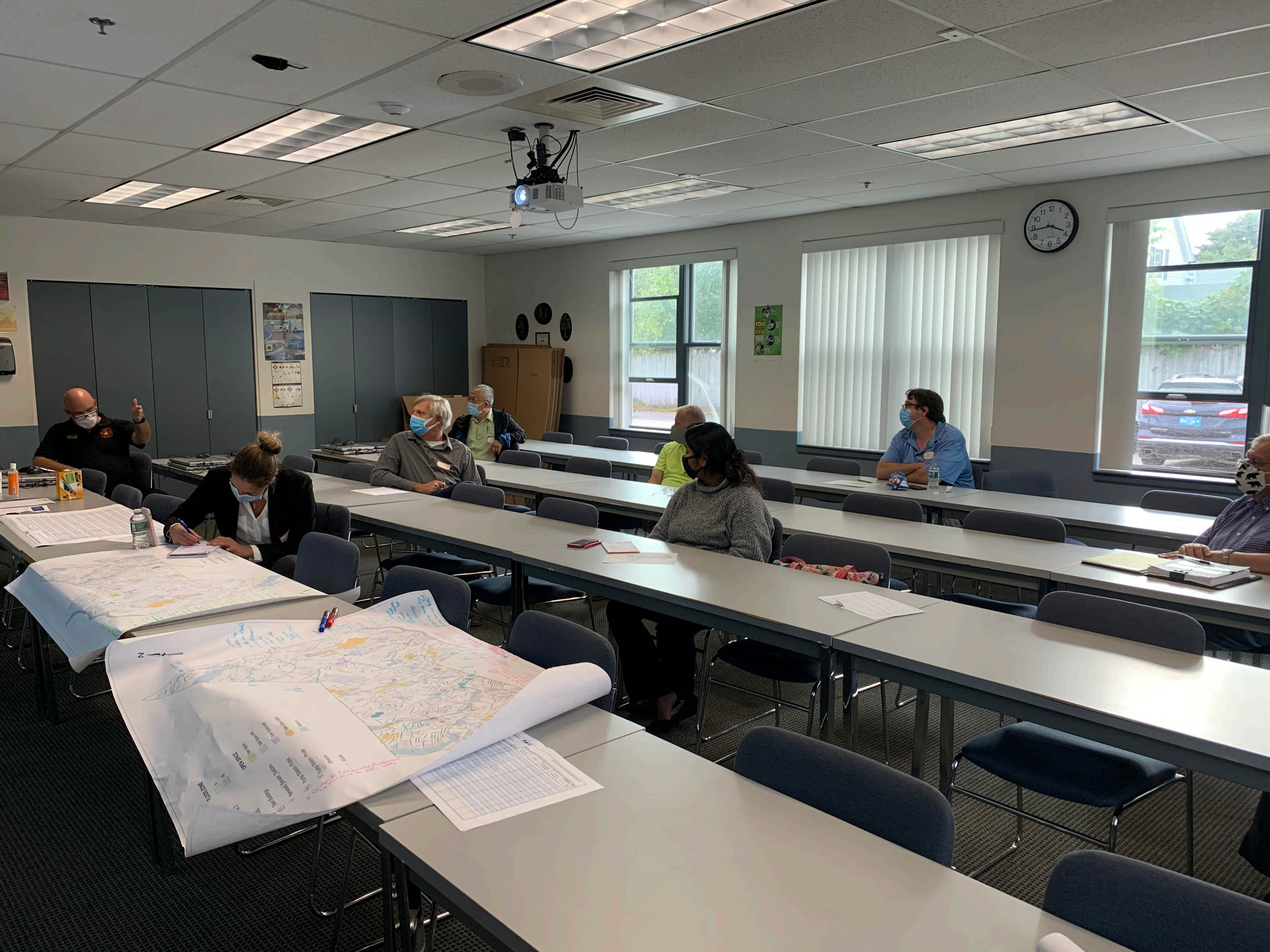


LISTENING SESSION

GREEN INTERNATIONAL AFFILIATES, INC.
239 LITTLETON ROAD, SUITE 3 WESTFORD, MA 01886
T: (978) 923-0400 | F: (978) 399-0033 | WWW.GREENINTL.COM

ATTENDANCE SHEET
Project: **Dracut MVP/HMP Listening Session**
Location: **Virtual – Microsoft Teams Meeting**
Date: **Tuesday, January 12, 2021**
Time: **11am- 12pm**

Name	Representing	Phone	Email
1. Danielle Spicer	Green International Affiliates, Inc., State Certified MVP Provider, P.E., CFM, LEED AP, ENV SP	978-923-0400	dspicer@greenintl.com
2. Oxana Fartushnaya	Green International Affiliates, Inc., Environmental Scientist	978-923-0400	ofartushnaya@greenintl.com
3. Jamie Caplan	Jamie Caplan Consulting LLC, State Certified MVP Provider, Mitigation Planning Lead	413-586-0867	jamie@jamiecaplan.com
4. Darrin Punchard	Principal, Punchard Consulting	617-777-2001	darrin@punchardconsulting.com
5. Tina Douk	Dracut, Stormwater Manager	978-957-1497	tdouk@dracutma.gov
6. Mark Hamel	Dracut, Town Engineer	978-454-2594	Mhamel@dracutma.gov
7. Ed Patenaude	Dracut, DPW Director	978-957-0411	Epatenaude@dracutma.gov
8. Ann Vandal	Dracut, Town Manager	978-452-1227	Avandal@dracutma.gov
9. Betsy Ware	Dracut, Community Development Coordinator	978-453-4557	eware@dracutma.gov
10. Alison Genest	Dracut, Board of Selectmen, Vice-Chairman	(978) 452-1908	
11.			
12.			
13.			

Dracut
Municipal Vulnerability Preparedness (MVP) Plan & Hazard Mitigation Plan (HMP) Listening Session

Danielle Spicer, P.E., LEED AP, ENV SP from
Green International Affiliates, Inc
Jamie Caplan, from Jamie Caplan Consulting LLC
(State Certified MVP Providers)

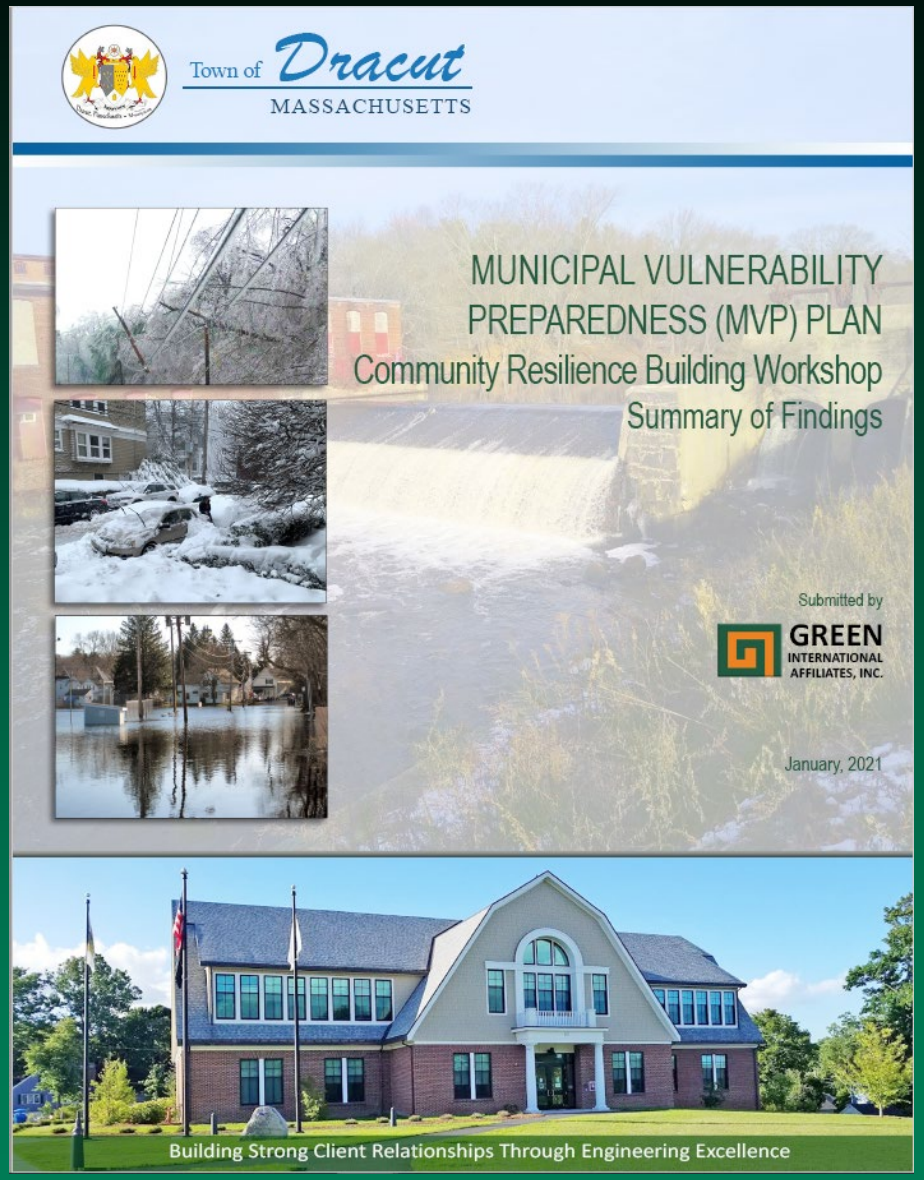
January 12, 2020

Town of Dracut
MASSACHUSETTS

GREEN INTERNATIONAL AFFILIATES, INC.

Building Strong Client Relationships Through Engineering Excellence

JAMIE CAPLAN CONSULTING LLC
Emergency Management Services



HAZARD MITIGATION PLAN UPDATE

Town of Dracut, Massachusetts

DECEMBER 2020

Town of Dracut
62 Arlington Street
Dracut, MA 01826

GREEN INTERNATIONAL AFFILIATES, INC.

JAMIE CAPLAN CONSULTING LLC
Emergency Management Services

Core Team

- Ann Vandal – Town Manager
- Ed Patenaude – Director of Public Works
- Mark Hamel – Town Engineer
- Lori Cahill – Conservation Agent/Parks and Recreation
- Dan MacLaughlin – Building Inspector
- Richard Patterson – Deputy Fire chief/emergency response
- Betsy Ware – Community Development
- Bethany Loveless – Council on Aging
- Tina Douk - Stormwater Manager (DPW)

Provide supporting data or information.

Assist in the identification and prioritization of mitigation actions.

Review and comment on the draft plan.

Approve final draft for submission to MEMA and EOEEA.

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

JAMIE CAPLAN CONSULTING LLC
Emergency Management Services

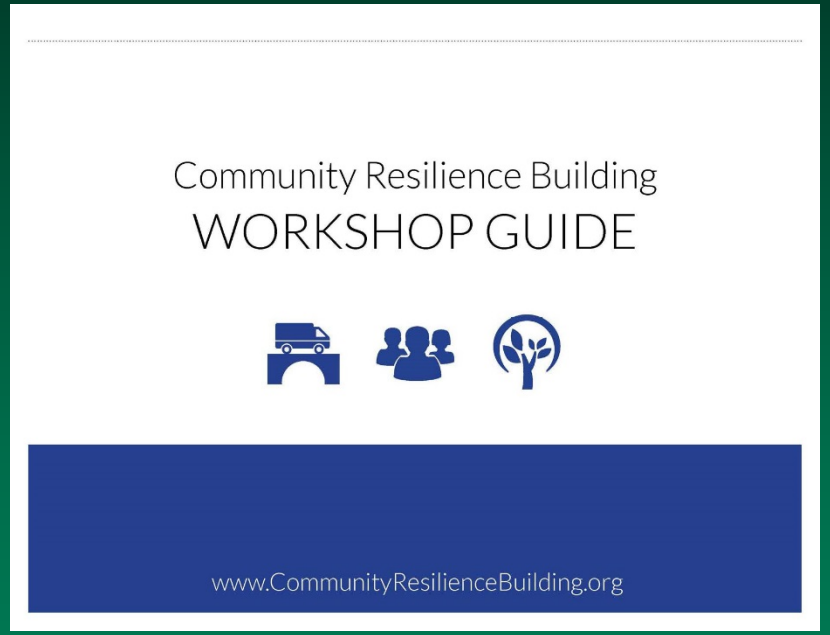
Overview of MVP Program

The Massachusetts Climate Change Clearinghouse (resilient MA)

www.resilientma.org

Community Resilience Building Workshop Guide

www.CommunityResilienceBuilding.com



UMASS Climate Change Projections (March 2018)

https://www.mass.gov/doc/massachusetts-statewide-climate-projections-2018/download

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Civil and Structural Engineers

Overview of MVP Program

MERRIMACK BASIN

MUNICIPALITIES WITHIN MERRIMACK BASIN:

Amesbury, Andover, Ashburnham, Ashby, Ayer, Boxborough, Boxford, Chelmsford, Dracut, Dunstable, Georgetown, Groton, Groveland, Harvard, Haverhill, Lawrence, Littleton, Lowell, Merrimac, Methuen, Newbury, Newburyport, North Andover, Salisbury, Tewksbury, West Newbury, and Westford

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.

MERRIMACK BASIN

Merrimack 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	48.1	+2.2 to +4.4	+3.0 to +6.4	+3.6 to +9.1	+3.9 to +10.9
	Winter	26.8	+2.5 to +5.3	+3.2 to +7.8	+4.0 to +9.5	+4.3 to +10.8
	Spring	46.1	+1.7 to +3.5	+2.6 to +5.4	+2.7 to +7.7	+3.3 to +9.4
	Summer	68.8	+2.1 to +4.3	+2.8 to +6.7	+3.2 to +9.9	+3.8 to +12.5
	Fall	50.3	+2.3 to +5.0	+3.3 to +6.7	+3.5 to +9.6	+4.0 to +11.8
Maximum Temperature	Annual	59.1	+2.1 to +4.2	+2.7 to +6.3	+3.3 to +9.1	+3.6 to +10.9
	Winter	36.7	+2.1 to +4.8	+2.8 to +7.3	+3.4 to +8.8	+3.8 to +10.0
	Spring	57.5	+1.6 to +3.4	+2.2 to +5.5	+2.6 to +7.9	+3.2 to +9.4
	Summer	80.5	+1.9 to +4.4	+2.7 to +6.7	+3.1 to +10.2	+3.6 to +12.8
	Fall	61.5	+2.4 to +4.9	+3.5 to +6.9	+3.4 to +9.9	+3.9 to +12.2
Minimum Temperature	Annual	37.0	+2.3 to +4.8	+3.2 to +6.5	+3.9 to +9.1	+4.2 to +11.0
	Winter	16.9	+2.7 to +5.8	+3.6 to +8.3	+4.6 to +10.2	+4.8 to +11.6
	Spring	34.7	+1.9 to +3.8	+2.7 to +5.7	+2.9 to +7.5	+3.4 to +9.3
	Summer	57.1	+2.2 to +4.5	+3.0 to +7.1	+3.4 to +9.7	+4.0 to +12.2
	Fall	39.1	+2.2 to +5.2	+3.5 to +6.6	+3.6 to +9.4	+4.1 to +11.6

- The Merrimack 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 6.7 °F (3-8% increase); end of century increase of 3.6 °F to 12.8 °F (4-16% increase).
  - Fall mid-century increase of 3.5 °F to 6.9°F (6-11% increase); end of century increase by and 3.9 °F to 12.2 °F (6-20% increase).
- Seasonally, minimum winter and fall temperatures are expected to see increases throughout the 21st century.
  - Winter mid-century increase of 3.6 °F to 8.3 °F (21-49% increase); end of century increase by 4.8 °F to 11.6 °F (28-68% increase).
  - Fall mid-century of 3.5 °F to 6.6 °F (9-17% increase); end of century increase of 4.1°F to 11.6 °F (11-30% increase).

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Civil and Structural Engineers

Overview of MVP Program

- 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 15-36% (258 -614 degree-days) by mid-century, and by 20-66% (344 -1147 degree-days) by end of century.
  - Spring is expected to see an increase by 32-86% (89 -239 degree-days) by mid-century and 42-171% (116 -471 degree-days) by end of century.
  - Fall is expected to see an increase by 41-94% (179 -415 degree-days) by mid-century and 49-176% (214 -779 degree-days) by end of century.

MERRIMACK BASIN

Merrimack 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	7	+<1[65] to +2	+<1[65] to +3	+1 to +3	+1 to +4
	Winter	2	-0 to +1	+<1[65] to +1	+<1[65] to +1	+<1[65] to +2
	Spring	2	-0 to +1	-0 to +1	+<1[65] to +1	+<1[65] to +1
	Summer	1	-0 to +<1[65]	-0 to +1	-0 to +1	+0 to +1
	Fall	2	-0 to +1	-0 to +1	-0 to +1	+0 to +1
Days with Precipitation Over 2"	Annual	1	+<1[65] to +<1[65]	+0 to +1	+<1[65] to +1	+<1[65] to +1
	Winter	<1[65]	-0 to +<1[65]	-0 to +1	-0 to +<1[65]	+0 to +<1[65]
	Spring	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Summer	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Fall	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
Days with Precipitation Over 4"	Annual	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Winter	0	+0 to +0	+0 to +0	+0 to +0	+0 to +<1[65]
	Spring	0	-0 to +<1[65]	+0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Summer	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]
	Fall	<1[65]	-0 to +<1[65]	-0 to +<1[65]	-0 to +<1[65]	+0 to +<1[65]

- The projections for expected number of days receiving precipitation over one inch are variable for the Merrimack 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 0-2 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.

[65] Over the observed period, there were some years with at least 1 day with seasonal precipitation over a certain threshold while in all the other years that threshold wasn't crossed seasonally at all.

MERRIMACK BASIN

Merrimack 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	44.2	+0.1 to +4.5	-0.0 to +5.8	+0.9 to +6.9	+0.9 to +7.6
	Winter	10.8	-0.5 to +1.9	-0.0 to +2.4	+0.4 to +3.0	+0.4 to +3.8
	Spring	11.3	-0.1 to +2.2	-0.1 to +2.1	+0.1 to +2.6	+0.2 to +2.5
	Summer	10.3	-0.2 to +1.3	-0.6 to +2.0	-0.8 to +1.8	-1.1 to +1.8
	Fall	11.9	-1.1 to +1.1	-1.1 to +1.5	-1.6 to +1.4	-1.4 to +1.3

- Similar to projections for number of days receiving precipitation over a specified threshold, seasonal projections for total precipitation are also variable for the Merrimack basin.
  - The winter season is expected to experience the greatest change with an increase of 0-22% by mid-century, and of 4-35% 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 Merrimack or basin could see a decrease of 0.6 to an increase of 2.0 inches by mid-century (decrease of 6% to increase of 20%) and a decrease of 1.1 to an increase of 1.8 inches by the end of the century (decrease of 10% to increase of 17%).
    - The fall season projections for the Merrimack basin could see a decrease of 1.1 to an increase of 1.5 inches by mid-century (decrease of 10% to increase of 13% and a decrease of 1.4 to an increase of 1.3 inches by the end of the century (decrease of 12% to increase of 11%).

Merrimack Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century: Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century: Projected Change in 2090s (Days)
Consecutive Dry Days	Annual	17	-1 to +1	-0 to +2	-1 to +2	-0 to +3
	Winter	12	-1 to +1	-1 to +2	-1 to +2	-1 to +2
	Spring	12	-1 to +1	-1 to +1	-2 to +1	-1 to +1
	Summer	13	-1 to +1	-1 to +2	-1 to +2	-1 to +2
	Fall	12	-0 to +2	-0 to +2	-0 to +3	-0 to +3

- 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 Merrimack 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 summer season is expected to experience a decrease of 1 day to an increase of 2 days in consecutive dry days by the end of the century.

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CRB Workshop Process

Kickoff Meeting (06/25/2020 & 08/13/2020):

✓ **Step A**

Workshop No. 1 (09/29/2020):

✓ **Steps B & C**

Workshop No. 2 (10/06/2020):

✓ **Steps D & E**

Listening Session (01/12/2021):

Steps F & G

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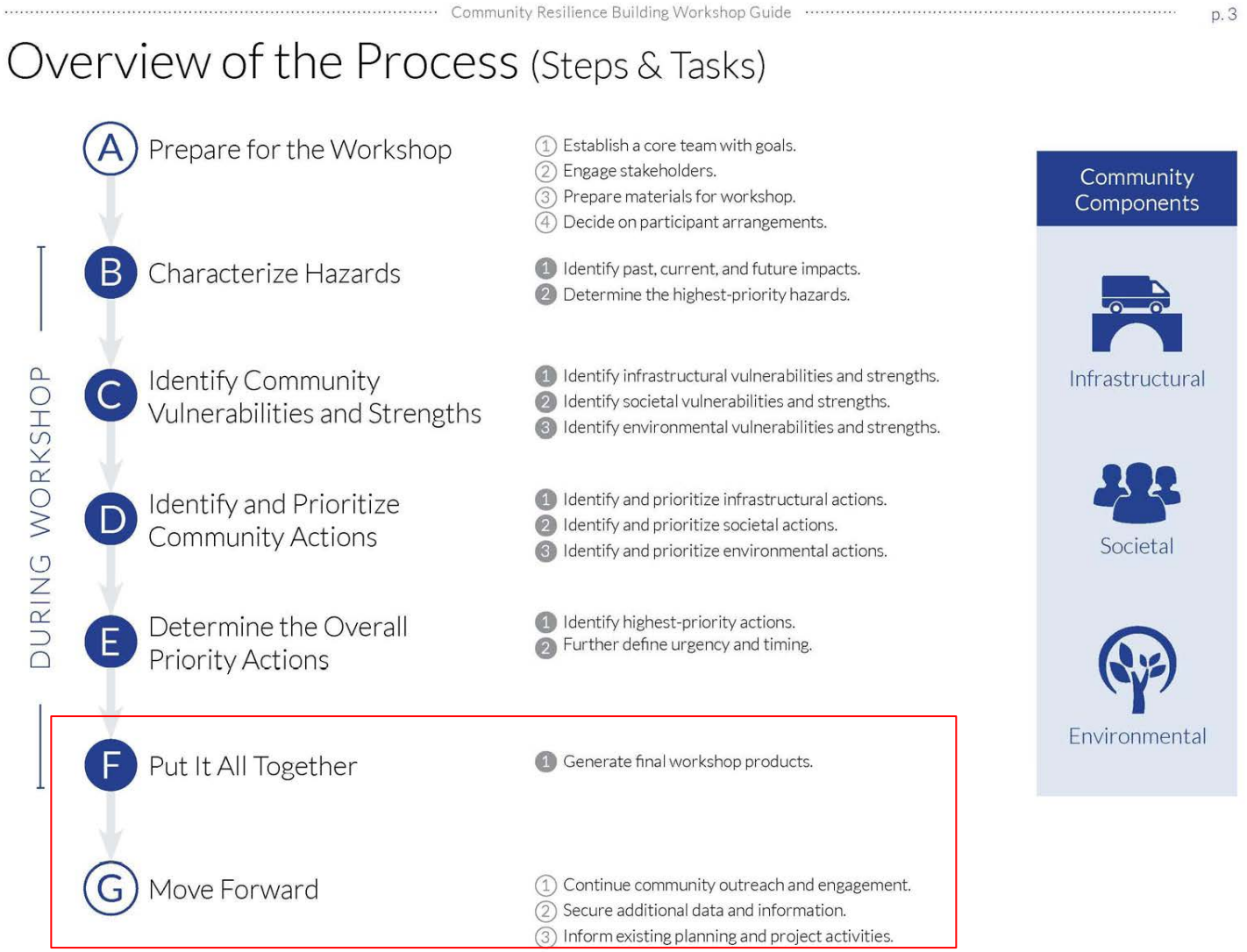

CRB Workshop Process

Goals for the Town's MVP Plan – Created during Kick-off Meeting

1. *Successful completion of the CRB process to become designated as a **"Municipal Vulnerability Preparedness Program Climate Community,"** or **"MVP Climate Community"** which may lead to increased standing in future funding opportunities and follow-on opportunities.*
2. *Develop a HMP plan in conjunction with the MVP plan*
3. *Eligibility for an Action Grant to acquire Funding for 3 dams to be removed or substantially repaired using MVP grants*
4. *Building resilience for future unexpected events due to natural hazards and climate change, such as COVID-19 and other unexpected emergencies*
5. *Evaluate municipal shelter buildings and ensure the future plans include the expanse of the shelter infrastructure in the community*
6. *Develop municipal programs or update regulations to build options for future vulnerabilities*

Dracut's Top Four Natural Hazards as a Result of Climate Change for MVP Plan

1. Snow Storms/Extreme Cold
2. Flooding
3. Wind Damage/High Winds
4. Extreme Temperatures

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JAMIE CAPLAN CONSULTING LLC
Emergency Management Services

CRB Workshop Process

Step B & C: Characterize Hazards & Identify Community Vulnerabilities and Strengths

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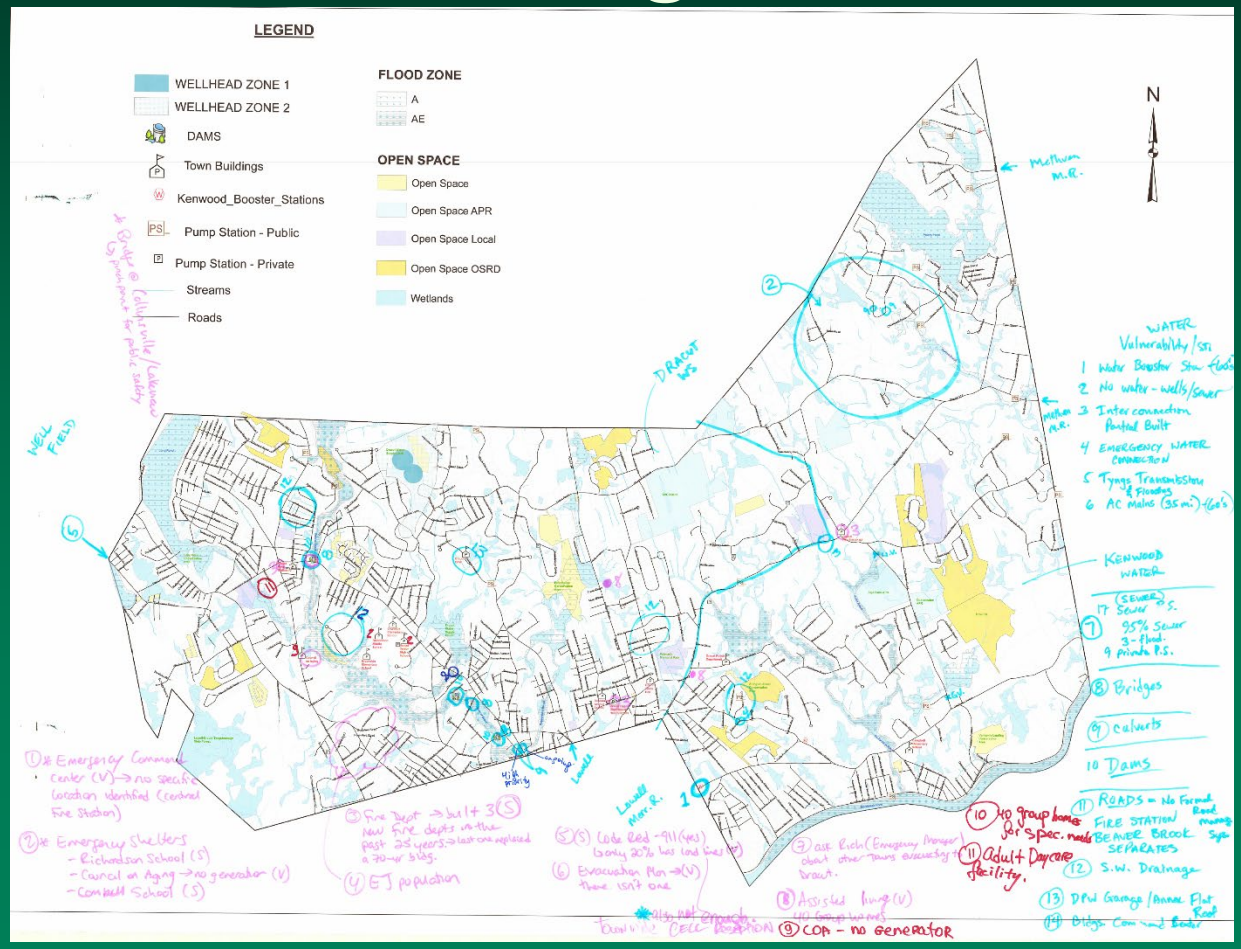
Civil and Structural Engineers

JAMIE CAPLAN CONSULTING LLC
Emergency Management Services

CRB Workshop Process

Identifying Dracut's Vulnerabilities and Strengths



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CRB Workshop Process

Vulnerable Areas and Attributes identified in Workshops

INFRASTRUCTURAL	SOCIETAL	ENVIRONMENTAL
• Water Booster Pump Station • Area with no Municipal Water/Sewer • Booster Station - Interconnection • Tyngsborough Transmission • Asbestos-cement (AC) Water Mains • Sewer Pump Stations • Bridges over Beaver Brook • Structurally Failing Culverts • Dams • Road Management • Stormwater Drainage Issues • DPW Garage & Parking Lot • Impervious Surfaces • Overhead Powerlines	• EJ Communities • Code Red - "Mass Notification System" (Reverse 911) • City of Lowell Emergency Evacuation Route Traffic Flow • Assisted Living Facilities & Adult Daycare Facility • Council on Aging & Elderly housing • Group Homes for People with Special Needs	• Open Space • No Forest Management Plan for open spaces • Densely Developed Riparian Buffers • Bridge Street FEMA Projections • Untreated Discharges from Old and Undersized Drainage Systems • Impaired Waterbodies in Town with no TMDL • Water Supply Land (North) • Dam Removal/Substantial Repair Issues • Stormwater Bylaw • Zoning Bylaw

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CRB Workshop Process

Current Strengths and Assets identified in Workshops

INFRASTRUCTURAL	SOCIETAL	ENVIRONMENTAL
• Water Booster Pump Station • Emergency Water Connection • Municipal Sewer System • Bridges over Beaver Brook • DPW Garage • Emergency Buildings/Buildings Command Center	• Emergency Command Center & Fire Department Buildings • Emergency Shelters • Code Red - "Mass Notification System" (Reverse 911) • Dracut Evacuation Plan • Assisted Living Facilities and Adult Daycare Facilities	• Open Space • Municipal Separate Storm Sewer Systems (MS4) • State Forest • Stormwater Bylaw

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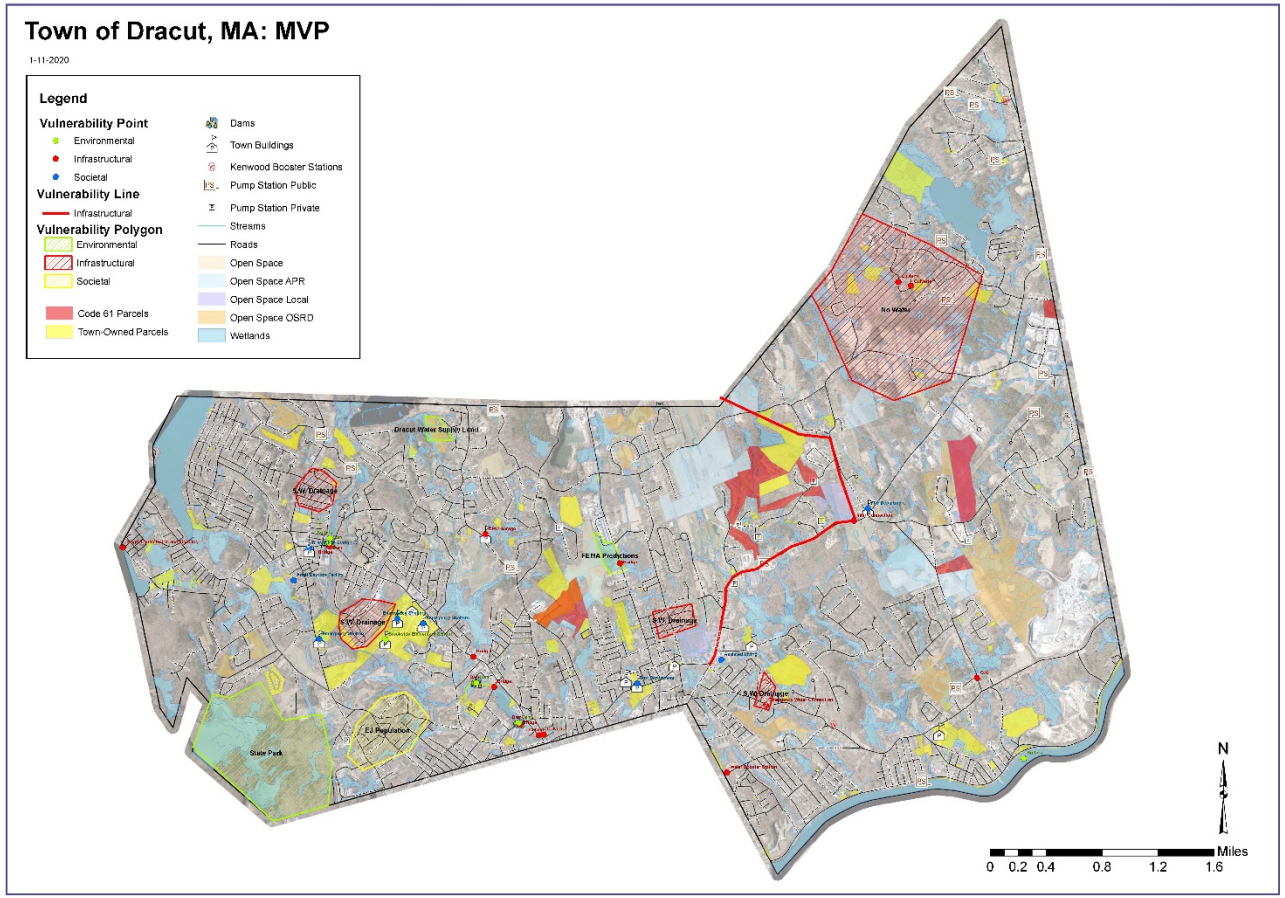
CRB Workshop Process

Map of Dracut Infrastructural, Societal and Environmental Features



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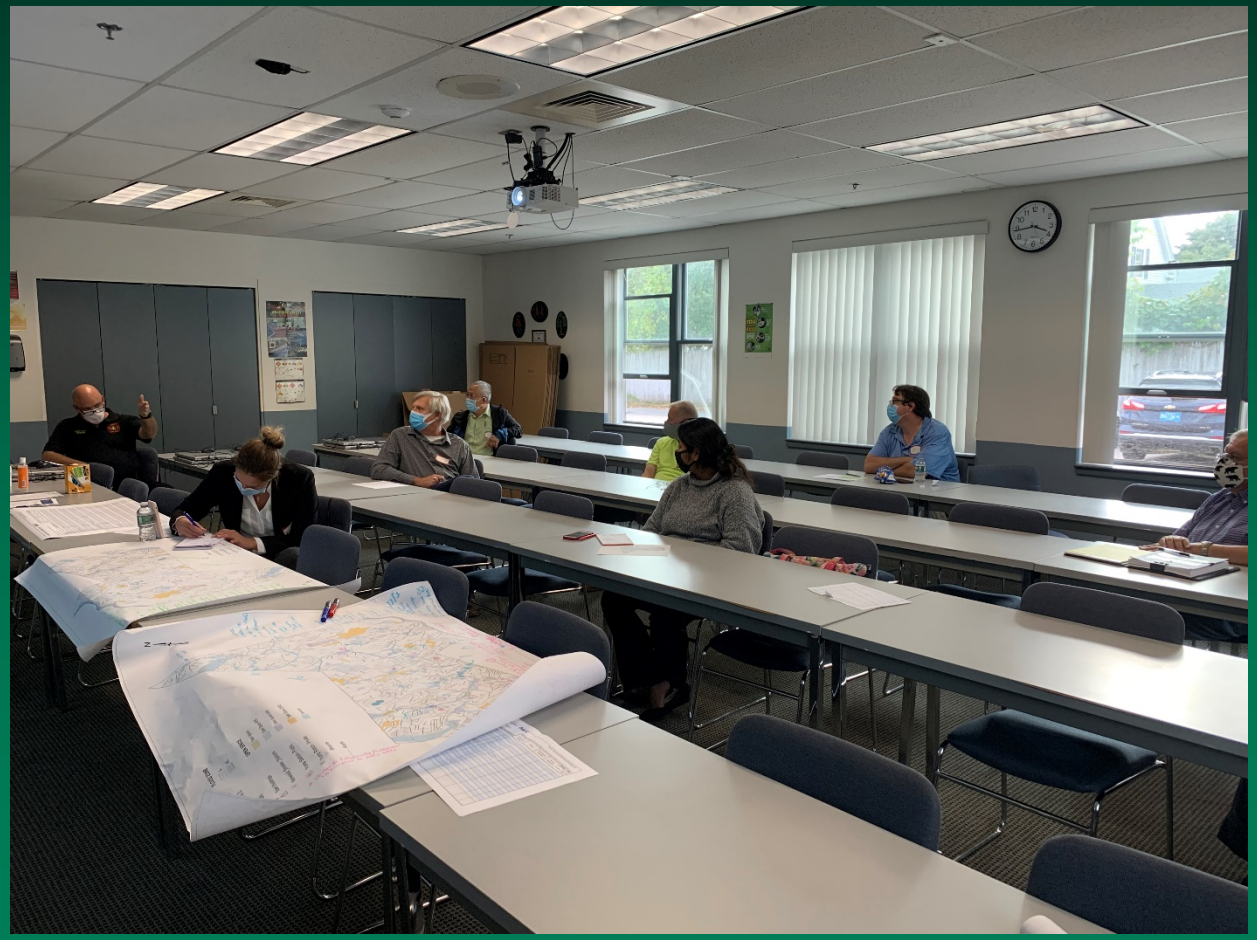
Development of Action Items

Step D: Identify & Prioritize Community Actions in Workshop #2



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Summary of Findings

Step E: Determine the Overall Priority Actions

The action steps have been prioritized in Table 3 below as follows:

High MVP Priority
Medium MVP Priority
Low MVP Priority

The estimated cost for the projects was determined as follows:

- High – over $100,000
- Medium – $25,000 - $100,000
- Low – under $25,000

Table 3: Recommended Action Steps to Improve Resiliency to Climate Change in Dracut

Project No.	Mitigation Action	Timeframe	Responsible Organization	Potential Funding Source	Estimated Cost
1	**Lakeview Avenue Culvert Replacement** Replacement of the town-owned structurally failing culvert conveying Peppermint Brook under Lakeview Ave to meet Stream Crossing Standards, considering ROW constraints; include a Hydrologic and Hydraulic (H&H) model for change in flow using projected climate change data	2021-2023	DPW	MVP Grant	High ~ upwards of $1,000,000
2	**Victory Lane Dam Removal** Include information demonstrating that removal would not result in downstream flooding. Study will include public outreach with upstream and downstream communities about the effects of removal of these dams	2021-2030	DPW	State & MVP Grant	High
3	**Beaver Brook Dam Removal** Design of Removal of Beaver Brook Dam based on the results of Study; Design shall include test sediment substrate upstream and along the brook, study of sediment upstream of dams (make sure there is no contamination), and the H&H study for the dam removal. FEMA will require map revisions (LOMR)	2021-2030	DPW	State & MVP Action Grant	High
4	**Collinsville Dam Removal** Design of Removal of Collinsville Dam based on the results of Study; Design shall include test sediment substrate upstream and along the brook, study of sediment upstream of dams (make sure there is no contamination), and the H&H study for the dam removal. FEMA will require map revisions (LOMR)	2021-2030	DPW	State & MVP Action Grant	High
5	**Well Heads Improvements** Flood proof existing well heads and provide transmission main upgrades by building new well heads up above 100-year floodplain (Tyngsborough Transmission)	2021-2023	Dracut Water District	MVP Grant	High ~ Approx. $600,000
6	**Overhead Powerlines Improvements** Coordinate with the Power company to remove hazard trees Town wide near overhead wires.	2021-2025	DPW	Town	Low
7	**Update Regulations & Bylaws** Update Zoning Bylaw using Climate Change projection data to comply with applicable local, State and Federal regulations	2021-2025	Zoning Board	Town	Medium
8	**Update Regulations & Bylaws** Update Wetlands Bylaw using Climate Change projection data to comply with applicable local, State and Federal regulations	2021-2025	Conservation	Town	Medium
9	**NFIP Compliance** Expand compliance with NFIP and certify a floodplain manager.	2021-2025	Building	FEMA BRIC	Medium
10	**LID Drainage Improvements** Rehabilitate or retrofit the undersized drainage system using LID and Green Infrastructure techniques in the following neighborhoods: • south of Mammoth Rd/ Pine Valley Dr to Lakeview Ave • Tennis Plaza Rd/ Wimbledon Crossing • Arlington St/ Cricket Ln • Montaup Ave/Fox Ave	2021-2030	DPW	MVP Grant	High ~ approx. $300,000
11	**Bartlett Brook Culvert Replacements under Sawmill Drive** Research options to replace 2 private failing culverts conveying Bartlett Brook under Sawmill Drive to meet Stream Crossing Standards without increasing downstream flooding (open bottom, higher capacity); include a Hydrologic and Hydraulic (H&H) model for change in flow using projected climate change data	2021-2025	DPW	MVP Grant	High ~ approx. $400,000-$500,000

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Summary of Findings

Step E: Determine the Overall Priority Actions

12	**Water System Improvements** • Rehabilitate the Water Booster Pump Station on Methuen Street and address safety and confined space issues • Replace old AC water main pipes townwide	2021-2025	Kenwood Water (Town)	Town/Grant Funded	High ~ approx. $400,000 High ~ approx. $5,000,000
13	**Water System Improvements** • Rehabilitate the Water Booster Pump Station and address safety and confined space issues • Replace old AC water main pipes townwide	2021-2025	Dracut Water District (Private)	Town	High ~ approx. $12,500,000
14	**Sewer System Improvements** • Sewer line rehabilitation • Oversight of private pump stations	2021-2025	DPW	Town	High ~ approx. $5,000,000 $0
15	**Road System Management Planning** • Formalize a plan for road management system • Coordinate with City of Lowell to mitigate Emergency Evacuation Route Traffic Impacts	2021-2023	DPW & Emergency Management	Ch.90	High ~ approx. $100,000
16	**Generator at Council of Aging** Purchase and Install an emergency generator at the Council on Aging	2021-2023	Emergency Management	FEMA Grant	TBD
17	**Snow Accumulations** Determine snow load capacity for town buildings.	2022-2025	Building	FEMA BRIC	Low
18	**Open Space Improvements** • Update & Revise OSRP 2009 in coordination with the Master Plan 2020 and with other disciplines, departments and permitting changes • Incorporate Nature-based Solution options into revised OSRP • Develop & Coordinate Maintenance Plan for OSRP and Forest Management Plan for Open Spaces	2021-2023	Planning and Conservation	Town	TBD
19	**Water Supply & Water Quality Improvements in the area with no municipal water** • Study water level within wells and drainage discharges • Implement water conservation efforts depending on the results of the study	2022-2025	Kenwood Water	Town	Medium/High ~ approx. $50,000 – $100,000 for study
20	**Public Education & Outreach Planning** • Develop public education and outreach programs for vulnerable populations (EJ population, elderly housing and facilities and group homes for special needs population) relative to climate change and availability of helpful municipal resources • Develop specific evacuation procedures and location for various groups of vulnerable populations	2021-2025	Planning and Emergency Management	Town	Low

* MVP Action Grants typically include a Town cost share commitment of 25%

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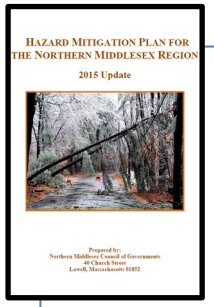
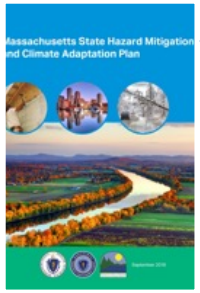
Mitigation Plan Development



Hazard Mitigation Plan for the Northern Middlesex Region (2015)



State Hazard Mitigation and Climate Adaptation Plan 2018

Municipal Vulnerability Preparedness Program (MVP)

Town of Dracut
MASSACHUSETTS

Town of Dracut Hazard Mitigation Plan 2020

Jamie Caplan Consulting LLC

History of success in MA

- Commonwealth of MA (State Plan)
- Town of Becket (MVP/HMP)
- Town of Blandford (HMP)
- Town of Dighton (MVP/HMP)
- Town of Fairhaven (MVP/HMP)
- Town of Lexington (MVP/HMP)
- Town of Ludlow (HMP)
- Town of North Reading (HMP)
- City of Pittsfield (MVP/HMP)
- Town of South Hadley (HMP)
- UMASS Amherst (HMP)

Nationwide experience

- Territory of American Samoa
- County of Maui
- American Indian Tribes
- South Central Region of Connecticut

Mitigation Defined

- Any sustained actions taken to reduce or eliminate long term risk to people and property from hazards and their effects.

FEMA's Pre-Disaster Mitigation Funding

- Building Resilient Infrastructure and Communities (BRIC)
  - Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- Hazard Mitigation Grant Program (HMGP)
  - Only available after a Presidential Disaster Declaration

Mitigating Risk Saves Lives and Money

A FEMA-approved Hazard Mitigation Plan is required to receive Federal Grant Funds for Hazard Mitigation Projects.

National Institute of BUILDING SCIENCES™

	ADOPT CODE	ABOVE CODE	BUILDING RETROFIT	LIFELINE RETROFIT	FEDERAL GRANTS
Overall Benefit-Cost Ratio	11:1	4:1	4:1	4:1	6:1
Cost ($ billion)	$1/year	$4/year	$520	$0.6	$27
Benefit ($ billion)	$13/year	$16/year	$2200	$2.5	$160
Riverine Flood	6:1	5:1	6:1	8:1	7:1
Hurricane Surge	not applicable	7:1	not applicable	not applicable	not applicable
Wind	10:1	5:1	6:1	7:1	5:1
Earthquake	12:1	4:1	13:1	3:1	3:1
Wildland-Urban Interface Fire	not applicable	4:1	2:1	not applicable	3:1

Possible Mitigation Actions

- Property acquisition
- Structure elevation
- Flood risk reduction (culverts, drainage upgrades)
- Retrofitting buildings
- Soil stabilization
- Generators (FEMA only)

- Nature-based solutions and low-impact development prioritized!

Core Team

- Ann Vandal – Town Manager
- Ed Patenaude – Director of Public Works
- Mark Hamel – Town Engineer
- Lori Cahill – Conservation Agent/Parks and Recreation
- Dan MacLaughlin – Building Inspector
- Richard Patterson – Deputy Fire chief/emergency response
- Betsy Ware – Community Development
- Bethany Loveless – Council on Aging
- Tina Douk - Stormwater Manager (DPW)

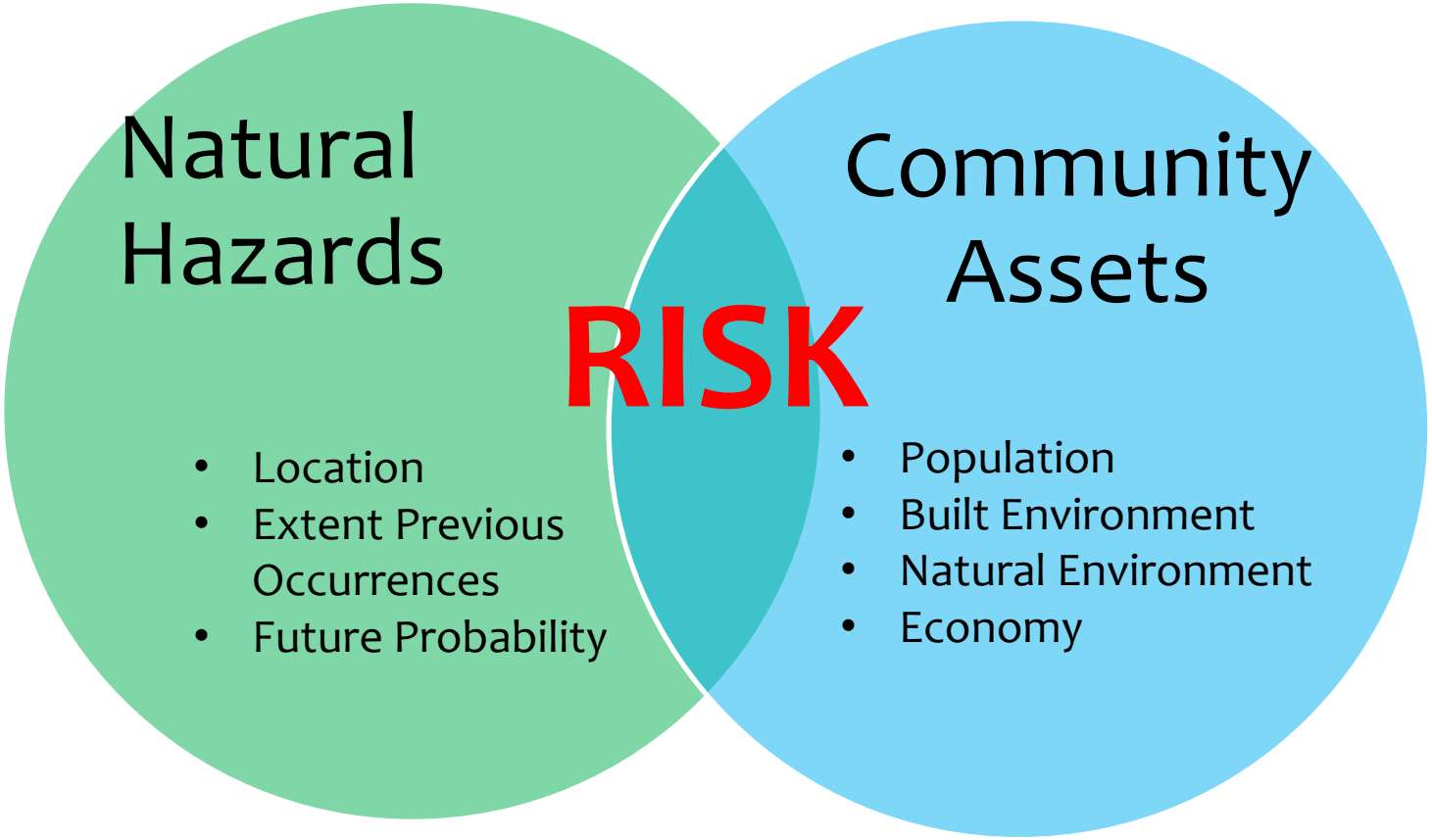
Provide supporting data or information.

Assist in the identification and prioritization of mitigation actions.

Review and comment on the draft plan.

Approve final draft for submission to MEMA.

Defining Risk



Hazard Mitigation Plan Hazards

Primary Climate Change Interactions	Natural Hazards
Changes in Precipitation	• Flooding • Drought • Landslide
Rising Temperatures	• Average/Extreme Temperatures • Wildfires • Invasive Species
Extreme Weather	• Hurricanes/Tropical Storms • Severe Winter Storm/Nor'easter • Tornadoes • Severe Weather (strong winds/extreme precipitation)
Non-Climate Influenced Hazards	• Earthquake

Risk Assessment Summary (DRAFT)

HIGH RISK	**Flooding** **Severe Winter Storm/Nor'easter** **Hurricanes/Tropical Storms** **Other Severe Weather**
MODERATE RISK	**Average/Extreme Temperatures** **Drought** **Earthquake** **Tornadoes** **Wildfires**
LOW RISK	**Dam Failure** **Invasive Species**

Critical Facilities in Hazard Mitigation Plan

Facility	Address	Generator? (y/n)
Emergency Operations Center (Primary)	488 Pleasant Street	Y
Emergency Operations Center (Secondary)	Broadway Road (Route 113)	Y
Central Fire Station	488 Pleasant Street	Y
Fire Station 2	15 Jones Avenue	Y
Fire Station 3	1990 Lakeview Avenue	Y
Police Station	110 Loon Hill Road	Y
Dracut Junior High School (shelter)	1580 Lakeview Avenue	Y
Joseph A. Campbell Elementary School (shelter)	1021 Methuen Street	Y
Dracut High School	1540 Lakeview Avenue	Y
Justus C Richardson Middle School (shelter)	1540 Lakeview Avenue	Y
Brookside Elementary School	1560 Lakeview Avenue	Y
George H. Englesby Elementary School	1580 Lakeview Avenue	Y
Greenmont Avenue Elementary School	37 Greenmont Avenue	N
Town Hall	62 Arlington Street	N
Public Works Department	833 Hildreth Street	Y
Council on Aging	951 Mammoth Road	N

Goal Statements

1. Reduce losses of life, property, infrastructure, and cultural and historic resources from natural hazards.

2. Prioritize green solutions and environmental protection when implementing mitigation actions.

3. Investigate, design, and implement infrastructure projects to reduce and minimize the risk of flooding and other high hazards such as winter storms and hurricanes.

4. Increase public awareness of natural hazard risks and mitigation activities through education and outreach.

5. Build resilience for future events through integration of hazard mitigation principles into town plans and regulations.

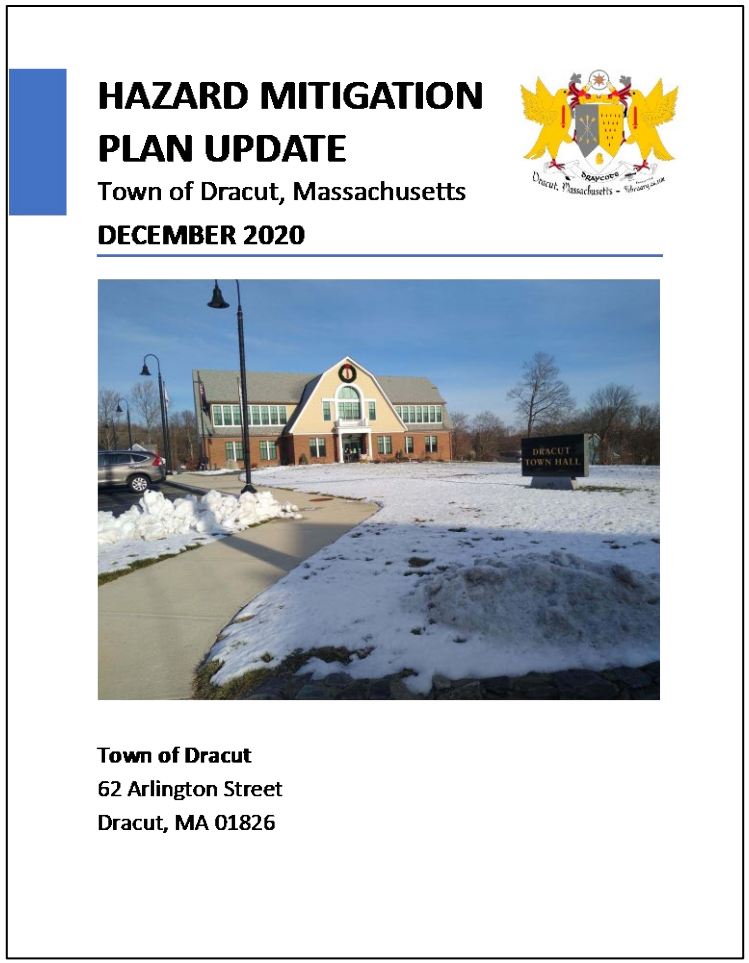
20 Mitigation Actions

- Action Title
- Action Description
- Timeframe (within 5 years)
- Lead Department
- Potential Funding Sources
- Estimated Cost
  - High (over $100,000)
  - Medium ($25,000 - $100,000)
  - Low (under $25,000)
- Hazard(s) Addressed
- Critical Facility Protection
- Goal Statement Affiliation

Plan Review

- Chapter 1. Introduction
  - Changes since 2015
- Chapter 2. Planning Area Profile
  - Population
  - Infrastructure
  - Land Use
- Chapter 3. Planning Process
  - Who was involved
  - Studies reviewed
- Chapter 4. Risk Assessment
  - Hazard profiles
  - Critical Facilities
  - Summary of Risk
- Chapter 5. Capability Assessment
  - Plans, Administration, Finances, Education
  - National Flood Insurance Program
- Chapter 6. Mitigation Strategy
  - Goals
  - Mitigation Actions
- Chapter 7. Plan Implementation and Maintenance
  - Method and schedule for implementation

Plan Adoption And Implementation



Scheduled for Review in January 2021 by MEMA - FEMA

Plan Adoption and Implementation

FEMA Approval Every 5 years

High Priority Actions

Project No.	Mitigation Action	Action Description
1	Lakeview Avenue Culvert Replacement	Replacement of the town-owned structurally failing culvert conveying Peppermint Brook under Lakeview Ave. to meet Stream Crossing Standards, considering ROW constraints.
2	Victory Lane Dam Removal	Include information demonstrating that removal would not result in downstream flooding. Study will include public outreach with upstream and downstream communities about the effects of removal of these dams.
3	Beaver Brook Dam Removal	Design of removal of Beaver Brook Dam based on the results of Study; Design shall include test sediment substrate upstream and along the brook, study of sediment upstream of dams (make sure there is no contamination), and the H&H study for the dam removal. FEMA will require map revisions (LOMR).
4	Collinsville Dam Removal	Design of removal of Collinsville Dam based on the results of Study; Design shall include test sediment substrate upstream and along the brook, study of sediment upstream of dams (make sure there is no contamination), and the H&H study for the dam removal. FEMA will require map revisions (LOMR).
5	Well Heads Improvements	Flood proof existing well heads and provide transmission to main upgrades by building new well heads up above 100-year floodplain (Tyngsborough Transmission).
6	Overhead Powerlines Improvements	Coordinate with the power company to remove hazard trees town-wide near overhead wires.
7	Update Regulations & Bylaws	Update Zoning Bylaw using Climate Change projection data to comply with applicable local, State and Federal regulations.
8	Update Regulations & Bylaws	Update wetlands bylaw using Climate Change projection data to comply with applicable local, State and Federal regulations.
9	NFIP Compliance	Expand compliance with NFIP and certify a floodplain manager.
10	LID Drainage Improvements	Rehabilitate or retrofit the undersized drainage system using LID and Green Infrastructure techniques in the following neighborhoods: • South of Mammoth Rd/ Pine Valley Dr to Lakeview Ave • Tennis Plaza Rd/Wimbledon Crossing • Arlington St/ Cricket Ln • Montaup Ave/Fox Ave

Medium Priority Actions

Project No.	Mitigation Action	Action Description
11	Bartlett Brook Culvert Replacements under Sawmill Drive	Research options to replace 2 private failing culverts conveying Bartlett Brook under Sawmill Drive to meet Stream Crossing Standards without increasing downstream flooding (open bottom, higher capacity).
12	Water System Improvements	• Rehabilitate the Water Booster Pump Station on Methuen Street and address safety and confined space issues. • Replace old AC water main pipes town wide.
13	Water System Improvements	• Rehabilitate the Water Booster Pump Station and address safety and confined space issues. • Replace old AC water main pipes town wide.
14	Sewer System Improvements	• Sewer line rehabilitation. • Oversight of private pump stations.
15	Road System Management Planning	• Formalize a plan for road management system. • Coordinate with UMass Lowell to mitigate Emergency Evacuation Route traffic impacts.
16	Generator at Council of Aging	Purchase and Install an emergency generator at the Council on Aging.
17	Snow Accumulations	Determine snow load capacity for town buildings.
18	Open Space Improvements	• Update and Revise OSRP 2009 in coordination with the Master Plan 2020 and with other disciplines, departments and permitting changes. • Incorporate nature-based solution options into revised OSRP. • Develop and coordinate maintenance plan for OSRP and Forest Management Plan for Open Spaces.

Low Priority Actions

Project No.	Mitigation Action	Action Description
19	Water Supply & Water Quality Improvements in the area with no municipal water	• Study water level within wells and drainage discharges. • Implement water conservation efforts depending on the results of the study.
20	Public Education & Outreach Planning	• Develop public education and outreach programs for vulnerable populations (EJ population, elderly housing and facilities and group homes for special needs population) relative to climate change and availability of helpful municipal resources. • Develop specific evacuation procedures and location for various groups of vulnerable populations.

Questions/Discussions

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