HAZARD MITIGATION PLAN UPDATE

Town of Dracut, Massachusetts

DECEMBER 2020

Town of Dracut

62 Arlington Street

Dracut, MA 01826

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Prepared by:

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Acknowledgements

The Town of Dracut would like to thank the following people and organizations for supporting the development of this plan. This group was considered the Core Team throughout the planning process.

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Certificate of Local Adoption

E1. Does the Plan include documentation that the Plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))

TOWN OF DRACUT, MASSACHUSETTS

BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE

TOWN OF DRACUT 2020 LOCAL HAZARD MITIGATION PLAN UPDATE

WHEREAS, the Town of Dracut established a Committee to prepare the **2020 HAZARD MITIGATION PLAN UPDATE**; and

WHEREAS, the Town of Dracut participated in the development of the Town of Dracut **2020 HAZARD MITIGATION PLAN UPDATE**;

and WHEREAS, the Town of Dracut **2020 HAZARD MITIGATION PLAN UPDATE** contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Dracut, and

WHEREAS, a duly noticed public meeting was held by the Dracut Board of Selectmen on _____ for the public and municipality to review prior to consideration of this resolution; and

WHEREAS, the Town of Dracut authorizes responsible departments and/or agencies to execute their responsibilities demonstrated in the plan,

NOW, THEREFORE BE IT RESOLVED that the Town of Dracut Board of Selectmen formally approves and adopts the Town of Dracut **2020 HAZARD MITIGATION PLAN UPDATE,** in accordance with M.G.L. c. 40.

ADOPTED AND SIGNED by the Dracut Board of Selectmen on this_____ _____, 2021.

Jesse Forcier, Chairman

Tony Archinski, Member

Alison Genest, Vice-Chairman

Shannon Rowe, Secretary

Heather Santiago-Hutchings, Clerk

Joseph DiRocco, Jr., Member

Record of Changes

This 2020 Hazard Mitigation Plan Update, including Appendices, will be reviewed and approved on a biannual basis by the Core Team and following any major disasters. All updates and revisions to the plan will be tracked and recorded in the following table. This process will ensure the most recent version of the plan is disseminated and implemented by the town.

Table 1. Summary of changes.

Date of Change	Entered By	Summary of Changes

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Chapter 1. Introduction

The Federal Emergency Management Agency (FEMA) defines mitigation as "the effort to reduce loss of life and property by lessening the impact of disasters. Mitigation is taking actions now – before the next disaster – to reduce human and financial consequences later (analyzing risk, reducing risk, insuring against risk.)"[1]

"The purpose of mitigation planning is to identify policies and actions that can be implemented over the long term to reduce risk and future losses. Mitigation plans form the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage. The planning process is as important as the plan itself. It creates a framework for risk-based decision making to reduce damages to lives, property, and the economy from future disasters."[2]

"DMA 2000 (Public Law 106-390)[3] provides the legal basis for FEMA mitigation planning requirements for State, local and Indian Tribal governments as a condition of mitigation grant assistance. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous mitigation planning provisions and replacing them with a new set of requirements that emphasize the need for State, local, and Indian Tribal entities to closely coordinate mitigation planning and implementation efforts."[4]

The Town of Dracut, Massachusetts created this plan as part of an ongoing effort to reduce the negative impacts and costs from damages associated with natural hazards, such as nor'easters, floods, and hurricanes. This plan meets the requirements of the Disaster Mitigation Act 2000. More importantly, the plan was created to reduce loss of life, land, and property due to natural hazards that affect the Town of Dracut. It is difficult to predict when natural hazards will impact the planning area, but it is accurate to say that they will. By implementing the mitigation actions listed in this plan, the impact of natural hazards will be lessened.

Local Mitigation Plans must be updated at least once every five years in order to remain eligible for FEMA hazard mitigation project grants. A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five (5) years in order to continue to be eligible for mitigation project grants. (44 CFR §201.6(d)(3))

[1] What is Mitigation? (2014). Federal Emergency Management Agency. Retrieved January 2014 from http://www.fema.gov/what-mitigation

[2] Multi-Hazard Mitigation Planning. (2014). Federal Emergency Management Agency. Retrieved January 2014 from http://www.fema.gov/multi-hazard-mitigation-planning

[3] Disaster Mitigation Act of 2000, Pub. L. 106-390, as amended

[4] Disaster Mitigation Act of 2000. (2014). Federal Emergency Management Agency. Retrieved January 2014 from http://www.fema.gov/media-library/assets/documents/4596?id=1935

Combined with Municipal Vulnerability Preparedness

The previous Hazard Mitigation Plan was a regional plan written by the Northern Middlesex Council of Governments, adopted in 2015. This document serves as an update to that plan.

Another significant change was in the planning process; development of this plan was in conjunction with the Municipal Vulnerability Preparedness (MVP) program implemented by the town. All aspects of the MVP program influenced development of this plan, including the Core Team, the Community Resilience Building Workshop, and the listening sessions. The Planning Process chapter details how the MVP program was incorporated.

Purpose of the Plan

The purpose of the Local Hazard Mitigation Plan is to provide the Town of Dracut (known throughout this document as *the planning area*) with a comprehensive examination of all natural hazards affecting the area, as well as a framework for informed decision-making regarding the selection of cost-effective mitigation actions. When implemented, these mitigation actions will reduce the town's risk and vulnerability to natural hazards.

This plan is a result of a collaborative effort between the Town of Dracut and the surrounding communities. Throughout the development of the plan, the Core Team consulted the public for input regarding identified goals, mitigation actions, risk assessment, and mitigation implementation strategy. The public included stakeholders to the town, such as the Northern Middlesex Council of Government, the Massachusetts Division of Ecological Restoration, and the MVP Northeast Regional Coordinator.

Guiding principles for plan development

The Core Team adhered to the following guiding principles in the plan's development. [5]

- Focus on mitigation strategy as the plan's primary purpose. All other sections contribute to and inform the mitigation strategy and specific hazard mitigation actions.
- Process is as important as the plan itself. In mitigation planning, as with most other planning efforts, the plan is only as good as the process and people involved in its development. The plan should also serve as the documentation of the planning process.
- This is your community's plan. To have value, the plan must represent the current needs and values of the community and be useful to local officials and stakeholders. Develop the mitigation plan in a way that best serves your community's purpose and people.

Mitigation Goals

The Core Team identified the following list of hazards to profile. They are shown in order of climate change interaction for consistency with the State Hazard Mitigation and Climate Adaptation Plan.

[5] Federal Emergency Management Agency. (2013). *Local Mitigation Planning Handbook,* p. I-2.

Table 2. Hazards considered.

Primary Climate Change Interactions	Hazards
Changes in Precipitation	Flooding (including riverine and urban/stormwater related flooding, etc.) Drought
Rising Temperatures	Average/Extreme Temperatures Wildfires Invasive Species
Extreme Weather	Hurricanes/Tropical Storms Severe Winter Storm/Nor'easter Tornadoes Other Severe Weather (including severe thunderstorms, high winds, lightning, hail, etc.)
Non-Climate Influenced Hazards	Earthquake
Technological and Human Caused Hazards	Dam Failure

The hazard mitigation strategy is the culmination of work presented in the planning area profile, risk assessment, and capability assessment. It is also the result of multiple meetings and sustained public outreach. The Core Team developed the five goals shown below. The goals from the 2015 Hazard Mitigation Plan were revised to develop this current list. Information about the goal development process is in Chapter 6. Mitigation Strategy. These goals are considered "broad policy-type statements"[6] that represent the long-term vision for mitigating risk to natural hazards in the Town of Dracut.

[6] Federal Emergency Management Agency. (2013). *Local Mitigation Planning Handbook,* p. 6.

Mitigation Goals	1. Reduce losses of life, property, infrastructure, and cultural resources from natural hazards. 2. Prioritize green solutions and environmental protection when implementing all mitigation actions. 3. Investigate, design, and implement infrastructure projects to reduce and minimize the risk of flooding. 4. Increase public awareness of natural hazard risks and mitigation activities through education and outreach. *5.* Integrate hazard mitigation principles into town government regulations and plans.

Figure 1. Mitigation plan goals

Plan Update and Changes

The Town of Dracut was previously included in the 2015 Northern Middlesex Region Hazard Mitigation Plan. This document was reviewed for the development of this plan but was not updated. This Plan is just for the Town of Dracut and reflects a complete revision of the 2015 Northern Middlesex Region plan. The Northern Middlesex Council of Governments was consulted during the planning process, and then given the opportunity to review the draft plan.

> *D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))*

The list of critical facilities shown in Chapter 4 includes town-owned buildings and indicates the presence or lack of backup power capacity. The 2015 plan included a list of critical facilities based on the Town's CEMP. This list was completely revised by the Core Team. The mitigation action list indicates if each action directly relates to the protection of a critical facility.

The Massachusetts State Hazard Mitigation and Climate Adaptation Plan of September 2018 was referred to regularly, and a lot of content was extracted from it for the Town of Dracut Risk Assessment. The Town of Dracut adopted the state's methodology for categorizing hazards based on climate change interaction. Details from the State Plan were used to understand risk in the Town of Dracut.

Finally, changes were incorporated based on changes related to growth, hazard risk, and priorities. The town anticipates that climate change has and will continue to impact hazards. For this reason, adapting to climate change is a priority for Dracut.

> *D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))*

The Mitigation Strategy chapter details previous hazard mitigation actions that the 2015 Northern Middlesex Region plan indicated specifically for Dracut. Each of these actions is identified as completed,

in-progress, or no longer relevant. It also indicates if actions should be included in this updated Plan. The current mitigation action list represents present and future needs for Dracut. In addition, the public engagement process that included the development of the Core Team and the Community Resilience Building Workshop led to identification of mitigation actions that the community supports. The new mitigation actions are substantially more detailed, leading the town toward grant applications and plan implementation.

> *D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))*

The 2015 Hazard Mitigation Plan included regional goal statements and Dracut specific mitigation actions. The Core Team revised the goal statements to reflect the needs of the town and for consistency with the State Hazard Mitigation and Climate Adaptation Plan. The Town of Dracut has prioritized green solutions and environmental protection, flood mitigation for infrastructure, and the integration of hazard mitigation into government planning and regulations.

Authority and Assurances

The Town of Dracut will continue to comply with all applicable Federal laws and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 201.6. It will amend its plan whenever necessary to reflect changes in town, State or Federal laws and regulations, as required in 44 CFR 201.6.

The Core Team recognizes the following FEMA publications:

- Local Mitigation Planning Handbook (March 2013)
- Local Mitigation Plan Review Guide (October 2011)
- Demonstrating Good Practices Within Local Hazard Mitigation Plans (January 2017, FEMA Region 1)

Plan Adoption

> *E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))*

The Town of Dracut will adopt the Plan when it has received “approved-pending adoption” status from the Federal Emergency Management Agency. The Certificate of Adoption is included on page 3.

Document Overview

Below is a summary of the Hazard Mitigation Plan Update chapters, including appendices. The FEMA guidelines and requirements for each portion of this Plan are included in their respective chapters. The planning process closely adhered to FEMA guidelines and to the intent of those guidelines.

Chapter 2: Planning Area Profile

The Planning Area Profile chapter describes the Town of Dracut completely, including geography, the built environment, the local economy, and utilities.

Chapter 3: Planning Process

The Planning Process chapter documents the methodology and approach of the hazard mitigation planning process. The chapter summarizes the Core Team meetings, the public outreach process (including public meetings), and how the MVP process was incorporated. This chapter guides the reader through the process of generating this Plan and reflects its open and inclusive public involvement process.

Chapter 4: Risk Assessment

The Risk Assessment identifies the natural hazard risks to the Town of Dracut and its citizens. The risk assessment looks at current and future vulnerabilities based on development of structures and infrastructure. Included in this chapter is a list of critical facilities identified by the Core Team.

Chapter 5: Capability Assessment

The Capability Assessment looks at the town's ability to mitigate risk prior to and following disaster.

Chapter 6: Mitigation Strategy

This chapter provides a blueprint for reducing losses identified in the Risk Assessment. The chapter presents the overall hazard mitigation goals and identifies mitigation actions in priority order. Where applicable, funding sources are identified, as are responsible town departments and potential partners.

Chapter 7: Plan Implementation and Maintenance

The Plan Implementation and Maintenance establishes a system and mechanism for periodically monitoring, evaluating, and updating the Hazard Mitigation Plan. It also includes a plan for continuing public outreach and monitoring the implementation of the identified mitigation actions.

Appendices

The Appendices includes documentation regarding the planning process, such as Core Team and public meeting presentations. In addition, resources supporting each chapter are included.

Chapter 2. Planning Area Profile

Overview

The Town of Dracut is located in northeastern Middlesex County about 28 miles north of Boston. It is bordered on the north by Pelham, New Hampshire, on the east by Methuen, Massachusetts, on the south by Lowell and Tewksbury, Massachusetts and on the west by Tyngsborough, Massachusetts. The Town occupies a total area of 21.4 square miles, 20.8 of which is land with the remainder being bodies of water. The southern end of Dracut is on the Merrimack River and the town is bisected by Beaver Brook, a lengthy tributary that flows south from New Hampshire through the entire west side of town. Figure 2 shows the location of Dracut in the Northeast and Figure 3 shows a basemap of the planning area included within the town's jurisdictional boundaries.

Figure 2. Dracut, MA Location.

Dracut was incorporated as a Town in the Commonwealth of Massachusetts in 1701. Dracut's early economy relied on fishing, lumbering, and milling, which led in turn to the 19th century industries of paper making and cotton textile manufacturing, including the Beaver Brook Mill. Today the town is developed primarily as a residential community, situated with ready access to the Lowell and Boston metropolitan areas to the south, the Atlantic seacoast to the east and the mountains and lakes of New England to the north. There is an abundance of recreational, healthcare, and educational institutions all within an hour or less drive.

Dracut describes itself as a pleasant residential community with a rich agricultural, historical, and open space heritage. Former mill buildings along Beaver Brook have undergone adaptive reuse as commercial and residential facilities. There has been intense modern development in Dracut with suburban residential pressures from the City of Lowell. Much of this development has come at the expense of agricultural land, however, some rural landscapes remain intact, as do some historic structures. The relationship between history and the local economy is well represented by the remaining mills, while more modern structures constructed as part of the town's newer economy can be found along the town's main arterials, such as Routes 110 and 113. Elements of the past and the present have been woven together to create the Dracut of today, which offers a full range of housing from high end surrounding a golf course to deed restricted affordable units and much in between.

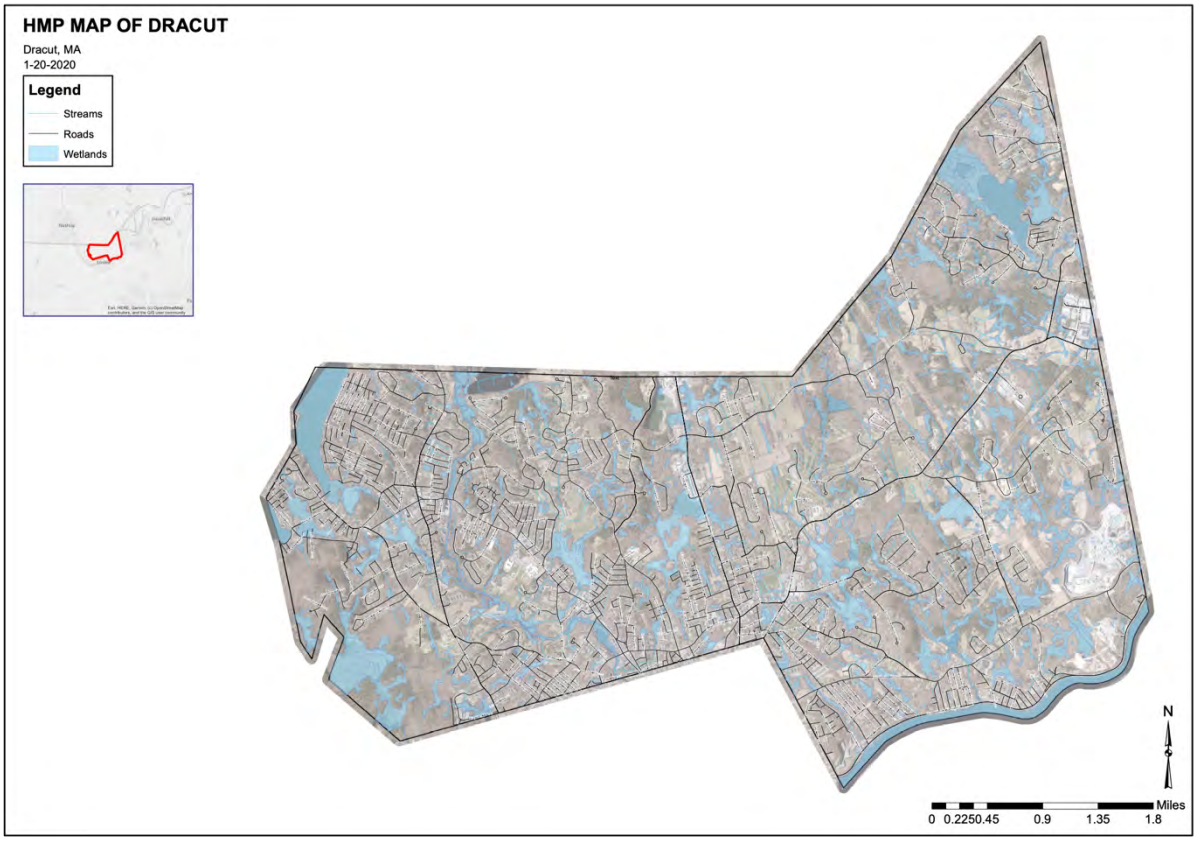


Figure 3. Dracut Basemap.

Dracut continues to have a modest economic base, which includes commercial development, industrial activities, health care and small businesses. While Routes 38 and 113 run through the center of town, the lack of direct highway access has limited non-residential development and often has been perceived as a barrier to economic development. Yet, Dracut is only two miles from Interstate 93.

Town Government

Dracut is one of the largest towns in Massachusetts to still be governed by an open town meeting, whereby every registered voter is entitled to gather at stated times to conduct the business of the town.

Routine town governance and administrative duties are also carried out by an elected five-member Board of Selectmen, a Town Manager, and numerous Town Departments. General governmental services for the town include police and fire protection, disposal of garbage and recyclables, public education in grades K through 12, sewer services, streets, and parks and recreation. Water services are provided by the town and the Dracut Water Supply District, the latter of which is an independent entity.

Population and Housing

According to the latest estimates provided by the U.S. Census Bureau (2019), Dracut's total population is 31,634 which equates to a current population density of nearly 1,500 people per square mile. This represents a growth rate of 7.6% since the 2010 Census, which is more than the state average growth rate of 5.3%. In 2018 there were an estimated 11,274 year-round housing units, with a household size of 2.8 people per household. Figure 4 provides some additional relevant demographic and housing statistics for Dracut as reported by the U.S. Census Bureau.

Demographic Statistics

- Median age is 39.4
- 6.6% are under age 5
- 22.1% are under age 18
- 15.3% are over age 65
- 6.7% have a disability
- 13.3% speak a language other than English at home
- 1.7% have no health insurance
- 70.2% are in the civilian labor force
- Per capita income is #37.166
- Median household income is $88,555
- 7.5% are below the poverty level

Housing Statistics

- Number of housing units = 11,274
- Median value = $316,000
- Average household size = 2.77
- 79.2% of housing units are owner-occupied
- Median gross rent is $1,287

Figure 4. Dracut Characteristics from U.S. Census Bureau.[7]

Infrastructure and Public Facilities

Dracut is well served in terms of infrastructure, utilities, facilities, and services. This section provides a summary overview of these community assets, and more detailed information on all of them can be found in the Town's Master Plan, adopted by the Dracut Planning Board in May 2020.

Transportation System

Dracut's transportation infrastructure includes nearly 160 miles of state and local roadways. This includes approximately 20 miles of arterials which provide the highest level or service, including the principal arterials of Route 38 (Bridge Street), Route 110 (Merrimack Avenue), and Route 113 (Pleasant Street and Broadway Road). Urban minor arterials include Lakeview Avenue, Mammoth Road, Nashua Road, and Textile Avenue. There are an additional 18 miles of collector roads that serve to connect arterials with the approximately 120 miles of local roads that account for 76% of the Town's roadway mileage.

Ownership of roadways is key to identifying the responsible parties for maintaining and improving Dracut's transportation network. MassDOT currently owns 4.5% of the roadway mileage in Dracut, including Broadway Road (Route 113), Willard Street and Merrimack Avenue (Route 110). The town's highway department is responsible for the maintenance of all remaining public roads, including snow and ice removal. The town also has just over 15 miles of private ways that do not meet local standards for roadway construction and for which the town provides only minimum essential maintenance, including snow plowing and other measures to allow access for public safety operations.

In terms of public transit, Dracut lies within the Lowell Regional Transit Authority (LRTA) service area. The LRTA is one of sixteen regional transit authorities across the Commonwealth dedicated to the mission of increasing the use of mass transit on a regional basis. In addition to Dracut, the LRTA service area includes Acton, Billerica, Carlisle, Chelmsford, Dunstable, Groton, Lowell, Maynard, Pepperell, Tewksbury, Townsend, Tyngsborough, and Westford. The LRTA provides both fixed route bus service and paratransit service. Dracut is also situated in proximity to Massachusetts Bay Transportation Authority (MBTA) commuter rail service with a station in the neighboring City of Lowell.

Currently, Dracut does not have any designated on-road bicycle facilities, but signs encouraging motorists to share the roads with bicyclists are located along major roadways such as Route 113 (Broadway Road). Closed circuit trails, multi-use paths, and walkways can be found in many of Dracut's parks and open space areas, but these trails do not connect to a larger network and do not promote multimodal transportation throughout the community due to their isolation. According to the Town's Master Plan, the lack of a connected sidewalk and trail system is one of the most notable deficiencies in Dracut's transportation network.

[7] U.S. Census Bureau, 2018 American Community Survey 5-Year Estimates.

Bridges

In Dracut, there are five bridge crossings of Beaver Brook. These include three town-owned bridges (Lakeview Avenue, Phineas Street, and Parker Avenue and two state-owned bridge (Route 113). Each of these bridges are routinely monitored and inspected by MassDOT on a bi-annual basis. MassDOT uses standards developed by the American Association of State Highway and Transportation Officials (AASHTO) to rate the structural condition all bridges in Massachusetts, and according to the latest ratings in 2018, there are no structurally deficient bridges in Dracut.

Water Supply Systems

Dracut is served by the Dracut Water Supply and Kenwood Water Districts. The majority of town receives water through the Dracut Water Supply District (DWSD), with the eastern portion of the town receiving water through the Kenwood Water Department. The remainder of the town is supplied by private wells.

The DWSD's water distribution system includes more than 100 miles of water main ranging in size from 1- to 24-inches in diameter. Water is drawn from five wells located in the Tyngsborough Well Field, located along the Merrimack River, and from two wells in the New Boston Well Field, located in Dracut. The District supplements the well supplies with water purchased through an interconnection with the Lowell Regional Water Utility (LRWU). The District supplies approximately 8,000 households in Dracut, in addition to about 1,000 residents in Tyngsborough. According to the Dracut Water System Master Plan, the District's well supplies, pumping stations, and storage tanks have been well maintained and are generally in very good condition.

The Kenwood Water District was established in 1966 as a separate entity from the DWSD, and is under the jurisdiction of the Town Manager, acting as Superintendent. The system is a distribution system only; it does not have its own water source, nor does it treat water. The District's system contains approximately 35 miles of main ranging in size from 6 inch to 12 inch. The District purchases water from the Lowell and Methuen Water Departments and supplies it to customers located in the eastern portion of Dracut. Both Lowell and Methuen's source of water is the Merrimack River. There are 1,980 accounts in the Kenwood District, and the system continues to expand with ongoing development.

Wastewater Infrastructure

The town's municipal sewer system services about 95% of Dracut's population, and extends throughout most of the community. As of December 2018, there were 9,183 accounts connected to the sewer system. A small portion of the town is supported by on-site septic systems, primarily located in the vicinity of Jones Avenue, Methuen Road, Island Pond Road, and the northern portion of Marsh Hill Road.

Discharge from the sewer system is sent to the Lowell Regional Wastewater Utility (LRWWU) and Greater Lawrence Sanitary District (GLSD). In addition to sewer mains and laterals, the town's Sewer Department owns and maintains seventeen pump stations. There are also nine additional pump stations that are privately owned and operated.

Over the past 40 years, 32 sewer construction contracts were completed by the town. These projects followed a phased sewer construction program developed as part of a 1982 Wastewater Facilities Plan and a Comprehensive Wastewater Management Plan (CWMP) completed in 2001 and updated in 2007. The CWMP is now considered to be fully implemented. Figure 5 shows the extent of Dracut's water and sewer infrastructure, which include most of the community except for the relatively rural portions of East Dracut.

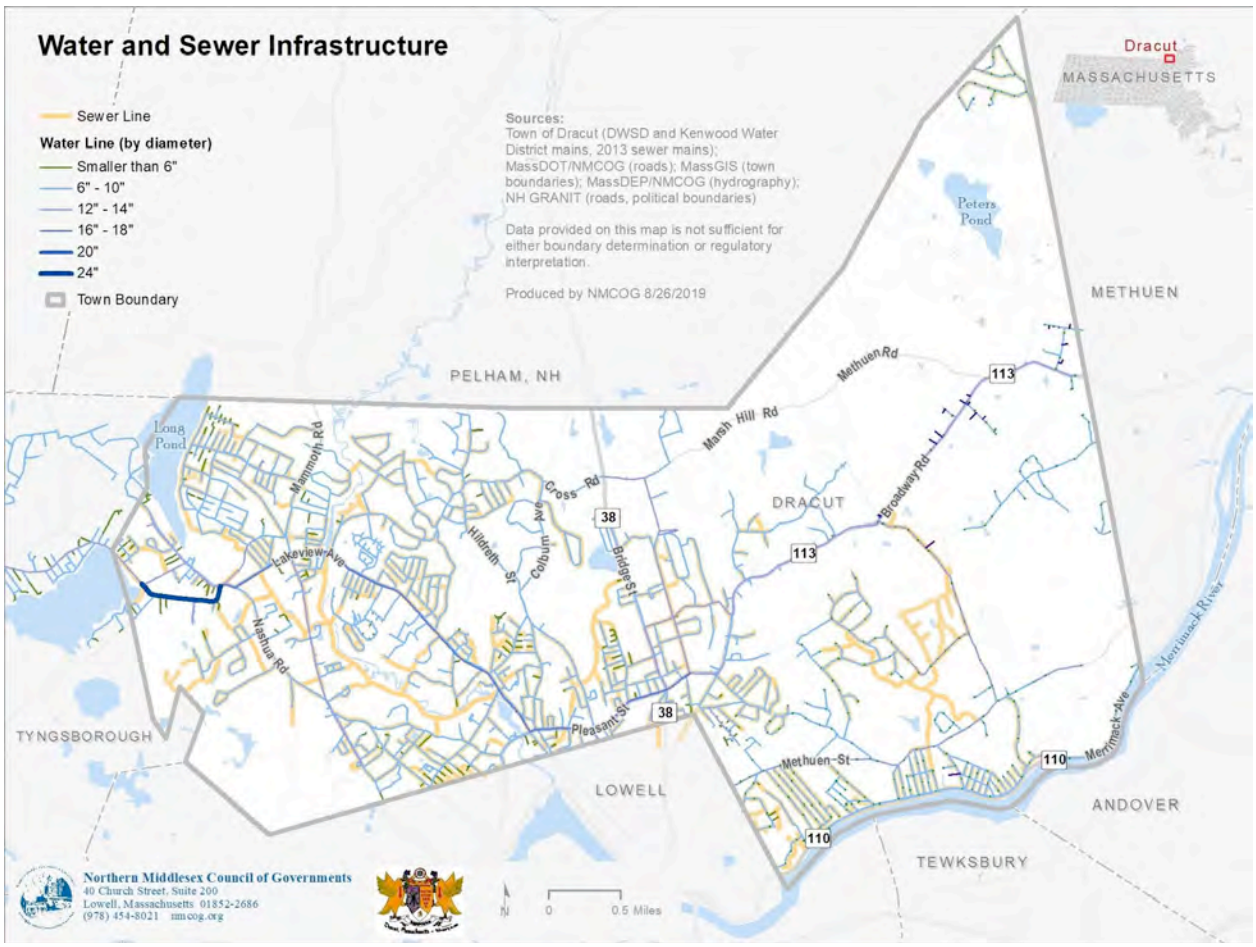


Figure 5. Dracut's Water and Sewer Infrastructure.

Stormwater Infrastructure

Although most residents are unaware of the town's stormwater system, the catch basins, outfalls, swales, and pipes that handle falling rain and melting snow are part of the Town's infrastructure. Dracut's stormwater system includes 77 miles of pipes, 1,125 culverts, 3,800 catch basins, 150 detention ponds, 430 outfalls and 160 miles of public streets, as shown in Figure 6.

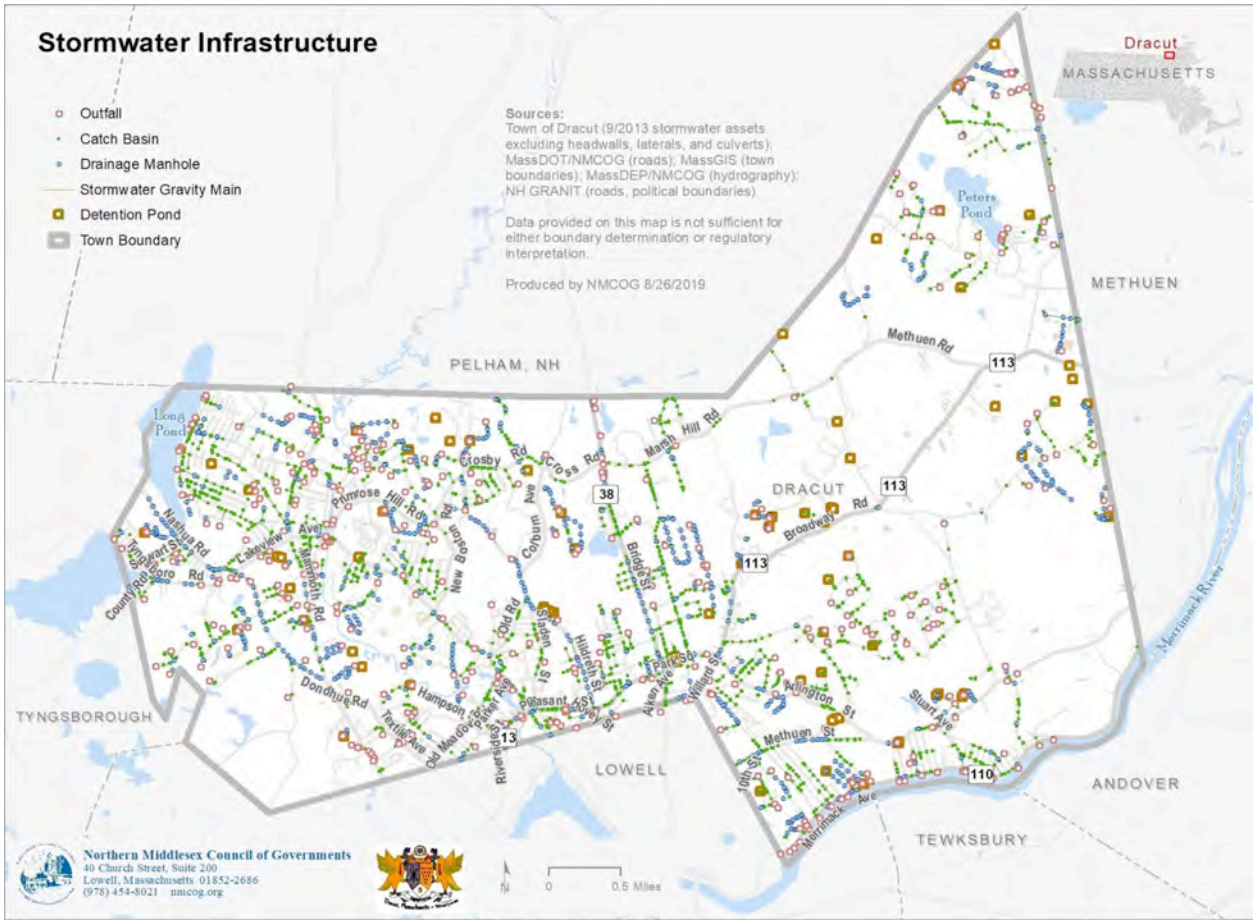


Figure 6. Dracut's Stormwater Infrastructure.

Like most communities in eastern Massachusetts, Dracut is subject to the requirements of the US EPA's National Pollutant Discharge Elimination System (NPDES) Small Municipal Separate Storm Sewer System (MS4) Permit. Under the MS4 permit, the town must develop, implement, and enforce a stormwater management program that controls pollutants to the maximum extent practical, protect water quality, and satisfy appropriate requirements of the federal Clean Water Act. The town's compliance with the permit is expected to increase the town's stormwater costs substantially, but non-compliance is not an option it brings the potential for federal regulatory action and fines.

Town Meeting has established an enterprise account for stormwater, but the establishment of the fee structure is still under discussion. In the meantime, the town has hired a full-time stormwater coordinator to oversee permit implementation and compliance. The town is also a member of the Northern Middlesex Stormwater Collaborative, which works to assist communities with compliance activities, such as public education, municipal staff training, mapping activities, and procurement.

Energy Services and Initiatives

Dracut's electric distribution grid is owned and managed by National Grid. Natural gas service for Dracut residents and businesses is also provided by National Grid.

The town participates in the Commonwealth's Community Electricity Aggregation program currently through Public Power, LLC. This program allows for the bulk purchasing of electricity with twenty-two other cities and towns in Massachusetts. The principal goal for entering into this utility aggregation is to save residents and businesses money on their electric bills, and it is estimated that approximately 94% of the Town of Dracut is enrolled in this program.

The town also has an agreement with Lodestar Energy, LLC to supply its municipal and school-controlled buildings through a renewable solar power net metering project in Charlton, MA. It is estimated that the town is saving approximately $87,000 in annual electricity costs. Dracut is also a designated Green Community. The state-funded Green Community Designation and Grant Program provides a road map, along with financial and technical support, to municipalities that pledge to cut municipal energy use by 20 percent over 5 years.

Public Facilities

There are many public facilities in Dracut that provide important services to residents and businesses across the community. These include Town Hall, the Town Hall Annex/Dracut Centre School, Parker Memorial Library, the police station, three fire stations, and the public works building. Dracut Public Schools, which serves over 3,000 students, operates four elementary schools, the Richardson Middle School, and Dracut High School. Many of the town's public facilities and other community assets are shown on the map provided in Figure 7, and those considered to be most critical by the Town of Dracut are identified and further described in Chapter 4: Risk and Vulnerability Assessment (see Critical Facilities section). Figure 8 shows all of the infrastructure, societal, and environmental features in Dracut.

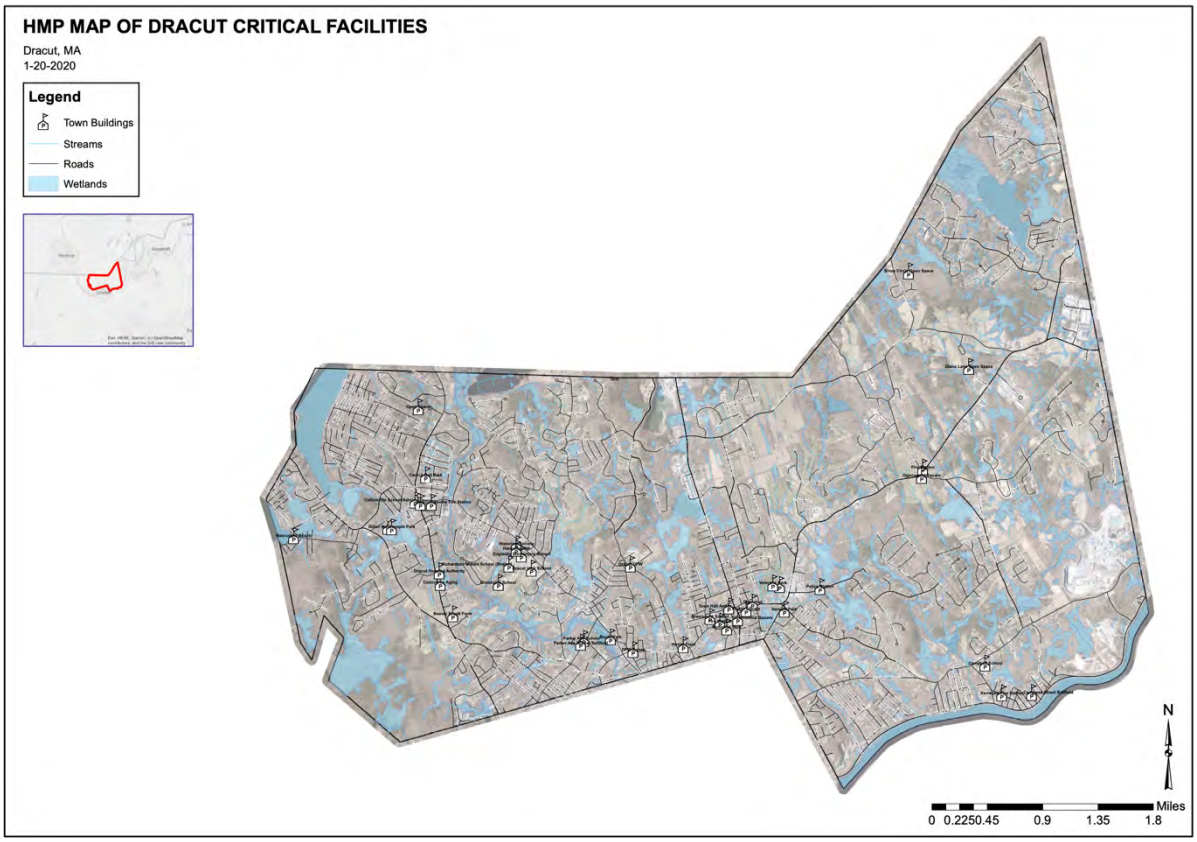


Figure 7. Dracut's Public Facilities.

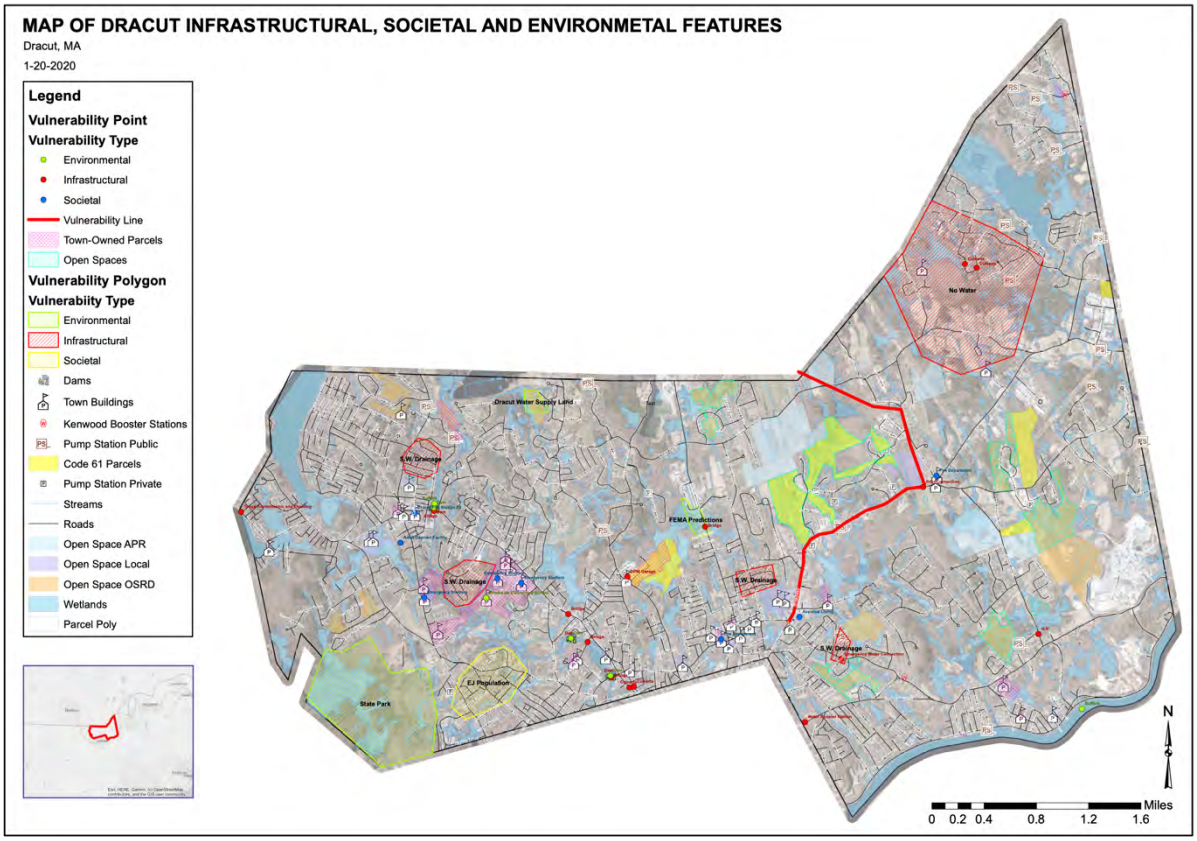


Figure 8. Dracut's Infrastructure, Societal, and Environmental Features.

Natural and Cultural Resources

Dracut residents value the town's agricultural landscapes, open spaces, natural resources, and historic buildings. Each of these attributes contributes to the town's character and links residents to the community's heritage. Some of Dracut's natural and cultural resources are permanently protected, but many are not. Finding a means to protect the resources that remain intact are identified in the Town's Master Plan as one of its greatest challenges.

While not specifically described here, Dracut's natural resources include land, surface water, streams, wetlands, aquifers, wildlife habitat, open space and riparian corridors, and other ecologically sensitive areas. The entire town is located within the Merrimack River watershed, meaning that all precipitation that falls on Dracut eventually drains into the Merrimack River. This includes an extensive hydrological system that includes groundwater, ponds, lakes, rivers, brooks, aquifers, and wetlands, as shown on Figure 9.

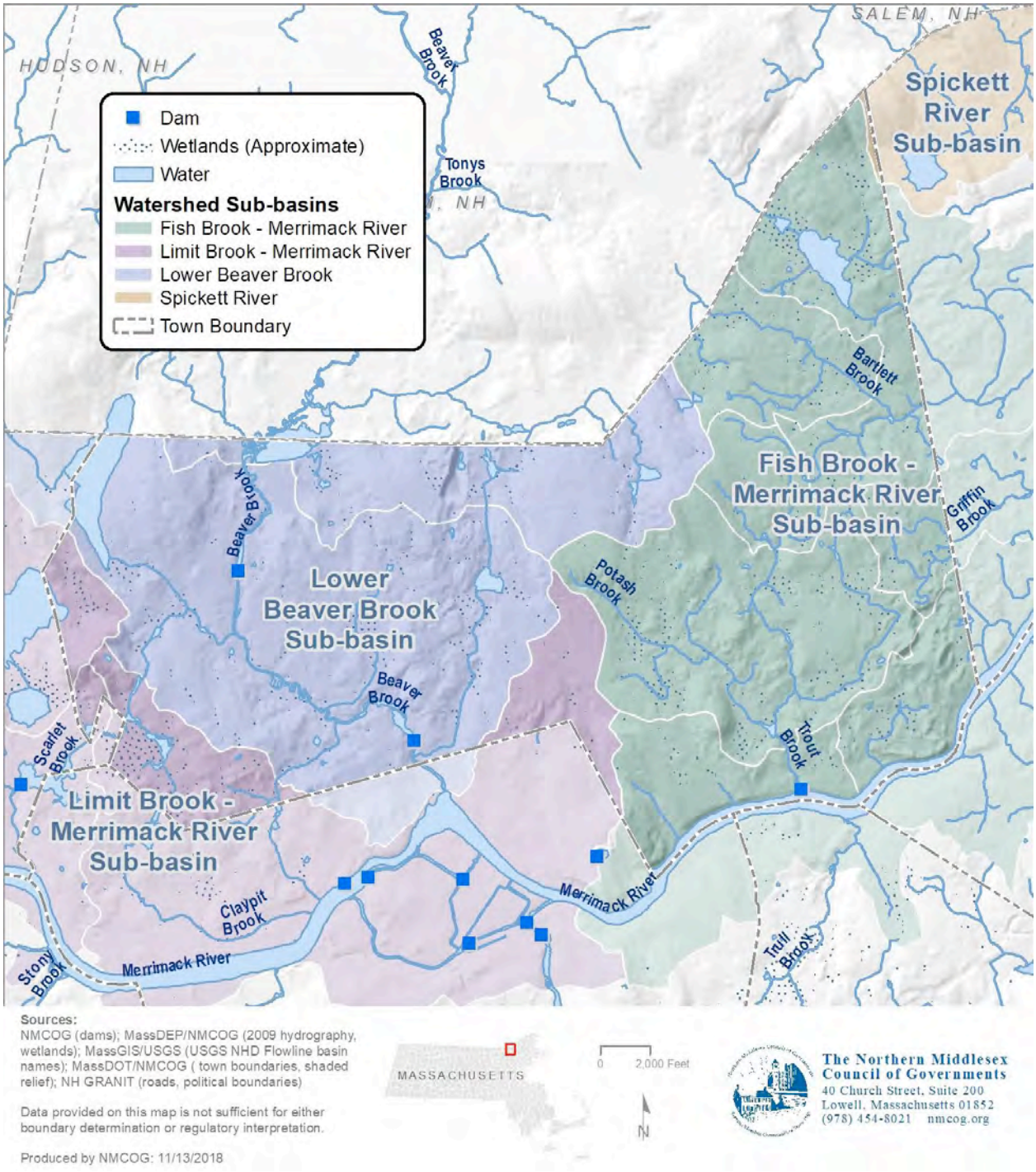


Figure 9. Dracut's Water Resources.

Dracut's cultural resources include historic buildings and their settings, outbuildings, such as sheds and barns, archaeological remnants and features, and archaeologically sensitive areas. Landscape features such as stonewalls and foundations, burial grounds and cemeteries, agrarian fields, trails and paths are also an important part of the town's history, contribute to its inventory of cultural resources, and are key public assets.

Dracut has an impressive inventory of historic buildings, spanning three centuries with the oldest structures dating back to the 1700s. Although there are no local historic places or districts on the National Register of Historic Places within Dracut, the town's 2012 Preservation Plan recommended completing and updating intensive level surveys for many properties to be submitted for potential listing. This included sixty houses, including the Old Meeting House (10 Arlington Street), Merrimack Woolen Mills complex (76 Pleasant Street), Dracut Center School (11 Spring Park Avenue), Kenwood School (920 Methuen Street), and St. Mary's of the Assumption Church (1868 Lakeview Avenue). The Preservation Plan recommended that seven historic districts be established in Dracut.

Land Use

Dracut's landscape can be described as gently rolling, with elevation changes that rarely exceed 200 feet. The highest elevations are found in northeast Dracut at Poplar Hill (380 feet) and in the west at Whortleberry Hill (363 feet) and the Reservoir (322 feet). The open farm fields and meadows in the east, the forests of eastern and southeast Dracut, and the waterways scattered throughout town, add variety to the town's landscape.

In terms of current land use, the western half of the town is suburban in character, while the eastern half is more rural. Although development in this area has been increasing, a significant amount of land remains in agriculture and open space, contributing to the rural and agrarian character. Much of this undeveloped land is not protected however, and could be converted to residential, commercial, or industrial uses.

Land use in Dracut has largely followed the historic patterns laid out prior to zoning, though new residential development is consuming agricultural lands and open space in some areas of town. Dracut residents often refer to areas of town by their traditional village designations: Collinsville, Dracut Center, East Dracut, Kenwood, and the Navy Yard. These historic neighborhoods that define the town can still be recognized, although in some cases their distinctions are fading with recent land use changes. The historically denser areas of western and southern Dracut have become more residential and suburban as the population has expanded, while eastern Dracut has retained more rural character, even though several of the town's larger industrial and commercial sites are located along Route 113.

Table 3 summarizes parcel-based land use statistics from the Tax Assessor's database as of July 2017. These land uses are also graphically displayed in Figure 10.

Table 3. Current Land Use in Dracut.

Land Use	Total Acres	% of Land Area	No. of Parcels
Residential - Single Family Dwellings	6,067	48.2	7,794
Residential - Two Family Dwellings	323	2.6	322

Residential - Multi-Family Dwellings	481	3.8	248
Residential - Accessory Land	229	1.8	45
Commercial	508	4.0	234
Industrial - Manufacturing and R&D	142	1.1	31
Industrial - Mining/Quarry	168	1.3	5
Public utilities	89	0.7	18
Agricultural	326	2.6	11
Conservation/Open Space (State, Municipal & Private)	618	4.9	10
Recreational	112	0.9	7
Institutional	66	0.5	20
Municipal and State Land *(excluding conservation)*	904	7.2	293
Vacant	2,282	18.2	1,033
Water	259	2.1	11
Total	12,574	100.0	10,082

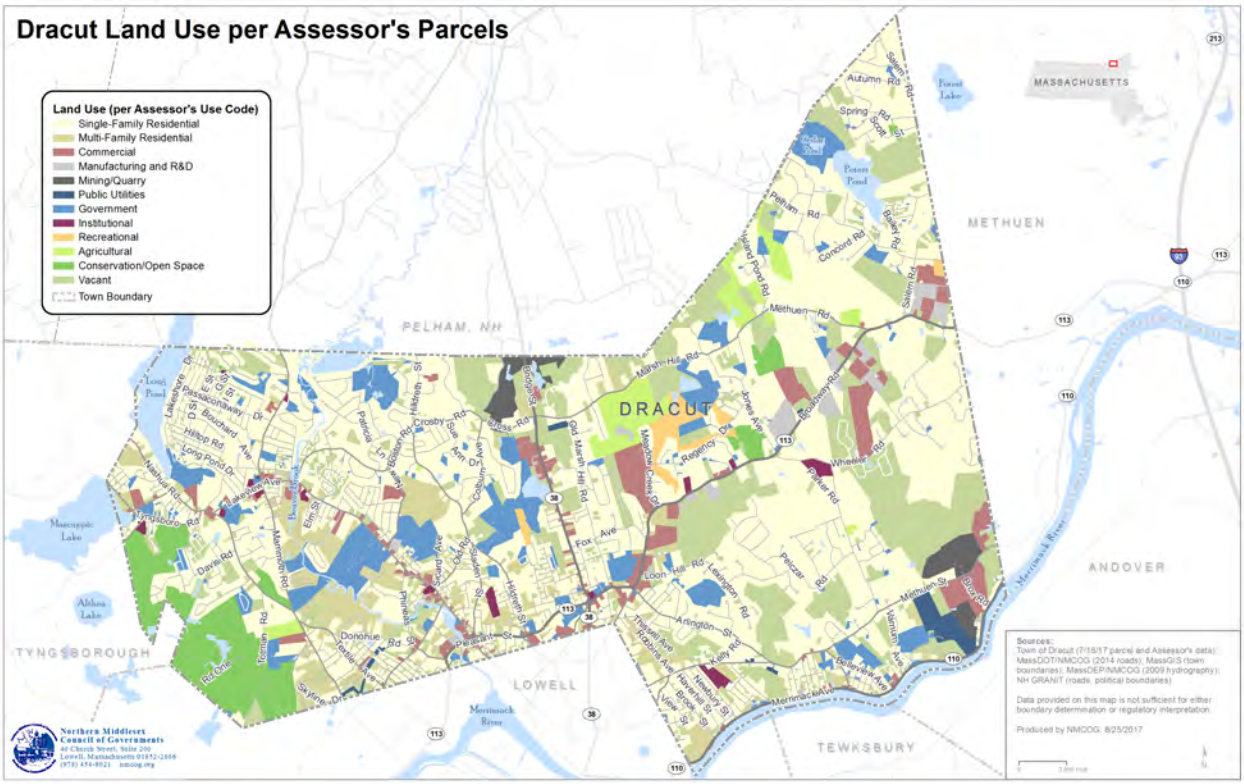


Figure 10. Dracut's Land Use

As illustrated in Table 3, 56.5% of the town's land is classified as residential by the Assessor's parcel data. Single-family residences, by far the largest residential use, account for 48.2% of the total acreage in Dracut and 85.5% of Dracut's residential acreage.

Future Development

Dracut has experienced slow but steady population growth, a trend that is expected to continue with generally limited patterns of future land development. As noted in Table 3 above, the Town Assessor's database classifies 1,033 parcels as undeveloped or vacant. Combined, these undeveloped parcels total 2,282 acres, or 18.2% of Dracut's total land area. This land includes 826 acres categorized as developable residential land and 229 acres of developable industrial land. In addition, 394 acres were classified as potentially developable, while 751 acres were classified as undevelopable. The remaining 82 acres include 18 acres of vacant land owned by the Dracut Housing Authority and 64 acres of developable commercial land.

The town uses its Master Plan and other important policy documents (such as the Housing Production Plan or the Open Space and Recreation Plan) to understand, guide, and manage future growth and development. While these main policy tools are utilized by the Board of Selectmen, Planning Board, Zoning Board of Appeals, Conservation Commission, and other local decision-makers, the regulation of all new development is more directly administered and controlled through the town's zoning, subdivision control, Board of Health regulations, and wetlands regulations.

Given its role in guiding the development of vacant land and reuse of developed land, zoning is the most important of these regulatory tools. The town's first zoning bylaw and zoning map were adopted by Town Meeting in February 1946, and over seventy-five amendments to the bylaw have been approved since the 1980s. The Planning Board and the Board of Selectmen serve as the special permit granting authorities within the town's Zoning Bylaw, and the Building Inspector is responsible for enforcement of the bylaw.

Dracut's zoning framework includes nine conventional use districts that are identified on its current zoning map (3 residential, 5 business and commercial, and 1 industrial). In addition, Dracut has five (5) zoning overlay districts. Depending on the purpose of a zoning overlay district, it may encourage or limit certain uses within the overlay district boundary. For example, the Dracut Center Neighborhood Overlay encourages development that is in keeping with the historic character of the area, while the Wetland and Water Conservancy District is intended to protect the town's water resources and wetlands.

Currently, residential zoning accounts for approximately 87% of the land area in Dracut. As a result, the town's residential zoning regulations will shape the development and future land use for a majority of Dracut. Like the town as a whole, most of East Dracut is zoned Residential 1 (R-1), with a minimum lot size of 40,000 square feet. However, per Dracut's Master Plan, the town's remaining rural character could still gradually disappear without efforts to protect open space, modify land use policy, and implement design guidelines to ensure that future development projects are consistent with the Town's goals and aspirations.

Table 4 depicts the current acreage for each zoning district within Dracut, which are graphically displayed in Figure 11.

Table 4. Zoning District Acreages.

Zoning District	Acres	Percentage
Residential 1 (R-1)	9,244.26	67.9
Residential 2 (R-2)	718.28	5.3
Residential 3 (R-3)	1,934.17	14.2
Business 1 (B-1)	113.3	0.8
Business 2 (B-2)	0	0
Business 3 (B-3)	496.37	3.6
Business 4 (B-4)	161.39	1.2
Business 5 (B-5)	9.89	0.1

Industrial 1 (I-1)	942.05	6.9
Industrial 2 (I-2)	0	0
Total	13,619.71	100.00

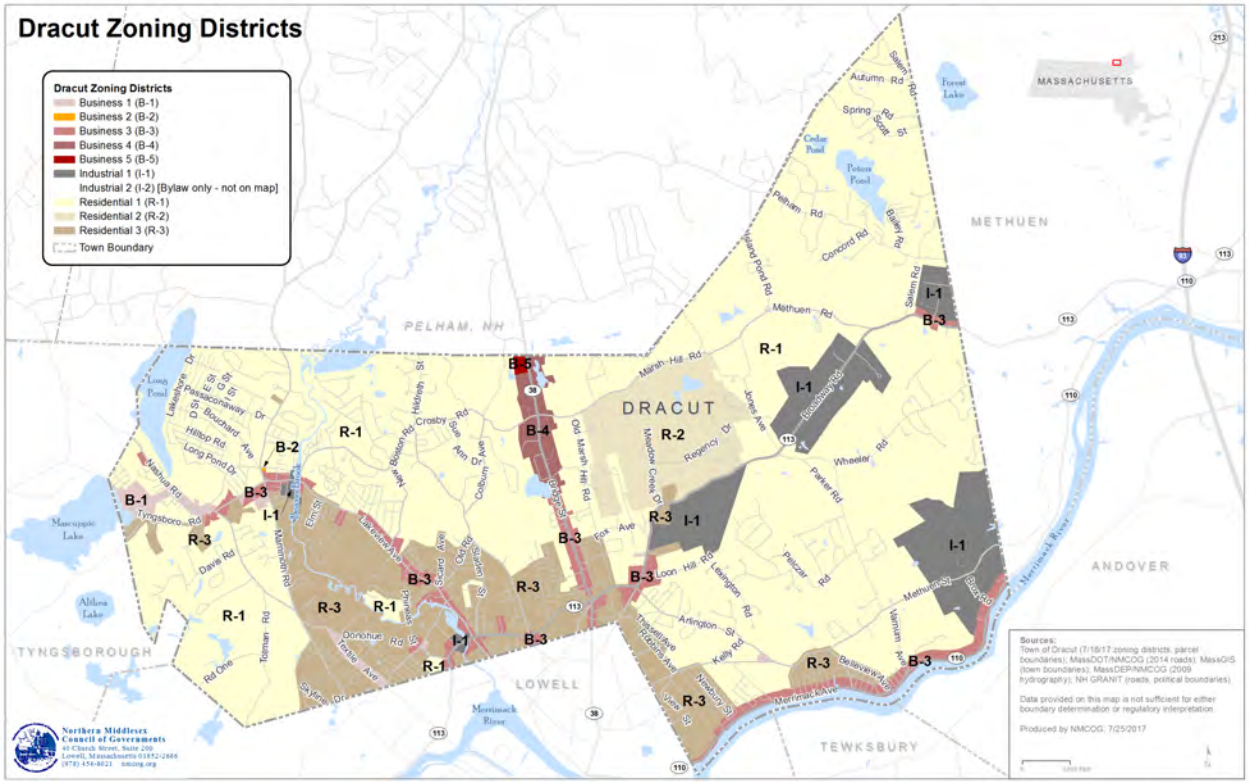


Figure 11. Dracut's Zoning Districts.

Chapter 3. Planning Process

> *A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))*

The planning process was developed in full compliance with the current planning requirements of the Federal Emergency Management Agency (FEMA) per the following rules and regulations:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288), as amended by the Disaster Mitigation Act of 2000
- Code of Federal Regulations – Title 44, Chapter 1, Part 201 (§201.6: Local Mitigation Plans)
- Federal Emergency Management Agency *Local Mitigation Plan Review Guide* (dated October 1, 2011)

In addition, the Plan was prepared with the suggestions found in the *Demonstrating Good Practices Within Local Hazard Mitigation Plans*, FEMA Region 1, January 2017.

The planning process for this updated mitigation plan took place in conjunction with the town's Massachusetts Municipal Vulnerability Preparedness Program (MVP). Efforts were made to align the update with the MVP throughout the process. Tina Douk, Stormwater Manager, led the mitigation planning effort as well as the MVP. With support from other town staff, Ms. Douk facilitated all activities related to the mitigation plan update, including meeting logistics, data gathering, and public outreach.

Core Team

A Core Team was formed to lead the planning process. This team included town employees as well as stakeholders. A list of Core Team members is shown in the table below. The Core Team met for a Kick-off Meeting on June 25, 2020. They met again on August 13, 2020. During this meeting, the consulting team of Green International (MVP provider) and Jamie Caplan Consulting (mitigation planning lead) reviewed the goals and objectives of each project and identified next steps for each. The Core Team identified stakeholders to invite to the September 29, 2020 Community Resilience Building (CRB) workshop. They reviewed the process and purpose of updating the hazard mitigation plan and identified a preliminary list of hazards to review. The Core Team met for the final time on December 22, 2020 to review the risk assessment conclusions, the mitigation actions and the plan implementation and maintenance procedures. All meetings were held via Zoom due to the Covid-19 pandemic.

- Lori Cahill – Dracut Conservation Agent/Parks and Recreation – 978-458-4478
- Tina Douk – Dracut Stormwater Manager (DPW) - 978-957-1497 - tdouk@dracutma.gov
- Mark Hamel – Dracut Town Engineer - 978-454-2594 - Mhamel@dracutma.gov
- Bethany Loveless – Dracut Council on Aging, Director - 978-957-2611 - Bloveless@dracutma.gov
- Dan MacLaughlin – Dracut Building Inspector - Dmclaughlin@dracutma.gov
- Ed Patenaude – Dracut Director of Public Works - 978-957-0411 - Epatenaude@dracutma.gov

- Richard Patterson – Dracut Deputy Fire Chief/Emergency Response - 978-479-3786 - Rpatterson@dracutma.gov
- Ann Vandal – Dracut Town Manager - 978-452-1227 - Avandal@dracutma.gov
- Betsy Ware – Dracut Community Development Coordinator - 978-453-4557 – eware@dracutma.gov

In between Core Team meetings, the Core Team participated in identifying and refining the list of mitigation actions that were based on recommendations gathered from the Community Resilience Building Workshop. The Core Team contributed data and information by completing a number of questionnaires related to town capabilities, critical facilities, and the National Flood Insurance Program. They actively participated in the MVP process which occurred simultaneously.

The Core Team also participated in two public meetings, or listening sessions, one on October 21, 2020 and one on January 12, 2020. These were also attended via Zoom. Finally, the Core Team reviewed the Draft Hazard Mitigation Plan update prior to sending it to the Massachusetts Emergency Management Agency (MEMA) for their review.

Stakeholder Engagement

> *A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))*

The majority of stakeholder engagement occurred through the MVP process and specifically the Community Resilience Building (CRB) workshop. The CRB workshop was held on consecutive weeks, September 29, 2020 and October 6, 2020. Each was approximately four hours. Community members chosen as key stakeholders were invited to the workshop. This was an opportunity for them to come together and prioritize resilience and climate adaptation actions. The CRB methodology is an "anywhere at any scale" format that draws on stakeholder's wealth of information and experience to foster dialogue about the strengths and vulnerabilities within the town. Workshop participants interacted at both large and small group levels, using an iterative process to gather input, synthesize ideas across groups, and ultimately develop a set of priority resilience and adaptation actions. The hazard mitigation plan was presented at each workshop, so participants understood that these projects were occurring simultaneously, and they were in effect participating in both projects.

The CRB workshop's central objectives were to:

- Define top local natural and climate-related hazards of concern
- Identify existing and future strengths and vulnerabilities
- Develop prioritized actions for Dracut
- Identify immediate opportunities to collaboratively advance actions to increase resilience

The Core Team worked to invite participants and organize the workshop. The workshop was held on two consecutive weeks and sign-in sheets for each week are included in Appendix A.

Figure 12. CRB Workshop In-Person Participants.

The outcome of the CRB Workshop was compiled into the *Town of Dracut Community Resilience Building Workshop Summary of Findings, December 2020,* by Green International. This summary includes a tremendous amount of information that was incorporated into this plan. Most significantly, the Core Team used the list of resilience recommendations to develop mitigation actions. The Concerns, Challenges, Strengths, and Weaknesses portions of the Summary all contributed to the Capability Assessment and Risk Assessment. The thoroughness of the Summary of Findings enabled a streamlined mitigation planning process.

Public Outreach

> *A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))*

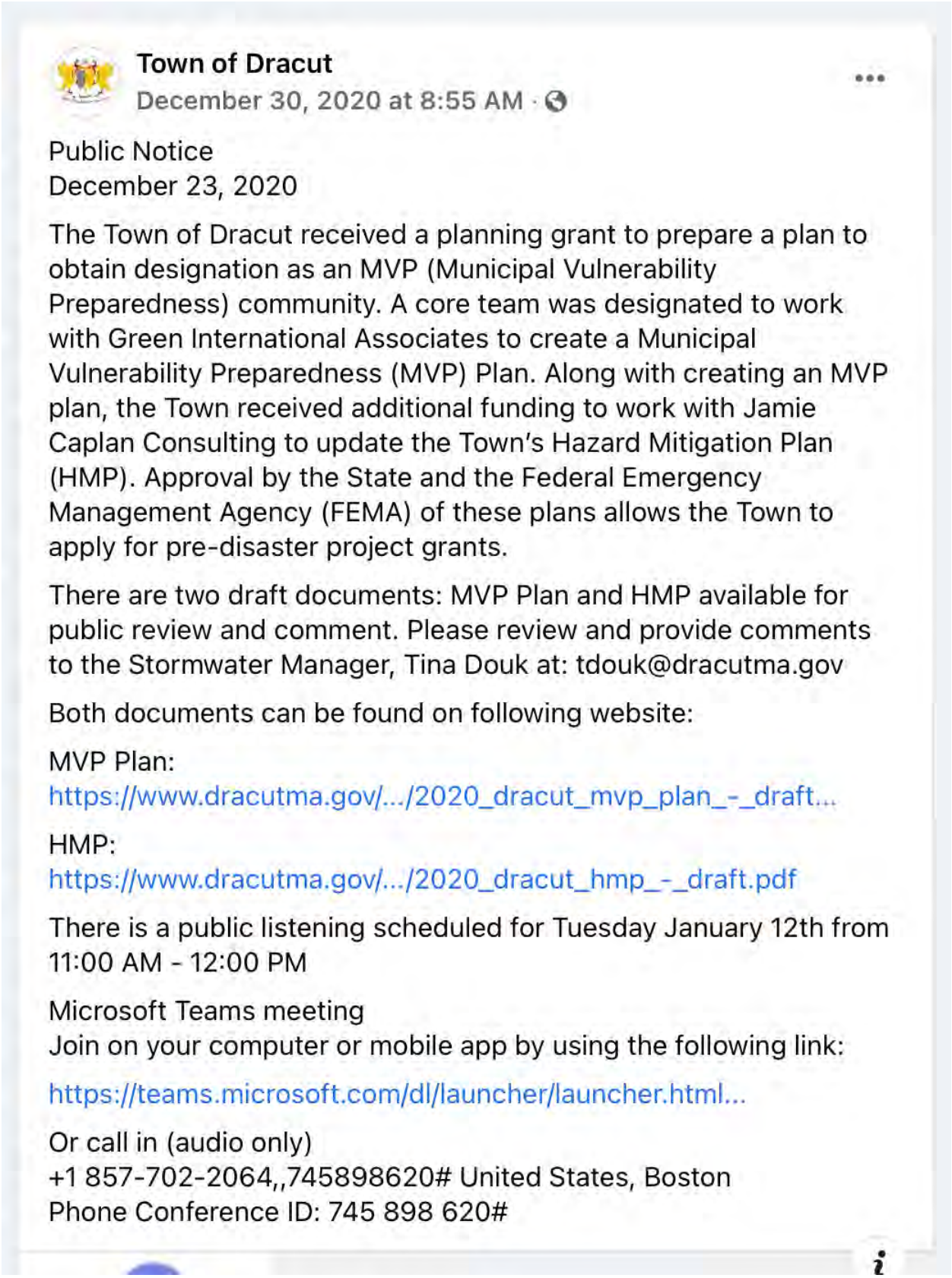
The Public Outreach Strategy was designed to involve the public in the mitigation planning process. The purpose of public outreach and stakeholder involvement was to:

- Generate public interest in mitigation planning
- Identify and accommodate special populations
- Solicit public input
- Engage local stakeholders
- Create opportunities for public and local stakeholders to be actively involved in the mitigation planning process

The public outreach strategy included Public Meetings/Listening Sessions, and an opportunity for the public to review the draft plan. These meetings were advertised in the local newspaper, on the town website and on the stormwater management web page. A copy of an article discussing the mitigation plan and the opportunity to participate in a listening session and to review the plan is included in Appendix A.

Public meetings/MVP listening sessions

The first public meeting occurred on October 21, 2020 and focused primarily on the hazard mitigation plan. The second public meeting occurred on January 12, 2021 and featured both the MVP Summary of Findings and the hazard mitigation plan. Both meetings were hosted virtually due to the Covid-19 pandemic. Each meeting included a PowerPoint presentation and plenty of opportunity for questions and discussion. The Core Team participated in each meeting. The meetings were advertised by the town by way of the town website, the local newspaper and email invitation.



Town of Dracut
December 30, 2020 at 8:55 AM ·

Public Notice
December 23, 2020

The Town of Dracut received a planning grant to prepare a plan to obtain designation as an MVP (Municipal Vulnerability Preparedness) community. A core team was designated to work with Green International Associates to create a Municipal Vulnerability Preparedness (MVP) Plan. Along with creating an MVP plan, the Town received additional funding to work with Jamie Caplan Consulting to update the Town's Hazard Mitigation Plan (HMP). Approval by the State and the Federal Emergency Management Agency (FEMA) of these plans allows the Town to apply for pre-disaster project grants.

There are two draft documents: MVP Plan and HMP available for public review and comment. Please review and provide comments to the Stormwater Manager, Tina Douk at: tdouk@dracutma.gov

Both documents can be found on following website:

MVP Plan:
https://www.dracutma.gov/.../2020_dracut_mvp_plan_-_draft...

HMP:
https://www.dracutma.gov/.../2020_dracut_hmp_-_draft.pdf

There is a public listening scheduled for Tuesday January 12th from 11:00 AM - 12:00 PM

Microsoft Teams meeting
Join on your computer or mobile app by using the following link:

https://teams.microsoft.com/dl/launcher/launcher.html...

Or call in (audio only)
+1 857-702-2064,,745898620# United States, Boston
Phone Conference ID: 745 898 620#

Review of draft plan

The town made the Plan available for review in December 2020 through the middle of January 2021 (https://www.dracutma.gov/home/news/draft-hazardous-mitigation-plan-draft-municipal-vulnerability-plan). The Core Team reviewed the Plan as did members of the public. Comments regarding the Plan were collected by the Stormwater Manager and then incorporated by the consulting team. The town advertised the opportunity to review the Plan on their website, in the newspaper, and kept a hard copy available in the Stormwater Manager's office. The draft plan was also shared with NMCOG and the Northern Middlesex Stormwater Collaborative; neither organization submitted comments.

Review and Incorporation of Existing Studies

> *A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))*

Many sources were used to develop this plan, including web-based resources, reports, and stakeholder engagement. Throughout the plan, these sources are cited within the text as footnotes and listed in the Resources section of the Appendix. The Massachusetts Hazard Mitigation and Climate Adaptation Plan, as well as several Town of Dracut plans, were reviewed for consistency. The goal was to develop a plan that would easily integrate with the key aspects of other plans in the Town and State. This section reviews how the content of several key plans and studies influenced the development of this plan.

Hazard Mitigation Plan for the Northern Middlesex Region, 2015

The Hazard Mitigation Plan for the Northern Middlesex Region plan and the associated Plan Review Tool were examined throughout the development of this updated hazard mitigation plan. Emphasis was placed on review of the risk assessment, critical facilities identified, and the list of mitigation actions. This was a multi-jurisdiction plan written by the Northern Middlesex Council of Governments.

Massachusetts Hazard Mitigation and Climate Adaptation Plan, 2018

Consistency with the State plan is not only required, it makes sense. The State Plan was used as a starting point for hazard identification and then for hazard analysis; details are included in the Risk Assessment. Of significance is the classification of natural hazards in terms of climate change interactions, changes in precipitation, rising temperatures, extreme weather, and non-climate influenced hazards. (http://www.resilientma.org/data/documents)

Town of Dracut Community Resilience Building Workshop Summary of Findings, December 2020

Since the Town of Dracut took on the mitigation planning process and the Municipal Vulnerability Preparedness (MVP) program simultaneously, each project benefitted from the other. The final outcome of the MVP program was the Summary of Findings. This document was used throughout the mitigation

planning process to detail strengths and weaknesses of the town, identify mitigation actions, and engage stakeholders. The Summary of Findings is referenced frequently throughout the plan.

Several Town of Dracut Plans were Reviewed

- Dracut Master Plan
- Open Space & Recreation Plan
- Historical Preservation Plan

Relevant regulations

These regulations were reviewed to inform the development of the mitigation actions.

- Town of Dracut Rules and Regulations, 2007
- Town of Dracut Zoning Bylaws, 2018

Chapter 4. Risk and Vulnerability Assessment

The risk assessment includes four parts: natural hazard identification, profile hazards, inventory assets, and estimate losses. The risk assessment is updated according to FEMA local hazard mitigation planning regulations as found in C.F.R. 44 201.6. Conducting a risk assessment is a way of asking and answering "what if …" questions. For instance, what if the Town of Dracut experiences a hurricane? The risk assessment answers questions regarding history, location, frequency, probability, and impact for each hazard. These answers are used toward developing a mitigation strategy. Gathering information for the risk assessment included historical research, conversations with stakeholders, and available hazard mapping. It also includes information gathered from the MVP Workshop and the Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP).[8]

Hazard Identification

The first step in the risk assessment was to identify the hazards for study. All of the categories of hazard risks from the previous (2015) hazard mitigation plan for the Northern Middlesex Region[9] are included in this update. They were all deemed relevant and are shown in Table 5.

Table 5. Hazard Rationale

2015 NMCOG Regional Hazard Mitigation Plan	Dracut Update Rationale
Flood-Related Hazards - Flood **- Dam Failure**	Flood-related hazards remain a significant concern for Dracut. The 2006 Mother's Day storm caused flood in many low-lying areas and the Town has noted high-intensity/short-duration rainfall events are becoming more frequent, a trend that is expected to continue due to climate change. There are also two dams located within the town classified as a significant hazard.
Wind-Related Hazards - Hurricane - Tornado **- Severe Thunderstorms**	Wind-related hazard events continue to occur frequently across the planning area, including large storms that can result in widespread power outages and other local impacts. The Town's DPW staff is responding to tree damage calls more frequently, and severe storms are of increasing concern due to climate change and potentially more frequent extreme weather events.

[8] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018.
[9] Hazard Mitigation Plan for the Northern Middlesex Region. Northern Middlesex Council of Governments (NMCOG). 2015.

2015 NMCOG Regional Hazard Mitigation Plan	Dracut Update Rationale
Winter-Related Hazards - Snowstorm/blizzard **- Nor'easter/severe storm** **- Ice Storm** **- Ice Jam**	Dracut frequently experiences severe winter storm events including damaging and disruptive impacts from major snowstorms/blizzards as well as occasional nor'easters and ice storms. The town remains at relatively low risk for ice jams as noted in the 2015 hazard risk assessment.
Fire-Related Hazards **- Drought** **- Wildfire** **- Urban Fire**	The town has experienced drought events in the past, and they are of increasing concern due to climate change. Wildfire was identified as a high risk hazard for the town back in 2015 and remain a possible threat in the future. Urban fires will not be addressed in this update since the plan is focused on natural hazards only, consistent with the SHMCAP.
Geologic Hazards **- Earthquake** **- Landslide**	Although not of great concern, the earthquake hazard remains a potential risk for the Town to consider in its mitigation planning efforts. Landslide is not considered risks for Dracut as noted in the 2015 hazard risk assessment and based on the lack of any past events or related concerns identified by the Town.
Other Natural Hazards - Extreme Temperatures	Extreme temperatures remain a concern for the Town. Extreme cold events remain a frequent occurrence during winter and the Town has seen increasing impacts from extreme heat events, including the need to more frequently open and extend hours for cooling stations for all residents (not just seniors). Extreme heat events are projected to become more frequent and severe in the future based on the anticipated effects of climate change.

The next step was to review the recently updated Massachusetts State Hazard Mitigation and Climate Adaptation Plan of September 2018. The list of hazards from the State plan are included in Table 6, along with the rationale for including or excluding them in the Town of Dracut's plan update.

Table 6. Rationale for Including Hazards Listed in the State Plan

MA State Plan Hazards	Town of Dracut Rationale for Inclusion/Exclusion
Inland Flooding	Flooding is a significant concern for many parts of Dracut.

MA State Plan Hazards	Town of Dracut Rationale for Inclusion/Exclusion
Drought	Drought is a risk to the region.
Landslide	All of Dracut is classified as having a low risk for landslides, and local officials did not identify any past events or significant issues related to landslides. Based on this information landslides will not be addressed in the plan update for Dracut. This determination is validated by hazard data and mapping provided in the State Plan.
Coastal Flooding	Not applicable to Dracut as a non-coastal community.
Coastal Erosion	
Tsunami	
Average/Extreme Temperatures	Dracut has experienced summer temperatures over 100 °F and numerous heat waves. Extreme temperatures remain a significant risk to vulnerable populations and are of increasing concern due to future climate change projections.
Wildfires	Wildfires are not considered a major risk to Dracut; however, there are some large areas of intermix (where housing and vegetation intermingle) on the eastern part of town. The area surrounding the Lowell-Dracut-Tyngsborough State Forest is also of concern as it is one of the most heavily forested areas of town. This, coupled with projected increases in extreme heat and drought conditions, suggest that future wildfire events are possible.
Invasive Species	Invasive species are found in Dracut, including multiflora rose, Norway maple, Russian Olive, Garlic Mustard and Oriental bittersweet. Purple loosestrife and phragmites can also be found in wetland areas. Invasive species are one of the greatest threats to the integrity of natural communities and may become a greater problem in the future due to the effects of climate change.
Hurricanes/Tropical Storms	Hurricanes and tropical storms have occurred in the past and continue to be a risk for the region.
Severe Winter Storm/Nor'easter	Severe winter storms are a risk every year.

MA State Plan Hazards	Town of Dracut Rationale for Inclusion/Exclusion
Tornadoes	Tornadoes continue to be a low-probability but potentially high consequence event for the area.
Other Severe Weather (including strong wind and extreme precipitation)	Dracut has experienced large storms with high winds and extreme precipitation, including damaging ice and hailstorms. Severe weather is an increasing threat as future storms are projected to occur with more intensity due to climate change.
Earthquake	Dracut is considered to have a low risk to earthquakes; however, the consequences of a low-probability event could still result in moderate to significant impacts to the community.
Dam Failure	There are multiple dams located within or upstream from Dracut, including some classified as significant hazard.

For purposes of Dracut's MVP Workshop, participants focused on the following top four climate-related natural hazards, they are deemed of biggest concern to the community. These four hazards have already had demonstrated impacts on the town, and as climate change progresses, these hazards are expected to have ever greater consequences for infrastructure and environment, as well as for various societal elements.

1. Snowstorms/Extreme Cold
2. Flooding
3. High Winds
4. Extreme Temperatures

The Massachusetts State Hazard Mitigation and Climate Adaptation Plan grouped hazards according to primary climate change interactions. These categories are also consistent with the Commonwealth's Resilient Massachusetts Climate Change Clearinghouse website (www.resilientma.org). In an effort to ensure consistency with the State Plan and to emphasize the impact of climate change on hazards, this Plan used these four categories to group hazards. All hazards identified fit into one of these categories with the exceptions of earthquake, which is considered a non-climate induced hazard, and dam failure, which is considered a technological/human-caused hazard. The four categories and definitions are included in Table 7.

Table 7. Definitions of Climate Change Interactions

Climate Change Interaction	Definition
1. **Changes in Precipitation**	Changes in the amount, frequency, and timing of precipitation—including both rainfall and snowfall—are occurring across the globe as temperatures rise and other climate patterns shift in response.
2. **Sea Level Rise**	Climate change will drive rising sea levels, and rising seas will have wide-ranging impacts on communities, natural resources, and infrastructure along the Commonwealth's 1,519 tidal shoreline miles.
3. **Rising Temperatures**	Average global temperatures have risen steadily in the last 50 years, and scientists warn that the trend will continue unless greenhouse gas emissions are significantly reduced. The nine warmest years on record all occurred in the last 20 years (2017, 2016, 2015, 2014, 2013, 2010, 2009, 2005, and 1998), according to the U.S. National Oceanographic and Atmospheric Administration (NOAA).
4. **Extreme Weather**	Climate change is expected to increase extreme weather events across the globe as well as in Massachusetts. There is strong evidence that storms—from heavy downpours and blizzards to tropical cyclones and hurricanes—are becoming more intense and damaging and can lead to devastating impacts for residents across the state.

The final list of hazards for this plan is shown in Table 8, sorted according to climate change interaction.

Table 8. Town of Dracut Hazards

Primary Climate Change Interactions	Hazards
Changes in Precipitation	Flooding (including riverine and urban/stormwater related flooding, etc.) Drought
Rising Temperatures	Average/Extreme Temperatures Wildfires

Primary Climate Change Interactions	Hazards
	Invasive Species
Extreme Weather	Hurricanes/Tropical Storms Severe Winter Storm/Nor'easter Tornadoes Other Severe Weather (including severe thunderstorms, high winds, lightning, hail, etc.)
Non-Climate Influenced Hazards	Earthquake
Technological and Human Caused Hazards	Dam Failure

Hazard Profiles

The next step in the risk assessment process was to develop hazard profiles. These were developed to be consistent with Element B, Hazard Identification and Risk Assessment, from 44 C.F.R. 201.6.

> *B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))*
>
> *B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))*
>
> *B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))*

The hazard profiles have been organized by primary climate change interaction and include the following sections: Hazard Description, Location, Extent, Previous Occurrences, Probability of Future Events and Changes Since the Previous Plan, and Impact on the Community and Vulnerability. Impacts of climate change were added to the end of each hazard section. A description of each of these analysis categories is provided in Table 9. Data for these sections comes from three primary sources: the 2015 Hazard Mitigation Plan for the Northern Middlesex Region as prepared by NMCOG, the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan, and the Town of Dracut's 2020 MVP planning process and findings. Supplemental data on previous hazard occurrences from NOAA's

Storm Events Database and other official State or Federal datasets as cited throughout this chapter. Lastly, several Town of Dracut employees and MVP Core Team members gathered and provided best available data in support of the hazard profiles.

Table 9. Categories for Hazard Analysis

Categories	Definition
Hazard Description	A basic description of each hazard.
Location	Location refers to the geographic areas within the planning area that are affected by the hazard. Some hazards affect the entire planning area universally, while others apply to a specific portion, such as a floodplain or area that is susceptible to wildfires.
Extent	Extent describes the strength or magnitude of a hazard. Where appropriate, extent is described using an established scientific scale or measurement system. Other descriptions of extent include water depth, wind speed, and duration.
Previous Occurrences	Previous hazard events that have occurred are described. Depending on the nature of the hazard, events listed may have occurred on a local or regional level.
Probability of Future Events and Changes Since the Previous Plan	The likelihood of a future event for each natural hazard and any significant changes to probability since the previous plan are listed.
Impact on the Community and Vulnerability	Described by stakeholders and inferred from data analysis.

Changes in Precipitation

Flooding

Hazard Description

The Town of Dracut has an extensive system of water resources that includes groundwater, ponds, lakes, rivers, brooks, aquifers, and wetlands. The entire town is located within the Merrimack River watershed, meaning that all precipitation that falls on Dracut eventually drains into the Merrimack River. The river forms much of Dracut's southern border, where the riverbank is relatively steep, and the floodplain is quite narrow. There are three watershed sub-basins within Dracut. The Fish Brook sub-

basin covers the eastern section of town, while the Limit Brook sub-basin encompasses the very western portion. The Lower Beaver Brook sub-basin lies in between the Fish Brook and Lower Beaver Brook sub-basins.

The Merrimack River has a number of tributaries in Dracut, the most notable of which is Beaver Brook which flows south from New Hampshire in the western part of Dracut. Other perennial streams in Dracut include Trout Brook, Richardson Brook, Bartlett Brook, Peppermint Brook, and Double Brook. These streams are among the town's principal sources of flooding along with the shorelines of Peter's Pond, Cedar Pond, and Lake Mascuppic.

Historically, excessive rainfall along, or in combination with, snowmelt runoff has produced flooding in low-lying areas across Middlesex County.[10] The principal cause of flooding along the Merrimack River is runoff from spring snowmelt, which is greatest during heavy spring rains when the still frozen ground cannot absorb the runoff.[11] Other storms that include heavy amounts of rain can pose significant flooding threats to Dracut regardless of the time of year. These may include three different types of storms as generally defined below.

- Continental storms are typically low-pressure systems that can be either slow- or fast-moving. These storms originate from the west and occur throughout the year.
- Coastal storms, also known as nor'easters, usually occur in late summer or early fall, and originate from the south. The most severe coastal storms—hurricanes—occasionally reach Massachusetts and generate very large amounts of rainfall. This was the case for Middlesex County in 1938, 1955, and 1958.
- Thunderstorms form on warm, humid summer days and cause locally significant rainfall, usually over the course of several hours. These storms can form quickly and are more difficult to predict than continental and coastal storms.

Flooding in Middlesex County may be caused or worsened by a number of other human-caused factors, including inadequate and deteriorated river channels, constricting culverts and bridges, inadequate storm drain discharge, increased development, topographic conditions, and undersized culverts.[12]

Previous flood events in Middlesex County indicate that flooding can occur during any season of the year. Most major floods have occurred during March or April and are usually the result of heavy spring rains and snowmelt or occasional ice jams. Floods occurring during mid to late summer are often associated with coastal storms moving up the Atlantic coastline, with more localized flooding caused by summer thunderstorms. While there have not been any recorded incidents in Dracut, flooding may also occur from a dam breach or failure as discussed later in this chapter.

[10] Flood Insurance Study for Middlesex County. Federal Emergency Management Agency. July 2016. P. 24.
[11] Dracut Master Plan. May 2020. P. 224.
[12] Flood Insurance Study for Middlesex County. Federal Emergency Management Agency. July 2016. P. 25.

Location

Within Dracut, there are 1,230 acres considered to be special flood hazard areas as delineated by FEMA's Flood Insurance Rate Map (FIRM).[13] These high-risk areas include what has been determined to be the 1 percent annual chance flood zone for Dracut, commonly referred to as the 100-year floodplain. Figure 13 illustrates Dracut's various flood hazard zones according to the Town's currently effective FIRM.[14] Full descriptions for these areas are provided in the *Extent* portion of this section.

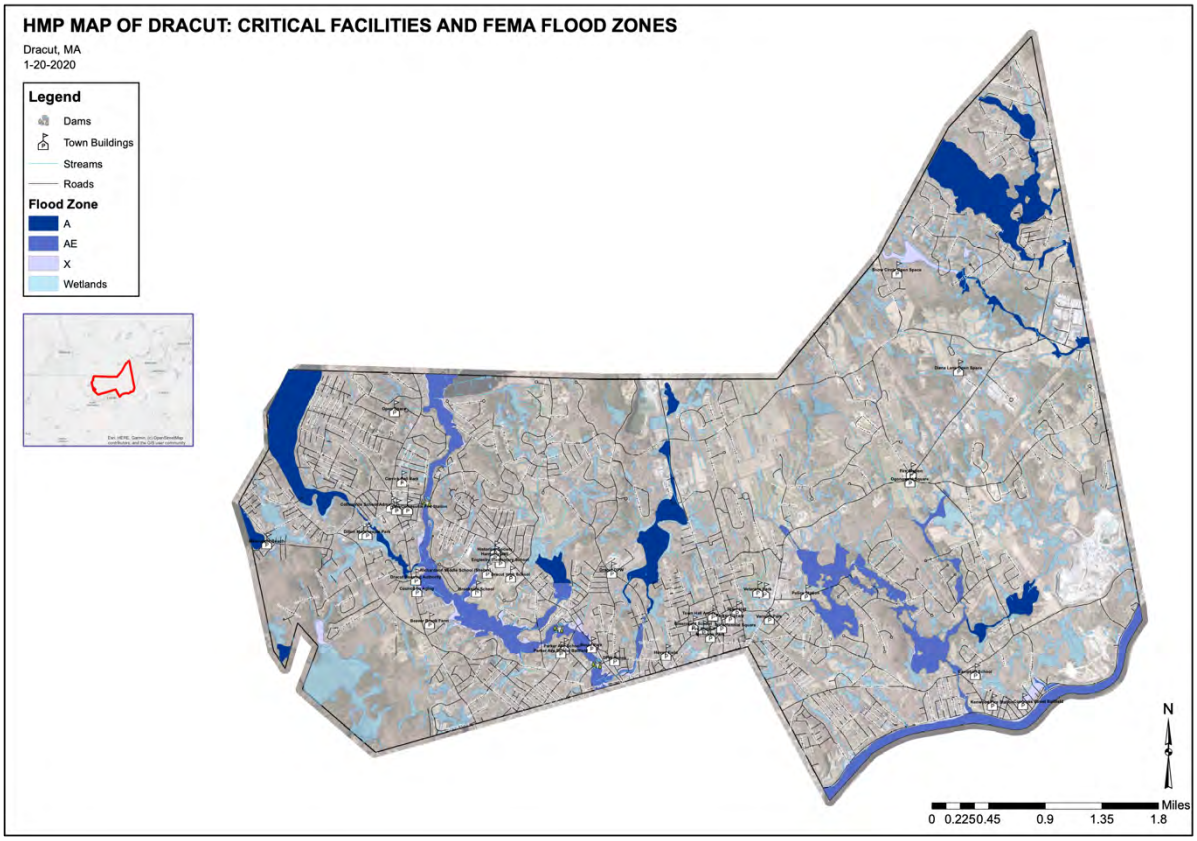


Figure 13. FEMA Flood Zone Map

Specific locations in Dracut that have been identified in the past as subject to high risk flood hazards include the following areas: Kelly Road, Tennis Plaza, Nottingham Circle, the Peters Pond and Cedar Pond shorelines, including associated wetlands and waterways; the banks of Bartlett Brook, especially downstream; the banks of Richardson and Trout Brooks, including associated wetlands and a tributary

[13] Dracut Master Plan. May 2020. P. 224.

[14] The latest FEMA Flood Insurance Study (FIS) for Middlesex County is dated July 6, 2016; however, Dracut's watersheds were last studied in 1978. More recent FIS updates did not restudy any areas in Dracut, therefore, the data used to generate the current FIRM is considered by the Town to be severely outdated and does not accurately depict current flood risks or anticipated future risks based on climate change or other projected future conditions.

running southwest to Trout Brook; the shoreline of Long Pond, the banks of Double Brook, the banks of Beaver Brook and tributaries; and the shoreline of Lake Mascuppic.[15]

Specific areas of concern as identified within the Town's Master Plan include the following:[16]

- Sections of Peabody Avenue and Lakeview Avenue – During the 2006 flood the E. Butterworth Mill sustained significant flood damage, and water flooded the Lakeview Avenue Bridge when Beaver Brook topped its banks.
- Tennis Plaza Road – This is an access road for hundreds of residential properties.
- Kelly Road – Past flood events have been severe enough to warrant evacuations.
- Vinal and Cook Streets
- Loon Hill Road
- Peters and Cedar Pond shorelines
- Lake Mascuppic shoreline
- Cricket Lane
- Bridge Street
- Nottingham Road
- Dean Avenue

In addition, there were several geographic areas of concern identified by MVP workshop participants that encounter flooding issues at low points on the roadways and/or caused by undersized or structurally failing drainage systems. These areas include the following:

- 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)
- DPW Parking Lot – susceptible to flooding

There are no significant developed areas in Dracut where chronic flooding is a problem. However, there is intense development of the riverine zones of Beaver Brook and Peppermint Brook with a high percentage of impervious surface, causing concerns about future potential flooding of these highly populated areas (and due to previous flooding incidents in the vicinity of the Beaver Brook Dam). In

[15] Dracut Open Space and Recreation Plan. 2009 Update. P. 27.
[16] Dracut Master Plan. May 2020. P. 224.

addition, a few low point areas and areas with poor drainage issues which get flooded during the intense rain events were pointed out by MVP workshop participants, as listed above. 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, meaning this area is vulnerable to the potential increase in precipitation and flooding, as it is projected to overtop.

The town's Flood Plain and Floodway District is an overlay district that regulates land use in all special flood hazard areas as identified on the town's FIRM. In the interest of maintaining the flood storage capacity of floodplains and avoiding property damage, all new construction or earthmoving is prohibited in this district, except certain agricultural and conservation uses, repairs to pre-existing structures, and new structures that have been shown by an engineer not to be subject to flooding. The Conservation Commission has jurisdiction in all floodplains.

Extent

The severity of a riverine flood event is typically determined by a combination of several major factors, including stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; the degree of vegetative clearing; and impervious surface. The periodic flooding of lands adjacent to rivers, streams, and shorelines (floodplains) is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is typically defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude (spatial extent and depths) increases with increasing recurrence intervals.

Floodplain areas are delineated according to the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will be covered by the 10-year flood and the 100-year floodplain by the 100-year flood. A more appropriate way of expressing flood frequency is the percent chance of occurrence in any given year (annual probability). For example, the so-called "100-year flood" has a 1 percent chance of occurring in any given year, and the 500-year flood has a 0.2 percent chance of occurring in any given year. Statistically, the 1 percent annual chance flood has a 26 percent chance of occurring during a 30-year period, equal to the duration of many home mortgages. Contrary to what the term suggests, a "100-year flood" is not a flood that occurs only once every 100 years. A "100-year flood" can and often does occur in the same location multiple times in a century.

Special flood hazard areas identified on FEMA FIRMs (as shown as Zones A and AE in Figure 13) are defined as the areas that will be inundated by the flood event having a 1 percent chance of being equaled or exceeded in any given year. The 1-percent-annual-chance flood is also referred to as the base flood elevation (BFE) and is the national minimum standard for applying FEMA's NFIP regulations and mandatory flood insurance purchase requirements. Areas shown to be inundated by the 0.2-percent-annual-chance flood are considered moderate flood hazard areas, and areas outside of these areas are considered minimal flood hazard areas.

Previous Occurrences

According to the State Hazard Mitigation and Climate Adaptation Plan, Middlesex County has had 14 federally declared flood-related disasters between 1954 and 2017.[17] Most of this flooding occurred during severe storms during the fall, winter, and spring months.[18] Many additional flood events have occurred in the region but did not result in a federal disaster declaration.

Per NOAA's Storm Events Database, Middlesex County experienced a total of 202 flood events which have caused an estimated $57 million in property damages since 1996.[19] Notable events for the area include flooding from severe storms in October 1996, June 1998, April 2001, April 2004, October 2005, May 2006, and March 2010. The May 2006 "Mother's Day Flood" damaged 14,000 homes in 44 communities on the North Shore, including Middlesex County. During this event, several rivers including the Merrimack and their tributaries were impacted by flooding, including Dracut which experienced inundation from flood waters in low-lying areas across town. In March 2010, heavy rainfall of 6 to 10 inches fell over much of Southern New England resulting in major flooding across eastern Massachusetts.

Looking further back in time there have been numerous other flood events recorded for the region, though little data on impacts specific to Dracut exist. The flood of August 1955 resulted from two hurricanes that arrived almost concurrently-Hurricane Connie, occurring between August 11 and 15; and Hurricane Diane occurring between August 17 and 20. As a result of these two storms, roads and bridges were overtopped, and residences and businesses were flooded. Further, significant recorded floods were those occurring in May 1850, December 1878, July 1891, July 1897, February and March 1900, November 1927, March 1936, July and September 1938, October 1942, October 1955, April 1960, March 1968, and January 1979.[20]

The flooding history of the Merrimack River includes information of floods dating back to 1785, although little factual information on these early floods exists. The dates of the five largest floods recorded at the USGS gage on the Merrimack River include, in order of severity, March 1936, September 1938, April 1852, April 1987, April 1960, and November 1927.[21]

Probability of Future Events and Changes Since the Previous Plan

Based on historical data and projected future conditions, flooding will remain a likely occurrence in Dracut. In addition to a changing climate which has already increased the frequency of heavy rainfall events, aging infrastructure—specifically antiquated pipes, storm drains and undersized or failing culverts—will continue to increase the probability and magnitude of flooding events. In particular, as

[17] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-9.
[18] Flood Insurance Study for Middlesex County. Federal Emergency Management Agency. July 2016. P. 29.
[19] NOAA's Storm Events Database: https://www.ncdc.noaa.gov/stormevents/
[20] Flood Insurance Study for Middlesex County. Federal Emergency Management Agency. July 2016. P. 24-25.
[21] Ibid. P. 27.

precipitation events become more intense and less predictable, older and undersized stormwater systems are expected to pose a greater threat of failure and flooding.

Impact on the Community and Vulnerability

The impacts of extreme precipitation and flooding, specifically for pre-existing developments in the floodplain and/or along riparian buffers, were a primary concern that emerged in through the MVP process. Dracut has reportedly been seeing an increasing regularity of storms, with isolated but heavy downpours happening more frequently. More intense storms, delivering higher volumes of precipitation in a single event, are expected to put significant pressure on dams, culverts, and other drainage infrastructure that were designed to handle smaller storms with more consistent distributions of precipitation. This problem manifests at points across the town and is acute where the local drainage systems concentrate and discharge, especially near existing problem areas such as Lakeview Avenue (where a structurally failing culvert was identified as a high priority mitigation action at the MVP Workshop).

There were several other critical facilities identified through the MVP process as susceptible to flooding and subject to potential future impacts. This includes the water transmission main/connection and well heads on Tyngsborough Road (owned by Dracut Water Supply), three pump stations, and multiple bridge crossings and culverts that convey flows along Beaver Brook.

Impacts of Climate Change

Climate scientists predict that in the next few decades, climate change will increase the frequency and intensity of all storms. According to the Massachusetts Climate Change Projections Report released by the Commonwealth, the Merrimack Basin is expected to see nearly 3 additional days with precipitation over 1 inch by the 2050s, and 4 additional days by the end of the century.[22]

Drought

Hazard Description

Droughts can vary widely in duration, severity, and local impact. They may have widespread social and economic significance that require the response of numerous parties, including water suppliers, firefighters, farmers, and residents. Droughts are often defined as periods of deficient precipitation. How this deficiency is experienced depends on factors such as land use change, the existence of dams, and water supply withdrawals or diversions. For example, impervious surfaces associated with development can exacerbate the effects of drought due to decreased groundwater recharge.[23]

[22] Massachusetts Climate Change Projections. Northeast Climate Adaptation Science Center at UMass-Amherst. Published by Massachusetts Executive Office of Energy and Environmental Affairs. March 2018.
[23] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-38.

Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e., evaporation + transpiration) in a particular area. It is also related to the timing and the effectiveness of the rains (i.e., rainfall intensity, number of rainfall events). Other climatic factors, such as high temperature, high wind, and low relative humidity, can significantly aggravate its severity.

The beginning of a drought is difficult to determine. Several weeks, months, or even years may pass before drought conditions become apparent. The first evidence of drought is usually seen in record low levels of rainfall, and the soil moisture becomes unusually low. The effects of a drought on streamflow and water levels in lakes and reservoirs may not be noticed for several weeks or months. Groundwater levels may not reflect drought conditions for a year or two later. The end of a drought can occur as gradually as it began. Dry periods can last for 10 years or more.

Location

Drought is an atmospheric hazard that may impact all of Dracut. However, agricultural areas with working farms and related industries may experience the greatest impacts due to drought.

Extent

The severity and extent of drought would vary among residents based on where they get their water supply. The vast majority (95%) of Dracut is served by municipal water (Dracut Water Supply and Kenwood Water Districts), with those remaining areas relying on the use of private wells. In these areas, drought may lead to the failure of individual wells and there is a significant financial cost to replace these wells. The public water system could also be impacted by drought, though this has never happened. The town currently draws most of its water from five wells located in the Tyngsborough Well Field, located along the Merrimack River in Tyngsborough, and two wells in the New Boston Well Field, located in Dracut. These supplies are supplemented with water purchased through interconnections with the Lowell Regional Water Utility (LRWU) and the Lowell and Methuen Water Departments.

In terms of classifying the severity of drought conditions, the U.S. Drought Monitor categorizes drought on a D0-D4 scale as shown in Table 10.

Table 10. U.S. Drought Monitor[24]

Classification	Category	Description
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting and growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered

[24] https://droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx

D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies

Previous Occurrences

The Town of Dracut hasn't been severely impacted by historic drought conditions, as Massachusetts generally has enough precipitation to support the demands residents and businesses place on water. Periods of significant drought are not unheard of though, as Massachusetts has experienced multi-year drought periods in 1879-83, 1908-12, 1929–32, 1939–44, 1961-69, 1980–83, and 2016-2017. Several less-severe droughts occurred in 1999, 2001, 2002, 2007, 2008, 2010, and 2014. At the time of this plan writing (October 2020), most of Massachusetts was experiencing mild drought conditions due to over six months of below normal rainfall and above normal temperatures.

The most severe drought on record in the Northeast was during 1961-69. Water supplies and agriculture were affected because of the severity and long duration of the drought. Precipitation was less than average beginning in 1962 for eastern Massachusetts. During this drought, several communities declared water supply emergencies. As a point of reference, Quabbin Reservoir, the major water source for the metropolitan Boston area, reached 45% of capacity in 1967.

More recently, notable times of water stress in eastern Massachusetts (including Dracut) include 1999-2000, 2002, 2012, 2016-17, and 2020. During these events rivers, streams, lakes, and ponds were most affected as many ran at record low levels during the spring run-off season, and there were periods of very high fire danger. While soil moisture was well below normal, little to no monetary losses to the agricultural sector were recorded for the region. The 2016-2017 drought was the most significant drought in Massachusetts since the 1960s. In many parts of the state, USGS data for streamflow and groundwater reached new record low levels for several consecutive months. In total, between 2001 and 2017, the Town of Dracut experienced between 15-21 weeks in Extreme Drought (D3) conditions.[25]

[25] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-43 – 4-45.

Probability of Future Events and Changes Since the Previous Plan

Massachusetts is often considered a "water-rich" state. Under normal conditions, regions across the state annually receive between 40 and 50 inches of precipitation and the Commonwealth has never received a Presidential Disaster Declaration for a drought-related disaster. However, Massachusetts has and will continue to experience extended periods of dry weather, from single-season events to multi-year events.

Drought is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. It occurs in all climatic zones across the northeast, but each drought will affect subregions differently. Historically, most droughts in Massachusetts have started with dry winters rather than dry summers. However, based on recent climate projections this trend may shift the probability of future events to summer and fall seasons, particularly for what are anticipated to be more frequent, short-term drought occurrences.

Impact on the Community and Vulnerability

Severe droughts could create challenges for Dracut's local water supply by reducing surface water storage and the recharge of groundwater supplies. MVP Workshop participants also raised concerns for the small areas that are not connected to public water supplies, but rather depend on the use of private wells. 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. This area needs to be monitored and studied more for potential vulnerabilities of wells to drought and climate change with regards to water levels and additional water conservation efforts. More frequent droughts could also potentially exacerbate the impacts of localized flood events by damaging vegetation that could otherwise help mitigate flooding and the impacts of streambank erosion. Droughts may also weaken tree root systems, making them more susceptible to toppling during high wind events. Lastly, droughts may increase the frequency and intensity of wildfire events.

Although they represent a small percentage of the Town's current land uses, Dracut has been able to retain many of its farms and agricultural enterprises. Climate change impacts such as longer or more frequent short-term droughts have the potential to threaten these agriculture-based industries. Climate change is expected to result in a longer growing season for New England, which can be beneficial for some crops but may lead to issues with others, for instance, by allowing additional time for blight or other crop diseases to develop.

Impacts of Climate Change

It is anticipated that the effects of climate change will result in an increase in the frequency, duration, and intensity of short-term droughts. According to the 2011 Massachusetts Climate Change Adaptation Report, by the end of the century and under the high emissions scenario, the occurrence of droughts lasting one to three months could go up by as much as 75 percent over existing conditions. Also, per the downscaled climate projections for the Merrimack Basin as made available by the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) in 2018, both summer and fall seasons are

expected to continue to experience the highest number of consecutive dry days. Annually the region is expected to experience an increase of up to 3 days in consecutive dry days by the end of the century.[26]

Rising Temperatures

Average/Extreme Temperatures

Hazard Description

There is no universal definition for extreme temperatures. The term is relative to the usual weather in the region based on climatic averages. Extreme heat for Massachusetts is usually defined as a period of three or more consecutive days above 90 degrees Fahrenheit (°F), but more generally as a prolonged period of excessively hot weather which may be accompanied by high humidity. Extreme cold is also considered relative to the normal climatic lows in a region.[27]

Location

Extreme temperatures impact the entire state. According to NOAA, Massachusetts is made up of three climate divisions: Western, Central, and Coastal. Average annual temperatures vary slightly over the divisions, with annual average temperatures of around 46°F in the Western division (area labeled "1" in Figure 14), 49°F in the Central division (area labeled "2"), where Dracut is located, and 50°F in the Coastal division (area labeled "3").[28]

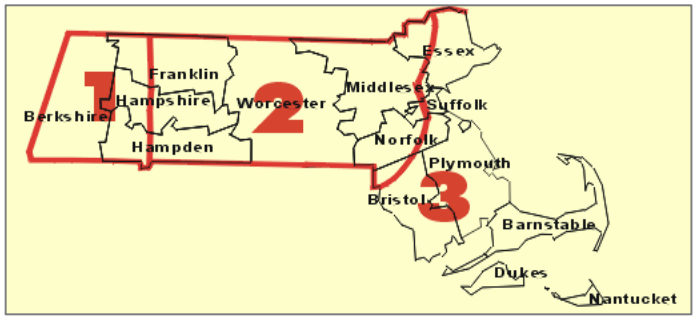


Figure 14. NOAA Climate Divisions

Extent

According to the Massachusetts State Hazard Mitigation and Climate Adaptation Plan, extreme temperatures are relative to the region being studied. For Massachusetts, extreme heat is considered three or more consecutive days of temperatures above 90 degrees. Extreme cold is less well defined and relative to wind chill. On average, Massachusetts experiences the highest consecutive days of heat in July, and the lowest consecutive days of cold in January.

[26] Massachusetts Climate Change Projections. Northeast Climate Adaptation Science Center at UMass-Amherst. Published by Massachusetts Executive Office of Energy and Environmental Affairs. March 2018.
[27] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-143-144.
[28] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-149.

Wind chill temperature is the temperature people and animals feel when outside, and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. Figure 15 shows three shaded areas of frostbite danger. Each shaded area shows how long a person can be exposed before frostbite develops. In Massachusetts, a wind chill warning is issued by the National Weather Service (NWS) when the Wind Chill Temperature Index, based on sustained wind, is –25°F or lower for at least three hours.

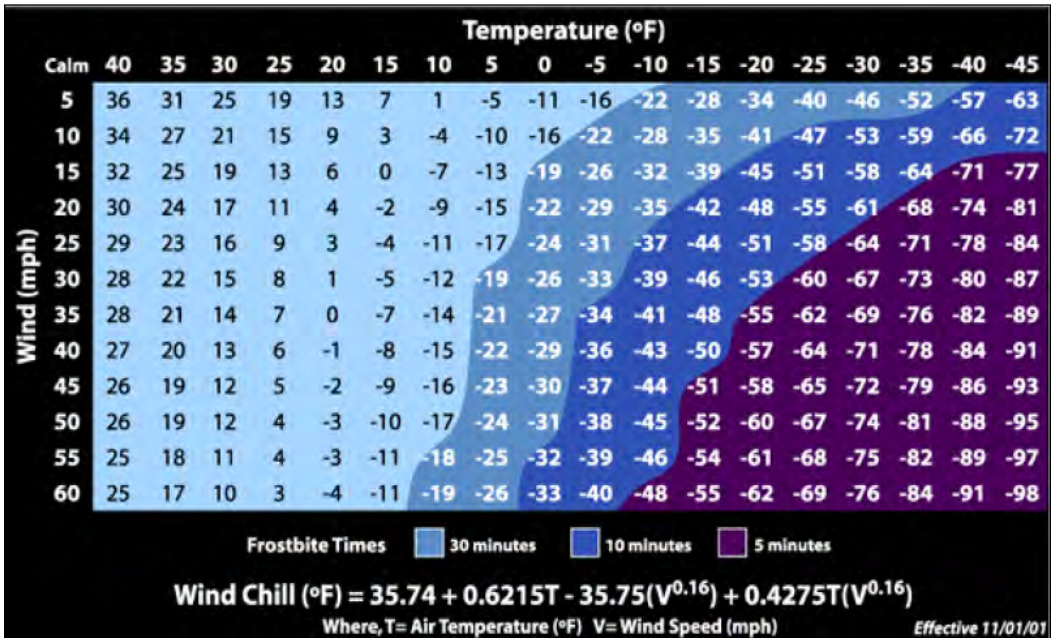


Figure 15. Wind Chills[29]

For extremely hot temperatures, the Heat Index Scale is used, which combines relative humidity with actual air temperature to determine risk to humans. The NWS issues a Heat Advisory when the Heat Index is forecast to reach 100-104 °F for two or more hours. The NWS issues an Excessive Heat Warning if the Heat Index is forecast to reach 105+ °F for two or more hours. Figure 16 indicates the relationship between heat index and relative humidity.

[29] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-146.

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Category	Heat Index	Health Hazards
Extreme Danger	130 °F – Higher	Heat Stroke or Sunstroke is likely with continued exposure.
Danger	105 °F – 129 °F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Extreme Caution	90 °F – 105 °F	Sunstroke, muscle cramps, and/or heat exhaustions possible with prolonged exposure and/or physical activity.
Caution	80 °F – 90 °F	Fatigue possible with prolonged exposure and/or physical activity.

Figure 16. Heat Index[30]

Previous Occurrences

According to the State Hazard Mitigation and Climate Adaptation Plan, there have been 33 extreme cold weather events in Massachusetts since 1994. Extreme cold/wind chill events were reported in February 2016 in many climate zones across the state, including Middlesex County where many locations reported wind chills between 25 and 35 degrees below zero. There have been 43 warm weather events since 1995. In 2012, Massachusetts temperatures broke 27 heat records in June. According to NOAA's Storm Events Database, Middlesex County most recently experienced excessive heat events in July 2010 and July 2013 (including heat index values above 105 degrees). The 2013 heat wave lasted four days resulted in one casualty in Middlesex County (City of Medford) when a 45-year old postal worked died as a result of heat illness.

According to Town staff and MVP stakeholders, the Town of Dracut has experienced increasing impacts from extreme heat events, including the need to more frequently open and extend hours for the Town's Senior Center and additional cooling stations for residents of all ages. In July 2019, a cooling station was opened two times, from July 19-21 and July 28-30. The Town also reports that If it were not for COVID-19, it would have been open during a heatwave in June 2020.

Probability of Future Events and Changes Since the Previous Plan

Since the previous plan was prepared, the Town of Dracut has noticed an increasing number of days they experience extreme temperatures. This includes summer temperatures over 100 degrees and more heat waves. The future probability for these types of occurrences is very high and documented by history and climate change science.

[30] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-147.

Impact on the Community and Vulnerability

Extreme temperatures place vulnerable populations at increased risk, such as children, seniors, lower income residents, and those already dealing with respiratory or other health problems. Fortunately, Dracut's Council on Aging provides respite for vulnerable populations during the day, including the opening of cooling centers during extreme temperatures. Impacts on local schools are another concern. As days above 90 degrees increase, heat stroke is a concern for the student population in general, even though schools are air conditioned. Heat related health conditions are particularly a concern for special needs students and student athletes, but extreme heat conditions also make for a poor learning environment in general. There are also concerns about the increasing utility costs of running the schools during extreme temperatures, and the need to replace AC units due to stress from continued use, raising maintenance costs.

MVP Workshop participants also expressed concerns that extended heat waves could have impacts on the electrical and communications infrastructure, as it could lead to extended power outages. The widespread use of air conditioning stresses the electrical system and increases the risk of brownouts and outages, particularly if heat impacts are region wide. The Town anticipates a continual upward trend in the number of extreme temperatures days which may cause infrastructure system failures or overload, but most likely would not damage building structures. Town officials in Dracut have however indicated that extreme temperatures are impacting the ability to effectively heat or cool some municipal buildings.

Impacts of Climate Change

Climate change is known to increase incidences of extreme temperatures. Table 11 is taken from the Massachusetts Climate Change Projections Report released by EOEEA in 2018. The table shows that for the Merrimack Basin (where Dracut is located) not only are the average temperatures increasing, but the total number of high heat days is increasing.

Table 11. Average/Extreme Temperature Figures

Merrimack Basin	Observed Baseline 1971-2000	Projected Change in 2030s	Projected Change in 2050s	Projected Change in 2070s	Projected Change in 2090s
Average Annual Temperature (°F)	48.1	+2.2 to +4.4	+3.0 to +6.4	+3.6 to +9.1	+3.9 to +10.9

Merrimack Basin	Observed Baseline 1971-2000	Projected Change in 2030s	Projected Change in 2050s	Projected Change in 2070s	Projected Change in 2090s
Annual Days with Maximum Temperature over 90°F (Days)	7	+7 to +20	+11 to +33	+13 to +55	+15 to +74
Annual Days with Minimum Temperature below 32°F (Days)	148	-12 to -30	-19 to -43	-23 to -56	-25 to -66

Wildfires

Hazard Description

A wildfire can be defined as any non-structural fire in vegetative wildland that contains grass, shrub, leaf litter, and forested tree fuels. Wildfires in Massachusetts are caused by natural events, human activity, or prescribed fire. Wildfires often begin unnoticed but spread quickly, igniting brush, trees, and, potentially, homes.

The wildfire season in Massachusetts usually begins in late March and culminates in early June, corresponding with the driest live fuel moisture periods of the year. April is historically the month in which wildfire danger is the highest. Drought, snowpack level, and local weather conditions impact the length of the fire season.[31]

Location

Wildfires are a natural part of the Massachusetts ecosystem. Increasingly, however, development is encroaching into isolated areas and wildfires present a danger to human life and manmade facilities. This trend is further validated by current wildfire hazard mapping data which show a large and increasing amount of Wildland-Urban Interface (WUI) zones across the state.

[31] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-171.

Figure 17 shows the location of WUI zones in Dracut as mapped in 2010 by the SILVIS Laboratory at the University of Wisconsin and as included in the Massachusetts State Hazard Mitigation and Climate Adaptation Plan. These hazard areas include two types of WUI areas: intermix and interface. Intermix areas are described as areas where housing and vegetation intermingle; interface areas are described as areas with housing in the vicinity of contiguous wildland vegetation.[32] Per the 2015 regional hazard mitigation plan prepared by NMCOG, the risk of wildfire in the Lowell/Dracut/Tyngsborough State Forest, located in the southwest corner of Dracut, is of particular concern to local fire and emergency management officials.[33]

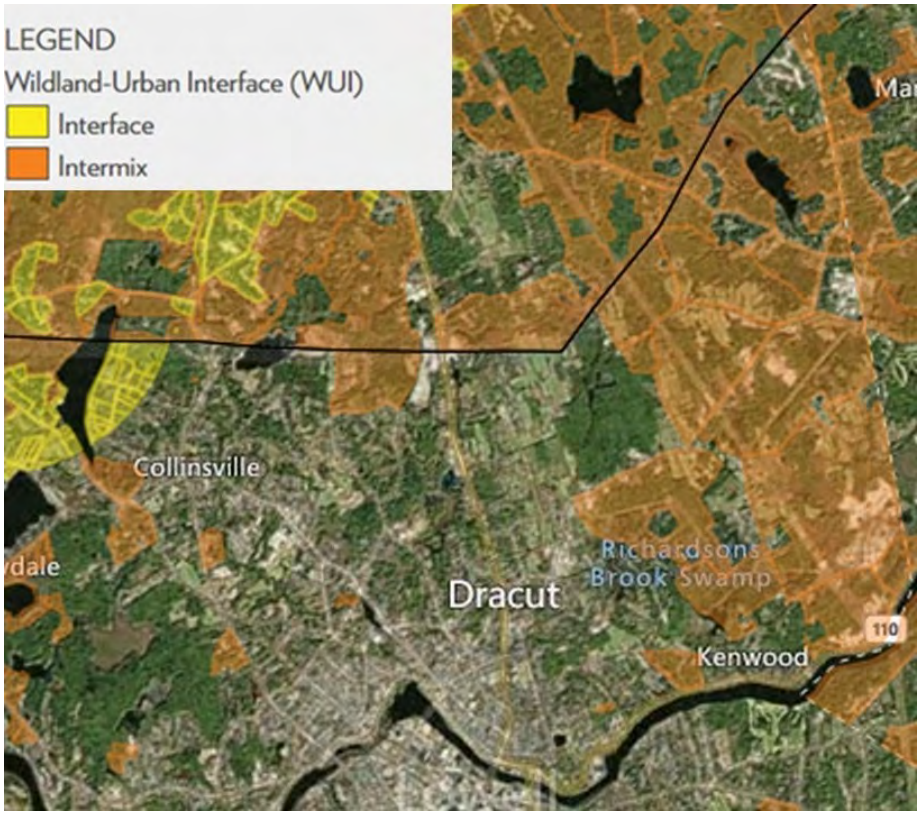


Figure 17. Wildland-Urban Interface (WUI) Map

Extent

Wildfires can cause widespread damage to the areas they affect. They can spread very rapidly, depending on local wind speeds and be very difficult to get under control. Fires can last for several hours up to several days.

[32] Radeloff, V.C., R.B. Hammer, S.I Stewart, J.S. Fried, S.S. Holcomb, and J.F. McKeefry. 2005. The Wildland Urban Interface in the United States. Ecological Applications 15: 799-805.

[33] Hazard Mitigation Plan for the Northern Middlesex Region. Northern Middlesex Council of Governments (NMCOG). 2015. P. 112.

Previous Occurrences

Several notable wildfires have occurred in Massachusetts history, although none has ever resulted in a FEMA disaster declaration. According to the previous plan and NOAA's Storm Events Database, there is no recorded history of damaging wildfire events in Middlesex County. However, according to the State Hazard Mitigation and Climate Adaptation Plan, wildfire risk for Middlesex County is considered high in many areas. Nearly 30% of the population in the county is considered to be in wildfire hazard areas.[34]

Although Dracut has not experienced major wildfire events in the past, the town averages approximately 80 small brush fires per year. As noted above the area surrounding the Lowell-Dracut-Tyngsborough State Forest is susceptible, as it is one of the most heavily forested areas of the town. This area is managed by the Massachusetts Department of Conservation and Recreation (DCR). On July 5, 2012, Dracut firefighters responded to a brush fire in the State Forest which was brought under control and extinguished.[35]

Probability of Future Events and Changes Since the Previous Plan

The probability of future wildfire events is predicted to increase as the average numbers of dry days and those with extreme heat are projected to increase. The magnitude of future events will largely depend on weather, fuel conditions, and existing fire detection, control, and suppression capabilities.

Impact on the Community and Vulnerability

Dracut has several areas that are deemed to have the highest risk of wildfires (shown as low density intermix in Figure 17), most of which are located along the town's eastern edge. Fortunately, the magnitude and impact of most wildfire events will be contained due to early detection and fire suppression. However, the potential for larger, destructive fires does exist for Dracut due to several factors including the availability of fuel, large concentrations of wood frame structures, and development within some heavily wooded areas of town.

Impacts of Climate Change

It is anticipated that the effects of climate change, including more frequent and prolonged drought conditions, will increase the frequency and intensity of wildfire events. Another related factor that is expected to increase the probability of future wildfire events is the introduction of disease, pests, and invasive plants that result in the dieback of mature tree species thus creating increased vegetative fuel loads in forested areas. In addition, lightning strikes may increase with climate change and can be responsible for igniting more wildfires.[36]

[34] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-181.
[35] Hazard Mitigation Plan for the Northern Middlesex Region. Northern Middlesex Council of Governments (NMCOG). 2015. P. 117.
[36] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-172.

Invasive Species

Hazard Description

Invasive species are defined as non-native species that cause or are likely to cause harm to ecosystems, economies, and/or public health (NISC 2006).[37] The Massachusetts Department of Agricultural Resources (DAR) recognizes sixty-nine (69) invasive species that are of particular concern in the Commonwealth. Massachusetts has a variety of laws and regulations in place that attempt to mitigate the impacts of these species. The Town of Dracut also recognizes invasive species as one of the greatest threats to the integrity of natural communities, representing a direct threat to the survival of many indigenous species. For most species, eradication is possible only in the earliest stages of invasion.

Location

Numerous invasive species are found throughout Dracut, such as multiflora rose, Norway maple, Russian Olive, Garlic Mustard, and Oriental bittersweet. Some of these species can be found in hedgerows, along roadsides, in overgrown pastures and orchards, and in fallow fields in town. Purple loosestrife and Phragmites can also be found in wetland areas.

Extent

Invasive species are a widespread problem throughout the state and may be monitored by observation. The State conducts surveillance to monitor the incidence of invasive species and has a variety of laws and regulations in place that attempt to mitigate their impacts. As it relates to vector-borne diseases, Dracut is part of the Central Massachusetts Mosquito Control Project (CMMCP) which serves to reduce mosquito populations through surveillance, water management, biological and chemical controls. All of these methods are performed in an environmentally sensitive manner to minimize potential effects on people, wildlife, and the environment. CMMCP's primary goal is to reduce mosquito exposure to the public, and the potential for disease transmission by mosquitoes, by utilizing proven, sound mosquito control techniques.

Previous Occurrences

Invasive species do not represent a singular event but rather on on-going problem, so it is difficult to measure the frequency of occurrences.

Probability of Future Events and Changes Since the Previous Plan

Invasive species were not considered in the previous regional mitigation plan or the Town's MVP planning process; however, they are expected to be an increasing problem in Dracut and throughout the State due to a changing climate and projected increases in non-native plant and animal infestations. The Town of Dracut does not have an invasive species management plan but coordinates with State authorities as appropriate. Also, per its 2020 Master Plan, the Town of Dracut has recommended the establishment of a "Detection and Response" plan to address invasive plants based on the understanding that this problem will increase with a changing climate. The Master Plan also recognizes

[37] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-188.

the need to educate homeowners and the agricultural community on the importance of using only native plantings, and on how to detect and report the presence of invasive species.[38]

Impact on the Community and Vulnerability

The entire community is vulnerable to negative impacts of invasive species. Invasive species already pose a significant challenge and have serious long-term consequences for ecosystem health and resilience, and as described below these impacts are likely to increase in response to climate change. Warming temperatures will likely bring new invasive species to the area, as well increases in the presence of existing pests and related vector-borne diseases which pose serious threats to human health. Invasive species will have an easier time gaining a foothold if the town's natural ecosystems are simultaneously weakened due to changes in climatic conditions.

Impacts of Climate Change

Climate change is affecting flora and fauna as well as pests and disease vectors both through changing precipitation conditions and changing temperature conditions. Warmer, wetter conditions lead to increased mosquito populations, while the absence of sufficient periods of cold means that pest populations that would historically have been killed off or reduced are able to survive the winter and emerge in greater numbers the following season. A recent Centers for Disease Control (CDC) report showed that vector-borne diseases tripled between 2004 and 2016, with approximately 75% of cases being related to tick-borne disease.

As the Massachusetts climate begins to look more like the climate of the mid-Atlantic and southern states, it is seeing higher incidents of vector-borne diseases. 2018 marked the Commonwealth's highest ever incidence of West Nile Virus diagnosis, and 2019 marked the highest number of EEE cases in recent history (a time when Dracut was classified by the State as having a moderate risk for EEE). These changes present a major public and animal health challenge in terms of education, prevention, and treatment.

Extreme Weather

Hurricanes/Tropical Storms

Hazard Description

Hurricanes begin as tropical storms over the warm moist waters of the Atlantic Ocean, off the coast of West Africa, and over the Pacific Ocean near the equator. As the moisture evaporates, it rises until enormous amounts of heated, moist air are twisted high in the atmosphere. The winds begin to circle counterclockwise north of the equator or clockwise south of the equator. The center of the hurricane is called the eye.[39] Hurricanes are often associated with heavy rainfall and high sustained winds, but they

[38] Dracut Master Plan. May 2020. P. 326.
[39] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-204.

can also spawn tornadoes that generally occur in thunderstorms embedded in rain bands well away from the center of the hurricane. Tornadoes can also occur near the eye wall.

Although heavy rains associated with hurricanes are considered to present the highest recurrent risk to Dracut and the surrounding region, high winds are also a risk. Downed trees and tree limbs, blocked roads, and downed telephone and power lines can disrupt transportation routes and communication channels.[40]

Location

Hurricanes are an atmospheric hazard and have the potential to impact the entire town of Dracut. It is likely that western portions of the community along Beaver Brook are more susceptible to damage due to the combination of both high winds and potential flooding, though all low-lying areas should be considered at risk for flooding from heavy rain and wind damage.

Extent

Hurricanes can range from 50 miles to 500 miles across; in 1980, Hurricane Allen stretched across the entire Gulf of Mexico. There are generally two source regions for storms that have the potential to strike New England: (1) off the Cape Verde Islands near the west coast of Africa, and (2) in the Bahamas. The Cape Verde storms tend to be very large in diameter, since they have a week or more to traverse the Atlantic Ocean and grow. The Bahamas storms tend to be smaller, but they can also be just as powerful, and their impact can reach New England in only a day or two. The majority of hurricanes that have made landfall in New England and impacted the Town of Dracut were a Category 1. Hurricanes are measured by the Saffir-Simpson Wind Scale, shown in Table 12.[41]

Table 12. Saffir-Simpson Wind Scale

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	**Very dangerous winds will produce some damage.** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles will likely result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	**Extremely dangerous winds will cause extensive damage**. Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or

[40] Hazard Mitigation Plan for the Northern Middlesex Region. Northern Middlesex Council of Governments (NMCOG). 2015. P. 116.
[41] https://www.nhc.noaa.gov/aboutsshws.php

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
		uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Devastating damage will occur.** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Catastrophic damage will occur.** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur.** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Previous Occurrences

Since 1900, thirty-nine tropical systems have impacted New England. Twenty-five were hurricanes and 14 were tropical storms. Any tropical storm or hurricane is capable of bringing a combination of high winds, large storm surges and severe inland flooding along rivers and streams. Of the 24 hurricanes, nine made landfall along the southern New England coast. Of those nine hurricanes, seven of them were either of category 2 or 3 intensity based on the Saffir-Simpson hurricane scale. Though the primary threat to New England is during August and September, the region has been affected as early as June and as late as mid-October.[42]

NOAA has kept records of hurricanes since 1851. From 1851 to October 2020, 32 hurricane and tropical storms have come within 75 miles of Dracut. These storm events have included two (2) category 3 hurricanes, three (3) category 2 hurricanes, five (5) category 1 hurricanes, and 22 tropical storms. Figure 18 displays these historic tracks of hurricanes across the region.[43] The most damaging storms made

[42] http://nesec.org/hurricanes/
[43] https://coast.noaa.gov/hurricanes/

landfall and tracked to the west of Dracut, including the Great Hurricane of 1938 and Hurricane Carol in 1954. The most recent hurricane to affect the region and the town was Hurricane Irene in August 2011, which became a tropical storm as it passed over the region.

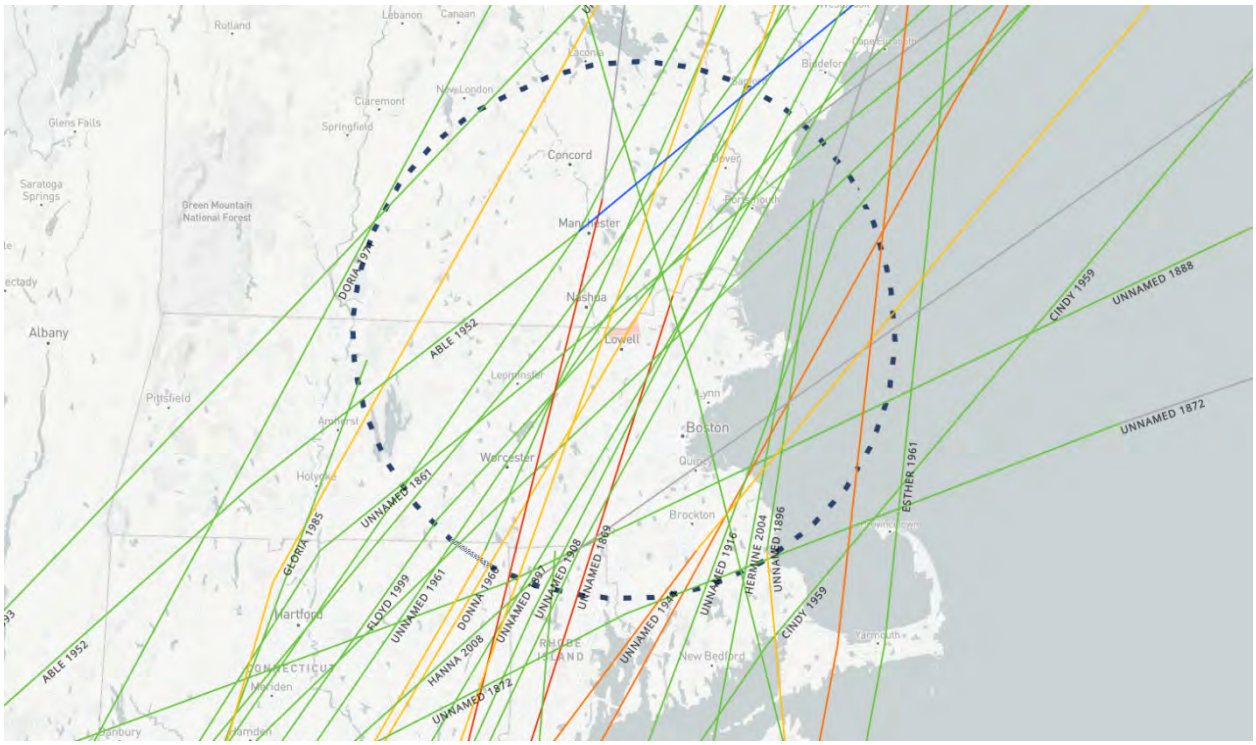


Figure 18. Historical Hurricane and Tropical Storm Tracks

Probability of Future Events and Changes Since the Previous Plan

Over the last 168 years, Dracut has experienced a storm event approximately once every 5 years (not including tropical depressions or extratropical storms). Based on this frequency of past storm activity, it is very probable that the town will continue to be impacted by hurricanes and tropical storms. For Dracut, these events are generally limited to the months of August, September, and October, with some storms arriving in May, June, July, or November.

Impact on the Community and Vulnerability

While the coastal communities of southeastern Massachusetts generally take the brunt of hurricanes, flooding and winds can also affect areas much further inland. All of Dracut is vulnerable to damages from hurricane winds and high levels of rainfall. Localized flooding of roads could significantly impact the town and residents' ability to travel, and the community's power and communication infrastructure could be impacted by severe winds. Additionally, high winds could down trees, which could impact structures in town.

Impacts of Climate Change

According to the State Hazard Mitigation and Climate Adaptation Plan, climate change is increasing extreme weather and rising temperatures, which produce warmer oceans and more energy for storms. In addition, warmer air may hold more moisture, increasing the rate of rainfall.

Severe Winter Storm/Nor'easter

Hazard Description

Winter storms are the most common and most familiar Massachusetts hazards which affect large geographical areas. The majority of winter storms in the Commonwealth cause more massive inconvenience than they do serious property damage, injuries, or deaths. However, periodically, a storm will occur which is a true disaster, necessitating intense, large-scale emergency response.

Severe winter storms can produce a wide variety of hazardous weather conditions, including heavy snow, ice, freezing rain, sleet, and extreme wind and cold. As defined in the 2015 regional hazard mitigation plan, a severe winter storm is one that results in four or more inches of snow over a twelve-hour period, or six or more inches over a twenty-four-hour period. The leading cause of death during severe winter storms is from an automobile or other transportation accidents. Exhaustion or heart attacks caused by overexertion are the second most likely cause of winter storm-related deaths. Dracut, like the rest of the region, is at high risk for winter storms.

Nor'easters are low pressure, severe storm systems that affect the Mid-Atlantic and New England states primarily during winter months. They can form over land or water and are notorious for producing heavy snow, rain, and tremendous waves that crash onto Atlantic beaches, often causing beach erosion and structural damage. Wind gusts associated with these storms can exceed hurricane force in intensity, and when combined with snow result in blizzard conditions that form deep drifts capable of paralyzing a region. A nor'easter gets its name from the continuously strong northeasterly winds blowing in from the ocean ahead of the storm. A blizzard is defined as a storm with winds in excess of 35 miles per hour, with falling and blowing snow reducing visibility to less than ¼ mile for at least three hours.

Location

The entire town of Dracut is equally at risk to severe winter storms. However, winter storms impact vulnerable populations more significantly, including seniors, lower-income residents, and the homeless.

Extent

NOAA's National Centers for Environmental Information (NCEI) recently developed the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two thirds of the U.S. The RSI ranks snowstorm impacts on a scale from 1 to 5, as shown in Table 13. RSI values are based on the spatial extent of the storm, the amount of snowfall, and the association of these elements with population and societal impacts. For mitigation planning purposes the maximum probable extent of a severe winter storm in Dracut is a Category 5 on the RSI. The climate report from Best Places shows that Dracut has an average of 56 inches of snowfall each year, nearly 20 more inches than the national

average.[44]

Table 13. Regional Snowfall Index (RSI)

Category	RSI Value	Description
1	1–3	Notable
2	3–6	Significant
3	6–10	Major
4	10–18	Crippling
5	18.0+	Extreme

There is no widely used scale to classify nor'easters. However, the classification scheme developed by Gregory A. Zielinski and presented in Table 14 is a useful index to categorize nor'easters (and other severe winter storms) by intensity.[45] It consists of a five-level hierarchy similar to the Saffir-Simpson Hurricane Wind Scale, with a category 1 storm being the least severe in terms of its intensity and a category 5 storm being the most severe. For mitigation planning purposes, the maximum probable extent of a nor'easter for Dracut is an Intensity Index Category 4.

Table 14. Classification Scheme for Nor'easters

Intensity Index Category	Maximum Snowfall Amounts	Maximum Snowfall Rate	Potential Wind Speeds	Maximum Drifting Potential	Closings/Delays on Communities, Schools, and Travel	Impact on Coastal and Maritime Interests	Nature of Disruption
1	< 10 in.	Very low < 1 in./hr	Weak	Minor < 20 in.	Maybe minor (hours)	Minor	Minimal-nuisance

[44] https://www.bestplaces.net/climate/city/massachusetts/dracut
[45] Gregory A. Zielinski, Institute for Quaternary and Climate Studies, University of Maine.

Intensity Index Category	Maximum Snowfall Amounts	Maximum Snowfall Rate	Potential Wind Speeds	Maximum Drifting Potential	Closings/Delays on Communities, Schools, and Travel	Impact on Coastal and Maritime Interests	Nature of Disruption
2	10-20+ in.	Moderate 1+ in./hr	Strong	Moderate 3 ft.	Maybe moderate (hours to a day common)	Minor to moderate	Nuisance-inconvenience
3	20-30+ in.	High 2+ in./hr	Gale force	High 4-6+ ft.	Possibly extensive/ lengthy (several days possible)	Moderate to severe	Inconvenience-crippling
4	30-40+ in.	Very High 2-3 in./hr	Gale force hurricane	Very High 6-10+ ft.	Probably extensive/ lengthy (up to a week may be common)	Severe	Crippling-paralyzing
5	40-50+ in.	Overwhelming > 3+ in.hr	Gale force hurricane	Exceptional 10-15 ft.	Extensive/ lengthy (up to a week common)	Extreme	Paralyzing

Previous Occurrences

Severe winter storms are a very frequent occurrence in Dracut and the surrounding region. According to NOAA's Storm Events Database, Middlesex County experienced a total of 310 winter storm events since 1996 which have caused an estimated $12.5 million in property damages, 2 fatalities, and 5 injuries. These events include those recorded as blizzard, ice storm, heavy snow, winter storm, and winter

weather. Of the 34 federally-declared disasters or emergencies that have affected Middlesex County since 1953, 15 have been associated with severe winter storms.[46]

The most severe winter storm to ever strike New England was the Blizzard of 1888. The storm that occurred from March 11-14, 1888, deposited up to 50 inches of snow. The Blizzard of 1978, a classic nor'easter, dumped 24-36 inches of snow on the eastern part of the state and paralyzed the area for several days. The region experienced another major nor'easter in March 2001, when more than two feet of snow fell over a three-day period. Wind gusts to 64 miles per hour were reported in some areas, and the combination of heavy wet snow and high winds resulted in broken tree limbs that blocked roadways and downed power lines.

More recently, the winter of 2010-2011 produced some of the largest snowfall totals in the region's and state's history, and included two blizzards, both occurring in January 2011. According to the National Weather Service, Boston received 80.1 inches of snow that winter, while the Northern Middlesex region received 79.6 inches. Less than a year later, an early season snowstorm in October 2011 (known as the Halloween Nor'easter) left 640,000 Massachusetts homes and residents without power, including more than 12,000 in Dracut (approximately 95% of residents). The storm produced a snow fall in excess of 30 inches in some parts of the state, and, due to the amount of foliage still on the trees, resulted in widespread power outages for up to seven days. A little more than a year later Dracut recorded nearly 25 inches of snow during another major snowstorm event in February 2013.

Since 1983, the most significant winter snowfall accumulations for the region occurred during the winter of 1995, when snowfall measurements in the City of Lowell reached 126.5 inches. Snowfall totals in Dracut were similar, however the Town does not maintain its own records. The most recent ice storm in the region occurred in December 2008. The storm resulted in one fatality and left over one million people without power, some for as long as two weeks. Damage from the storm was measured in millions of dollars in property damage, lost business, and cleanup costs.

Probability of Future Events and Changes Since the Previous Plan

Using history as a guide for the probability of future events, it can be assumed that Dracut will be affected by numerous severe winter weather events each year (up to 10 or more). The highest risk of these storms occurs in January, with significant risk also occurring in December through March.

Impact on the Community and Vulnerability

Dracut's location in Northern Middlesex County places it at a high risk for winter storms, including damaging Nor'easters that typically track up the East Coast with severe winds, heavy snow, and blizzard conditions. Severe winter storms and nor'easters pose multiple threats and impacts to Dracut. Heavy snow or ice conditions can disrupt transportation and may impede the passage of emergency vehicles, and may also bring down trees and power lines, leading to large-scale power outages. Heavy accumulations of seasonal snowfall can also lead to roof collapses across the community.

[46] FEMA Disaster Declarations Summary: https://www.fema.gov/media-library/assets/documents/28318

As expected, a number of public safety issues can arise during severe winter storms. Impassible streets are a challenge for emergency vehicles but also will affect residents and employers. Snow-covered sidewalks force people to walk in streets, which are already less safe due to snow, slush, puddles, and ice. Large piles of snow can block sight lines for drivers, particularly at intersections. Not all residents are able to clear their properties (including roofs), especially the elderly. In addition, when that snow melts, the potential for flooding increases and the refreezing of melting snow can cause dangerous roadway and sidewalk conditions.

Recovery from a severe winter storm poses a number of challenges. Prolonged curtailment of all forms of transportation can have significant adverse impacts for people stranded at home, preventing the delivery of critical services such home heating fuel supplies or the ability to get to a local food store. Extended power outages, the cost of snow removal, repairing damages, and the loss of business can have severe economic impacts on local communities. The elderly and infirmed are populations of particular concern during these events.

Impacts of Climate Change

Climate change is expected to increase the amount of severe winter storms. This is due to "increased sea surface temperature in the Atlantic Ocean will cause air moving north over the ocean to hold more moisture. As a result, when these fronts meet cold air systems moving from the north, an even greater amount of snow than normal can be anticipated to fall in Massachusetts."[47]

Tornadoes

Hazard Description

A tornado is a narrow, violently rotating column of air that extends from the base of a cumulonimbus cloud to the ground. The observable aspect of a tornado is the rotating column of water droplets, with dust and debris caught in the column. Tornadoes are the most violent of all atmospheric storms.[48]

Location

The location of tornado impact is totally unpredictable. Tornadoes are fierce phenomena which generate wind funnels of up to 200 mph or more, and usually occur in Massachusetts during June, July, and August. Worcester County and areas just to its west have been dubbed the "tornado alley" of the state, as the majority of significant tornadoes in Massachusetts history have occurred in that region. Most tornadoes are a few dozen yards wide and touch down only briefly, but even small short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes may carve out a path over a mile wide and several miles long.

[47] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-224.
[48] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-242.

Extent

The Enhanced Fujita Scale (EF-scale), shown in Table 15, is used to categorize the strength and magnitude of tornado events based on estimated wind speeds and related damage. This represents an update to the original Fujita Scale (F-scale) and has been widely used since February 2007. For mitigation planning purposes the maximum probable extent of a tornado in Dracut is an EF-3.

Table 15. Enhanced Fujita Scale

Rating	Wind Speed (3 second gust)	Potential Damage
EF-0	65–85 mph	Light – Causes some damage to siding and shingles.
EF-1	86–110 mph	Moderate – Considerable roof damage. Winds can uproot trees and overturn singlewide mobile homes. Flagpoles bend.
EF-2	111–135 mph	Considerable – Most singlewide mobile homes destroyed. Permanent homes can shift off foundations.
EF-3	136–165 mph	Severe – Hardwood trees debarked. All but small portions of houses destroyed.
EF-4	166–200 mph	Devastating – Complete destruction of well - built residences, large sections of school buildings.
EF-5	Over 200 mph	Incredible – Significant structural deformation of mid- and high-rise buildings.

Previous Occurrences

Although Dracut hasn't experienced a confirmed tornado event, historical records indicate there have been numerous incidents across the surrounding region. According to NOAA's Storm Events Database, Middlesex County experienced a total of 18 tornado events since 1950 which have caused 1 fatality, 6 injuries, and an estimated $4.9 million in property damages. Prior to 2007, tornados were based on the Fujita Tornado Scale. During this period Middlesex County had 17 tornadoes classified as two (2) F0 events, nine (9) F1 events, four (4) F2 events, and (2) two F3 events. Beginning in 2007, tornados were rated based on the Enhanced Fujita Tornado Scale as described above. Since then, Middlesex County has had 1 recorded tornado event, which was classified as an EF-1 event.

Probability of Future Events and Changes Since the Previous Plan

According to the State Hazard Mitigation and Climate Adaptation Plan, Massachusetts experiences an average of 1.7 tornadoes per year. Tornadoes will continue to be a possible occurrence in Dracut, though it remains unlikely that very strong tornadoes (EF-3, EF-4, or EF-5) will strike the area.

Impact on the Community and Vulnerability

The damage caused by a tornado is a result of the high wind velocity and wind-blown debris, which is also often accompanied by lightning or large hail. Like other atmospheric hazards, the entire town of Dracut is uniformly exposed and susceptible to tornadoes. Thus, all populations are vulnerable, but especially those who are less mobile or capable to find adequate shelter. Tornadoes often develop so rapidly that little, if any, advance warning is possible making them a significant life/safety threat to people.

Impacts of Climate Change

According to the State Hazard Mitigation and Climate Adaptation Plan, "future environmental changes may result in an increase in the frequency and intensity of severe thunderstorms, which can include tornadoes."[49]

Other Severe Weather (strong winds/extreme precipitation)

Hazard Description

Several frequent natural hazards in Massachusetts—particularly strong winds and extreme precipitation events—occur outside of notable storm events. This section discusses the nature and impacts of these and other severe weather hazards, such as lightning and hail, and the ways in which severe weather occurrences are likely to respond to a changing climate.[50]

Location

Each community in the Northern Middlesex region is at equal risk of being impacted by a severe thunderstorm and it is not possible to predict where damage from such a storm might occur. Major storm events have been a recurring threat to Dracut throughout its history, from hurricanes bringing wind, intense precipitation, and localized flooding to winter storms delivering ice and snow. Notable historic events include impacts from the Great Hurricane of 1938, the most intense hurricane to ever strike Massachusetts. More recently, the town has experienced increasing regular storms (severe thunderstorms and other high wind or heavy rainfall events) with greater intensity. More intense storms delivering higher volumes of precipitation in a single event are expected to put significant pressure on dams, culverts, and other drainage infrastructure, which were all designed to handle smaller storms with more consistent distributions of precipitation.

[49] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-243.
[50] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-253.

Extent

The National Weather Service considers a thunderstorm to be severe if it produces hail at least ¾ inch in diameter, has winds of 58 mph or higher, or has the potential to produce a tornado. Lightning accompanies all thunderstorms and can cause death, injury, and property damage. Straight-line winds can exceed 100 mph and are responsible for most thunderstorm wind damage. A downburst, a small area of rapidly descending air beneath a thunderstorm, can reach speeds equal to that of a strong tornado. In addition, hail can cause substantial damage to property and crops. Large hailstones can fall faster than 100 miles per hour and can be very costly in terms of economic losses.

An average thunderstorm is 15 miles across and lasts 30 minutes; severe thunderstorms can be much larger and longer. Southern New England typically experiences 10 to 15 days per year with severe thunderstorms. The amount of precipitation from a 100-year 24-hour storm event has increased from approximately 7 inches to 9 inches for Boston. Based on this fact, Dracut may expect a similar increase.

Previous Occurrences

According to NOAA's Storm Events Database, Middlesex County experienced a total of 1,171 severe weather events since 1950 which have caused 2 fatalities, 62 injuries, and an estimated $11.3 million in property damage. These events include those recorded as high or strong wind, thunderstorm wind, heavy rain, or lightning as shown in Table 16.[51] Most of the wind-related casualties and recorded property damages were caused by downed trees or falling limbs and typical event impacts included power outages, road closures, and other relatively short-term disruptions. Lightning has been recorded as the cause for 1 fatality and 31 injuries across the county since 1996, in addition to nearly $3 million in property damages. This includes lightning striking and causing minor damage to a home in Dracut in August 2012. Although events classified as heavy rain resulted in no damages, these are separate from events classified by the NWS as "flood" or "flash flood" events which are more likely to have caused property damages (and are covered in this chapter under "Flooding").

Table 16. Other Severe Weather Events for Middlesex County, 1950 – October 2020

Event Type	# of Events	Fatalities	Injuries	Property Damage
High / Strong Wind	307	1	7	$3,941,000
Thunderstorm Wind	507	0	24	$4,356,650
Heavy Rain	112	0	0	$0
Lightning	58	1	31	2,901,600

[51] NOAA's Storm Events Database: https://www.ncdc.noaa.gov/stormevents/

Event Type	# of Events	Fatalities	Injuries	Property Damage
Hail	187	0	0	$75,250
Total	1,171	2	62	$11,274,500

Probability of Future Events and Changes Since the Previous Plan

Severe storms comprising of thunderstorms, high winds, and hail will continue to affect all of Dracut with increasing frequency and intensity. While these events may occur during any month, they are most likely to occur between May and August. In recent years there has been an observed shift in the type and timing of storms. Many storm events now encompass a mixture of rain, ice, and snow, making it more difficult to maintain safe, accessible roadways. Early season storms of wet, heavy snow when leaves were still on the trees have caused extensive damage to electrical infrastructure, leading to extended power outages.

Impact on the Community and Vulnerability

As mentioned above, one of the greatest impacts resulting from severe weather in Dracut is electrical power outages. During severe storms with strong winds, tree branches often fall and break electric lines, causing widespread power outages for local residents. In addition, storms that come with extreme precipitation are expected to put significant pressure on Dracut's dams, culverts, and other drainage infrastructure that were designed to handle smaller storms with more consistent distributions of precipitation. This problem manifests at points across the town and is acute where the local drainage systems concentrate and discharge, especially near areas such as Lakeview Avenue and other low-lying areas of town.

Impacts of Climate Change

According to NOAA, the effects of climate change on future severe weather events cannot be determined at the present time due to insufficient scientific evidence. However, multiple studies cite that the Northeast region of the US will continue experience more very heavy rainfall events which are often associated with severe thunderstorms and other extreme weather events. The Northeast has already experienced a larger increase in the intensity of rainfall events than any other region in the United States in the last fifty years, and this trend is expected to continue."[52]

[52] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-254.

Non-Climate Influenced Hazards

Earthquake

Hazard Description

An earthquake is a combination of different phenomena. An earthquake initiates with the sudden slip of rock on either side of a crack in the earth, called a fault. The sliding of the rock on the fault due to the rock slip radiates seismic waves in all directions. The seismic waves vibrate the ground surface and are experienced as earthquake ground shaking. Different kinds of seismic waves travel with different speeds and have different amplitudes or strengths. For this reason, even though the rock slip that initiates an earthquake might be over in a few or several seconds, the ground shaking radiated by a large earthquake slip on a fault can last many tens of seconds.[53]

Location

Because of the regional nature of the hazard, the entire community of Dracut is equally susceptible to earthquakes. Unlike other areas of the country where earthquakes occur along known fault lines, earthquakes in the Northeast do not correlate with the many known faults that exist in the region. They occur in the middle of plates, far from the plate boundaries. Much of the research on earthquakes in the northeast has involved attempts to identify pre-existing faults and other geological features that may be susceptible to such stress, but this has proven to be quite difficult.

Extent

The magnitude and intensity of an earthquake is measured by the Richter Scale and the Modified Mercalli Intensity (MMI) scale, respectively. The Richter Magnitude Scale (shown in Table 17) measures the amount of seismic energy released by an earthquake, while the Modified Mercalli Intensity Scale (shown in Table 18) describes the intensity of an earthquake based on its observed effects at a site where earthquake shaking is felt.[54] For mitigation planning purposes the maximum probable extent of an earthquake in Dracut is a 6.5 on Richter Scale and Intensity VII on Modified Mercalli Intensity Scale.

[53] http://nesec.org/earthquakes-hazards/
[54] http://nesec.org/earthquakes-hazards/

Table 17. Richter Scale

Magnitude	Effects
< 3.5	Generally, not felt, but recorded.
3.5 - 5.4	Often felt, but rarely causes damage.
5.4 - 6.0	At most, slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 - 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Table 18. Modified Mercalli Intensity Scale

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs.	
II	Feeble	Some people feel it.	< 4.2
III	Slight	Felt by people resting; like a truck rumbling by.	
IV	Moderate	Felt by people walking.	
V	Slightly Strong	Sleepers awake; church bells ring.	< 4.8
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves.	< 5.4
VII	Very Strong	Mild alarm; walls crack; plaster falls.	< 6.1

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
VIII	Destructive	Moving cars become uncontrollable; masonry fractures, poorly constructed buildings damaged.	
IX	Ruinous	Some houses collapse; the ground cracks; pipes break open.	< 6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread.	< 7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes, and cables destroyed; general triggering of other hazards.	< 8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves.	> 8.1

Previous Occurrences

Earthquakes occur on a regular basis in the Northeast US. According to the Weston Observatory Northeast Earthquake Catalog, more than 5,000 earthquakes have occurred in the region since 1638, including more than 1,500 earthquakes in New England and more than 350 with epicenters in Massachusetts. Generally, most earthquakes that occur in the Northeast US are small in magnitude and cause little to no damage, though ground shaking is felt across large areas due to the geologic composition and rock structure of the region. In terms of potential impacts, this makes the specific location of the epicenter in the Northeast less relevant than in other regions of the US.

Between 1924 and 2016, there were 105 earthquakes in the Northeast measuring a magnitude 4.5 or greater on the Richter scale. Out of these 104 earthquakes, 10 were centered within New England and the other 94 occurred within New York State and the Province of Quebec. Historically, moderately damaging earthquakes strike somewhere in the region every few decades, and smaller earthquakes are felt approximately twice per year. The largest known New England earthquakes occurred in 1638 (magnitude 6.5) in New Hampshire, and in 1755 (magnitude 5.8) offshore from Cape Ann northeast of Boston. The most recent New England earthquake to cause moderate damage occurred in 1940 (magnitude 5.6) in central New Hampshire. Reported damages included toppled chimneys, cracked walls, broken water pipes, fallen plaster, and broken furniture.

Based on past records, the maximum experienced earthquake intensities on the Mercalli Scale in Northern Middlesex County have been in the range of VI (where there is damage to objects indoors, the tremor is felt by all people indoors and outdoors, movement is unsteady, moderately heavy furniture moves, and pictures fall off walls) to VII (where there is damage to architecture, the tremors are frightening, it is difficult to stand, cracks occur in chimneys and plaster, bricks may fall, and stream banks may cave in).

Probability of Future Events and Changes Since the Previous Plan

Although New England has not experienced a damaging earthquake since 1755, seismologists state that a serious earthquake occurrence is possible. Based on the historic occurrences, which have been few and of limited severity, Dracut should be considered to be at a moderate risk for earthquake damage in the future. Because the region's geologic faults zones do not correlate strongly to earthquake locations or aid in predication of occurrence, it is difficult to determine level of probability. However, Dracut falls within a seismic zone with a peak ground acceleration value of 12-14%g, which is considered a moderate risk zone in terms of potential ground shaking and damage from such an event. This zone generally indicates that there is a 1 in 10 chance that in any given fifty-year period a potentially damaging earthquake will occur.

Impact on the Community and Vulnerability

The entire population of Massachusetts is potentially exposed to direct and indirect impacts from earthquakes. The degree of exposure depends on many factors, including the age and construction type of the structures where people live, work, and go to school, and the soil type these buildings are constructed on. Ground movement during an earthquake is seldom the direct cause of injury or death. Collapsing walls, falling objects, and flying glass cause most casualties. Buildings with foundations resting on unconsolidated landfill, old waterways, or other unstable soils are most at risk.

Most buildings and infrastructures in Massachusetts were constructed without specific earthquake-resistant design features. Massachusetts introduced earthquake design requirements into their building code in 1975 and improved building code for seismic reasons in the 1980s. However, these specifications apply only to new buildings or to extensively modified existing buildings. Buildings, bridges, water supply lines, electrical power lines and facilities built before the 1980s may not have been designed to withstand the forces of an earthquake. Seismic standards were upgraded in the 1997 revision of the State Building Code. Older buildings, including some historic properties, are most vulnerable to earthquakes. If bridges or other key infrastructure assets were damaged by an earthquake, that could lead to travel challenges. Underground infrastructure, such as water, gas or electric, may also be negatively impacted by an earthquake.

The greatest damage in the Northern Middlesex region from an earthquake event is likely to occur where structures were designed prior to seismic standards being incorporated into the State Building Code. Such structures are scattered throughout the region. In addition, older structures in the region

such as schools, hospitals, and fire stations, which are built of un-reinforced masonry and are particularly vulnerable to damage or collapse in the event of an earthquake.

Lastly, due to their potential widespread damage and disruption, earthquakes can greatly impact the region's economy, including loss of business functions, damage to inventories, relocation costs, wage losses, and rental losses due to the repair or replacement of buildings. According to the State Hazard Mitigation and Climate Adaptation Plan, in terms of vulnerabilities, residents may be displaced by earthquakes and some of those residents may require sheltering. Vulnerable populations tend to be the most susceptible to displacement; this may include those living at or below the poverty line and the elderly.

Impacts of Climate Change

The effects of climate change will have no relation to the probability or magnitude of future earthquake events.

Technological and Human Caused Hazards

Dam Failure

Hazard Description

A dam failure is the structural collapse of a dam that releases the water being detained or stored behind it. Dam failures are usually the result of the age of the structure, inadequate spillway capacity, or structural damage caused by an earthquake or flood. Failures due to prolonged periods of rainfall can result in overtopping (the most common cause), and total failure occurs if internal erosion, overtopping, or damage results in a complete structural breach. Overtopping occurs when a dam's spillway capacity is exceeded and portions of the dam that are not designed to convey flow begin to pass water, erode away, and ultimately fail. Other potential causes of dam failure include design flaws, foundation failure, internal soil erosion, inadequate maintenance, or mis-operation.

Location

According to the Massachusetts Office of Dam Safety's database, there are 4 state-regulated dams located in Dracut. These include two dams that are classified as Significant Hazard, where failure or improper operation may cause loss of life, property damage, and/or service interruptions as further described under the *Extent* portion of this hazard profile. Figure 19 shows the location of all dams with the Significant Hazard dams marked in red.[55] These two Significant Hazard dams are located on Beaver Brook and are not currently being used for any specific purpose. These dams were previously studied by the State which recommended the Town consider these dams for potential removal to eliminate restrictions to natural fish passage to the Merrimack River.

[55] Dam locations as derived from the Massachusetts Dams data layer provided by MassGIS, current as of 2012. Not all point locations have been confirmed by the Office of Dam Safety; however, the Significant Hazard dams for Dracut have been verified.

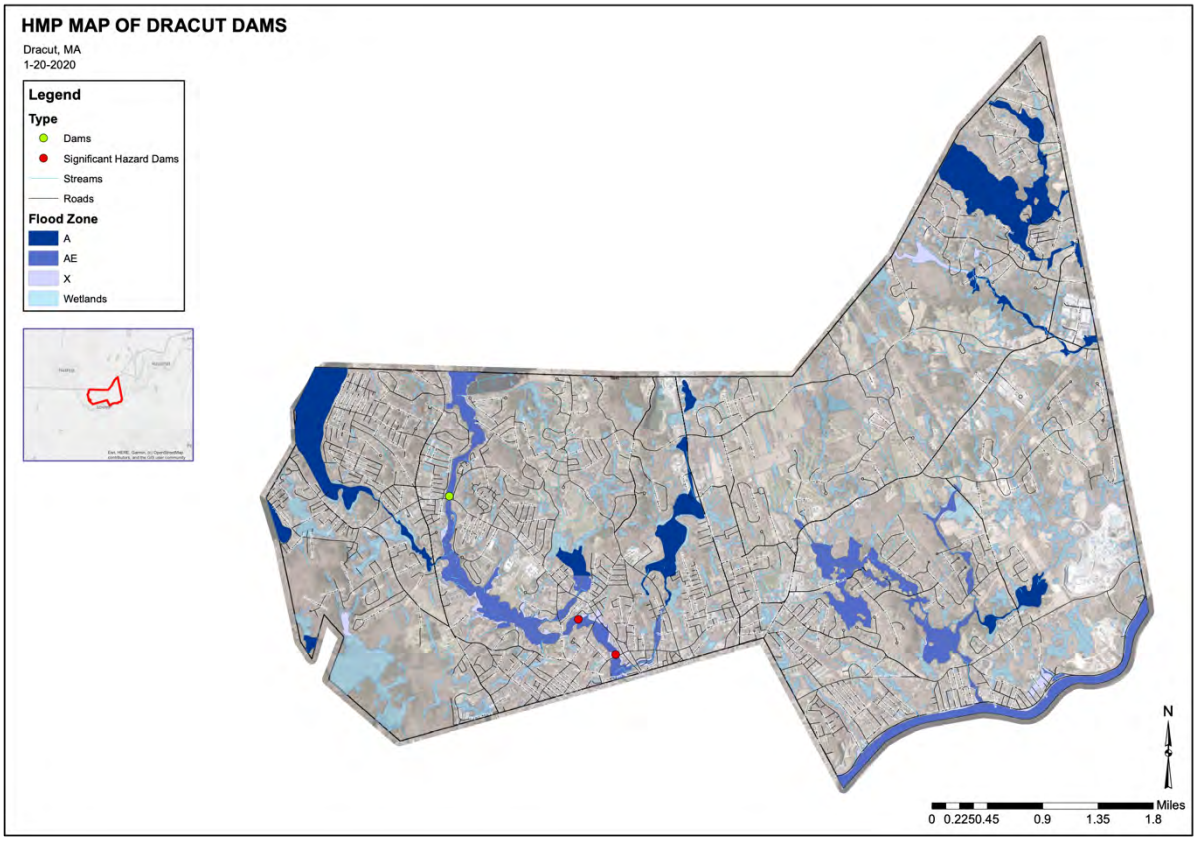


Figure 19. Dam Locations

All dams located in Dracut are privately owned, though the Office of Dam Safety has regulatory authority over those two with hazard classifications. More information on these dams is provided in Table 19. Other dams in Dracut are generally smaller and have not been issued hazard classifications. This includes another dam on Beaver Brook near Victory Lane that has not been inventoried or studied and has unknown ownership but was identified as a potential concern by participants in the Town's MVP planning process.

Table 19. State-Regulated Dams in Dracut

Dam Name	Owner Type	Impoundment Name	Hazard Classification	Downstream Population
Beaver Brook Dam	Private	Beaver Brook	Significant Hazard	250
Collinsville Dam	Private	Beaver Brook	Significant Hazard	500

Dam Name	Owner Type	Impoundment Name	Hazard Classification	Downstream Population
Peters Pond Dam	Private	Peters Pond	N/A	N/A
Old Tub & Dye Printing Works Dam	Private	N/A	N/A	N/A

Extent

Dam breaches often lead to catastrophic consequences as the water ultimately rushes in a torrent downstream, flooding an area engineers refer to as an "inundation area." The number of casualties and the amount of property damage depends on the timing of the warning provided to downstream residents, the number of people living or working in the inundation area, and the number of structures in the inundation area.

Dams in Massachusetts are assessed according to their risk to life and property. The State has three hazard classifications for dams:

- *High Hazard*: Dams located where failure or improper operation is likely to cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways, or railroads.
- *Significant Hazard*: Dams located where failure or improper operation may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways or railroads, or cause interruption of use or service of relatively important facilities.
- *Low Hazard*: Dams located where failure or improper operation may cause minimal property damage to others. Loss of life is not expected.

Previous Occurrences

Upon a review of data available from the Massachusetts Office of Dam Safety, the National Performance of Dams Program (NPDP) at Stanford University, the Association of State Dam Safety Officials, and NOAA's Storm Events Database, there have been no recorded dam failures causing impacts in Dracut. According to local Town staff and stakeholders, they are aware of the risk but have not experienced a dam failure or breach. Areas surrounding Beaver Brook Dam have flooded in the past, including flooding of the Lakeview Avenue Bridge, but these incidents are not attributed to the failure of the existing dam structure itself.

Probability of Future Events and Changes Since the Previous Plan

Dam failure is not a common occurrence, but dams do represent a potentially disastrous hazard. The likelihood of dam failure increases if dams are not maintained. In Massachusetts, all jurisdictional-dam owners are responsible for inspecting and maintaining their dams in safe operating condition. This includes hiring a qualified engineer to inspect and report results every 2 years for High Hazard dams, every 5 years for Significant Hazard dams, and every 10 years for Low Hazard dams. Owners of High or

Significant Hazard dams are also required to develop and annually update Emergency Action Plans (EAPs). For this reason, the probability of failure for state-regulated dams remains low.

Impact on the Community and Vulnerability

According to information previously gathered from the State's Office of Dam Safety, there are an estimated total of 750 people that could be impacted by dam failure events along Beaver Brook as noted in Table 19 (500 for Collinsville Dam and 250 for Beaver Brook Dam).

During the Town of Dracut's MVP planning process, three dams along Beaver Brook (including Dracut's two Significant Hazard dams in addition to another of unknown ownership near Victory Lane) were identified as a vulnerability of concern. Their possible future removal was identified as a high priority for resiliency improvements during the Town's MVP Workshop. The Town has also previously expressed concern over the lack of coordination between New Hampshire and Massachusetts officials relative to dam releases upstream on Beaver Brook, as such releases have caused flooding in Dracut in the past.

Climate Change Impact

It is anticipated that the effects of climate change will not increase the probability of dam failure events, though projected increases in the frequency of extreme precipitation events (as described in previous sections) should continue to be considered in the regulation, construction, operation, and maintenance or repair of dam structures. As further explained in the State Hazard Mitigation and Climate Adaptation Plan, there are a number of ways in which climate change could alter the flow behavior of a river, causing conditions to deviate from what the dam was initially designed to handle. Therefore, although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures.[56]

Critical Facilities

Critical facilities are considered structures or institutions necessary for the Town of Dracut in terms of emergency response and recovery. These facilities must continue to operate during and following a disaster to reduce the severity of impacts and accelerate recovery. Critical facilities typically include airports, emergency operation centers (EOCs), fire stations, hospitals, police stations, schools, government buildings, and railroad stations. Table 20 lists critical facilities as identified by Town staff through previous emergency management and hazard mitigation planning processes. Below the table are some additional critical facilities as identified by the Town's MVP Core Team in 2020.

[56] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. September 2018. P. 4-5.

Table 20. Critical Facilities

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

Additional Critical Facilities (per MVP Core Team)

- New Fire Station to go live Spring 2021, located at 539 Nashua Road.
- Town-owned and Operated Sewer Pump Stations:
    - 75 Autumn Road

    - 2 Beaver Brook Road
    - 136 Black Oak Lane
    - 136 Broadway Road
    - 1521 Broadway Road
    - 8 Cherrywood Drive
    - 30 Clough Drive
    - 59 Coach Drive
    - 70 Cricket Lane
    - 16/17 Douglas Drive
    - 40 Indian Hill Road
    - Liakos Way (375 Pelham Road)
    - 1560 Mammoth Road
    - 525 Merrimack Avenue
    - 361A Salem Road
    - 56 Scott Street
    - 88 Wheeler Street
- Privately Owned and Operated Sewer Pump Stations:
    - 65 Stonebridge Drive
    - 15 Royal Avenue
    - 253 Broadway Road
    - 1540 Lakeview Ave School Complex
    - 8 Cedar Creek Drive
    - 38 Regency Drive
    - 58 Regency Drive
    - 3 Schiripo Way
    - 37 Honeybee Road
- 3 Water Booster Stations (Owned and Operated by Kenwood Water Department):
    - Methuen Street @ Lowell Line
    - 626 Arlington Street
    - 128 Autumn Road

Other Community Assets and Key Resources

In addition to the above listed critical facilities, there are many other community assets and key resources throughout the town. These include those infrastructure elements and other public facilities described in Chapter 2 such as the local transportation network, utilities, water supply systems, stormwater infrastructure, and other facilities that provide important services to residents and businesses across the community. These also include Dracut's natural, cultural, and historic resources that contribute to the town's character and are important to continue preserving and protecting against the threat of natural hazards or other potential adverse impacts.

Although there are no local historic places or districts on the National Register of Historic Places within Dracut, there are certain areas and some specific structures identified for potential future listing per the Town's 2012 Preservation Plan. These include but are not limited to the Old Meeting House (10 Arlington Street), Merrimack Woolen Mills complex (76 Pleasant Street), Dracut Center School (11 Spring Park Avenue), Kenwood School (920 Methuen Street), and St. Mary's of the Assumption Church (1868 Lakeview Avenue). The Preservation Plan recommended that seven historic districts be established in Dracut.

National Flood Insurance Program Insured Structures

> B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))

According to FEMA records as of August 12, 2020, there are 37 active NFIP policies in Dracut that provide approximately $10.8 million in insurance coverage. The majority of these policies (26) are single family structures, along four other residential structures (e.g., multi-family, condominium) and seven non-residential structures. Fifteen of these structures are located in FEMA-mapped special flood hazard areas while the remaining 22 are located in areas classified as moderate to low risk of flooding. Total annual premiums for these properties are approximately $68,000, and to date nearly $360,000 in claims have been paid to NFIP policyholders under a total of 23 recorded losses.

In an effort to further understand flood impact, including financial impact, information was gathered from the Massachusetts Department of Conservation and Recreation regarding repetitive loss properties. Repetitive loss properties are those for which two or more losses of at least $1,000 each have been paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978.

According to FEMA records, there are 2 repetitive loss structures in Dracut. Dracut's repetitive loss properties consist of one single-family residential structure and one non-residential structure, with a combined total of four flood losses totaling approximately $182,000 in claims paid. Per NFIP records both properties are located in FEMA-mapped special flood hazard areas.

Severe repetitive loss properties are residential properties that have at least four NFIP payments over $5,000 each and the cumulative amount of such claims exceeds $20,000, or at least two separate claims payments with the cumulative amount exceeding the market value of the building. According to current NFIP records the Town of Dracut has no severe repetitive loss properties located within its jurisdiction.

Summary of Vulnerability

The Town's previous hazard mitigation plan (2015 NMCOG Regional Hazard Mitigation Plan listed the region including Dracut to be most at risk to wildfire, earthquake, nor'easters, hurricanes, ice storms, snowstorms, and blizzards. Moderate risks included flooding, urban fire, and drought and low risks included ice jams, dam failure, and tornadoes.[57] The updated risk analysis for Dracut generally agrees with the previous list though there are some notable differences, such a higher hazard ranking for flooding, and lower hazard rankings for earthquake and wildfire. The Town of Dracut's updated hazard rankings for 2020 are shown in Table 21.

Table 21. Hazard Ranking

Hazard Ranking	Hazards
High	Flooding Severe Winter Storm/Nor'easter Hurricanes/Tropical Storms Other Severe Weather
Moderate	Average/Extreme Temperatures Drought Earthquake Tornadoes Wildfires
Low	Dam Failure Invasive Species

[57] Hazard Mitigation Plan for the Northern Middlesex Region. Northern Middlesex Council of Governments (NMCOG). 2015. P. 113.

Chapter 5. Capability Assessment

The purpose of the capability assessment is to identify the strengths and weaknesses of the town in terms of mitigating risks. The capability assessment looks at current proficiencies as well as any change in capabilities from the previous mitigation plan and serves as the foundation for designing an effective hazard mitigation strategy. It not only helps establish the goals for the mitigation plan but ensures that those goals are realistically achievable under local conditions.

The capability assessment looks at the town's pre- and post-disaster hazard management capabilities and its financial resources for mitigating risk. Government departments, first responders, and regional resources were all considered. The Town of Dracut is prone to flooding, severe winter storms, hurricanes, and extreme temperatures. Government and business leaders are aware of these risks and work to proactively mitigate risks. The town has a history of securing grants to mitigate risk.

> C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))

The Summary of Findings from the Community Resilience Building Workshop developed in December 2020 included a list of current strengths and assets. This list was reviewed and sorted to represent strengths and assets in infrastructure, environment, and society. These three categories were chosen because of their relevance and consistency with the Municipal Vulnerability Preparedness Program and because they were used in the Mitigation Strategy.

For reference, the categories include the following list of potential facilities, as defined on pages 12 and 13 in the Community Resilience Building Workshop Guide.

1. **Infrastructure**: culverts, bridges, stormwater basins, conveyances, roads, public water supply, wastewater infrastructure, underground storage tanks, electrical and communications infrastructure, buildings and facilities, beavers, dams, Berkshire gas, microgrid
2. **Environment**: Polychlorinated biphenyls (PCBs), wildlife habitat, trees and forests, invasive species, water quality, local agriculture, debris management
3. **Society**: water-based recreation, vulnerable neighborhoods, vulnerable populations, communications systems, shelters, schools, childcare centers, pest and disease control, provisions, medicine and fuel, economic revitalization, stress on emergency services, transportation, local and state regulations, parks, open space

As noted on p.24 of the Community Resilience Building Workshop Summary of Findings, some strengths and assets may also be considered vulnerabilities. For instance, infrastructure such as the water booster

pump station on Methuen Street is a benefit to the community but it is also in need of repair. The two graphics below show a complete list of strengths and vulnerabilities taken from the Summary of Findings.

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

Figure 20. Current Strengths and Assets

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) • UMass 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 •

Figure 21. Current Vulnerable Areas and Attributes.

FEMA defines four types of capabilities.

1. **Planning and Regulatory Capabilities:** capabilities based on the jurisdiction's implementation of ordinances, policies, local laws, State statutes, and plans and programs that relate to managing growth and development.
2. **Administrative and Technical Capabilities:** capabilities associated with the jurisdiction's staff, skills, and tools that can be used for mitigation planning and implementation.
3. **Financial Capabilities**: the fiscal resources a jurisdiction has access to or is eligible to use to fund mitigation actions.
4. **Education and Outreach:** programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Town leaders completed a questionnaire regarding capabilities. The questionnaire was based on the one in FEMA's *Local Mitigation Planning Handbook* and is broken into the four categories defined above. Additional information for the Capability Assessment was gathered from review of town plans, the CRB Workshop and stakeholder conversations.

Planning and Regulatory Capabilities

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. The first step in the capability assessment was to gather and review existing plans to understand the town's current ability to mitigate risk. Information regarding current plans is included in the table below.

Table 22. Planning and Regulatory Capability documents

Planning/Regulatory Tool	Responsible Authority Dracut	General Description and Effectiveness for Hazard Risk Reduction Dracut
Plans		Does the plan address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan	Planning Board/Community Development/Board of Selectmen	The plan addresses hazards. The plan needs to be more comprehensive to include mitigation strategies and actions.
Open Space and Recreation Plan (OSRP)	Open Space Committee/ Planning Board/ Conservation/ Recreation	No. There is a mitigation action for updating the OSRP.

Planning/Regulatory Tool	Responsible Authority Dracut	General Description and Effectiveness for Hazard Risk Reduction Dracut
Hurricane/Emergency Plan	EMA/Fire Department	Included in CEMP.
Economic Development Plan	Board of Selectmen	No
Capital Improvements Plan	Town Manager/Finance Committee/Respective Departments	The Plan addresses hazards, but is not comprehensive enough to address mitigation strategies and actions.
Emergency Operations Plan	EMA	All hazards .
Continuity of Operations Plan	None	No
Transportation Plan	DPW/Engineering Department/Town Manager/Board of Selectmen	No
Stormwater Management Plan	Stormwater Department/DPW/Engineering	The plan does not effectively address hazards/mitigation strategies/mitigation actions in its' entirety.
Wastewater Management Plan	Sewer Department/DPW	No
Historic Preservation Plan	Historical Society	No
Community Wildfire Protection Plan	FD	Minimal risk, included in CEMP.

Planning/Regulatory Tool	Responsible Authority Dracut	General Description and Effectiveness for Hazard Risk Reduction Dracut
Building Code, Permitting, and Inspections		
Building Code	Building Department	The plan does not effectively address hazards/mitigation strategies/mitigation actions in its' entirety.
Fire Department ISO Mitigation Ratings	FD and water departments	I believe we are at a 4/7 manpower and water are obstacles.
Site Plan Review Requirements	Planning Board/Community Development Director/Board of Selectmen	The plan addresses hazards, but needs help with addressing mitigation strategies/actions.
Zoning and Development Regulations		
Zoning Bylaws/Ordinances	Zoning Board/Building Dept.	Includes a flood zone ordinance. The mitigation actions include revision of the Zoning Bylaw.
Subdivision Regulations	Planning Board/Community Development Director	The plan does not effectively address hazards/mitigation strategies/mitigation actions in its' entirety.
Floodplain Regulations	Planning Board/Building Dept.	The plan does not effectively address hazards/mitigation strategies/mitigation actions in its' entirety.
Stormwater Management Regulations	Stormwater Manager/Stormwater Permitting Authority/DPW	Currently, there are only bylaws in place, no rules and regs have been fully developed. The plan does not effectively address hazards/mitigation strategies/mitigation actions in its' entirety.

Planning/Regulatory Tool	Responsible Authority Dracut	General Description and Effectiveness for Hazard Risk Reduction Dracut
How can these capabilities be expanded and improved to reduce risk? Communication coordination, organization and reformatting of the bylaws. These are addressed in with this Plan's mitigation actions.		
Have you adopted new policies, plans, regulations, or reports, since the original plan, that could be incorporated into this plan? What has changed since the original plan? No.		

Town officials completed the Safe Growth Survey. This is a survey designed to capture general information about how the town is positioned to grow safely relative to natural hazards. It is included in Appendix C. The table below shows the average score for each category of question. Based on a scale of 1 to 5 (with 1 being Strongly Disagree and 5 being Strongly Agree), the results show that Dracut's town officials believe their Safe Growth policies are strong.

Table 23. Safe Growth Survey Results

Category	Average Score
Land Use	3.3
Transportation	2.6
Environmental Management	2.6
Public Safety	3
Zoning Ordinance	3
Subdivision Regulations	2.6
Capital Improvement Program and Infrastructure Policies	2.6
Other	3

Administrative and Technical Capabilities

The Town of Dracut is well-staffed, which is reflected in the responses gathered for this section of the survey. The town also participates in regional and local groups such as the Long Pond Clean Water Committee and projects organized by the Northern Middlesex Council of Governments.

Table 24. Administrative and Technical Capabilities

Administrative/Technical Resource	Full-time (FT)/Part-time (PT)/Volunteer (V)	General Description and Effectiveness for Hazard Risk Reduction Dracut
Administration		Describe capability. Is coordination effective?
Planning Board/Commission	V	Good Working group – can be effective with guidance.
Local Planning Team (for Mitigation Planning)	FT	Limited staffing levels/focuses on economic growth.
Conservation Commission	FT/V	1 full time employee and a volunteer board - Focus on wetland mitigation.
Mutual Aid Agreements	FT	Statewide mutual aid agreements in place.
Staff		Is staffing adequate to administer programs/enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?

Administrative/Technical Resource	Full-time (FT)/Part-time (PT)/Volunteer (V)	General Description and Effectiveness for Hazard Risk Reduction Dracut
Chief Building Official	FT	Staffing levels are not adequate to administer programs/enforce regulations. Staff is trained on hazards and mitigation. Coordination between agencies and staff are effective.
Floodplain Administrator	FT	Staffing levels are not adequate to administer programs/enforce regulations. Staff is somewhat trained on hazards and mitigation. Coordination between agencies and staff are effective.
Emergency Manager	PT	Yes, trained certified MEMD and good coordination.
Community Planner	FT	Staffing levels are not adequate to administer programs/enforce regulations. Staff is trained on hazards and mitigation. Coordination between agencies and staff are effective.
Civil Engineer	FT	Staffing levels are not adequate to administer programs/enforce regulations. Staff is not trained on hazards and mitigation. Coordination between agencies and staff are effective.

Administrative/Technical Resource	Full-time (FT)/Part-time (PT)/Volunteer (V)	General Description and Effectiveness for Hazard Risk Reduction Dracut
GIS Coordinator	Vacant FT Position	This was a full-time position, however that person is now retired, and with the financial effects of COVID-19, this person will not be filled at this time.
Resource Development Staff or Grant Writers	N/A	Currently, each department is responsible for finding/writing their own grants.
Public Information Officer	FT	Town Manager and Town Clerk.
Technical		Describe capability. Has capability been used to assess/mitigate risk in the past?
Staff with knowledge of land development and land management practices	FT	This is knowledge between all department staff that participate in new and redeveloping sites with special permits and or site plan review processes.
Staff trained in construction practices related to buildings and/or infrastructure	FT	Building Department, Engineering Department, and Public Works Department.
Staff with an understanding of natural hazards and risk mitigation	FT	Staffing levels are not adequately trained on hazard risk reduction.
Hazards data and information	FT	No formal list/data is distributed to all departments.
Warning systems/services (e.g., Reverse 911, outdoor warning signals, etc.)	FT	Code Red used for emergency and general notifications.

Administrative/Technical Resource	Full-time (FT)/Part-time (PT)/Volunteer (V)	General Description and Effectiveness for Hazard Risk Reduction Dracut
Opportunities to Improve, Expand, or Enhance for Hazard Risk Reduction Purposes		
Coordination with associated departments to develop interactive GIS mapping/identifying risks and monitoring progress for mitigation risks.		
Are there different or additional administrative, human, technical, and financial resources available for mitigation planning since the original plan was developed? No- more community input could be utilized.		

Financial Capabilities

Financial capabilities include any and all funds collected for the use of hazard mitigation. The town does not have a grant writer on staff; each department usually prepares their own grant.

Table 25. Financial Capabilities

Financial Tool/Source	Accessible for Hazard Mitigation (Yes/No)	General Description and Effectiveness for Hazard Risk Reduction Dracut Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
General funds	No	No
Capital Improvement Program (CIP) funding	Yes	No
Special purpose taxes	No	No
Fees for water, sewer, gas, or electric services	Yes	No

Financial Tool/Source	Accessible for Hazard Mitigation (Yes/No)	General Description and Effectiveness for Hazard Risk Reduction Dracut Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Stormwater utility fee	No	No
Development impact fees	No	No
Incur debt through general obligation bonds and/or special tax bonds	No	No
Incur debt through private activities	No	No
FEMA Hazard Mitigation Assistance (HMA)	yes	For sewer pump station repairs, yes it could be used again.
HUD Community Development Block Grant (CDBG)	Limited Eligibility	No
Other federal funding programs	No	No
State funding programs	yes	Hazard mitigation grants .

Education and Outreach Capabilities

Education and outreach capabilities include emergency training, public outreach campaigns, and other school or business-related education programs focused on hazard mitigation.

Table 26. Education Capabilities

Program/Organization	Yes/No	Description and Effectiveness for Hazard Risk Reduction Dracut Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	No	
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	yes	FD has SAFE programs for Schools and elderly.
Natural disaster or safety-related school programs	No	
StormReady certification	No	
Firewise Communities certification	No	Extremely low risk of wildfire.
Public-private partnership initiatives addressing disaster-related issues	No	

National Flood Insurance Program Participation

C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))

The Town of Dracut is in good standing with the National Flood Insurance Program (NFIP). They entered the NFIP on 8/9/1974. The Flood Insurance Rate Map (FIRM) is from 7/2/1980 and the effective rate map is from 7/7/2014. Dan McLaughlin, Building Inspector is the town's designated Floodplain Administrator. A mitigation action is included for NFIP compliance to expand the town's compliance efforts and to certify the Floodplain Administrator.

A pre-FIRM building is a building for which construction or substantial improvement occurred on or before December 31, 1974, or before the effective date of an initial Flood Insurance Rate Map (FIRM). A post-FIRM building is a building for which construction or substantial improvement occurred after December 31, 1974, or on or after the effective date of an initial FIRM, whichever is later.

The Town of Dracut does not participate in the Community Rating System (CRS). The CRS is part of the NFIP. It is a voluntary program for recognizing and encouraging community floodplain management activities exceeding the minimum NFIP standards. Any community in full compliance with the minimum NFIP floodplain management requirements may apply to join the CRS. Flood insurance premium rates are discounted under the CRS program.

The town's Zoning Bylaws prohibit building in the floodplain. However, these bylaws are outdated, and a mitigation action is included to update the bylaws based on climate change projection data and current State and Federal regulations. The town participated in a 2016 MS4 Permitting Workshop that included floodplain management provision.

When asked about possible new actions related to NFIP compliance, town leaders checked the following boxes in the NFIP Program Survey.

- Maintain digital FEMA elevation certificates for all construction in the floodplain.
- Evaluate and consider the adoption of "higher standards" that are proven to reduce flood damage such as those described under Question #3 (especially freeboard, setbacks, limitations on lower-level enclosure size, and the prohibition on use of fill).
- Evaluate permit application forms to determine possible modifications focused on flood hazard prevention.
- Develop a checklist for review of building/development permit plans and for inspection of development in floodplains (a model is available).
- Establish a goal to have each plan reviewer and building inspector attend a related training periodically (for example, ASFPM's Annual National Conference, chapter conferences, webinars, etc).
- Sponsor a periodic NFIP workshop for local surveyors and builders.
- Encourage or require certain local staff positions to obtain and maintain Certified Floodplain Manager (CFM) certification.
- Maintain a map of areas that flood frequently (e.g., areas where repetitive loss properties are located) and prioritize those areas for inspection immediately after the next flood. If outside FEMA special flood hazard areas, consider requiring existing NFIP regulatory standards (compliance with existing ordinance) through overlay zoning, etc.

- Maintain supplies of FEMA/NFIP materials to help property owners evaluate measures to reduce potential hazard damage. Make available in public buildings, local library, website, etc. and inform people who they can call to learn more information.

Summary of Findings and Conclusions

The Town of Dracut has risk-mitigating capacity, and, more importantly, is actively working to increase this capacity. The town is in good standing with the NFIP and have included a mitigation action to expand this ability. They are aware of their risks and are committed to mitigating those risks in multiple ways. The town is in the process of updating their wetlands and zoning bylaws and they are actively investigating opportunities to secure funding toward dam removal. They have participated in an Impervious Surfaces study and a Wind Study. The town government has the capacity to fulfill the needs of the town and have successfully secured funding in the past to support projects. The town would benefit from expanding their public outreach and stakeholder engagement. In the future, the Town of Dracut intends to expand their capabilities to mitigate risk by implementing the actions in the mitigation strategy and maintaining this Hazard Mitigation Plan Update.

Chapter 6. Mitigation Strategy

The hazard mitigation strategy is the culmination of work presented in the planning area profile, risk assessment and capability assessment. It is also the result of multiple meetings and thorough public outreach. The work of the Core Team was essential in developing the mitigation goals and actions included in this chapter. As described in Chapter 3 Planning Process, the Core Team worked in a consistent, coordinated manner to identify and prioritize the goals and mitigation actions for this Plan.

Mitigation Goals

> *C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))*

Mitigation *goals* represent broad statements that are achieved through the implementation of more specific mitigation *actions*. These actions include both hazard mitigation policies (such as land use regulations) and hazard mitigation projects (such as structure or infrastructure projects). The 2015 Hazard Mitigation Plan for the Northern Middlesex Region included sixteen goal statements for the region. The Core Team developed seven goal statements for the Municipal Vulnerability Preparedness (MVP) plan. In consideration of the previous plan's goal statements and the MVP goals, the Core Team developed five goal statements for this plan. The concepts from the previous goal statements are included such as preventing development in hazard prone areas, protecting critical facilities, increasing outreach and education, and expanding the town's capacity. Climate change is viewed in this plan as something that exacerbates natural hazards and mitigating this risk is prioritized throughout this plan and the following mitigation goal statements and actions. The Core Team developed these goal statements to reflect priorities as well as the highest hazards identified in the Community Resilience Building Workshop. The figure below shows the current list of goal statements.

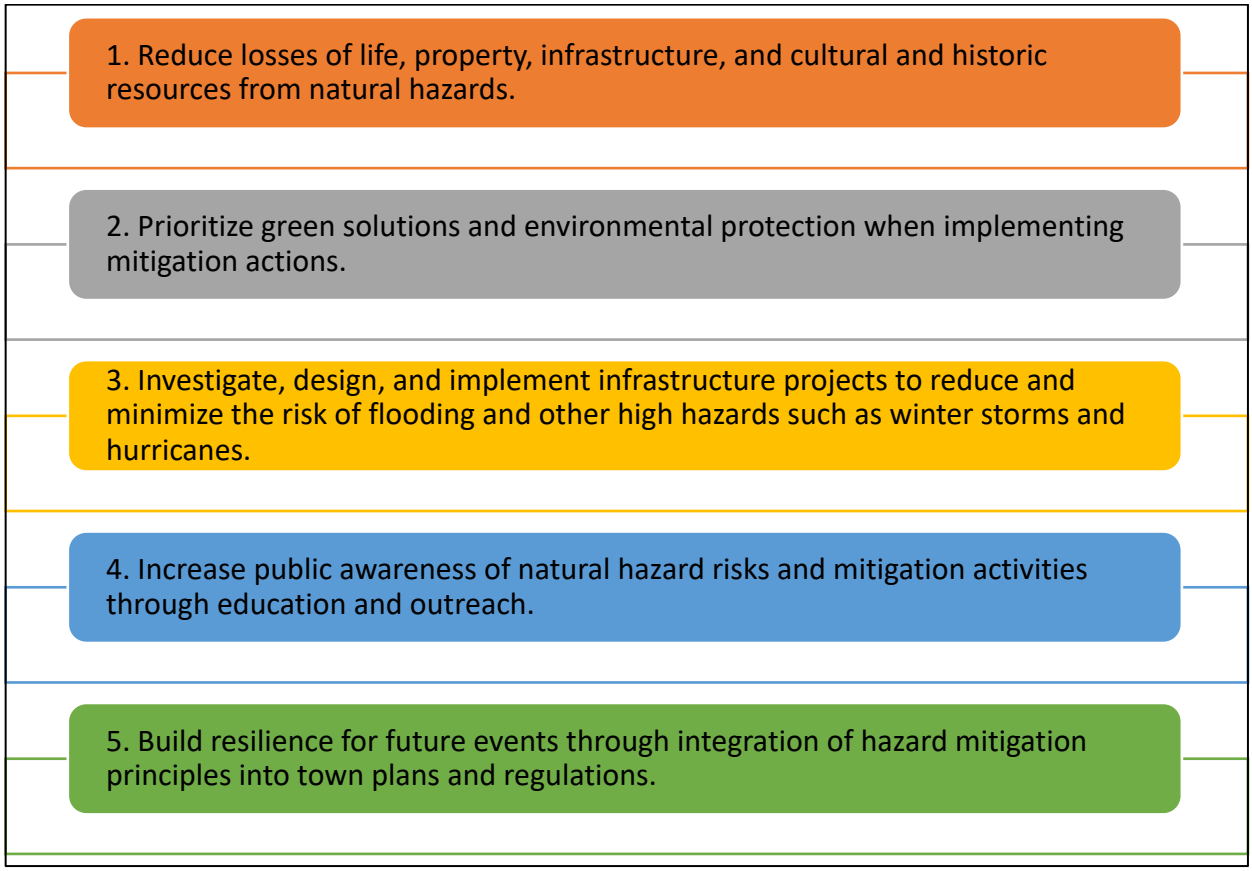


Figure 22. Mitigation Plan Goal Statements.

Climate change is identified as a significant concern and adaptation as a priority for the town. The town's biggest natural hazard concerns are flooding, severe winter storm/nor'easter, hurricanes/tropical storms, and extreme temperatures, the town is actively working to mitigate those risks and they are prioritizing green solutions. Finally, increasing public awareness and the public's ability to mitigate risk is a priority for the Core Team.

Mitigation Actions

> *C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))*

The Core Team reviewed the mitigation actions from the 2015 Hazard Mitigation Plan for the Northern Middlesex Region to identify completed actions and those needing revision. The following table shows

the previous plan's 21 mitigation actions and the current status of each. Some of the actions that were marked to "Keep for Updated Plan," were included in this plan in combination with other actions.

Table 27. 2015 Mitigation Action Status.

	Mitigation Action	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?
1	Replace the Kelly Road culvert and construct drainage improvements.	No	Cancelled	The area was repaired, and no additional mitigation actions are required.	No
2	Continue to work with NMCOG in exploring the possibility of establishing an Regional Emergency Communications Center (RECC).	No	Not during this time	Should be continued	Yes
3	Study mitigation options to address riverine flooding on Nottingham Road.	Yes	Partially completed & in progress	The Water Department flood proofed the pump station, however there is still mitigation work to be done at the residential level to address flooding issues	Yes
4	Increase public awareness of the dangers of extreme temperatures and outline locations where vulnerable populations (elderly, homeless and those with health issues) can have access to air conditioning or shelter from the cold	Yes	Completed & to be continued	The Town has been very communicative with vulnerable populations to have access to air conditioning or shelter from the cold. This is a continuous effort during dangers of extreme temperatures	Yes
5	Continue system upgrades and water main replacements, as funds allow.	Yes	Partially completed & in progress	Inspections and upgrades are conducted on an on-going basis and where funds are available	Yes

	Mitigation Action	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?
6	Study overflow/flooding issues created by restricted stormwater outfall on private property which result in significant flooding during heavy rain events	Yes	Partially completed & in progress	Through the MS4 permit, the Town is accessing and studying overflow and flooding issues related to Stormwater and its outfalls on both private and public properties	Yes
7	Identify and remove hazardous trees in the town-owned right-of- way.	Yes	Completed & to be continued	The integrity and wellness of trees are being assessed every day	Yes
8	Work with DCR Bureau of Fire Control to complete mapping of the state forest for public safety purposes.	Yes	Completed	A Complete map was produced	No
9	Develop a joint Fire Wise Program in cooperation with DCR, the City of Lowell and the Town of Tyngsborough.	No	Cancelled	The Town looked into doing this, but the findings concluded that there are no concerns for encroachment of fire bordering the shared state forest between DCR, City of Lowell, and Town of Tyngsborough.	No
10	Continue to identify NFIP non-compliant structures and submit to rate structures.	Yes	Partially completed & in progress		Yes
11	Continue to work toward certification of the Building Commissioner as the town's flood plain manager	Yes	Completed & to be continued	The Building Inspector/Building commissioner is certified as the Town's Flood Plain Manager	Yes

	Mitigation Action	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?
12	Work with federal and state officials to address existing compliance issues relative to the NFIP.	Yes	Completed & to be continued	On-going activity	Yes
13	Ensure that administrators of schools, businesses, and medical facilities have a shelter plan in the event of a tornado warning	Yes	Completed & to be continued	This is issued through the fire department. Richardson School is the official Town Shelter	Yes
14	Complete remaining phases of the sewer program.	Yes	Completed	The remaining phases of the sewer program is completed, however the Town is inspecting and evaluating the sewer system. Replacements are being conducted when it is determined that it is failing, has aged, or there are any issues that warrant a replacement.	Yes
15	Distribute educational information to residents and businesses on protecting life and property from severe winter storm events	No	In progress	The town posts messages on Facebook and on the town website about storms, but it does not talk about protecting life and property. No material is specifically distributed to businesses	Yes
16	Inspect public buildings to evaluate the capacity to withstand snow loads and prevent roof collapse. Develop plans to clear roofs of excessive snow	Yes	Completed & to be continued	This is an on-going activity. The building inspector consistently inspects public buildings and evaluates them. The building maintenance supervisor has a plan to remove excess snow from	Yes

	Mitigation Action	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?
	accumulations to prevent collapse.			roofs after major snow events.	
17	Identify locations for snow storage farms for utilization in severe winters with heavy snowfall	Yes	Completed & to be continued	The Town continuously evaluates snow storage locations before the winter of every year	Yes
18	Evaluate public buildings and critical facilities for the potential to withstand high winds	No	No progress has been made	Unknown	Yes
19	Assess bridges and roadways to ascertain their capability to support fire apparatus and develop alternative routing plans where deficiencies are noted	Yes	Completed & to be continued	Currently, all bridges and roadways in Town is able to support fire apparatus. As additional bridges are presented and subdivisions are filed, they will be continued to be assessed.	Yes
20	Develop an inventory of public buildings that do not currently meet seismic standards	Yes	Completed	On-going effort as seismic standards can change	Yes
21	Provide information to homeowners on how to protect their property from brush fire or wildfire during times of drought	Yes	Completed	Information can be found with the Fire Department. Residents to acquire a burning permit	No

Comprehensive range of mitigation actions

The Core Team worked simultaneously on the Municipal Vulnerability Preparedness project and the development of the Hazard Mitigation Plan, for this reason the mitigation actions were developed for both projects. They initially reviewed the list of high-, medium- and low-priority recommendations from the CRB Workshop Summary of Findings. They then considered actions from the previous plan to move

forward and considered the full list of natural hazards and high hazard areas. They reviewed the risk assessment and capability assessment.

In addition to the suggestions from the Community Resilience Building Workshop Summary of Findings, a comprehensive range of mitigation actions were considered. During each Core Team meeting, the group was educated on the possible range of mitigation actions. The Federal Emergency Management Agency's online *Mitigation Ideas* publication was shared, and the following list of example actions was shared electronically with the Core Team.

Types of Mitigation Actions

Local Plans and Regulations

- Comprehensive plans
- Land use ordinances
- Subdivision regulations
- Development review
- Building codes and enforcement
- NFIP Community Rating System
- Capital improvement programs
- Open space preservation
- Stormwater management regulations and master plans

Structure and Infrastructure Projects

- Acquisitions and elevations of structures in flood-prone areas
- Utility undergrounding
- Structural retrofits
- Floodwalls and retaining walls
- Detention and retention structures
- Culverts

Natural Systems Protection

- Sediment and erosion control
- Stream corridor restoration
- Forest management
- Conservation easements
- Wetland restoration and preservation

Education and Awareness Programs

- Radio or television spots
- Websites with maps and information
- Real estate disclosure
- Presentations to school groups or neighborhood organizations
- Mailings to residents in hazard-prone areas

Preparedness and Response Actions

- Creating mutual aid agreements with neighboring communities to meet emergency response needs
- Purchasing radio communications equipment for the Fire Department
- Developing procedures for notifying citizens of available shelter locations during and following an event

Mitigation Action Plan

> *C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))*

An online Mitigation Action Tracker was developed for the town to track the implementation of each mitigation action. The Mitigation Action Tracker is a Google Sheet with separate tabs showing pre-sorted actions and can sort the list of actions based on a number of criteria.

During the Community Resilience Building Workshop, participants prioritized all identified actions by high, medium, or low for priority. Choices were made based on guidance in the *Community Resilience Building Workshop Guide*:

- Funding availability and terms
- Agreement on outstanding impacts from recent hazard events
- Necessity for advancing longer-term outcomes
- Contribution towards meeting existing local and regional planning objectives[58]

After each item was prioritized, workshop participants discussed and then agreed upon the highest-priority actions across the three profiles of infrastructure, society, and environment. These decisions were made based on "existing programs into which priority actions can be integrated easily or used to strengthen related actions with existing funding."[59] The Core Team reviewed these lists and refined them to develop the current list of mitigation actions and their priority order.

The Core Team further refined the list of mitigation actions to include:

- 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

[58] The Nature Conservancy. *Community Resilience Building Workshop Guide*. Retrieved from https://docs.wixstatic.com/ugd/29a871_4840fcbf56c54f8b8064c264b9ec4bee.pdf, p. 15.
[59] Ibid, 18.

- Critical Facility Protection
- Goal Statement Affiliation

Below is a list of all mitigation actions sorted by priority. The highest-ranking actions are shown in red, the medium priority actions in orange, and the low priority actions in green. The mitigation actions are also shown in Appendix C with essential details for each action. The Core Team and the Town Selectmen understand that mitigation actions may not be implemented in order of priority, they may be implemented in the order by which they receive funding.

Table 28. Hazard Mitigation 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).

Project No.	Mitigation Action	Action Description
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
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.

Project No.	Mitigation Action	Action Description
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.
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.

System to Integrate this Plan with other Planning Mechanisms

C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning

> *mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))*

This Plan will be implemented and integrated throughout town government. The Stormwater Manager and the Core Team are committed to integrating this Plan with the other aspects of town government because they understand the value of hazard mitigation and they have actively participated in the planning process.

The Core Team identified Town plans, policies, procedures, and projects as well as other Town government activities as ways to integrate the hazard mitigation plan. They intend to do this throughout the five-year implementation timeframe of this plan. Some specific ways to integrate mitigation actions that the Core Team identified include:

- Assigning implementation of some mitigation actions to town committees, such as the Zoning Committee.
- Collaboration with other public and private businesses such as Northern Middlesex Council of Governments (NMCOG).

Possible funding sources

All of the mitigation actions included in this Plan have identified one or more potential funding sources. The Core Team focused on projects eligible for MVP Grant funding and FEMA BRIC funding. Below is a list of some of the federal funding mechanisms to keep in mind when identifying or implementing mitigation actions.

Federal Emergency Management Agency (FEMA) Mitigation Grants

The Federal Emergency Management Agency (FEMA) makes grant funding available for a range of mitigation activities via several Hazard Mitigation Assistance (HMA) programs. These grant programs provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. They are not intended to fund repair, replacement, or deferred maintenance activities but are rather designed to assist in developing long-term, cost-effective improvements that will reduce risk to natural hazards.

- **Building Resilient Infrastructure and Communities (BRIC)**
  BRIC is a new FEMA hazard mitigation program designed to replace the agency's former HMA Pre-Disaster Mitigation (PDM) grant program, aiming to categorically shift the federal focus away from reactive disaster spending and toward research-supported, proactive investment in community resilience. It is a result of recent amendments made to Section 203 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) by Section 1234 of the Disaster Recovery Reform Act of 2018 (DRRA). BRIC will support states, local communities, tribes, and territories as they undertake hazard mitigation projects reducing the risks they face from natural hazards. The BRIC program's guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency.

- **Hazard Mitigation Grant Program (HMGP)**
  The HMGP is authorized under Section 404 of the Stafford Act. The HMGP provides grants to states, tribes, and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not lost during the recovery and reconstruction process following a disaster. HMGP is typically available only in the months subsequent to a federal disaster declaration, as funding amounts are determined based on a percentage of the funds spent on FEMA's Public and Individual Assistance programs.
- **Flood Mitigation Assistance (FMA) Program**
  The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the NFIP. FEMA provides FMA funds to assist states and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities. One limitation of the FMA program is that it is generally used to provide mitigation for structures that are insured or located in Special Flood Hazard Areas (SFHAs) as mapped by FEMA. Federal funding for this nationally competitive grant program is generally an annual allocation (subject to Congressional appropriation) and eligibility is linked to a community's good standing in the NFIP.

Municipal Vulnerability Preparedness Action Grants[60]

The MVP Action Grant offers financial resources to municipalities seeking to advance priority climate adaptation actions to address climate change impacts resulting from extreme weather, sea level rise, inland and coastal flooding, severe heat, and other climate impacts.

Responses to the RFR may be submitted by municipalities who have received designation from the Executive Office of Energy and Environmental Affairs (EEA) as a Climate Change Municipal Vulnerability Preparedness (MVP) Community, or "MVP Community." All projects are required to provide monthly updates, project deliverables, a final project report, and a brief project summary communicating lessons learned. The municipality is also required to match 25% of total project cost using cash or in-kind contributions. All proposals must include the following:

- Completed application template
- Project budget and deliverables
- MVP yearly progress report describing any relevant work toward advancing community priorities since earning MVP designation

[60] State of Massachusetts. *MVP Action Grant.* https://www.mass.gov/service-details/mvp-action-grant.

- Statement of match
- Letters of support from landowner (if applicable), partners, and the public

Project types include:

- ***Detailed Vulnerability and Risk Assessment*** – In-depth vulnerability or risk assessment of a particular sector, location, or other aspect of the municipality.
- ***Public Education and Communication*** – Projects that increase public understanding of climate change impacts within and beyond the community and foster effective partnerships to develop support.
- ***Local Bylaws, Ordinances, Plans, and other Management Measures*** – Projects to develop, amend, and implement local ordinances, bylaws, standards, plans, and other management measures to reduce risk and damages from extreme weather, heat, flooding, and other climate change impacts.
- ***Redesigns and Retrofits*** – Engineering and construction projects to redesign, plan, or retrofit vulnerable community facilities and infrastructure (e.g., wastewater treatment plants, culverts, and critical municipal roadways/evacuation routes) to function over the life of the infrastructure given projected climate change impacts.
- ***Energy Resilience Strategies*** — Projects that incorporate clean energy generation and that are paired with resilience enabling technology to maintain electrical and/or heating and cooling services at critical facilities.
- ***Chemical Safety and Climate Vulnerabilities*** — Projects that seek to engage the business and manufacturing community through assistance or training on identifying vulnerabilities to chemical releases due to severe weather events, reducing use of toxic or hazardous chemicals, outreach to improve operations and maintenance procedures to prevent chemical releases and accidents, outreach to improve emergency and contingency planning, and/or identifying existing contaminated sites that pose chemical dispersion risks during flood events.
- ***Nature-Based Storm-Damage Protection, Drought Mitigation, Water Quality, and Water Infiltration Techniques*** – Projects that utilize natural resources and pervious surfaces to manage coastal and inland flooding, erosion, and other storm damage, such as stormwater wetlands and bio-retention systems, and other Smart Growth and Low Impact Development techniques.
- ***Nature-Based, Infrastructure and Technology Solutions to Reduce Vulnerability to Extreme Heat and Poor Air Quality*** – Projects that utilize natural resources, vegetation, and increasing pervious surface to reduce ambient temperatures, provide shade, increase evapotranspiration, improve local air quality, and otherwise provide cooling services within the municipality.
- ***Nature-Based Solutions to Reduce Vulnerability to other Climate Change Impacts*** – Nature-based projects that address other impacts of climate change such as extreme weather, damaging wind and power outages, and increased incidence of pests and vector-borne illnesses and other public health issues.
- ***Acquisition of Land to Achieve a Resiliency Objective*** — Land purchases are eligible for grant funding if the parcel has been identified through a climate vulnerability assessment as an

appropriate location for a specific eligible adaptation activity to occur, such as accommodating an infrastructure or facility redesign or retrofit project, providing natural flood storage to reduce downstream flooding, or removal of pavement and planting of trees to reduce flooding and heat island effects.

- ***Ecological Restoration and Habitat Management to Increase Resiliency*** — Projects that repair or improve natural systems for community and ecosystem adaptation, such as right-sizing culverts, dam removal, restoration of coastal wetlands, etc.
- ***Subsidized Low Income Housing Resilience Strategies*** — Investments in resiliency measures for affordable housing to protect vulnerable populations that may not have the resources to recover from an extreme climate event.
- ***Mosquito Control Districts*** — Projects to reduce the risk to public health from mosquito-borne illness and to increase mosquito surveillance and control capacity by incentivizing municipalities not in an organized mosquito control project or district to form a new mosquito control district or join an existing mosquito control district. Also funding for municipalities currently in a mosquito control district for new or proactive mosquito control measures.

Chapter 7. Plan Implementation and Maintenance

The Core Team will implement the mitigation strategy and specific mitigation actions outlined in this Plan, and update and maintain the Plan according to the guidelines below. The Core Team includes key stakeholders in the town, who will use the Plan's goals, as well as continued analysis of hazard risks and capabilities, to weigh the available resources against the costs and benefits for each mitigation action. The town understands the value of this Plan and its positive mitigation impact and intend to continue updating this Plan and implementing the Plan's strategies.

Continued Public Participation

> *A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))*

Public participation is an integral component of the mitigation planning process and will continue to be essential as this plan is implemented and updated over time. Based on the high level of interest in the mitigation planning process and in the Municipal Vulnerability Preparedness project, town residents and stakeholders are interested in mitigation. The Core Team included an education and outreach mitigation action designed to engage the public. The town plans to involve the public throughout the five-year implementation of this Plan, as well as in the reviewing and updating process. The Stormwater Manager and the Department of Public Works will take the lead in soliciting participation from the public. This participation will take multiple forms, including all of those outlined in the Planning Process Chapter of this plan. Efforts to involve the public include:

- Advertising on the Town's website, and via flyers and press release.
- Private sector representatives will join town officials in implementing mitigation actions.
- Copies of this Plan will remain on the town's website, and a hard copy will be kept in the Department of Public Works office for public review. Updates to the Plan will also be posted on the town's website.
- The Town of Dracut will continue to work with private industry, regional agencies, and adjacent communities as this plan is implemented.

Method and Schedule for Keeping the Plan Current

> *A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))*

The Core Team and the Town of Dracut recognize the importance of keeping the mitigation plan up to date. Keeping the plan current includes monitoring, evaluating, and updating the Plan over a five-year period, a process led by the Stormwater Manager. The Stormwater Manager has the support of the Core Team, the Town Engineer and the Fire Chief.

The Core Team has agreed to the following procedures.

- The overall responsibility for monitoring the implementation of the Plan rests with the Stormwater Manager. The Stormwater Manager will maintain the Mitigation Action Tracker (a tool to record the status of all mitigation actions). The Stormwater Manager will send a reminder email with a link to the web-based Mitigation Action Tracker on a quarterly basis to all Department Heads responsible for a mitigation action. The Stormwater Manager may also distribute the Mitigation Action Progress Worksheet (shown in Appendix D) for Department Heads who prefer a form over a spreadsheet.
- If the town experiences a large-scale disaster, the Stormwater Manager will call a Core Team meeting to update the list of mitigation actions and review the order of priorities.
- The Core Team has agreed to meet on a semi-annual basis to review the implementation of the mitigation plan. The first meeting will take place in January; the second, in July.
    - At the first meeting (January 2021), the Core Team will review the effectiveness of the planning process, public and stakeholder engagement, risk analysis, and the mitigation strategy, including its implementation. It is recommended that the Core Team use the worksheet provided in Appendix D.
    - At each semi-annual meeting, the Core Team will review the plan's goal statements and mitigation action status. If necessary, the goal statements and mitigation actions may be revised to reflect current town priorities. In addition, the Core Team will discuss methods for continuing to integrate the mitigation plan with other plans, processes, and projects in the town.
    - The Stormwater Manager will prepare a one-page brief regarding the January Core Team meeting to share with the Selectmen and to post on the town's website. The Core Team and the Stormwater Manager recognize the value in keeping the public informed about the implementation and status of the mitigation plan.
- Core Team members will continue to participate in regional and state-based meetings in an effort to stay current with best risk-mitigation practices. Such meetings may include the Massachusetts Emergency Management Agency (MEMA), the Northern Middlesex Council of Governments (NMCOG), and the MA Department of Conservation and Recreation.

The Town of Dracut agrees to update and adopt this mitigation plan on a five-year basis. The update will include a comprehensive review and planning process similar to the one used to develop this mitigation plan update. It will update the mitigation action list, current land use practices, collecting and reviewing best available data, reviewing the capability assessment, and engaging the public and stakeholders. This process will occur according to FEMA guidelines. The Core Team will seek funding for the development of the plan update a year before the plan expires. The plan update process gives the town the chance to add and/or re-prioritize mitigation actions based on current risk, capabilities, and public/stakeholder suggestions. The Stormwater Manager will serve as the Project Manager for the update process.

Responsible Parties for Plan Implementation and Maintenance

Tina Douk, Stormwater Manager

Department of Public Works, Town of Dracut

833 Hildreth St. |Dracut, MA 01826

t: 978. 770. 2578

https://www.dracutma.gov

For State resources, contact the Massachusetts Emergency Management Agency:

Address: 400 Worcester Road, Framingham, MA 01702-5399

Phone: 508-820-2000 (MEMA Headquarters and Communications Center)

or 978-328-1500 (MEMA Region 1 Office)

Website: https://www.mass.gov/orgs/massachusetts-emergency-management-agency

For Federal resources, contact the Federal Emergency Management Agency:

Address: 99 High Street, Boston, MA 02110

Phone: 877-336-2734

Email: fema-r1-info@fema.dhs.gov

Website: https://www.fema.gov/region-i-ct-me-ma-nh-ri-vt

List of Acronyms

AASHTO	American Association of State Highway and Transportation Officials
AC	Asbestos-cement
ASFPM	Association of State Floodplain Managers
BFE	Base Flood Elevation
BMP	Best Management Practice
BRIC	Building Resilient Infrastructure and Communities
CDBG	Community Development Block Grant
CDC	Centers for Disease Control
CEMP	Comprehensive Emergency Management Plan
CFM	Certified Floodplain Manager
CIP	Capital Improvement Program
CLEAR	Clean Energy and Resiliency
CMMCP	Central Massachusetts Mosquito Control Project
CPR	Coastal Pollutant Remediation
CRB	Community Resilience Building
CWMP	Comprehensive Wastewater Management Plan
CZM	Coastal Zone Management
DAR	Department of Agricultural Resources
DCR	Department of Conservation and Recreation
DER	Division of Ecological Restoration
DMA	Disaster Mitigation Act
DRRA	Disaster Recovery Reform Act
DWSD	Dracut Water Supply District
EEA	Energy and Environmental Affairs
EEE	Eastern Equine Encephalitis

EF-scale	Enhanced Fujita Scale
EOC	Emergency Operation Center
EOEEA	Executive Office of Energy and Environmental Affairs
EOI	Expression of Interest
FD	Fire Department
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
F-scale	Fujita Scale
FT	Full-time
FY	Fiscal Year
GHG	Greenhouse Gas
GLSD	Greater Lawrence Sanitary District
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HUD	Housing and Urban Development
LID	Low Impact Development
LOMR	Letter of Map Revision
LRTA	Lowell Regional Transit Authority
LRWU	Lowell Regional Water Utility
LRWWU	Lowell Regional Wastewater Utility
MassCEC	Massachusetts Clean Energy Center
MassDEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation
MBTA	Massachusetts Bay Transportation Authority
MEMA	Massachusetts Emergency Management Agency
MMI	Modified Mercalli Intensity

MS4	Small Municipal Separate Storm Sewer System
MVP	Municipal Vulnerability Preparedness
NCEI	National Centers for Environmental Information
NFIP	National Flood Insurance Program
NFIRA	National Flood Insurance Reform Act
NISC	National Invasive Species Council
NMCOG	Northern Middlesex Council of Governments
NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPDP	National Performance of Dams Program
NPS	Nonpoint Sources
NWS	National Weather Service
OSRP	Open Space and Recreation Plan
PCB	Polychlorinated biphenyl
PDM	Pre-Disaster Mitigation
PT	Part-time
RECC	Regional Emergency Communications Center
RFR	Request for Responses
RFR	Right of First Refusal
ROW	Right of Way
RSI	Regional Snowfall Index
RSI	Regional Snowfall Index
SAFE	Student Awareness of Fire Education
SFHA	Special Flood Hazard Area
SHMCAP	State Hazard Mitigation and Climate Adaptation Plan
USGS	United States Geological Survey
V	Volunteer

WUI	Wildland-Urban Interface

Resources

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NESEC: Hurricanes http://nesec.org/hurricanes/

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State of Massachusetts. Culvert Replacement Municipal Assistance Grant Program. https://www.mass.gov/how-to/culvert-replacement-municipal-assistance-grant-program

State of Massachusetts. Grants & Financial Assistance: Watersheds & Water Quality, Section 319 Nonpoint Source Competitive Grants Program. https://www.mass.gov/info-details/grants-financial-assistance-watersheds-water-quality#section-319-nonpoint-source-competitive-grants-program-.

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Town of Dracut Community Resilience Building Workshop Summary of Findings, December 2020

U.S. Census Bureau, 2018 American Community Survey 5-Year Estimates.

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What is Mitigation? (2014). Federal Emergency Management Agency. Retrieved January 2014 from http://www.fema.gov/what-mitigation

Appendices

Appendix A. Planning Process Supporting Materials

Kick-off Meeting June 25, 2019

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 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.			

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MEETING MINUTES
Project: **Dracut MVP/HMP Kick-off Meeting**
Location: **Virtual Teams Meeting**
Date: **Thursday, June 25, 2019 at 10:00am**

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, were presenting the project to the Core Team selected by the Town of Dracut followed by the questioning session in the end of the presentation.

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.

In the end of the presentation, Tina Douk, Dracut Stormwater Manager, requested the presentation PowerPoint slides to be sent to the Town, so that other members of the Core team, who were not able to attend the Kick-off meeting, are able to participate early in the process. Green forwarded the document to Tina. Tina also requested the updated FEMA Guidelines and best practices guide from Jamie Caplan, which she forwarded to Tina as well.

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.

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 meeting ended around 11 am.

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Core Team Meeting August 13, 2020

Hazard Mitigation Planning
Town of Dracut
Core Team Meeting
August 13, 2020

AGENDA

- Introductions
- Review Critical Facility List
- Hazards
  - 4 Hazards of Biggest Concern
  - Identify High Hazard Areas
- Capability Assessment Questions
- CRB Workshop Preparation
  - Who to invite?
  - What stakeholders are you working with regionally?
- Goal Statement Review
- Mitigation Action Identification and Review
  - What moves forward?
  - Mitigating Risk to Critical Facilities
  - Action Ideas
- Next Steps

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ATTENDANCE SHEET
Project: **Dracut MVP/HMP 2nd Core Team Meeting**
Location: **Virtual Teams Meeting**
Date: **Thursday, August 13, 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. 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 Patenuade	Dracut, DPW Director	978-957-0411	Epatenaude@dracutma.gov
8. Betsy Ware	Dracut, Community Development Coordinator	978-453-4557	eware@dracutma.gov
9. Bethany Loveless	Dracut, Council on Aging Director	978-957-2611	Bloveless@dracutma.gov
10. Ann Vandal	Dracut, Town Manager	978-452-1227	Avandal@dracutma.gov
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MEETING MINUTES

Project Name:	MVP/HMP Plans for Dracut
Subject:	MVP/HMP 2nd Core Team Meeting
Date / Time:	August 13, 2020 at 10:00am – 11:20am
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 2nd Core Team meeting for the MVP/HMP Planning process for the Town of Dracut. Action items are noted in bold below.

1. Introductions: The 2nd virtual MVP/HMP meeting was held via Microsoft Teams as a follow up to the MVP/HMP kick-off meeting occurred on 6/25/2020. Danielle Spicer with Green International Affiliates, Inc. (Green) and Jamie Caplan with Jamie Caplan Consulting LLC, both State Certifies MVP Providers, discussed the overall goals for the MVP and HMP plan as well as plans to move forward efficiently in preparation for the upcoming Workshops. (see attached attendance list for who attend the meeting virtually).

2. MVP Goals:
   a. Danielle Spicer asked the Core Team what are the goals the Town would like to focus on for the MVP plan process besides becoming a designated "MVP Climate Community", becoming eligible for action grants, and developing a HMP that is in conjunction with the MVP plan.

      i. Betsy Ware mentioned additional goals within the Town are:
      - Funding for 3 dams to be removed or substantially repaired (2 private and 1 unknown ownership); how to ensure that there will be no flooding after dam removal if it occurs to the downstream communities; 2 dams have written reports, where the State would recommend their removal. These types of project can be funded through MVP action grants.
      - Preparing the Town for future events, such as COVID-19 and anything else that is not normally expected; evaluating municipal shelter buildings, special shelters for seniors; ensuring the future plans include the expanse of the shelter infrastructure in the community.
      - Developing municipal programs to build options for future vulnerabilities.

3. Critical HMP Facilities list:
   a. Jamie Caplan went over the Critical HMP Facilities list developed within the past month with Tina Douk to see which other facilities should be included. The following was noted:
      - Library Building should be included in list
      - Generator for Council of Aging (COA): Bethany Loveless mentioned that the COA has been a heating station, cooling station and energy station during non-COVID times to all ages. They have extended their hours and added weekend hours to accommodate and serve meals. However, they do not have a generator, and if there is a power outage that takes out the Center's power,

they will be useless. Therefore, it is important to include the generator for the COW in the mitigation actions list. A new generator would only qualify for a FEMA grant and not a MVP action grant.

- Emergency Operations Centers (EOC) primary and secondary are both Fire Stations (the Central FS and the secondary one); another FS is opening in Spring 2021 on Nashua Road, it will replace Station 3
- Consider adding facilities critical for water, wastewater and electrical infrastructure to the list (e.g. issues with sewage pumps flooding and groundwater pump stations were mentioned)
  - Have six pump stations in Tuttle Hill Road area
  - 2005 added a containment flood mitigation area with a $40,000 FEMA grant

4. HMP and MVP Hazards:
   a. Jamie Caplan listed typical HMP hazards to be considered for the process
   b. Danielle Spicer went over the list of typical MVP hazards, which are climate related hazards only. The Core Team was then asked to select the 4 main hazards that the MVP process will be focused on, and the results are as follows:
      - Snow Storms/Extreme Cold
      - Flooding
      - Wind Damage/High Winds
      - Extreme Temperatures
   c. Peter Richardson asked about Dracut's water supply situation and any emergency connection with Lowell to be considered in the process. Mark Hamel replied that about 95% population are getting water from a municipal water supply district with less than 5% population from wells.
   d. There are 4 dams, the one in East Dracut is not an issue, the other 3 are concerns and all are on Beaver Brook
   e. Jamie Caplan then went over the list of High Hazard Areas from the Town's previous regional HMP to determine if these areas are still at issue and if new areas should be included in the list in preparation for the workshops.

5. Dracut's Future: Jamie Caplan asked the Core Team to think about the future of Dracut for the next 5-10 years, while going through the HMP/MVP process in the next few month and include as much of the future known items that are planned, in consideration, possible subdivisions, etc. in the process.
   a. Betsy Ware mentioned that DPW is expected to be remodeled in the next 5-10 years; Campbell Elementary School is expected to go through either substantial renovation or a construction of a new building within the next 5 years;
   b. Peter Richardson suggested, if there are any natural resources the Town wants to protect in the future, to also include them in the planning process (e.g. purchasing land around wells, including MVP in the updated Open Space and Recreation Plan (OSRP), consider Nature-Based solutions). Town has begun updating an Open Space Plan.
   c. Betsy Ware noted that the Town is in the process of updating the OSRP and she will work on incorporating the MVP/HMP process and nature-based solutions into an OSRP.
   d. May have new subdivisions

6. Workshops:
    a. MVP Workshop Risk Matrix: Danielle Spicer went over the MVP Workshop Risk Matrix, explaining the process during the upcoming workshops
    b. Jamie Caplan suggested who can be included in the Workshops process; the representatives from the following regional and local stakeholders are suggested to be invited in addition to the Town's representatives and other parties:
        - Power Supply companies (National Grid)
        - Merrimack River Watershed Council (MWRA) and other important environmental groups and initiatives
        - Chamber of Commerce
        - Regional Planning Commission
        - MVP Coordinator (Danielle Spicer will contact)
        - Dracut's Floodplain Coordinator and any other local or regional stakeholders not mentioned above
    c. At a minimum, the productive workshop should include at least 10 attendees, but preferable more.
    d. Bethany Loveless suggested, it could be of benefit to show a presentation on cable once the MVP and HMP plan is prepared, and it can be shown repeatedly. The end of the presentation can have information on how to get more involved.
    e. Workshop Dates: when and how the Town prefers to hold the workshops.
        - Issues with the COVID-19 situation and remote meeting options were discussed along with opportunities to hold a hybrid (virtual/in person) Town Hall meeting to attract more participants to attend the workshops. Danielle will work with Tina as we get closer on whether a hybrid option is feasible.
        - The dates for the 2 4-hour Workshops were tentatively selected to be:
            Workshop #1: 9/29/2020 (Tuesday) – 3pm-7pm (location TBD)
            Workshop #2: 10/6/2020 (Tuesday) – 3pm-7pm (location TBD)

7. GIS Capabilities:
    a. Tina Douk and Mark Hamel will be helping with the maps required for the workshop materials. Danielle will email them on the specifics required for making the maps that will be needed
    b. Northern Middlesex Council of Governments may have suitable plans from the recent updated Master Plan to work with during the workshops
    c. Mark Hamel mentioned an existing Infrastructure Map may be available as well to be used

8. Vulnerable Populations:
    a. Discussion of vulnerable population (e.g. seniors, injured, persons with disabilities, Environmental Justice populations, low income, etc.) to be considered along with economical aspects during the process
    b. Bethany Loveless pointed out that 25% of Dracut is expected to be 60+ when 2020 Census is completed; 12.4% of those in Dracut 65+ are diagnosed with Alzheimer's or Dementia; 23% of residents age 65+ have an annual house hold income of less than $20,000; which are all included in the Town's vulnerable populations.

9. Review of possible Mitigation Actions:
    a. Additional mitigation actions can include Zoning Regulations and Stormwater Bylaw revisions/updates to consider the outcomes of the MVP plan and HMP during this process.
    b. Revising/ updating flood mitigation actions from the previous HMP

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:
Sign-In sheet

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Community Resilience Building Workshops

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. 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

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239 LITTLETON ROAD, SUITE 3 WESTFORD, MA 01886
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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
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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

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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
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Listening Sessions

For Immediate Release
October 2020

Contact: Tina Douk, Stormwater Manager
Department of Public Works
Phone: 978-957-1497
Email: tdouk@dracutma.gov

Town of Dracut Invites All to a Public Listening Session
October 14, 2020, 2:00 pm – 3:00 pm on Zoom

DRACUT, Mass. – The Town of Dracut is simultaneously developing two plans to identify and prioritize actions the Town can take to mitigate the impacts of natural hazards and climate change. Citizen participation in each project is essential!

A public "Listening Session" will be held on Wednesday, October 14th at 2 p.m. on Zoom. At the Listening Session the Town will outline the process of developing the Hazard Mitigation Plan Update and ask residents about their experiences and concerns with natural hazards. You will have the opportunity to contribute your ideas for making the Town more resilient to natural hazards at the Listening Session. A link to join the Listening Session will be posted on the Town's website prior to the meeting.

The Town is developing the Hazard Mitigation Plan Update for approval by the Federal Emergency Management Agency (FEMA). This plan serves as an essential strategy for reducing current and future risks to natural hazards by identifying projects to minimize those risks. Projects include providing back-up power to all critical facilities, mitigating flood risk and implementing natural hazard and climate adaptation education and awareness programs. All residents and business owners are encouraged to attend the meeting and learn about the Hazard Mitigation Plan Update. Jamie Caplan Consulting LLC, a Northampton, MA based firm, leading the effort to develop the plan will lead the Zoom meeting.

FEMA approval and Town adoption of the Hazard Mitigation Plan Update allows the Town to apply for pre- and post-disaster hazard mitigation grant funds. This Plan is developed in conjunction with the Municipal Vulnerability Preparedness (MVP) project which is simultaneously underway. A second Listening Session will be held later in the Fall, to share findings from the MVP project and further discuss the Hazard Mitigation Plan Update.

For questions regarding the Listening Session, or the Hazard Mitigation Plan Update, please contact Tina Douk, Stormwater Manager, Department of Public Works, Town of Dracut, phone: 978-957-1497, or email: tdouk@dracutma.gov.

PRESS RELEASE
For Immediate Release
October 14, 2020

Contact: Tina Douk
Stormwater Manager
978-957-1497

Town of Dracut Invites the Public to a Zoom Meeting to Learn About the Hazard Mitigation Plan

The Town of Dracut is simultaneously developing two plans to identify and prioritize actions the Town can take to mitigate the impacts of natural hazards and climate change. Citizen participation in each project is essential.

A public meeting will be held on Wednesday, October 21, 2020 at 2pm via Zoom.
To join the Zoom meeting:

- https://us02web.zoom.us/j/81054479879?pwd=ZTRsL1RQcVFRNmFqQi9tQjlwaEVDdz09
- Meeting ID: 810 5447 9879
- Passcode: 207206

At the meeting, the Town will present the process of developing the Hazard Mitigation Plan and request feedback from citizens regarding natural hazards and their impacts. The Town is updating the previously developed Hazard Mitigation Plan for approval by the Federal Emergency Management Agency (FEMA). This plan will serve as an essential strategy for reducing current and future risks to natural hazards by identifying projects to minimize those risks.

At the meeting, you will have an opportunity to contribute your ideas for making the Town more resilient to natural hazards such as flooding, snowstorms, high winds and extreme temperatures. This plan is being developed by a Core Team of Town officials and local stakeholders. Jamie Caplan Consulting LLC, a Northampton, MA based firm, is leading this effort. FEMA approval, and Town adoption, of the Hazard Mitigation Plan Update allows the Town to apply for pre- and post-disaster hazard mitigation grant funds.

The Town recently completed a Community Resilience Building (CRB) Workshop as part of the Municipal Vulnerability Preparedness (MVP) planning process. This Workshop is part of a second plan the Town is developing with funding from the Massachusetts Executive Office of Energy and Environmental Affairs through an MVP Planning Grant. Green International is leading the MVP project. The Town will host a second public meeting in about a month to share details regarding this project. Completion of the MVP plan results in MVP Certification, which allows certified communities access to additional state grants for projects related to climate change resiliency.

For questions regarding either project, please contact Tina Douk, Stormwater Manager, Town of Dracut, phone: 978-957-1497 or email: tdouk@dracutma.gov.

Dracut 'committed' to climate change action

BY PRUDENCE BRIGHTON

January 4, 2021 at 9:14 a.m.

sable items off of their hands. as of Jan. 1, the Townsend Re- ling Center has higher fees the removal of certain items. alth Administrator Carla zenbuhler said last month that the Board of Health made the decision during its meeting on Nov. 30 after planning the fee increase for about a year.

Hitzenbuhler explained this is the first time the center is raising the fees in a decade and to the coronavirus pandemic causing many residents to work from home.

"We're so busy with everyone staying home and the market the fees to be self-sufficient, she explained. "Everyone is throwing away their exercise equipment for new stuff, so we have their

FEES » 6A

PHOTOS COURTESY MARY LEACH

grapher Mary Leach was out walking over the weekend and captured these images during a walk along the Valley Technical High School

GREAT OORS

FEMA GRANTS

Dracut commits to climate change action

By Prudence Brighton
Correspondent

DRACUT » Town officials and department heads have been developing a Municipal Vulnerability Plan and updating a Hazard Mitigation Plan that, once in place, will qualify the town for grants from the Federal Emergency Management Administration and other federal sources.

Drafts of the plans are now available on the town's Stormwater Department website (dracut-ma.gov/stormwater-department) for residents to review.

Although still works-in-progress, the plans cover issues ranging from ensuring residents receive timely emergency notifications, to the town's water transmission system to failing culverts and structural issues with Beaver Brook bridges.

Also under study are ways to ensure the health and safety of older residents and those with developmental issues.

The state provided funds to the planning process in Dracut and other communities to develop action plans to lessen the effects of climate change and to make the town more resilient to natural disasters. Communities that complete the MVP program become certified and eligible for grants and other opportunities to address issues identified.

Town officials working on the plans are Town Manager Ann Vandal, Department of Public Works Director Ed Patenaude, Town Engineer Mark Hamel, Conservation Agent Lori Cahill, Building Inspector Dan MacLaughlin, Deputy Fire Chief Richard Patterson, Community Development Director Betsy Ware, Council on Aging Director

Items including car batteries, grills, electric lawn equipment, ... The Recycling Center will be open every first and third Saturday of the month this year.

Dracut

FROM PAGE 3A

Lakeview Avenue culvert would cost in excess of $1 million. It is listed as a high-priority project, ... so any additional sources of funding for it will be welcomed, Douk said.

A listening session is planned for Jan. 12 from 11 a.m. to noon. Links are provided in the public notice on the Stormwater Department's website.

Briefs

FROM PAGE 3A

Any previously registered voter who has not returned their annual census for two consecutive years will be added to the Inactive Voters List and therefore, by law, will be required to fill out an Affirmation of Current and Continuous Residence form and provide identification to prove continuous residency in the Town of Tewksbury.

New residents who did not receive a census form are urged to notify the Town Clerk's Office by phone at 978-640-4355 or by email at townclerk@tewksbury-ma.gov.

Nomination papers now available in Chelmsford

CHELMSFORD – Nomination papers for town offices are now available at the Chelmsford Town Clerk's office until Feb. 11 at 5 p.m.

Positions available include Select Board, School Committee, Board of Health and more. The last day for nomination papers to be filed with the Board of Registrars is Feb. 16 at 5 p.m. Visit the town website for more information on open positions and candidates.

Patient

FROM PAGE 1A

a holiday-related surge, the hospital said in a prepared statement.

There were 56 COVID-19 patients in the hospital Tuesday, with three more under investigation, and six patients in the intensive care unit, according to Will Courtney, a hospital spokesman.

"We saw a clear rise in patients a couple of weeks after Thanksgiving that had us over 70, and anticipate a similar surge as we come away from the holidays," Courtney said.

He said the hospital has been "very busy" but that it has not reached capacity for beds.

The field hospital opened its first 14 beds on Monday and has enough staffing available to scale up to as many as 28 beds by the end of this week, the hospital said in a statement.

"We are proud to be able to provide this resource for the region and stand ready to accept additional patients," said Jody White, president and CEO of Lowell General Hospital and Circle Health. "Patients and families should take comfort that this site is staffed by skilled physicians, nurses and support personnel, and will provide the same standard of care as they would expect in the hospital."

The facility, set up in the same ...

JUAN MALARIE / LOWELL SUN

Lowell General Hospital COO Amy Hoey gives Gov. Charlie Baker a tour of the field hospital at the UML Recreation Center.

... ons setup.

When Gov. Charlie Baker and City Manager Eileen Donoghue toured the facility late last year, hospital officials said finding nurses to staff the facility was one of the biggest challenges, since regular hospital staff are staying at the hospital.

The facility will be used to treat patients who are recovering from the virus but who still need medications or therapies before being discharged. Moving those patients to the Alternate Care Site will free up inpatient capacity at the hospital for more severely ill patients.

Health and Human Services Secretary Marylou Sudders said Monday that there are no plans to open a third such facility in the state, but that there is planning to open a dedicated long-term care facility in the southeastern part of the state to serve "discharge-ready COVID-positive nursing ...

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By Bill Barrow... and Jeff Amy
Associated Press

ATLANTA – Pr... Biden on Mon... Democrats the... to "chart the co... ation as Pre... Trump rehashe... over his Noven... pleas ahead of ... that will deter... the U.S. Senate.

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"Folks, this is i... a new year, and ... be a new day fo... Georgia and for A... said at a drive-in ... any time in my ca... ... one state – ... course, not just ... years but for the ... tion."

The stakes hav... dreds of millions ... campaign spendi... solidly Republica... now finds itself a... premier battlegr... won Georgia's 16 ... by about 12,000 ... million cast in ... though Trump con... ing false assertio... spread fraud that ... former attorney ... Georgia's Republic... of state – along wi... state and federal ju... said did not happe...

The president's ... comes a day after di... remarkable telepho... made to the Geor... of state over the ... Trump pressured ... Brad Raffensperger...

Attendees and Notes to the 10/21/2020 Listening Session

Jamie Caplan
Tina Douk
Ed Patenaude
Mark Hamel
Darrin Punchard
Ann Vandal
Danielle Spicer
Oxana Fartushnaya
Peter Richardson
Betsy Ware
Dam McLaughlin

Meeting notes/comments from Betsy Ware, Community Development Director:

1. Betsy was inquiring about the Beaver Brook Dams. She mentioned the 2006 Mother's Day storms (2 back-to-back 100-year storms) that caused flooding of the Beaver Brook in the vicinity of the Butterworth Mill Dam, wondering what would have happened if these dams were removed. She mentioned that they have someone who would be very interested in using the dam for water supply and electricity, however the State wants the dams removed, and she is wondering what would happen if there were no dams in case of such extreme precipitation events. Jamie answered that this could be something to look into as part of this HMP/MVP planning process.
2. Betsy also mentioned that she remembers snow storms from the past, giving an example of 1969 severe winter storms, when no one had school for a week. And she asked what the climate projection data we discuss as part of HMP/MVP process is based on, and why does this data say that we have more precipitation than before. She also noted that this summer we did not have enough precipitation, and had the draught instead. So she wanted us to share what this data about more precipitation is based on, and how can it relate to what is happening this summer (draught). Darrin gave a general answer about the research and that this data is based on multiple research and is adapted by the agencies and governments. This data is not specific to just Dracut, however, it is used for the purpose of planning.
3. Betsy's last comments was again about the Beaver Brook, how do we know exactly what the impacts of potentially higher precipitation would be on Beaver Brook. Darrin answered that the FEMA maps are only looking at historic data, and in order to know exactly at what can potentially happen in a specific location, the studying/modeling of this specific brook would need to be done. He also mentioned that some communities are actually doing this and this can be incorporated into the HMP and MVP plan.
   Betsy mentioned again, that because the State would like to see the dams removed, and because of the existence of these pictures of Beaver Brook from the 2006 flooding, no one knows what would actually happen, while there are some parties that would like to actually use the dams for water supply and energy, but currently can't.

Oxana's comments:

The data is based on the research from UMass Northeast Climate Science Center at the University of Massachusetts Amherst who developed downscaled projections for changes in temperature,

precipitation, and sea level rise for the Commonwealth of Massachusetts. The Executive Office of Energy and Environmental Affairs has provided support for these projections to enable municipalities, industry, organizations, state government and others to utilize a standard, peer-reviewed set of climate change projections that show how the climate is likely to change in Massachusetts through the end of this century.

The *Massachusetts Climate Change Projections - Statewide and for Major Drainage Basins: Temperature, Precipitation, and Sea Level Rise Projections* can be downloaded from here: https://www.mass.gov/doc/massachusetts-statewide-climate-projections-2018/download

First few pages of this report explain the research and methodology used for these projection. However, regarding Betsy's specific question for precipitation, this is what is mentioned in the beginning of this report:

> "The temperature and precipitation climate change projections are based on simulations from the latest generation of climate models from the International Panel on Climate Change and scenarios of future greenhouse gas emissions. The models were carefully selected from a larger ensemble of climate models based on their ability to provide reliable climate information for the Northeast U.S., while maintaining diversity in future projections that capture some of the inherent uncertainty in modeling climate variables like precipitation."

This is the link to the UMass climate adaption science center where anyone can see who they were partnering with in their research:
https://necsc.umass.edu/projects/massachusetts-climate-change-projections

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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.			

Appendix B. Capability Assessment Supporting Materials

Safe Growth Survey

Town of Dracut

SAFE GROWTH SURVEY

This survey instrument is designed to capture some general information for purposes of developing the *Dracut Hazard Mitigation Plan Update*. It has been adapted from a technique recommended by the American Planning Association (APA) and FEMA to help evaluate the extent to which the Town of Dracut is positioned to grow safely relative to its natural hazards. These hazards include but are not limited to hurricanes, floods, fires, winter storms and other severe weather systems.

Please indicate how strongly you agree or disagree with the following statements as they relate to the Town's current plans, policies, and programs for guiding future community growth and development.

1 = Strongly Disagree 2 = Somewhat Disagree 3 = Neutral 4 = Somewhat Agree 5 = Strongly Agree

GENERAL PLAN						
Land Use						
1.	The general plan includes a future land use map that clearly identifies natural hazard areas.	1	2	3	4	5
2.	Current land use policies discourage development and/or redevelopment within natural hazard areas.	1	2	3	4	5
3.	The general plan provides adequate space for expected future growth in areas located outside of natural hazard areas.	1	2	3	4	5
Transportation						
4.	The transportation element limits access to natural hazard areas.	1	2	3	4	5
5.	Transportation policy is used to guide future growth and development to safe locations.	1	2	3	4	5
6.	Transportation systems are designed to function under disaster conditions (e.g., evacuation, mobility for fire/rescue apparatus, etc.).	1	2	3	4	5
Environmental Management						
7.	Environmental features that serve to protect development from hazards (e.g., wetlands, riparian buffers, etc.) are identified and mapped.	1	2	3	4	5
8.	Environmental policies encourage the preservation and restoration of protective ecosystems.	1	2	3	4	5

Safe Growth Survey
Page 2

9. Environmental policies provide incentives to development that is located outside of protective ecosystems.	1	2	3	4	5
Public Safety					
10. The goals and policies of the general plan are related to and consistent with those in the Hazard Mitigation Plan.	1	2	3	4	5
11. Public safety is explicitly included in the plan's growth and development policies.	1	2	3	4	5
12. The monitoring and implementation section of the plan covers safe growth objectives.	1	2	3	4	5
ZONING ORDINANCE					
13. The zoning ordinance conforms to the general plan in terms of discouraging development and/or redevelopment within natural hazard areas.	1	2	3	4	5
14. The ordinance contains natural hazard overlay zones that set conditions for land use within such zones.	1	2	3	4	5
15. Rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use.	1	2	3	4	5
16. The ordinance prohibits development within, or filling of, wetlands, floodways, and floodplains.	1	2	3	4	5
SUBDIVISION REGULATIONS					
17. The subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas.	1	2	3	4	5
18. The regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources.	1	2	3	4	5
19. The regulations allow density transfers where hazard areas exist.	1	2	3	4	5
CAPITAL IMPROVEMENT PROGRAM AND INFRASTRUCTURE POLICIES					
20. The capital improvement program limits expenditures on projects that would encourage development and/or redevelopment in areas vulnerable to natural hazards.	1	2	3	4	5

Safe Growth Survey
Page 3

21.	Infrastructure policies limit the extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards.	1	2	3	4	5
22.	The capital improvements program provides funding for hazard mitigation projects identified in the Hazard Mitigation Plan.	1	2	3	4	5
OTHER						
23.	Small area or corridor plans recognize the need to avoid or mitigate natural hazards.	1	2	3	4	5
24.	The building code contains provisions to strengthen or elevate new or substantially improved construction to withstand hazard forces.	1	2	3	4	5
25.	Economic development and/or redevelopment strategies include provisions for mitigating natural hazards or otherwise enhancing social and economic resiliency to hazards.	1	2	3	4	5

Thank you for your assistance in completing this survey.

Appendix C. Mitigation Strategy Supporting Materials

CRB Workshop 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	Notes Action Items
Infrastructural										
1. Water Booster Pump Station	Methuen Street	Town	V					H	L	1. Rehabilitate the pump station (originally built 1965); 2. Address safety issue and confined space issue
2. 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
3. Booster Station - Interconnection/Partical Built	Broadway Street	Town	S	X	X			M	S	1. Install 40-foot pump; complete the interconnection
4. Emergency Water Connection	Arlington Street	Town	S	X	X	X	X	L	O	1. Maintain multiple connections
5. 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 500-year floodplain)
6. AC Water Mains (35 in.) (60's)	Townwide	Town	V	X			X	H	L	1. Replace the AC pipes w/ appropriate contractor
7. Municipal Sewer Systems (95% of Town has municipal sewer)	Townwide	Town	S						L/O	1. Improve 3 pump stations that are succeptable to flooding; 2. Continue proper maintainace plan for 9 private pump stations; 3. Find solution for backups/not enough capacity - the P.S. is at the max. capacity that is allowed to go to Lowell Treatment Center
8. Sewer Pump Stations	Townwide	Town	V		X			H	L/O	
9. Bridges over Beaver Brook (1 succeptable 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).
10. Structurally Failing Municipal Culverts (2)	Peppermint Brook: Sladen St & Lakeview Ave	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
11. 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 increaseing downstream flooding (open bottom, higher capacity) - if collapses, it is a public safety issue as it will isolate the people, there are utilites located beneath the culverts
12. Dams (3 medium hazard dams)	Beaver Brook	2-private; 1-not known	V		X			H	L	1. Study removal of Victory Lane dam; 2. Incorporate the 2 compelted 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
13. 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
14. 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
15. DPW Garage - old building, flat roof, no AC, no ventilation	833 Hildreth St	Town	V/S	X		X	X	H	L	1. Research options to improve DPW garage; 2. Stormwater outfall that discharges to a wetland(w/ only CB's for treatement) could be retrofitted for treatment; 3. Research options to improve stormwater considering the building is located on a landfill
16. DPW Parking Lot	833 Hildreth St	Town	V		X			H	L	1. Upgrade DPW parking lot incorporating nature base solution.
17. High amount of impervisous area throughout the Town	Townwide	Town	V		X			H	L	1. Upgrade DPW parking lot incorporating nature base solution; 2. Upgrade School parking lots (50 years old) incorporating nature based solutions
18. Emergency Buildings/Buildings Command Center	488 Pleasant St	Town	S							1. Continue maintaining emergency buildings and command center

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	Notes Action Items
Societal										
1. Emergency Command Center	488 Pleasant St	Town	S							
2. Emergency Shelters	HS/Richardson	Town	S							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 occosite side of the Town.
3. Fire Department/Stations (3 building replaced in the past 25 years)	see Appendix X	Town	S							
4. EJ Communities	SW side - b/w Mammoth & Donalme 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
5. 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 townwide cell reception, multiple dead zones withing the Town); 2. Public education on how to keep informed in cases of emergency events/disasters
6. Evacuation Plan	Townwide	Town	S							
Umass Lowell - traffic flow en route to evacuate there	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, route is developed, but final plan for Mass Care Shelter is being developed, result in influx of traffic.
8. Assisted Living Facilities (2)	Broadway/Loon Hill Rd; Bridge St/Avis Ave	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
9. 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)
10.Group homes for 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.
11. Adult Daycare facility	Darren Rd	Private	V	X		X	X	L	O	

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	Notes Action Items
Environmental										
1. Open Space	Townwide	Town	V/S		X		X	M	L	1. Complete/Revise outdated OSRP in coordaintion with the Master Plan 2020 and with other diciplines/departments (permitting); 2. Coordinate and establish on-going maintennace for OSRP; 3. Incorporate Nature-Based solutions into revised OSRP; 4. Study to see what new parcels can be included in the updated OSRP
2. No Forest Management Plan for open spaces	Townwide	Town	V		X	X	X			1. Create a forest management plan for open spaces
2. 61A Land - a lot of farming	Townwide	Private/State	S							
4. The riparian buffers are very developed	Beaver Brook/Peppermint Brook	Town/Private	V		X		X	H	S/L	1. Conduct Townwide water quality sampling at the outfalls; 2. Update Wetlands bylaw in coordingation with SW bylaw
5. 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)
6. 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)?)
8. 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
9. State Park (1 in Town)		State	S							
10. Water Supply Land (North) is not being used due to high Mn		Legislative distri	V				X	M	L	1. Continue the process to develop a treatment system
11. 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)
12. Recently Updated Stormwater Bylaw 2018	Townwide	Town	S/V		X		X	H	S	1. Update for peak volume and rainfall events (NOAA Atlas 14)

Mitigation Actions

Project Number	Mitigation Action	Action Description	Timeframe	Lead Department	Potential Funding Sources	Estimated Cost	Hazard(s) Addressed	Critical Facility Protection	Goal Statement
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.	2021-2023	DPW	MVP Grant	High	Flooding, Severe Winter Storm/Nor'easter, Hurricanes/Tropical Storms, Extreme Temperatures	Yes	3
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	Flooding, Dam Failure	Yes	3
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	Flooding, Dam Failure	Yes	3

Project Number	Mitigation Action	Action Description	Timeframe	Lead Department	Potential Funding Sources	Estimated Cost	Hazard(s) Addressed	Critical Facility Protection	Goal Statement
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	Flooding, Dam Failure	Yes	3
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).	2021-2023	Dracut Water District	MVP Grant	High	Flooding, Severe Winter Storm/Nor'easter, Hurricanes/Tropical Storms	Yes	3
6	**Overhead Powerlines Improvements**	Coordinate with the power company to remove hazard trees town-wide near overhead wires.	2021-2025	DPW	Town	Low	Severe Winter Storms/Nor'easter, Hurricanes/Tropical Storms, Tornadoes, Wildfire	Yes	1
7	**Update Regulations & Bylaws**	Update Zoning Bylaw using Climate Change projection data to comply with applicable local, State and Federal regulations.	2021-2025	Planning Board	Town	Medium	Flooding, Severe Winter Storm/Nor'easter, Hurricanes/Tropical Storms, Wildfires	No	5

Project Number	Mitigation Action	Action Description	Timeframe	Lead Department	Potential Funding Sources	Estimated Cost	Hazard(s) Addressed	Critical Facility Protection	Goal Statement
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	Flooding, Severe Winter Storm/Nor'easter, Hurricanes/Tropical Storms, Invasive Species	No	5
9	**NFIP Compliance**	Expand compliance with NFIP and certify a floodplain manager.	2021-2025	Building	Town and FEMA BRIC	Medium	Flooding	Yes	5
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	2021-2025	DPW	MVP Grant	High	Flooding, Severe Winter Storm/Nor'easter, Hurricanes/Tropical Storms	No	2
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).	2021-2025	DPW	MVP Grant	High	Flooding, Severe Winter Storm/Nor'easter, Hurricanes/Tropical Storms	Yes	3

Project Number	Mitigation Action	Action Description	Timeframe	Lead Department	Potential Funding Sources	Estimated Cost	Hazard(s) Addressed	Critical Facility Protection	Goal Statement
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	2021-2025	Kenwood Water	Town	High	Flooding, Severe Winter Storm/Nor'easter, Hurricanes/Tropical Storms	Yes	3
13	**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	2021-2025	Dracut DPW with Support from Dracut Water District	Town	High	Flooding, Severe Winter Storm/Nor'easter, Hurricanes/Tropical Storms	Yes	3
14	**Sewer System Improvements**	- Sewer line rehabilitation - Oversight of private pump stations	2021-2025	DPW	Town	High	Flooding, Severe Winter Storm/Nor'easter, Hurricanes/Tropical Storms	Yes	3
15	**Road System Management Planning**	- Formalize a plan for road management system. -Coordinate with UMass Lowell to mitigate Emergency Evacuation Route traffic impacts.	2021-2023	DPW & Emergency Management	Ch. 90	High	All Hazards	No	3
16	**Generator at Council of Aging**	Purchase and Install an emergency generator at the Council on Aging.	2021-2023	Emergency Management	FEMA BRIC	Medium	Snow Storms/Extreme Cold, Wind Damage/High Winds, Extreme Temperatures	Yes	1
17	**Snow Accumulations**	Determine snow load capacity for town buildings.	2022-2025	Building	Town	Low	Severe Winter Storm/Nor'easter	Yes	3

Project Number	Mitigation Action	Action Description	Timeframe	Lead Department	Potential Funding Sources	Estimated Cost	Hazard(s) Addressed	Critical Facility Protection	Goal Statement
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	2021-2023	Planning & Conservation	Town	Medium	Flooding, Drought, Wildfire	No	5
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	Flooding, Severe Winter Storm/Nor'easter, Hurricanes/Tropical Storms, Extreme Temperatures	Yes	3
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 availability of helpful municipal resources. -Develop specific evacuation procedures and	2021-2025	Planning and Emergency Management	Town	Low	All Hazards	No	4

Project Number	Mitigation Action	Action Description	Timeframe	Lead Department	Potential Funding Sources	Estimated Cost	Hazard(s) Addressed	Critical Facility Protection	Goal Statement
		location for various groups of vulnerable populations.							

Appendix D: Plan Implementation and Maintenance Supporting Materials

Plan Update Evaluation Worksheet

Plan Section	Considerations	Explanation
Planning Process	Should the town invite any additional stakeholders to participate in the planning process? What public outreach activities have occurred? How can public involvement be improved?	
Risk Assessment	What disasters has the town, or the region experienced? Should the list of hazards be modified? Are new data sources, maps or studies available? If so, what have they revealed, and should the information be incorporated into the plan update? Has development in the region occurred and could it create or reduce risk?	
Capability Assessment	Has the town adopted new policies, plans, regulations, or reports that could be incorporated into this plan? Are there different or additional administrative, human, technical, and financial resources available for mitigation planning? Are there different or new education and outreach programs and resources available for mitigation activities?	
Mitigation Strategy	Is the mitigation strategy being implemented as anticipated? Were the cost and timeline estimate accurate? Should new mitigation actions be added to the Action Plan? Should existing mitigation actions be revised or removed from the plan? Are there new obstacles that were not anticipated in the plan that will need to be considered in the next plan update? Are there new funding sources to consider?	

Plan Section	Considerations	Explanation
	Have elements of the plan been incorporated into other planning mechanisms?	
Implementation Plan	Was the plan monitored and evaluated as anticipated? What are needed improvements to the plan implementation procedures?	

Mitigation Action Progress Worksheet

Mitigation Action Progress Worksheet				
Progress Report Period	From Date		To Date	
Action/Project Title				
Responsible Department				
Contact Name				
Contact Phone/Email				
Project Description				
Project Goal				
Project Objective				
Project Cost				
Project Status				
Date of Project Approval	Date of Project Start	Anticipated Date of Completion	Project Canceled	Project Delayed
Explanation of Delay or Cost Overruns				
Project Report Summary				
What was accomplished for this project during this reporting period?				
What obstacles, problems, or delays did the project encounter?				
Plans for next reporting period.				