

THE TOWN OF MONTAGUE
LOCAL NATURAL HAZARDS
MITIGATION PLAN

FINAL DRAFT

June 2011

Adopted by the Montague Board of Selectmen on

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1- INTRODUCTION

Hazard Mitigation

The Federal Emergency Management Agency (FEMA) and the Massachusetts Emergency Management Agency (MEMA) define Hazard Mitigation as any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards such as flooding, storms, high winds, hurricanes, wildfires, earthquakes and other disasters. Mitigation efforts undertaken by communities will help to minimize damage to buildings and infrastructure, such as water supplies, sewers, and utility transmission lines, as well as natural, cultural and historic resources.

Planning efforts, like the one undertaken by the Town of Montague and the Franklin Regional Council of Governments, make mitigation a proactive process. Pre-disaster planning emphasizes actions that can be taken before a natural disaster occurs. Future property damage and loss of life can be reduced or prevented by a mitigation program that addresses the unique geography, demography, economy, and land use of a community within the context of each of the specific potential natural hazards that may threaten a community.

Preparing a Local Natural Hazard Mitigation Plan before a disaster occurs can save the community money and will facilitate post-disaster funding. Costly repairs or replacement of buildings and infrastructure, as well as the high cost of providing emergency services and rescue/recovery operations, can be avoided or significantly lessened if a community implements the mitigation measures detailed in the Plan. Many disaster assistance agencies and programs, including FEMA, require that a community adopt a pre-disaster mitigation plan as a condition for both mitigation funding and for disaster relief funding. For example, the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance Program (FMA) and the Community Rating System (CRS), are programs with this requirement.

Planning Process

The natural hazard mitigation planning process for the Town of Montague included the following tasks:

Review of the Montague 2005 Local Natural Hazards Mitigation Plan, assessment of relevancy of existing materials, status of action items and addition of new materials based upon MEMA recommendations and Committee input.

Identifying the natural hazards that may impact the community, and past occurrences of hazards at the local or regional level.

Conducting a Vulnerability/Risk Assessment to identify the infrastructure (i.e., critical facilities, public buildings, roads, homes, businesses, etc.) at the highest risk for being damaged by the identified natural hazards, particularly flooding and brush fires.

Identifying and assessing the policies, programs, and regulations a community is currently implementing to protect against future disaster damages. Examples of such strategies include:

- Preventing or limiting development in natural hazard areas like floodplains, wetlands, drinking water recharge areas, and conservation land;
- Implementing hazard mitigation recommendations in planning documents including the Comprehensive and Community Development Plans, Open Space and Recreation Plans, Emergency/Evacuation Plans that address the impacts of natural hazards; and
- Requiring or encouraging the use of specific structural requirements for new buildings such as buried utilities, flood-proofed structures, and lightning grounding systems that will enhance personal safety and minimize property damage to town residents.

Identifying deficiencies in the current strategies and establishing goals for updating, revising or adopting new strategies.

Identifying specific projects that will mitigate the risk to public safety and damages to both private and public property and infrastructure from natural hazards.

Adopting and implementing the final Natural Hazards Mitigation Plan.

The planning process for the Town of Montague also incorporated the following procedures:

- Provide an opportunity for the public to comment on the plan during the drafting and prior to the approval of the plan. A press release was publicized in the Greenfield Recorder and Montague Reporter in March 2011 and May 2011. A copy of the draft plan was available to the public at the Town Hall. Two Public Meetings were held – one each on March 29, 2011 and May 19, 2011.
- Provide an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities and agencies that have the authority to regulate development, and businesses, academia and other private and nonprofit organizations to be involved in the planning process. Representatives from the Gill Montague School District, FirstLight Power, and the Farren Care Center attended committee meetings.
- Review and incorporate, if appropriate, existing plans, studies, reports and technical information. Plans reviewed and incorporated include the 2010 Montague Comprehensive Emergency Management Plan, the 2010 Montague Open Space and Recreation Plan, and data sources cited in footnotes throughout this Plan.
- Document the planning process, including how it was prepared, and how the public was involved.

Much of this work was carried out by the staff of the FRCOG Planning Department with the assistance of the Montague Natural Hazards Mitigation Planning Committee, which includes representatives of the Department of Public Works, Police Department, Turners Falls Fire

Department, Montague Center Fire Department, Turners Falls Water Department, Montague Center Water Commission, and the Montague Town Administrator and Town Planner. Meeting minutes, sign in sheets and other correspondence are located in the appendix of this document.

Plan Updates and Changes

As indicated above in the Planning Process section, changes and updates were made to this Plan based upon MEMA recommendations and committee input. The following sections of the 2011 plan were added to and/or substantially updated:

- **Section 2: Local Profile**
 - Cultural and Historic Resources section added 13

- **Section 3: Risk Assessment**
 - Natural Hazard Identification and Profile
 - Location and Extent for Each Hazard added 15-39
 - Beaver Dams (Sub-Category of Dam Failure) added 26-27
 - Landslides added 32-35
 - Ice Jams added 35
 - Manmade Hazards added 36-39

 - Risk Assessment Methodology
 - All Hazards Risk Assessment Methodology expanded 40-43
 - TABLE 3-16: All Hazards Vulnerability Assessment Table added 44

 - Vulnerability Assessment
 - Environmental Justice section added 45-47
 - Assessment by Hazard – detailed section for each hazard added
 - Exposure 48-76
 - Damages 48-76
 - Loss estimates 48-76
 - Population impacts 48-76
 - Data deficiencies 48-76
 - Development Trends Analysis added 77-79
 - Zoning Map added 80
 - Critical Facilities and Infrastructure Map added 81

- **Section 4: Mitigation Strategy**
 - Current Mitigation Strategies were added for new hazards
 - Landslides 123-124
 - Ice Jams 125
 - Manmade Hazards 126-127
 - Future Mitigation Strategies modified based on TABLE 3-16: All Hazards Vulnerability Assessment Table
 - 2011 Action Plan - Prioritization of Goals and Action Items 128-130

Prioritized Action Plan in new table format with Potential Funding Sources added 131-136
NFIP Community Rating System (CRS) and addition NFIP added 137-139

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2 – LOCAL PROFILE¹

Community Setting

The Town of Montague is located in western Massachusetts, in central Franklin County. Montague is bordered by the Millers River and the towns of Gill and Erving on the north and northeast; Wendell on the east and the towns of Leverett and Sunderland on the south. The Connecticut River and the towns of Deerfield and Greenfield form Montague's western boundary. The Deerfield River runs into the Connecticut River just south of Montague City.

Historical documentation has established that areas adjacent to the Connecticut, Millers and Deerfield Rivers, as well as the Montague Plains, hosted extensive Native American hunting and fishing activity. Until the late 17th century, large numbers of Native American people congregated at the falls on the Connecticut River, at the place then known as Peskeomskut, and at Millers Falls during the annual spring spawning runs of salmon and shad.

Europeans came to Montague in the early 18th century and settled in the area around Taylor Hill and Dry Hill in Montague Center, the oldest of the Town's five villages. These Colonial settlers farmed the excellent soils of the surrounding river lowlands. Lumbering was also a part of the economic base, with dams along the Sawmill River to power the mills.

Around the turn of the 19th century, with the construction of the Upper Locks and Canal in Turners Falls by Dutch capitalists, as well as improvements in roadways and bridges such as the Fifth Massachusetts Turnpike from Montague City to Millers Falls and the Connecticut River Bridge, the Town of Montague began to expand beyond the village of Montague Center to Montague City and Millers Falls.

The railroad came to the Town of Montague in the 1850s. Millers Falls was the hub of both east-west and north-south routes. In 1865, John Alvah Crocker purchased the Upper Locks and Canal Co. and began the creation of Turners Falls as a planned industrial community. He built the power canal and dam on the Connecticut River and marketed both industrial and home sites in the village. Avenue A was laid out as a wide commercial street flanked by narrower streets designed to accommodate dense housing for mill workers. Development of Lake Pleasant as a spiritualist summer tent camp on the edge of the Montague Plains can also be attributed to the coming of the railroad.

Steady growth continued into the early 20th century, with the population of the Town reaching 7,925 in 1915. The Turners Falls Company began generating hydroelectric power in 1904 and went on to construct the Cabot Station hydroelectric plant in 1915, which is still in operation today. In 1936, the Town acquired and expanded the existing private airport on 185 acres on the north section of the Montague Plains, making it the largest airport in the state at the time.

¹ The majority of the information for this section was obtained from the Town of Montague's 2010 Open Space and Recreation Plan and 2004 Economic Development Plan, which were prepared by committees of residents and Town staff from various departments, with assistance from the Franklin Regional Council of Governments.

With the decline of industry in the latter half of the 20th century came the increase of residential/suburban growth, particularly in the villages of Turners Falls, Montague City, Montague Center and Millers Falls. Industrial development in the 1990s was concentrated in the Airport Industrial Park located between Turners Falls and Millers Falls.

The past twenty-five years of history in Montague reflect the national trend of increasing public concern about the environment. In the 1970s, there were proposals to locate first a large-scale landfill, then a nuclear power facility on the 2,000-acre Montague Plains, one of the few remaining examples of an intact inland Pitch Pine-Scrub Oak forest in southern New England. The proposals met with strong local opposition and eventually were withdrawn.

Montague Center residents successfully advocated for protection of approximately 50 acres of floodplain meadow along the Sawmill River off North Street during the 1980s, and the town's farmers have been active participants in the state's Agricultural Preservation Restriction Program. Farming and forestry are still widely practiced in Montague, and the rivers that once provided power for industry continue to do so today while providing economic opportunities through recreational activities and tourism.

While population growth in Montague has been slow since the early 20th Century, it is still one of the largest towns in Franklin County, with a 2010 population of 8,437 residents.² Montague serves as a regional employment center for surrounding towns.

Most of Montague's housing is located in the five villages. The main streets in downtown Turners Falls feature three-story brick buildings with housing above and ground-floor commercial uses, mostly constructed between 1870 and 1890. Housing on side streets in the downtown is a combination of duplexes and multi-family buildings, both masonry and wood, built during the same period on very small lots. The "hill" section of Turners Falls is residential in character, with single-family homes on ¼- to ½-acre lots.

The village of Montague City runs along the Power Canal from Turners Falls to the Town's boundary with Greenfield, and is composed of a mix of single-family homes, duplexes, multi-family buildings and commercial and industrial uses, including Cabot Station, the former Farren Hospital (now an extended care facility) and medical offices.

Millers Falls is a small mill village, with a mix of densely-packed housing and commercial uses, as well as a freight rail yard. Lake Pleasant is a unique community on the edge of the Montague Plains. Wood residences were built on tent lots laid out in the 1870s, resulting in very tightly-clustered housing. The village is surrounded by Pitch Pine/Scrub Oak forest.

The village of Montague Center has a traditional village green, flanked by residences on ¼- to ¾-acre lots, with a few remaining commercial uses. Agricultural uses predominate to the west and south of Montague Center. The eastern section of town, bounded by the Central New England Railroad on the west, is heavily forested, with scattered residences on large lots.

The total land area of the Town of Montague is approximately 20,109 acres.³ Approximately 14,170 acres, or 70% of the total land area, are undeveloped forest.⁴ More than 5,900 acres of

² 2010 U.S. Census Redistricting Data.

forest are permanently protected through public and private ownership, and are likely to remain undeveloped in perpetuity.⁵ There are approximately 2,736 acres in agricultural use (not including forestry), constituting 14% of the town's land base.⁶ More than 1,200 acres have been permanently protected for agriculture.⁷

Infrastructure

Transportation

Montague's transportation system consists of three state highways, bridges, a network of town roads, two rail lines, a limited regional bus system, a small airport, and an on- and off-road bike network.

Roads

Montague has a total of 135 miles of roadway.⁸ State Route 2, a major east-west route located just north of the Montague border, connects Montague with Greenfield and Route 91 to the west and Erving to the east. State Routes 63 and 47 are the major commuter roads connecting Montague to larger cultural and employment centers to the south.

Major town roads include Avenue A/Montague City Road, connecting Turners Falls and Montague City; Millers Falls Road, connecting Turners Falls and Millers Falls; Turners Falls Road connecting Montague Center and Turners Falls; and Greenfield Road, connecting Montague Center to Montague City. Greenfield Road is scheduled for comprehensive renovation in the next few years, including drainage repair, bridge restoration and addition of "share the road" signs alerting motorists to the presence of bicyclists. The town has many smaller roads, including several gravel roads in the eastern section of town that have been paved during the last five years.⁹ Gravel roads make up 21 miles, or nearly 16% of Montague's streets.¹⁰

Bridges

Bridge maintenance is a major problem in Massachusetts, and Montague is no exception. Out of Montague's 18 bridges,¹¹ several bridges in town are currently in need of repair, are being repaired or are closed. The Massachusetts Department of Transportation (MassDOT, formerly the Massachusetts Highway Department) is responsible for repair, replacement and maintenance of most of these structures.

³ MassGIS 2005 Land Use Data.

⁴ Ibid.

⁵ *Montague Open Space and Recreation Plan*. 2010.

⁶ Land Use analysis of assessor data by the Franklin Regional Council of Governments and the Montague Open Space and Recreation Plan Committee.

⁷ *Montague Open Space and Recreation Plan*. 2010.

⁸ Massachusetts Department of Transportation 2007 Road Inventory GIS File.

⁹ Montague Department of Public Works, personal communication.

¹⁰ Massachusetts Department of Transportation 2007 Road Inventory GIS File.

¹¹ Massachusetts Department of Transportation 2009 Bridge Inventory.

Major renovations on the Gill-Montague Bridge, which was constructed in 1937 and crosses the Connecticut River and Power Canal in Turners Falls, began in 2010. The \$40.1 million project should ensure that the 700-foot long span remains a critical link for industry, commerce and public safety in Montague. One lane, southbound into Turners Falls, remains open during bridge construction, which is expected to be completed in 2014.¹²

It is not clear at this writing how the partial closing of the Gill-Montague Bridge will impact commerce, daily commutes and emergency access. Remote cameras monitor traffic on the bridge, and in the event of an emergency, red lights on the Gill side of the bridge can be activated so that emergency vehicles can travel north out of Turners Falls. In August 2010, a Town of Montague fire truck heading to a blaze in Gill nearly hit a car that ignored the red light and drove onto the bridge headed to Turners Falls.

Repairs to the General Pierce Bridge over the confluence of the Connecticut and Deerfield Rivers on Montague's border with Greenfield, formerly listed as "structurally deficient" by MassDOT, was required before work on the Gill-Montague Bridge could begin. Crews worked for three months to stabilize the bridge temporarily during the spring of 2010. MassDOT plans to rehabilitate the bridge starting in 2015. In 2005, the department estimated the cost to be \$20 million.¹³ Current cost estimates from the Franklin Regional Council of Governments Planning Department run between roughly \$28 million to \$35 million, or more, depending on many variables. This overhaul represents a main infrastructure priority for the town.

The Greenfield Road Bridge over the New England Central Railroad tracks failed and was dismantled in 1999; MassDOT plans to construct a span for pedestrian and bicycle use on the site of the former bridge at a cost of \$1.4 million. No start date has been specified, however. A related project includes the reconstruction of Hatchery Road linking Greenfield Road to Turners Falls Road forming a major collector route circumventing the former bridge site. This project, with an estimated cost of \$1.2 million, is in the preliminary design stage, and is estimated to begin in 2013 or 2014.¹⁴

The Bridge Street Bridge connects the Montague and Erving sides of the village of Millers Falls across the Millers River. It was replaced by MassDOT between 2005 and 2008 for \$4 million. Also known as the Veteran's Memorial Bridge, the original span was built in 1953.¹⁵ The town-owned Sixth Street Bridge in Turners Falls, offers the primary access for the old Griswold Cotton Mill and for residents of "The Patch," a neighborhood on a peninsula of land in the canals of the Connecticut River between Turners Falls and Greenfield. The bridge, closed in 2006 when the deterioration of a nearby railroad building caused dangerous conditions on the bridge, was reopened to in-bound traffic in the summer of 2010 after Patch residents complained about the lack of access to their homes (Montague Department of Public Works, personal communication). The Eleventh Street Bridge remains open in both directions, connecting the mainland of Turners Falls to the Patch. Redevelopment of the old mill for intensive commercial or residential use could create access problems.

¹² Massachusetts Department of Transportation website, June 25, 2010, accessed September 1, 2010.

¹³ Ibid.

¹⁴ Ibid.

¹⁵ Ibid.

The Prospect Street Bridge over Spring Street in the “Hill” section of Turners Falls has been replaced by a new concrete span that was opened to traffic in the summer of 2010 (Montague Department of Public Works, personal communication). It was closed during construction, and had been shuttered since 2000. The repair cost \$2.2 million.¹⁶

Rail

The Pan Am Systems Main Freight line runs east-west across the Montague Plains, and the New England Central line runs north-south, parallel to Route 63. The lines intersect in Millers Falls. Currently, rail service in Montague is only for the transportation of freight. Amtrak’s Vermonter service between Washington D.C. and St. Albans, VT, currently travels through Montague twice a day on the New England Central line, but does not stop to pick up or drop off passengers. This service is slated to be rerouted to the west, with a stop added in Greenfield.

Air Transportation

The Turners Falls Airport is one of only two airports in Franklin County. It offers a 3,013-foot long, 75-foot wide runway that can accommodate small single-engine and two-engine planes. It is a general aviation airport, used for transportation, business, recreation, tourism, flight instruction and civil defense. There is currently space for 81 aircraft, 58 outdoor parking spaces on tie-downs and aprons, and 19 privately-owned hangars with capacity for 23 aircraft.

The Turners Falls Airport is undergoing total upgrade of the taxiway, apron, and a 1000 foot extension to the runway. The Airport’s sole runway was last reconstructed in 1978 and had an expected life of 20 years. Portions of the airport site are culturally significant to Native Americans and negotiations are underway between the Town and Narragansett and Wampanoag Tribes to preserve the sites. The plans are also sensitive to the ecological integrity of the site. Public access for non-aviation purposes is not allowed and increased site security will be developed in accordance with FAA regulations.¹⁷

Public Transportation

The Franklin Regional Transit Authority (FRTA) serves 40 towns in Franklin, Hampshire, Hampden, and Worcester counties. Three fixed routes currently serve the Town of Montague, on two of which the bulk of ridership is within Montague. Ridership for the Turners Falls route was 33,846 in FY 2009, the second highest out of all FRTA routes (FRTA personal communication). Despite these numbers, the vast majority of residents rely on automobiles for transportation. However, according to the 2000 U.S. Census, roughly 13 percent of occupied housing units in Montague did not have a vehicle available to the occupants, showing that transportation alternatives to the personal automobile need to be available to all residents.

¹⁶ Massachusetts Highway Department website.
http://www.mhd.state.ma.us/ProjectInfo/Main.asp?ACTION=GISReportByCity&SELECTED_CITY_ID=192.
Accessed September 16, 2010.

¹⁷ Montague Open Space and Recreation Plan. 2010.

Franklin County Bikeway

The Franklin County Bikeway is a project under implementation by the Franklin Regional Council of Governments (FRCOG) with the aim to provide a biking network, with both on-road and off-road facilities, throughout Franklin County, linking employment, recreational, and educational destinations. In 2008 the Canalside Trail Bike Path was completed, connecting Unity Park and the Great Falls Discovery Center in Turners Falls to northeast Deerfield on a 3.27 mile off-road path. The East Mineral Road Bridge, closed to motor vehicles, crosses the Millers River at Millers Falls, providing a connection to Erving and Northfield, including the Northfield Mountain Recreation and Environmental Center, on a shared roadway route. Other Bikeway routes traveling through Montague include the Greenfield-Montague Route (shared roadway facilities located in Montague, Bernardston, Deerfield, Greenfield, and Gill), and the Connecticut River Route (shared roadway leading to Sunderland).

Public Drinking Water Supply

Approximately 84% of the town's residents receive their drinking water from the municipal water supply system. The Town of Montague has three developed sources of municipal drinking water. There are two public wellfields located in the village of Montague Center. A single shallow well serves the village of Montague Center and is owned and operated by the Montague Center Water District, which is composed of 189 member households in the village center. In 2008, the District provided an average annual daily amount of roughly 35,000 gallons to approximately 450 people. This well is only 12 feet deep and is highly vulnerable to contamination.

The Turners Falls Water Department owns and operates two wells in the Tolan Farm well field, with a maximum capacity of approximately 2 million gallons per day. Water from the wells is piped to storage tanks with approximately 6.3 million gallons of capacity on top of Wills Hill. In 2008, the Turners Falls Water Department supplied 6,742 people with drinking water, which included residents of the Lake Pleasant Water District.¹⁸

The Turners Falls and Montague Center wells are hydrologically connected. During drought or times of high demand, pumping the Tolan Farm wells drains the Montague Center well. There is a valve connecting the two systems that allows the Turners Falls Water Department to supply Montague Center when necessary.

The third source of water is the Lake Pleasant Reservoir, which was the Town's main source of water until 1965. Lake Pleasant is owned by the Turners Falls Fire District. It covers 53 acres and has a storage capacity of approximately 150 million gallons. It is connected to Green Pond, a 15-acre reservoir that holds approximately 40 million gallons. The Turners Falls Fire District owns approximately 1,310 acres of land (MassGIS assessed acreage figure) in the watershed for Hannegan Brook, which feeds the reservoirs. Both the Lake Pleasant Reservoir and Green Pond are open bodies of water, therefore vulnerable to external contamination.

According to the Water Commissioners, summer water use in the 1990s was approaching the capacity of the Tolan Farm wells at 1.5 million gallons per day. In addition, says Water

¹⁸ Turners Falls Water Department, personal communication, 2010.

Department Superintendent Michael Brown, the department is worried about “having all of its eggs in one basket.” With all of the Town’s three municipal domestic water wells in the same aquifer, an incident that contaminated the aquifer would leave the Town without any useable drinking water.

The Turners Falls Water Department is currently developing a new well next to Lake Pleasant, scheduled to be completed in 2011. It is estimated that the well will have a 2 million gallon capacity, doubling the existing capacity¹⁹. This new source is greatly needed, as the two existing wells at Tolan Farm are being pumped close to the maximum capacity. The development of an additional water source also removes constraints to new industrial and large-scale residential development, which would otherwise strain the ability of the Water Department to provide water to all its users. In January 2011, Town Meeting voted to include the Delineated Zone II Recharge area surrounding the new well, excluding Millers Falls village center, in Montague’s Water Supply Protection District.²⁰ This change to the zoning bylaws will attempt to improve water quality for the new source of water.

In 1994, the Department of Environmental Protection (DEP) downgraded the Lake Pleasant and Green Pond reservoirs to an emergency water supply. Under current law, these sources cannot be brought back online for regular use unless the Water Department builds a filtration plant. The cost associated with this project is a significant issue for residents of the district and the town. Abandonment of Lake Pleasant and Green Pond as water supplies could make them available for swimming and other recreational uses. However, according to the DEP, Lake Pleasant is hydrologically connected to the new well being developed by the Water Department, and swimming will continue to be prohibited in the lake. Additionally, the Water Department and Fire District have concerns with allowing swimming in Green Pond due to its relative small size and shallow depth, which could result in high bacteria levels in the summer months (Turners Falls Water Department, personal communication).²¹

Sewer Service

Montague has a municipal wastewater treatment facility on Greenfield Road with a capacity of 1.83 million gallons per day of flow; 7,440 pounds Biological Oxygen Demand (BOD) per day and 6,000 pounds Total Suspended Solids (TSS) per day. Treated effluent is discharged to the Connecticut River; sludge is shipped out of town for disposal.

With the exception of Millers Falls, which is served by the Town of Erving’s wastewater treatment facility, all of the densely developed areas of town are served by the sewer system, including the remaining four village centers and the Airport Industrial Park off Millers Falls Road. Sewer service is also available at the old landfill off Turnpike Road, which has been identified as an area for future industrial development. The Riverside section of the Town of Gill is also serviced by the Montague facility.

¹⁹ Turners Falls Water Department, personal communication, 2010.

²⁰ Montague Planning Department, personal communication, 2010.

²¹ Updated information for water use compiled from the 2010 *Montague Open Space and Recreation Plan*.

Areas not served consist of rural areas of Montague Center, including Meadow Road, North Leverett Road and the Taylor Hill and Chestnut Hill areas, Route 47 and Route 63 south of Millers Falls, Dry Hill Road, and Turners Falls Road between Hatchery Road and the Cemetery, Greenfield Road south of Greenfield Cross Road, Hillside Road, Millers Falls Road between the Airport Industrial Park and Winthrop Street, Lake Pleasant and Green Pond Roads and Wendell Road.

Natural Resources

Montague falls into two ecological regions, and two different watersheds. The western section of town is part of the Connecticut River Valley, which is distinguished from its surrounding uplands by milder climate, relatively rich floodplain soils, and level terrain with some higher outcropping ridges. The remainder of Montague falls within the Worcester-Monadnock Plateau, which includes the hilliest areas of central Massachusetts. The higher elevations and geology in this region result in generally cool and acidic soils and vegetation typical of northern New England. The northeast corner of Montague is part of the Millers River watershed.

Water Resources

Montague is rich in water resources, including rivers, streams, ponds, wetlands and aquifers. In addition to the Connecticut and Millers River, many perennial streams run through the Town. Major tributaries to the Connecticut, listed from north to south, include Randall Brook, Hatchery Brook, the Sawmill River and Cranberry Pond Brook. The Sawmill has several perennial tributaries, including Goddard Brook, Pond Brook, Spaulding Brook, Chestnut Hill Brook and Williams Brook. Hannegan Brook feeds Lake Pleasant and Green Pond. Lyons Brooks flows into the Millers River.

Forests

As previously noted, Montague has extensive forests, extending from the town's eastern boundary to Route 63, and encompassing approximately 2,000 acres of pitch pine/scrub oak forest on the Montague Plains in the center of town. Pitch pine/scrub oak communities are the most fire-prone vegetation types in New England, and significant evidence exists suggesting that fire was an important influencing factor on the vegetation of the Plains for many years before European settlement.²²

Cultural and Historic Resources

Cultural and historic resources help define the character of a community and reflect its past. These resources may be vulnerable to natural hazards due to their location in a potential hazard area, such as a river corridor, or because of old or unstable structures. The 2010 Montague Comprehensive Emergency Management Plan lists the Carnegie Public Library, Colle Opera House, Millers Falls Branch Library, Montague Center Library, Shea Theater, and Williams Garage as significant cultural and historical resources in Montague. Montague has two historic

²² *Fire Management Plan for the Montague Plain Wildlife Management Area*. July 2003.

districts and one historic site listed on the National Register of Historic Places. The Montague Center Historic District comprises 1700 acres and 152 buildings in the traditional New England village center. The Turners Falls Historic District encompasses 1300 acres of the village, including 250 buildings.

The Montague Book Mill, also known as the Alvah Stone Mill, is perched on the banks of the Sawmill River. Listed on the National Register of Historic Places, it was built as a grist mill in 1842. The property now houses a used book store, a café and gourmet restaurant, an antique shop, and artists' studio. Until the 1930s, Montague families would visit by horse and buggy to buy grain and flour from the mill. Two of the old millstones can still be seen in the Sawmill River.

As idyllic a setting as the Book Mill grounds are, and despite many updates that have been made to the structure, the property is vulnerable in that it lies in a flood plain and is subject to periodic flooding. The dam was breached by flood waters in the late 1980s and a minor flash flood in 1997 took most of remaining dam structure down river. A flood in 2005 finished off the dam, taking away the last remains of the structure. An attempt was made to rebuild the dam but those efforts were stymied by environmental concerns, including fish passage and siltation.²³ While designation on the National Register of Historic Places is honorary in nature and does not provide any protective measures for the historic resources, designated sites may qualify for federal and state funding if damaged during a natural or manmade hazard.

Native American sacred sites along the Connecticut and Sawmill Rivers are at risk due to erosion along the banks of the rivers. FirstLight Power maintains an erosion control plan along the Connecticut River as required by the Federal Energy Regulatory Commission (FERC), and has repaired and maintained eroding riverbank and slopes at six Native American camp sites along the river since 2008 using bioengineering techniques, totaling 195 feet of non-adjacent sections. In 2009 similar bank stabilization work was completed on 1,000 linear in the vicinity of the Narrows on the Connecticut River.

23 <http://www.montaguebookmill.com/history.html>

3 - RISK ASSESSMENT

Natural Hazard Identification and Profile

Historical research, conversations with local officials and emergency management personnel, available hazard mapping and other weather-related databases were used to identify the natural hazards that are most likely to have an impact on the Town of Montague.

FLOODS

General Description

The average annual precipitation for Montague and surrounding areas in northwestern Massachusetts is 44 inches. Montague received 58.5 inches of rain in 2008.²⁴ There are three major types of storms that bring precipitation to the area. Continental storms that originate from the west continually move across the region. These storms are typically low pressure systems that may be slow-moving frontal systems or more intense, fast-moving storms. The second major storm type are coastal storms. There are two kinds that bring major precipitation and wind – nor'easters and hurricanes. Nor'easters bring heavy rain, high winds, ice storms or blizzards into New England from the coast of Maine and Canada. In late summer or early fall, hurricanes, may reach Massachusetts from the south and result in significant amounts of rainfall. The third type of storm is the result of local convective action. Thunderstorms that form on warm, humid summer days can cause locally significant rainfall.

Floods are classified as either *flash floods*, which are the product of heavy, localized precipitation in a short time period over a given location or *general floods*, which are caused by precipitation over a longer time period in a particular river basin. Since the town is located at the confluence of three major rivers, Montague has also experienced what is known locally as *backwater flooding* due to ice jams on the Connecticut and Sawmill Rivers. There are several local factors that determine the severity of a flooding event, including: stream and river basin topography, deep snow pack, precipitation and weather patterns, recent soil moisture conditions, amount of impervious surface area, and the degree of vegetative clearing. Floods occur more frequently and are the most costly natural hazard in the United States.

Flash flooding events typically occur within minutes or hours after a period of heavy precipitation, after a dam or levee failure, or from a sudden release of water from an ice jam. Most often, flash flooding is the result of a slow-moving thunderstorm or the heavy rains from a hurricane. In rural areas, flash flooding often occurs when small streams spill over their banks. However, in urbanized areas, flash flooding is often the result of clogged storm drains (leaves and other debris) and the higher amount of impervious surface area (roadways, parking lots, roof tops).

²⁴ Massachusetts Department of Conservation and Recreation 2009 precipitation data, <http://www.mass.gov/dcr/watersupply/rainfall/index.htm>.

In contrast, *general flooding* events may last for several days. Excessive precipitation within a watershed of a stream or river can result in flooding particularly when development in the floodplain has obstructed the natural flow of the water and/or decreased the natural ability of the groundcover to absorb and retain surface water runoff (e.g., the loss of wetlands and the higher amounts of impervious surface area in urban areas).

A floodplain is the relatively flat, lowland area adjacent to a river, lake or stream. Floodplains serve an important function, acting like large “sponges” to absorb and slowly release floodwaters back to surface waters and groundwater. Over time, sediments that are deposited in floodplains develop into fertile, productive farmland like that found in the Connecticut River Valley. In the past, floodplain areas were also often seen as prime locations for development. Industries were located on the banks of rivers for access to hydropower. Residential and commercial development occurred in floodplains because of their scenic qualities and proximity to the water. Although periodic flooding of a floodplain area is a natural occurrence, past and current development and alteration of these areas ensures that flooding will continue to be a costly and frequent hazard.

Location and Extent

Franklin County has several major rivers and numerous tributaries which are susceptible to flood events. The major rivers in the region include the Connecticut, the Deerfield, and the Millers. Some of the tributaries to these rivers which are prone to flooding include the Green River and the Sawmill River. Flooding poses a significant threat to life and public health and can cause severe property damage. Table 3-1 shows occurrences of flooding in Franklin County since 1993 and Table 3-2 shows occurrences of flooding specific to Montague, both taken from NOAA data and committee input.

Table 3-1: Flooding Events in Franklin County Since 1993

| Year | # of Flood Events | Annual Property Damage | Annual Crop Damage |
|------------|-------------------------|--------------------------------|----------------------------|
| 2010 | 1 | \$150,000 | \$0 |
| 2009 | 0 | \$0 | \$0 |
| 2008 | 3 | \$38,000 | \$0 |
| 2007 | 1 | \$250,000 | \$0 |
| 2006 | 0 | \$0 | \$0 |
| 2005 | 5 | \$11,435,000 | \$0 |
| 2004 | 2 | \$10,000 | \$0 |
| 2003 | 1 | \$10,000 | \$0 |
| 2002 | 0 | \$0 | \$0 |
| 2001 | 1 | \$0 | \$0 |
| 2000 | 1 | \$0 | \$0 |
| 1999 | 0 | \$0 | \$0 |
| 1998 | 4 | \$75,000 | \$0 |
| 1997 | 0 | \$0 | \$0 |
| 1996 | 11 | \$1,800,000 | \$0 |
| 1995 | 3 | \$0 | \$0 |
| 1994 | 2 | \$0 | \$0 |
| 1993 | 5 | \$0 | \$0 |
| # of Years | Total # of Flood Events | Average Annual Property Damage | Average Annual Crop Damage |
| 18 | 40 | \$764,889 | \$0 |

Source: <http://www4.ncdc.noaa.gov>

Table 3-2: Flooding Events in Montague Since 1993

| Date | Location | Type | Recorded Property Damages |
|---------------|----------------------------------|-----------------|------------------------------------|
| March 31 1993 | Connecticut River | Flood | \$0 |
| April 4 1993 | Connecticut River | Flood | \$0 |
| April 17 1993 | Connecticut River | Flood | \$0 |
| April 8 1994 | Connecticut River | Flood | \$0 |
| April 14 1994 | Connecticut River | Flood | \$0 |
| circa 1996 | Franklin County Technical School | Runoff | Unknown |
| June 13 1996 | Sawmill River, Spaulding Brook | Flash Flood | \$1,800,000 |
| Jan 9 1998 | Connecticut River | Flood | \$0 |
| March 30 1998 | Connecticut River | Flood | \$0 |
| April 1 1998 | Connecticut River | Flood | \$0 |
| April 22 1998 | Connecticut River | Flood | \$0 |
| April 1 2004 | Connecticut River | Flood | not available |
| Oct 8 2005 | Region-wide | Flood | \$4,200,000 |
| Oct 15 2005 | State-wide | Flood | \$6,000,000 |
| 2009 | Hillcrest School Building | Failed dry well | Approx. \$400 (school staff labor) |

Source: <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms> and committee input.

In Montague, 1,454 acres, 7% of the total land area, is in the floodplain, including approximately 14 acres of developed residential land.²⁵ Montague's 2010 Comprehensive Emergency Management Plan (CEM Plan) identifies Montague Center at the junction of the Sawmill and Connecticut rivers as prone to flooding. As noted previously, the Montague Book Mill, listed on the National Register of Historic Places, is located in the floodplain along the Sawmill River. Additionally, there are several historically significant Native American sacred sites in the vulnerable wetlands areas along the Connecticut and Millers Rivers.

The Town of Montague experienced severe flooding following a "microburst" rainstorm in June 1996. Six inches of rain fell in less than an hour, resulting in the worst flooding in 100 years of records on the Sawmill River and causing flooding along Goddard Brook, Chestnut Hill Brook, Spaulding Brook and Cranberry Pond Brook that washed out sections of Dry Hill Road, Chestnut Hill Road, Spaulding Brook Road and Old Sunderland Road. Sections of Center Street and South Street were impassible; and material from a local junk dealer located in or near the floodplain was widely distributed through the village. The Massachusetts Emergency Management Agency declared the Town a disaster area. A site survey was conducted by the National Weather Service on June 14th. More than 30 miles of roadway in southern Montague and Leverett were destroyed. The National Guard was dispatched to make temporary repairs to roads where detours were not possible, and the Town eventually received grant money from the state for permanent repairs. Numerous homes and businesses experienced some degree of flood damage. This event has been estimated as at least a 100-year event for southern Montague and a 500-year event for the Sawmill River and Spaulding Brook. The Massachusetts Emergency Management Agency has estimated damage from this flood at close to \$2 million. Local residents who have lived in the area for many years said this was the worst flooding they had witnessed since the Great New England Hurricane of 1938. A few thought that it exceeded even that historical flood event.²⁶

In September 1999, all of Franklin County was declared a disaster area due to flooding from Tropical Storm Floyd. Floods in July and October of 2005 caused major damage countywide. Flooding during the Columbus Day holiday in 2005 saw the Connecticut River rise to 35.04 feet, more than 7 feet above flood stage, at Montague City, according to press reports at the time. Federal disaster relief funds were distributed to one Montague household, but the town saw damage from the flood waters. There was flooding on Millers Falls Road near Highland Cemetery and part of Wendell Road was washed out because the culvert beneath the road was washed away, according to press reports. Parts of Montague Center near the Sunderland border were flooded, as well. In April 2007, minor flooding occurred along the main stem of the Connecticut River through Montague. A crest of 30.3 feet was recorded (flood stage is 28 feet).

In addition to these events, there are several areas in Montague identified by the committee with the potential for localized and/or chronic flooding. Key areas of concern include:

Montague City Road

The area between Montague City road and the power canal experiences annual flooding due to beaver dam activity and seepage from the canal. During heavy rains water percolates up through

²⁵ 2005 MassGIS land use data.

²⁶ NOAA National Climatic Data Center, <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>.

the cellars of homes. In response to concerns expressed by the Town, the Federal Energy Regulatory Commission commissioned a review of the structural integrity of the canal's left embankment in 2000, which determined that the integrity of the canal was sound and that the elevated groundwater levels and periodic flooding are likely due to the growing beaver population. However committee members feel that seepage from the canal is occurring and contributes to the flooding problems in this area of town.

Franklin County Technical School

Located in the Airport Industrial Park, the school's ball fields and driveways flooded approximately fifteen years ago due to runoff from the airport. The fire department was deployed to pump water away from the site as it threatened to reach the school building. Since then drainage has been improved at the airport. However this area is still prone to flooding from heavy snow melt or late winter rains when the ground is still frozen. Creating drainage to the nearby Connecticut River would be problematic as it could cause bank erosion in an area with potential cultural artifacts.

Meadow Road

Twenty five years ago the eastern bank of the Connecticut River was built up along Meadow Road near the border of Sunderland to prevent the road from being washed out due to annual flooding of the river. Additionally, a concrete basin up the road periodically is plugged by beaver activity and needs to be continually monitored.

Hillcrest School Building

The Hillcrest school building in Turners Falls experiences flooding approximately every five to ten years due to frozen dry wells. In 2009 flooding caused 12 to 18 inches of water to accumulate in the heating tunnels of the building. Members of the school facility staff, Fire Department, Department of Public Works, and the Water Department assisted with flood containment and clean up efforts. Dry wells are the only form of drainage available in this location.

SEVERE WINTER STORMS

General Description

Severe winter storms can pose a significant risk to property and human life because the rain, freezing rain, ice, snow, cold temperatures and wind associated with these storms can disrupt utility service, phone service and make roadways extremely hazardous, as well as impassable. Severe winter storms can be deceptive killers. The types of deaths that can occur as a result of a severe winter storm include: traffic accidents on icy or snow-covered roads, heart attacks while shoveling snow, and hypothermia from prolonged exposure to cold temperatures. Infrastructure and other property are also at risk from severe winter storms and the associated flooding that can occur following heavy snow melt. Power and telephone lines, trees, and telecommunications structures can be damaged by ice, wind, snow, and falling trees and tree limbs. Icy road conditions or roads blocked by fallen trees may make it difficult to respond promptly to medical emergencies or fires. Prolonged, extremely cold temperatures can also cause inadequately insulated potable water lines and fire sprinkler pipes to rupture and disrupt the delivery of drinking water and cause extensive property damage.

Location and Extent

Franklin County regularly experiences severe winter storm events between the months of December and April. According to the National Climatic Data Center (NCDC), there have been a total of 111 snow and ice events reported in Franklin County between February 1, 1993 and February 26, 2010, including heavy snow, snow, ice storms, snow squalls, freezing rain and winter storms.²⁷ The NCDC web site has more detailed information about each of the listed storms. Seven out of the 111 snow and ice events that impacted Franklin County (as well as other areas of Massachusetts) resulted in Presidential Disaster Declarations or Emergency Declarations, which then made the state, residents and businesses eligible for federal disaster relief funds. Table 3-3 lists the seven recent severe winter disasters that have led to Presidential Disaster or Emergency Declarations in Massachusetts.

Table 3-3: Major Winter Storm Disasters and Emergency Declarations Impacting Franklin County, 1993-2009

| Disaster Name | Date of Event | Declared Areas | Disaster #/Type of Assistance | Federal Share Disbursed | Non-Federal Share Disbursed | Total Disbursement |
|---|----------------------|---|--------------------------------------|--------------------------------|------------------------------------|---------------------------|
| Blizzards, High Winds and Record Snowfall | March 1993 | All 14 Counties | FEMA-3103-EM (PA) | \$1,284,873 | \$183,649 | \$1,468,522 |
| Blizzard | January 1996 | All 14 Counties | FEMA-1090-EM (PA) | \$16,177,860 | | \$16,177,860 |
| Snowstorm | March 2001 | Counties of Berkshire, Essex, Franklin, Hampshire, Middlesex, Norfolk, and Worcester. The cost share is 75% federal and 25% local. | FEMA-3165-EM (PA) | \$21,065,441 | | \$21,065,441 |
| Snowstorm | February 2003 | All 14 Counties. The cost share is 75% federal and 25% local. | FEMA-3175-EM (PA) | \$28,868,815 | | \$28,868,815 |
| Snowstorm | December 2003 | Counties of Barnstable, Berkshire, Bristol, Essex, Franklin, Hampden, Hampshire, Middlesex, Norfolk, Plymouth, Suffolk, and Worcester | FEMA-3191-EM (PA) | \$35,683,865 | | \$35,683,865 |
| Snowstorm | January 2005 | All 14 Counties | FEMA-3201-EM (PA) | \$49,945,087 | | \$49,945,087 |
| Severe Winter Storm | December 2008 | Berkshire, Bristol, Essex, Franklin, Hampden, Hampshire, Middlesex, Suffolk, and Worcester *(Figure as of | FEMA-3296-EM-MA | \$66,509,713 | | |

²⁷ NOAA National Climatic Data Center, <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>.

| Disaster Name | Date of Event | Declared Areas | Disaster #/Type of Assistance | Federal Share Disbursed | Non-Federal Share Disbursed | Total Disbursement |
|----------------------------|---------------|---|-------------------------------|-------------------------|-----------------------------|--------------------|
| | | 9/8/2009) | | | | |
| Severe Storms and Flooding | December 2008 | All 14 Counties (6 month lock-in \$7,200,000) | FEMA-1813-DR-MA(PA) | | | |

Notes: **Public Assistance (PA) Project grants.** Supplemental disaster assistance to states, local governments, certain private non-profit organizations resulting from declared major disasters or emergencies.

Although ice storms occur much less frequently than snow storms (4 out of 111 in the NCDC database), the effects can be devastating. On December 11, 2008, Franklin County residents awoke to a landscape coated with ice. Half an inch of ice accumulated on exposed surfaces across Franklin County. The conditions caused wires to fall off a house in Sunderland. This major ice storm affected interior Massachusetts and southern New Hampshire as well as much of northern New England. The ice buildup on exposed surfaces combined with breezy conditions resulted in numerous downed trees, branches, and power lines, which resulted in widespread power outages. More than 300,000 customers were reportedly without power in Massachusetts and an additional 300,000 were without power in the state of New Hampshire. Because of the breadth of this storm (from Pennsylvania to Maine), extra crews to reinstate power were harder to come by. Power crews from states as far away as South Carolina, as well as local National Guard teams, were called out to help with power restoration and clean up. While most people had their power restored within a week, others were still without power at Christmas (nearly 2 weeks later). According to the NCDC, during this period, temperatures were mostly below normal and at least one major snowstorm affected the same area. At the time of the December 19th snowstorm, which dumped 7 – 12 inches of snow in eastern Franklin County and 9 – 14 inches of snow in western part of the county, over 100,000 customers were still without power in the two states combined. Two days later, on December 21st, 5 – 7 inches of new snow blanketed eastern Franklin County.

In Montague’s rural areas, many households that lose power during winter storms also lose access to their wells and are without a potable drinking water source. A snow storm in February 2010 caused widespread power outages in Millers Falls and Montague Center, in some areas lasting up to three days. The Turners Falls High School was opened as a shelter for residents during this time. During the winter of 2010/2011, large snow loads on roofs were a concern, and caused the roof of a barn in town to collapse.

HURRICANES AND TROPICAL STORMS

General Description

Hurricanes are violent rainstorms with strong winds that can reach speeds of up to 200 miles per hour. Hurricanes generally occur between June and November and can result in flooding and wind damage to structures and above-ground utilities. August, September, and the first half of October are when most hurricanes occur in New England. In Massachusetts, major hurricanes occurred in 1904, 1938, 1954, 1955, 1960 and 1976, 1985 and 1991. The last hurricane to make

landfall in New England was Hurricane Bob, a weak category 2 hurricane, in August 1991. In Franklin County, Hurricane Bob caused roughly \$5,555,556 in property and crop damages.²⁸

Tropical storms, defined as having sustained winds from 34-73 mph, have also resulted in high winds and damages in Franklin County. Between 1990 and 2008, 16 tropical storms impacted the County, causing almost \$600,000 in property damages.²⁹ No significant damage was reported in Montague due to hurricanes or tropical storms.

Location and Extent

While hurricanes and tropical storm events are rare in Montague, the committee estimates that a hurricane or tropical storm would impact more than 50% of the town, and could result in multiple injuries and more than 25% property damage throughout town. A potential complete shutdown of facilities for more than one week is also possible.

TORNADOES AND MICROBURSTS

General Description

The category of Tornadoes and Microbursts includes thunderstorm events, and associated storm effects including hail and lightning. A tornado is defined as a violently rotating column of air extending from a thunderstorm to the ground.³⁰ Tornadoes typically form in the spring and summer during severe thunderstorm events. In a relatively short period of time and with little or no advance warning, a tornado can attain rotational wind speeds in excess of 250 miles per hour and can cause severe devastation along a path that ranges from a few dozen yards to over a mile in width. The path of a tornado may be hard to predict because they can stall or change direction abruptly. Within Massachusetts, tornadoes have occurred most frequently in Worcester County and in communities west of Worcester. High wind speeds, hail, and debris generated by tornadoes can result in loss of life, downed trees and power lines, and damage to structures and other personal property (cars, etc.). Since the 1950s, there have been over twenty tornadoes in Franklin County. Tornadoes have been recorded in nearby Sunderland (July 5, 1955), Northfield (July 3, 1972), Leverett (August 29, 1972), and Wendell (July 11, 2006). The July 2006 tornado in Wendell was rated F2 (Strong) on the Fujita Scale with winds estimated near 155 mph.³¹ A May 2009 weak tornado, or “gustnado” touched down in Sunderland, destroying a barn.³²

Of additional concern are microbursts, which often do tornado-like damage and can be mistaken for tornadoes. In contrast to the upward rush of air in a tornado, air blasts rapidly downward from thunderstorms to create microbursts.³³

²⁸ Spatial Hazard Events and Losses Database (SHELDUS), <http://webra.cas.sc.edu/hvri/>

²⁹ Ibid.

³⁰ Tornadoes, Nature’s Most Violent Storms: A Preparedness Guide. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service. 1995.

³¹ NOAA National Climate Data Center, <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>

³² NOAA. http://www.erh.noaa.gov/aly/Past/2009/May_9_2009/LSR_BOX.txt

³³ <http://www.fema.gov/regions/vii/2003/03r7n06a.shtm>

Location and Extent

The July 2006 tornado in Wendell also impacted parts of Montague on the border with Wendell, knocking down trees on Wendell Road. While tornadoes are rare in Montague, they can cause catastrophic damage to the impacted area when they do occur. The committee lists tornadoes as one of the highest priorities in terms of mitigation and planning largely due to the severity of the impacts and the level of preparedness needed to adequately respond to a devastating tornado.

According to data supplied by the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center and committee input, from August 1994-June 2010, the Town experienced nine microburst (or "thunderstorm wind") events. Many of these events caused downed trees and power lines. Several of these events caused significant damage. In June of 2008 a microburst caused downed power lines and several fallen trees. In September 2008, severe thunderstorms caused \$8,000 in damages from downed trees and wires. A microburst on Dry Hill Road in 2009 caused extensive damage to the area.

On May 26, 2010, strong thunderstorm winds caused damages throughout the Connecticut River Valley with numerous trees and wires down and widespread power outages. In Montague a shelter was opened for victims as power outages lasted for up to 3 or 4 days in some areas of town. Many trees were knocked down, resulting in a three week clean up effort to clear roads. Behind the Montague Public Safety Complex, a microburst downed approximately 50 trees. The State knocked down damaged trees in the affected area after the storm, however the town still needs to clean up the area and cut down several more trees. The Town suffered an estimated total of \$20,000 in damages and costs to clean up from the storm. A month later on June 24, 2010, a storm knocked down trees and wires on Greenfield Road, resulting in \$15,000 in damages.

WILDFIRES AND BRUSHFIRES

General Description

According to FEMA, there are three different classes of wildland fires: *surface fires*, *ground fires* and *crown fires*.³⁴ The most common type of wildland fire is a surface fire which burns slowly along the floor of a forest, killing or damaging trees. A ground fire burns on or below the forest floor and is usually started by lightning. Crown fires move quickly by jumping along the tops of trees. A crown fire may spread rapidly, especially under windy conditions, and is extremely difficult to extinguish.

Location and Extent

Fire is a significant natural hazard on the Montague Plains due to the extremely flammable nature of the Pitch Pine-Scrub Oak vegetation. Paleoecological evidence strongly suggests fire was a common occurrence on the Plains from 500 to at least 2,000 years before European settlement. It is believed that most of these fires were intentionally set for the purposes of land use management. Historical records indicate that extensive fires (some larger than 1,000 acres) burned through the Plains in the early and middle 20th century followed by numerous smaller fires (less than 5 acres) after about 1950. A 1907 fire destroyed most of the homes in Lake

³⁴ FEMA, "Fact Sheet: Wildland Fires," September 1993.

Pleasant. The last large fire (approximately 460 acres) occurred in 1957.³⁵ More than 110 fires have been documented to have occurred on the Plains in the past 80 years. There are a number of factors that contribute to the danger of fire on the Plains, including decades of suppressing natural occurrences of fire that have increased fuel loads, as well as land uses such as transmission lines, use of all-terrain vehicles and illegal campfires. Strategies to address the danger of fire on the Plains will be discussed later in this plan.

Montague has two independent fire districts: The Montague Center Fire District covers the southern section of town, encompassing the villages of Montague Center and Lake Pleasant, the southern 2/3 of the Montague Plains and most of the Town’s rural areas. The Turners Falls Fire District is responsible for the northern section of town, including the villages of Turners Falls (including the Industrial Park), Montague City and Millers Falls, as well as the northern 1/3 of the Plains and the forested areas in the northeast section of Town.

Between 2004 and 2009, the Montague Center Fire Department responded to a total of 38 brush fires. During the same period, the Turners Falls Fire Department reported 29 brush fires. The actual numbers of brushfires is likely larger, as the fire departments do not report fires that are less than a quarter acre in size. Many brushfires are started on residential lots to clear grass, leaves, brush and other woody debris and become a problem when the homeowner can no longer control them. Lightning strikes, while relatively uncommon, are also a concern—a fire started by lightning destroyed a barn in July 2004. In 2009, sparks from a passing train ignited dry brush in Montague Center; 8 acres burned before firefighters from 15 departments extinguished the blaze after 4 hours.

Table 3-4: Massachusetts Fire Incident Reporting System – Brushfires 2004-2009 in Montague and Surrounding Towns

| Department | Total # of Brush Fires | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|------------------------|------------------------|----------|----------|-----------|----------|----------|----------|
| Deerfield | 23 | 6 | 5 | | 1 | 4 | 7 |
| Erving | 10 | 4 | 2 | 1 | 0 | 3 | 0 |
| Gill | 14 | 0 | 1 | 7 | 4 | 1 | 1 |
| Greenfield | 35 | 0 | 1 | 4 | 11 | 13 | 6 |
| Leverett | 11 | 1 | 1 | 3 | 5 | 0 | 1 |
| Montague Center | 38 | 3 | 8 | 10 | 7 | 1 | 9 |
| South Deerfield | 18 | 4 | 2 | 3 | 5 | 2 | 2 |
| Sunderland | 17 | 4 | 6 | 6 | 0 | 1 | 0 |
| Turners Falls | 29 | 8 | 5 | 4 | 7 | 1 | 4 |
| Wendell | 9 | 0 | 0 | 6 | 2 | 0 | 1 |
| Franklin County | 398 | 63 | 67 | 77 | 84 | 48 | 59 |

Source: Massachusetts Fire Incident Reporting System (MFIRS), Massachusetts Department of Fire Services.

³⁵ Most of the information in this report about fire on the Montague Plains was taken from the *Fire Management Plan for the Montague Plain Wildlife Management Area*, prepared for the Massachusetts Dept. of Fisheries, Wildlife, and Environmental Law Enforcement and Natural Heritage and Endangered Species Program by Kennedy H. Clark and William A. Patterson III, July 2003.

The village of Lake Pleasant, on the eastern edge of the Plains, is an area of particular concern with respect to danger from wildfire. A crown fire west of the village could spread quickly, resulting in devastating loss of property and possibly life. Other residential and commercial buildings to the north, northwest, west and southwest of the Plains on Millers Falls Road, Hillside Road and Turners Falls Road are somewhat less susceptible to a catastrophic fire, but are still at risk. Smoke-sensitive areas close to the Plains include major roads, the Turners Falls Airport, Turners Falls High School/Great Falls Middle School, the Sheffield and Hillcrest Elementary Schools, Franklin County Technical School and the Farren Care Center.

DAM FAILURE

General Description

Although dams and their associated impoundments provide many benefits to a community, such as water supply, recreation, hydroelectric power generation, and flood control, they also pose a potential risk to lives and property. This potential risk is associated with dams constructed by people as well as those dams constructed by beavers. For example, beaver dams in the neighboring town of Leverett have impounded large quantities of water that could cause significant damage to private property and town infrastructure in Montague if the dams were to fail.

Dam failure due to natural causes is not a common occurrence but dams do represent a potentially disastrous hazard. When a dam fails, the potential energy of the stored water behind the dam is instantly released, oftentimes with catastrophic consequences, as the water 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 will depend upon 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. Many dams in Massachusetts were built in the 19th Century without the benefit of modern engineering design and construction oversight. Dams can fail because of structural problems due to age and/or lack of proper maintenance. Dam failure can also be the result of structural damage caused by an earthquake or flooding brought on by severe storm events.

The Massachusetts Department of Conservation and Recreation (DCR) is the agency responsible for regulating dams in the state (M.G.L. Chapter 253, Section 44 and the implementing regulations 302 CMR 10.00). Until 2002, DCR was also responsible for conducting dam inspections when state law was changed placing responsibility and cost for inspections on the owners of the dams. In accordance with the new regulations, which went into effect in 2005, dam owners must register, inspect and maintain dams in good operating condition. Owners of High Hazard Potential dams and certain Significant Hazard Potential dams are also required to prepare, maintain and update Emergency Action Plans.

The DCR’s Office of Dam Safety lists three hazard classifications for dams:

- ***High Hazard Potential:*** Dams located where failure or improper operation will likely cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways, or railroads.

- **Significant Hazard Potential:** 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 Potential:** Dams located where failure or improper operation may cause minimal property damage to others. Loss of life is not expected.

Owners of dams are required to hire a qualified engineer to inspect and report results using the following inspection schedule:

- Low Hazard Potential dams – 10 years
- Significant Hazard Potential dams – 5 years
- High Hazard Potential dams – 2 years

The time intervals represent the maximum time between inspections. More frequent inspections may be performed at the discretion of the state. Dams and reservoirs licensed and subject to inspection by the Federal Energy Regulatory Commission (FERC) are excluded from the provisions of the state regulations provided that all FERC-approved periodic inspection reports are provided to the DCR. All other dams are subject to the regulations unless exempted in writing by DCR.

Along with manmade dams, beaver dams can cause flooding as well. On one hand, beavers' alteration of the landscape is a natural process that creates habitat for shore birds, mammals and rare amphibians. On the other hand, beaver ponds can flood structures, roads and utilities, causing costly and potentially dangerous situations. Beaver activity can also pollute drinking water supplies. Mitigation measures suggested by Massachusetts Division of Fish and Wildlife (MassWildlife) and other agencies can help communities and homeowners deal with nature's master builders.

Until 1996, when a ballot initiative passed restricting the practice, Massachusetts residents were permitted to trap beavers. That change in policy caused a spike in the beaver population, which, in turn, led to a sharp increase in complaints about beaver activity and its effects. The law was modified in 2000 so that town Board of Health members could issue emergency trapping permission outside of the usual trapping season. But an increased beaver population, combined with land development reducing beaver habitat, means that humans and beavers continue to clash. Several mitigation measures, when applied thoughtfully, legally and with maintenance measures in mind, can help with beavers' negative effects, while preserving beavers' positive impact on the land.³⁶

State law makes it illegal for any person to disturb or tear open a beaver dam or beaver lodge without written permission from MassWildlife and the local Conservation Commission or Department of Environmental Protection. Permits are needed to disturb a beaver dam for any reason in Massachusetts. Even dams that cause flooding require permits to be breached.³⁷

³⁶ *Otsego County (NY) All Hazards Mitigation Plan*, 2010.

³⁷ Langlois, S.A. and T.A. Decker. 2004. *The Use of Water Flow Devices and Flooding Problems Caused by Beaver in Massachusetts* (Rev. Ed.). MA Division of Fisheries and Wildlife. 18pp.

While trapping beaver can have short-term benefits, the right conditions for beaver habitat will eventually lure new beavers. It may be best to combine trapping with measures that discourage beaver activity that's bad for humans. Techniques used to mitigate the flooding damage caused by beaver include breaching of beaver dams, protecting road culverts with fences or guards, and controlling water levels with water flow devices. All these techniques require a certain degree of effort and regular maintenance to insure water levels that can be tolerated (thereby preserving the positive aspects of the associated wetland). See the MassWildlife publication *The Use of Water Flow Devices and Flooding Problems Caused by Beaver in Massachusetts* for details on these mitigation measures. The following techniques were adapted from that publication.

- Dam breaching is an immediate but very short-term solution to flooding problems caused by beaver. Potato hoes or stone hooks are the best tools for dismantling dams by hand. Shovels and spading forks are ineffective. Good water control is possible if the breach is kept shallow and broad so that the water level falls slowly. Opening a deep breach creates a dangerous situation and may cause serious flooding and erosion downstream. Tractor- or truck-mounted excavators may be used by town, county or state highway employees to remove large amounts of material from beaver dams but care should be taken to avoid downstream flooding. Neighbors should be told where, when, and why a dam excavation is going to be done. If the method is justified and must be used, it is best done in mid-summer when the water level is low.
- Beavers build dams instinctively. When they sense running water, they start to build or repair dams. Culverts, especially ones made out of metal, will amplify the sound of the water rushing through them. Thus, beaver will commonly block road culverts with sticks, mud and rocks. This can cause flooding upstream. Culverts blocked from the inside are difficult to clean and potentially dangerous. The use of meshes and grills, placed on both the upstream and downstream ends of the culvert, can prevent beavers from entering. Several strategies are listed in *The Use of Water Flow Devices and Flooding Problems Caused by Beaver in Massachusetts*.
- Water Level Control Devices (WLCDs) keep beavers away from an intake pipe that lowers the water level of the pond. It's been estimated that only 4.5% of beaver problems in Massachusetts will respond to these devices. Using and maintaining a WLCD in conjunction with trapping young beavers can allow coexistence for years. Several types of WLCDs are available. For construction details, see *The Use of Water Flow Devices and Flooding Problems Caused by Beaver in Massachusetts*.

Location and Extent

Of particular note are the projects on the Deerfield River owned by TransCanada Corporation and Brookfield Power and licensed by the Federal Energy Regulatory Commission (FERC). These projects include the Somerset Dam, the Harriman Dam, the Sherman Dam (all owned by TransCanada), the Fife Brook Dam and the Bear Swamp Upper Reservoir (both owned by Brookfield Power), all of which are classified as High Hazard Dams. The Emergency Action Plans for these projects include a series of inundation maps for each dam which illustrate

potential flooding conditions for downstream areas including portions of Montague adjacent to the Connecticut and Sawmill Rivers.³⁸

A catastrophic failure of any one of these High Hazard dams would likely result in the cascading failure of all the downstream dams (both High and Low Hazard dams), resulting in widespread flooding of downstream areas in a matter of hours. For example, on a sunny day (no additional precipitation added to released water), water from a catastrophic failure of the Harriman Dam would reach the Route 5 Bridge which spans the Deerfield River (67.6 miles from origin) in 4.6 hours and the confluence of the Deerfield and Connecticut Rivers (68.9 miles from origin) in 5 hours and the B& M Railroad Bridge (70.8 miles from origin) in 5.2 hours.

Inundation maps for the Harriman Dam failure indicate significant areas of Montague would be flooded, including a large area west of Montague City Road. Flood waters would also impact areas along the Connecticut River west of Montague Center and also rise up the Sawmill River to Greenfield Road. Under “Probable Maximum Flood” (PMF) conditions, the worst-case scenario, floodwaters from a catastrophic failure of the Sherman Dam would reach the confluence of the Connecticut and Deerfield Rivers in 3.2 hours. Both “Sunny Day” and PMF conditions are presented on the inundation maps for the five TransCanada High Hazard Dams.

In 2010 the Franklin Regional Council of Governments (FRCOG) and the University of Massachusetts Transportation Center (UMTC) prepared a study that examined the impact of a Harriman Dam failure on the transportation network in the towns within the inundation zone as well as the county.³⁹ Building upon this exercise, the FRCOG developed town-specific recommendations in the event of flooding caused by failure of the Harriman Dam.⁴⁰ An analysis was conducted for each of the Towns located along the path of the flood including identification of critical facilities located within Town boundaries. The recommendations are intended to be used as a starting point for the development of specific emergency plans in each Town.

An analysis of the inundation area in Turners Falls found that the number of automobiles per household is less than one, indicating a potential need for additional evacuation assistance, such as buses, in the event of a dam failure. Additionally, the Farren Care Center, a 122 bed nursing home facility, is located in the inundation area and will need to be evacuated prior to a flood. Currently the evacuation plan for the facility calls for moving patients and staff to the Franklin County Technical School as a stopping point before transferring patients to other nursing homes throughout the region and state. An agreement should be executed between the school and the Farren Care Center to formalize this arrangement. Farren Care is part of an arrangement with over 270 nursing homes state-wide, through the Massachusetts Department of Public Health, that offer space for patients during an emergency. The Montague Town Hall is located adjacent to

³⁸ Emergency Action Plans for the Somerset, Harriman, and Sherman Dams, prepared for TransCanada Hydro Northeast, Inc., by Kleinschmidt Energy and Water Resource Consultants, December 2005. Emergency Action Plans for the Fife Brook and Bear Swamp-South Dams, prepared for U.S. GEN New England, Inc., by Kleinschmidt Energy and Water Resource Consultants, December 2004.

³⁹ Evacuation Planning in Western MA, Case Study: Failure of the Harriman Dam. Franklin Regional Council of Governments (FRCOG) and the University of Massachusetts Transportation Center (UMTC). 2010.

⁴⁰ Town Recommendations: Supplement to the Failure of the Harriman Dam Evacuation Planning Report. Franklin Regional Council of Governments (FRCOG). 2010.

the inundation area, and would benefit from the development of an emergency plan to ensure protection of vital records and documents in the event a flood reaches the building.

The remaining five dams on the Deerfield River are classified as Low Hazard Dams; therefore, no Emergency Action Plan or inundation mapping are required by FERC. In 2003, U.S. GEN New England, Inc., the owner at the time of the Low Hazard Deerfield River dams, hired consultants to examine a “Sunny Day” failure scenario for these dams to determine the downstream flooding hazard potential. Next, the incremental impact was determined for a dam failure that occurred at a flow equivalent to the 100-year frequency flood. For these two scenarios, the study indicates that the additional flooding above the 100-year flood stage was insignificant and therefore these projects do not present a significant hazard to life and property.⁴¹ However, the cascading failure of one or more of these dams that would occur if one of the High Hazard dams failed would result in the catastrophic flooding shown on the inundation maps in the Emergency Action Plan.

Of additional concern is the Moore Dam, owned by TransCanada and located on the Connecticut River in the towns of Littleton, New Hampshire, and Waterford, Vermont, approximately 166 miles upstream from the Turners Falls Dam. According to the Emergency Action Plan, flooding caused by a failure of the dam would reach Turners Falls within 24 hours. Under Probable Maximum Flood conditions, flood waters would inundate 1st and 2nd Streets and areas surrounding Unity Park in Turners Falls, the “Patch” neighborhood, and neighborhoods on both sides of Montague City Road in Montague City. Additionally sections of Greenfield Road would be inundated, along with sections of Meadow Road adjacent to the Sawmill River and the Connecticut River.

The Lake Wyola Dam is a High Hazard dam located in the Town of Shutesbury that could potentially impact Montague if it failed, releasing flood waters into the Sawmill River. Roads that would be impacted by a dam failure, according to the Emergency Action Plan, are North Leverett Road, Spaulding Brook Road, Main Street, Center Street, South Ferry Road, and Meadow Road. The EAP states that there would be less than a two foot increase in 500 year flood stage levels by the time the flood waters reach the Montague town line. The plan lists 22 home addresses in Montague that fall within the 500 year flood plain in the inundation area. The dam is owned by the Town of Shutesbury.

The 100-year flood plain in Montague includes approximately 27 acres of developed land in the town, including an estimated 14 acres of developed residential land. The area inundated by a catastrophic failure of one of the TransCanada dams would cover substantially more acreage. Emergency responders should review inundation areas presented in the Emergency Action Plans, and the findings and recommendations from the 2010 Harriman Dam study and Town Recommendations, and identify possible evacuation routes, since significant portions of Montague, Greenfield and neighboring communities such as Deerfield, including sections of Route 5/10, may be flooded. Montague City Road, a designated flood evacuation route, would also be inundated in the event of a major dam failure on the Deerfield or Connecticut River.

⁴¹ “Emergency Action Plans for the Deerfield River FERC Licensed Projects Nos. 2323 and 2669,” prepared for US GEN New England, Inc., by Kleinschmidt Energy and Water Resource Consultants, November 2003.

The Federal Energy Regulatory Commission is responsible for oversight of hydroelectric projects and regulates dams under its jurisdiction. In Montague, FERC oversees the Turners Falls Project, which consists of the following components:

- The Turners Falls Dam, consisting of the Gill and Montague spillways in the Connecticut River
- The Turners Falls Reservoir, which consists of the length of the Connecticut River upstream of the Turners Falls Dam to the base of the Vernon Dam in Vernon, Vermont.
- The Cabot Power Canal, a 11,600 foot long canal that discharges from the Turners Falls Reservoir near the eastern end of the dam and supplies water to two hydropower stations and other commercial and industrial users downstream
- A canal gatehouse at the head of the canal to regulate flow into the canal for up to 10.7 feet of head differential between maximum normal pond in the reservoir and the canal level
- Station Number 1 on the left bank of the Connecticut River and the right bank of the power canal
- Cabot Station at the downstream end of the canal
- A canal spillway located adjacent to Cabot Station.⁴²

The 2010 Montague Comprehensive Emergency Management Plan lists the Cabot Spillway, Turners Falls #1 Dam, Turners Falls Dam, and the Turners Falls Canal Headgates as High Hazard Potential dams in Montague. The Lake Pleasant Dam is listed in the plan as a Significant Hazard Potential dam, however the 2010 inspection of the dam recommends that the possibility of reclassifying the dam as Low Hazard be investigated. The inspection report recommends an Emergency Action Plan be created for the dam that would analyze a breach of the dam and how well downstream culverts could handle the flooding to determine the appropriate hazard level for the dam.⁴³

At the 2004 writing of this Natural Hazard Mitigation Plan, the MA DCR Office of Dam Safety provided data for ten dams and related structures in Montague, including the structures associated with the Turners Falls Project regulated by FERC. Of these ten structures, three are classified as **High Hazard Potential dams**, two are classified as **Significant Hazard Potential dams**, and five are classified as **Low Hazard Potential dams**. As of 2004, all of the structures in the High Hazard category had been last inspected in 2000 and were found to be in good condition. No more recent information was available from the Office of Dam Safety. Of the two structures in the Significant Hazard category, one was inspected in 2009 and is listed as being in

⁴² *Turners Falls Project FERC No.1889-MA, Report of Power Canal, Left Embankment Investigation*, prepared for Northeast Generation Services Company by Kleinschmidt Energy and Water Resource Consultants, November 2000.

⁴³ Lake Pleasant Dam Phase I Inspection/Evaluation Report. Root Engineering. November 23, 2010.

fair condition; the other was inspected in 2007 and a condition was not listed. Three of the “low hazard” structures were inspected in 2000. Two of these are listed as having been breached, and the third is listed as having no impoundment. The remaining two structures have not been inspected since 1975 and their condition is unknown. Again, no recent information for “low hazard” structures was available. The Turners Falls Fire District is the Owner and Caretaker of record for the Lake Pleasant dam, which was inspected in November 2010 and was found to be in good condition.⁴⁴ The remaining dams in Town are privately owned.

Landowners on the northwest side of Montague City Road have experienced high groundwater and periodic flooding, which Town officials have attributed to seepage from the Turners Falls Power Canal and beaver activity in the area. In response to concerns expressed by the Town, the Federal Energy Regulatory Commission commissioned a review of the structural integrity of the canal’s left embankment in 2000, which determined that the integrity of the canal was sound and that the elevated groundwater levels and periodic flooding are likely due to the growing beaver population. Human-beaver conflict continues to be a problem in Montague where a pond created by a beaver dam in 2010 made it difficult for utility workers to replace high-tension wires standing in water.

EARTHQUAKES

General Description

An earthquake is a sudden, rapid shaking of the ground that is caused by the breaking and shifting of rock beneath the Earth’s surface. Earthquakes can occur suddenly, without warning, at any time of the year. New England experiences an average of 30 to 40 earthquakes each year although most are not noticed by people.⁴⁵ Ground shaking from earthquakes can rupture gas mains and disrupt other utility service, damage buildings, bridges and roads, and trigger other hazardous events such as landslides, avalanches, flash floods (dam failure) and fires. Unreinforced masonry buildings, buildings with foundations that rest on filled land or unconsolidated, unstable soil, and mobile homes not tied to their foundations are at risk during an earthquake.⁴⁶

Table 3-5: Northeast Earthquakes with a Magnitude of 4.2 or more 1924 - 2007

| Location | Date | Magnitude |
|---------------------------|-------------------|-----------|
| Ossipee, NH | December 20, 1940 | 5.5 |
| Ossipee, NH | December 24, 1940 | 5.5 |
| Dover-Foxcroft, ME | December 28, 1947 | 4.5 |
| Kingston, RI | June 10, 1951 | 4.6 |
| Portland, ME | April 26, 1957 | 4.7 |
| Middlebury, VT | April 10, 1962 | 4.2 |
| Near NH Quebec Border, NH | June 15, 1973 | 4.8 |
| West of Laconia, NH | Jan. 19, 1982 | 4.5 |
| Plattsburg, NY | April 20, 2002 | 5.1 |
| Bar Harbor, ME | October 3, 2006 | 4.2 |

Source: Northeast States Emergency Consortium Web site: www.nesec.org/hazards/earthquakes.cfm

⁴⁴ Ibid.

⁴⁵ Northeast States Emergency Consortium web site: www.nesec.org/hazards/earthquakes.cfm

⁴⁶ Federal Emergency Management Agency web site: www.fema.gov/hazards/earthquakes/quake.shtm.

Table 3-6: Northeast States Record of Historic Earthquakes

| State | Years of Record | Number Of Earthquakes |
|--|-----------------|-----------------------|
| Connecticut | 1668 - 2007 | 137 |
| Maine | 1766 - 2007 | 544 |
| Massachusetts | 1668 - 2007 | 355 |
| New Hampshire | 1638 - 2007 | 360 |
| Rhode Island | 1776 - 2007 | 38 |
| Vermont | 1843 - 2007 | 73 |
| New York | 1840 - 2007 | 755 |
| Total Number of Earthquakes within the Northeast states between 1638 and 2007 = 2,403. | | |

Source: Northeast States Emergency Consortium Web site: www.nesec.org/hazards/earthquakes.cfm

Massachusetts introduced earthquake design requirements into their building code in 1975. However, these specifications apply only to new buildings or to extensively modified existing buildings. Existing buildings, bridges, water supply lines, electrical power lines and facilities, etc. have generally not been designed to withstand the forces of an earthquake.

Location and Extent

According to the United States Geological Survey, a fault line runs north-south through Montague, in the forested area east of Route 63 (see the Critical Facilities and Infrastructure map). The fault extends along the entire length of Franklin County, and was originally responsible for the creation of the Connecticut River.

In Montague, roughly 76%, or 2,903 homes, were built prior to the 1975 earthquake design requirements.⁴⁷ In addition, downtown Turners Falls, the most densely built section of town, is built on ledge. Although a major earthquake has not occurred in recent history in New England, if one were to occur it could cause significant damage to Montague's built environment and infrastructure, and cause multiple injuries or death among the population.

Potential Mitigation Measures for Earthquakes

- Consider participating in trainings offered by FEMA's National Earthquake Technical Assistance Program (NETAP). NETAP is designed to help state, local, and tribal governments obtain the knowledge, tools, and support that they need to plan and implement effective earthquake mitigation strategies.⁴⁸

LANDSLIDES

General Description

Landslides are geological phenomena that include a wide range of ground movement, such as rock falls, failure of slopes and shallow debris flows. They can occur in coastal, mountain, and river edge environments.

⁴⁷ 2000 U.S. Census.

⁴⁸ http://www.fema.gov/plan/prevent/earthquake/training_netap.shtml

Landslides occur when the stability of a slope changes from a stable to an unstable condition. A change in the stability of a slope can be caused by a number of factors, acting together or alone. Natural causes of landslides include:

- groundwater pressure acting to destabilize the slope
- loss or absence of vertical vegetative structure, soil nutrients, and soil structure (e.g. after a wildfire)
- erosion of the toe of a slope by rivers
- weakening of a slope through saturation by snowmelt or heavy rains
- earthquakes adding loads to barely-stable slopes
- earthquake-caused liquefaction destabilizing slopes
- volcanic eruptions

Landslides are created by human activities as well, including deforestation, cultivation and construction, and improper drainage from stormwater management systems, which destabilize already fragile slopes

- vibrations from machinery or traffic
- blasting
- earthwork which alters the shape of a slope, or which imposes new loads on an existing slope
- in shallow soils, the removal of deep-rooted vegetation that binds colluvium to bedrock
- construction, agricultural or forestry activities (logging) which change the amount of water which infiltrates the soil.

Location and Extent

Landslides rarely occur in Franklin County but have occurred in the eastern part of the state: following heavy rains in March 2010, Walpole and Topsfield experienced landslides that destroyed a storage building and closed a portion of Route 1. The Topsfield slide saw a tree land on a passing car, but no injuries were reported. Earlier that month, a mudslide at a construction site brought mud within 50 feet of train tracks at the Wellesley Hills station of the Massachusetts Bay Transportation Authority in Wellesley. The Connecticut River Valley is given a Moderate landslide incidence rating (1.5% to 15% of the area involved) while the remainder of the state is listed as Low landslide incidence (less than 1.5% of the area involved).⁴⁹ In March 2011, four homes in Greenfield were surrounded by a mudslide, causing thousands of dollars in damages, after 3 inches of rain fell over the course of a day.

In 2010 the Franklin Regional Council of Governments (FRCOG) received funding from FEMA to assist towns in the county with identifying and prioritizing mitigation projects. An engineering consultant is assisting the FRCOG with evaluating the project feasibility and design for up to four potential mitigation projects.

In December 2010, the Millers Falls Road erosion control project submitted by the Town of Montague was chosen as one of the priority projects in the county. According to the draft project

⁴⁹ U.S. Department of the Interior, U.S. Geological Survey. National Landslide Hazards Mitigation Strategy: A Framework for Loss Reduction. 2000.

scope, erosion along a steep slope is threatening a segment of Millers Falls Road located across from Highland Cemetery, in between the Turners Falls Airport and the village of Millers Falls. The route is a main artery and evacuation route, and is also currently the main detour for traffic traveling north from Turners Falls due to the closure of the Gill Montague Bridge. Further, Millers Falls Road is the most direct route to access Millers Falls from the fire and police services based in Turners Falls. According to Town officials, if no work is done to stabilize the slope, it is imminent that the road will ultimately wash out.

The potential project would be to stabilize the slope and prevent future erosion and failure of the roadway. Neither the road nor the slope is within a floodplain, although the Millers River at the base of the slope is. Web-based aerial photographs of the area depict a large sediment delta in the river, which is indicative of severe erosion. A reconnaissance revealed that the slope has been actively failing, with fallen trees and scarps that have not yet weathered. Although most of the work conducted by the Town has focused on management of drainage, there may be other factors contributing to the slope failure such as groundwater seepage and erosion of the toe of the slope at Millers River.

Mitigation for the failing slope will likely require three components:

- a) improved stormwater management;
- b) reduced vegetative mass on the slope; and
- c) reduced erosion at the toe of the slope.

Flat land adjacent to low mountains in the Montague State Forest at the southeastern area of town could be vulnerable to landslides. Any destabilization of the mountains (major development removing vegetative cover, heavy rains following a wildfire) could cause a landslide with potentially devastating consequences.

Cliffs along the Connecticut River at Barton's Cove in Turners Falls are vulnerable to erosion from stormwater runoff coming from residential streets that dead end near the edge of the precipice. Residences close to the cliffs could be in danger if erosion continues. There are also negative consequences to the increased amount of salt and silt eroding into the Cove, including the possibility of increased eutrophication and loss of clean habitat for resident nesting bird populations. FirstLight Power maintains an erosion control plan along the Connecticut River as required by the Federal Energy Regulatory Commission (FERC), and has repaired and maintained eroding riverbank and slopes along the river since 2008 using bioengineering techniques, totaling 195 feet of non-adjacent sections. In 2009 similar bank stabilization work was completed on 1,000 linear feet in the vicinity of the Narrows on the Connecticut River. As mentioned in the Flooding section, erosion along the banks of the Connecticut River near the Sunderland town line on Meadow Road has been an issue in the past. The bank was built up twenty five years ago to help secure the road.

Potential Mitigation Measures for Landslides

- The Town should continue to work with the Franklin Regional Council of Governments on evaluating the project feasibility and design for mitigating slope erosion along a

segment of Millers Falls Road. Apply for federal funding to implement the project if eligible.

ICE JAMS

General Description

Ice jams (or ice dams) occur when water builds up behind a blockage of ice. Ice jams can occur in various ways, but in New England they predominantly form on rivers and streams and mainly threaten infrastructure.

When the upstream part of a river thaws first and the ice is carried downstream into the still-frozen part of the watercourse, ice can form an ice dam and flood low lying areas upstream of the jam. Also, once an ice dam breaks apart, the sudden surge of water that breaks through the dam can flood areas downstream of the jam. Ice jams and flooding usually occur in spring; however, they can happen as winter sets in when the downstream reach of a river freezes first. Where floods threaten, the blockage can be removed mechanically.

Location and Extent

Ice jams in 1946 and 1957 both occurred on the Connecticut River near Montague City. Damages for these two events are unknown. An ice jam occurs annually on the Sawmill River at the South Street bridge. The jam causes flooding in a nearby field and culvert, as well as on the Goddard Brook near the access to the water department well houses. Once the water recedes, the town DPW has to clear out debris and vegetation that accumulates around the bridge. A similar situation often occurs at the Center Street bridge on the Sawmill River as well.

In 2003, with encouragement from the Town of Montague, the Natural Resources Conservation Service (NRCS) and the Franklin Conservation District collaborated on a grant application under Section 604 (b) of the Clean Water Act to conduct a geomorphological assessment of the Sawmill River, with the goal of developing conceptual restoration plans for disturbed areas. The grant was awarded to the Conservation District, and in 2006 a restoration report was completed. The report included preliminary designs for restoring 1,700 feet running east or downstream of Route 63 to the river's natural channel and reducing seasonal flooding and sedimentation by using bio-engineered approaches such as log jams and root wads. The Franklin Conservation District was awarded an implementation grant from the DEP in 2010, and the project is currently moving through the approval process. Construction is expected to begin in 2012, depending on many variables.⁵⁰ Although this project does not include the South Street or Center Street area of the river, it is expected that the overall stability of the river will be improved once the project is implemented. It is unclear at this point, however, how stabilization will impact the occurrence of ice jams at South Street and Center Street.

⁵⁰ Deborah Shriver, grant administrator. Personal communication.

MANMADE HAZARDS⁵¹

Most non-natural or manmade hazards fall into two general categories: intentional acts and accidental events, although these categories can overlap. Some of the hazards included in these two categories, as defined by MEMA, consist of intentional acts such as explosive devices, biological and radiological agents, arson and cyberterrorism and accidental events such as nuclear hazards, invasive species, infrastructure failure, industrial and transportation accidents. Accidental events can arise from human activities such as the manufacture, transportation, storage, and use of hazardous materials.

Note: This plan does not address all manmade hazards that could affect Montague. A complete hazards vulnerability analysis was not within the scope of this update. For the purposes of the 2011 plan, non-natural hazards that are of an accidental nature were evaluated. They include industrial transportation accidents and industrial accidents in a fixed facility.

Hazardous Materials General Description

Hazardous materials in various forms can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. Many products containing hazardous chemicals are used and stored in homes routinely. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines. Chemical manufacturers are one source of hazardous materials, but there are many others, including service stations, hospitals, and hazardous materials waste sites. Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. These substances are most often released as a result of transportation accidents or because of chemical accidents in plants.

A release may occur at a fixed facility or in transit. Communities with a large industrial base may be more inclined to experience a hazardous materials release due to the number of facilities that use such materials in their manufacturing process. Communities with several major roadways may be at a greater risk due to the number and frequency of trucks transporting hazardous materials.

Location and Extent

Industrial Accidents – Transportation

Franklin County transportation systems include road, rail, and air. Accessible and efficient freight transportation plays a vital function in the economy of the region. Most freight and goods being transported to and from Franklin County are by truck; however, a significant amount of freight that moves through the county is being hauled over the three main rail lines. Given that any freight shipped via air needs first to be trucked to an airport outside the region, air transportation is not being evaluated in this plan.

The major trucking corridors in Franklin County are Interstate 91, running north/south, and Route 2, running east/west. These two highways also represent the busiest travel corridors in the region for non-commercial traffic. According to the Franklin County Hazardous Material

⁵¹ Content adapted from Commonwealth of Massachusetts State Hazard Mitigation Plan 2010

Emergency Plan (HMEP)⁵², approximately 13 to 15 trucks per hour traveling through the region contain hazardous materials. While most of these vehicles are on Interstate 91, 2 trucks per hour carrying hazardous materials travel on Route 2 just north of Montague, and an average of 1 truck per hour carrying hazardous materials travels on Routes 63 and 47 in Montague. The HMEP identifies gasoline, fuel oil, kerosene, liquefied petroleum gas, and propane as hazardous materials that could be transported on these routes. Additionally, the 2010 Montague Comprehensive Emergency Management Plan (CEMP) lists the following routes as hazardous transportation routes in Montague:

- Avenue A
- Industrial Boulevard
- Millers Falls Road
- Montague City Road
- Route 63
- Turners Falls Road

Safe and efficient transportation routes for trucks to and through the region are important to the region's economy and to the safety of its citizens. The safer the transportation routes are, the less likely a transportation accident will occur.

The HMEP also identifies two railroads traveling through Montague that serve as primary routes for transportation of cargo, some of which is of a hazardous nature. Ten to 24 trains per day travel on the Pan Am Systems Main Freight line which runs through Montague. On each of these trains, an average of 4 cars carries hazardous waste, which might include the following materials:

- Hydrocyanic acid
- Sulfuric acid
- Liquefied Petroleum Gas
- Hydrochloric acid
- Chlorine
- Caustic soda
- Methanol
- Sodium chlorate

Two trains per day travel through Montague on the New England Central Railroad, with an average of 5 cars carrying hazardous waste materials per train. Materials could include:

- Liquefied Petroleum Gas
- Anhydrous Ammonia
- Sulfuric acid
- Carbon dioxide
- Nuclear devices

According to the committee, the New England Central Railroad is also now carrying major ethanol shipments.

⁵² Franklin County Local Emergency Planning Committee, Franklin County Hazardous Material Emergency Plan and Maps, 2006. Based on a one-time survey conducted in 2003.

Industrial Accidents – Fixed Facilities

An accidental hazardous material release can occur wherever hazardous materials are manufactured, stored, transported, or used. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas. Those facilities using, manufacturing, or storing toxic chemicals are required to report their locations and the quantities of the chemicals stored on-site to state and local governments. The Toxics Release Inventory (TRI) contains information about more than 650 toxic chemicals that are being used, manufactured, treated, transported, or released into the environment. Table 3-4 identifies facilities in Montague where toxic chemicals are stored. It is important to note that the Toxics Release Inventory (TRI) in no way indicates any issues with any of the sites but rather is an inventory of those facilities meeting TRI reporting requirements.

Table 3-7: Toxics Release Inventory (TRI) for Montague

| Facility Name | Facility Location | Number of Compounds Reported at Facility |
|------------------------------|-------------------|--|
| Esleek Manufacturing Co Inc. | Turners Falls | 6 |
| Judd Wire Inc. | Turners Falls | 59 |
| Montague Machine Co | Turners Falls | 5 |
| Selkirk Corp Heat-Fab | Turners Falls | 16 |
| Strathmore Paper Co. | Turners Falls | 4 |

Source: EPA Toxic Release Inventory, 2010.

Further information on facilities housing hazardous materials in Montague is available in the 2010 CEMP, and listed in Table 3-5.

Table 3-8: Hazardous Facilities in Montague

| Facility Name | Facility Location | Hazardous Chemical Inventory |
|---|--------------------------|--|
| Southworth Paper Company | Canal Street | Sodium Hydroxide 50%; Titanium Dioxide; Aluminum Sulfate; Sodium Hypochlorite Solution |
| Montague Water Pollution Control Facility | 34 Greenfield Road | Chlorine |
| Verizon | 185 Avenue A | Sulfuric Acid |
| Australis Aquaculture, LLC | One Australia Way | Oxygen Chyogenic Liquid; Sodium Hydroxide 50% |
| AT&T Broadband | 33 Industrial Drive | Sulfuric Acid |
| Hallmark Color Lab | Industrial Park | Kodak Flexi Color; Hydro-Oxylamine |
| Verizon | 12 Crescent Street | Sulfuric Acid |
| Judd Wire Inc. | 124 Turnpike Road | Polyvinyl Chloride Resin |
| New England Extrusion | 18 Industrial Boulevard | |
| LightLife Foods | 153 Industrial Boulevard | |
| Farren Care Center | 340 Montague City Road | |
| Montague Highway Department | Avenue A Extension | |
| Turners Falls Airport | 10 Aviation Way | |
| Lake Pleasant Pump House | Green Pond Road | Sodium Hypochloride |

Source: Montague 2010 Comprehensive Management Plan.

In addition to the above facilities, many farmers store agricultural chemicals on their properties. Given that much farmland is located in or near floodplains and their adjacent water bodies, the potential for an accidental hazardous materials spill to impact water quality is present. This plan does not include an in-depth evaluation of hazardous materials as they relate to farming. In many cases, farmers do use and store pesticides, herbicides and fertilizers on their property. And in most cases, farmers are utilizing best management practices in the use and storage of agricultural chemicals and have undergone any required training and licensing if they are applying these chemicals to the land. Despite training and best management practices, an accidental release of hazardous materials can occur and potentially threaten human health and the environment. One approach that the Town could take to help prepare for a hazardous materials spill on a farm would be to become familiar with the types and quantities of chemicals stored on site at the larger farms. This would assist first responders in being adequately prepared to protect human health and prevent contamination of the environment in the event of a major spill or other accidental release of hazardous materials.

Hazardous facilities located outside of town boundaries can also be of concern to Montague. The Vermont Yankee nuclear power plant is located on the Connecticut River in Vernon, Vermont, near the Vermont/Massachusetts border. In January 2010, the facility notified the Vermont Department of Health that samples taken in November 2009 from a ground water monitoring well on site contained tritium. This finding signals an unintended release of radioactive material into the environment. Testing has shown that contaminated groundwater has leaked into the Connecticut River, though tritium levels in the river have remained below the lower limit of detection.⁵³ More recently, the 2011 tsunami and earthquake in Japan that damaged a nuclear power plant demonstrates the potential vulnerability of these facilities to natural disasters, and the geographic extent that could be impacted by an accident. The future operation of the Vermont Yankee power plant is currently unclear. The Nuclear Regulatory Commissions recently extended the plant's operating license for 20 more years, while the State of Vermont has denied an extension of the current license, which expires in March 2012. Nevertheless, Montague officials should stay abreast of proper evacuation procedures in the event of an accident at the Vermont Yankee nuclear power plant.

⁵³ Vermont Department of Health. http://healthvermont.gov/enviro/rad/vt_yankee.aspx

Risk Assessment Methodology

In updating Montague's Natural Hazard Mitigation Plan, the Franklin Regional Council of Governments developed the All Hazards Risk Assessment methodology for assessing the risk of natural hazards. The All Hazards Risk Assessment is an interactive table that the Montague Natural Hazard Mitigation Planning (NHMP) Committee completed with the FRCOG staff to evaluate all the natural hazards that can impact the town based on frequency of occurrence, severity of impacts, area of occurrence and preparedness. The methodology yields a Weighted Hazard Index, which is a measure of the likelihood of future occurrence for each hazard as well as the potential impacts each hazard may have on the built and natural environments, the population and the infrastructure. The completed table gives the town an overall understanding of the natural hazards, provides guidance on which hazards the Town may want to focus mitigation efforts on, reaffirms that Northfield's planning and preparedness is on track, and shows residents that town departments and agencies are organized in case of a natural disaster.

In rating the hazards, the committee considered the following issues for each category:

Issues considered when ranking frequency of occurrence:

- 1) Known risk
- 2) Historical data (previous occurrences)

Issues considered when ranking severity of impacts:

- 1) Building stock
- 2) Critical facilities
- 3) Transportation systems
- 4) Lifeline utility systems
- 5) Communications systems and networks
- 6) High potential loss facilities
- 7) Hazardous material facilities
- 8) Economic elements
- 9) Special consideration areas
- 10) Historic, cultural, and natural resource areas
- 11) Natural resources

Issues considered when ranking preparedness:

- 1) Status of current plans
- 2) Training status
- 3) Availability of backup systems
- 4) Community resources (equipment, personnel, etc.)

The following rating charts were used to determine the rating for each event.

Table 3-9: Frequency of Occurrence Rating Chart

| Classification | # | Frequency of Occurrence |
|----------------|---|--|
| Very High | 5 | Events that occur at least once each year (100% per year) |
| High | 4 | Events that occur from once in 2 years to once in 4 years (25% to 50% per year) |
| Medium | 3 | Events that occur from once in 5 years to once in 50 years (2% to 20% per year) |
| Low | 2 | Events that occur from once in 50 years to once in 100 years (1% to 2% per year) |
| Very Low | 1 | Events that occur less frequently than once in 100 years (less than 1% per year) |

Table 3-10: Severity of Impacts Rating Chart

| Classification | # | Severity of Multiple Impacts |
|----------------|---|--|
| Catastrophic | 4 | Multiple deaths and injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of facilities for 30 days or more. |
| Critical | 3 | Multiple injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 week. |
| Limited | 2 | Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 day. |
| Minor | 1 | Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of facilities. |

Table 3-11: Severity of Impacts Definitions

| Severity of Impact Category | Severity of Impact Category Definitions |
|-----------------------------|---|
| Built | Building Stock includes residential, commercial, industrial, and institutional buildings. |
| Built | Hazardous Material Facilities include facilities housing industrial/hazardous materials, such as corrosives, explosives, flammable materials, radioactive materials, and toxins. |
| Built | Historic, Cultural, and Natural Resource Areas may include buildings, structures, objects, sites, national and local historic or significant districts, and historical archival storage facilities. |
| Infrastructure | Critical Facilities are essential to the health and welfare of the whole population and are especially important following hazard events. Since vulnerability is based on service losses as well as building structure integrity and content value, assess the effects on the service function interruption of critical facilities as well as their physical aspects. For purposes of this mitigation planning guidance, critical facilities may include emergency service facilities such as hospitals and other medical facilities, jails and juvenile detention centers, police and fire stations, emergency operations centers, public works facilities, evacuation shelters, schools, and other uses that house special needs populations. |

| Severity of Impact Category | Severity of Impact Category Definitions |
|-----------------------------|---|
| Infrastructure | Transportation Systems include airways (including airports, heliports, etc.), roadways (including highways, bridges, tunnels, roadbeds, overpasses, transfer centers, etc.), railways and public transit (including trackage, tunnels, bridges, rail yards, depots, etc.), and waterways (including canals, locks, seaports, ferries, harbors, dry-docks, piers, etc.). |
| Infrastructure | Lifeline Utility Systems such as potable water, wastewater, oil, natural gas, electric power, substations, power lines, etc. |
| Infrastructure | Communications Systems and Networks such as telephones, emergency service radio systems, repeater sites and base stations, television and radio stations, etc. |
| Natural | Natural Resources include agricultural land, water supply lands, rivers. |
| Population | High Potential Loss Facilities include facilities that would have a high loss associated with them, such as nuclear power plants or dams. |
| Population | Economic Elements include major employers, financial centers, and other business or retail districts in the community that could significantly affect the local or regional economy if interrupted. |
| Population | Special Consideration Areas include areas of high density residential, commercial, institutional, and industrial development that, if damaged, could result in economic and functional losses and in high death tolls and injury rates. |

Table 3-12: Area of Occurrence Rating Chart

| Classification | # | Percentage of Town Impacted |
|-----------------|---|-------------------------------------|
| <i>Large</i> | 3 | More than 50% of the town affected. |
| <i>Medium</i> | 2 | 10 to 50% of the town affected. |
| <i>Isolated</i> | 1 | Less than 10% of the town affected. |

Table 3-13: Preparedness Rating Chart

| Classification | # |
|----------------|---|
| <i>Poor</i> | 3 |
| <i>Fair</i> | 2 |
| <i>Good</i> | 1 |

To determine the final hazard index for each hazard, each category was assigned a weight. Frequency of Occurrence was given the most weight (45%), followed by Severity of Impacts (30%), Area of Occurrence (15%), and Preparedness (10%). Ratings were entered into a spreadsheet which calculated the weighted hazard index for each hazard. The Weighted Hazard Index (WHI) represents the probability of occurrence of future events. Hazards with higher index scores represent the events most in need of organization focus and resources for emergency planning and mitigation projects.

The results of the All Hazards Vulnerability Assessment can be seen in Table 3-14. The hazards receiving a Weighted Hazard Index (WHI) of 5 or more are – in order of vulnerability – Earthquakes (5.70), Wildfire/Brushfire (5.50), Severe Winter Storms (5.50), Microbursts (5.45) and Hurricanes and Tropical Storms (5.25).

A major earthquake has not occurred in Montague in recent history. However, the Town lies on a major fault, and damages to the built and natural environment, population, and infrastructure could be catastrophic if a major earthquake were to occur. Additionally the committee felt that

the Town was not well prepared for a major earthquake. Wildfires and brushfires, severe winter storms, and microbursts occur frequently in Montague. Both wildfires and microbursts can cause significant damages, though often the area affected is small. The negative impacts of wildfire can also affect populations not within the affected area, through smoke inhalation. The committee felt the town is well prepared for winter storms and wildfire, and fairly well prepared for microbursts. Hurricanes are much more rare, however they can cause critical damages to the built and natural environments, and to the population and infrastructure in town. A hurricane would impact the entire town and likely the region.

The committee felt that the town was not well-prepared for an earthquake or hurricane. One major issue is the town's lack of shelters with back-up power supplies, and the lack of shelter supplies in general. Currently the only identified shelter with a back-up generator is the high school. Additional shelter supplies are available regionally and are stored in a trailer in Greenfield. However in the event of a hurricane or earthquake, it is likely the entire region would be in need of these supplies. Another concern with earthquakes and hurricanes is the town's older building stock, which would be particularly vulnerable to these events.

Dam failure, given a weighted hazard index of 4.95, is another hazard that is rare in occurrence, but could be devastating to approximately 10-50% of the town. In general the committee felt that there would be adequate time to evacuate residents in inundation areas, but that the built and natural environment and the town's infrastructure could be severely damaged. An issue identified for preparedness in the event of a dam failure is notification. Currently the town does not have a notification system such as Reverse 911, and relies on local media and a door to door strategy. While this can be effective in certain circumstances, in the case of a major dam failure on the Deerfield or Connecticut River, the ability to communicate evacuation procedures to a large amount of households would improve the town's preparedness.

Flooding (WHI 4.55) and ice jams (WHI 3.65) occur frequently in Montague. The committee felt less prepared for dealing with annual flooding and ice jams, though the impacts of these events were considered to be limited or minor. Tornadoes (WHI 4.20) rarely occur in Montague and typically affect a small area, though impacts can be significant and the committee felt the Town was not well-prepared in dealing with tornadoes. Landslides (WHI 2.40) are rare in Montague, have limited impacts, and only affect a small area. However the town is not well-prepared for dealing with a major landslide.

Table 3-14: All Hazards Vulnerability Assessment

| EVENTS | FREQUENCY OF OCCURRENCE* | FOC WEIGHTED VALUE | SEVERITY OF IMPACTS* | | | | SOI WEIGHTED VALUE | AREA OF OCCURRENCE* | Add WEIGHTED VALUE | PREPAREDNESS | PREP. WEIGHTED VALUE | WEIGHTED HAZARD INDEX |
|-----------------------------------|--------------------------|--------------------|----------------------|--------------|-----------------|---------------------|--------------------|---------------------|--------------------|--------------|----------------------|-----------------------|
| ASSIGNED WEIGHTING FACTOR | 45% | | 30% | | | | | 15% | | 10% | | |
| INDEX VALUE | 1-5 | | Built 1-4* | Natural 1-4* | Population 1-4* | Infrastructure 1-4* | | 1-3 | | 1-3 | | |
| NATURAL HAZARDS: | | | | | | | | | | | | |
| Earthquake | 1 | 0.45 | 4 | 3 | 4 | 4 | 4.50 | 3 | 0.45 | 3 | 0.3 | 5.70 |
| Wild Fire/Brush Fire | 5 | 2.25 | 2 | 4 | 3 | 1 | 3.00 | 1 | 0.15 | 1 | 0.1 | 5.50 |
| Severe Winter Storm | 5 | 2.25 | 3 | 3 | 1 | 2 | 2.70 | 3 | 0.45 | 1 | 0.1 | 5.50 |
| Microbursts (Tornado subcategory) | 4 | 1.80 | 2 | 4 | 2 | 3 | 3.30 | 1 | 0.15 | 2 | 0.2 | 5.45 |
| Hurricane and Tropical Storm | 2 | 0.90 | 3 | 3 | 3 | 3 | 3.60 | 3 | 0.45 | 3 | 0.3 | 5.25 |
| Dam Failure | 1 | 0.45 | 3 | 4 | 2 | 4 | 3.90 | 2 | 0.30 | 3 | 0.3 | 4.95 |
| Flood | 5 | 2.25 | 2 | 2 | 1 | 1 | 1.80 | 2 | 0.30 | 2 | 0.2 | 4.55 |
| Tornado | 1 | 0.45 | 2 | 4 | 2 | 3 | 3.30 | 1 | 0.15 | 3 | 0.3 | 4.20 |
| Ice Jam | 4 | 1.80 | 1 | 2 | 1 | 1 | 1.50 | 1 | 0.15 | 2 | 0.2 | 3.65 |
| Landslide | 1 | 0.45 | 1 | 2 | 1 | 1 | 1.50 | 1 | 0.15 | 3 | 0.3 | 2.40 |

Vulnerability Assessment

Vulnerability Overview

This section presents exposure, damages, loss estimates, population impacts and data deficiencies for each of the hazards addressed in the Natural Hazard Identification and Profile Section of the Plan. Additionally, an overall vulnerability assessment is provided for each hazard. This analysis is an in-depth look at each hazard in Montague. Coupled with the All Hazards Vulnerability Assessment from the previous section, these findings will support planning efforts based on a better understanding of the potential impacts associated with each hazard and provide a foundation for the mitigation strategy presented in Section 5.

Vulnerability Assessment Methodology

The Vulnerability Assessment is a series of tables that enabled the committee and FRCOG staff to determine the vulnerability of Montague to flooding and to calculate the potential costs of flooding to the town.⁵⁴ Estimated losses for all other hazard event were also determined, based on damages from past recorded events. The potential implications for senior and low income populations in the event of a hazard are also assessed.

Environmental Justice

Identifying vulnerable populations in a town can be challenging. It can be assumed that senior populations are more vulnerable—and thus might be more at risk for certain hazards—due to their possible loss of mobility and the increased likelihood that elderly people live alone and may have less access to information. People of low income may also face higher risks due in part to less access to information and the higher likelihood of living in undesirable or poor quality housing and/or locations, such as those adjacent to areas zoned industrial or in the floodplain.

In 1994, President Clinton issued Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” directing federal agencies to address environmental injustices in their operations and in communities across the country. Since then, states and municipalities have developed policies and programs to proactively address environmental equity concerns to help ensure that minority and low-income communities are not disproportionately impacted by environmental hazards.⁵⁵

There are many obstacles that make it challenging for Environmental Justice (EJ) populations to participate in planning and development decisions in their communities. These residents are more likely to be unaware of environmental issues due to social issues including language

⁵⁴ These tables were developed to provide towns with a template for calculating and estimating potential losses and costs of flooding. They draw from and integrate the work of other Natural Hazard Mitigation Plans, specifically the Natural Hazard Mitigation Plan for Thurston County, Washington, September 2009, but the tables can be linked to the most recent demographic, land use, and infrastructure information and automatically calculate and estimate the cost of flooding to each town or region.

⁵⁵ <http://www.mass.gov>

barriers and limited access to educational resources. In addition, EJ populations are often unable to participate in environmental decision-making processes because they often must work longer hours to compensate for lower hourly wages.⁵⁶ Thus decisions that may directly impact where they live may be made by a town without their voices being heard.

In 2003, based upon 2000 census data, MassGIS produced Environmental Justice Populations layers representing neighborhoods across the state with high minority, non-English speaking, low-income, or foreign-born populations.⁵⁷

EJ Populations in Massachusetts are determined by the following criteria:

- Households earn 65% or less of the statewide household median income; or
- 25% or more of the residents are minority; or
- 25% or more of the residents are foreign-born; or
- 25% or more of the residents are lacking English language proficiency

Based upon these criteria, the Franklin County towns with Environmental Justice populations are Greenfield, Montague and Orange. Sections of all three towns were categorized as such based on the low income criteria. In Montague, the EJ area is located in Turners Falls and is roughly bounded by Montague City Road and the Power Canal to the west, Avenue A and Third Street to the north, Unity Street and Millers Falls Road to the east, and Turnpike Road to the south (See Figure 3-1, below). Some of the EJ area overlaps with areas in the floodplain, or are adjacent to areas zoned industrial which may contain hazardous materials. In 2000, roughly 3,253 people, 38% of Montague's population, lived within the Environmental Justice area.⁵⁸

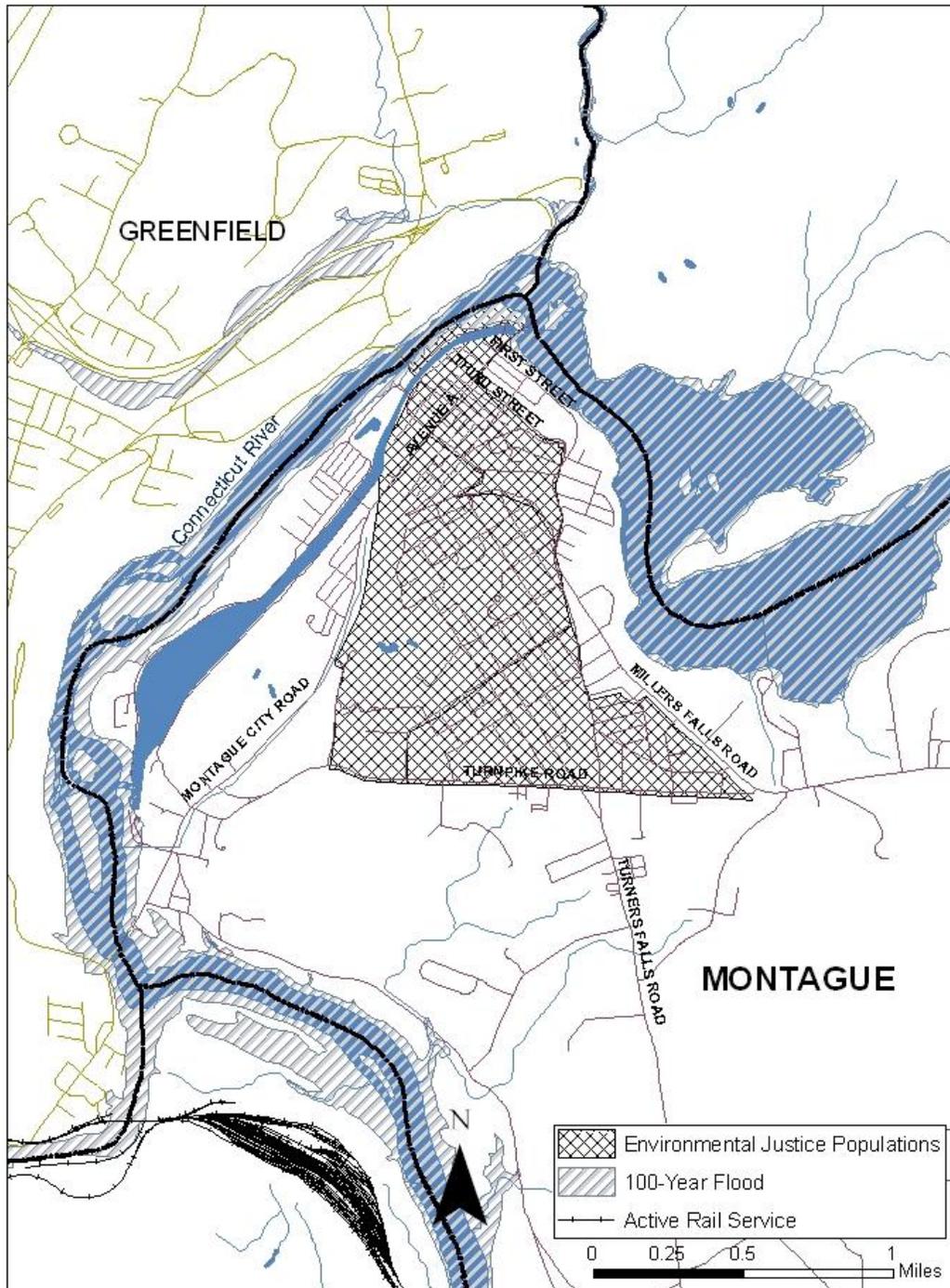
As Montague works to mitigate hazards in Town, concentrating public education and outreach in the Environmental Justice population area could be a priority. The Town could also evaluate action items to determine if their implementation could have a disproportionately high and adverse impact to Environmental Justice populations. Some hazard mitigation projects with the potential to cause these effects include flood control projects and stormwater management projects.

⁵⁶ http://www.mass.gov/envir/smart_growth_toolkit/pages/mod-ej.html

⁵⁷ http://www.mass.gov/mgis/cen2000_ej.htm

⁵⁸ 2000 U.S. Census

Figure 3-1: Environmental Justice Populations in Montague



FLOODING

Hazard Summary

In this section, a vulnerability assessment was prepared to evaluate the potential impact that flooding could have on the portions of Montague located within the 100-year floodplain. Flooding was chosen for this detailed evaluation because it is a natural hazard likely to impact the community and the location of the impact can be determined by mapping of areas inundated during severe flooding events. Some 1,454 acres lie in the floodplain in Montague, most of which is cropland.

Flooding can be caused by severe storms, such as hurricanes, nor'easters, and microbursts, as well as ice jams and snow melt. To determine the vulnerability of the town, data was gathered and calculated for the value of residential, commercial, and industrial properties. The damage estimates presented are rough estimates and likely reflect a worst-case scenario. Computing more detailed damage assessments based on assessor's records is a labor-intensive task and beyond the scope of this project.

Data Collected and Used

National weather databases and Town of Montague data were collected and analyzed. Data on historic property damage and loss, and injuries and deaths, was collected for Montague from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center website. Additional information on past flooding events and damage estimates was also provided by the committee. This data was used to support an evaluation of exposure and potential impacts associated with this hazard. Available historic data are presented in Table 3-22. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 was also reviewed for information on flooding.

Impact on the Community

Exposure and Loss Estimation

Flooding can cause a wide range of issues, from minor nuisance roadway flooding and basement flooding to major impacts such as roadway closures. Specific damages associated with flooding events include the following primary concerns:

- Blockages of roadways or bridges vital to travel and emergency response
- Breaching of dams
- Damaged or destroyed buildings and vehicles
- Uprooted trees causing power and utility outages
- Drowning, especially people trapped in cars
- Contamination of drinking water
- Dispersion of hazardous materials
- Interruption of communications and/or transportation systems

Property Damage

Table 3-15 displays the number of dwelling units and the estimated population living in the 100-year floodplain in Montague. According to 2005 MassGIS Land Use data there are 17 dwelling

units located in the floodplain. Using this number and Montague’s average household size as of the 2000 U.S. Census, it is estimated that 39 people, or less than 1% of Montague’s total population, reside in the floodplain.

Table 3-15: Number of Dwelling Units in the Flood Hazard Area

| Total Town Population | Average # of People per Household | Number of Dwelling Units in Flood Hazard Area | Estimated Population in Flood Hazard Area | % of Total Population that Reside in the Flood Hazard Area |
|-----------------------|-----------------------------------|---|---|--|
| 8,437 | 2.31 | 17 | 39 | 0.005 |

Source: 2000, 2010 U.S. Census; 2005 MassGIS Land Use data.

Table 3-16 shows the total acreage of each type of land use—commercial, industrial and public/institutional—in Montague, and the percentage of the total acreage for each land use in the floodplain.

Table 3-16: Number of Acres of Commercial, Industrial and Public/Institutional Land Uses in the Flood Hazard Area

| Land Use | Total acres in Town | Acres in Flood Hazard Area | % of total acres in Flood Hazard Area |
|----------------------|---------------------|----------------------------|---------------------------------------|
| Commercial | 98 | 5 | 5% |
| Industrial | 75 | 3 | 4% |
| Public/Institutional | 142 | 6 | 4% |

Source: 2005 MassGIS Land Use data.

Table 3-17 summarizes the average assessed value of residential, commercial and industrial land uses in Montague and in the floodplain. The total land value of these three land uses in the floodplain is more than \$10.7 million.

Table 3-17: Average Assessed Value of Land Use in Flood Hazard Area

| Land Use | Total Acres in Town | Total Assessed Value | Average Assessed Value per Acre | Acres in Floodplain | Average Assessed Value in Floodplain |
|-------------|---------------------|----------------------|---------------------------------|---------------------|--------------------------------------|
| Residential | 1,528 | \$568,550,480 | \$372,003 | 13.5 | \$5,022,038 |
| Commercial | 98 | \$34,257,686 | \$349,426 | 4.96 | \$1,733,151 |
| Industrial | 75 | \$110,060,690 | \$1,469,631 | 2.73 | \$4,012,094 |

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010; 2005 MassGIS Land Use data.

Actual 2011 assessed building values were collected from the Montague Assessors Office for the Water Pollution Control Facility, the Town Hall, Unity Park Field House, the Southworth Paper Company mill building, and the Montague Book Mill, significant structures located in or adjacent to the floodplain in Montague (Table 3-18). The value of the building contents was estimated using the percentages listed in Table 3-19 for different classes of buildings and facilities. The value is presented as a percentage of the replacement value of the building (the assessed value of the structure) based on the class of structure. The percentages vary for certain classes because the replacement cost of the contents is different from institution to business to

service. The Water Pollution Control Facility, Town Hall, and Field House are considered under the Government General Service category. Southworth Paper Company is an Industrial facility, and the Montague Book Mill is a Commercial facility. The total building value of the five structures is estimated to be \$11,589,500 .

Table 3-18: Total Building Value in or adjacent to Flood Hazard Area

| Structure | Building Structure Value* in Floodplain | Building Contents Value in Floodplain | Total Building Value in Floodplain |
|----------------------------------|---|---------------------------------------|------------------------------------|
| Water Pollution Control Facility | \$3,529,000 | \$3,529,000 | \$7,058,000 |
| Montague Town Hall | \$967,800 | \$967,800 | \$1,935,600 |
| Unity Park Field House | \$92,000 | \$92,000 | \$184,000 |
| Southworth Paper Company | \$748,600 | \$1,122,900 | \$1,871,500 |
| Montague Book Mill | \$270,200 | \$270,200 | \$540,400 |
| Total | \$5,607,600 | \$5,981,900 | \$11,589,500 |

* Building value includes the extra features value, but excludes land value.

Source: 2011 Montague Assessors data.

Table 3-19: Estimates of Building Contents by Class

| Occupancy Class | Contents Value % (as a percentage of building replacement value) |
|---|--|
| Residential (including temporary lodging, dormitory, and nursing homes) | 50% |
| Commercial (including retail, wholesale, professional, services, financial, entertainment & recreation) | 100% |
| Commercial (including hospital and medical office/clinic) | 150% |
| Commercial Parking | 50% |
| Industrial (including heavy, light technology) | 150% |
| Agriculture | 100% |
| Religion/Non-Profit | 100% |
| Government Emergency Response | 150% |
| Government General Services | 100% |
| Education Schools/Libraries | 100% |
| Education Colleges/Universities | 150% |

Source: Natural Hazard Mitigation Plan for Thurston County, Washington, September 2009.

Table 3-20 presents 1%, 5%, and 10% damage loss estimates for the Water Pollution Control Facility and the Montague Book Mill in the event of a flood.

Table 3-20: Potential Estimated Loss for Buildings in Flood Hazard Area

| Structure | Total Building Value in Flood Hazard Area | 1% Damage Loss Estimate | 5% Damage Loss Estimate | 10% Damage Loss Estimate |
|----------------------------------|---|-------------------------|-------------------------|--------------------------|
| Water Pollution Control Facility | \$7,058,000 | \$70,580 | \$352,900 | \$705,800 |
| Montague Book Mill | \$540,400 | \$5,404 | \$27,020 | \$54,040 |

Source: 2011 Montague Assessors data.

Table 3-21 takes the assessed value of residential, commercial or industrial land uses in the floodplain and shows the loss estimate if 1%, 5% or 10% if the property is damaged.

Table 3-21: Potential Estimated Loss by Land Use Category

| | Average Assessed Value of Land in Floodplain | 1% Damage Loss Estimate | 5% Damage Loss Estimate | 10% Damage Loss Estimate |
|--------------|--|-------------------------|-------------------------|--------------------------|
| Residential | \$5,022,038 | \$50,220 | \$251,102 | \$502,204 |
| Commercial | \$1,733,151 | \$17,332 | \$86,658 | \$173,315 |
| Industrial | \$4,012,094 | \$40,121 | \$200,605 | \$401,209 |
| Total | \$10,767,282 | \$107,673 | \$538,364 | \$1,076,728 |

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section

Table 3-22 identifies the recorded flood events and their associated damages in Montague according to the NOAA and to Committee input. In most years flooding events do not cause significant damages. However the potential for severe flooding that causes a large amount of damage to property is evident in the events of 1996 and 2005.

Table 3-22: Severe Flood Events in Montague, 1993 - 2010

| Date | Location | Type | Recorded Property Damages |
|---------------|----------------------------------|-----------------|------------------------------------|
| March 31 1993 | Connecticut River | Flood | \$0 |
| April 4 1993 | Connecticut River | Flood | \$0 |
| April 17 1993 | Connecticut River | Flood | \$0 |
| April 8 1994 | Connecticut River | Flood | \$0 |
| April 14 1994 | Connecticut River | Flood | \$0 |
| circa 1996 | Franklin County Technical School | Runoff | unknown |
| June 13 1996 | Sawmill River, Spaulding Brook | Flash Flood | \$1,800,000 |
| Jan 9 1998 | Connecticut River | Flood | \$0 |
| March 30 1998 | Connecticut River | Flood | \$0 |
| April 1 1998 | Connecticut River | Flood | \$0 |
| April 22 1998 | Connecticut River | Flood | \$0 |
| April 1 2004 | Connecticut River | Flood | not available |
| Oct 8 2005 | Region-wide | Flood | \$4,200,000 |
| Oct 15 2005 | State-wide | Flood | \$6,000,000 |
| 2009 | Hillcrest School Building | Failed dry well | Approx. \$400 (school staff labor) |

Source: <http://www4.ncdc.noaa.gov/cgi-win/wwcgl.dll?wwevent~storms> and committee input.

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 MEMA, there are no repetitive loss structures in Franklin County. See pages 134-136 for more information on the NFIP.

Population Impacts

The Town should be aware that senior and low income segments of Montague's population may be more vulnerable to hazard events due to a number of factors. Senior and low income populations may be physically or financially unable to react and respond to a hazard event and require additional assistance. Access to information about the hazard event may be lacking, as well as access to transportation in the case of an evacuation. The location and construction quality of housing can also pose a significant risk. Table 3-23 displays the number of senior and low income residents and environmental justice population (defined on pages 45-47 above) in Montague. It should be noted that there is overlap within the three categories, so that the total number of persons exposed is lower than all three categories added together. However the town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Table 3-23: Senior, Low Income, and Environmental Justice Populations Exposed to Natural Hazard Events*

| Population Category | Number of Persons Exposed | Percentage of Total Population |
|---|----------------------------------|---------------------------------------|
| Senior (over 65 years of age) | 1,404 | 16.5 |
| Low Income (persons with annual incomes of less than \$20,000)** | 2,506 | 29.5 |
| Environmental Justice | 3,253 | 38.3 |

* There is overlap between the population categories, so total number of persons exposed is lower than the three categories added together.

** Low income population was calculated by multiplying 2000 U.S. Census Households with Incomes of Less than \$20,000 (1,085) by 2000 U.S. Census Average Household Size (2.31).

Source: 2000 U.S. Census.

Overall Vulnerability Assessment

Flooding is common in New England, often causing significant impacts to the roads, structures, facilities, utilities, and population of Montague. Existing and future mitigation efforts should continue to be developed and employed that will enable Montague to be prepared for these events when they occur. Particular areas of vulnerability include low-income and elderly populations, trailer homes, and infrastructure such as bridges and the low-lying areas that can be impacted by flooding related to ice jams or rapid snow melt.

Data Deficiencies

In assessing the risks to Montague from flood hazards, the following data deficiencies were identified:

- Records of damages to the built and natural environment due to flooding in Montague are not consistently maintained. A more formal system of data collection and maintenance

could be established and would help improve the Town's hazard mitigation planning. Better data could also increase the Town's chance of qualifying for various grants.

- Lack of available data on the number of vulnerable populations living in households in the floodplain.
- Lack of digital floodplain data to overlay on zoning to determine number of developable lots in the flood hazard area.
- Data for the location and condition of non-FERC regulated dams within Montague provided by the DCR Office of Dam Safety Legal Department was incomplete. This plan uses 2005 data.
- The towns of Franklin County rely on farming as one of its income sources. Little data exists on localized crop damage due to flooding.

SEVERE WINTER STORMS

Severe winter storms are common in Montague, often causing impacts and losses to the Towns' roads, structures, facilities, utilities, and population. Existing and future mitigation efforts should continue to be developed and employed that will enable the Town to be prepared for these events.

Hazard Summary

Severe winter storms cause significant concern because they happen often and can be quite severe; they cost residents money; they require snow and ice removal, which can limit access to facilities and can cause health problems; they can cause utility failure and flooding from ice jams; and they put stress on community resources.

Data Collected and Used

National weather databases and Town of Montague data were collected and analyzed. Data on historic property damage and loss, and injuries and deaths, was collected for Franklin County from the National Oceanic and Atmospheric Administration's National Climatic Data Center website. This data was used to support an evaluation of exposure and potential impacts associated with this hazard. Available historic data are presented in Table 3-24.

Impact on the Community

Exposure and Loss Estimation

Heavy snowfall coupled with low temperatures often results in increases in traffic accidents; disruptions in transportation, commerce, government, and education; utility outages due to falling trees, branches, and other objects; personal injuries associated with slippery surfaces and freezing temperatures; and numerous other problems. Specific damages associated with severe winter storm (snow) events include the following primary concerns:

- Injuries, including fatalities, associated with accidents; low temperatures; power loss; falling objects and accidents associated with frozen and slippery surfaces and snow accumulation
- Increases in the frequency and impact of traffic accidents, which result in personal injuries

- Ice-related damage to trees, building and infrastructure inventory, and utilities (power lines, bridges, substations, etc.)
- Roads damaged through freeze and thaw processes
- Stress on the local shelters and emergency response infrastructure
- Lost productivity that occurs when people cannot go to work, school, or stores due to inclement conditions

In addition, due to the rural nature of several areas in Montague, access to emergency services are also heavily impacted during winter storms due to impassable roads.

New England’s climate offers no immunity to the potential damaging effects of severe winter storms. Some minimum damage is anticipated annually, with potential extensive damage occurring about once every 10 years.

Property Damage

As presented in Table 3-24, historic data for severe winter storm events indicate that between 1993 and 2010, 111 heavy snow events were recorded in Franklin County. An average of 6.1 such events occur each year. Over 18 years, winter storms have caused an average of \$4.5 million in damages per year in Franklin County.

Table 3-24: Severe Winter Storms in Franklin County (Heavy Snow/Ice)

| Year | # of Heavy Snow/Ice Events | Annual Property Damage | Annual Crop Damage |
|-----------------------------|---------------------------------------|--|--|
| 2010 | 3 | \$30,000 | \$0 |
| 2009 | 5 | \$0 | \$0 |
| 2008 | 12 | \$6,020,000 | \$0 |
| 2007 | 7 | \$10,000 | \$0 |
| 2006 | 0 | \$0 | \$0 |
| 2005 | 9 | \$625,000 | \$0 |
| 2004 | 3 | \$0 | \$0 |
| 2003 | 5 | \$50,000 | \$0 |
| 2002 | 7 | \$1,605,000 | \$0 |
| 2001 | 7 | \$11,000,000 | \$0 |
| 2000 | 7 | \$0 | \$0 |
| 1999 | 6 | \$0 | \$0 |
| 1998 | 3 | \$0 | \$0 |
| 1997 | 6 | \$10,030,000 | \$0 |
| 1996 | 10 | \$47,000,000 | \$0 |
| 1995 | 6 | \$0 | \$0 |
| 1994 | 8 | \$5,050,000 | \$0 |
| 1993 | 7 | \$0 | \$0 |
| Total # of years: 18 | Total snow and ice events: 111 | Average Annual Property Damage: \$4,523,333 | Average Annual Crop Damage: \$0 |

Source: NOAA National Climatic Data Center. <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>.

The entire built environment of Montague is vulnerable to a severe winter storm. Table 3-25 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a severe winter storm.

Table 3-25: Potential Estimated Loss by Land Use Category

| | Total Assessed Value | 1% Damage Loss Estimate | 5% Damage Loss Estimate | 10% Damage Loss Estimate |
|--------------------|-----------------------------|--------------------------------|--------------------------------|---------------------------------|
| Residential | \$568,550,480 | \$5,685,505 | \$28,427,524 | \$56,855,048 |
| Commercial | \$34,257,686 | \$342,577 | \$1,712,884 | \$3,425,769 |
| Industrial | \$110,060,690 | \$1,100,607 | \$5,503,035 | \$11,006,069 |
| Total | \$712,868,856 | \$7,128,689 | \$35,643,443 | \$71,286,886 |

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section

Population Impacts

As discussed above, some traffic accidents associated with storm events include injuries and in limited cases, deaths. However, the number of injuries and deaths reported for accidents is generally low.

Populations considered most vulnerable to severe winter storm impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-26 summarizes the population over the age of 65, living in households with an income below \$20,000 per year, and/or living within the Environmental Justice Population area (defined on pages 45-47 above).

Table 3-26: Senior, Low Income, and Environmental Justice Populations Exposed to Natural Hazard Events*

| Population Category | Number of Persons Exposed | Percentage of Total Population |
|---|----------------------------------|---------------------------------------|
| Senior (over 65 years of age) | 1,404 | 16.5 |
| Low Income (persons with annual incomes of less than \$20,000)** | 2,506 | 29.5 |
| Environmental Justice | 3,253 | 38.3 |

* There is overlap between the population categories, so total number of persons exposed is lower than the three categories added together.

** Low income population was calculated by multiplying 2000 U.S. Census Households with Incomes of Less than \$20,000 (1,085) by 2000 U.S. Census Average Household Size (2.31).

Source: 2000 U.S. Census.

Overall Vulnerability Assessment

Severe winter storms are common in New England, often causing significant impacts and losses to the roads, structures, facilities, utilities, and population of Montague. Existing and future mitigation efforts should continue to be developed and employed that will enable Montague to be prepared for these events when they occur. The cascade effects of severe winter storms include utility losses and transportation accidents and flooding. Losses associated with the flood hazard are discussed earlier in this section. Particular areas of vulnerability include low-income and elderly populations, trailer homes, and infrastructure such as roadways and utilities that can be

damaged by such storms and the low-lying areas that can be impacted by flooding related to ice jams or rapid snow melt.

Data Deficiencies

In assessing the risks to Montague from severe winter storms, the following data deficiencies were identified:

- Records of damages to the built and natural environment due to severe winter storms in Montague are not consistently maintained. A more formal system of data collection and maintenance could be established and would help improve the Town's hazard mitigation planning. Better data could also increase the Town's chance of qualifying for various grants.
- The towns of Franklin County rely on farming for one of its income sources. Little data exists on localized crop damage due to these hazards.

HURRICANES AND TROPICAL STORMS

Hazard Summary

Hurricanes and tropical storms are rare in Montague but could cause severe impacts such as flooding, power outages, and flying debris, damage to property and injury and loss of life. Existing and future mitigation efforts should continue to be developed and employed that will enable the Town to be prepared for these events.

Hurricanes or tropical cyclones can spin off tornadoes and bring thunderstorms, high winds and, in coastal areas, storm surges in the sea, possibly resulting in beach erosion and loss or damage to property (see Tornadoes and Microburst Section, below). Inland, hurricanes mainly bring heavy rains that can cause flooding.

Data Collected and Used

National weather databases and Town of Montague data were collected and analyzed. Data on historic property damage and loss, and injuries and deaths, was collected for Franklin County and Montague from the National Oceanic and Atmospheric Administration's National Climatic Data Center website. This data was used to support an evaluation of exposure and potential impacts associated with this hazard. Available historic data are presented in Table 3-27.

Impact on the Community

Exposure and Loss Estimation

High winds and heavy rain and/or hail associated with hurricanes and tropical storms can cause damage to utilities, structures, roads, trees (potentially causing vehicle accidents) and injuries and death.

Property Damage

As presented in Table 3-27, historic data for hurricane and tropical storm events indicate one hurricane and 16 tropical storms have been recorded in Franklin County. Hurricane Bob in 1991 caused over 5.5 million dollars in property damage in the county, and over \$500,000 in crop

damage. Overall, tropical storms and hurricanes have caused an average annual property damage of just over \$300,000 over the last 20 years.

Table 3-27: Hurricane and Tropical Storm Events in Franklin County

| Year | # of Hurricane/Tropical Storm Events | Annual Property Damage | Annual Crop Damage |
|-------------------|--------------------------------------|---------------------------------------|-----------------------------------|
| 2009 | 0 | \$0 | \$0 |
| 2008 | 0 | \$0 | \$0 |
| 2007 | 0 | \$0 | \$0 |
| 2006 | 5 | \$277,861 | \$0 |
| 2005 | 1 | \$33,889 | \$0 |
| 2004 | 1 | \$37,778 | \$0 |
| 2003 | 2 | \$127,381 | \$0 |
| 2002 | 0 | \$0 | \$0 |
| 2001 | 0 | \$0 | \$0 |
| 2000 | 0 | \$0 | \$0 |
| 1999 | 1 | \$7,692 | \$0 |
| 1998 | 2 | \$63,269 | \$0 |
| 1997 | 0 | \$0 | \$0 |
| 1996 | 0 | \$0 | \$0 |
| 1995 | 1 | \$0 | \$0 |
| 1994 | 1 | \$35,714 | \$0 |
| 1993 | 0 | \$0 | \$0 |
| 1992 | 0 | \$0 | \$0 |
| 1991 | 1 | \$5,555,556 | \$555,556 |
| 1990 | 2 | \$7,142 | \$0 |
| # of Years | Total # of Events | Average Annual Property Damage | Average Annual Crop Damage |
| 20 | 17 | \$307,314 | \$27,778 |

Source: Spatial Hazard Events and Losses Database (SHELDUS), <http://webra.cas.sc.edu/hvri/>.

The entire built environment of Montague is vulnerable to the high winds and/or flooding from a hurricane or tropical storm. Table 3-28 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of an extreme wind and rain storm storm.

Table 3-28: Potential Estimated Loss by Land Use Category

| | Total Assessed Value | 1% Damage Loss Estimate | 5% Damage Loss Estimate | 10% Damage Loss Estimate |
|--------------------|----------------------|-------------------------|-------------------------|--------------------------|
| Residential | \$568,550,480 | \$5,685,505 | \$28,427,524 | \$56,855,048 |
| Commercial | \$34,257,686 | \$342,577 | \$1,712,884 | \$3,425,769 |
| Industrial | \$110,060,690 | \$1,100,607 | \$5,503,035 | \$11,006,069 |
| Total | \$712,868,856 | \$7,128,689 | \$35,643,443 | \$71,286,886 |

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section

Population Impacts

Some traffic accidents associated with storm events include injuries and in limited cases, deaths. However, the number of injuries and deaths reported for accidents is generally low.

Populations considered most vulnerable to hurricane and tornado impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-29 summarizes the population over the age of 65, living in households with an income below \$20,000 per year, and/or living within the Environmental Justice Population area (defined on pages 45-47 above).

Table 3-29: Senior, Low Income, and Environmental Justice Populations Exposed to Natural Hazard Events*

| Population Category | Number of Persons Exposed | Percentage of Total Population |
|---|---------------------------|--------------------------------|
| Senior (over 65 years of age) | 1,404 | 16.5 |
| Low Income (persons with annual incomes of less than \$20,000)** | 2,506 | 29.5 |
| Environmental Justice | 3,253 | 38.3 |

* There is overlap between the population categories, so total number of persons exposed is lower than the three categories added together.

** Low income population was calculated by multiplying 2000 U.S. Census Households with Incomes of Less than \$20,000 (1,085) by 2000 U.S. Census Average Household Size (2.31).

Source: 2000 U.S. Census.

Overall Vulnerability Assessment

Hurricanes and tropical storms, while uncommon, have the potential to cause severe damage. Existing and future mitigation efforts should continue to be developed and employed that will enable Montague to be prepared for these events when they occur. The cascade effects of severe storms include utility losses and transportation accidents and flooding. Losses associated with the flood hazard are discussed earlier in this section. Particular areas of vulnerability include low-income and elderly populations, trailer homes, and infrastructure such as roadways and utilities that can be damaged by such storms and the low-lying areas that can be impacted by flooding.

Data Deficiencies

In assessing the risks to Montague from hurricanes and tropical storms, the following data deficiencies were identified:

- Records of damages to the built and natural environment due to hurricanes and tropical storms in Montague are not consistently maintained. A more formal system of data collection and maintenance could be established and would help improve the Town's hazard mitigation planning. Better data could also increase the Town's chance of qualifying for various grants.
- The towns of Franklin County rely on farming for one of its income sources. Little data exists on localized crop damage due to these hazards.

TORNADOS AND MICROBURSTS

Hazard Summary

Like hurricanes, tornadoes and microbursts are relatively rare in Montague but could cause severe impacts such as flooding, power outages, flying debris, damage to property and injury and loss of life. Existing and future mitigation efforts should continue to be developed and employed that will enable the Town to be prepared for these events. Thunderstorms, a sub-category of Tornados and Microbursts, are common in western Massachusetts and can cause significant damage. Additional data were available for hail and lightning events, and are included in tables 3-29 and 3-30. Hail and lightning are events generally associated with thunderstorms.

Thunderstorms bring strong winds, rain and, at times, hail, potentially causing damage to property, crops and utilities and injuries or deaths to residents. Persistent rain can also cause flooding.

Tornados can have devastating effects on infrastructure, property and human health. Striking at random, their conical winds leave trails of devastation, at times more than a mile wide, in their wake. Small tornadoes, known as "gustnadoes," have been known to strike in Franklin County, most recently in Sunderland in 2009. The gustnado does not appear in data compiled on tornadoes for this report, however, even gustnadoes can cause damage; the 2009 occurrence destroyed a barn and downed trees in Sunderland.

Data Collected and Used

National weather databases and Town of Montague data were collected and analyzed. Data on historic property damage and loss, and injuries and deaths, was collected for Franklin County from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center website, and the Spatial Hazard Events and Losses Database (SHELDUS). This data was used to support an evaluation of exposure and potential impacts associated with this hazard. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 was also reviewed for information on tornadoes and microburst hazard data and mitigation measures.

Impact on the Community

Exposure and Loss Estimation

High winds and heavy rain and/or hail associated with tornados and microbursts can cause damage to utilities, structures, roads, trees (potentially causing vehicle accidents) and injuries and death.

Property Damage

As presented in Table 3-30, historic data for tornado events indicate that between 1991 and 2010, 4 tornadoes were recorded in Franklin County. Over 20 years, tornadoes have caused an average of \$16,250 in property damages yearly countywide.

Table 3-30: Tornado Events in Franklin County

| Year | # of Tornado Events | Annual Property Damage | Annual Crop Damage |
|-----------------------------|--------------------------------|---|--|
| 2010 | 0 | \$0 | \$0 |
| 2009 | 0 | \$0 | \$0 |
| 2008 | 0 | \$0 | \$0 |
| 2007 | 0 | \$0 | \$0 |
| 2006 | 1 | \$200,000 | \$0 |
| 2005 | 0 | \$0 | \$0 |
| 2004 | 0 | \$0 | \$0 |
| 2003 | 0 | \$0 | \$0 |
| 2002 | 0 | \$0 | \$0 |
| 2001 | 0 | \$0 | \$0 |
| 2000 | 0 | \$0 | \$0 |
| 1999 | 0 | \$0 | \$0 |
| 1998 | 0 | \$0 | \$0 |
| 1997 | 2 | \$100,000 | \$0 |
| 1996 | 0 | \$0 | \$0 |
| 1995 | 0 | \$0 | \$0 |
| 1994 | 0 | \$0 | \$0 |
| 1993 | 0 | \$0 | \$0 |
| 1992 | 1 | \$25,000 | \$0 |
| 1991 | 0 | \$0 | \$0 |
| Total # of Years: 20 | Total Tornado Events: 4 | Average Annual Property Damage: \$16,250 | Average Annual Crop Damage: \$0 |

Source: NOAA National Climatic Data Center. <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>.

Severe thunderstorms, and their associated hail and lightning events, brought about significant property damage. Over the last 19 years, 115 thunderstorms caused an average annual property loss of more than \$59,000 in the county (Table 3-31). It is worth noting that the number of thunderstorms has increased in recent years; in the 1990s, there were an average of 3.8 storms per year, according to NOAA data. From 2000 to 2008, NOAA recorded an average of 9.6 storms per year, 2.5 times the previous decade. In 2007 and 2008, the most recent years with data

available, 40 storms were recorded countywide for an average number of 20 storms for those two years.

Table 3-31: Thunderstorm Events in Franklin County

| Year | # of Thunderstorm Events | Annual Property Damage | Annual Crop Damage |
|-----------------------------|---------------------------------------|---|--|
| 2008 | 21 | \$602,000 | \$0 |
| 2007 | 19 | \$0 | \$0 |
| 2006 | 9 | \$338,000 | \$0 |
| 2005 | 9 | \$85,000 | \$0 |
| 2004 | 4 | \$30,000 | \$0 |
| 2003 | 1 | \$10,000 | \$0 |
| 2002 | 6 | \$25,000 | \$0 |
| 2001 | 5 | \$0 | \$0 |
| 2000 | 3 | \$20,000 | \$0 |
| 1999 | 5 | \$0 | \$0 |
| 1998 | 8 | \$2,000 | \$0 |
| 1997 | 7 | \$10,000 | \$0 |
| 1996 | 5 | \$0 | \$0 |
| 1995 | 3 | \$0 | \$0 |
| 1994 | 4 | \$0 | \$0 |
| 1993 | 0 | \$0 | \$0 |
| 1992 | 2 | \$0 | \$0 |
| 1991 | 3 | \$0 | \$0 |
| 1990 | 1 | \$0 | \$0 |
| Total # of years: 19 | Total Thunderstorm Events: 115 | Average Annual Property Damage: \$59,053 | Average Annual Crop Damage: \$0 |

Source: NOAA National Climatic Data Center. <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>.

Eight thunderstorms over the last seventeen years produced high winds in Montague that caused damage to trees and power lines (Table 3-31). In 2010 two thunderstorm events caused a total of \$35,000 in property damage. No property damage was recorded for the other events, resulting in an average annual property damage of \$5,375 over seventeen years.

Table 3-31: Severe Thunderstorm Events in Montague

| Year | # of Thunderstorm Events | Annual Property Damage | Annual Crop Damage |
|-----------------------------|-----------------------------|--|--|
| 1994 | 1 | \$0 | \$0 |
| 1998 | 1 | \$0 | \$0 |
| 2001 | 1 | \$0 | \$0 |
| 2005 | 1 | unknown | \$0 |
| 2006 | 1 | unknown | \$0 |
| 2008 | 1 | \$8,000 | \$0 |
| 2010 | 2 | \$35,000 | \$0 |
| Total # of Years: 17 | Total # of Events: 8 | Average Annual Property Damage: \$5,375 | Average Annual Crop Damage: \$0 |

Source: NOAA National Climatic Data Center. <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>.

As Table 3-32 shows, 24 hail storms between 1993 and 2010 have caused an average of more than \$560,000 in property damage in Franklin County per year. Ten lightning events (Table 3-33) have caused an average of more than \$8,000 in property damage per year over the last 15 years in Franklin County.

Table 3-32: Hail Events in Franklin County

| Year | # of Hail Events | Annual Property Damage | Annual Crop Damage |
|-----------------------------|------------------------------|--|--|
| 2009 | 0 | \$0 | \$0 |
| 2008 | 0 | \$0 | \$0 |
| 2007 | 0 | \$0 | \$0 |
| 2006 | 5 | \$1,928,000 | \$0 |
| 2005 | 1 | \$305,000 | \$0 |
| 2004 | 1 | \$340,000 | \$0 |
| 2003 | 2 | \$1,350,000 | \$0 |
| 2002 | 0 | \$0 | \$0 |
| 2001 | 0 | \$0 | \$0 |
| 2000 | 0 | \$0 | \$0 |
| 1999 | 1 | \$0 | \$0 |
| 1998 | 0 | \$0 | \$0 |
| 1997 | 0 | \$0 | \$0 |
| 1996 | 2 | \$0 | \$0 |
| 1995 | 5 | \$0 | \$0 |
| 1994 | 4 | \$5,050,000 | \$0 |
| 1993 | 3 | \$550,000 | \$0 |
| Total # of Years: 17 | Total Hail Events: 24 | Average Annual Property Damage: \$560,176 | Average Annual Crop Damage: \$0 |

Source: Source: NOAA National Climatic Data Center. <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>.

Table 3-33: Lightning Events in Franklin County

| Year | # of Lightning Events | Annual Property Damage | Annual Crop Damage |
|---------------------------|---|--|--|
| 2008 | 1 | \$10,000 | \$0 |
| 2007 | 0 | \$0 | \$0 |
| 2006 | 0 | \$0 | \$0 |
| 2005 | 1 | \$50,000 | \$0 |
| 2004 | 1 | \$35,000 | \$0 |
| 2003 | 0 | \$0 | \$0 |
| 2002 | 1 | \$15,000 | \$0 |
| 2001 | 1 | \$20,000 | \$0 |
| 2000 | 0 | \$0 | \$0 |
| 1999 | 0 | \$0 | \$0 |
| 1998 | 0 | \$0 | \$0 |
| 1997 | 1 | \$3,000 | \$0 |
| 1996 | 0 | \$0 | \$0 |
| 1995 | 2 | \$0 | \$0 |
| 1994 | 2 | \$0 | \$0 |
| # of Years: 15 | Total Lightning Events: 10 | Average Annual Property Damage: \$8,867 | Average Annual Crop Damage: \$0 |

Source: Source: NOAA National Climatic Data Center. <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>.

Two hail events, one in 1994 and one in 1998, have been reported in Montague according to the NOAA National Climatic Data Center. Dime sized hail was reported in the village of Turners Falls in the 1998 storm. Neither hail storm resulted in any known property or crop damage. Three lightning events have been reported in Montague in recent years as well. In 1994 a lightning strike set a house on fire in Turners Falls, although no property damage amounts were reported. In 2004 lightning ignited a barn fire in Montague, destroying the barn, a truck, and a hay baler. The dollar amount of the damage from this event is also unknown. In June 2008, a lightning strike ignited a house fire on Maple Street.

The entire built environment of Montague is vulnerable to the high winds and/or flooding from a tornado or microburst. Table 3-34 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of an extreme wind and rain storm.

Table 3-34: Potential Estimated Loss by Land Use Category

| | Total Assessed Value | 1% Damage Loss Estimate | 5% Damage Loss Estimate | 10% Damage Loss Estimate |
|--------------------|----------------------|-------------------------|-------------------------|--------------------------|
| Residential | \$568,550,480 | \$5,685,505 | \$28,427,524 | \$56,855,048 |
| Commercial | \$34,257,686 | \$342,577 | \$1,712,884 | \$3,425,769 |
| Industrial | \$110,060,690 | \$1,100,607 | \$5,503,035 | \$11,006,069 |
| Total | \$712,868,856 | \$7,128,689 | \$35,643,443 | \$71,286,886 |

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section

Population Impacts

Some traffic accidents associated with storm events include injuries and in limited cases, deaths. However, the number of injuries and deaths reported for accidents is generally low.

Populations considered most vulnerable to tornado and microburst impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-35 summarizes the population over the age of 65, living in households with an income below \$20,000 per year, and/or living within the Environmental Justice Population area (defined on pages 45-47 above).

Table 3-35: Senior, Low Income, and Environmental Justice Populations Exposed to Natural Hazard Events*

| Population Category | Number of Persons Exposed | Percentage of Total Population |
|--|---------------------------|--------------------------------|
| Senior (over 65 years of age) | 1,404 | 16.5 |
| Low Income (persons with annual incomes of less than \$20,000)** | 2,506 | 29.5 |
| Environmental Justice | 3,253 | 38.3 |

* There is overlap between the population categories, so total number of persons exposed is lower than the three categories added together.

** Low income population was calculated by multiplying 2000 U.S. Census Households with Incomes of Less than \$20,000 (1,085) by 2000 U.S. Census Average Household Size (2.31).

Source: 2000 U.S. Census.

Overall Vulnerability Assessment

Thunderstorms and microbursts are common in New England, often causing significant impacts and losses to the roads, structures, facilities, utilities, and population of Montague. Tornadoes, while less common, have the potential to cause severe damage. Existing and future mitigation efforts should continue to be developed and employed that will enable Montague to be prepared for these events when they occur. The cascade effects of severe storms include utility losses and transportation accidents and flooding. Losses associated with the flood hazard are discussed earlier in this section. Particular areas of vulnerability include low-income and elderly populations, trailer homes, and infrastructure such as roadways and utilities that can be damaged by such storms and the low-lying areas that can be impacted by flooding.

Data Deficiencies

In assessing the risks to Montague from tornadoes and microbursts, the following data deficiencies were identified:

- Records of damages to the built and natural environment due to tornadoes, microbursts, and associated storm events such as thunderstorms, hail and lightning in Montague are not consistently maintained. A more formal system of data collection and maintenance could be established and would help improve the Town's hazard mitigation planning. Better data could also increase the Town's chance of qualifying for various grants.
- The towns of Franklin County rely on farming for one of its income sources. Little data exists on localized crop damage due to these hazards.

WILDFIRES AND BRUSHFIRES

Hazard Summary

Wildfires can damage woodlands, homes, utilities and buildings, and could cause injuries or deaths. Existing and future mitigation efforts should continue to be developed and employed that will enable the Town to be prepared for these events.

Burn piles that blaze out of control, lightning strikes in forested land, campfires improperly managed, and arson can cause wildfires. Montague is vulnerable to these conflagrations, especially in times of drought. The Montague Plains Wildlife Management Area and adjacent areas is particularly susceptible to wildfires, and is discussed in more detail below. Fire suppression can be expensive and dangerous for firefighters, and wildfires can threaten wildlife and human habitat and health.

Data Collected and Used

National weather databases and Town of Montague data were collected and analyzed. Data on historic property damage and loss, and injuries and deaths, was collected for Franklin County from the National Oceanic and Atmospheric Administration's National Climatic Data Center website. Data from this website shows no wildfires have occurred in or impacted Franklin County in the last 20 years. According to the Massachusetts Department of Fire Services Fire Incident Reporting System (MFIRS), 67 brushfires were reported in Montague between 2004 and 2009. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 was also reviewed for information on wildland fires and brushfires hazard data and mitigation measures.

Impact on the Community

Exposure and Loss Estimation

A major out-of-control wildfire can damage property, utilities and forested land; create smoke that can cause breathing problems; and injure or kill people.

Property Damage

No property damage, injuries or deaths have been recorded for Montague's 67 fires between 2004 and 2009.

Because Montague is heavily wooded, the entire built environment of the Town is vulnerable to a wildfire. Table 3-36 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a wildfire.

Table 3-36: Potential Estimated Loss by Land Use Category

| | Total Assessed Value | 1% Damage Loss Estimate | 5% Damage Loss Estimate | 10% Damage Loss Estimate |
|--------------------|----------------------|-------------------------|-------------------------|--------------------------|
| Residential | \$568,550,480 | \$5,685,505 | \$28,427,524 | \$56,855,048 |
| Commercial | \$34,257,686 | \$342,577 | \$1,712,884 | \$3,425,769 |
| Industrial | \$110,060,690 | \$1,100,607 | \$5,503,035 | \$11,006,069 |
| Total | \$712,868,856 | \$7,128,689 | \$35,643,443 | \$71,286,886 |

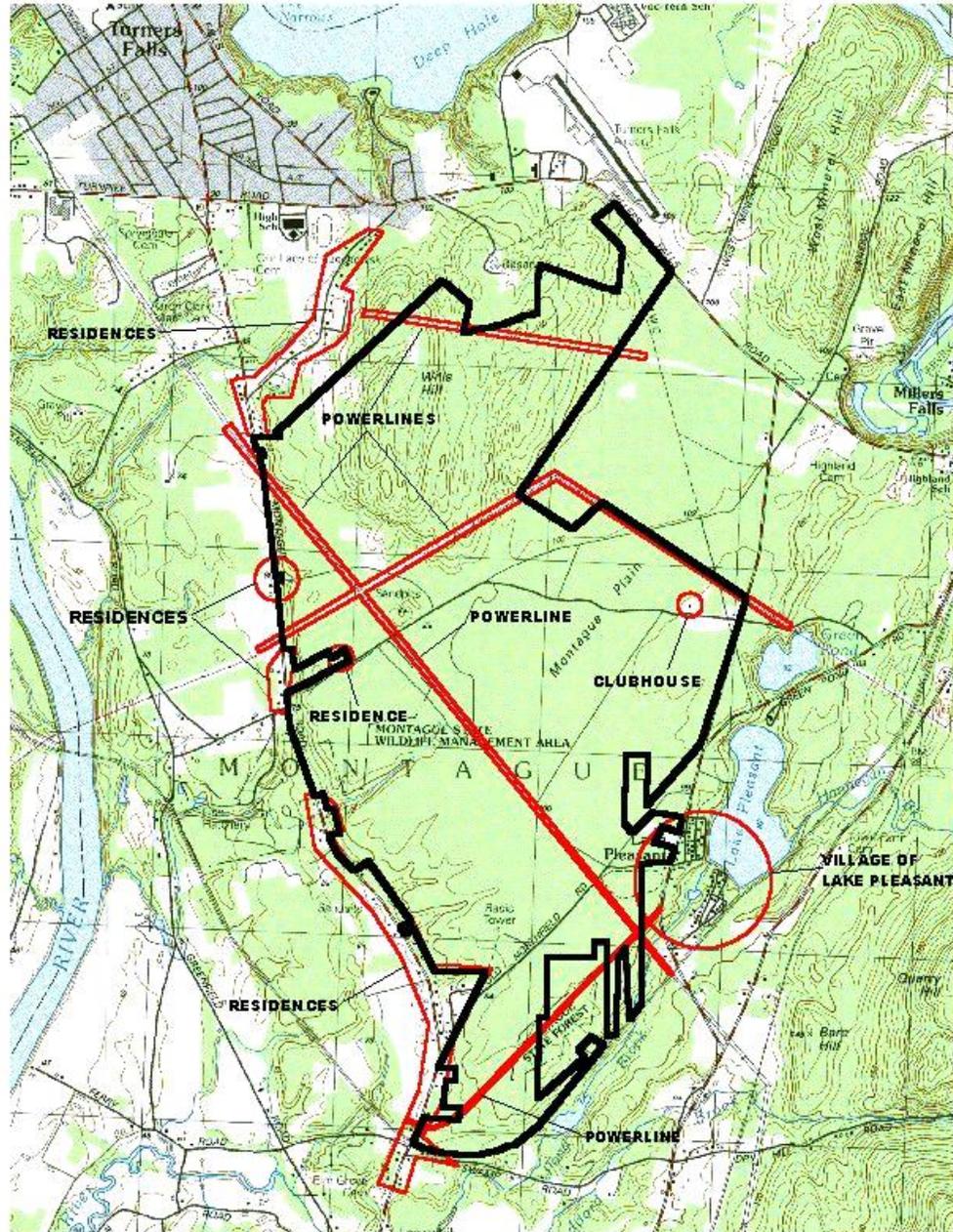
Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

The Fire Management Plan for the Montague Plains Wildlife Management Area (WMA) included a vulnerability assessment of structures particularly susceptible to fire. It identified two fire-sensitive areas on the WMA itself, including a clubhouse building along Plains Road on the eastern side of the WMA. This approximately 800 square foot structure has concrete block construction and an asphalt shingle roof. Defensible space is minimal behind the structure (west), but excellent on all other sides. There is an exterior above-ground propane tank adjacent to the west exterior wall. A dense stand of pitch pine to the west of this structure puts it at considerable risk from wildfire. Electrical transmission lines are the other fire sensitive areas of the WMA. Most of the lines that cross the WMA have wooden poles which could be damaged or consumed by a wildfire, causing power outages in the region and electrical and structural hazards at the site. Only the largest power line, running northwest-southeast across the property has metal towers.

The plan also identified numerous fire sensitive areas off-site (see Figure 5 from the plan, below). The village of Lake Pleasant lies adjacent to the MP WMA to the southeast just across Lake Pleasant Road. A large, uninterrupted area of closed canopy pitch pine occurs west of the village of Lake Pleasant. Due to the arrangement and flammability of the fuels, a crown fire could sweep across the southern part of the WMA and into the village when winds are high and humidity is low. The village of Lake Pleasant has been affected by wildfires on several occasions in the past, and during at least one incident houses were destroyed.

There are a number of houses and other buildings adjacent to or near the boundary of the WMA to the north, northwest, west and southwest along Millers Falls Road, Hillside Road, and Turners Falls Road. While still at some risk of being affected by fires from the Montague Plain, these areas are at substantially less risk than the village of Lake Pleasant, because they occur at the bottom of slopes and are adjacent to mixed or hardwood forests (which do not support crown fires). A single residence lies in an inholding north of Plains Road at the western edge of the site. This residence is at particular risk to fire because it is surrounded by scrub oak thicket and pitch pine fuel types. The Fire Management Plan includes a variety of strategies designed to protect vulnerable structures from the risk of wildfire on the Plains. These strategies are outlined in greater detail in Section 4, Current Mitigation Strategies, of this plan.

**Figure 5: Fire Sensitive Areas on/near
Montague Plain Wildlife Management Area**



0 1 2 Miles

 WMA boundary
 fire sensitive areas



Source: Fire Management Plan for the Montague Plains Wildlife Management Area

Population Impacts

Populations considered most vulnerable to wildfire impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-37 summarizes the population over the age of 65, living in households with an income below \$20,000 per year, and/or living within the Environmental Justice Population area (defined on pages 45-47 above).

Table 3-37: Senior, Low Income, and Environmental Justice Populations Exposed to Natural Hazard Events*

| Population Category | Number of Persons Exposed | Percentage of Total Population |
|---|----------------------------------|---------------------------------------|
| Senior (over 65 years of age) | 1,404 | 16.5 |
| Low Income (persons with annual incomes of less than \$20,000)** | 2,506 | 29.5 |
| Environmental Justice | 3,253 | 38.3 |

* There is overlap between the population categories, so total number of persons exposed is lower than the three categories added together.

** Low income population was calculated by multiplying 2000 U.S. Census Households with Incomes of Less than \$20,000 (1,085) by 2000 U.S. Census Average Household Size (2.31).

Source: 2000 U.S. Census.

Overall Vulnerability Assessment

While wildfires have caused minimal damage, injury and loss of life to date in Montague, their potential to destroy property and cause injury or death exists. Existing and future mitigation efforts should continue to be developed and employed that will enable Montague to be prepared for these events when they occur. Wildfires can also cause utility disruption and air-quality problems. Particular areas of vulnerability include low-income and elderly populations.

Data Deficiencies

In assessing the risks to Montague from wildfire hazards, the following data deficiencies were identified:

- Records of damages to the built and natural environment due to wildfires and brushfires in Montague are not consistently maintained. A more formal system of data collection and maintenance could be established and would help improve the Town's hazard mitigation planning. Better data could also increase the Town's chance of qualifying for various grants.
- The towns of Franklin County rely on farming for one of its income sources. Little data exists on localized crop damage due to wildfires.

DAM FAILURE

Hazard Summary

The failure of a dam upstream from Montague could have devastating effects on the Town. Dams that straddle the Connecticut and Deerfield rivers could impact Montague, should they fail. Dams hold back water, and when a dam fails, the potential energy of the stored water behind the dam is instantly released as water rushes in torrent downstream, flooding an area engineers

refer to as an “inundation area.” The number of casualties and the amount of property damage will depend upon 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. Existing and future mitigation efforts should continue to be developed and employed that will enable the Town to be prepared for these events.

When a dam fails, huge quantities of water quickly flow downstream. Areas adjacent to a river or stream or on low ground are in danger of being inundated by a large volume of water that could destroy structures, utilities, roadways and bridges, and cause injuries or deaths. Many dams in Massachusetts were built in the 19th Century without the benefit of modern engineering design and construction oversight. Dams can fail because of structural problems due to age and/or lack of proper maintenance. Dam failure can also be the result of structural damage caused by an earthquake or flooding brought on by severe storm events.

Data Collected and Used

Data from the National Oceanic and Atmospheric Administration’s National Climatic Data Center website shows no dam failures have occurred in or impacted Franklin County in the last 20 years. According to the members of the Local Natural Hazard Mitigation Team, no dam failures have occurred in Montague in the last 20 years.

Impact on the Community

Exposure and Loss Estimation

While dam failures are rare, their impacts can be devastating, including loss of property, disruption to infrastructure, and injury and death.

Property Damage

Historic data for dam failure events indicate that between 1993 and 2010, no events were recorded in Franklin County, causing no property damage or population impacts.

Structures that lie in the inundation area of Montague are most vulnerable to a dam failure. Table 3-38 identifies the building type and valuation for all residential, commercial, and industrial land uses in Montague, as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a dam failure.

Table 3-38: Potential Estimated Loss by Land Use Category

| | Total Assessed Value | 1% Damage Loss Estimate | 5% Damage Loss Estimate | 10% Damage Loss Estimate |
|--------------------|-----------------------------|--------------------------------|--------------------------------|---------------------------------|
| Residential | \$568,550,480 | \$5,685,505 | \$28,427,524 | \$56,855,048 |
| Commercial | \$34,257,686 | \$342,577 | \$1,712,884 | \$3,425,769 |
| Industrial | \$110,060,690 | \$1,100,607 | \$5,503,035 | \$11,006,069 |
| Total | \$712,868,856 | \$7,128,689 | \$35,643,443 | \$71,286,886 |

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

Population Impacts

Populations considered most vulnerable to dam failure are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-39 summarizes the population over the age of 65, living in households with an income below \$20,000 per year, and/or living within the Environmental Justice Population area (defined on pages 45-47 above).

Table 3-39: Senior, Low Income, and Environmental Justice Populations Exposed to Natural Hazard Events*

| Population Category | Number of Persons Exposed | Percentage of Total Population |
|---|----------------------------------|---------------------------------------|
| Senior (over 65 years of age) | 1,404 | 16.5 |
| Low Income (persons with annual incomes of less than \$20,000)** | 2,506 | 29.5 |
| Environmental Justice | 3,253 | 38.3 |

* There is overlap between the population categories, so total number of persons exposed is lower than the three categories added together.

** Low income population was calculated by multiplying 2000 U.S. Census Households with Incomes of Less than \$20,000 (1,085) by 2000 U.S. Census Average Household Size (2.31).

Source: 2000 U.S. Census.

Overall Vulnerability Assessment

Dam failures, while rare, can destroy roads, structures, facilities, utilities, and impact the population of Montague. Existing and future mitigation efforts should continue to be developed and employed that will enable Montague to be prepared for these events when they occur. Particular areas of vulnerability include low-income and elderly populations, buildings in the floodplain, and infrastructure such as roadways and utilities.

Data Deficiencies

In assessing the risks to Montague from dam failure hazards, the following data deficiencies were identified:

- Data for the location and condition of dams within Montague provided by the DCR Office of Dam Safety Legal Department was incomplete. This plan uses 2005 data.

EARTHQUAKES

Hazard Summary

Earthquakes are rare in Franklin County, however temblors are unpredictable and can cause significant damage to roads, structures, facilities, utilities, and population. Existing and future mitigation efforts should continue to be developed and employed that will enable the Town to be prepared for earthquakes.

While rare in Franklin County, earthquakes have happened in New England. New England experiences an average of 30 to 40 earthquakes each year although most are not noticed by

people.⁵⁹ Ground shaking from earthquakes can rupture gas mains and disrupt other utility service, damage buildings, bridges and roads, and trigger other hazardous events such as landslides, avalanches, flash floods (dam failure) and fires. Un-reinforced masonry buildings, buildings with foundations that rest on filled land or unconsolidated, unstable soil, and mobile homes not tied to their foundations are at risk during an earthquake.⁶⁰

Data Collected and Used

The National Oceanic and Atmospheric Administration recorded no earthquakes for Franklin County in the last 20 years. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 was also reviewed for information on earthquake hazard data and mitigation measures.

Exposure and Loss Estimation

A major earthquake could cause severe damage to Montague buildings, including older structures that were built before the 1975 law requiring new buildings to withstand earthquakes. In Montague, approximately 76% of the housing stock (2,903 units) were built before 1970, according to the 2000 U.S. Census.

Property Damage

Historic data for earthquake events indicate that between 1991 and 2010, no earthquakes were recorded in Franklin County, causing no damage to property.

If a major earthquake were to occur, the entire built environment of Montague would be vulnerable. Table 3-40 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a severe earthquake.

Table 3-40: Potential Estimated Loss by Land Use Category

| | Total Assessed Value | 1% Damage Loss Estimate | 5% Damage Loss Estimate | 10% Damage Loss Estimate |
|--------------------|-----------------------------|--------------------------------|--------------------------------|---------------------------------|
| Residential | \$568,550,480 | \$5,685,505 | \$28,427,524 | \$56,855,048 |
| Commercial | \$34,257,686 | \$342,577 | \$1,712,884 | \$3,425,769 |
| Industrial | \$110,060,690 | \$1,100,607 | \$5,503,035 | \$11,006,069 |
| Total | \$712,868,856 | \$7,128,689 | \$35,643,443 | \$71,286,886 |

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section

Population Impacts

Populations considered most vulnerable to earthquake impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-41 summarizes the population over the age of 65, living in households with an income below \$20,000 per year, and/or living within the Environmental Justice Population area (defined on pages 45-47 above).

⁵⁹ Northeast States Emergency Consortium web site: www.nesec.org/hazards/earthquakes.cfm

⁶⁰ Federal Emergency Management Agency web site: www.fema.gov/hazards/earthquakes/quake.shtm.

Table 3-41: Senior, Low Income, and Environmental Justice Populations Exposed to Natural Hazard Events*

| Population Category | Number of Persons Exposed | Percentage of Total Population |
|--|---------------------------|--------------------------------|
| Senior (over 65 years of age) | 1,404 | 16.5 |
| Low Income (persons with annual incomes of less than \$20,000)** | 2,506 | 29.5 |
| Environmental Justice | 3,253 | 38.3 |

* There is overlap between the population categories, so total number of persons exposed is lower than the three categories added together.

** Low income population was calculated by multiplying 2000 U.S. Census Households with Incomes of Less than \$20,000 (1,085) by 2000 U.S. Census Average Household Size (2.31).

Source: 2000 U.S. Census.

Overall Vulnerability Assessment

Earthquakes, while rare, could cause significant impacts and losses to the roads, structures, facilities, utilities, and population of Montague. Existing and future mitigation efforts should continue to be developed and employed that will enable Montague to be prepared for these events when they occur. Particular areas of vulnerability include low-income and elderly populations, trailer homes and buildings erected before 1975, and infrastructure such as roadways and utilities that could be damaged by earthquakes.

Data Deficiencies

In assessing the risks to Montague from earthquakes, no data deficiencies were identified.

LANDSLIDES

Hazard Summary

Landslides rarely occur in Franklin County but have occurred in the eastern part of the state: Following heavy rains in March 2010, Walpole and Topsfield experienced landslides that destroyed a storage building and closed a portion of Route 1. The Topsfield slide saw a tree land on a passing car, but no injuries were reported. Earlier that month, a mudslide at a construction site brought mud within 12 feet of train tracks at the Wellesley Hills station of the Massachusetts Bay Transportation Authority in Wellesley. Landslides are most often caused by heavy rains destabilizing slopes but can have other causes, including clearing land for development, earthquakes, and vibrations from machinery or blasting. Landslides can be dangerous because they are unexpected and fast. They can bury structures with little warning and rescue efforts can be threatened by new slides.

Data Collected and Used

National Oceanic and Atmospheric Administration’s National Climatic Data Center website shows no landslide events in Franklin County for the last 20 years. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 was also reviewed for information on landslide hazard data and mitigation measures. Information was also collected from the committee and the Franklin Regional Council of Governments on the Millers Falls Road erosion control project in Montague.

Impact to the Community

Exposure and Loss Estimation

While landslides are rare, their impacts can be devastating, including loss of property, disruption to infrastructure, and injury and death. Continued development increases the chances that landslides will be a danger.

Property Damage

Historic data for landslide events indicate that between 1993 and 2010, no landslide events were recorded in Franklin County.

In Montague, according to Town officials, it is probable that a portion of Millers Falls Road will wash out if action to control slope erosion is not taken. In December 2010 the Town applied for assistance through the Franklin Regional Council of Governments for an engineering consultant to evaluate the project feasibility and design for mitigating a potential wash out of the road. Work is underway on the evaluation, and estimated construction costs for the project are still unknown at the time of writing this plan.

Table 3-42 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a massive landslide.

Table 3-42: Potential Estimated Loss by Land Use Category

| | Total Assessed Value | 1% Damage Loss Estimate | 5% Damage Loss Estimate | 10% Damage Loss Estimate |
|--------------------|-----------------------------|--------------------------------|--------------------------------|---------------------------------|
| Residential | \$568,550,480 | \$5,685,505 | \$28,427,524 | \$56,855,048 |
| Commercial | \$34,257,686 | \$342,577 | \$1,712,884 | \$3,425,769 |
| Industrial | \$110,060,690 | \$1,100,607 | \$5,503,035 | \$11,006,069 |
| Total | \$712,868,856 | \$7,128,689 | \$35,643,443 | \$71,286,886 |

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

Population Impacts

Populations considered most vulnerable to landslide impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-43 summarizes the population over the age of 65, living in households with an income below \$20,000 per year, and/or living within the Environmental Justice Population area (defined on pages 45-47 above).

Table 3-43: Senior, Low Income, and Environmental Justice Populations Exposed to Natural Hazard Events*

| Population Category | Number of Persons Exposed | Percentage of Total Population |
|---|----------------------------------|---------------------------------------|
| Senior (over 65 years of age) | 1,404 | 16.5 |
| Low Income (persons with annual incomes of less than \$20,000)** | 2,506 | 29.5 |
| Environmental Justice | 3,253 | 38.3 |

* There is overlap between the population categories, so total number of persons exposed is lower than the three categories added together.

** Low income population was calculated by multiplying 2000 U.S. Census Households with Incomes of Less than \$20,000 (1,085) by 2000 U.S. Census Average Household Size (2.31).

Source: 2000 U.S. Census.

Overall Vulnerability Assessment

Landslides, while rare in Franklin County, can destroy roads, structures, facilities, utilities, and impact the population of Montague. Existing and future mitigation efforts should continue to be developed and employed that will enable Montague to be prepared for these events when they occur. Particular areas of vulnerability include low-income and elderly populations, and buildings, roadways, and utilities near the foot of slopes, especially when slopes are destabilized.

Data Deficiencies

- Records of damages to the built and natural environment due to landslides in Montague are not consistently maintained. A more formal system of data collection and maintenance could be established and would help improve the Town’s hazard mitigation planning. Better data could also increase the Town’s chance of qualifying for various grants.

ICE JAMS

Hazard Summary

Ice jams (or ice dams) occur when water builds up behind a blockage of ice. Ice jams can occur in various ways, but in New England they predominantly form on rivers and streams and mainly threaten infrastructure.

When the upstream part of a river thaws first and the ice is carried downstream into the still-frozen part of the watercourse, ice can form an ice dam and flood low lying areas upstream of the jam. Also, once an ice dam breaks apart, the sudden surge of water that breaks through the dam can flood areas downstream of the jam. The resulting flow of water when an ice jam is broken can cause flooding downstream, threatening infrastructure, structures, and roadways.

Data Collected and Used

The National Oceanic and Atmospheric Administration’s National Climatic Data Center website shows no ice jam events or damage in Montague over the last 20 years. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 was also reviewed for information on ice jam hazard data and mitigation measures. According to the Local Natural Hazard Mitigation Team,

ice jams occur annually in Montague on the Sawmill River at the South Street bridge, and less frequently at the Center Street bridge.

Impact to the Community

Exposure and Loss Estimation

Losses to ice jams include the rising waters along the river or stream that is being dammed, and the rush of water downstream when the dam either melts or is broken up by human intervention. Buildings, roadways and utilities are threatened by ice blockages. The structures and people most at risk from an ice jam are those within the floodplain.

Property Damage

Data on ice jams in Franklin County indicate that no property damage or injuries or deaths occurred as the result of ice jams in the last 20 years.

Structures located within the floodplain in Montague are most at risk of being damaged by an ice jam. The average assessed values of the residential, commercial, and industrial land uses located within the floodplain are displayed in Table 3-44, along with 1%, 5%, and 10% loss estimates. The total average assessed value for these three land uses within the floodplain is \$10,767,283. If 10% of this inventory were destroyed in a flood, the damages would amount to approximately \$1,076,728.

Table 3-44: Potential Estimated Loss by Land Use Category

| | Average Assessed Value of Land in Floodplain | 1% Damage Loss Estimate | 5% Damage Loss Estimate | 10% Damage Loss Estimate |
|--------------------|---|--------------------------------|--------------------------------|---------------------------------|
| Residential | \$5,022,038 | \$50,220 | \$251,102 | \$502,204 |
| Commercial | \$1,733,151 | \$17,332 | \$86,658 | \$173,315 |
| Industrial | \$4,012,094 | \$40,121 | \$200,605 | \$401,209 |
| Total | \$10,767,282 | \$107,673 | \$538,364 | \$1,076,728 |

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section

Population Impact

Populations considered most vulnerable to ice jam impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-45 summarizes the population over the age of 65, living in households with an income below \$20,000 per year, and/or living within the Environmental Justice Population area (defined on pages 45-47 above).

Table 3-45: Senior, Low Income, and Environmental Justice Populations Exposed to Natural Hazard Events*

| Population Category | Number of Persons Exposed | Percentage of Total Population |
|--|---------------------------|--------------------------------|
| Senior (over 65 years of age) | 1,404 | 16.5 |
| Low Income (persons with annual incomes of less than \$20,000)** | 2,506 | 29.5 |
| Environmental Justice | 3,253 | 38.3 |

* There is overlap between the population categories, so total number of persons exposed is lower than the three categories added together.

** Low income population was calculated by multiplying 2000 U.S. Census Households with Incomes of Less than \$20,000 (1,085) by 2000 U.S. Census Average Household Size (2.31).

Source: 2000 U.S. Census.

Overall Vulnerability Assessment

Ice jams occur throughout New England, often causing significant impacts and losses to roads, structures, facilities, utilities, and the population. Existing and future mitigation efforts should continue to be developed and employed that will enable Montague to be prepared for these events when they occur. Particular areas of vulnerability include low-income and elderly populations, trailer homes, and infrastructure such as roadways near rivers and streams and utilities and low-lying areas.

Data Deficiencies

- Records of damages to the built and natural environment due to ice jams in Montague are not consistently maintained. A more formal system of data collection and maintenance could be established and would help improve the Town’s hazard mitigation planning. Better data could also increase the Town’s chance of qualifying for various grants.

MANMADE HAZARDS

Hazard Summary

Manmade hazards are being assessed at the local level for the first time in this plan update. A preliminary assessment was made only of those manmade hazards of an accidental nature, such as transportation accidents or fixed facility accidents involving hazardous materials. The Committee evaluated the potential for these types of hazardous materials accidents as quite high. Particular concern was expressed for transportation related manmade hazard accidents, especially rail-related. Discussion of fixed facility accidents revolved around the Vermont Yankee nuclear facility in Vernon, Vermont. No formal vulnerability assessment was done on manmade hazards, however the potential for accidents, the unknown impact of such accidents and the lack of well-analyzed data make this hazard a high priority on the Action Plan.

Data Deficiencies

- Need to research available models and data requirements to adequately evaluate the potential impact of hazardous accidents in Montague, including impacts on drinking water supply and on public health.

Development Trends Analysis

In assessing development trends for the Town of Montague, and the impact those trends might have on hazard mitigation, the Committee was asked to evaluate the probability of development in town and areas most likely to be targeted for development. The Committee was also asked about changes in industry, proposed housing and retail development, and any major highway or public transit improvements that might change accessibility to parts of town. Additionally, data such as the number of construction permits issued, change in population, current zoning bylaws and the acres of developable land was considered.

Recent residential development has extended beyond the village centers along roads and into forested areas. Commercial/industrial expansion has occurred in the Town-owned industrial park along Millers Falls Road and on Turnpike Road near the old town landfill. Revitalization of the downtown areas in Turners Falls and Millers Falls is one of the key challenges identified in both the Town's 1998 Comprehensive Plan and the 2004 Community Development Plan. The Town is working to promote adaptive reuse of abandoned industrial sites and storefronts in these villages, and community planning efforts emphasize the importance of developing retail, craft-based and recreational businesses to draw residents and visitors to the downtown areas. Zoning changes implemented in 1999 were intended to facilitate the development of pedestrian-oriented business in downtown Turners Falls and Millers Falls and an underused industrial area of Montague City. Due to space constraints, however, most new industrial growth will likely continue to take place outside the village centers.

The current industrial park is occupied at close to capacity for large manufacturing operations. Land retained by Northeast Utilities on the Montague Plains along Millers Falls Roads has been identified by the Town as a potential site for future industrial development. This site has significant ecological value for plants and wildlife, and is a Priority Habitat of Rare Species and an Estimated Habitat of Rare Wildlife according to the 2008 Massachusetts Natural Heritage Atlas. Development of one or more new industrial park sites could also increase demand for new housing in Montague.

From 2003 through 2010, 69 building permits were issued for new single family homes, an average of 8.6 per year (Montague Building Department, personal communication; 2002 data unavailable). New building has slowed since 2008, with only three permits issued in 2010, reflecting the current economic downturn. During the 1990s, three subdivisions were built in Montague—the tightly-clustered community of Randall Woods near Montague City, a publicly-subsidized affordable housing development on Winthrop Street in Millers Falls, and a private development known as Whitney's Way near the Town boundary with Sunderland. A fourth planned subdivision along Millers Falls Road near the Airport Industrial Park has not been fully developed.

Much of the new residential construction has taken place in the hilly, forested areas surrounding Montague Center, on Chestnut Hill, Dry Hill and Taylor Hill. This development is predominantly higher-end construction on large wooded lots that are accessible yet not readily visible from the road. On Federal Street and Turners Falls Road, lots are being developed along

the road frontage. There is a parallel trend of development of small vacant or underused lots in the village of Turners Falls, primarily consisting of modular home construction. While development in the hills around Montague Center has had relatively little aesthetic impact, it has raised concerns about increased runoff and flooding due to clearing, grading and increases in impervious surfaces. A severe flood in 1996 resulted in major washouts on Dry Hill Road. Lack of adequate drainage is also causing runoff problems on Taylor Hill Road.⁶¹

The Gill Montague Bridge connecting Route 2 to the village of Turners Falls is a critical bridge for both industry and tourism in Montague. Reconstruction of the bridge began in late Spring 2010, and is expected to take four years to complete. During reconstruction the bridge is only open to one-way traffic traveling inbound to Turners Falls, potentially impacting the downtown economy adversely. Lack of good roads for truck traffic has been consistently mentioned as a barrier to industrial development in Montague. Ongoing safety improvements to Route 2 on the northern boundary of Montague could remove this barrier and promote the development of the Town's remaining industrial land.

Both the New England Central and Pan Am Systems Main Freight line & Maine railroad tracks run through the Town but do not serve town businesses. These trains do, however, carry hazardous materials through town, as discussed above. The Amtrak passenger train connecting Vermont to points south currently passes through the village of Millers Falls, but does not stop. The train is scheduled to be rerouted within the next two years to tracks located west of Montague, with a passenger stop in Greenfield. If passenger rail service were developed along an east-west route, it could dramatically increase residential development by making commuting to the Boston area a more viable alternative.

The 2010 population for Montague is 8,437. Between 2000 and 2010, Montague's population decreased slightly by 52 people, or 0.6 percent, while Franklin County's population also slightly decreased by 163 people, or 0.2 percent.⁶²

As discussed in the Vulnerability Assessment Section of this plan, current development in the flood plain includes approximately fourteen acres of commercial, public/ institutional and industrial uses and fourteen acres of residential use. The majority of the land in and along the floodplain is undeveloped and is zoned Agricultural Forest. Some exceptions include a Residential district and a Rural Business district in Montague Center that lie within the Sawmill river floodplain. The Connecticut River floodplain extends slightly into Industrial, Unrestricted, Neighborhood Business, and Residential Education districts in Turners Falls. In Montague City, the floodplain extends into Public/Semi Public, Residential, and Industrial zoning districts. A small part of the Residential district in Lake Pleasant also falls within the floodplain.

In general the floodplain along the Connecticut and Millers rivers is a narrow strip that does not extend very far inland. The floodplain for the Sawmill River is wider, and encompasses wetlands, forest, cropland, and a small portion of existing residential uses. As mentioned above, much of the land within the floodplain in Montague is zoned as Agricultural Forest (AF). Single family dwellings, farming and forestry, and accessory uses customarily associated with these

⁶¹ Recent development information is derived from the 2010 Montague Open Space and Recreation Plan.

⁶² 2010 U.S. Census Redistricting Data.

uses are allowed by right within the AF district. Two-family dwellings are allowed by special permit. The minimum lot size for single family homes in the AF is 22,500 square feet, and 45,000 square feet for a two family home.

Development within the 100 year floodplain in Montague is regulated by the Flood Plain Overlay District (FP), established in 1979. Within the FP, all encroachments in the floodplain, “including fill, new construction, substantial improvements to existing structures, and other development are prohibited unless certification by a registered professional engineer or architect is provided by the applicant demonstrating that such encroachment shall not result in any increase in flood levels during the occurrence of the 100 year flood,” (Section 5.2.9 (b) (1), Montague Zoning Bylaws). In addition any development that meets these criteria must comply with floodplain requirements of the State Building Code.

DRAFT

[Montague Zoning Map]

DRAFT

[Montague Critical Facilities and Infrastructure Map]

DRAFT

4 –MITIGATION STRATEGY

This section of the Hazard Mitigation Plan is the long-term blueprint for reducing the losses identified in the risk assessment.

Current Mitigation Strategies

FLOODING

The Critical Facilities, Infrastructure, 2005 Land Use & Natural Hazards Map for the Town of Montague shows the 100-year flood zone identified by FEMA flood maps. The 100-year flood zone is the area that will be covered by water by a flood that has a 1% chance of occurring in any given year. This map also shows the areas in town that are subject to localized flooding problems.

The 100-year floodplain has been mapped by FEMA for the Connecticut, Millers and Sawmill Rivers, as well as Cranberry Pond Brook, Pond Brook, and Hatchery Brook. Most of the land in mapped floodplain in Montague is either forested or in agricultural use, with a few notable exceptions, including the town's wastewater treatment facility and several nearby residences on Greenfield Road. The other major exception is along the Sawmill River in and near the village of Montague Center, where roads, bridge abutments and residences have been constructed in the floodplain.

The Town experienced severe flooding along the Sawmill following the microburst of 1996. Sections of Center Street and South Street were impassible; and material from a local junk dealer located in or near the floodplain was widely distributed through the village. Flooding during the Columbus Day holiday in 2005 saw the Connecticut River rise to 35.04 feet, more than 7 feet above flood stage, at Montague City, according to press reports at the time. Federal disaster relief funds were distributed to one Montague household, but the town saw damage from the flood waters. There was flooding on Millers Falls Road near Highland Cemetery and part of Wendell Road was washed out because the culvert beneath the road was washed away, according to press reports. Parts of Montague Center near the Sunderland border were flooded, as well.

One of the goals of this Natural Hazards Mitigation Plan is to evaluate all of the town's existing policies and practices related to natural hazards and identify potential gaps in protection.

Management Plans

The Comprehensive Emergency Management (CEM) Plan for Montague lists the following generic mitigation measures for flood planning:

- Identify areas in the community that are flood prone and define methods to minimize the risk. Review National Flood Insurance Maps.

- Disseminate emergency public information and instructions concerning flood preparedness and safety.
- Community leaders should ensure that Northfield is enrolled in the National Flood Insurance Program.
- Strict adherence should be paid to land use and building codes, (e.g., Wetlands Protection Act), and new construction should not be built in flood prone areas.
- Ensure that flood control works⁶³ are in good operating condition at all times.
- Natural water storage areas⁶⁴ should be preserved.
- Maintain plans for managing all flood emergency response activities including addressing potentially hazardous dams.

The Comprehensive Emergency Management (CEM) Plan for Montague lists the following generic preparedness and response measures for floods:

- Place emergency operations center (EOC) personnel on standby during stage of flood ‘watch’ and monitor NWS/New England River Forecast Center reports.
- Ensure that public warning systems are working properly and broadcast any information that is needed at this time.
- Review mutual aid agreements.
- Monitor levels of local bodies of water.
- Arrange for all evacuation and sheltering procedures to be ready for activation when needed.
- Carry out, or assist in carrying out needed flood-proofing measures such as sand bag placement, etc.
- Regulate operation of flood control works such as flood gates.
- Notify all emergency management related groups that will assist with flood response activities to be ready in case of flood ‘warning.’
- Broadcast warning/notification of flood emergency.
- Coordinate traffic control and proceed with evacuation of affected populations as appropriate.
- Open and staff shelters and reception centers.
- Undertake, or continue to carry out flood proofing measures.
- Dispatch search and rescue teams and emergency medical teams.

⁶³ Refers to manmade levees, dikes and dams. This definition includes dams not specifically constructed for flood control.

⁶⁴ Refers to ponds, lakes, vernal ponds and other such bodies of water. Wetlands are not included in this definition.

Flood Control Structures

Floods on the Connecticut River in Montague and portions of its major tributaries that are prone to backwater effects are controlled by flood control reservoirs located upstream in New Hampshire and Vermont.

Land Use Regulations that Mitigate Impacts from Flooding

The Town of Montague has adopted land use regulations that serve to limit or regulate development in floodplains and to protect groundwater resources, the latter which often provide important flood storage capacity. These regulations are detailed in Appendix 1 and summarized and evaluated in Table 4-1.

Zoning Bylaw (See Appendix 1 for complete language)

- Section 5.2.9 Floodplain District
- Section 9 Water Supply Protection District
- Section 5.4.1 Minimum Lot Area
- Section 8 Environmental Impact and Site Plan Review

Subdivision Rules and Regulations (See Appendix 1 for complete language)

The most recent version of the Montague Subdivision Regulations was approved in 1989. The purpose of the regulations is “protecting the safety, convenience and welfare of the inhabitants...” The Planning Board and Board of Appeals shall exercise their powers to secure the safety of residents in the case of fire, flood, panic and other emergencies and to ensure adequate drainage for the subdivision. The Subdivision Rules and Regulations contain several provisions that mitigate the potential for flooding, including:

- Section 3.4.2, Definitive Plan Submission Requirements
- Section 3.4.4 Wetland Protection Act
- Section 3.4.5 Environmental Impact Statement
- Section 4.1.3 Design Guidelines
- Section 4.2 Open Space,
- Section 4.3 Protection of Natural Features
- Section 4.4 Easements

Stormwater System Policy

In 2009 the Planning Board adopted a stormwater system policy to ensure high quality water standards and address any potential water quantity problems associated with development, and to:

- Preserve hydrologic conditions that closely resemble pre-development conditions;
- Prevent or reduce flooding and erosion by managing the peak discharge and volume of runoff;

- Reduce the amount of suspended solids and other pollutants in order to maintain water quality.

Industrial Park Development Standards

The Airport Industrial Park in Turners Falls is located in proximity to the Connecticut River, with several industrial lots that actually front on the river. The Town has a policy that all drainage for development projects in the park shall be accommodated on-site, and that all drainage systems must be designed to accommodate 125% of the expected rainfall from a 100-year storm.

Montague Planning Documents

Comprehensive Plan (1999)

One of the overall goals of the 1999 Montague Comprehensive Plan is to “guide appropriate use of our open space and sensitive natural resources.” Action steps that relate to this goal that are also pertinent to flood mitigation include the following:

- Seek to establish or continue open space uses on SUEZ Energy North America properties along the Connecticut River and canals (sic).
- Cooperate with the Agricultural Preservation Restriction program and Agricultural Viability program
- Protect sensitive natural areas by working with land trusts
- Cooperate with the plans for development of the Conte Fish and Wildlife Refuge

The Future Land Use Map developed for the Comprehensive Plan recommends long-term agricultural use of land along the Connecticut River from the village of Montague City to the Town’s boundary with Sunderland. The plan recommends that development of housing be concentrated in and near existing villages, in areas with the services designed to support such development.

Open Space and Recreation Plan (2010)

Montague’s 2010 Open Space and Recreation Plan includes a comprehensive inventory of the Town’s natural resources and strategies for their protection. The plan identifies all of the Town’s major water resources, including rivers and perennial streams, ponds, extensive wetlands, floodplains and floodplain forests. A goal identified in the plan is “to conserve native plants and wildlife habitat, protect rivers and streams, river corridors and their watersheds and maintain scenic landscapes.” The plan calls for Town officials to “encourage permanent protection of land along the banks of the Connecticut, Sawmills and Millers rivers and support ecological restoration efforts in these watersheds.” The plan also calls for the conservation of land with prime farmland soils, much of which is located in the floodplain of the Connecticut and Sawmill rivers. Preserving these areas in an undeveloped state will provide flood storage capacity as well as other benefits not directly related to natural hazard mitigation.

Sawmill River Watershed Assessment

In the wake of flooding following the severe storm of June 1996 and the acceleration of serious erosion problems along the banks of the Sawmill River, the Town of Montague requested assistance from the Natural Resources Conservation Service (NRCS) in conducting an assessment of sediment and erosion and agricultural flood damage problems in the Sawmill River watershed. NRCS assembled an interdisciplinary team of scientists to perform the assessment, and released a preliminary report in March 2002.

The report described significant disturbance in the watershed between Federal Street (Route 63) and the confluence of the Sawmill with the Connecticut River, noting that “Throughout this reach, the river is not in equilibrium, likely due to some or all of the following factors:”

1. Dredging occurred in long sections of the reach, reducing the available sediment supply and removing sediment sizes such as cobbles and boulders that would tend to stabilize the channel. This dredging resulted in the confinement of the river channel between dredge spoil on the north side of the channel and rock riprap on the other. This effectively put the stream between a rock and hard place, confining high flood flows and accelerating erosion of the channel perimeter where not covered by riprap.
2. The riparian vegetation was degraded by the earlier dredging and subsequent encroachment of invasive species, which limit the ability of native species to establish strong root networks to hold the soil in place.
3. The rebuilding of Route 63 as shown on historic maps indicated that the channel was likely relocated and filled in the 1930s.
4. Installation of the riprap along both North Leverett and Montague roads further restrict the ability for woody vegetation to become established, thus reducing the ability for native plant species to effect channel stabilization.
5. Riprap also likely increased the velocity through the stream reaches near Sunderland Road resulting in aggressive erosion on the opposite bank.
6. Previous dredging in the reach along Sunderland Road resulted in a lowering of the channel bottom and removal of large amounts of sediment. The result of this confinement can be seen downstream where large amounts of cobble size sediment lies in both point bars and mid channel bars. This sediment was delivered downstream by the higher velocities and then dropped out when the river was able to communicate with its floodplain once again. Unfortunately, the first location where the river is no longer entrenched due to the sediment building is adjacent to farmland which is now flooding more frequently.
7. A contributing factor to the sediment deposition was apparently a diversion that acted as a bypass about 750 feet downstream of South Street. There is a small earthen embankment at the meander apex at this location, which appears to have been rebuilt following the flood of 1997 (sic). This diversion of flood flows effectively reduced the stream energy at the meander bend. This diversion likely resulted in deposition of much of the bedload at a large point bar immediately downstream of this meander.

8. A large point bar has been deposited upstream of Center Street. This deposition narrows the channel, reducing its flow capacity and ability to transport sediment. Flooding of the farm field on the right bank is a result. A secondary result is the beginning of a meander cutoff initiating at the apex of the meander and proceeding across the field edge. Inspection of this area shows that the new channel cut has deepened to the point where it has intercepted the groundwater and a small base flow has begun. The only impediment to this meander cutoff and formation of the new channel is a narrow row of trees and boulders piled up along the bank. It appears this area is likely to become the new channel as water continues to flow out of bank and deepen the channel.

NRCS made a variety of recommendations, including a comprehensive geomorphology study of the Sawmill River. In 2003, with encouragement from the Town of Montague, NRCS and the Franklin Conservation District collaborated on a grant application under Section 604 (b) of the Clean Water Act to conduct a geomorphological assessment of the Sawmill River, with the goal of developing conceptual restoration plans for disturbed areas. The grant was awarded to the Conservation District, and in 2006 a restoration report was completed. The report included preliminary designs for restoring 1,700 feet running east or downstream of Route 63 to the river's natural channel and reducing seasonal flooding and sedimentation by using bio-engineered approaches such as log jams and root wads. The Franklin Conservation District was awarded an implementation grant from the DEP in 2010, and the project is currently moving through the approval process. Construction is expected to begin in 2012, depending on many variables.⁶⁵

National Flood Insurance Program

The Town of Montague participates in the National Flood Insurance Program. NFIP develops maps showing flood hazard areas in each community, and provides insurance to owners of property in high-hazard areas. The most recent set of NFIP maps for Montague were developed in 1982. As of January 31, 2011, there were 11 NFIP policies in effect in Montague for a total value of \$3,057,900. NFIP records list one recent claim in Montague, for damages to a residence following the Sawmill River flood in June 1996. There are no records of "repetitive loss" buildings in Montague.⁶⁶

Montague is not a member of the Community Rating System, which entitles policyholders to a discount on flood insurance premiums. The CRS ranking is based on the steps the town has taken to control flood losses. The Community Rating System reduces flood insurance premiums to reflect what a community does above and beyond the National Flood Insurance Program's (NFIP) minimum standards for floodplain regulation. The objective of the CRS is to reward communities for what they are doing, as well as to provide an incentive for new flood protection activities. To participate in the CRS, a community must fill out an application and submit documentation that shows what it is doing and that its activities deserve at least 500 points. More information including instructions and applications is available at <http://www.fema.gov/business/nfip/crs.shtm>. See pages 136-138 for more information on the NFIP.

⁶⁵ Deborah Shriver, grant administrator. Personal communication.

⁶⁶ National Flood Insurance Program, <http://bsa.nfipstat.com/reports/1011.htm#MAT>, <http://bsa.nfipstat.com/reports/1040.htm#25>.

State Building Code

Each new or recently built dwelling is constructed according to the State Building Code, which are designed to withstand certain impacts of hazardous conditions. The Town of Montague has its own inspectors to provide building, plumbing and electrical inspection services.

Emergency Shelters

The Comprehensive Emergency Management (CEM) Plan for Montague identifies shelters to be used to accommodate victims of natural hazards. It does not spell out which shelter should be used for which specific hazard. The Town does not have a Memorandum of Understanding in place with the Franklin County Technical School for use of their facilities during an emergency. Turners Falls High School is the only shelter, except for Franklin County Technical School, that currently has a back-up power supply.

- Turners Falls High School
- Franklin County Technical School
- Sheffield Elementary School
- Hillcrest School

**Table 4-1
Existing Flood Hazard Mitigation Measures**

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|---|---|--|---|---|--|------------------------|
| Zoning Bylaws | | | | | | |
| Section 5.2.9 Floodplain Overlay District | Permitted uses are allowed if they meet standard below.No encroachment allowed within the 100-year floodplain without certification from Registered Professional Engineer that it will not result in increase in flood levels during 100-year flood; any encroachment meeting this standard must comply with State Building Code. | Special Flood Hazard Areas (Zones A on Flood Insurance Rate Maps) | Somewhat effective for controlling new development within the 100-year floodplain; vigilance required in enforcement. There have been instances where buildings have been constructed without permits and allowed to remain, and of dubious certification from engineers. | Consider prohibiting all new development within the 100-year floodplain; or requiring a special permit for development in floodplain in addition to current requirements. | Still Relevant. | |
| Section 9 Water Supply Protection District | Regulations protect and preserve existing and potential sources of groundwater supply and recharge and watershed areas. | Areas identified on the Zoning Map, including in and around Montague Center and Lake Pleasant. | Effective for mitigating the potential for contamination of water supplies during flooding by prohibiting uses that could result in such contamination. | None. | Still Relevant. In January 2011, Town Meeting voted to include the Delineated Zone II Recharge area surrounding a new well next to Lake Pleasant in Montague’s Water Supply Protection District. | |

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|--|---|--|---|--|---|--|
| Section 5.4.1 Minimum lot area | Ranges from 10,000 sq. ft. in urban areas to four acres in rural, forested areas. | Areas identified on Zoning Map; 4-acre zone encompasses most of Town east of Central New England Railroad track. | Four-acre zone is effective for limiting impervious surfaces, thus promoting recharge in upstream sections of Sawmill River, Lyons Brook, Hannegan Brook, Goddard Brook, Spaulding Brook, Chestnut Hill Brook, Williams Brook . | Consider impervious surface limits for other areas of town, as well as stormwater regulations for commercial and industrial development. | In 2009 the Planning Board adopted a stormwater system policy (see below for detail). | |
| Section 8 Environmental Impact and Site Plan Review | Requires careful review of drainage plans for large-scale uses. | Large-scale residential, commercial and industrial development projects. | Effective for addressing impacts of stormwater runoff from new development; requires vigilance during review and use of engineering consultants when in-house expertise is not available. | Consider stormwater regulations or more detailed standards for review of stormwater plans. | In 2009 the Planning Board adopted a stormwater system policy (see below for detail). | Encourage the Zoning Board of Appeals to adopt the stormwater system policy. |
| Subdivision Regulations | | | | | | |
| | Requires that subdivision design reduce, to the extent reasonably possible, flood damage. Includes several other provisions that mitigate the potential | Areas of town identified on the Zoning Map for Residential Development. | Effective for mitigating or preventing localized flooding of roads and other infrastructure. Effective for controlling impacts | Consider adding Flood Prevention and Mitigation to Purpose Section of the Subdivision Rules and Regulations as | Still relevant. | |

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|--|--|-------------------------------------|--|--|-------------------------------|--|
| | for flooding and its associated impacts. | | from stormwater runoff. | well as other sections of regulations. | | |
| Other Protections | | | | | | |
| Stormwater System Policy | Aims to preserve hydrologic conditions in pre-development conditions, prevent or reduce flooding and erosion by managing runoff. | Entire Town | | New Mitigation Measure | New Mitigation Measure. | Encourage the Zoning Board of Appeals to adopt the policy. |
| Industrial Park Development Standards | Requires all drainage from new development to be accommodated on-site; drainage infrastructure must be designed to accommodate 125% of runoff from the 100-year storm. | Property in Airport Industrial Park | Effective for mitigating localized flooding by regulating stormwater runoff. | None. | Still relevant. | |
| Montague Open Space and Recreation Plan | Inventories natural resources in Town, including floodplain, wetlands, aquifer recharge areas, farms, rivers, streams and brooks. | Entire town. | Effective in identifying sensitive resource areas, including floodplains. Encourages thinking on a “watershed scale.” Prioritizes protecting | None. | Still relevant. | Support the implementation of the plan’s goals and objectives, including: <ul style="list-style-type: none"> • Conserve native plants and wildlife habitat, protect rivers and streams, river corridors and |

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|------------------------------------|---|--------------|--|---------------------|-------------------------------|--|
| | | | <p>areas along the Connecticut, Sawmill and Millers rivers, and recommends that the Town take a proactive role in preserving farmland, much of which lies within the floodplain.</p> | | | <p>their watersheds and maintain scenic landscapes.</p> <ul style="list-style-type: none"> • Encourage permanent protection of land along the banks of the Connecticut, Sawmill, and Millers Rivers and support ecological restoration efforts in these watersheds. • Consider adoption of a local wetland protection bylaw. • Promote conservation of valuable agricultural soils and permanent protection of farmland through the APR program, consistent with the plans of landowners. |
| Montague Comprehensive Plan | Provides a framework for guiding development in Town. | Entire town. | Effective in establishing priorities for environmentally sensitive development that will | None. | Still relevant. | |

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|---|--|--|---|--|-------------------------------|---|
| | | | mitigate flooding impacts. | | | |
| Participation in the National Flood Insurance Program | As of January 2011, there were 11 homeowners with flood insurance policies. | Areas identified by the FEMA maps. | Effective for homeowners who have insurance policies. | None | Still relevant. | The Town should consider becoming a part of FEMA's Community Rating System. |
| State Building Code | The Town of Montague has adopted the Massachusetts State Building Code. | Entire Town | Effective | None | Still relevant. | |
| Millers River 5-Year Watershed Action Plan | This project was completed in 2004. A regional Millers River Watershed Advisory Committee was formed to implement a Five-Year Action Plan. | Area of Montague within Millers River Watershed—northeast section of Town. | Effective in raising awareness of water resources in Town and potential negative impacts of uncontrolled development (loss of open space, farmland, stormwater runoff and other nonpoint source pollution). Will encourage thinking on a watershed scale. | None | Still relevant. | |
| National Pollutant Discharge Elimination System – EPA Construction | Construction activities that disturb one acre or more are regulated under the NPDES stormwater program which is | Entire Town. | Effective to the extent of compliance. | Building Inspector should remind developers that this permit is required for | Still relevant. | |

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|--|---|--------------|-----------------------|---|-------------------------------|--|
| General Permit | <p>administered by the US EPA.</p> <p>Operators of regulated construction sites are required to develop and implement stormwater pollution prevention plans and obtain a permit from the EPA.</p> | | | <p>projects that will disturb more than one acre of land.</p> | | |
| Emergency Shelter during Flood Hazard | <p>The Town has identified school buildings as shelters for general hazards.</p> | Entire Town | Moderately effective. | <p>Specify which shelters are suited specifically for flooding.</p> | Still relevant. | <p>Sign a Memorandum of Understanding with the Franklin County Technical School for use of their facility during an emergency.</p> |
| | | | | | | <p>Obtain a backup generator for the Sheffield school building.</p> |

SEVERE WINTER STORMS

Winter storms can be especially challenging for Emergency Management personnel because, although the storm has usually been forecast and schools and businesses may close, emergency services must still be able to access residents, hospitals, and accident sites. The Massachusetts Emergency Management Agency (MEMA) serves as the primary coordinating entity in the state-wide management of all types of winter storms and monitors the National Weather Service alerting systems during periods when winter storms are expected.

Management Plans

The CEM Plan for Montague lists the following generic mitigation measures for severe winter storms:

- Develop and disseminate emergency public information concerning winter storms, especially material that instructs individuals and families how to stock their homes, prepare their vehicles, and take care of themselves during a severe winter storm.
- As it is almost guaranteed that winter storms will occur annually in Massachusetts, local government bodies should give special consideration to budgeting fiscal resources with snow management in mind.
- Maintain plans for managing all winter storm emergency response activities.

To the extent that some of the damages from a winter storm can be caused by flooding, all of the flood protection mitigation measures described in Table 4-1 can also be considered as mitigation measures for severe snowstorms/ice storms.

The CEM Plan for Montague lists the following generic preparedness and response measures for severe winter storms:

- Ensure that warning/notification and communications systems are in readiness.
- Ensure that appropriate equipment and supplies, (especially snow removal equipment), are in place and in good working order.
- Review mutual aid agreements.
- Designate suitable shelters throughout the community and make their locations known to the public.
- Implement public information procedures during storm ‘warning’ stage.
- Prepare for possible evacuation and sheltering of some populations impacted by the storm (especially the elderly and special needs).
- Broadcast storm warning/notification information and instructions.
- Conduct evacuation, reception and sheltering activities.
- If appropriate, activate media center. Refer to Resource Manual for media center information.

- Dispatch search and rescue and emergency medical teams.
- Take measures to guard against further danger from power failure, downed trees and utility lines, ice, traffic problems, etc.
- Close roads and/or limit access to certain areas if appropriate.
- Provide assistance to homebound populations needing heat, food and other necessities.
- Provide rescue and sheltering for stranded/lost individuals.

Restrictions on Development

The Planning Board regulates construction of new roads through the Subdivision Regulations and ensures that roads are designed properly to provide for safe winter travel and removal of snow and ice.

Other Mitigation Measures

Severe snowstorms or ice storms can often result in a small or widespread loss of electrical service. The public water supply wells and water treatment plant are both equipped with standby power sources. The distribution system functions by gravity; therefore, no auxiliary power is needed. The sewage pump stations and the wastewater treatment plant are also equipped with standby power sources.

State Building Code

Each new or recently built dwelling is constructed according to the State Building Code, which are designed to withstand certain impacts of hazardous conditions, such as high winds (100 miles per hour) and snow loads on roofs (65 pounds per square foot).⁶⁷

Emergency Shelters

The Comprehensive Emergency Management (CEM) Plan for Montague identifies shelters to be used to accommodate victims of natural hazards. It does not spell out which shelter should be used for which specific hazard. The Town does not have a Memorandum of Understanding in place with the Franklin County Technical School for use of their facilities during an emergency. Turners Falls High School is the only shelter, except for Franklin County Technical School, that currently has a back-up power supply.

- Turners Falls High School
- Franklin County Technical School
- Sheffield Elementary School
- Hillcrest School

⁶⁷ Massachusetts State Building Code—Seventh Edition, Chapter 16

**Table 4-2
Existing Severe Winter Storm Hazard Mitigation Measures**

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/Still Relevant? | 2011 Potential Changes |
|---|--|---------------------|--|--|-------------------------------------|-------------------------------|
| Subdivision Regulations | | | | | | |
| Section 4.1.2 Design Standards for Roads | Standards include street grade regulations. | Entire Town. | Effective. | None. | Still relevant. | |
| Section 5.7 Utility Wires (electric and telephone) | The Town requires all utilities to be placed underground for new subdivisions. | Entire Town. | Effective for ensuring that utility service is uninterrupted by severe storms in new areas of residential development. | Encourage utility companies to underground existing utility lines in locations where repetitive outages occur. | Still relevant. | |
| | | | | Encourage utility companies to underground expanded utility lines in locations where repetitive outages occur. | Still relevant. | |
| | | | | Encourage regular tree maintenance to reduce number of overhead limbs near overhead electrical lines. | Still relevant. | |
| State Building Code | The Town of Montague has adopted the Massachusetts | Entire Town. | Effective for ensuring new construction can withstand snow | None. | Still relevant. | |

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/Still Relevant? | 2011 Potential Changes |
|---|---|--------------|--|---|------------------------------|---|
| | State Building Code. | | loads. | | | |
| Curb Cut Regulations | Increased surface drainage onto public ways is forbidden. | Entire Town. | Effective for controlling roadway icing. | None. | Still relevant. | |
| Emergency Shelter during Winter Storm Hazard | The Town has identified school buildings as shelters for general hazards. | Entire town. | Moderately effective. | Specify which shelters are suited specifically for winter storms. | Still relevant. | Sign a Memorandum of Understanding with the Franklin County Technical School for use of their facility during an emergency. |
| | | | | | | Obtain a backup generator for the Sheffield school building. |

HURRICANES AND TROPICAL STORMS

Of all the natural disasters that could potentially impact Montague, hurricanes and tropical storms provide the most lead warning time because of the relative ease in predicting the storm's track and potential landfall. MEMA assumes "standby status" when a hurricane's location is 35 degrees North Latitude (Cape Hatteras) and "alert status" when the storm reaches 40 degrees north Latitude (Long Island).⁶⁸ The flooding associated with hurricanes and tropical storms can be a major source of damage to buildings, infrastructure and a potential threat to human lives. Therefore, all of the flood protection mitigation measures described in Table 4-1 can also be considered hurricane mitigation measures. High winds that oftentimes accompany hurricanes can also damage buildings and infrastructure and cause downed trees.

Management Plans

The CEM Plan for Montague includes the following generic mitigation measures for hurricane planning and response:

- Develop and disseminate emergency public information and instructions concerning hurricane preparedness and safety.
- Community leaders should ensure that Montague is enrolled in the National Flood Insurance Program.
- Develop and enforce local building codes to enhance structural resistance to high winds and flooding. Build new construction in areas that are not vulnerable to direct hurricane effects.
- Maintain plans for managing all hurricane emergency response activities.

The CEM Plan for Montague includes the following generic preparedness and response measures for hurricanes:

- Ensure that warning/notification systems and equipment is ready for use at the 'hurricane warning' stage.
- Review mutual aid agreements.
- Designate suitable wind and flood resistant shelters in the community and make their locations known to the public.
- Prepare for coordination of evacuation from potentially impacted areas including alternate transportation systems and locations of special needs facilities.
- Activate warning/notification systems to inform public of protective measures to be taken, including evacuation where appropriate.
- Conduct evacuation of affected populations.
- Open and staff shelters and reception centers.

⁶⁸ Ibid.

Town of Montague Local Natural Hazard Mitigation Plan

- Dispatch search and rescue and emergency medical teams.
- Activate mutual aid activities.
- Take measures to guard against further danger from downed trees and utility lines, debris, etc.

Evacuation Options

The Montague CEM Plan lists the following roads as hurricane evacuation routes: Route 63, Millers Falls Road, Montague City Road, Avenue A, Turners Falls Road.

Zoning Bylaws

Sections 7.5 and 8.5 of the Montague Zoning Bylaw regulate wireless communications facilities. The purpose of the regulation is “to allow telecommunication and wireless services with minimal effect to the public health, safety and general welfare...” The bylaw requires a special permit from the Zoning Board of Appeals. A building permit is also required. Towers must be set back from property lines by a distance of at least 125% of the height of the structure. Montague is home to three telecommunication towers.

Restrictions on Development

The only restrictions on development that are wind-related are the provisions in the zoning bylaw related to Wireless Communications Facilities. In addition, new mobile homes, which are susceptible to catastrophic damage during high wind events, are prohibited in town.

State Building Code

For new or recently built structures, the primary protection against wind-related damage is construction according to the State Building Code which adequately addresses designing buildings to withstand winds of up to 100 miles per hour.⁶⁹

Emergency Shelter

The Comprehensive Emergency Management (CEM) Plan for Montague identifies shelters to be used to accommodate victims of natural hazards. It does not spell out which shelter should be used for which specific hazard. The Town does not have a Memorandum of Understanding in place with the Franklin County Technical School for use of their facilities during an emergency. Turners Falls High School is the only shelter, except for Franklin County Technical School, that currently has a back-up power supply.

- Turners Falls High School
- Franklin County Technical School
- Sheffield Elementary School
- Hillcrest School

⁶⁹ Massachusetts State Building Code—Seventh Edition, Chapter 16
Town of Montague Local Natural Hazard Mitigation Plan

**Table 4-3
Existing Hurricane and Tropical Storm Hazard Mitigation Measures (Wind-related)**

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|--|---|--------------|---|--|-------------------------------|------------------------|
| Zoning Bylaws | | | | | | |
| Section 7.5 Telecommunications facilities | <p>Requires a special permit from the Zoning Board of Appeals and a building permit from the Inspector of Buildings before a facility can be erected.</p> <p>Applicant must provide plans for anchoring and supporting the structure.</p> <p>The bylaw also establishes a “fall zone” for the structure in relation to property lines and road right-of-ways.</p> | Entire town. | Effective. | Add safety and prevention of wind-related damage as a stated purpose. | Not relevant. | |
| Section 7.1 Trailer Regulations | Montague Zoning Bylaws prohibit new mobile homes in town. | Entire Town. | Effective in reducing the potential for loss of life and property damage. Existing mobile homes are “grandfathered” and can be replaced. Replacements must meet | Require that replacement mobile homes be tied down to reduce the damaging impacts of high winds. | Still relevant. | |

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|--|---|--------------|-------------------------------------|--|-------------------------------|---|
| | | | standards of current building code. | | | |
| Other Protections | | | | | | |
| State Building Code | The Town of Montague has adopted the Massachusetts State Building Code. | Entire Town | Effective | No Changes | Still relevant. | |
| Emergency Shelter during Hurricane Hazard | The Town has identified school buildings as shelters for general hazards. | Entire Town | Moderately effective. | Specify which shelters are suited specifically for hurricanes. | Still relevant. | Sign a Memorandum of Understanding with the Franklin County Technical School for use of their facility during an emergency. |
| | | | | | | Obtain a backup generator for the Sheffield school building. |

TORNADOES AND MICROBURSTS

Worcester County and areas just to its west have been dubbed the “tornado alley” of the state because the majority of significant tornadoes in Massachusetts weather history have occurred in that region.⁷⁰ According to the *Institute for Business and Home Safety*, the wind speeds in most tornadoes are at or below design speeds that are used in current building codes.⁷¹ However, structures built before the building code was enacted in 1975 may not be able to withstand these winds. In addition, it is important for buildings to have a safe place for people to take refuge during a tornado, such as a secure interior room or, preferably, a below ground level space like a cellar.

Like earthquakes, the location and extent of potential damaging impacts of a tornado are completely unpredictable. Most damage from tornadoes – and associated storm events including thunderstorms, hail and lightning– comes from high winds which can fell trees and electrical wires, generate hurtling debris and, possibly, hail. Since the 1950s, there have been over twenty tornadoes that have touched down in Franklin County.

Management Plans

The Montague CEM Plan lists the following generic mitigation measures for tornado planning and response.

- Develop and disseminate emergency public information and instructions concerning tornado safety, especially guidance regarding in-home protection and evacuation procedures, and locations of public shelters.
- Strict adherence should be paid to building code regulations for all new construction.
- Maintain plans for managing tornado response activities. Refer to the non-institutionalized, special needs and transportation resources listed in the *Resource Manual*.

The CEM Plan for Montague includes the following generic preparedness and response measures for tornadoes:

- Designate appropriate shelter space in the community that could potentially withstand tornado impact.
- Periodically test and exercise tornado response plans.
- Put emergency management on standby at tornado ‘watch’ stage.
- At tornado ‘warning’ stage, broadcast public warning/notification safety instructions and status reports.
- Conduct evacuation, reception and sheltering services to victims.
- Dispatch search and rescue and emergency medical teams.

⁷⁰ Montague Comprehensive Emergency Management Plan, 1998.

⁷¹ www.ibhs.org.

- Activate mutual aid agreements.
- Take measures to guard against further injury from such dangers as ruptured gas lines, downed trees and utility lines, debris, etc.
- Acquire needed emergency food, water fuel and medical supplies.
- Take measures relating to the identification and disposition of remains of the deceased.

Zoning Bylaws

As previously discussed, Montague’s Zoning Bylaws regulate wireless communications facilities that might be prone to damage from high winds. A special permit from the Zoning Board of Appeals and a building permit are required. The bylaw also establishes a “fall zone” for the structure in relation to property lines.

Restrictions on Development

The only restrictions on development that are wind-related are the provisions in the zoning bylaw related to Wireless Communications Facilities. In addition, new mobile homes, which are susceptible to catastrophic damage during high wind events, are prohibited in town.

State Building Code

For new or recently built structures, the primary protection against wind-related damage is construction according to the State Building Code which adequately addresses designing buildings to withstand winds of up to 100 miles per hour.⁷²

Emergency Shelter

The Comprehensive Emergency Management (CEM) Plan for Montague identifies shelters to be used to accommodate victims of natural hazards. It does not spell out which shelter should be used for which specific hazard. The Town does not have a Memorandum of Understanding in place with the Franklin County Technical School for use of their facilities during an emergency. Turners Falls High School is the only shelter, except for Franklin County Technical School, that currently has a back-up power supply.

- Turners Falls High School
- Franklin County Technical School
- Sheffield Elementary School
- Hillcrest School

Note: The Table for Existing Tornado and Microburst Mitigation Measures is not shown as it is the same as Table 4-3: Existing Hurricane and Tropical Storm Hazard Mitigation Measures in previous section.

⁷² Massachusetts State Building Code—Seventh Edition, Chapter 16

WILDFIRES AND BRUSHFIRES

Montague's two independent fire departments responded to 38 brush fires between 2004 and 2009. Although Montague has five villages and more than 8,100 residents, roughly 70% of the Town's land base remains forested. There are several areas of concern with respect to brush fires, most notably in and around the Montague Plains and the village of Lake Pleasant. Unattended brush fires and illegally set fires in remote areas are also a concern.

Management Plans and Regulatory Measures

The CEM Plan for Montague includes the following generic mitigation measures for wildfire planning and response:

- Promote fire safety measures such as fire-safe landscaping and construction practices to the public and business communities.

The CEM Plan for Montague includes the following generic preparedness and response measures for wildfires:

- Restrict outside burning etc. based on moisture levels, fuels supply conditions such as drought.
- Identify high vulnerability or problem areas.
- Utilize mutual aid, including the State Fire Mobilization Plan, as needed.

Fire Management Plan for Montague Plain Wildlife Management Area

The Massachusetts Department of Fish and Game (DFG) owns approximately 1,500 acres of land on the Montague Plains, encompassing roughly 75 % of the remaining intact Pitch Pine/Scrub Oak forest. The purpose of the Montague Plain Wildlife Management Area (MPWMA) is to "protect and preserve an outstanding example of a xeric outwash pitch pine-scrub oak barren natural community and to provide public access for hunting, fishing, wildlife observation and compatible recreational activities." In July 2003, Kennedy Clark and William Patterson III of the Department of Natural Resources Conservation at the University of Massachusetts developed a fire management plan for the MPWMA. Fire management is needed at the MPWMA to "sustain and restore the health of the ecosystem and its component biota, and to protect on-site and off-site infrastructure and lives from wildfire."

The Fire Management Plan for the MPWMA includes a detailed description of the site, including location, boundaries, site context, land use, physical features, vegetation, rare species and communities and fire history; as well as a detailed analysis of fuels and sensitive areas. The plan establishes fire management goals and objectives and outlines fire management practices. The MPWMA is divided into five distinct fire management zones based on vegetation and land use, and a management regime is specified for each zone.

Fire management goals and objectives for the MPWMA are as follows:

- **Goal 1:** Manage the Montague Plain Wildlife Management Area so as to protect lives and property from threats of wildfire, ensuring that firefighter and public safety is the highest priority in every fire management activity.

Related objectives:

- A. Actively suppress, control, and extinguish all wildfires (*i.e.*, non-management ignited fires) on the MPWMA to the smallest size reasonably possible.
 - B. Continue to build capacity to prevent, detect, and respond to wildfires on the site by developing relationships with local and state fire agencies, Northeast Utilities, and local communities.
 - C. Judiciously use mechanical techniques and prescribed burning to reduce hazardous loadings of fuels with particular emphasis on dangerous fuel types and near structures.
 - D. Increase public awareness about wildfire and interface fire in the communities surrounding the MPWMA.
 - E. Control access to and increase patrol of the site in order to minimize ignitions and facilitate early detection.
 - F. Manage smoke from prescribed burns to minimize impacts on the surrounding community.
 - G. Conduct prescribed burns only in accordance with approved prescribed burn plans, which include acceptable weather and fuel parameters, a smoke management strategy, and contingency provisions.
 - H. Conduct monitoring of fuel management units to determine if fuel management objectives are being met.
- **Goal 2:** Perpetuate an ecologically viable pitch pine-scrub oak barren complex with special emphasis on restoring and maintaining rare, threatened, and endangered species and natural communities.

Related Objectives:

- A. Conduct all fire management activities in a manner which will minimize adverse impacts on rare species populations and rare natural communities.
- B. Conduct all fire management activities in a manner that will minimize adverse impacts on game species and other wildlife of conservation concern.
- C. Judiciously use mechanical techniques and prescribed fire to manage rare species and natural communities, control invasive species, and benefit game and regionally declining species.

D. Conduct monitoring of rare species, game species, and rare natural communities to determine if management objectives are being met.

E. Manage smoke from prescribed burns to minimize undesirable effects to the community.

F. Conduct prescribed burns in accordance with prescribed burn plans which include acceptable weather and fuel parameters, smoke management strategy, and contingency provisions.

- **Goal 3:** Make the site available to and encourage its use for fire ecology and fuels management research and for fire suppression and prescribed fire training.

Related Objectives:

A. Continue and expand the research prescribed burning program conducted by DFG and the University of Massachusetts (UMass) at Amherst.

B. Continue and expand the prescribed fire/fire suppression training activities cooperatively conducted by DFG, Bureau of Forest Fire Control, and UMass; expand the training program to include local municipal fire departments.

C. Seek funding and recruit researchers to initiate original research on fuels management and fire effects on rare species known from the site.

D. Re-sample on a regular basis a portion of the research plots on the Montague Plain originally established by Harvard Forest research staff (Motzkin 2001); establish additional plots on Wills Hill using the same protocol.

The report outlines three strategies for fire management, including *Wildfire Control*, *Prescribed Fire Use*, and *Mechanical Fuel Reduction*.

Wildfire Control addresses strategies for prevention and detection of fires, as well as actions to be taken in response, an inventory of available personnel, apparatus and equipment, training, water resources, plans for initial and extended attack of fires on the Plains, and public education.

Prescribed Fire Use is defined as “the intentional ignition of wildland fuels by qualified land managers under specified weather and fuels conditions within a confined area during a predetermined time frame under the guidance of a carefully formulated plan for the purpose of accomplishing one or more resource management objectives.” The plan outlines four purposes for the use of prescribed burns on the Plains: reduction of fuels, ecological management, scientific research and training.

The purpose of *Mechanical Fuel Reduction* on the Plains WMA is to reduce hazardous fuel loads, especially near structures and residential areas. The plan recommends the use of this method to prevent crown fires in stands of pitch pine by decreasing canopy cover.

All three of these strategies are currently in use on the Montague Plains. DFG personnel have been working with the Turners Falls Water District and in coordination with the DCR Section 9

Fire Warden and the prescribed fire program at the University of Massachusetts to conduct controlled burns on the Plains for several years. In 2003, DFG filed a “cutting plan” under the Forest Cutting Practices Act to conduct timber harvesting on approximately 70 acres of the MPWMA along the west side of Lake Pleasant Road. The Montague Board of Selectmen conducted a public hearing on the Fire Management Plan for the MPWMA in the village of Lake Pleasant in November 2003. At the hearing, DFG personnel explained the risk of fire on the Plains, and presented strategies for fire prevention. Clearing occurred in winter 2003 and 2004. More recently, extensive removal of low undergrowth along County Road was completed, and similar work is being done in other areas of the Plains.

Montague 2010 Open Space and Recreation Plan

One of the stated goals of the plan is to safeguard the future of the Montague Plains. The plan recommends the formation of a volunteer “friends of the Plains” group to assist with stewardship and management of the Montague Plains. The plan also recommends preparing development guidelines for the Plains in order to minimize impact on the ecology, especially endangered species.

Burn Permits

Permits are required for the seasonal outdoor burning of leaves on residential property, generally permitted between January and early May. In Montague, these permits are issued by Shelburne Fire Control. There were approximately 201 burn permits issued for residents of Montague in 2009. Specific burn permit guidelines are established by the state, such as the burning season and the time when a burn may begin on a given day. It may be beneficial for the state to change some of their regulations to prevent wildfires and brushfires. Currently, the burning season extends from January 15th to May 1st. If the burning season were to start in November or December and end in April, this would allow for a longer season during the months found to be, traditionally, the least dry in Massachusetts. Currently, residents may only burn between 10 a.m. and 4 p.m. If state guidelines were changed to allow for an earlier start time, this would allow for most of the burning to be conducted in the morning before winds traditionally increase.

Subdivision Review

Plans for new subdivisions are submitted to the appropriate Fire Department for review to ensure that fire trucks will have adequate access and that the water supply is adequate for fire-fighting purposes.

Public Education/Outreach

The Turners Falls Fire Department implements an ongoing educational program in the schools to teach fire safety and fire prevention in and around the home, including emergency evacuation plans, the safe use of cooking and heating appliances, and seasonal fire safety. The department is also using fire-prevention grants to increase its fire-safety outreach to seniors and the general population. It is planning to deliver workshops to the senior center and public housing in Turners Falls. The Montague Center Fire Department conducts a fire prevention program at their annual open house for children and seniors.

Restrictions on Development

There are currently no restrictions on development that are based on the need to mitigate the hazard of wildfires/brushfires.

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**Table 4-5
Existing Wildfire and Brushfire Hazard Mitigation Measures**

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|---|--|--|--|--|-------------------------------|------------------------|
| Fire Management Plan for Montague Plains WMA | <p>Comprehensive plan for prevention and control of forest fires, including public education, observation and detection, fire fighting plans, use of prescribed fire and mechanical fuel reduction.</p> <p>Recommends actions that property owners in high-risk areas can take to prevent and reduce severity of forest fires.</p> | 1500 acres of land on Montague Plains owned by Massachusetts Division of Fisheries and Wildlife. | Very effective for the area covered; this program is a statewide model | Increase efforts to educate landowners in high risk areas about the danger of forest fire and what they can do to prevent it. | Still relevant. | |
| | | | | Consider restrictions in Subdivision Regulations and Zoning Bylaws to reduce the danger of fire in high risk areas; for example, establish a “fire hazard overlay zone” with restrictions on the proximity of trees and other flammable materials to structures. | Still relevant. | |

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|---|--|-----------------|--|---------------------|-------------------------------|---|
| Montague 2010 Open Space and Recreation Plan | <p>Recommends the formation of a volunteer “Friends of the Plains” group to assist with stewardship and management of the Plains.</p> <p>Recommends the creation of development guidelines for the Plains that would minimize the impact to the ecology of the Plains.</p> | Montague Plains | <p>Potentially effective in involving the community in the management of the Plains.</p> <p>Potentially effective in protecting the sensitive ecology of the Plains.</p> | | Still relevant. | Support the formation of a “Friends of the Plains” volunteer group, and educate them about fire management on the Plains. |
| | | | | | | Include measures to mitigate the risk of damage from wildfires in the development guidelines for the Plains. |
| Burn Permits | Residents are required to obtain permits for brush burning. | Entire Town. | Effective. | None. | Still relevant. | |
| Subdivision Review | The Fire Departments are involved in the review of subdivision plans. | Entire Town. | Effective. | None. | Still relevant. | |
| Public Education/ Outreach | The Fire Departments have ongoing educational program in the schools. | Entire Town. | Effective. | None. | Still relevant. | |
| Forestry Warden | The Town has a Forest Warden who has responsibility for | Entire Town. | Effective. | None. | Still relevant. | |

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|-----------------------------|---|--|---------------|---------------------|-------------------------------|------------------------|
| | addressing forest fires. | | | | | |
| Forest Management | The Turners Falls Fire District, which owns more than 1500 acres of forest in Montague, has an active forest management plan that involves timber harvesting. | Land of Turners Falls Fire District in Dry Hill Area and on the east side of Lake Pleasant Road. | Effective | None. | Still relevant. | |

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EARTHQUAKES

Although there are five mapped seismological faults in Massachusetts, there is no discernable pattern of previous earthquakes along these faults, nor is there a reliable way to predict future earthquakes along these faults or in any other areas of the state. Consequently, earthquakes are arguably the most difficult natural hazard for which to plan. Most buildings and structures in the state were constructed without specific earthquake resistant design features. However, the 8th Edition of the Massachusetts State Building Code incorporates seismic requirements for new construction. Built areas underlain by artificial fill, sandy or clay soils are particularly vulnerable to damage during an earthquake.

Earthquakes can involve several potentially devastating secondary effects including:

- The collapse of buildings, bridges, roads, dams, and other vital structures;
- Rupture of utility pipelines;
- Flooding caused by dam failure;
- Landslides;
- Major transportation accidents, (railroad, chain highway crashes, aircraft, and marine);
- Extended power outage;
- Fire and/or explosion;
- HAZMAT accident; and,
- Water contamination.

Management Plans

The Montague CEM Plan lists five generic earthquake mitigation measures, including:

- Community leaders in cooperation with Emergency Management Personnel should obtain local geological information and identify and assess structures and land areas that are especially vulnerable to earthquake impact and define methods to minimize the risk.
- Strict adherence should be paid to land use and earthquake resistant building codes for all new construction.
- Periodic evaluation, repair, and/or improvement should be made to older public structures.
- Emergency earthquake public information and instructions should be developed and disseminated.
- Earthquake drills should be held in schools, businesses, special care facilities and other public gathering places.

The Montague CEM Plan also lists the following generic preparedness and response measures for earthquakes:

- Earthquake response plans should be maintained and ready for immediate use.
- All equipment, supplies and facilities that would be needed for management of an earthquake occurrence should be maintained for readiness.
- Emergency management personnel should receive periodic training in earthquake response.
- If the designated EOC is in a building that would probably not withstand earthquake impact, another building should be chosen for an earthquake EOC.
- Mass Care shelters for earthquake victims should be pre-designated in structures that would be most likely to withstand earthquake impact.
- It is assumed that all special needs facilities could be affected to some extent by earthquake effects therefore preparedness measures should be in place to address the needs of all facilities listed in the Resource Manual.
- Most likely the entire population of the community will be affected by a seismic event. Estimate the maximum peak population affected, considering peak tourism, special event populations, and work hours.
- EOC will be activated and response will immediately be engaged to address any and all earthquake effects.
- Emergency warning/notification information and instructions will be broadcast to the public.
- Search and rescue and emergency medical teams will be dispatched.
- Firefighters will address fires/explosions and HAZMAT incidents.
- Law enforcement personnel will coordinate evacuation and traffic control as well as protecting critical facilities and conducting surveillance against criminal activities.
- Reception centers will be opened and staffed.
- Animal control measures will be taken.
- Immediate life-threatening hazards will be addressed such as broken gas lines, or downed utility wires.
- Emergency food, water and fuel will be acquired.
- Activate mutual aid.
- Measures will be taken by the chief medical examiner relating to identification and disposition of remains of the deceased.

State Building Code

State and local building inspectors are guided by regulations put forth in the Massachusetts State Building Code. The first edition of the Massachusetts State Building Code went into effect on January 1, 1975, and included specific earthquake-resistant design standards. These seismic requirements for new construction have been revised and updated over the years and are part of

the current, 8th Edition of the Massachusetts State Building Code. Given that most structures in Massachusetts were built before 1975, many buildings and structures do not have specific earthquake resistant design features. In Montague, approximately 76% of the housing stock (2,903 units) were built before 1970, according to the 2000 U.S. Census. In addition, built areas underlain by artificial fill, sandy or clay soils are particularly vulnerable to damage during an earthquake.

Restrictions on Development

There are no seismic-related restrictions on development.

Emergency Shelters

The Comprehensive Emergency Management (CEM) Plan for Montague identifies shelters to be used to accommodate victims of natural hazards. It does not spell out which shelter should be used for which specific hazard. The Town does not have a Memorandum of Understanding in place with the Franklin County Technical School for use of their facilities during an emergency. Turners Falls High School is the only shelter, except for Franklin County Technical School, that currently has a back-up power supply.

- Turners Falls High School
- Franklin County Technical School
- Sheffield Elementary School
- Hillcrest School

**Table 4-6
Existing Earthquake Hazard Mitigation Measures**

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|--|--|--|-----------------------------------|----------------------------|--------------------------------------|--|
| State Building Code | The Town of Montague has adopted the 8 th Edition of the State Building Code. | Entire Town, but applies to new construction only. | Effective for new buildings only. | None. | Still relevant. | |
| Emergency Shelters for Earthquake Hazards | The Town has identified school buildings as shelters for general hazards. | Entire Town | Moderately Effective | | Still relevant. | Determine which shelters were built after 1975 and designate these as the appropriate shelter in the event of an earthquake. |
| | | | | | | Sign a Memorandum of Understanding with the Franklin County Technical School for use of their facility during an emergency. |
| | | | | | | Obtain a backup generator for the Sheffield school building. |

DAM FAILURE

The only mitigation measures in place are the state regulations that control the construction and inspection of dams. SUEZ Energy North America, which owns and operates the Turners Falls Project, conducts a regular maintenance program to ensure the safety of its facilities.

TransCanada, which owns the hydroelectric projects on the Deerfield River (discussed in Section 3) and the Vernon Dam, located on the Connecticut River in Vernon, VT, also conducts a regular maintenance program to ensure the safety of its facilities.

Management Plans and Regulatory Measures

The Montague CEM Plan contains the following generic mitigation measures for dam failure:

- Develop and conduct public education programs concerning dam hazards.
- Maintain up-to-date plans to deal with threat and actual occurrence of dam overspill or failure.
- Emergency management and other local government agencies should familiarize themselves with technical data and other information pertinent to the dams that impact Montague. This should include determining the probable extent and seriousness of the effect to downstream areas.
- Dams should be inspected periodically and monitored regularly.
- Repairs should be attended to promptly.
- As much as is possible burdens on faulty dams should be lessened through stream re-channeling.
- Identify dam owners.
- Determine minimum notification time for downstream areas.

The Montague CEM Plan contains the following generic preparedness and response measures for dam failure:

- Pre-place adequate warning/notification systems in areas potentially vulnerable to dam failure effects.
- Develop procedures for monitoring dam site conditions at first sign of any irregularity that could precipitate dam failure.
- Identify special needs populations, evacuation routes and shelters for dam failure response.
- Have sandbags, sand and other items to reinforce dam structure or flood proof flood prone areas.
- Disseminate warning/notification of imminent or occurring dam failure.
- Coordinate evacuation and sheltering of affected populations.
- Dispatch search and rescue teams.

- Coordinate evacuation and sheltering of affected populations.
- Activate mutual aid if needed.
- Acquire additional needed supplies not already in place, such as earthmoving machinery.
- Establish incident command post as close to affected area as safely possible.
- Provide security for evacuated public and private property.

The CEM Plan states that there are three categories of dam failure or overflow and that action should be taken according to hazard rating:

Type 1: Slowly developing condition

- Activate EOC;
- Activate all communication networks and establish 24-hour communications with Command Post.
- Release public information;
- Notify the following:
 - MEMA region headquarters
 - American Red Cross
 - downstream communities;
- Review plans for evacuation and sheltering
 - Evacuation
 - Routes
 - Notification
 - Sheltering
 - Availability and capacity
 - Food, supplies and equipment
 - Shelter owners and managers
 - Other communities (if out of Town sheltering is required)
- Require ‘stand by’ status of designated emergency response forces.

Type 2: Rapidly developing condition

- Establish 24-hour communication from the damsite to EOC;
- Assemble, brief and assign specific responsibilities to emergency response forces;
- Release public information;
- Obtain and prepare required vehicles/equipment for movement; and,

- Prepare to issue warning.

Type 3: Practically instantaneous failure

- Issue warning;
- Commence immediate evacuation;
- Commit required resources to support evacuation;
- Activate shelters or coordinate activation of shelters located outside the community;
- Notify:
 - MEMA region headquarters
 - American Red Cross
- Initiate other measures as required to protect lives and property.

Turners Falls Project

Northeast Utilities repurchased its hydroelectric facilities on the Connecticut River when it went through the deregulation process in 2000. Since then the company was sold to FirstLight Hydro Generating Company, and recently sold again to SUEZ Energy North America. SUEZ Energy North America operates the Turners Falls Project, and has a regular maintenance program that involves draining the Power Canal for inspection and maintenance purposes.

In 2000, in response to concerns expressed by Town officials about flooding in Montague City, FERC directed Northeast Utilities to conduct a study of the integrity of the left embankment of the Power Canal. As requested by FERC, the investigation included a review of available data, a site visit, a review of the capacity of the Burnham's Field drainage system and an evaluation of its adequacy, an assessment of the seepage apparently related to the embankment, a breach analysis to investigate whether a failure of the embankment could potentially present a hazard to nearby residences, and recommendations for further investigation.

The study found that seepage from the left embankment of the canal has been occurring virtually since its construction in the early 20th century. A drainage system at Burnham's Field was installed in the 1920s to accommodate the seepage and appeared to be functioning. Recent construction of beaver dams in the Burnham's Field area and heavy rainfall appeared to be contributing factors in periodic flooding experienced by residents.

The left embankment of the canal appeared to be stable and in good condition. Clearing of vegetation and monitoring of areas of concentrated seepage were recommended, as well as regular maintenance of drainage structures. The analysis found that flows from a hypothetical breach of the canal would likely produce significant flooding in Montague City, with possible structural damage to roads and residences. The report recommended that Northeast Utilities study potential ways to modify the operating methods of controls for the canal to enhance the ability to respond to an incipient or actual breach in the canal embankment.

Permits Required for New Dam Construction

Massachusetts State Law (M.G.L. Chapter 253 Section 45) regulates the construction of new dams. The Massachusetts Department of Conservation and Recreation (DCR) issues permits for new dams and does have the authority to deny a permit if it is determined that the design and/or location of the dam is not acceptable. One of the permit requirements is that all local approvals or permits must be obtained. In the late 1990s, a property owner proposed restoration of a breached dam on the Sawmill River. The project met with significant opposition from residents and environmental advocates, and was not pursued.

Dam Inspections

The DCR requires that dams rated as Low Hazard Potential be inspected every ten years, as Significant Hazard Potential be inspected every five years, and as High Hazard Potential be inspected every two years. Changes to state law (2005) have shifted the responsibility of dam inspections from the state to the owner of the dam, which may create a significant financial hardship, both for towns and individuals who own dams, and result in fewer dams being inspected according to the required schedule.

Restrictions on Development

There are no Town restrictions on dam locations. The DCR issues permits for new dams and does have the authority to deny a permit if it is determined that the design and/or location of the dam is not acceptable.

Emergency Planning

The Federal Energy Regulatory Commission (FERC) requires an Emergency Action Plan to be created for licensing of hydropower facilities. The primary purpose of an Emergency Action Plan is “to provide operating and mobilization and notification procedures to be followed in the case of an emergency” (such as a sudden release of water caused by a natural disaster or accident).⁷³ The Plans include warning system information and inundation maps.

⁷³ FERC’s Division of Dam Safety and Inspections Operating Manual:
<http://www.ferc.gov/industries/hydropower/safety.asp>

**Table 4-7
Existing Dam Failure Hazard Mitigation Measures**

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|---|---|---|--|---|--------------------------------------|-------------------------------|
| FERC regulation of structures under its jurisdiction | The Federal Energy Regulatory Commission oversees the operation and safety of hydroelectric projects | Power generation structures along the Connecticut River and Power Canal in Turners Falls and Montague City. | Effective | The Town and its residents should be aware of any changes in or threats to the integrity of the Turners Falls Dam, power canal and associated structures and promptly express concerns to public safety officials, SUEZ Energy North America, and FERC. | Still relevant. | |
| Permits required for new dam construction | State law requires a permit for the construction of any dam. | Entire Town. | Effective. Ensures dams are adequately designed. | None. | Still relevant. | |
| Dam Inspections | DCR has an inspection schedule that is based on the hazard rating of the dam (low, significant, high hazard). | Entire Town. | Low. Since 2004, new State regulations have gone into effect placing the responsibility of dam inspections on the owners of the dams, rather than the DCR. Owners of High Hazard Potential and | Adequate staff and resources should be given to DCR to ensure the inspection schedules are maintained. | Still relevant. | |

| Type of Existing Protection | Description | Area Covered | Effectiveness | 2004 Needed Changes | Accomplished/ Still Relevant? | 2011 Potential Changes |
|-----------------------------|-------------|--------------|--|---|-------------------------------|------------------------|
| | | | certain Significant Hazard Potential dams are also responsible for preparing Emergency Action Plans. | | | |
| | | | | Map dams and inundation areas. | Still relevant. | |
| | | | | Evaluate the Need for Dam Inspections by the Town. | Still relevant. | |
| | | | | Incorporate Dam Safety into Development Review process. | Still relevant. | |

LANDSLIDES

Landslides occur when a slope or slopes become destabilized for a number of reasons including heavy rains, vibrations from an earthquake, or construction. A moving wall of mud can bury whatever is in its path. Recently a landslide occurred in Greenfield, causing extensive damage to several homes.

Most of the mitigation measures for landslides were found to be the same as for Floods. Please see Table 4-1: Existing Flood Hazard Mitigation Measures for a summary of the Land Use Regulations that help to mitigate landslides, and Appendix 1 for detailed Land Use Regulations.

Millers Falls Road Erosion Control Project

In 2010 the Franklin Regional Council of Governments (FRCOG) received funding from FEMA to assist towns in the county with identifying and prioritizing mitigation projects. An engineering consultant is assisting the FRCOG with evaluating the project feasibility and design for up to four potential mitigation projects in the county.

In December 2010, the Millers Falls Road erosion control project submitted by the Town of Montague was chosen as one of the priority projects in the county. According to the draft project scope, erosion along a steep slope is threatening a segment of Millers Falls Road located across from Highland Cemetery, in between the Turners Falls Airport and the village of Millers Falls. The route is a main artery and evacuation route, and is also currently the main detour for traffic traveling north from Turners Falls due to the closure of the Gill Montague Bridge. Further, Millers Falls Road is the most direct route to access Millers Falls from the fire and police services based in Turners Falls. According to Town officials, if no work is done to stabilize the slope, it is imminent that the road will ultimately wash out.

The potential project would be to stabilize the slope and prevent future erosion and failure of the roadway. Neither the road nor the slope is within a floodplain, although the Millers River at the base of the slope is. Web-based aerial photographs of the area depict a large sediment delta in the river, which is indicative of severe erosion. A reconnaissance revealed that the slope has been actively failing, with fallen trees and scarps that have not yet weathered. Although most of the work conducted by the Town has focused on management of drainage, there may be other factors contributing to the slope failure such as groundwater seepage and erosion of the toe of the slope at Millers River.

Mitigation for the failing slope will likely require three components:

- d) improved stormwater management;
- e) reduced vegetative mass on the slope; and
- f) reduced erosion at the toe of the slope.

**Table 4-7
Existing Landslide Hazard Mitigation Measures**

| Type of Existing or Proposed Protection | Description | Area Covered | Effectiveness | 2011 Potential Changes |
|---|---|--|---|-------------------------------|
| Millers Falls Road Erosion Control Project | Consultant will evaluate the project feasibility and design for mitigating slope erosion along a segment of Millers Falls Road. | Segment of Millers Falls Road between Turners Falls Airport and Millers Falls. | Effective in assisting the Town with qualifying for federal funding to implement the project. | |

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ICE JAMS

The most common hazard associated with ice jams is flooding upstream of the ice jam. Therefore strategies to mitigate flooding are also appropriate for mitigating the impacts of ice jams. Please see Current Mitigation Strategies for Flooding section and refer to Table 4-1: Existing Flood Hazard Mitigation Measures as well as Appendix A for complete language for same measures.

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MANMADE HAZARDS

Timely, informative and accurate notification of a hazardous material emergency is critical for an effective emergency response and for the safety and protection of Montague's citizens. With the frequency of transportation of hazardous materials along routes through town and railroad, the possibility exists of a catastrophic accident or spill. Strategies to plan for the evacuation of residents and for the cleanup of any chemical spill are key to hazard mitigation.

Management Plans and Regulatory Measures

The following are generic preparedness and response measures for manmade hazards listed in the Town CEM Plan, specifically hazardous materials emergencies:

- The immediate notification of the community emergency coordinator and the State is required when a release of an extremely hazardous substance or hazardous chemical in an amount above the Reportable Quantity (RQ) occurs. Specific information is required by the notification such as chemical name, method of release, health effects, medical attention and protective actions.
- The Hazardous Materials Release Report Form must be used in the event of the release of a hazardous substance
- Both local and State response personnel, including the DEP must be notified immediately of a release. The local point of contact is the local fire department through the 911 dispatch Center.

Evacuation Options

Evacuation of an incident site could be required upon the recommendation of the on-scene commander. The routes of evacuation and staging areas for the evacuees will be determined by the Incident Commander. Once the incident site has been evacuated, law enforcement officials will support expanded evacuation if required. The necessity for additional evacuation will be determined by the Incident Commander.

Zoning Bylaws (See Appendix 1 for complete language)

- Section 9. Water Supply Protection District

**Table 4-9
Existing Manmade Hazard Mitigation Measures**

| Type of Existing or Proposed Protection | Description | Area Covered | Effectiveness | 2011 Potential Changes |
|--|--|--|--|------------------------|
| Zoning Bylaws | | | | |
| Section 9. Water Supply Protection District | Regulations protect and preserve existing and potential sources of groundwater supply and recharge and watershed areas by restricting uses that could cause groundwater contamination. | Areas identified on the Zoning Map, including in and around Montague Center and Lake Pleasant. | Effective for mitigating the potential for hazardous material spills in the Water Supply Protection District by prohibiting hazardous material use or storage. | |

Future Mitigation Strategies

Goal Statements and Action Items

As part of the natural hazards mitigation planning process undertaken by the Montague Natural Hazards Planning Committee, existing gaps in protection and possible deficiencies were identified and discussed. The Committee then developed general goal statements and action items that, when implemented, will help to reduce risks and future damages from natural hazards. The goal statements, action items, town department(s) responsible for implementation, and the proposed timeframe for implementation for each category of natural hazard are described below. There are also several general action items that were developed.

Action items from the previous plan were carried over where they were still applicable and/or where the item had not yet been completed. Those action items that have been completed since the last plan are listed below in the **2004 Action Items Completed** section.

Action Items were evaluated for potential costs and benefits. Several of the action items have multiple benefits because, if implemented, these action items will mitigate or prevent damages from more than one type of natural hazards.

2004 Action Items Completed

Action Item: Review recommendations of 604(b) report on the Sawmill River once it is complete and identify potential funding sources and implement recommendations.

Responsible Department: Planning & Conservation, in cooperation with relevant state and federal agencies.

Proposed Completion Date: Dependent on availability of funding

2011 Status Update: In 2006 a restoration report was completed and included preliminary designs for restoring 1,700 feet running east or downstream of Route 63 to the river's natural channel and reducing seasonal flooding and sedimentation by using bio-engineered approaches such as log jams and root wads. The Franklin Conservation District was awarded an implementation grant from the DEP in 2010, and the project is currently moving through the approval process. Construction is expected to begin in 2012, depending on many variables.

2011 Action Plan

Prioritization of Goals and Action Items

The Committee prioritized Mitigation Action Items by examining the results of the All Hazards Risk Assessment completed by the Committee (see Section 3, pages 40 through 44). The All Hazards Risk Assessment is an interactive table that the Committee completed with the FRCOG staff to evaluate all the natural hazards that can impact the town based on frequency of

occurrence, severity of impacts, area of occurrence and preparedness. The completed table gives the town an overall understanding of the natural hazards, provides guidance on which hazards the Town may want to focus mitigation efforts on, reaffirms that Montague’s planning and preparedness is on track, and shows residents that town departments and agencies are organized in case of a natural disaster. Those hazards receiving the highest Weighted Hazard Index number were assigned the highest priority. Hazards were rated as follows:

Table 4-10: Weighted Hazard Index Priority Level

| Weighted Hazard Index | Priority Level |
|------------------------------|-----------------------|
| > 5.0 | High |
| 4.0 – 4.99 | Medium |
| < 4.0 | Low |

Table 4-11: Hazard Priority Level Rating

| Natural Hazard | Weighted Hazard Index | Priority Level |
|-----------------------|------------------------------|-----------------------|
| Earthquake | 5.70 | High |
| Wildfire & Brushfire | 5.50 | High |
| Severe Winter Storm | 5.50 | High |
| Microburst | 5.45 | High |
| Hurricane | 5.25 | High |
| Dam Failure | 4.95 | Medium |
| Flood | 4.55 | Medium |
| Tornado | 4.20 | Medium |
| Ice Jam | 3.65 | Low |
| Landslide | 2.40 | Low |

The final 2011 Montague Natural Local Hazards Mitigation Prioritized Action Plan is shown in Table 4-12. Some Action Items were evaluated as being associated with several hazards and were labeled “Multiple Hazard”. Multiple Hazard Action Items were assigned a high priority given their association with more than one hazard. Potential funding sources to assist the town with implementation of the Action Item were listed. Finally, each Action Item was given an estimated completion date and assigned a responsible department or board.

With respect to Manmade Hazards, the Committee evaluated the potential for fixed facility and transportation hazardous materials accidents as quite high – particularly transportation related accidents, given the proximity of the railroad tracks to more densely populated areas of Town. However, no formal vulnerability assessment was done for manmade hazards due to the lack of available data to use in an appropriate assessment model. The consensus of the Committee was that the potential for these types of manmade hazards to occur, the unknown impact of such accidents on the town’s population, infrastructure, and the natural and built environment, and the

lack of available and well-analyzed data make this hazard and the implementation of associated Action Items a high priority.

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Table 4-9: 2011 Montague Local Natural Hazards Mitigation Prioritized Action Plan

| Hazard | Goal | Action Item | Responsible Department / Board | Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I) | Potential Funding Source | Estimated Completion Date | Status |
|--|------|--|--|---|--------------------------|---------------------------|---|
| HIGH PRIORITY (≥ 5.0 Weighted Hazard Index) | | | | | | | |
| MULTIPLE HAZARDS | | | | | | | |
| | | Form a Hazard Mitigation Committee, made up of volunteers knowledgeable in the field, to work on implementing specified actions in the Local Natural Hazard Mitigation Plan. The members of the existing Local Natural Hazard Mitigation planning committee will act in an advisory role to the volunteer committee. | Emergency Management Director, Select Board | B, N, P, I | Volunteer time | 2011 | New Action Item. |
| | | Develop a formal system for departments to record costs and property damages from natural hazard events. Encourage businesses and residents to report property damages, and farmers to report crop damages. | Hazard Mitigation Committee, Emergency Management Director, Public Works Superintendent, Fire Chiefs, Police | B, N, P, I | Town, Volunteer time | 2012 | New Action Item. |
| <i>To provide adequate shelter, water, food and basic first aid to displaced residents in the event of a natural disaster.</i> | | | | | | | |
| | | Identify <u>existing</u> shelters that are equipped with an auxiliary power supply and/or are earthquake resistant. Disseminate this information to appropriate town departments. | Emergency Management Director, Building Inspector, Public Works Superintendent | P | Town | 2011 | Carried over from 2004 plan. Still relevant. The Turners Falls High School has a backup power supply. |
| | | Identify potential locations for <u>new</u> shelters, in particular, buildings that are equipped with an auxiliary power supply and/or are earthquake resistant. Disseminate this information to appropriate town departments. | Emergency Management Director, Building Inspector, Public Works Superintendent | P | Town | 2011 | Carried over from 2004 plan. Still relevant. The Franklin County Technical School and the Public Safety Complex have been identified as potential new shelters. |
| | | Sign a Memorandum of Understanding with the Franklin County Technical School for use of their facility during an emergency. | Emergency Management Director, Select Board | P | Town | 2011 | New Action Item. |
| | | Obtain a backup generator for the Sheffield school building. | Emergency Management Director | P | Town | 2012 | New Action Item. |
| | | Identify the number of people that could need shelter during various types of natural hazard emergencies and identify evacuation routes and shelters to be used. Special attention to Individuals Requiring Additional Assistance (IRAA) should be made. | Hazard Mitigation Committee, Emergency Management Director, Public Works Superintendent, Fire Chiefs, Police | P | Town, Volunteer time | 2012 | Carried over from 2004 plan. Still relevant. |
| | | Inventory supplies at existing shelters. Establish arrangements with local or neighboring vendors for supplying shelters with potable water, food and first aid supplies, and ensure that arrangements for transportation are in place in the event of a natural disaster. Identify separate storage areas for supplies, as necessary. | Hazard Mitigation Committee, Emergency Management Director, Public Works Superintendent, Planning & Conservation Department, Fire Chiefs, Police, Franklin County REPC | P | Town, Volunteer time | 2012 | Carried over from 2004 plan. Still relevant. A shelter supply trailer is housed in Greenfield and can be transported to Montague to be used during an emergency. The Franklin County REPC is developing a regional sheltering plan. |

| Hazard | Goal | Action Item | Responsible Department / Board | Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I) | Potential Funding Source | Estimated Completion Date | Status |
|--|------|---|--|---|--------------------------|---------------------------------|---|
| | | Investigate the availability of funding sources to purchase auxiliary power generators and other shelter equipment and supplies. | Emergency Management Director, Planning & Conservation Department, Franklin County REPC | P | Town, volunteer time | 2012 | Carried over from 2004 plan. Still relevant. |
| | | Inventory the number of livestock in Town that could need sheltering during a natural hazard. Identify potential shelter locations for companion animals (pets) and livestock. Collaborate with the Franklin County DART (Disaster Animal Response Team) on developing a local disaster animal response plan and standard operating procedures. | Hazard Mitigation Committee, Emergency Management Director, Animal Control Officer, Franklin County DART | P | Town, volunteer time | 2012 | New Action Item. The Western Regional Homeland Security Council has funded a DART Response Planning project that will develop a local and regional companion animal sheltering plan template, checklist and best practices. The anticipated completion date is February 2012. |
| <i>To provide adequate notification and information regarding evacuation procedures, etc., to residents in the event of a natural disaster.</i> | | | | | | | |
| | | Work with the Franklin County REPC and other towns to investigate the feasibility of a Reverse 911 system for the Town of Montague and other interested towns. Develop a preliminary project proposal and cost estimate. | Emergency Management Director, Fire Department, Police Department | P | Town | When funding becomes available. | Carried over from 2004 plan. Still relevant. |
| | | Collect, periodically update, and disseminate information on which local radio stations provide emergency information, what to include in a "home survival kit," how to prepare homes and other structures to withstand flooding and high winds, and the proper evacuation procedures to follow during a natural disaster. Include a link on the Town website to WesternMassReady.org and Ready.gov | Hazard Mitigation Committee, Emergency Management Director, Director of Public Health | P | Town | On-going | On-going from 2004 plan. Still relevant. |
| | | Encourage business owners to develop continuity of operations plans. | Hazard Mitigation Committee, Emergency Management Director | P | Town | On-going | New Action Item. |
| EARTHQUAKES | | | | | | | |
| <i>To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to an earthquake.</i> | | | | | | | |
| | | The Town should review its municipal buildings and structures to determine if they are particularly vulnerable to earthquake damage and determine if any retrofitting measures could mitigate this vulnerability. | Building Inspector, Public Works Superintendent | B, P, I | Town | 2012 | Carried over from 2004 plan. Still relevant. |
| | | Ensure Compliance with the Massachusetts State Building Code: The Building Inspector should ensure that all new construction complies with the appropriate seismic requirements of the State Building Code. | Building Inspector | B, P, I | Town | On-going | Ongoing from 2004 plan. Still relevant. |
| | | Emergency earthquake public information and instructions should be developed and disseminated. Earthquake drills should be held in schools, businesses, special care facilities and other public gathering places. | Emergency Management Director | P | Town | 2012 | New Action Item. |
| | | Earthquake response plans should be maintained and ready for immediate use. Emergency management personnel should receive periodic training in earthquake response. | Emergency Management Director, Police Department, Fire Department | P | Town, FEMA | On-going | New Action Item. |

| Hazard | Goal | Action Item | Responsible Department / Board | Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I) | Potential Funding Source | Estimated Completion Date | Status |
|-----------------------------------|---|---|---|---|--------------------------------|---------------------------|--|
| | | Determine which shelters were built after 1975 and designate these as the appropriate shelter in the event of an earthquake. | Emergency Management Director | P | Town | 2011 | New Action Item. |
| WILDFIRE AND BRUSHFIRE | | | | | | | |
| | <i>To minimize the loss of life, damage to property, infrastructure and natural resources, and the disruption of governmental services and general business activities due to wildfire and brushfires.</i> | | | | | | |
| | | Encourage forest stewardship practices that produce more stable, successional forested landscapes and which reduce the risk of fire hazards (such as the removal of slash). | Planning & Conservation, Turners Falls Water Department, Fire Departments | N | Town | On-going | On-going from 2004 plan. Still relevant. |
| | | Educate homeowners about general fire safety. | Fire Departments | B, P | Town | On-going | On-going from 2004 plan. Still relevant. |
| | | Work in partnership with the Massachusetts Division of Fish and Game to implement recommendations of Fire Management Plan for the Montague Plains; encourage Northeast Utilities to engage in fire management planning for the utility-owned portion of the Plains. | Planning & Conservation, Fire Departments | N | Town, DFG, Northeast Utilities | On-going | On-going from 2004 plan. Still relevant. |
| | | Conduct education on how homeowners in fire-prone areas can reduce the risk of damage from wildlife; consider land-use regulations to reduce risk of fire in new developments. | Planning & Conservation, Building Inspector, Fire Departments | B, P | Town | 2014 | Carried over from 2004 plan. Still relevant. |
| SEVERE WINTER STORMS | | | | | | | |
| | <i>To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to a severe winter storm.</i> | | | | | | |
| | | Encourage homeowners and businesses to trim tree branches around power lines. | Hazard Mitigation Committee, Department of Public Works | I | Volunteer Time | On-going | New Action Item. |
| TORNADOS/MICROBURSTS | | | | | | | |
| | <i>To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to high winds associated with tornadoes and microbursts.</i> | | | | | | |
| | | Maintain plans for managing tornado and microburst response activities. | Emergency Management Director, Police Department, Fire Department | B, N, P, I | Town | On-going | New Action Item. |
| HURRICANES/TROPICAL STORMS | | | | | | | |
| | <i>To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to high winds associated with hurricanes and tropical storms.</i> | | | | | | |
| | | Encourage homeowners and businesses to trim tree branches around power lines. | Hazard Mitigation Committee, Department of Public Works | I | Volunteer Time | On-going | New Action Item. |
| | | Maintain plans for managing all hurricane emergency response activities. | Emergency Management Director, Police Department, Fire Department | B, N, P, I | Town | On-going | New Action Item. |
| MANMADE HAZARDS | | | | | | | |
| | <i>To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to manmade hazards, particularly chemical spills or accidents in fixed structures and in transportation.</i> | | | | | | |
| | | Research appropriate vulnerability assessment models for fixed facility and transportation hazardous materials accidents, collect relevant data, and populate model to further prioritize manmade hazard action items. | Emergency Management Director, FRCOG | B, N, P, I | FEMA | 2012 | New Action Item. |

| Hazard | Goal | Action Item | Responsible Department / Board | Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I) | Potential Funding Source | Estimated Completion Date | Status |
|---|---|---|--|---|--------------------------|---------------------------|--|
| | | Develop an evacuation plan and notification system in the event of a chemical spill in a fixed structure or in a transportation setting. | Emergency Management Director | P | FEMA | 2012 | New Action Item. |
| | | Remain up to date on evacuation procedures for an accident at the Vermont Yankee nuclear power plant. | Emergency Management Director | P | Town | On-going | New Action Item. |
| MEDIUM PRIORITY (4.0 – 4.99 Weighted Hazard Index) | | | | | | | |
| DAM FAILURE | | | | | | | |
| | <i>To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to a dam failure.</i> | | | | | | |
| | | Advocate for adequate funding for Office of Dam Safety at the Massachusetts Department of Conservation & Recreation. | Board of Selectmen, State Legislators | | Town, volunteer time | 2013 | Carried over from 2004 plan. Still relevant. |
| | | Map Dams and Inundation Areas. Prepare a Geographic Information System map that shows the location of all dams in the town and immediately upstream of the town's borders and the areas that are likely to be flooded in the event of a dam failure. Include those areas shown on the TransCanada Inundation Areas mapping for the Deerfield River projects and the Vernon Dam, as well as the Moore Dam and Lake Wyola Dam. Distribute map to public safety officials in Montague. | Planning & Conservation (to oversee consultant) | B, N, P, I | Town | 2014 | Carried over from 2004 plan. Still relevant. |
| | | Identify locations for emergency shelters and evacuation routes for people who live in an inundation area. | Emergency Management Director, Police, Fire, Planning & Conservation | P | Town | 2013 | Carried over from 2004 plan. Still relevant. |
| | | Identify the locations of beaver dams in Montague and neighboring towns (Leverett) that have the potential to flood private property and town infrastructure if the dams were to fail. Work with the Franklin County REPC and neighboring towns to map potential inundation areas associated with beaver dams in and adjacent to Montague. | Planning and Conservation Department | B, N, P, I | Town | Ongoing | Ongoing from 2004 plan. Still relevant. |
| FLOOD | | | | | | | |
| | <i>To minimize the loss of life, damage to property, infrastructure and natural resources, and the disruption of governmental services and general business activities due to flooding.</i> | | | | | | |
| | | Review and update the Floodplain District Overlay Zoning Bylaw. Special consideration should be given to further restricting or eliminating new development within the 100-year floodplain. | Planning and Conservation Department, Planning Board | B, N, P, I | Town | 2015 | Carried over from 2004 plan. Still Relevant. |
| | | As appropriate, consider adding flood prevention and mitigation to the Purpose Section of the Land Use regulations. | Planning and Conservation Department, Planning Board | B, N, P, I | Town | 2015 | Carried over from 2004 plan. Still Relevant. |
| | | Consider new land use regulations, including impervious surface limits, and local wetlands bylaw to further regulate development in floodplain, reduce runoff and minimize risk of localized flooding. | Planning and Conservation Department, Planning Board | B, N, P, I | Town | 2015 | Modified from 2004 plan. Still Relevant. |
| | | Encourage the Zoning Board of Appeals to adopt the stormwater system policy. | Planning and Conservation Department | B, N, I | Town, volunteer time | 2012 | New Action Item. |
| | | Consider becoming part of NFIP's Community Rating System. | Planning and Conservation Department, Select Board | B, N, P, I | Town, volunteer time | 2012 | New Action Item. |
| | | Provide homeowners in flood prone areas information on the National Flood Insurance Program. | Hazard Mitigation Committee, Emergency Management Director, Planning and Conservation Department | B, P | Town | On-going | New Action Item. |

| Hazard | Goal | Action Item | Responsible Department / Board | Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I) | Potential Funding Source | Estimated Completion Date | Status |
|---|------|---|---|---|--|---------------------------|--|
| | | Conduct research to review changes in extent of the 100-year floodplain of the Sawmill River since the NFIP study and mapping effort in 1982. | Planning & Conservation, in cooperation with relevant state and federal agencies. | N | Massachusetts Division of Ecological Restoration Riverways Program, Town | 2015 | Carried over from 2004 plan. Still Relevant. |
| | | Using Assessors' data and other available information, expand and update the Vulnerability Assessment for properties located within the 100-year floodplain, including information on crop damages if available. | Hazard Mitigation Committee, Planning and Conservation Department | B | Town | 2015 | Carried over from 2004 plan. Still Relevant. |
| | | Review evacuation procedures for the flood prone areas in town (identified on the map, including areas shown on the TransCanada Inundation Areas mapping for the Deerfield River Projects and the Vernon Dam, and update, if necessary.) | Emergency Management Director, Police Chief, Fire Chiefs | P | Town | 2014 | Carried over from 2004 plan. Still Relevant. |
| | | Coordinate with state and regional agencies to identify a location(s) for the temporary storage of contaminated/hazardous flood debris. | Public Works, Planning & Conservation, Franklin County REPC, Franklin Regional Council of Governments (FRCOG) | B, N, P, I | FEMA | 2015 | Carried over from 2004 plan. Still Relevant. The Western Regional Homeland Security Council is funding the FRCOG, with guidance from the REPC, to develop a regional disaster recovery plan, which will include a disaster debris plan. The anticipated completion date is May 2012. |
| | | Support local and regional watershed-wide open space protection efforts, particularly in floodplain areas, with special attention to the Sawmill River Watershed. | Planning and Conservation Department | B, N, P, I | N/A | On-going | On-going from 2004 plan. Still relevant. |
| LOW PRIORITY (< 4.0 Weighted Hazard Index) | | | | | | | |
| ICE JAMS | | | | | | | |
| <i>To minimize the loss of life, damage to property, infrastructure and natural resources, and the disruption of governmental services and general business activities due to ice jams and associated flooding.</i> | | | | | | | |
| | | Continue work to clear floodway ditches in the floodplain of overgrown vegetation and any other debris. | Town Administrator, Select Board, Highway Department | N, I | Town, Volunteer time | On-going | New Action Item. |
| | | Support local and regional, watershed-wide open space protection efforts, particularly in floodplain areas. | Planning Board, Select Board, Conservation Commission | B, N, P, I | N/A | On-going | New Action Item. |
| LANDSLIDES | | | | | | | |
| <i>To minimize the loss of life, damage to property, infrastructure and natural resources, and the disruption of governmental services and general business activities due to landslides.</i> | | | | | | | |
| | | Work with the Franklin Regional Council of Governments on evaluating the project feasibility and design for mitigating slope erosion along a segment of Millers Falls Road. Apply for federal funding to implement the project if eligible. | Planning and Conservation Department | N, I | FEMA | 2011 | New Action Item. An engineering consultant is assisting the Town and FRCOG with evaluating the project feasibility and design for the Millers Falls Road project. |
| | | Ensure compliance with existing land use regulations (zoning bylaws, subdivision regulations, building codes) that direct development to stable slopes and soils. Protect existing development from potential landslides by ensuring that surface water and groundwater are properly managed. | Building Inspector, Conservation Commission, Planning Board, Zoning Board of Appeals | B, N, P, I | Town, Volunteer time | On-going | New Action Item. |

| Hazard | Goal | Action Item | Responsible Department / Board | Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I) | Potential Funding Source | Estimated Completion Date | Status |
|--------|------|---|--|---|--------------------------|---------------------------|------------------|
| | | Encourage forest stewardship practices that produce more stable, successional forested landscapes. | Conservation Commission, Planning Board, Fire Department | N | Town, Volunteer time | On-going | New Action Item. |
| | | Support regional efforts to determine if landslide-prone areas have been mapped. If these maps have been created, efforts are to be made to obtain this information and disseminate it to potentially impacted communities. | Select Board | B, N, P, I | Town | On-going | New Action Item. |

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National Flood Insurance Program Compliance

The Town of Montague participates in the National Flood Insurance Program. The goals of the National Flood Insurance Program (NFIP) are to provide flood insurance to property owners, to encourage flood loss reduction activities by communities, and to save taxpayers' money.

As of September 2010, there were ten policies in effect in Montague for a total of \$2,707,900 worth of insurance.

NFIP Community Rating System (CRS)⁷⁴

The town is not a member of the NFIP Community Rating System, which entitles policyholders to a discount on flood insurance premiums. The Community Rating System is a part of NFIP and provides incentives and tools to further these goals. The goals of the CRS are to recognize, encourage, and reward, by the use of flood insurance premium adjustments, community and state activities beyond the minimum required by the NFIP that:

- Reduce flood damage to insurable property,
- Strengthen and support the insurance aspects of the NFIP, and
- Encourage a comprehensive approach to floodplain management.

The Community Rating System reduces flood insurance premiums to reflect what a community does above and beyond the National Flood Insurance Program's (NFIP) minimum standards for floodplain regulation. The objective of the CRS is to reward communities for what they are doing, as well as to provide an incentive for new flood protection activities. It provides lower insurance premiums under the National Flood Insurance Program. The premium reduction is in the form of a CRS Class, similar to the classifications used for fire insurance. For example, a Class 1 provides a 45% premium reduction while a Class 10 provides no reduction. The CRS Class is based on the floodplain management activities a community implements. In many cases, these are activities already implemented by the community, the state, or a regional agency. The more activities implemented, the better the CRS class.

Benefits of participating in the Community Rating System:

- Money stays in the community instead of being spent on insurance premiums.
- Every time residents pay their insurance premiums, they are reminded that the community is working to protect them from flood losses, even during dry years.
- The activities credited by the CRS provide direct benefits to the community, including:
 - Enhanced public safety,
 - Reduction in damage to property and public infrastructure,
 - Avoidance of economic disruption and losses,
 - Reduction of human suffering, and
 - Protection of the environment.
- Local flood programs will be better organized and more formal.

⁷⁴ <http://training.fema.gov/EMIWeb/CRS/>

- The community can evaluate the effectiveness of its flood program against a nationally recognized benchmark.
- Technical assistance in designing and implementing some activities is available at no charge.
- The community will have an added incentive to maintain its flood programs over the years.
- The public information activities will build a knowledgeable constituency interested in supporting and improving flood protection measures.

Costs to the local government to participate in the Community Rating System:

- The community must designate a CRS Coordinator who prepares the application papers and works with FEMA and the Insurance Services Office (ISO) during the verification visit.
- Each year the community must recertify that it is continuing to implement its activities. It must provide copies of relevant materials (e.g., permit records).
- The community must maintain elevation certificates, permit records, and old Flood Insurance Rate Maps forever.
- The community must maintain other records of its activities for five years, or until the next ISO verification visit, whichever comes sooner.

Community Rating System Process

One of the actions that Montague can take to improve their CRS rating (and subsequently lower their premiums) is to develop a CRS plan. The CRS 10-step planning process provides additional points for activities that communities can take during their planning process that go above the minimum described below, thus possibly lowering insurance rates. At a minimum, an *approved* multi-hazard mitigation plan that addresses floods could qualify for CRS credit. Although communities are not required to participate in CRS in order to receive approval of a Local Natural Hazards Mitigation Plan, FEMA encourages jurisdictions to integrate the CRS planning steps into their multi-hazard mitigation plans.

Credit is provided for preparing, adopting, implementing, evaluating, and updating a comprehensive floodplain management plan or repetitive loss area analyses. The Community Rating System does not specify what must be in a plan, but it only credits plans that have been prepared and kept updated according to CRS standard planning process. Credit is also provided for implementing a habitat conservation plan.

Community Rating System Credit Points⁷⁵

A total of up to 359 points are provided for three elements. Up to 294 points are provided for adopting and implementing a floodplain management plan (FMP) that was developed using the following standard planning process. There must be some credit for each of the 10 planning steps:

⁷⁵ FEMA Local Multi-Hazard Mitigation Planning Guidance, July 1, 2008.
Town of Montague Local Natural Hazard Mitigation Plan
 June 2011 **FINAL DRAFT**

| Step | Maximum Points |
|-----------------------------------|----------------|
| • Organize to prepare the plan | 10 |
| • Involve the public | 85 |
| • Coordinate with other agencies | 25 |
| • Assess the hazard | 20 |
| • Assess the problem | 35 |
| • Set goals | 2 |
| • Review possible activities | 30 |
| • Draft an action plan | 70 |
| • Adopt the plan | 2 |
| • Implement, evaluate, and revise | 15 |

Up to 50 additional points are provided for conducting repetitive loss area analyses (RLAA) and up to additional 15 points are provided for adopting and implementing a Habitat Conservation Plan (HCP).

More information is available at <http://www.fema.gov/business/nfip/crs.shtm>. A copy of the “Local Official’s Guide to Saving Lives, Preventing Property Damage, and Reducing the Cost of Flood Insurance” is including in the Appendix of this plan or can be downloaded at <http://www.fema.gov/library>.

5 – PLAN ADOPTION & MAINTENANCE

Plan Adoption

The Franklin Regional Council of Governments (FRCOG) provided support to the Montague Local Natural Hazards Mitigation Planning Committee as they underwent the planning process. Town officials such as the Emergency Management Director and Town Planner were invaluable resources to the FRCOG and provided background and policy information and municipal documents, which were crucial to facilitating completion of the plan.

When the preliminary draft of the Local Natural Hazards Mitigation Plan was completed, copies were disseminated to the Montague Local Natural Hazards Mitigation Planning Committee for comment and approval. The Committee was comprised of representatives of Town boards and departments who bear the responsibility for implementing the action items and recommendations of the completed plan. Members of the community also took part in committee meetings and provided feedback on the plan, including a town resident and representatives from the Gill Montague School District, Farren Care Center, and FirstLight Power. The committee was asked to submit any further comments before the final draft was submitted to the Montague Board of Selectmen.

Copies of the Final Draft Local Hazards Mitigation Plan for the Town of Montague were distributed to the Town boards for their review and comment. A copy of the plan was also posted on the town website for public review. On [REDACTED], the Board of Selectmen voted to forward the plan to the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency (FEMA) for their approval.

Plan Maintenance Process

Implementation of the Montague Local Natural Hazard Mitigation Plan will begin following its formal adoption by the Board of Selectmen. Work has already begun on several of the mitigation strategies identified in this Plan, especially in the area of addressing the hazard of wildfire on the Montague Plains. Specific Town Departments will be responsible for ensuring the development of policies, bylaw revisions, and programs as described in Section 4 of this Plan. The Montague Natural Hazards Planning Committee will oversee the implementation of the Plan.

Monitoring, Evaluating and Updating the Plan

The measure of success of the Montague Local Natural Hazard Mitigation Plan will be the number of identified mitigation strategies implemented. In order for the Town to become more disaster resilient and be better equipped to respond to natural disasters, there must be a coordinated effort between elected officials, appointed bodies, Town employees, regional and state agencies involved in disaster mitigation, and the general public.

The Montague Natural Hazards Planning Committee (Committee) will meet on an annual basis or as needed (i.e., following a natural disaster) to monitor the progress of implementation, evaluate the success or failure of implemented recommendations, and brainstorm for strategies to remove obstacles to implementation. Following these discussions, it is anticipated that the Committee may decide to reassign the roles and responsibilities for implementing mitigation strategies to different town departments and/or revise the goals and objectives contained in the Plan. At a minimum, the Committee will review and update the Plan every five years, beginning in the fall of 2015. The meetings of the Committee will be organized and facilitated by the staff of the Montague Planning and Conservation Department.

Incorporating the Plan into Existing Planning Mechanisms

Upon approval of the Montague Local Hazards Mitigation Plan by MEMA, the Committee will provide all interested parties and implementing departments with a copy of the plan. The committee should also consider initiating a discussion with each department on how the plan can be integrated into that department's ongoing work. At a minimum, the plan should be distributed to and reviewed with the following entities:

- Fire Departments
- Emergency Management Director
- Police Department
- Public Works / Highway Department
- Planning Board
- Zoning Board of Appeals
- Conservation Commission
- Franklin County Regional Emergency Planning Committee
- Building Inspector
- Board of Selectmen
- Northeast Utilities
- First Light Power

The 2004 Montague Local Natural Hazards Mitigation Plan was incorporated into other planning projects in the following ways:

- The public safety complex was completed in 2009. Its centralized location in Town allows optimal emergency response time and emergency shelter space.
- A 604(b) report on the Sawmill River was completed in 2006 and the Franklin Conservation District is seeking funding to use bio-engineering to restore the natural flow of the river for a stretch along Route 47.
- In 2009 the Planning Board adopted a stormwater system policy to ensure high quality water standards and address any potential water quantity problems associated with development and to:
 - Preserve hydrologic conditions that closely resemble pre-development conditions;

- Prevent or reduce flooding and erosion by managing the peak discharge and volume of runoff;
- Reduce the amount of suspended solids and other pollutants in order to maintain water quality.
- Montague adopted the 2010 Open Space and Recreation Plan update that included action items to conserve native plants and wildlife habitat, protect rivers and streams, river corridors and their watersheds and maintain scenic landscapes and to safeguard the Montague Plains.
- In 2011 Montague included the Hannegan Brook aquifer recharge area into the water supply protection district in the Zoning Bylaws.

In addition to distributing the 2011 Montague Local Natural Hazards Mitigation Plan to the above entities, the Town will also use the updated plan to prioritize the risk and highlight the benefits of repairing an unstable stretch of Millers Falls Road.

Continued Public Involvement

The Town of Montague is dedicated to continued public involvement in the hazard mitigation planning and review process. During all phases of plan maintenance, the public will have the opportunity to provide feedback. The 2011 Plan will be maintained and available for review on the Town website through 2015. Individuals will have an opportunity to submit comments for the Plan update at any time. Any public meetings of the Committee will be publicized. This will provide the public an opportunity to express their concerns, opinions, or ideas about any updates/changes that are proposed to the Plan.

APPENDIX

Appendix 1: Zoning Bylaws and Subdivision Regulations

ZONING BYLAWS

Section 5.2.9 Floodplain Zoning Bylaw

Montague's Zoning Bylaw establishes a Floodplain District as an overlay district. Permitted uses in underlying districts are allowed provided that they meet the requirements of the overlay district as well as those of the Massachusetts State Building Code dealing with construction in floodplains. Specifically, the bylaw imposes the following requirements:

Within Zone A, where the base flood elevation is not provided on the (FEMA) Flood Insurance Rate Maps, the applicant shall obtain any existing base flood elevation data and it shall be reviewed by the Building Commissioner for its reasonable utilization toward meeting the elevation or floodproofing requirements, as appropriate, of the state building code.

In the Floodway, designated on the (FEMA) Flood Boundary and Floodway Map, the following provisions shall apply:

All encroachments, including fill, new construction, substantial improvements to existing structures, and other development are prohibited unless certification by a registered professional engineer or architect is provided by the applicant demonstrating that such encroachment shall not result in any increase in flood levels during the occurrence of the 100-year flood.

Any encroachment meeting the above standard shall comply with the floodplain requirements of the state building code.

Section 5.4.1 Minimum Lot Size

The area of Montague east of Route 63, which is approximately 45 percent of the Town's land base, is characterized by rocky soils, steep slopes and dense forest. As previously noted, much of this land is in public ownership and protected from development. The zoning in most of this area requires four (4) acres for the construction of a single-family home, further limiting development in the watershed to the Sawmill River and several smaller perennial streams, including Lyons Brook, Hannegan Brook, Goddard Brook, Spaulding Brook, Chestnut Hill Brook and Williams Brook. Minimum lot sizes in other areas of Montague range from 10,000 square feet in the village centers of Turners Falls, Millers Falls and Montague City, 22,500 square feet in most residential and agricultural areas, 1 acre along Route 63 and in the Water Supply Protection District, and 2 acres in the Taylor Hill section of Montague Center.

Section 8 Environmental Impact and Site Plan Review

The purpose of Environmental Impact and Site Plan Review is “to provide detailed review of certain uses and structures which have a potential for significant impact on the character and infrastructure of the Town, thereby affecting the public health, safety and general welfare. The Environmental Impact and Site Plan Review is intended to promote and protect the natural, environmental, scenic and aesthetic qualities of the Town of Montague.” Factors for evaluation of the Impact Statement (8.3.2) and Site Plan (8.4.2) include assurance of “Preservation of the flow and quality of surface and ground waters, provision of adequate surface water drainage and consideration of the degree to which water is recycled into the ground,” directly addresses the impacts of uncontrolled surface water runoff and sedimentation of streams and surface water bodies by requiring temporary and permanent erosion control measures.

Section 7.2 Earth Removal Regulations

The Montague Zoning Bylaws regulates the removal of topsoil, borrow, rock, sod, loam, peat, humus, clay, sand, or gravel from any premise, except when the amount is less than 50 cubic yards within a twelve month period, or is allowed under a currently valid building permit or agreements governing road construction in an approved subdivision, or is part of routine farming operations. A Special Permit is required for earth removal that does not fall under these exceptions. Conditions for permit approval that may mitigate the potential for a landslide include the following provisions:

- The application shall be accompanied by a plan showing all manmade features, property lines, ...topography at 5 foot contour interval of the site and all land within 100 feet of the area from which the above material is to be removed, together with the grades below which finish surface will not lie, and the proposed cover vegetation and trees. If involving more than five (5) acres and/or 10,000 cubic yards of removal, the plan shall be prepared by a Registered Land Surveyor or Engineer.
- A performance bond in the amount determined by the Board of Appeals shall be posted in the name of the Town assuring satisfactory performance in the fulfillment of the requirements of the permit.
- Before granting a permit, the Board of Appeals shall give due consideration to the location of the proposed earth removal, to the general character of the neighborhood surrounding such location, to the protection of water supply, to the general safety of the public on the public ways in the vicinity, and to the recommendation of the Conservation Commission.
- In the Water Supply Protection District, excavation for removal of earth, sand, gravel and other soils shall not extend closer than six (6) feet above the mean maximum ground water table for the site.
- Provision shall be made for safe drainage of water, and for prevention of wind and water erosion carrying material onto adjoining properties.

Following the earth removal, the site must be restored as follows:

- All land shall be so graded that no slope exceeds one (1) foot vertical rise in three (3) feet horizontal distance and shall be so graded as to provide safety for drainage without erosion.
- All boulders larger than one-half cubic yard shall be removed or buried, and all tree stumps removed.
- The entire area excepting exposed ledge rock shall be covered with not less than four (4) inches of topsoil, which shall be planted with perennial cover vegetation adequate to prevent soil erosion.

Section 9 Water Supply Protection District

The purpose of Section 9 of the Montague Zoning Bylaws is to “protect the public health, safety and welfare by preventing the contamination of surface water and ground water resources providing present and significant potential public water supplies for the Town of Montague...” The Water Supply Protection district is an overlay district that encompasses sections of the 100-year floodplain for the Sawmill River. In January 2011, Town Meeting voted to include the Delineated Zone II Recharge area surrounding a new well next to Lake Pleasant, excluding Millers Falls village center, in Montague’s Water Supply Protection District.⁷⁶ The following uses are prohibited in the Water Supply Protection District:

- Business and industrial uses, not agricultural, which manufacture, use, process, store or dispose of hazardous waste or materials as a principal activity or in amounts exceeding the minimum threshold amount require compliance with Massachusetts Department of Environmental Protection Hazardous Waste Regulation 310 CMR 30. These uses include, but are not limited to:
 - dry cleaning
 - metal plating, finishing or polishing
 - chemical or bacteriological manufacturing
 - electronic circuit assembly
 - photographic processing
 - wood preserving
 - furniture stripping
 - printing
 - auto body repair
 - machine shops
- Business and industrial uses, not agricultural, which involve the on-site disposal of hazardous waste from operations
- Motor vehicle gasoline sales
- Commercial and self-service laundries, unless connected to municipal sewer lines.
- Sanitary landfills, dumps, septage lagoons, wastewater treatment facilities for municipal or industrial wastes, junk and salvage yards
- Disposal of liquid or leachable wastes, except for (1) residential subsurface waste disposal systems, (2) normal agricultural operations; and (3) business or industrial uses which

⁷⁶ Montague Planning Department, personal communication.
Town of Montague Local Natural Hazard Mitigation Plan
 June 2011 **FINAL DRAFT**

involve the on-site disposal of wastes from personal hygiene and food preparation for patrons and employees

- Underground storage of oil, gasoline, or other petroleum products excluding liquefied petroleum gas. Underground storage of any other hazardous materials.
- Outdoor storage of salt, de-icing materials, pesticides or herbicides
- Disposal of snow from outside the Water Supply Protection District
- The use of septic system cleaners.

The following uses require a Special Permit in the district:

- The rendering impervious of more than 20% of the area of any single lot
- Any use retaining less than 50% of the lot area, regardless of size, in its natural vegetative state with no more than minor removal of existing trees and vegetation
- Trucking or bus terminals
- Commercial car and other motor vehicle washes
- Commercial motor vehicle, airplane or boat repair.

The bylaw also includes special permit standards designed to protect groundwater supplies. While the existence of this Bylaw, in and of itself, would not prevent hazardous materials accidents, it could potentially minimize the possibility of such accidents occurring in an area containing a drinking water source.

SUBDIVISION RULES AND REGULATIONS

- Section 3.4.2, Definitive Plan Submission Requirements, states that applicants must:
 - Identify existing water courses
 - Indicate all areas believed to be subject to the Massachusetts Wetlands Protection Act, Section 40 of M.G.L., Chapter 131,
 - Identify the applicable zoning district, and
 - Prepare an Erosion Control Plan, indicating the erosion control measures to be employed, including description of locations of temporary stockpiles, spoil areas, temporary drainage systems, slope stabilization techniques, sediment basins, etc., and narrative description of how erosion from individual lots onto streets and into drainage systems is proposed to be controlled.

- Section 3.4.4 Wetland Protection Act states:

In accordance with Chapter 131 Section 40 of the General Laws, no person shall remove, fill, dredge or alter any bank...marsh, meadow or swamp bordering on any existing creek, river, stream, pond, lake or any land under said waters or subject to flooding without filing a written Notice of Intent to perform said work with the local Conservation Commission and State Departments of Natural Resources and Public Works.

In order to determine if the proposed subdivision or parts thereof, are subject to the provisions of the Wetlands Protection Act, the Planning Board will, where it deems

necessary, submit a copy of the Definitive Plan to the Conservation Commission. The Conservation Commission shall, to the extent practicable, file a report with the Planning Board not later than forty-five (45) days after receipt of the plan stating that the proposed plans (1) are not subject to the provisions of the Wetlands Protection Act, or (2) the Wetlands Protection Act applies to certain designated areas. In the event the plan shall be governed by said Act, the Planning Board shall include in its decision for approval a condition that the applicant shall obtain approval from the Conservation Commission prior to any construction activity in the affected areas.

- Section 3.4.5 – Environmental Impact Statement requires the applicant to:
 - Describe location, extent and type of existing water and wetlands, including existing surface drainage characteristics, both within and adjacent to the project
 - Describe the methods to be used during construction to control erosion and sedimentation; i.e., use of sediment basins and type of mulching, matting or temporary vegetation; describe approximate size and location of land to be cleared at any given time and length of time and exposure; covering of soil stockpiles; and other control methods use. Evaluate effectiveness of proposed methods on the site and on the surrounding areas.
 - Describe the temporary and permanent methods to be used to control erosion and sedimentation. Include description of Any areas subject to flooding or ponding; proposed surface drainage system; proposed land grading and permanent vegetative cover; methods to be used to protect existing vegetation; the relationship of the development to the topography; any proposed alterations of wetlands as defined in Ch. 131, Sec. 40 M.G.L.; any existing or proposed flood control or wetland easements; estimated increase of peak runoff caused by altered surface conditions, and methods to be used to return water to the soils.
- Section 4.1.3 Design Guidelines requires subdivision designs to reduce
 - Volume of cut and fill
 - Area over which existing vegetation will be disturbed, especially if within 200 feet of a river, pond, or stream, or having a slope of more than 15%;
 - Number of mature trees removed;
 - Extent of waterway altered or relocated;
 - Erosion and siltation; and
 - Flood damage.
- Section 4.2 Open Space, Section 4.3 Protection of Natural Features, and Section 4.4 Easements contain design requirements that can reduce the potential for flooding. However, the prevention of flooding is not explicitly stated as a purpose for these requirements.

Appendix 2: Montague Board of Selectmen Approval Memorandum

DRAFT

Appendix 3: Meeting Minutes, Sign-In Sheets, and Correspondence

MEMA Natural Hazards Mitigation Montague Project Tuesday, March 29, 2011 Meeting

Attendance:

| Name | Email | Position/Affiliation |
|------------------|--|---|
| Michael Nelson | michaelnelsonmba@aol.com | Chair, Montague Board of Health |
| Steve Roberto | S.Roberto@gmrtd.org | Gill-Montague Regional School District |
| Tom Bergeron | HwySupt@Montague-MA.gov | Montague Department of Public Works |
| Mike Brown | | Turners Falls Water Department |
| Barbara Fish RN | bfurse@yahoo.com | School Nurse Turners Fall High School and Great Falls Middle School |
| Robert Escott | tf23@comcast.net | Montague Emergency Management Director |
| John Greene | jgreene@smith.edu | Montague Center Fire Department |
| Raymond Godin | Ray.Godin@verizon.net | Turners Falls Fire Department |
| Walter Ramsey | Planner@Montague-MA.gov | Montague Town Planner |
| Alyssa Larose | alarose@frcog.org | Franklin Regional Council of Governments |
| Kimberly MacPhee | natres@frcog.org | Franklin Regional Council of Governments |

Introductions by Walter Ramsey

Review by Kimberly MacPhee:

- Reviewed timeline and expectations for remaining project timeline
- 2004 plans expired in June 2010
- Approved plan by MEMA/FEMA = grant eligibility
- MEMA wants more public involvement
- Expectation that committee will have to meet 1 or 2 times without FRCOG attendance due to budget
- MEMA wants to see tangible action items and projects
- FRCOG has hired an engineering consultant for hazard mitigation projects – Montague has a project that is currently being analyzed by the consultant. Plan needs to be updated in time for funding application.

Hazard Identification and Profile Section Review by Alyssa LaRose:

- Specific recollections and details captured in updated plan but not detailed in minutes
- Past flooding events
 - Committee members identified areas on the map where flooding has been an issue.
 - Annual flooding in between Montague City Road and the power canal. This is caused by beaver activity and seepage from the canal. During heavy rains high ground water seeps up through basements.
 - West Chestnut Hill loop – beavers. This has been addressed and is being drained.
 - Across from Judd Wire –drainage issue, will be fixing soon.
 - Tech School experienced major flooding due to runoff from the airport about fifteen years ago. This occurs when the ground is still frozen and there is significant rain or snow melt. Water needed to be pumped away from buildings. Since then have put in more drainage at airport. This is more of a Tech School property issue. Drainage to Connecticut River could cause erosion of a bank where cultural artifacts might be located.

- Meadow Road near Sunderland town line. Twenty five years ago town built up the bank of the Connecticut to avoid losing the road from erosion caused by flooding of the river. A concrete basin near the site gets plugged up by beavers on occasion.
- About 2 years ago a dry well failed at the Hillcrest School and caused flooding in the parking lot and 12-18 inches in the heating tunnels. The school experiences this type of flooding about every 5 – 10 years, though this was the worst reported so far. There is no drainage except for dry wells in this area.
- Winter storm events
 - Snow load this year was a huge burden on structures – at least 2 barn roofs collapsed.
 - In 2009 (?) a winter storm caused power outages in Millers Falls and Montague Center for up to 3 days in some areas. A shelter was opened.
- Tornados and Microbursts
 - 2006 Wendell tornado impacted Wendell Road in Montague. Work had to be done to clear the road of fallen trees.
 - During the May 2010 wind storm, a microburst downed approximately 50 trees behind the public safety complex. Parts of town were out of power for 3-4 days. It took a massive amount of work to clear the roads in town – took 3 weeks to clean up. A shelter was opened. Cost of the cleanup was submitted to Town Hall, DPW clerk would have this information.
- Wildfire and Brushfires
 - It was noted that the brushfire numbers from the MA Fire Incident Reporting System seemed low. This is likely because fires under a quarter acre are not reported.
 - The Montague Plains was identified as an area in town prone to wildfire and brushfires.
- Dam Failure
 - Evacuating the Farren Care Center is a concern in the event of a dam failure on the Deerfield or Connecticut Rivers. The population is immobile and the places they have identified to evacuate to are full. Western MA EMS has been working on evacuation plans for the facility and would have more information.
 - Evacuation routes – would lose Montague City Road.
 - High School is the only functional shelter in town. The Town has plans for getting a generator for the Sheffield School. The Tech School would be willing to be a shelter, but the Town needs a Memorandum of Agreement.
 - The town is lacking shelter supplies – have been working regionally but regional supplies would be in high demand for a major dam failure or other regional event.
 - Notification – town does not have Reverse 911, relies on local media and going door to door to notify residents.
 - Dam inspection report is pending for the dam owned by the water department. It has been inspected every five years. The other “dam” identified on the map that is owned by the water dept. are actually two water storage tanks.
- Earthquakes
 - Turners Falls is built on ledge, could be significantly damaged from a large earthquake.
- Landslides
 - Meadow Road – erosion into Connecticut River
 - Millers Falls Road project.
- Ice jam events
 - Sawmill River, South Street bridge. Ice jam every year. DPW has to go in and clear out debris once ice melts. Causes flooding of nearby field and culvert. Gravel comes down and settles in river. Goddard Brook floods the access to the well houses at least once a year due to the Sawmill

backing up. An ice jam often occurs at Center Street bridge as well. The Sawmill River 604b report might have recommendations that could help mitigate this.

- Manmade hazards
 - Committee noted that the New England Central line is now carrying major ethanol shipments.
 - It was also noted that train cars carrying hazardous materials are no longer candy striped for identification.

Completion of the All Hazards Vulnerability Assessment

Next Steps:

- Alyssa will incorporate feedback from today's meeting into the draft plan and send it to Walter, along with a memo highlighting where additional information is needed from the committee. The committee will review the draft and send updates to Walter.

DRAFT

**MEMA Natural Hazards Mitigation
Montague Project
Thursday, May 19, 2011 Meeting**

Attendance:

| Name | Email | Position/Affiliation |
|-----------------|--|--|
| Tom Bergeron | HwySupt@Montague-MA.gov | Montague Department of Public Works |
| Mike Brown | turnerswater@yahoo.com | Turners Falls Water Department |
| Robert Escott | tf23@comcast.net | Montague Emergency Management Director |
| David Galbraith | dgalbr@sphs.com | Farren Care |
| Chuck Momnie | cmomnie@gdfsuezna.com | Northfield Mountain |
| Rachel Roy | Racheljroy@comcast.net | Montague resident |
| Walter Ramsey | Planner@Montague-MA.gov | Montague Town Planner |
| Ray Zukowski | RZukowski@Montague.net | Chief of Police |
| Alyssa Larose | alarose@frcog.org | Franklin Regional Council of Governments |

Introductions by Walter Ramsey

Review of committee memo and changes since last meeting by committee and Alyssa Larose:

- Missing damage figures for past flooding events: it was noted that the NFIP should have damage figures for past flood events. Walter has emailed Steve Roberto about the Hillcrest school flood. Alyssa will follow up with the Tech school facilities manager about their flood.
- Severe winter storms: additional information was provided about a shelter being opened during the February 2010 winter storm. Walter will check with the building inspector to find out how many barn roofs collapsed over the past winter.
- Microbursts – the Dry Hill microburst in the 1990s caused significant damages. The DPW provided figures for costs incurred during the May 2010 wind storm. It was noted that the state came and knocked down trees behind the safety complex after the microburst there, but that more clean up was needed.
- The committee decided that only Montague and surrounding towns should be included in table 3-4 brushfires, instead of all of Franklin County.
- The Farren Care Center is part of an agreement with 270 other nursing homes in the state to take patients during emergencies. The facility needs a stopping point, however, to shelter patients until they can be moved to other nursing homes. The Tech School has agreed to shelter the patients. A formal agreement should be executed between the two organizations.
- The committee decided it was fine to list hazardous facilities from the CEM plan in the Natural Hazard Mitigation Plan.
- The committee reviewed the results of the All Hazards Vulnerability Assessment that was completed at the previous meeting. It was determined that some of the results were not consistent with the level of risk they pose to the community. New ratings were given to microbursts, tornados, earthquake, severe winter storms, wildfire/brushfire, and floods.
- There was a question as to whether 2010 income data could be used for the environmental justice population section. Alyssa will check to see if this is available from the 2010 census.

Review of draft action plan by committee and Alyssa Larose:

- New action items to be added:
 - Form a volunteer hazard mitigation committee to help implement the plan.
 - Develop a formal system for reporting and recording damages and costs to the town from hazard events.
 - Animal shelter planning
 - Collaborate with regional sheltering initiative.

- Encourage business owners to develop a continuity of business plan.
 - Encourage homeowners and business owners to trim trees around power lines.
- The committee decided to remove action items dealing with the zoning bylaws and building code.

Next Steps:

- It was decided that the committee would meet without FRCOG staff to finish reviewing the plan, and will send comments and feedback to Alyssa who will compile the final plan for the committee to vote on.

DRAFT

[insert sign in sheet from first meeting]

DRAFT

[insert sign in sheet from 2nd meeting]

DRAFT

Press release sent to the Greenfield Recorder and the Montague Reporter before the first committee meeting.

Montague Hazard Mitigation Plan Update Underway

The Montague Hazard Mitigation Local Planning Committee is currently updating the Hazard Mitigation Plan for Montague, in partnership with the Franklin Regional Council of Governments (FRCOG) Planning Department. Funding for the update is being provided through a grant from the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency (FEMA).

Once the updated Plan is adopted by the Town and approved by FEMA, the Town will be eligible for state and federal grant monies to fund pre- and post-disaster mitigation projects to reduce the impact of future natural and man-made disasters. These funds are co-administered on behalf of FEMA by MEMA and the Department of Conservation and Recreation (DCR). The Plan can also help communities obtain credit in the form of reduced flood insurance premiums for policy holders under the National Flood Insurance Program (NFIP) Community Rating System, or CRS.

The purpose of this Hazard Mitigation Plan update is to identify natural and other hazards that may impact the community, such as floods, winter storms, and spills of hazardous substances; conduct a risk assessment to identify the hazards that mitigation efforts are most needed for; inventory and assess current Town hazard mitigation policies, programs, and regulations; and identify action steps to prevent damage to property and loss of life.

The Montague Hazard Mitigation Local Planning Committee will be meeting twice with FRCOG staff during this process and several other times, as needed, to compile the new and updated information for the Plan. The first meeting is scheduled for March 29, 2011 at 11 a.m. in the Montague Public Safety Complex community meeting room, 180 Turnpike Road, Turners Falls, MA 01376. All meetings of the Committee are open to the public; meeting notices and agendas can be found on-line at <http://www.montague.net/Pages/index> and at the Town Hall located at 1 Avenue A, Montague, MA 01376. The draft plan is expected to be ready for public review in May 2011, and will be made available on the Town website, as well as at the Town Hall and at all three town libraries.

Montague residents are encouraged to share their experience with prior hazard events and their suggestions for mitigation projects that could be undertaken to minimize future damage to property and loss of life. To find out more about this project and how you can become involved, please contact Walter Ramsey, Montague Town Planner, at (413) 863-3200 Ext. 207 or planner@montague-ma.gov, or Alyssa Larose, Land Use Planner, Franklin Regional Council of Governments, at (413) 774-1194 x120 or alarose@frcog.org.

Press release sent to the Greenfield Recorder and Montague Reporter before second committee meeting.

Final Meeting Scheduled for Montague's Local Hazard Mitigation Plan Update

The Montague Hazard Mitigation Local Planning Committee, in partnership with the Franklin Regional Council of Governments (FRCOG) Planning Department, has updated the Montague Natural Hazard Mitigation Plan. The Committee will meet on Thursday, May 19, from 11 a.m. to 1 p.m., in the community meeting room at the Montague Public Safety Complex, 180 Turners Falls Road, to review the final draft of the plan. The meeting is open to the public; meeting notices and agendas can be found on-line at <http://www.montague.net/Pages/index> and at the Montague Town Hall. A two-week public comment period will follow the meeting, during which time the plan will be posted on the Town's website for public review. A hardcopy will also be available at the Town Hall.

Funding for the update has been provided through a grant from the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency (FEMA). After the public comment period, the plan will be submitted to FEMA for approval.

Once the updated Plan is adopted by the Town and approved by FEMA, the Town will be eligible for state and federal grant monies to fund pre- and post-disaster mitigation projects to reduce the impact of future natural and man-made disasters. These funds are co-administered on behalf of FEMA by MEMA and the Department of Conservation and Recreation (DCR). The Plan can also help communities obtain credit in the form of reduced flood insurance premiums for policy holders under the National Flood Insurance Program (NFIP) Community Rating System, or CRS.

The update of the hazard mitigation plan included identifying natural hazards that may impact the community, such as floods, winter storms, and hazardous substance spills; conducting a risk assessment to identify infrastructure at the highest risk for being damaged by hazards; inventorying and assessing current Town hazard mitigation policies, programs, and regulations; and identifying action steps to prevent damage to property and loss of life. The planning process also provided opportunities for public comment and included the review and incorporation of existing relevant documentation.

For additional information, please contact Walter Ramsey, Montague Town Planner, at (413) 863-3200 Ext. 207 or planner@montague-ma.gov, or Alyssa Larose, Land Use Planner, Franklin Regional Council of Governments, at (413) 774-1194 x120 or alarose@frcog.org.

Montague Local Natural Hazard Mitigation Plan – 1st Memo to Committee

April 2011

Please review the plan and provide information on any of the following items that you can. **The items are highlighted in yellow within the text of the draft plan.** Items highlighted in blue are for FRCOG staff to follow up on.

Section 3: Risk Assessment

Page 17, Table 3-2: Flooding Events in Montague Since 1993

- Provide damage figures for flooding at the Tech School and Hillcrest School, if available.

Page 22:

- Provide damage figures/cost of clean up for the May 2010 wind storm and microburst, if available.

Page 24:

- Provide more accurate count of brushfires if available.

Page 37: Manmade Hazards

- Is the committee comfortable with listing hazardous facilities from the Comprehensive Emergency Management Plan in the Natural Hazard Mitigation Plan?

Pages 15 – 38:

- Provide information on potential mitigation projects for any of the hazards.

Page 41-43: All Hazards Vulnerability Assessment

- Review the results of the assessment and make any comments – were these the results you expected? Etc.

Page 46: Table 3-18 Total Building Value in Floodplain

- Are there additional significant structures located in the floodplain that would be worth collecting assessment information on?

Page 44 – 72: Vulnerability Assessment

- Include any data deficiencies that exist for each hazard, which, if resolved, would help determine Montague's vulnerability to the hazard.

Page 72-74: Development Trends Analysis

- This is a completely new section since the last plan. Please review and make comments where changes are needed.

Section 4: Mitigation Strategy

- Review the mitigation measures and “2004 Needed Changes” column in all tables. Fill in the “Accomplished/Still Relevant?” and “2011 Potential Changes” columns.

Page 101-102:

- Are controlled burns still being conducted on the Montague Plains? Have additional mitigation strategies or public outreach been done since 2004?
- Are the fire prevention and fire safety educational programs still ongoing? Have workshops been conducted at the senior center and public housing?

Pages 125-132:

- Review action items, responsible departments, and proposed completion dates and update as needed.
- Add any new action items.
- Note: Any completed action items will be moved to the “2005 Action Items Completed” section on page 123.

Section 5: Plan Adoption and Maintenance

Page 137:

- Was the previous Hazard Mitigation Plan incorporated into other planning mechanisms? If yes, please describe.
- List ways that the Hazard Mitigation Plan can be incorporated into existing planning mechanisms and future plans

DRAFT

Montague Local Natural Hazard Mitigation Plan – 2nd Memo to Committee

May 2011

Please review the plan and provide information on any of the following items that you can. **The items are highlighted in yellow within the text of the draft plan.** Items highlighted in blue are for FRCOG staff to follow up on.

SECTION 3: RISK ASSESSMENT

Page 17, Table 3-2: Flooding Events in Montague Since 1993

- Provide damage figures for flooding at the Tech School and Hillcrest School, if available.
 - Update: Walter contacted the facility manager at the Hillcrest School. Alyssa contacted facility manager at Tech School on 5/23, waiting for reply.

Page 21:

- Provide damage figures/costs for the February 2010 winter storm if available.
- Walter is confirming number of barn roof collapses in 2010/2011 with Building Inspector.

Page 23:

- Provide details about the 2009 Dry Hill microburst, including damage/cost estimates if available.
- Provide damage figures/cost of clean up for the May 2010 wind storm and microburst, if available.
 - Update: The DPW provided info on their costs for the storm - \$4,623.

Page 24:

- Provide more accurate count of brushfires if available. Specify what years the information provided are for.

Page 30-31:

- Review the paragraph on dams in Montague. Update as necessary.
 - Update: There was a problem obtaining data from the disc provided by the TF Water Dept. on the Lake Pleasant Dam inspection. Please add any details about the results of the inspection – condition of the dam etc.

Page 46: Table 3-18 Total Building Value in Floodplain

- Are there additional significant structures located in the floodplain that would be worth collecting assessment information on? For example: Strathmore; Southworth Paper; RR Salvage; Town Hall and Recreation Building?

SECTION 4: MITIGATION STRATEGY

Tables:

- Review the mitigation measures and “2004 Needed Changes” column in all tables. Fill in the “Accomplished/Still Relevant?” and “2011 Potential Changes” columns.

Page 106:

- Are the fire prevention and fire safety educational programs still ongoing? Have workshops been conducted at the senior center and public housing?
 - Update: Have received info from Montague Center Fire Dept.

ACTION PLAN

Pages 129-134:

- Review action items and associated columns and update as needed.
- Add any new action items.

- Note: Any completed action items will be moved to the “2004 Action Items Completed” section on page 126.

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Montague Local Natural Hazard Mitigation Plan – 3rd Memo to Committee

May 2011

Please review the plan and provide information on any of the following items that you can. **The items are highlighted in yellow within the text of the draft plan.** Items highlighted in blue are for FRCOG staff to follow up on.

SECTION 3: RISK ASSESSMENT

Page 17, Table 3-2: Flooding Events in Montague Since 1993

- Provide damage figures for flooding at the Tech School and Hillcrest School, if available.
 - Update: Walter contacted the facility manager at the Hillcrest School. Alyssa contacted facility manager at Tech School on 5/23, waiting for reply.

Page 21:

- Provide damage figures/costs for the February 2010 winter storm if available.
- Walter is confirming number of barn roof collapses in 2010/2011 with Building Inspector.

Page 23:

- Provide details about the 2009 Dry Hill microburst, including damage/cost estimates if available.
- Provide damage figures/cost of clean up for the May 2010 wind storm and microburst, if available.
 - Update: The DPW provided info on their costs for the storm - \$4,623.

Page 24:

- Provide more accurate count of brushfires if available. Specify what years the information provided are for.

Page 30-31:

- Review the paragraph on dams in Montague. Update as necessary.
 - Update: There was a problem obtaining data from the disc provided by the TF Water Dept. on the Lake Pleasant Dam inspection. Please add any details about the results of the inspection – condition of the dam etc.

Page 46: Table 3-18 Total Building Value in Floodplain

- Are there additional significant structures located in the floodplain that would be worth collecting assessment information on? For example: Strathmore; Southworth Paper; RR Salvage; Town Hall and Recreation Building?

SECTION 4: MITIGATION STRATEGY

Tables:

- Review the mitigation measures and “2004 Needed Changes” column in all tables. Fill in the “Accomplished/Still Relevant?” and “2011 Potential Changes” columns.

Page 106:

- Are the fire prevention and fire safety educational programs still ongoing? Have workshops been conducted at the senior center and public housing?
 - Update: Have received info from Montague Center Fire Dept.

ACTION PLAN

Pages 129-134:

- Review action items and associated columns and update as needed.
- Add any new action items.

- Note: Any completed action items will be moved to the “2004 Action Items Completed” section on page 126.

CRITICAL FACILITIES AND INFRASTRUCTURE MAP

- Please review and make changes/comments
 - Update: Walter has a hardcopy of the most recent map.

DRAFT