DRAFT

TOWN OF ORANGE
LOCAL MULTI-HAZARD MITIGATION PLAN

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Town of Orange
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TABLE OF CONTENTS

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 natural disasters. Mitigation efforts undertaken by communities will help minimize damages 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 Orange 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 reduced if a community implements the mitigation measures detailed in the Plan. Many disaster assistance agencies and programs, including FEMA, require that a community have adopted 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 Orange included the following tasks:

- Review of the Orange 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.

- 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, and wetlands;
    - Implementing recommendations in planning documents including Stormwater Management Plans, Master Plans, Open Space and Recreation Plans and 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.

- 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 infrastructure from natural hazards.

- Adopting and implementing the final Natural Hazards Mitigation Plan.

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

- Providing an opportunity for the public to comment on the plan during the drafting and prior to the approval of the plan. Publicity was done with a press release in the Greenfield Recorder and the Athol Daily News as well as through flyers posted in town throughout the planning process. A copy of the draft plan was available to the public at the Town Hall. Two Public Meetings were held – one on April 6, 2011 and November 17, 2011.

- Providing 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.

- Reviewing and incorporating, if appropriate, existing plans, studies, reports and technical information. Plans reviewed and incorporated include the 2010 Orange Comprehensive Emergency Management Plan, the 2008 Orange Open Space and Recreation Plan, the 2008 Orange Heritage Landscape Inventory Reconnaissance Report, 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 Orange Multi-Hazard Mitigation Planning Committee, which includes representatives of the Fire Department, Police Department, Highway Department, Water Department, Sanitation Department, Board of Health, Planning Board, and the Town Administrator. 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 12-13

- **Section 3: Risk Assessment**
  - Natural Hazard Identification and Profile
    - Drought and Extreme Temperatures added 14
    - Location and Extent for Each Hazard added 15-50
    - Beaver Dams (Sub-Category of Dam Failure) added 37-38
    - Landslides added..... 43-44
    - Ice Jams added 44-46
    - Manmade Hazards added 46-50
  - Risk Assessment Methodology
    - All Hazards Risk Assessment Methodology expanded 51-54
    - TABLE 3-20: All Hazards Vulnerability Assessment Table added 55
  - Vulnerability Assessment
    - Environmental Justice section added.....56-59
    - Assessment by Hazard – detailed section for each hazard added
      - Exposure 59-85
      - Damages..... 59-85

2 – LOCAL PROFILE

Community Setting

The Town of Orange is located in the north central portion of Massachusetts, in eastern Franklin County. The town contains both rural and urban landscapes, and has the third highest population in the county, with an estimated 7,839 residents in 2010.[1] Orange is a regional employment center for surrounding communities.

European settlement of the town began in the mid 1700s. Farming dominated the town's economy until the early 1800s, although the power of the Millers River was used for mill operations after its damming in 1790. By early 1800s, a shift from agriculture to manufacturing had begun, which would transform the town socially, economically and physically. Orange saw many new industries spring up along the Millers River, including the manufacturing of furniture, sewing machines, palm-leaf hats and shoes.

During the last half of the 19th century, Orange's population grew significantly, primarily due to the expansion of local industries. Orange Center became the hub of economic and civic activity with a primary industrial corridor along the Millers River Railroad line. Throughout the 20th century and into this century, the Town of Orange has been known for its various manufacturing businesses, contributing to its reputation as a regional employment center in the greater Franklin County area.

According to the 2005 land use data provided by MassGIS, the total land area of the Town of Orange is approximately 23,029 acres with 9% or 2,153 of those acres developed as either residential, commercial, industrial, or public/institutional uses. Forest land comprises the largest category (72% of all land in town) with 16,688 acres. Forested and non-forested wetlands make up 6% of the total land area with 1,318 acres, followed by cropland and pasture, which make up 5% of all land in town with 1,222 acres. Other categories make up the remaining 8% of land use.

Waterpower, manufacturing, the railroad, and Route 2, all have influenced the development and growth of the Town of Orange. The Town developed from a sparsely populated agricultural community with its civic center in the northern highlands to a red brick downtown based on manufacturing powered by the river with transportation access provided by the railroad. This resulted in small lot housing to the north of the Main Streets, suburban neighborhoods to the south, and large lot single family residential uses along all the main roads. Like many communities across New England, Orange's pattern of development over the past one hundred and fifty-years has been one of attraction to and exodus from the Town Center. People were attracted away from farming in the highlands to manufacturing in the village center. Much later this was followed by an exodus of residents from the failing manufacturing centers to the ample open spaces of rural residential districts by way of suburban subdivisions and large lot single family development along the Town's scenic roadways.[2]

[1] 2010 U.S. Census.
[2] Orange Open Space and Recreation Plan, 2008.

The population of Orange is estimated to have grown by 321 people or 4.3% between 2000 and 2010, from 7,518 to 7,839. According to the 2000 U.S. Census, there are a total of 3,303 housing units in town, with 2,041 of these built before 1970. The Town has poor traditional economic indicators including high unemployment rates, lower household incomes, and higher poverty rates as compared to other communities in the region. However, Orange's rural and urban nature, improvements being implemented for Route 2, the development of a second industrial park, and the presence of the municipal airport could create job opportunities and as a result, population growth in the future.

Orange has six employers with at least fifty employees each. In 2009, according to Massachusetts Labor and Workforce data[3], there were 1,928 people employed in Orange by 197 employers. Roughly fifty percent of the total employment in Orange is currently provided by the six major employers. Two of the six employers are manufacturing firms, which are more likely to provide full-time jobs. In addition, this group represents a large share of the industrial property that provides tax revenues. By the same token, 185 small businesses provide 50 percent of the employment in town. These businesses provide basic services and commerce for the community and visitors to the area.[4]

Infrastructure

Orange's geography has been a major factor in the development of its infrastructure. The Millers River is the dominant natural feature in the town, and will continue to guide the economy, growth, and commercial opportunities of Orange.

Roads and Highways

The major artery running through Orange is Route 2 which traverses the width of the town. Route 2 connects Orange to nearby towns and urban centers, and offers three exits to enter the town, from Routes 2A, 122 and 202. Route 2A connects the center of Orange with that of Athol. Route 122 is a north/south route which links to Route 202. Route 202 travels south and then west, and is a link to urban centers such as Holyoke. The closest access to I-91, Franklin County's major north/south route, is in Greenfield via Route 2. Route 2 is the major east/west highway in Northern Massachusetts and is currently going through a significant upgrade to improve safety and access for commercial and industrial users. When this project is completed, it could have major implications for land use in Orange. Orange has a total of 127 miles of roads, of which slightly more than 10% or 13.5 miles are gravel.[5]

[3] Employment and Wages (ES-202), MA Department of Workforce Development.
[4] Orange Open Space and Recreation Plan, 2008.
[5] Massachusetts Department of Transportation, 2007.

Rail

The main rail line of Pan Am Systems connects New England to the Midwest, serving Orange-based companies like Rodney Hunt and the Leavitt Machine Company. Passenger rail service can be accessed in Fitchburg in Worcester County.

Aviation

The Orange Regional Airport covers four hundred and eighty (480) acres in the southern portion of town in between the town's two industrial parks. The airport, originally named Orange-Athol Airport, was created in 1929 on the site of an existing private landing site. During World War II the U.S. Civil Aeronautics Administration expanded the airport from what was originally only the front field to its current 480 acres and constructed three 5,000 foot runways to upgrade the airport for military use as an alternate landing site to Westover Air Force Base.

The airport offers several transportation benefits to the local community. The airport provides access to the national air transportation system, and likewise, the airport provides communities and businesses throughout the United States with access to Orange. In fact, the location of an airport is one of the most important considerations in locating a major business. A recent survey conducted by the Dow Jones Company found that local air transportation access is the single most important attribute in selecting a location for corporate headquarters, and research and development facilities.

The airport enhances the well being of the community, maintains environmental resources, supports law enforcement, transports goods and supplies, provides emergency medical transportation, and is used extensively by area businesses. The airport is a valuable economic development resource for the area and is self sufficient.

The airport also provides many recreational opportunities to the community. The front field area is available to the public and is frequently used by local residents for various activities including youth sports, dog walking, kite flying, and picnic lunches. The Jumptown skydiving facility provides thrill seekers with state of the art parachute instruction for the novice as well as the advanced jump enthusiast. Jumptown and the airport both sponsor several events throughout the year which are enjoyed by spectators from near and far.

Although the airport is still utilized largely for recreational purposes, recent trends have changed the airport's role much more toward corporate use. The airport currently has about 38,000 aircraft operations annually and about 60 percent of those operations are non-recreational in nature.[6]

Public Transportation

The Franklin Regional Transit Authority (FRTA) operates fixed route service between Greenfield and Athol with stops in Orange. In Athol, the service connects to the Montachusett Regional Transit Authority with routes to Gardner and an intermodal transportation station in

[6] Orange Open Space and Recreation Plan, 2008.

Fitchburg offering commuter rail service to the Boston area. Demand response door-to-door transit service for seniors and the disabled is also provided by the FRTA.

The Community Transit Service (CTS), which operates out of Athol, is a dial-a-ride transit service available for workers to commute between home and work. It also provides residents with rides around town and from their homes to connection points with the FRTA route.

Public Drinking Water Supply

The Orange Water Department is a community water supply system with 1,837 service connections serving approximately 1,634 residences plus businesses and industries from three groundwater sources (Wells #1, #2, and #3). Private wells serve the remainder of Orange. Well #1 is located on North Pond Brook, Well #2 is located west of Holtshire Road and Well #3 is east of Route 202 in the southeastern portion of town. These ground sources are supported by two, one million gallon storage tanks. The wells had their Zone II and Zone III recharge areas delineated and mapped in 1994. That same year the safe yields were calculated for each well and the entire system's permitted withdrawal volume was established. The permit is for twenty years with reviews of the water withdrawal data occurring every five years by the Department of Environmental Protection. It is expected that the permitted withdrawal volume will increase over time as the community's population and demand for water increases.

Currently the average daily use is approximately 490,000 gallons per day (GPD) or 0.49 million gallons per day (MGD), and the maximum daily use is 646,050 GPD (0.65 MGD). The current registered/permitted daily average withdrawal volume is 960,000 GPD (0.93 MGD). The safe yield of the three wells combined is estimated at 1,717,000 GPD (1.72 MGD), which exceeds current demand under normal operating conditions. The safe yield is the amount of water that can be withdrawn on a continuous basis during an extended dry period without adverse hydrological or ecological impacts. Despite current safe yield estimates, Wells #1 and #2 are aging and inefficient. In addition, Well #1 has poor water quality and neither well is capable of fully backing up Well #3 in the event that Well #3 is unavailable. For those reasons, the Orange Water Department is currently upgrading Well #2 and developing a new source of drinking water elsewhere in town.

Orange Town Officials are considering the long-term protection of both the quantity and quality of the public drinking water supplies. The public water supply wells' Zone II recharge areas are now part of the Town's zoning bylaws and are considered as Water Resource Districts. Within these districts land uses that are commonly associated with the use, production and storage of materials that could contaminate the water within the aquifers are prohibited.

There are also three surface water supplies that are reserved for use as emergency drinking water sources by the Orange Water Department. These include Lake Mattawa , Crystal Spring Reservoir and Vorces Pond. None of these emergency sources is connected to the current distribution system. All would require an on-site package treatment plant for the treatment of water. There are four transient non-community water supply systems in Orange serving three commercial establishments and the Farm School. A non-transient non-community water supply system serves the Gale Brook School.

Water supplies and the reach of their delivery systems could limit growth in the future. A watershed can only supply a certain volume of water before its plants and animals suffer. This is theoretically the basis for having registered withdrawal volumes and for the calculation of safe yield figures. Because drinking water is a finite natural resource that is heavily regulated in Massachusetts, Town Officials should consider use of the water mains as a boundary to new growth in the future. At some point in the future, demand for water could exceed both drinking water and fire protection supplies.

The Quabbin Reservoir, Boston's water supply, is a unique resource which is located southeast of Orange and which could have a significant impact on the availability of water. Quabbin is part of the Chicopee River watershed, some of which is located in Orange, and is a major tributary to the larger Connecticut River. The Millers River is also a major tributary of the Connecticut. As the number of cities and towns with access to the Quabbin Reservoir increase, so does the risk of shortages in supply when periodic droughts occur. The same is true of cities to the south in the Connecticut River watershed – Springfield, Massachusetts and Hartford, Connecticut – which would want to protect flows upstream from rivers like the Millers and Chicopee Rivers. This is an issue that communities such as Orange need to consider and to present to the Commonwealth and the Massachusetts Water Resources Authority as they consider growth and change in the eastern portion of the State.

Sewer Services

The Town's sewer system includes one wastewater treatment plant located off Route 2A along the Millers River and a collection system that dates back to the 1890's. The facility serves a population of approximately 3,500 residents in the area of Orange Center. The remaining parts of Town are served by private septic systems. Orange upgraded the treatment facility in the late 1990's. These improvements included increasing the capacity of the pumps, a new fine bubble aeration system, and upgrades to the return activated sludge controls. The current design capacity of the plant for handling hydraulic flow, which is the water entering the plant, is 1.1 MGD.

The age of the sewer pipes has contributed to problems of infiltration and inflow (I & I). Infiltration is groundwater entering cracked pipes and inflow is storm water getting into the pipes from cracked manholes and other sources. Fixing I & I problems can be an expensive proposition. One main section of pipe was repaired and according to the Chief Operator, Ed Billiel, the wastewater treatment plant has seen a significant reduction in hydraulic flow.

The Town of Orange is in the process of updating the Comprehensive Wastewater Treatment Master Plan, completed in 2000. The updated plan will evaluate the existing conditions of the wastewater treatment facility (WWTF) and wastewater collection system, make recommendations for cost-effective improvements for increasing the system's efficiency over the next twenty years, and look at the potential of expanding the sewer system. Ongoing improvements for the WWTF will include a number of collection system improvements and construction projects, including flow equalization, grit removal, an additional clarifier, and a new aeration and disinfection system.

The public sewer system can impact development in a number of ways. First, where new sewer lines go, development will follow. Sewer infrastructure should be expanded to ensure that new

industrial development occurs away from sensitive natural resources and that new dense residential development is built ideally within existing areas of service. Second, due to Title 5 regulations, Towns may be inclined to rescue residents with problem sewer systems. Expanding sewer to areas with physical and hydrogeologic constraints may open up other areas to future development. Third, expanding sewer lines increases the cost of upkeep and repair to the Town of Orange, particularly with respect to infiltration and inflow problems. In addition, new demand for public sewer service may require further expansion of the wastewater treatment capacity, which can be very expensive.[7]

Natural Resources

Orange's most noteworthy natural features are its forested uplands, farmlands and water resources. The Town of Orange is almost entirely within the Millers River Watershed. The Millers River itself, which flows through Orange Center, generally flows east to west, through the central portion of the town on its way to the Connecticut River. The southwestern portion of town lies within the Swift River Watershed. Large contiguous forested areas in the town can be found in North Orange, West Orange and the Chestnut Hill area. Tully Mountain, in northeastern Orange, is the town's highest point at 1,163 feet.

Water Resources

The Town of Orange has approximately 1,318 acres covered by wetlands, which are fed by nearby brooks and rivers.[8] Wetlands are essential for promoting water quality and biodiversity of both plant and animal species. The town also has a fairly substantial amount of open water within its borders (approximately 586 acres). The rivers and wetlands in Orange are buffered in accordance with the Massachusetts Wetlands Protection Act. The Millers River is supportive of recreational use.

There are a number of other surface water resources in Orange, including Lake Mattawa, Lake Rohunta/Eagleville Pond, and Tully and Packard Ponds, as well a number of rivers and brooks.

Terrain & Topography

The topography of Orange offers unusual hill formations and magnificent local views, as well as low-lying farmland and wetlands. The areas with the least change in elevation occur in the area of the Municipal Airport and in a valley just northeast of Orange Center.
The steeper slopes occur along the upland ridges in the west, northwest, and northern portions of Town.

The Town of Orange as viewed from above is situated in an area of lush forested uplands and rolling hills, all interlaced with diverse water bodies. The terrain is that of the western slope of a basin. The hills to the northwest have a predominantly southeastern aspect, those in the southwest face northeast. And in the middle of this basin the Millers River cuts through the

[7] Orange Open Space and Recreation Plan, 2008.
[8] 2005 MassGIS Land Use Data.

landscape over the more level plains in the east and then dividing the steeper banks of the river in West Orange.

The outstanding and distinctive scenic characteristics of this landscape are best observed by traveling through the different parts of Town. Downtown in Orange Center, on the floodplain of the Millers River, is the heart of the Town's cultural activities as well as the center for most of the community's institutional and economic activities. Today, the
Millers River still links Orange Center to its industrial beginnings. The river, waterfall, and red brick mill buildings create a sense of place in Orange Center.

Traveling north on North Main Street one can view the upland ridges of Far Hill and Beech Hill that demarcate the Town's western boundary. The road takes you over gentle rises towards the wetlands referred to as "The Rookery" which is one of several areas known for bird sightings. Beyond "The Rookery" lies scenic North Orange, the original 18th century settlement, which is home to the few remaining active farms that were first settled in the 1700's. These farms, for the most part, provide only supplementary income to their owners, today, largely from haymaking operations. North Orange also offers views of Tully Mountain, the most pronounced topographical feature in the North Quabbin Region. Views to and from Tully are among the most significant in the area. Nearby, Tully and Packard Ponds (both man-made) are surrounded by a mix of vacation homes and full time residences.

Traveling south from North Orange down Wheeler Avenue one finds an area of gentle hills and streams that are part of the drainage of West Brook. This area has been called "wild" by area residents but parts are also blanketed with crop and pasture land.

A drive south of Orange Center takes one through the glacial outwash plain, known locally as "The Plains," where the Municipal Airport takes advantage of broad, flat terrain. The nearby lakes, Mattawa and Rohunta/Eagleville are both popular fishing and recreation spots. Continuing south, Orange State Forest and Chestnut Hill provide wildlife habitat and hunting grounds.

Cultural and Historic Resources

The importance of integrating cultural resource and historic property considerations into hazard mitigation planning is demonstrated by disasters that have occurred in recent years, such as the Northridge earthquake in California, Hurricane Katrina in New Orleans, or floods in the Midwest. The effects of a disaster can be extensive—from human casualty to property and crop damage to the disruption of governmental, social, and economic activity. Often not measured, however, are the possibly devastating impacts of disasters on historic properties and cultural resources. Historic structures, artwork, monuments, family heirlooms, and historic documents are often irreplaceable, and may be lost forever in a disaster if not considered in the mitigation planning process. The loss of these resources is all the more painful and ironic considering how often residents rely on their presence after a disaster, to reinforce connections with neighbors and the larger community, and to seek comfort in the aftermath of a disaster.[9]

[9] Integrating Historic Property and Cultural Resource Considerations Into Hazard Mitigation Planning, State and Local Mitigation Planning How-To Guide, FEMA 386-6 / May 2005.

Historic properties and cultural resources can be important economic assets, often increasing property values and attracting businesses and tourists to a community. While preservation of historic and cultural assets can require funding, it can also stimulate economic development and revitalization. Hazard mitigation planning can help forecast and plan for the protection of historic properties and cultural 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.

In 2008, Orange residents identified seven heritage landscapes in Town as part of the Massachusetts Heritage Landscape Inventory Program. Heritage landscapes are special places created by human interaction with the natural environment that help define the character of a community and reflect its past. They are dynamic and evolving, reflect the history of a community and provide a sense of place. They show the natural ecology that influenced land use patterns and often have scenic qualities.[10] These resources can be vulnerable for a number of reasons, including damage from natural hazard events. The Heritage Landscapes identified in Orange are North Orange, Tully Village, Hunt Farm, Orange Municipal Airport, Chestnut Hill, downtown industrial areas along the Millers River, and the Town's scenic roads.
Downtown Orange includes the Orange Center Historic District, listed on the National Register of Historic Places and comprised of 120 acres with 37 buildings and 2 objects. Some of the significant historic and cultural buildings located in the downtown include the former New Home Sewing Machine Company buildings along either side of the Millers River, the Putnam Hall building that once housed an opera house, and the Town Hall, with an auditorium known for its superior acoustical design by architect Eldridge Boyden. The auditorium seats 750 and hosts concerts, dances, plays, movies, and other events. Memorial Park is also located in the downtown, and features the Commonwealth's official "Peace Statue". The 12-foot bronze sculpture features a WWI veteran with one arm around a schoolboy with the inscription "It Shall Not Be Again." 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.

The 2010 Orange Comprehensive Emergency Management (CEM) Plan identifies cultural resources in Orange, some of which contain historic documents and cultural artifacts (Table 2-1).

Table 2-1: 2010 Orange CEM Plan Cultural Resources

Resource Name	Resource	Resource Type	Materials
Moore-Leland Library	Athol Road	Library	
Orange Historical Society	41 North Main Street	Historical Building; Historical Landscape; Library; Museum	Archives; Art; Artifacts
Peace Statue – Orange	South Main	Outdoor Sculpture	
Town Hall	6 Prospect Street	Historical Building	Archives

Source: 2010 Orange Comprehensive Emergency Management Plan.

[10] Orange Reconnaissance Report, Massachusetts Heritage Landscape Inventory Program, 2008.

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 Orange. It should be noted that because different sources of data are used for various hazards, the year of most recent information available may vary from one hazard to another. In all cases the most recent information available at the time that data collection began for this update (March 2011) was used. In the case of Tropical Storm Irene, information was added later in the update process due to the significance of the event.

Two hazards, drought and temperature extremes, historically have not been significant hazards for Orange. These hazards are no more likely to occur in Orange than elsewhere in the state. Therefore, drought and extreme temperatures were not covered in detail in this plan, other than a summary of these two hazards, which is presented, below.[11] For more information on these hazards, please refer to the recently updated Massachusetts State Hazard Mitigation Plan (2013).[12]

Drought is a period characterized by long durations of below normal precipitation. Drought conditions occur in virtually all climatic zones yet its characteristics vary significantly from one region to another, since it is relative to the normal precipitation in that region. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life. The Commonwealth of Massachusetts is often considered a 'water-rich' state. Abundant precipitation results from frontal systems or storms that move across the continent and exit through the Northeast. Under normal conditions, regions across the state annually receive between 44 and 47 inches of precipitation.

There is no universal definition for extreme temperatures. The term is relative to the usual weather in the region based on climatic averages. Extreme heat, for this climatic region, is usually defined as a period of 3 or more consecutive days above 90 °F, but more generally a prolonged period of excessively hot weather, which may be accompanied by high humidity. Extreme cold, again, is relative to the normal climatic lows in a region. Temperatures that drop decidedly below normal and wind speeds that increase can cause harmful wind-chill factors. The wind chill is the apparent temperature felt on exposed skin due to the combination of air temperature and wind speed. Massachusetts has four well-defined seasons. The seasons have several defining factors, with temperature one of the most significant. Extreme temperatures can be defined as those that are far outside of the normal ranges for Massachusetts.

[11] Adapted from the 2010 Massachusetts State Hazard Mitigation Plan.
[12] http://www.mass.gov/eopss/agencies/mema/hazard-mitigation/planning/planning-and-the-state-hazard-mitigation-plan.html

FLOODING

General Description

The average annual precipitation for Orange and surrounding areas in north-central Massachusetts is 47 inches. There are three major types of storms that bring precipitation to Orange. 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 can be 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. Orange has also experienced what is known locally as *backwater flooding* due to ice jams on Moss Brook in the western portion of the town.[13] There are several local factors that determine the severity of a flooding event, including: stream and river basin topography, 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 one of the most costly natural hazards 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).

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

[13] According to the state MEMA maps, there were three historic ice jams located on the Moss Brook. They occurred in Feb. 1925, Feb. 1970 and March 1972.

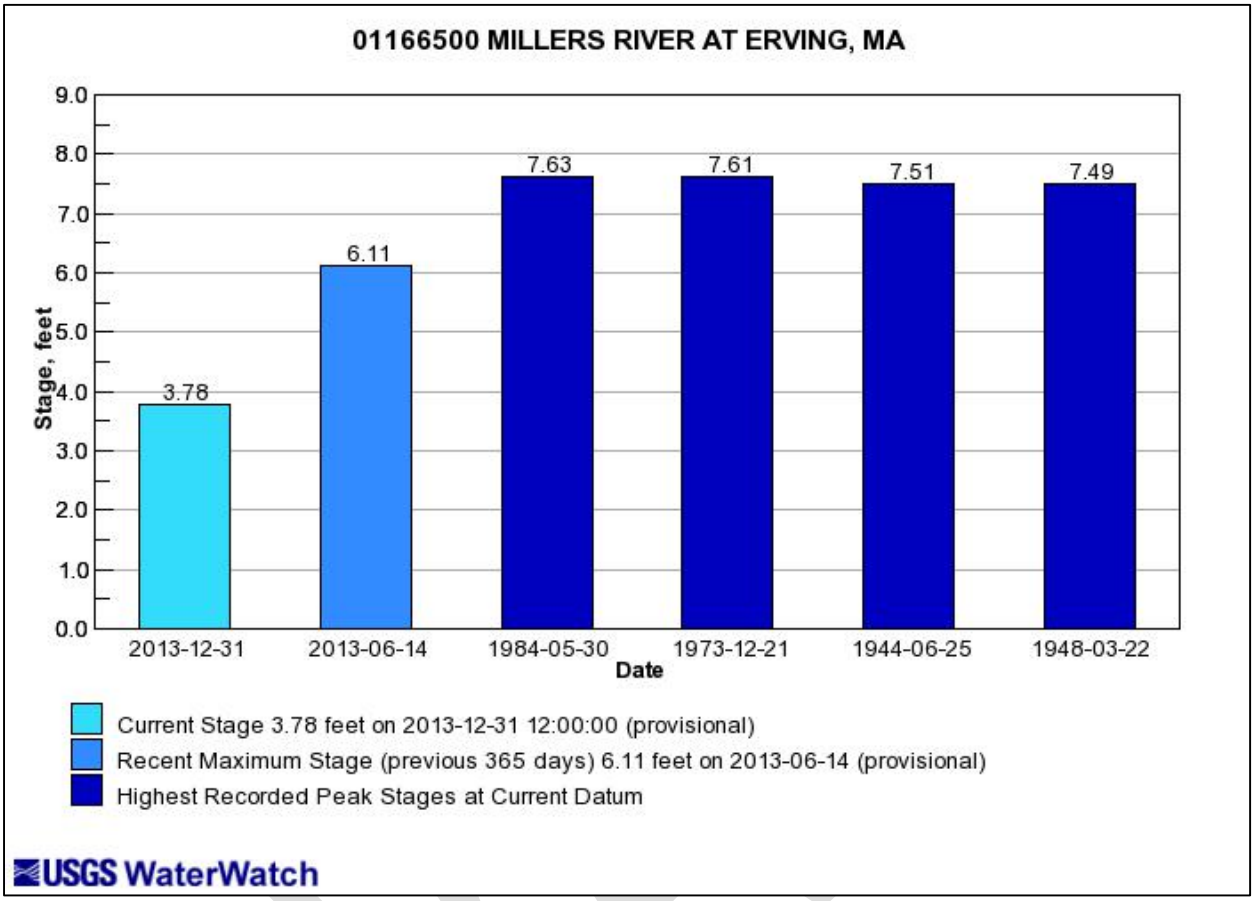
development occurred in floodplains because of their scenic qualities and proximity to the water. Although periodic flooding of a floodplain area is a natural occurrence, past and current development and alteration of these areas will result in flooding that is a costly and frequent hazard.

Fluvial erosion hazard (FEH) zones are areas along rivers and streams that are susceptible to bank erosion caused by flash flooding. Any area within a mapped FEH zone is considered susceptible to bank erosion during a single severe flood or after many years of slow channel migration. While the areas of the FEH zones often overlap with areas mapped within the 100-year floodplain on Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs), the FIRMs only show areas that are likely to be inundated by floodwaters that overtop the riverbanks during a severe flood. However, much flood-related property damage and injuries is the result of bank erosion that can undermine roads, bridges, building foundations and other infrastructure. Consequently, FEH zones are sometimes outside of the 100-year floodplain shown on FIRMs. FEH zones can be mapped using fluvial geomorphic assessment data as well as historic data on past flood events. Both the FIRMs and FEH maps should be used in concert to understand and avoid both inundation and erosion hazards, respectively.[14]

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. The graph below shows the four highest recorded peak flooding events on the Millers River at Erving, MA. This gage is located downstream of Orange.

[14] *Ammonoosuc River Fluvial Erosion Hazard Map for Littleton, NH*. Field Geology Services, 2010.



Source: http://waterwatch.usgs.gov/index.php?r=ma&id=ww_flood

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 Orange, both taken from NOAA data.

Table 3-1: Flood Events in Franklin County since 1993

Year	# of Flood Events	Annual Property Damage	Annual Crop Damage
2013	0	$0	$0
2012	2	$0	$0
2011	8	$22,275,000	$0
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

Year	# of Flood Events	Annual Property Damage	Annual Crop Damage
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
Total # of Years	**Total # of Flood Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
21	**50**	**$720,860**	**$0**

Source:
http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=06&endDate_dd=30&endDate_yyyy=2013&eventType=%28C%29+Flood&county=FRANKLIN&zone=ALL&submitbutton=Search&statefips=25%2CMASSACHUSETTS#

On August 27 and 28, 2011, Tropical Storm Irene brought heavy rain to the region, causing extensive and long term damage to a number of Franklin County towns. According to the National Weather Service, up to 9.92 inches of rain fell during the storm, though amounts varied significantly across Franklin County. Rivers, streams, and brooks throughout the county reached and surpassed flood levels. Rising water gathered debris that clogged culverts, roads and bridges were washed out, and homes and businesses were flooded, and in some cases, literally washed downriver. After the storm, Franklin, Berkshire, Hampshire and Hampden Counties were declared a disaster area by President Barack Obama, freeing up federal funds to assist towns with emergency work and road, bridge, and facility repairs. Up to 75 percent of repair costs can be covered by federal funds, as well as the cost of approved hazard mitigation efforts. Tropical Storm Irene resulted in over $22 million in property damages in Franklin County from flooding and an additional $3,050,000 in other, mostly wind-related, damage.[15]

Tropical Storm Irene caused minimal impact to the town of Orange, largely because the path of the storm caused more rain to fall west of town. Several culverts were damaged due to flooding from the storm, and there were periods of short power outages in parts of town. In anticipation of the storm, the Orange Water Department opened the North Dam on Lake Mattawa to lower the water levels in case of a large rainfall amount.

The one hundred year floodplain in Orange occurs in several places, including along the length of the Millers River, around Lake Rohunta, and along the Tully River, Cheney, Poor Farm, North Pond and West Brooks, and Coolidge Swamp. In Orange, 1,132 acres are within the floodplain, or 5% of the total land area in Town.[16] An estimated 24 acres of the floodplain is developed residential land. In 1936 and 1939, Orange experienced severe flooding that resulted in large

[15] Hazards & Vulnerability Research Institute (2012). The Spatial Hazard Events and Losses Database for the United States, Version 10.0 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org

[16] 2005 MassGIS land use data

property losses. The 2010 Orange Comprehensive Emergency Management Plan lists the Millers River from the Athol town line to downtown Orange as a flood prone area.

There are a number of areas in Orange identified by the committee with the potential for localized and/or chronic flooding. In many of these areas, flooding can be at least partially attributed to beaver activity. Beaver dams will be addressed in more detail in the dam failure section of this plan.

Key areas of concern include:

Flagg Road
An old mill spillway along the West Branch Tully River has washed out a section of Flagg Road during past heavy rain events, causing one residence to be locked in. The last event to cause the road to wash out was during Hurricane Floyd in 1999.

Royalston Road East
Beaver dams have caused high ground water levels in this area, including flooding of several home septic systems. During a 100 year storm, the whole area can surcharge and the causeway on which the road is located can overflow. The beaver dams are on private property and there are currently no solutions proposed for the problem.

Town Farm Road
During Hurricane Floyd the road washed out due to flooding from the Poor Farm Brook. This section of the road has since experienced flooding problems. The area should be inspected to determine if mitigation measures, such as a maintenance plan or culvert work, are needed.

Big Swamp
The swamp located along the Fall Hill Brook just north of the Fisher Hill Elementary and Dexter Park Elementary schools has been very close to cresting over during heavy rain storms. The school buildings are not currently at risk. However a number of beaver dams exist both in the swamp and upstream from the swamp. If these were to fail it could cause flooding high enough to reach the school property.

East Myrtle Street
The drainage system in this area of downtown Orange is old and does not always drain effectively. The town is applying for Community Development Block Grant funds to improve the sewer, water, and drainage infrastructure in this area.

Eagleville Road
High groundwater in this area has seeped into basements. The town has had studies completed in this area to determine the cause of the problem, but no definitive cause has yet been identified.

South Park
An access road to the airport located off of Route 122, just north of the Route 2 interchange, has been washed out in the past due to flooding from beaver activity. A culvert under the road is obstructed by beaver dams and needs to be cleared out periodically. Due to the blockage, the

culvert essentially acts as a dam, holding back water and causing a potentially dangerous situation if it were to fail. The airport now owns this road.

Lake Mattawa Road/Old Hickory Road
A detention pond next to the road is approximately 30 percent filled with debris from the road.

Of additional concern to the committee are three water main crossings along the Millers River. These large diameter water pipes supply water to the section of town north of the Millers River. If one or more of these pipes were wiped out due to a flood along the Millers River, water would quickly drain into the river, depleting the town's drinking water for an extended period of time. There would also be the possibility of water from the river draining into the pipes and contaminating the town's drinking water. Two options to reduce this vulnerability would be to either bury one or more of the water main crossings under the bed of the Millers River, rather than having the pipes exposed on top of the bed, or to find a source of water on the north side of the river that could be used in the event that distribution is cut off.

Another possible flooding issue for the Water Department is what appears to be an undersized culvert through the high bank of West River Street just below Wells #2 and #2A. The department is concerned that a concentrated rain event in the uplands along Coolidge Brook could result in severe localized flooding that backs up behind the culvert.

Potential Mitigation Measures for Floods
Some potential projects to help mitigate the effects of flooding include:

- Develop a culvert management plan that identifies the locations of culverts in town, existing and potential issues and the extent of flooding caused at each location, and possible solutions. The plan should prioritize projects in the locations that require intervention, including South Park, Town Farm Road, and West River Street.
- Look into the feasibility of either replacing and burying the oldest, western-most water main crossing the Millers River in order to mitigate the potential of the pipe being destroyed by flooding in the river, or finding a source of drinking water on the north side of the Millers River.
- Consider hiring a consultant to map Fluvial Erosion Hazard (FEH) areas in town, and adding a Fluvial Erosion Hazard Area Overlay District bylaw to the zoning bylaws to limit development in FEH areas along rivers and streams that are highly susceptible to flood-related erosion.

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, telephone service and make roadways extremely hazardous. 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.

Severe winter storms can include blizzards, heavy snow, sleet, freezing rain and ice storms. A blizzard is a severe snowstorm characterized by strong winds and low temperatures. The difference between a blizzard and a snowstorm is the strength of the wind. To be a blizzard, a snow storm must have sustained winds or frequent gusts that are greater than or equal to 56 km/h (35 mph) with blowing or drifting snow which reduces visibility to 400 meters or a quarter mile or less and must last for a prolonged period of time — typically three hours or more.[17] Snowfall amounts do not have to be significant. A severe blizzard has winds over 72 km/h (45 mph), near zero visibility, and temperatures of −12 °C (10 °F) or lower. A ground blizzard has snowdrifts and blowing snow near the ground, but no falling snow.[18] Blizzards can bring near-whiteout conditions, and can paralyze regions for days at a time, particularly where snowfall is unusual or rare. Freezing Rain is rain that falls as a liquid but freezes into glaze upon contact with the ground.[19] Heavy Snow generally means snowfall accumulating to 4" or more in depth in 12 hours or less; or snowfall accumulating to 6" or more in depth in 24 hours or less.[20] Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces. Heavy sleet is a relatively rare event defined as an accumulation of ice pellets covering the ground to a depth of approximately ½" or more.[21] The term ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous. Significant ice accumulations are usually accumulations of approximately ¼" or greater.[22]

Location and Extent

Franklin County regularly experiences severe winter storm events between the months of December and April. The entire town of Orange is equally susceptible to severe winter storms. 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.[23] 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 3-2 lists the twelve

[17] http://w1.weather.gov/glossary/index.php?letter=b
[18] http://www.britannica.com/EBchecked/topic/69478/blizzard
[19] http://w1.weather.gov/glossary/index.php?letter=f
[20] http://w1.weather.gov/glossary/index.php?letter=h
[21] http://w1.weather.gov/glossary/index.php?letter=s
[22] http://w1.weather.gov/glossary/index.php?letter=i
[23] NOAA National Climatic Data Center, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

recent severe winter disasters and other events that have led to Presidential Disaster or Emergency Declarations in Massachusetts.

Table 3-2: Major Disaster and Emergency Declarations in Massachusetts, 1993 - 2013

Disaster Name	Date of Event	Declared Areas	Disaster #/ Type of Assistance	Federal Share Disbursed
Blizzards, High Winds and Record Snowfall	March 1993	All 14 Counties	FEMA-3103-EM (PA)	$1,284,873
Blizzard	January 1996	All 14 Counties	FEMA-1090-EM (PA)	$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
Snowstorm	February 2003	All 14 Counties. The cost share is 75% federal and 25% local.	FEMA-3175-EM (PA)	$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
Snowstorm	January 2005	All 14 Counties	FEMA-3201-EM (PA)	$49,945,087
Severe Winter Storm	December 2008	Berkshire, Bristol, Essex, Franklin, Hampden, Hampshire, Middlesex, Suffolk, and Worcester *(Figure as of 9/8/2009)	FEMA-3296-EM-MA	$66,509,713
Severe Storms and Flooding	December 2008	5 counties (Berkshire, Franklin, Hampden, Hampshire, and Worcester Counties)	FEMA-1813-DR-MA(PA)	$32,058,172
Severe Winter Storm and Snowstorm	January 2011	Berkshire, Essex, Hampshire, Middlesex, Norfolk, Suffolk and Hampden Counties	FEMA-1959-DR (PA)	$1,050,102
Tropical Storm Irene	August 27-29, 2011	Berkshire, Franklin, Hampden, Hampshire, Norfolk, Bristol, Plymouth, Barnstable, Martha's Vineyard, and Nantucket Counties	FEMA-4028-DR	$26,620,515
Severe Storm and Snowstorm	October 2011	Berkshire, Franklin, Hampden, Hampshire, Middlesex, and Worcester Counties	FEMA-4051-DR (PA)	$71,927,443 (obligated)
Severe Winter Storm, Snowstorm and Flooding	February 8-9, 2013	All 14 Counties	FEMA-DR-4110	$16,474,989 (obligated)

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.
http://www.fema.gov/disasters/grid/year Accessed September 16, 2013.

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. 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.

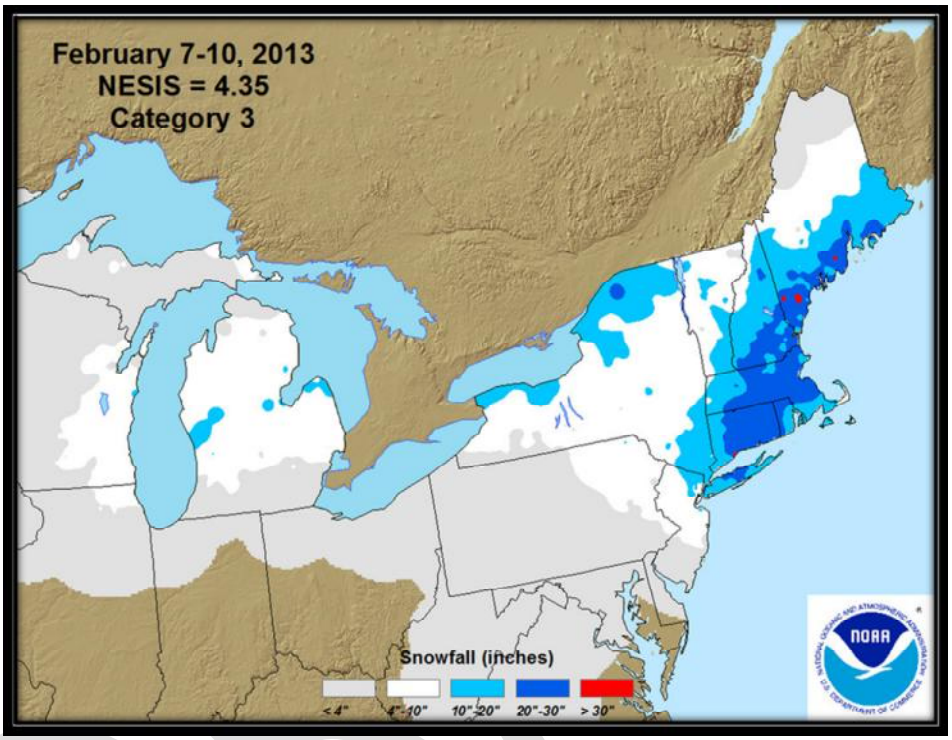
While most people had their power restored within a week, others were still without power at Christmas (nearly 2 weeks later). During this period, temperatures were mostly below normal and at least one major snowstorm affected the same area. At the time of the December 19th snowstorm, which dumped 7 – 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.

On October 29, 2011, an early snow storm brought over a foot of snow in some areas of the county. In lower elevations, the snow was heavier and caused many tree limbs, most of which still held their leaves, to break and fall. Power outages were widespread across New England, and lasted over a week in a few places in the Connecticut River valley. In Orange, extensive tree damage caused power outages and road blockages. In parts of town power was out for five days. The extended power outage was a challenge for the town's Water Department, due to the system being based largely on electronics. The Department used back-up generators to run the system, and is in the process of purchasing two additional generators in order to be prepared for future outages.

The Wendell Depot power substation owned by National Grid just over the town's border in Wendell provides power to much of Orange. Wires at the substation have been downed by ice, snow, and wind storms, causing large power outages in Orange. Placing the wires at the substation underground would help prevent future outages from severe winter storms. Additionally, placing wires underground that serve critical town facilities, such as shelters, the wastewater treatment plant, water pump stations, and police and fire stations, would help ensure these facilities remain operational during widespread outages.

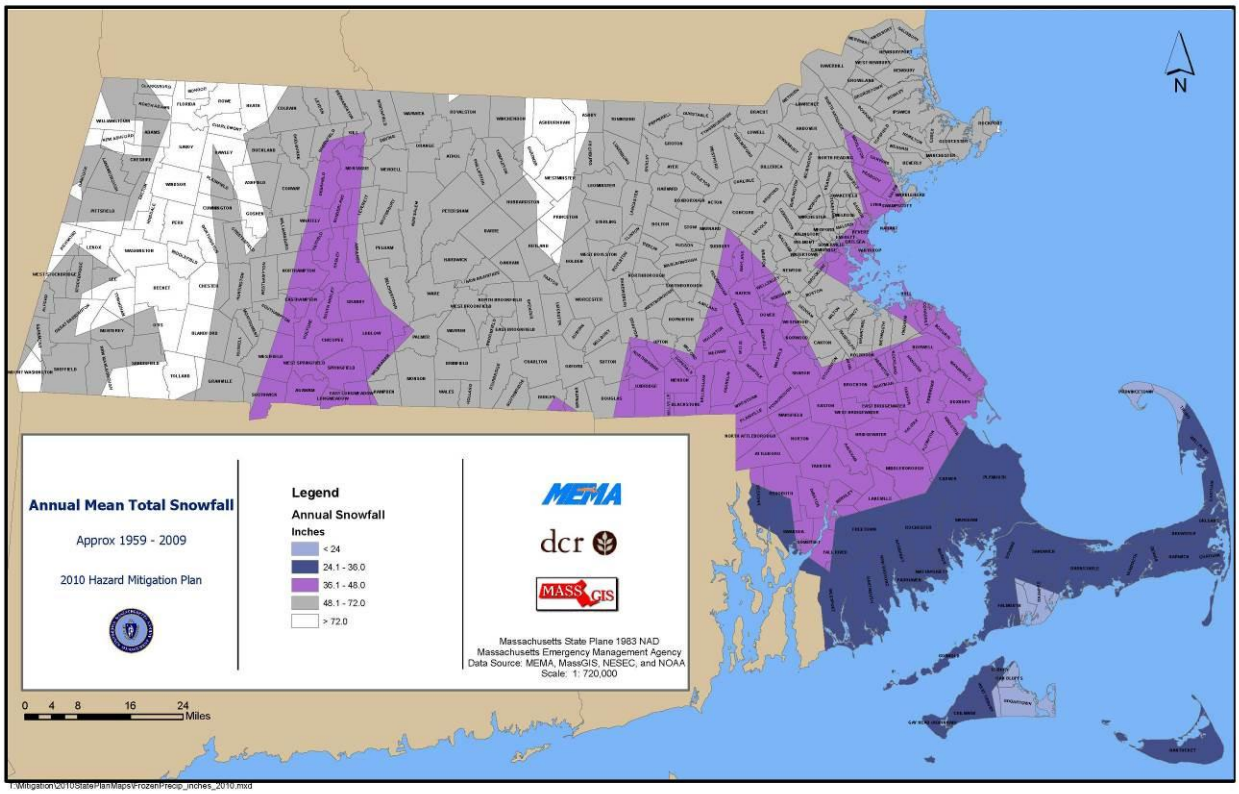
Not all severe winter storms result in Presidential Disaster Declarations or Emergency Declarations although damage to property and infrastructure, fatalities, and interruptions to critical services and businesses can occur as a result of these events. The Northeast Snowfall Impact Scale (NESIS) developed by Paul Kocin and Louis Uccellini of the National Weather Service (Kocin and Uccellini, 2004) characterizes and ranks Northeast snowstorms that have a large geographic impact. NESIS has five categories: Extreme (5), Crippling (4), Major (3), Significant (2), and Notable (1). The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. Thus NESIS gives an indication of a storm's societal impacts. This scale was developed because of the impact Northeast snowstorms can have on the rest of

the country in terms of transportation and economic impact.[24] The NESIS database includes 47 storms, many of which have dumped at least 10-20 inches on Franklin County towns. The database also includes maps of the affected areas.[25] Because of the rural nature of the county, a storm classified as Extreme or Crippling for the affected area may not have had as devastating an impact on the towns in Franklin County. However, the severity of these storms and their impact on Franklin County, neighboring counties and other New England states may affect the availability of disaster relief services.



The entire Town of Orange is at risk to the impacts of severe winter storms. The 2010 Massachusetts State Hazard Mitigation Plan includes a map of Mean Annual Snowfall for the period 1959-2009. This map shows that many of the towns in western Franklin County receive the greatest amount of annual snowfall in the state. The mean annual snowfall for the eastern portion of the county and for the Town of Orange is 48.1-72 inches.

[24] http://www.ncdc.noaa.gov/snow-and-ice/nesis.php
[25] http://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis



Potential Mitigation Measures for Severe Winter Storms

Potential projects relating to mitigating the effects of severe winter storm are:

- Work with the utility to review distribution to critical municipal facilities, including the potential for placing main feeder lines underground.
- Implement a continuous tree cutting plan along roadways.

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. The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures.[26] Tropical storms, defined as having sustained winds from 34-73 mph, have also resulted in damages to buildings and infrastructure from the high winds and flooding associated with these storms.

[26] National Weather Service National Hurricane Center: http://www.nhc.noaa.gov/aboutsshws.php.

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: http://www.nhc.noaa.gov/aboutsshws.php

Location and Extent

In Massachusetts, major hurricanes occurred in 1904, 1938, 1954, 1955, 1960, 1976, 1985 and 1991.[27] The Great New England Hurricane of 1938, a Category 3 hurricane which occurred on September 21, 1938, was one of the most destructive and powerful storms ever to strike Southern New England. Sustained hurricane force winds occurred throughout most of Southern New England. Extensive damage occurred to roofs, trees and crops. Widespread power outages occurred, which in some areas lasted several weeks. Rainfall from this hurricane resulted in severe river flooding across sections of Massachusetts and Connecticut. The combined effects from a frontal system several days earlier and the hurricane produced rainfall of 10 to 17 inches across most of the Connecticut River Valley. This resulted in some of the worst flooding ever recorded in this area.[28] 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.[29]

Between 1990 and 2008, 16 tropical storms impacted the County, causing almost $600,000 in property damages.[30] Tropical Storm Irene hit Franklin County on August 28, 2011, resulting in over $22 million in property damages from flooding and an additional $3,050,000 in other, mostly wind-related, damage.[31] Wind gusts did cause power outages in parts of the county, with

[27] http://www.nhc.noaa.gov/aboutsshws.php
[28] http://www.erh.noaa.gov/box/hurricane/hurricane1938.shtml
[29] Spatial Hazard Events and Losses Database (SHELDUS), http://webra.cas.sc.edu/hvri/
[30] Ibid.
[31] Hazards & Vulnerability Research Institute (2012). The Spatial Hazard Events and Losses Database for the United States, Version 10.0 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org

several short outages occurring in Orange. The entire Town of Orange is at risk to the effects of hurricanes and tropical storms.

The Wendell Depot power substation owned by National Grid just over the town's border in Wendell provides power to much of Orange. Wires at the substation have been downed by ice and wind storms, causing large power outages in Orange. Placing the wires at the substation underground would help prevent future outages due to high winds. Additionally, placing wires underground that serve critical town facilities, such as shelters, the wastewater treatment plant, and police and fire stations, would help ensure these facilities remain operational during widespread outages.

Potential Mitigation Measures for Hurricanes and Tropical Storms

Some potential projects to help mitigate the effects of Hurricanes include:

- Work with the utility to review distribution to critical municipal facilities, including the potential for placing main feeder lines underground.
- Implement a continuous tree cutting plan along roadways.

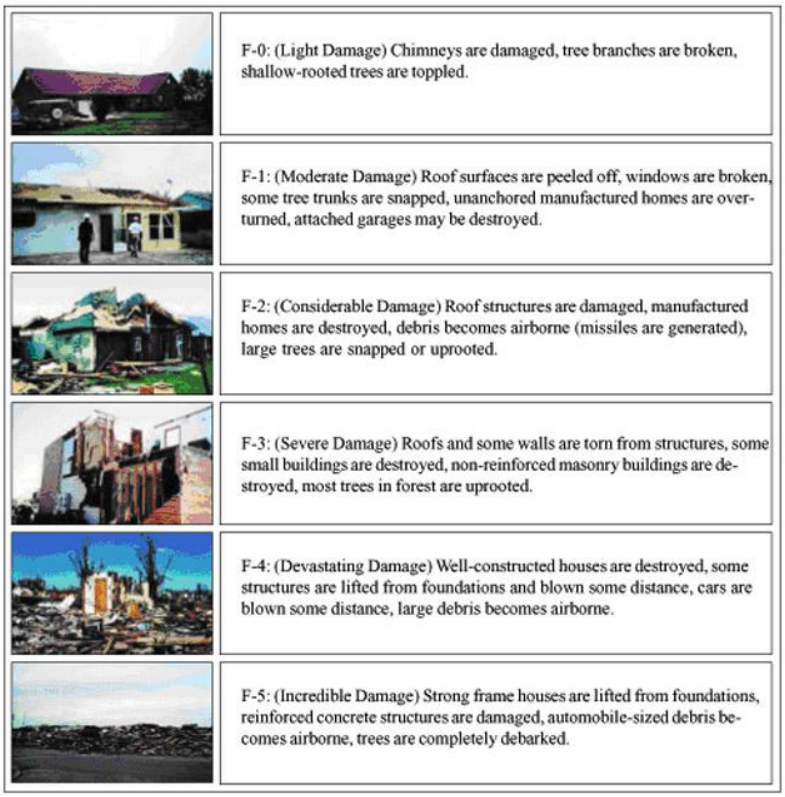
TORNADOS

General Description

Tornados are swirling columns of air that 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, tornados have occurred most frequently in Worcester County and in communities west of Worcester. High wind speeds, hail, and debris generated by tornados can result in loss of life, downed trees and power lines, and damage to structures and other personal property (cars, etc.).

Location and Extent

The Enhanced Fujita Scale, implemented in February 2007, is used by meteorologists to rate tornado damage on a scale from EF0 to EF5. The EF Scale incorporates more damage indicators and degrees of damage than the original Fujita Scale, allowing more detailed analysis and better correlation between damage and wind speed.



Since 1996, three tornadoes have been reported in Franklin County, in the towns of Heath (1997), Charlemont (1997), and Wendell (2006). See Table 3-3. The July 2006 tornado in Wendell was rated F2 (Strong) on the Fujita Scale with winds estimated near 155 mph. On July 29, 1964, a tornado was reported in Orange, in the area of Warwick Road, and was ranked F1 (Moderate Tornado, estimated winds of 73-112 mph) on the Fujita Scale of Tornado Intensity.[32] Two tornados touched down in Hampden County on June 1, 2011, one of which resulted in three deaths and caused extensive damage to downtown Springfield and surrounding towns.

"Gustnado" is a slang term for a short-lived, ground-based, shallow, vortex that develops on a gust front associated with either thunderstorms or showers. Gustnadoes have been known to cause damage in Franklin County. In 2009, a gustnado destroyed a tobacco barn and downed trees in the neighboring town of Sunderland. According to NOAA, a gustnado may only extend to 30 to 300 feet above the ground with no apparent connection to the convective cloud above. They may be accompanied by rain, but usually are 'wispy', or only visible as a debris cloud or dust whirl at or near the ground. Wind speeds can reach 60 to 80 mph, resulting in significant damage, similar to that of a F0 or F1 tornado. However, gustnadoes are not considered to be a tornado, and in some cases, it may be difficult to distinguish a gustnado from a tornado. Gustnadoes are not associated with storm-scale rotation (i.e. mesocyclones) that is involved with true tornadoes; they are more likely to be associated visually with a shelf cloud that is found on the forward side of a thunderstorm.

Table 3-3: Tornado Events in Franklin County, 1995-2013

Date	Location	Hazard Type	Injuries	Fatalities	Property Damage	Crop Damage	Remarks
7/3/1997	Heath	Tornado	0	0	$ 50,000	$0	
7/3/1997	Charlemont	Tornado	0	0	$ 50,000	$0	
7/11/2006	Wendell	Tornado	0	0	$ 200,000	$0	Tornado (F2)

Source: NOAA National Climate Data Center
http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=08&endDate_dd=31&endDate_yyyy=2013&eventType=%28C%29+Tornado&county=FRANKLIN&zone=ALL&submitbutton=Search&statefips=25%2CMASSACHUSETTS

[32] More information on the Fujita Scale can be found at: http://www.spc.noaa.gov/faq/tornado/f-scale.html.

WIND STORMS (Includes Severe Thunderstorms)

General Description

Damaging winds due to severe thunderstorms and microbursts are common in western Massachusetts and can cause significant damage. The National Weather Service defines a severe thunderstorm as having large hail, at least 3/4 inches (0.75 inches) in diameter, and/or damaging winds, at least 58 mph, or 50 knots.[33] A microburst is a downdraft (sinking air) in a thunderstorm that is less than 2.5 miles in scale. Some microbursts can pose a threat to life and property, but all microbursts pose a significant threat to aviation. Although microbursts are not as widely recognized as tornados, they can cause comparable, and in some cases, worse damage than some tornados produce. In fact, wind speeds as high as 150 mph are possible in extreme microburst cases. There are a handful of factors that cause microbursts to develop, including mid-level dry air entrainment, cooling beneath the thunderstorm cloud base, sublimation (occurs when the cloud base is above the freezing level), and the existence of rain and/or hail within the thunderstorm (i.e. precipitation loading).[34]

Severe thunderstorms and microbursts and their associated wind, hail and lightning effects - can cause severe damage. Microbursts often cause tornado-like destruction and can be mistaken for tornados. In contrast to the upward rush of air in a tornado, air blasts rapidly downward from thunderstorms to create microbursts.

Location and Extent

Table 3-4 shows data supplied by the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center for high wind events in Franklin County between 1993 and 2013. A "high wind" event is defined by NOAA as one with sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration.

Table 3-4: High Wind Events in Franklin County, 1993-2013[35]

Year	# of High Wind Events	Annual Property Damage	Annual Crop Damage
2013	0	$0	$0
2012	0	$0	$0
2011	0	$0	$0
2010	0	$0	$0
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

[33] http://www.erh.noaa.gov/box/sevwxdef.html
[34] http://www.srh.noaa.gov/ama/?n=microbursts
[35] The NOAA database was accessed on November 17, 2013 to update this information. The database has been undergoing upgrades and no longer has most of the older data listed. For Western Franklin County, 5 event(s) were reported between 01/01/1996 and 08/31/2013 (6453 days). These events are highlighted in the table. http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=08&endDate_dd=31&endDate_yyyy=2013&eventType=%28Z%29+High+Wind&county=FRANKLIN&zone=WESTERN%2BFRANKLIN&submitbutton=Search&statefips=25%2CMASSACHUSETTS

Year	# of High Wind Events	Annual Property Damage	Annual Crop Damage
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
21		**$453,476**	**$0**
# of Years		Average Annual Property Damage	Average Annual Crop Damage

The entire Town of Orange is susceptible to wind storms and microbursts. According to data supplied by the NOAA National Climatic Data Center, from 1996 - 2013, the Town of Orange experienced nine microburst (or "thunderstorm wind") events. The most severe of these occurred in August, 2000 in North Orange with wind speeds of 80-90 mph. This microburst caused $20,000 in damage. A thunderstorm wind event in June 2005 caused $10,000 in damage, while a storm in July 2010 caused a tree to fall on a house on Main Street. The damage amount from this storm is unknown. North Orange is prone to microbursts, according to the committee. In 1999 a microburst in the Tully Road area caused a tree to fall on a pickup truck with three passengers inside.

Table 3-5: Thunderstorm Wind Events in Orange, 1993-2013

Date	Type	Property Damage	Crop Damage	Excerpts from storm details for Orange only
7/26/1994	Thunderstorm Wind	$0	$0	Trees were reported blown down along Route 2.
7/8/1996	Thunderstorm Wind	$0	$0	
7/17/1997	Thunderstorm Wind	$0	$0	Trees were reported blown down in Northfield and Orange. A chicken coop was struck by lightning and caught fire in Orange. Also in Orange, lightning struck the police station, resulting in damage to computers and other equipment.
5/31/1998	Thunderstorm Wind	$2,000	$0	A severe thunderstorm occurring at about the same time as the storm farther to the east resulted in wind damage in the town of Orange in Franklin County, where two trees were blown down and a third tree landed on a truck, damaging the roof and windshield.
8/3/2000	Thunderstorm Wind	$20,000	$0	A severe thunderstorm moved through Orange, and produced a microburst of one and a half miles in length across North Orange. The microburst was a little over one half mile wide at the west end, and about one and a half miles wide at the east end. Dozens of trees up to at least three and a half feet in diameter were downed, most in a west to east direction. Some were uprooted and others were

Date	Type	Property Damage	Crop Damage	Excerpts from storm details for Orange only
				snapped off at various heights. Three people were injured when a large tree fell on their vehicle. A large shed used to house a motor home was totally destroyed, with debris strewn over 50 yards. Wind speeds were estimated between 80 and 90 mph based upon the damage observed.
6/26/2005	Thunderstorm Wind	$10,000	$0	Scattered thunderstorms, with embedded severe thunderstorms, produced lightning and severe wind gusts that damaged property and brought down trees and power lines across Massachusetts. The hardest hit were Franklin, Hampshire, Worcester, Essex, and Plymouth counties. Various lightning strikes downed power lines and trees, set fires to homes, and caused multiple injuries.
7/6/2007	Thunderstorm Wind	$0	$0	Trees down.
5/4/2010	Thunderstorm Winds	$0	$0	The Automated Surface Observing System at Orange Municipal Airport (KORE) recorded a wind gust of 67 mph. No associated damage was reported, though damage was reported elsewhere in Franklin County.
7/21/2010	Thunderstorm Winds	$0	$0	A tree on Main Street was downed onto a house on Main Street. Amount of damage unknown.

Source: NOAA National Climate Data Center
http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=08&endDate_dd=31&endDate_yyyy=2013&eventType=%28C%29+Tornado&county=FRANKLIN&zone=ALL&submitbutton=Search&statefips=25%2CMASSACHUSETTS

Lightning strikes have caused significant damage to the Orange Police Department in 1992, 1996, and 1997, resulting in a total of $32,487 in damages. The base radio, telephone system, and computer system suffered damages in each event. In the 1996 event, a police officer was struck by lightning that came out of a computer or wall socket, but did not sustain any serious injury.[36]

The Wendell Depot power substation owned by National Grid just over the town's border in Wendell provides power to much of Orange. Wires at the substation have been downed by ice and wind storms, causing large power outages in Orange. Placing the wires at the substation underground would help prevent future outages due to high winds. Additionally, placing wires underground that serve critical town facilities, such as shelters, the wastewater treatment plant, water pump stations, and police and fire stations, would help ensure these facilities remain operational during widespread outages.

Potential Mitigation Measures for Wind Storms:

Some potential projects to help mitigate the effects of Tornados and Microbursts include:

- Work with the utility to review distribution to critical municipal facilities, including the potential for placing main feeder lines underground.
- Implement a continuous tree cutting plan along roadways.

[36] Information on lightning strikes provided by Chief Spear, June 2011.

WILDFIRES AND BRUSHFIRES

General Description

According to FEMA, there are three different classes of wildland fires: *surface fires, ground fires* and *crown fires*.[37] 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 lightening. Crown fires move quickly by jumping along the tops of trees. A crown fire may spread rapidly, especially under windy conditions. While wildland fires may have not been a significant problem for towns in this region, there is always a possibility that changing land use patterns and weather conditions will increase a community's vulnerability. For example, drought conditions can make forests and other open, vegetated areas more vulnerable to ignition. Once the fire starts, it will burn hotter and be harder to extinguish. Soils and root systems starved for moisture are also vulnerable to fire. Residential growth in rural, forested areas increases the total area that is vulnerable to fire and places homes and neighborhoods closer to areas where wildfires are more likely to occur.

Location and Extent

According to data from Massachusetts Fire Incident Reporting System of the Massachusetts Department of Fire Services, the Orange Fire Department responded to 25 brush fires between 2004 and 2009. This is compared to an average 16 fires during the same time period countywide. (See Table 3-6.) Orange has 16,688 acres of forest, and is therefore at risk of fire. Approximately 573 burn permits were issued in 2010. Often brushfires are started on residential lots to clear grass, brush and other woody debris and become a problem when the homeowner can no longer control them. Other types of fires may be started by campground visitors or others. Areas of concern, or critical facilities, such as schools and senior housing complexes are important to identify because these populations may need special assistance in times of an emergency.

Table 3-6: Massachusetts Fire Incident Reporting System – Brushfires 2004-2009

Department	Total # of Brush Fires	2004	2005	2006	2007	2008	2009
BERNARDSTON	44	5	14	7	5	8	5
CHARLEMONT	15	3	1	0	8	1	2
COLRAIN	8	3	1	0	3	0	1
CONWAY	25	4	5	5	3	4	4
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
HAWLEY	2	0	0	2	0	0	0
HEATH	6	1	1	0	0	2	2
LEVERETT	11	1	1	3	5	0	1
LEYDEN	3	1	0	0	2	0	0
MONTAGUE CENTER	38	3	8	10	7	1	9
NEW SALEM	14	0	0	3	5	1	5

[37] FEMA, "Fact Sheet: Wildland Fires", September 1993.

Department	Total # of Brush Fires	2004	2005	2006	2007	2008	2009
NORTHFIELD	1	0	0	0	0	1	0
ORANGE	**25**	**4**	**3**	**3**	**9**	**0**	**6**
SHELBURNE CTR	13	4	2	5	2	0	0
SHELBURNE FALLS	7	0	0	1	4	1	1
SHUTESBURY	4	0	1	0	0	1	2
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
WARWICK	4	2	1	1	0	0	0
WENDELL	9	0	0	6	2	0	1
WHATELY	23	6	7	6	1	3	0
Total	398	63	67	77	84	48	59

In Orange, wildfires are often started either by lightning or are caused by all terrain vehicles. In 2006 fifteen acres burned on Walnut Hill. In 2009, over thirty acres along Tully Road burned. The committee noted that privately owned conservation land in town is not managed for wildfire. An accumulation of dead trees and limbs from the 2008 ice storm, and the 2011 October snow storm, could also contribute fuel to a fire. Ice storm debris is what helped spread a fire over fifty acres in neighboring Erving in 2010.

Potential Mitigation Measures for Wildfires and Brushfires

- Incorporate the National Fire Protection Association's "Firewise" standards into the Town Zoning Bylaws and Subdivision Regulations to reduce the impact of wildfire and brushfires on the built environment.

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. Dam failure 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 the 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. State legislation is currently pending that would create a loan fund to help owners maintain and inspect their dams.

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 submitted to the DCR. FERC typically requires inspections on an annual basis. All other dams are subject to the regulations unless exempted in writing by DCR.

Along with manmade dams, failure of beaver dams can cause flooding as well. Alteration of the landscape by beavers is a natural process that creates habitat for shore birds, mammals and rare amphibians. However, 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.[38]

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.[39]

In 2011, a bill is under consideration with the State Legislators which would give individuals and towns an additional option when they are having issues with beavers. Under this new bill, a special permit could be obtained from the State Department of Fisheries and Wildlife. The bill does not aim to repeal the bill that bans trapping but rather allows the issuing of an emergency permit under the provisions allowed within the laws of the State. The proposed bill also calls for the State to begin keeping better records of all permits issued and how many beavers are trapped each year.

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.[40]

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

[38] *Otsego County* (NY) *All Hazards Mitigation Plan*, 2010.

[39] 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.

[40] *Otsego County* (NY) *All Hazards Mitigation Plan*, 2010.

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

Updated information on dams in Orange was provided to the Town by DCR, and is listed below in Table 3-7 and displayed in Figure 3-1. There are ten dams in town considered to be Significant Hazard, four considered Low Hazard, and nine that are non-jurisdictional, meaning they do not fall under the Office of Dam Safety regulatory authority. There is one dam located in the Town of Orange that comes under FERC supervision, the New Home Sewing Machine Company Dam, a privately-owned hydroelectric dam. This dam is considered a Low Hazard Dam by FERC and as such, is not required to have an Emergency Management Plan or inundation mapping. The Mahar Regional School dam on Haskins Road, owned by the Ralph C. Mahar Regional School District, is in the process of being removed.

Table 3-7: Dams in the Town of Orange, 2011

Name of Dam	Owner	Office of Dam Safety Hazard Rating	Date of Last Inspection
Lake Mattawa Dam South	Town of Orange	Significant	10/13/2006
Lake Mattawa Dam North	Town of Orange	Significant	10/13/2006
Tully Pond Dam	Town of Orange	Significant	11/2/2006
Packard Pond Dam	Privately owned	Significant	8/30/2007
North Pond Brook Dam	Town of Orange	Significant	Unknown
Haskins Pond Dam	Privately Owned	Significant	6/15/2006
Orange Water District Reservoir Dam	Town of Orange	Significant	10/13/2006
Vorces Pond Dam	Town of Orange	Significant	10/13/2006
Mahar Regional School Dam	Mahar Regional School District	Significant	7/2/2009
Gale Brothers Dam	Town of Orange	Significant	11/2/2006
New Home Sewing Machine Co. Dam	Privately Owned	Low	6/14/2006
Whites Pond Dam	Unknown	Low	unknown
Johnsonian Pond Dam	Privately owned	Low	unknown
Williams Pond Dam	Town of Orange	Low	11/2/2006

Name of Dam	Owner	Office of Dam Safety Hazard Rating	Date of Last Inspection
Pumping Station Dam	Town of Orange	N/A	1/9/1992
Plazas Pond Dam	Mass Department of Fish and Game	N/A	unknown
Minute Tapioca Upper Pond Dam	Unknown	N/A	unknown
Minute Tapioca Lower Pond Dam	Unknown	N/A	unknown
Boston Fiber Co. Dam	Privately owned	N/A	unknown
Diversion Dam	Privately owned	N/A	unknown
Eagleville Dam	Unknown	N/A	unknown
Fire Pond Dam	Privately owned	N/A	unknown
Randall Pond Dam	Orange Economic Development Commission	N/A	unknown

Source: MA Department of Conservation and Recreation, Office of Dam Safety, 2011.

The Orange Water Department is looking at the potential to remove the Vorces Pond dam and the Orange Water District Reservoir dam. Removal of these dams would eliminate the need to maintain the dams, and could have environmental benefits. Removal would also eliminate any dam failure hazard potential in these areas.

The committee expressed concerned with the inspection of privately owned dams, now that owners are responsible for inspections. Some owners may not be aware that they own a dam, or in some cases the owner may be deceased.

There are two dams located in Royalston, Massachusetts that could impact persons and property within Orange and other towns were a catastrophic failure to either dam to occur: Birch Hill and Tully Lake dams. According to inundation maps of the U.S. Army Corps of Engineers, the areas that would be impacted independent of which dam failed include the following areas: southeast of Little Tully Mountain, and the neighborhoods in the vicinity of East River Street and East Main Street. Other areas in Orange that could be impacted by failures of either of these dams include neighborhoods of Orange Center and Route 2A west of the center. The Lake Rohunta Dam in Athol would also impact Orange if it failed. In the 1930s water crested the dam, causing flooding that reached all the way to the center of Town.

The 100-year floodplain covers about five percent, or approximately 1,132 acres of the town, including an estimated twenty-five acres of developed residential land, thirteen acres of industrial land, six acres of commercial land, and one acre of public/institutional land. An inundation area due to dam failure would cover substantially more acreage. There are also several critical facilities located either within or near the 100-year floodplain including the town's wastewater treatment facility, the town transfer station, town offices, the Mahar Regional School, and a number of bridges.

Beaver Dams

Beaver activity is a significant issue in the Town of Orange. Beaver dams have caused flooding in numerous areas (see Flooding section, above). Of special concern are beaver dams built in culverts under roads. In some cases the back up of water behind the culverts can be quite large, in effect turning the culvert into a dam, something it has not been designed for. Beaver dams and culverts acting as dams can fail, causing damaging flooding downstream. In Orange, the south park culvert along an access road to the airport backs up regularly. In recent years two culverts

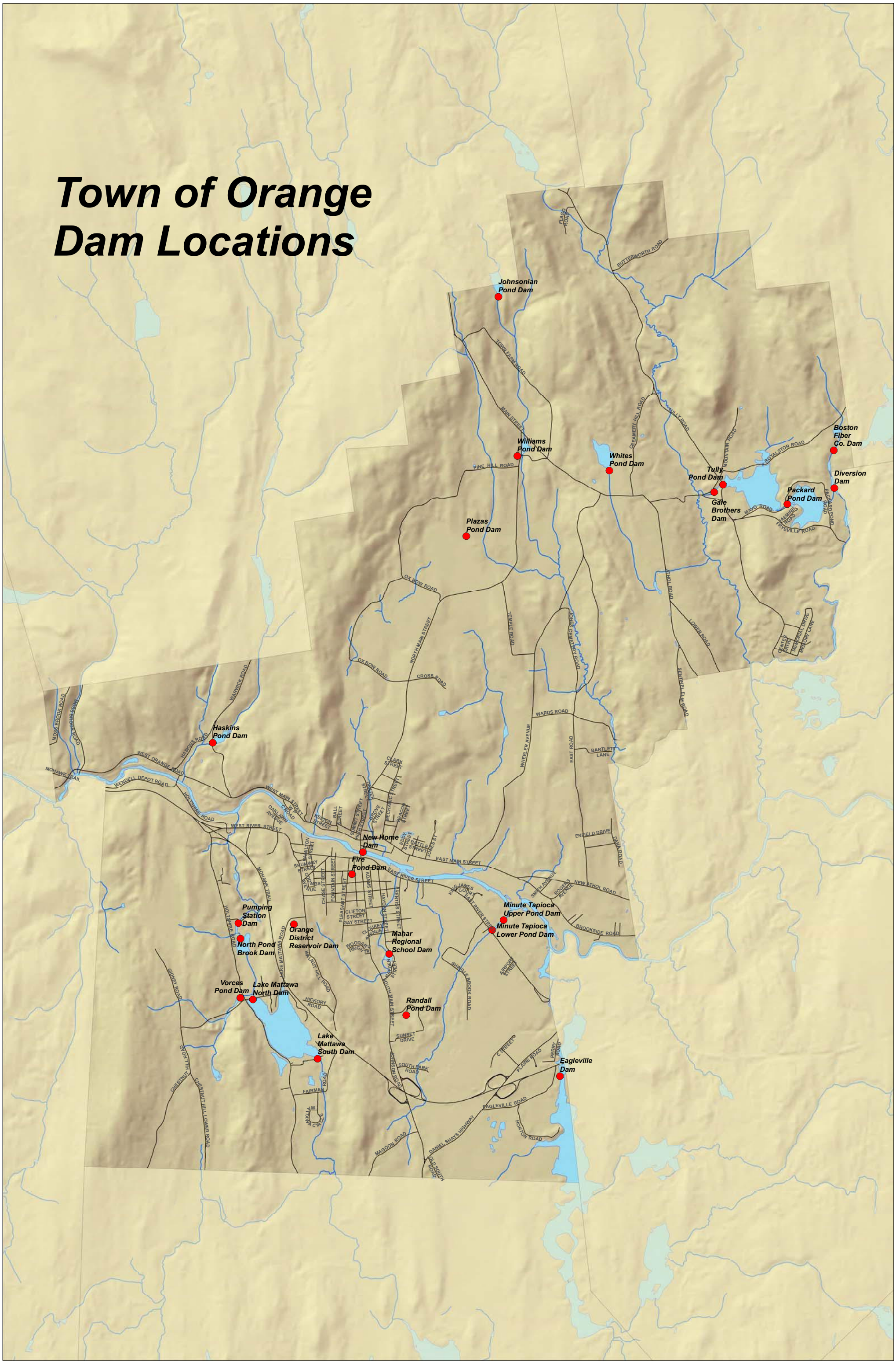
under a runway at the airport became blocked and backed up water all the way to Randall Pond. The blockage was discovered and removed before any damage occurred.

The Town has installed "beaver deceivers," fences that are meant to deter beaver dam construction, in many locations where beaver activity has caused detrimental impacts. It is estimated that there are upwards of 100 of these devices around town. Unfortunately the beaver deceivers are only effective if they are regularly maintained. Otherwise beavers find ways to build up dams along the fencing. Maintenance of all sites is time consuming work that the Town cannot keep up with. Beaver dams located away from roads are also a concern. These dams are not easily accessible, and may be located on private property, beyond the control of the town.

Potential Mitigation Measures for Dam Failure

- Educate dam owners of their inspection responsibilities, and work with significant hazard dam owners to prepare up-to-date evacuation plans.
- Develop a culvert management plan that identifies the locations of culverts in town, existing and potential issues and the extent of flooding caused at each location, and possible solutions. The plan should prioritize projects in the locations that require intervention, including South Park and Town Farm Road.
- Determine the potential impact to the town from a failure of the Lake Rohunta dam in Athol, and develop an evacuation plan.

Town of Orange Dam Locations



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.[41] 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.[42]

The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Earthquakes with magnitude of about 2.0 or less are usually called microearthquakes; they are not commonly felt by people and are generally recorded only on local seismographs. Events with magnitudes of about 4.5 or greater - there are several thousand such shocks annually - are strong enough to be recorded by sensitive seismographs all over the world. Great earthquakes, such as the 1964 Good Friday earthquake in Alaska, have magnitudes of 8.0 or higher. On the average, one earthquake of such size occurs somewhere in the world each year. The Richter Scale has no upper limit.

It is important to note that the Richter Scale is not used to express damage. An earthquake in a densely populated area which results in many deaths and considerable damage may have the same magnitude as a shock in a remote area that does nothing more than frighten the wildlife. Large-magnitude earthquakes that occur beneath the oceans may not even be felt by humans.[43]

The effect of an earthquake on the Earth's surface is called the intensity. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally - total destruction. Although numerous *intensity scales* have been developed over the last several hundred years to evaluate the effects of earthquakes, the one

[41] Northeast States Emergency Consortium web site: www.nesec.org/hazards/earthquakes.cfm
[42] Federal Emergency Management Agency web site: www.fema.gov/hazards/earthquakes/quake.shtm.
[43] Adapted from http://earthquake.usgs.gov/learn/topics/richter.php

currently used in the United States is the Modified Mercalli (MM) Intensity Scale. It was developed in 1931 by the American seismologists Harry Wood and Frank Neumann. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects.

The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced at that place.

The **lower** numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The **higher** numbers of the scale are based on observed structural damage. Structural engineers usually contribute information for assigning intensity values of VIII or above.[44] The figure below shows the Modified Mercalli Scale (far left column) and the corresponding Richter Scale magnitude rating (far right column).[45]

Category	Effects	Richter Scale (approximate)
I. Instrumental	Not felt	1-2
II. Just perceptible	Felt by only a few people, especially on upper floors of tall buildings	3
III. Slight	Felt by people lying down, seated on a hard surface, or in the upper stories of tall buildings	3.5
IV. Perceptible	Felt indoors by many, by few outside; dishes and windows rattle	4
V. Rather strong	Generally felt by everyone; sleeping people may be awakened	4.5
VI. Strong	Trees sway, chandeliers swing, bells ring, some damage from falling objects	5
VII. Very strong	General alarm; walls and plaster crack	5.5
VIII. Destructive	Felt in moving vehicles; chimneys collapse; poorly constructed buildings seriously damaged	6
IX. Ruinous	Some houses collapse; pipes break	6.5
X. Disastrous	Obvious ground cracks; railroad tracks bent; some landslides on steep hillsides	7
XI. Very disastrous	Few buildings survive; bridges damaged or destroyed; all services interrupted (electrical, water, sewage, railroad); severe landslides	7.5
XII. Catastrophic	Total destruction; objects thrown into the air; river courses and topography altered	8

Location and Extent

Tables 3-8 and 3-9 show historic occurrences of earthquakes in the Northeastern part of the United States. This Northeast States Emergency Consortium data is current as of October 2013. A NOAA data query for earthquake events in Franklin County between the years 1996 and 2013 turned up no events.[46]

[44] Adapted from http://earthquake.usgs.gov/learn/topics/mercalli.php
[45] Adapted from http://img.docstoccdn.com/thumb/orig/80153368.png
[46] http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=25%2CMASSACHUSETTS

On June 22, 2010 there was a magnitude 5.8 earthquake in Canada which could be felt in Franklin County. No damage was reported, but residents stated they felt the quake and were unnerved by the experience. On August 23, 2011 an earthquake measuring 5.8 on the Richter scale centered in Virginia was felt throughout the northeast, prompting the evacuation of a number of multi-story buildings in the Franklin County region, but causing no property damage or personal injury, though shaking of the building and power lines was observed at the Orange Water Department office.

Table 3-8: 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*.

Table 3-9: 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. may not have been designed to withstand the forces of an earthquake.

While a major earthquake has not occurred in Orange in recent history, the potential for a destructive earthquake exists. Local fault lines run along East Road and Tully Road in North Orange, and along Fall Hill and Walnut Hill near downtown. In addition, a major fault line runs north/south along the entire Connecticut River Valley, just west of Orange. Orange is vulnerable to a major earthquake because of the age of its building stock. According to the 2000 U.S.

Census, 62 percent of the housing in Orange was built before 1970. The entire Town of Orange is vulnerable to the impacts of an earthquake.

Potential Mitigation Measures for Earthquakes

- Identify public structures and shelters built before 1975, and evaluate if repair or improvements are needed to mitigate potential damage from an earthquake. If significant improvements are needed, alternative shelters may need to be identified.

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.

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, 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

According to the committee, Orange is not very susceptible to landslides as most of the town is built on ledge. However further analysis should be conducted to determine what areas in town could be susceptible to landslides. No major landslides have occurred in town in recent years.

Potential Mitigation Measures for Landslides

- Identify areas in town that might be vulnerable to landslides and determine appropriate mitigation measures.

ICE JAMS

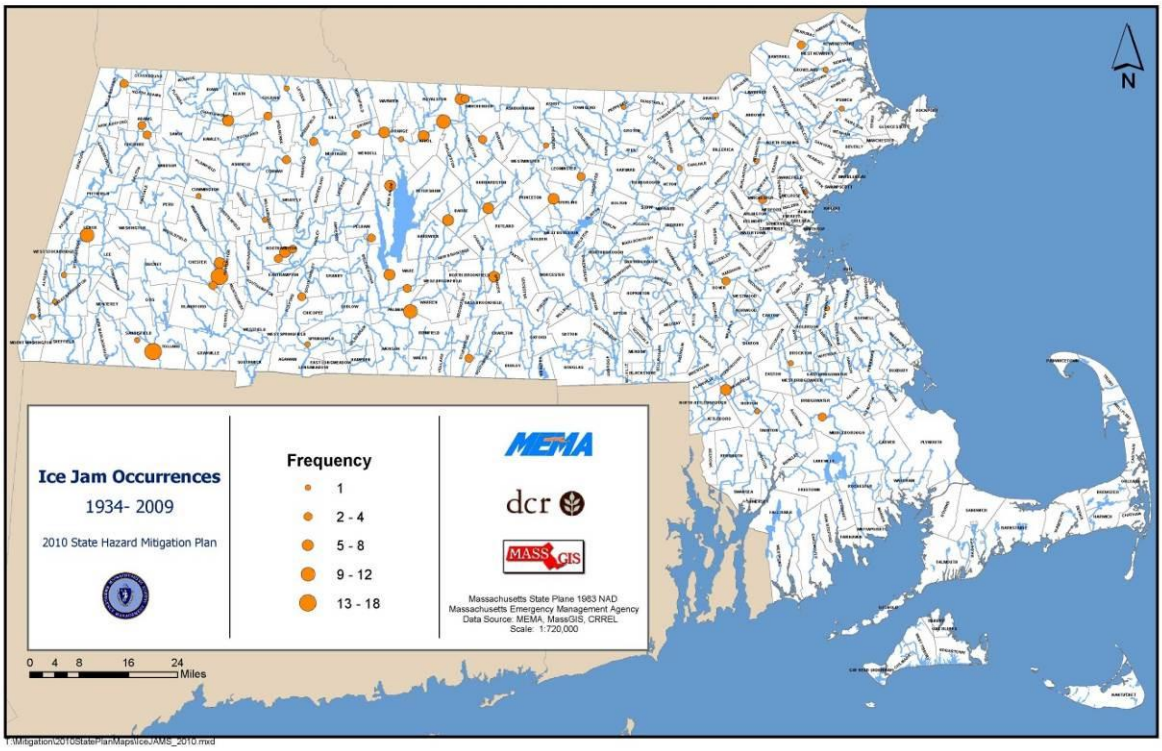
General Description

Ice jams (or ice dam) 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

According to information in the 2010 Massachusetts State Hazard Mitigation Plan, ice jams have occurred with varying frequency on several rivers in Franklin County, including the Deerfield, Millers, Green, North and South Rivers between 1934-2009 (see map, below).



Data from the U.S. Army Cold Regions Research and Engineering Laboratory[47] show ice jam occurrences on the Millers River, one of which occurred in Orange in 2008 (see Table 3-10).

Table 3-10: Ice Jam Occurrences on the Millers River

Date	Type	Town	Description or other information
02/21/2008	**Break-Up**	**Orange**	**Located near Rodney Hunt Co., about 1500 feet long, with the downstream edge 1-2 feet thick. It is thought to be the remainder of the jam that had been in Athol, which released due to the runoff from snowmelt, rain, and spring-like temperatures in the region. No flooding was observed.**
02/13/2008	Freeze-Up	Athol	The freeze up accumulation was located upstream of the wastewater treatment plant, continuing to about 1000 ft upstream of Main St. bridge. The water was flowing freely, carrying small chunks of ice down to the jam.
12/15/2005	Freeze-Up	Athol	Downstream of the South Main Street Bridge, in Athol MA. The jam has reduced the river's flow near Shore Drive, resulting in frazil ice jammed in that location. This is upstream from the location of the 2004 and 2005 ice jams.
01/24/2005	Freeze-Up	Athol	Water in the Millers River had risen 20 inches overnight due to freeze up jamming. Water was flooding basements and parking lots, and beginning to enter roadways. Flooding was affecting the area from the Tully River confluence up to the next dam on the Millers River. Although flow was estimated at less than 1-yr recurrence interval, stages reached about 500-yr flood levels.
01/17/2004	Freeze-Up	Athol	The last two severe cold spells resulted in backyard flooding, with the most significant being on the weekend of 17 January. Measurements of the ice thickness at #149 Pequoig Avenue indicated two layers of ice from the two flooding events. The first event left an ice thickness of 0.7 foot frozen to the existing ground. The second cold event added an additional 1.8 feet of water with a 0.6 feet thick floating ice sheet on top. The fact that the water level was still at this level indicates that the restriction in the channel still remains and could get worse with the forecast of additional cold weather this weekend.
01/01/1996	Break-Up	Athol	The largest ice jam is located near Morton Meadows. The toe of the jam is located near the wastewater treatment plant and extends upstream 2000ft to 300 ft below the Main Street Bridge. The jam was made up of broken ice cover about 3-4 feet thick. Flow is passing the jam and there are no signs of grounding. The other two jams are located upstream. The larger of the two is about 1000 feet long, 2-3 ft. thick, and is located at the Starrett Co. Dam
01/10/1973	unknown	S Royalston	Maximum annual gage height, 7.10 feet due to backwater from ice. Discharge 400 cfs
01/24/1971	unknown	S Royalston	Maximum annual gage height, 9.42 feet due to backwater from ice. Discharge 92 cfs
02/04/1970	unknown	Winchendon	Maximum annual gage height, 8.34 feet due to backwater from ice. Discharge 640 cfs
01/15/1970	unknown	S Royalston	Maximum annual gage height, 9.27 feet due to an ice jam. Discharge 160 cfs
01/03/1969	unknown	S Royalston	Maximum annual gage height, 7.53 feet due to backwater from ice. Discharge 200 cfs.
01/26/1964	unknown	Erving	Maximum annual gage height, 5.81 feet due to an ice jam. Discharge 1,750 cfs

[47] www.crrel.usace.army.mil

Date	Type	Town	Description or other information
01/23/1964	unknown	S Royalston	Maximum annual gage height, 6.52 feet due to backwater from ice. Discharge 710 cfs
02/27/1961	unknown	Erving	Maximum gage height 7.18 feet due to ice jam. Discharge 2,000 cfs
02/26/1961	unknown	S Royalston	Maximum gage height, 6.98 feet due to ice jam. Discharge 950 cfs
01/24/1959	unknown	S Royalston	Maximum gage height for period of July 1939 to September 1974 of 9.42 feet
02/22/1958	unknown	S Royalston	Maximum annual gage height of 7.41 feet
01/24/1957	unknown	S Royalston	Maximum annual gage height of 8.29 feet
01/23/1957	unknown	Erving	Maximum annual gage height of 5.77 feet
12/21/1951	unknown	S Royalston	Maximum annual gage height of 6.94 feet
01/09/1943	unknown	S Royalston	Maximum annual gage height of 7.70 feet
02/11/1941	unknown	S Royalston	Maximum annual gage height of 7.39 feet
01/25/1938	unknown	Winchendon	Gage height of 8.05 feet
03/12/1936	Break-Up	Athol	"Ice from a broken jam in Millers River smashed one side of a four story brick factory at Athol, Mass., carried a house 40 feet, injured several persons and strewed boxes." "Mills closed at Orange, Mass. and ice jams on the Millers River were dynamited to release flood waters that threatened the town."
01/10/1935	unknown	Erving	Maximum annual gage height of 5.62 feet. Discharge "about" 4,400 cfs

Source: U.S. Army Cold Regions Research and Engineering Laboratory, 2008. www.crrel.usace.army.mil

Ice jams have occurred at the East Road bridge over the West Brook. When ice jams have occurred on the Millers River, it has caused flooding along East River Street. In particular the King James Court apartment complex has been impacted in the past.

MANMADE HAZARDS[48]

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 Orange. 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 are 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

[48] Content adapted from Commonwealth of Massachusetts State Hazard Mitigation Plan 2010

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 passing through.

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. Two regional airports are also located in the County, one in Orange. The Orange Regional Airport is used for both recreational and corporate uses, though recent trends have changed the airport's role more toward corporate use. The airport has about 38,000 aircraft operations annually, with about 60 percent of these non-recreational in nature.[49]

According to the Franklin County Hazardous Material Emergency Plan (HMEP)[50], approximately 12 to 22 trucks per hour traveling through the region contain hazardous materials (Table 3-11). While most of these vehicles are on Interstate 91, an estimated 2 trucks per hour travel on Route 2, which pass through Orange. Routes 2A, 122, 78, and 202 all pass through Orange and have an average of 1 or 0 trucks carrying hazardous materials traveling on them per hour. According to the HMEP, the hazardous materials regularly carried on these trucks passing through Orange include:

- Gasoline
- Fuel oil
- Kerosene
- Liquified petroleum gas
- Propane
- Sodium aluminate
- Sulfuric acid
- NOS liquids 3082

Ten to 24 trains per day travel on the Pan Am Systems Main Freight line which bisects Orange and runs adjacent to the Millers River (Table 3-12). On each of these trains, an average of 4 cars carries hazardous waste. The hazardous materials regularly carried on these trains passing through Orange include:

[49] Orange Open Space and Recreation Plan, 2008.

[50] Franklin County Regional Emergency Planning Committee, Franklin County Hazardous Material Emergency Plan and Maps, 2006. Based on a one-time survey conducted in 2003.

- Hydrocyanic acid
- Sulfuric acid
- Liquified petroleum gas
- Hydrochloric acid
- Chlorine
- Caustic soda
- Methanol
- Sodium chloride

Table 3-11: Estimated Levels of Hazardous Material Transported on Area Roadways

Roadway	Number of Tank or Van Trucks Carrying Hazardous Materials per hour
Interstate 91	10
Route 2	2
Other major roadways *(Routes 5/10, 63, 47, 116,202, 8A, 78, 122, 142, and 2A)*	1 or 0

Source: Franklin County Hazardous Material Emergency Plan, 2006.

Table 3-12: Estimated Level of Hazardous Material Transport on Area Train Lines

Train Line	Trains per Day (General Merchandise)	Average Number of Cars per Train	Average Number of Cars per Train with Hazardous Waste
Main Freight Line, Pan Am Systems	**10 to 24**	**50**	**4**
Connecticut River Line, Pan Am Systems	2 to 3	30	2
East Deerfield Rail Yard, Pan Am Systems	10 to 15 trains passing through yard	n/a	2 to 5
New England Central	2	60	5

Source: Franklin County Hazardous Material Emergency Plan, 2006.

Safe and efficient transportation routes for trucks traveling 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. Some challenges to safe transportation routes were identified in the FRCOG 2007 Regional Transportation Plan and include:

- The lack of climbing and turning lanes on Route 2 East. Freight trucks are susceptible to the hazard of rapid stops, as they cannot slow the momentum of their vehicles quickly.
- The severity of the exit ramp curves impacts the safety of exiting for top-heavy vehicles such as freight trucks.
- Steep declines. The feasibility of adding runaway truck lanes is being evaluated.

Currently safety changes on Route 2 in Orange are addressing the first two challenges. Of particular concern to the committee is a potential spill in the recharge areas of the town's wells. Route 2, 2A, 202, and 122 pass through the recharge areas. The soil in these areas is sandy and a

spill would potentially reach the water table quickly, contaminating a large portion of the Town's drinking water.

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 3-13: Toxic Release Inventory for Orange

Facility Name	Number of Compounds Reported at Facility
Echo Industries Inc. Orange MA	4
Harris Manufacturing & Supply Co Inc.	23
Rodney Hunt Co	93

Source: EPA Toxic Release Inventory, 2010.

Note: Table 3-13: 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.

Further information on facilities housing hazardous materials in Orange is available in the 2010 CEMP, which is compiled by the Emergency Management Director, and listed in Table 3-14. This list does not necessarily include all facilities in Orange with hazardous materials. An action item has been added to the Action Plan for the town to determine an appropriate threshold for listing facilities in this inventory, and then to determine what facilities need to be added.

Table 3-14: Hazardous Facilities in Orange

Facility Name	Facility Location	Hazardous Chemical Inventory
Jumptown USA	80 Airport Road	Jet A Fuel
Seaman Paper Company	131 and 184 Dukakis Drive	Propane
Orange Municipal Airport	80 Airport Street	100 Low Lead Aviation Gas; Jet A Fuel
MBW Incorporated	184 Dukakis Drive	Propane
Echo Industries	61 East River Road	
DPW Headquarters	526 East River Street	Diesel; salt
Orange Wastewater Treatment	295 West Main Street	Chlorine
Orange Fire Station #2	50 Millyard Road	Diesel; Propane

Source: Orange Comprehensive Emergency Management Plan, 2010.

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 Orange. The Vermont Yankee nuclear power plant is located on the Connecticut River in Vernon, Vermont, near the Vermont/Massachusetts border, approximately 16.5 miles from downtown Orange. 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.[51]

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, Orange officials should stay abreast of proper evacuation procedures in the event of an accident at the Vermont Yankee nuclear power plant.

The Orange Fire Department has internal procedures for responding to hazardous material releases. Evacuation routes will depend on the location of the spill, and wind direction and speed.

[51] Vermont Department of Health. http://healthvermont.gov/enviro/rad/vt_yankee.aspx

Risk Assessment Methodology

In updating Orange's Natural Hazard Mitigation Plan, the Franklin Regional Council of Governments (FRCOG) 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 Orange Natural Hazard Mitigation Planning 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 Orange'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 probability 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 3-15: Probability of Occurrence Rating Chart

Classification	#	Probability 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 3-16: 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 3-17: 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.
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	NaturalResources include agricultural land, water supply lands, rivers.

Severity of Impact Category	Severity of Impact Category Definitions
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 3-18: Area of Occurrence Rating Chart

Classification	#	Percentage of Town Impacted
Large	3	More than 50% of the town affected.
Medium	2	10 to 50% of the town affected.
Isolated	1	Less than 10% of the town affected.

Table 3-19: Preparedness Rating Chart

Classification	#
Poor	3
Fair	2
Good	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 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 All Hazards Vulnerability Assessment can be seen in Table 3-20. The hazards receiving a Weighted Hazard Index of 4.5 or more are – in order of vulnerability – Hurricane and Tropical Storm (5.6), Severe Winter Storm (5.2), Tornado (4.7), and Earthquake (4.6).

According to the results of the assessment, each of the four hazards listed above are likely to impact 50% or more of the town. Earthquakes and tornados occur infrequently, but could have severe impacts to the built and natural environments and the town's population and infrastructure. Severe winter storms occur at least once a year, but have less critical impacts. Hurricanes and tropical storms occur once every 5 to 50 years, and can have critical impacts. The committee felt that the town is fairly well prepared for hurricanes and tropical storms, severe winter storms, and tornados, but less prepared for a major earthquake.

Wildfire and brushfire, flooding, and ice jams occur frequently, but are considered to have minor or limited impacts to the built and natural environments and the town's population and infrastructure. Dam failure has a low probability of occurrence, but could have critical impacts on the natural environment. Microbursts occur anywhere from once in 5 years to once in 50

years, while landslides occur once in 50 to once in 100 years. Both are listed as having minor to limited impacts. All hazards falling below a 4.5 weighted hazard index in the assessment are considered to only impact an isolated area of town when they occur. In terms of preparedness, the committee felt that the town is well-prepared for dealing with flooding and microburst events, and fairly well prepared for wildfire and brushfire, dam failure, ice jams, and landslides.

Table 3-20: All Hazards Vulnerability Assessment

EVENTS	PROBABILITY OF OCCURRENCE *	FOC WEIGHTED VALUE	SEVERITY OF IMPACTS*				SOI WEIGHTED VALUE	AREA OF OCCURRENCE *	AOO WEIGHTED VALUE	PREPARED-NESS	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***	**Infra-structure 1-4***		**1-3**		**1-3**		
NATURAL HAZARDS												
Hurricane & Tropical Storm	3	1.35	3	3	3	3	3.60	3	0.45	2	0.17	**5.6**
Severe Winter Storm	5	2.25	2	2	2	2	2.35	3	0.40	2	0.17	**5.2**
Tornado	2	0.90	2	3	3	3	3.15	3	0.45	2	0.15	**4.7**
Earthquake	1	0.45	4	2	3	3	3.45	3	0.38	3	0.30	**4.6**
Wildfire & Brushfire	5	2.25	1	2	1	1	1.50	1	0.15	2	0.15	**4.1**
Flooding	4	1.65	1	2	1	2	1.90	1	0.15	1	0.13	**3.8**
Dam Failure	2	0.90	2	3	2	2	2.55	1	0.15	2	0.20	**3.8**
Microburst	3	1.50	2	2	1	1	1.90	1	0.20	1	0.13	**3.7**
Ice Jam	4	1.58	1	1	1	2	1.35	1	0.15	2	0.20	**3.3**
Landslide	2	0.90	2	2	1	1	1.50	1	0.15	2	0.20	**2.8**

* See Rating Charts.
Note: This assessment does not include Manmade Hazards given the lack of data assessed for this plan.

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 Orange. 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 FRCOG staff to determine the vulnerability of Orange to flooding and to calculate the potential costs of flooding to the town.[52] Estimated losses for all other hazard events were also determined, based on damages from past recorded events. The potential implications for vulnerable populations such as 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, for example.

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 pro-actively address environmental equity concerns to help ensure that minority and low-income communities are not disproportionately impacted by environmental hazards.[53]

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

[52] 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 (databases) and automatically calculate and estimate the cost of flooding to each town or region.

[53] http://www.mass.gov

work longer hours to compensate for lower hourly wages.[54] Thus decisions that may directly impact where they live may be made by a town without their voices being heard.

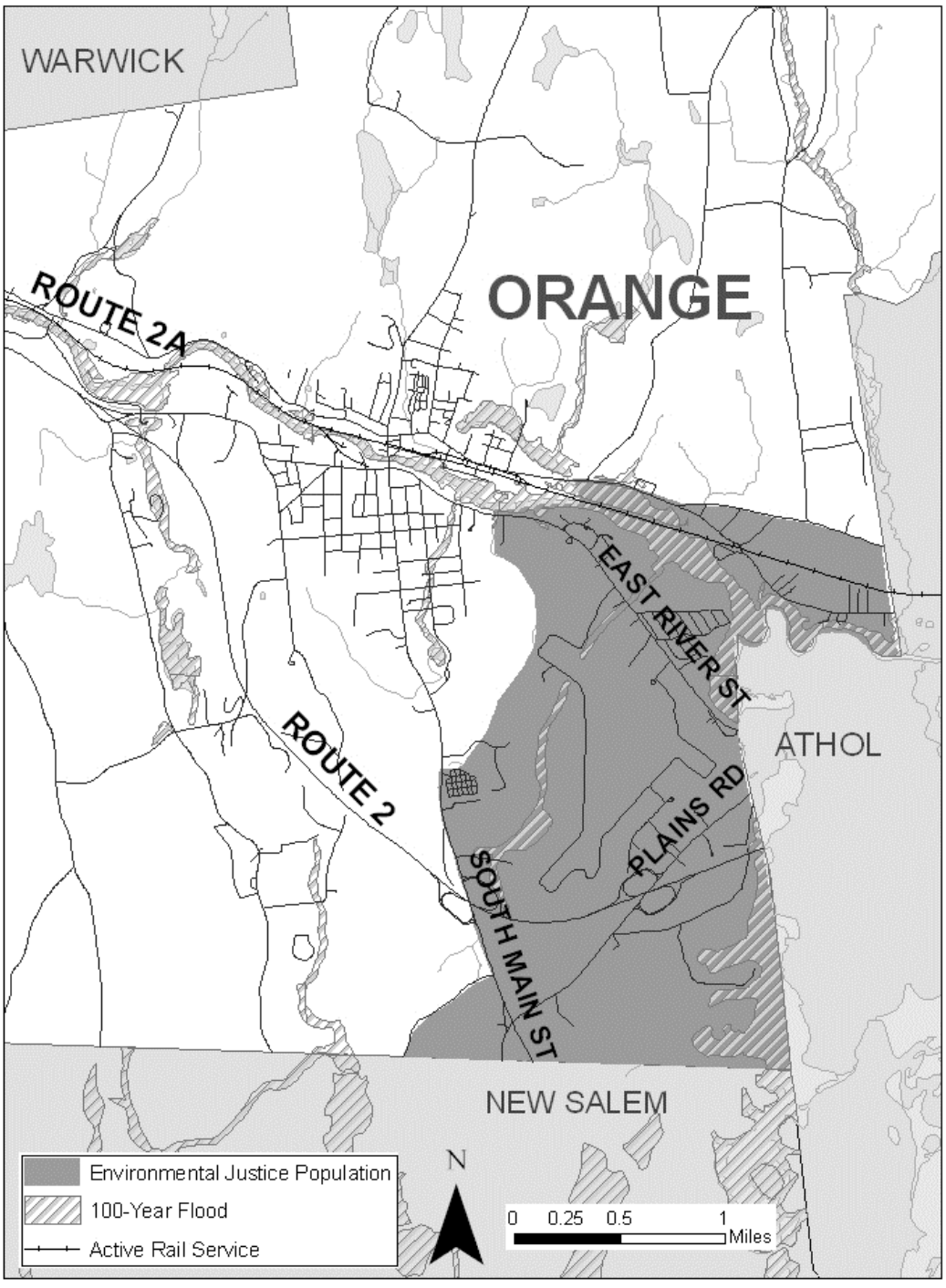
In 2003, based upon 2000 census data, MassGIS produced Environmental Justice Populations layers representing neighborhoods across the state with high minority, non-English speaking, low-income, or foreign-born populations.[55]

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 Orange, the EJ area is roughly bounded by the Red Brook and South Main Street to the west, Route 2A to the north, the town border with Athol to the east and the town border with New Salem to the south (See Figure 3-1, below). Route 2 and the railroad pass through the EJ area. As discussed in the Manmade Hazards section above, these transportation routes carry hazardous materials on a regular basis. Some of the EJ area also overlaps with areas in the floodplain, or are adjacent to areas zoned industrial which may also contain hazardous materials.

[54] http://www.mass.gov/envir/smart_growth_toolkit/pages/mod-ej.html
[55] http://www.mass.gov/mgis/cen2000_ej.htm



Source: 2000 U.S. Census and MassGIS, 2003.

As Orange 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.

FLOODING

Hazard Summary

In this section, a vulnerability assessment was prepared to evaluate the potential impact that flooding could have on the portions of Orange 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. 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 Orange 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. 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. 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

Of Orange's total acreage, 1,132 acres lie within the 100-year floodplain. Table 3-21 displays the number of dwelling units and the estimated population living in the 100-year floodplain in Orange. According to 2005 MassGIS Land Use data[56] there are 33 dwelling units located in the floodplain. Using this number and Orange's average household size, it is estimated that 76 people, or approximately 1% of Orange's total population, reside in the floodplain.

Table 3-21: Number of Dwelling Units and Percent of Total Population Residing in Flood Hazard Area

Total Town Population	Average Per Household Population	Number of Dwelling Units in Floodplain	Estimated Population in Floodplain	% of Total Population that Reside in the Floodplain
7,839	2.31	33	76	1.0%

Source: 2010 U.S. Census; 2005-2009 American Community Survey; 2005 MassGIS Land Use data.

Table 3-22 shows the total acreage of each type of land use—commercial, industrial and public/institutional—in Orange, and the percentage of the total acreage for each type of land use in the floodplain. Roughly 12.5 acres of industrial uses lie within the floodplain, or 9.4% of all industrial uses in Town. Approximately 6.4 acres of commercial and 1.5 acre of public/institutional land uses fall within the floodplain, accounting for less than 5% of these uses within Orange.

Table 3-22: Acres of Commercial, Industrial, and Public/Institutional Land Use Within the Flood Hazard Area

Land Use	Total Acres in Town	Acres in Floodplain	% of Total Acres in Floodplain
Commercial	165.4	6.4	3.9%
Industrial	132.5	12.5	9.4%
Public/Institutional	67.6	1.5	2.1%

Source: 2005 MassGIS Land Use data.

The average assessed values of the residential, commercial, and industrial land uses located within the floodplain are displayed in Table 3-23. The total average assessed value for these three land uses within the floodplain is $9,765,612, with the largest assessed value falling within the residential land use category at $6,219,057. This is of concern because should a catastrophic flooding event befall Orange, the assessed values of these structures and facilities would likely be significantly reduced, which in turn would impact the town's tax revenues.

[56] The land use figures presented in this section are based on data provided by MassGIS. MassGIS classifies land uses based on aerial photograph interpretation conducted by the Department of Forestry's Resource Mapping Project at the University of Massachusetts, Amherst. Statewide data including all municipalities are available for 2005, 1999, 1985, and 1971.

Table 3-23: Average Assessed Value of Land Use in Flood Hazard Area

	Total Acres in Town	Total Assessed Value	Average Assessed Value per Acre	Acres in Floodplain	Average Assessed Value in Floodplain
Residential	1787.6	$454,499,700	$254,254	24.46	$6,219,057
Commercial	165.4	$42,572,988	$257,456	6.4	$1,658,019
Industrial	132.5	$19,986,495	$150,841	12.5	$1,888,535

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 Orange Assessors Office for the wastewater treatment plant, a significant structure located in the floodplain in Orange. The total building value (Table 3-25) 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 (see Table 3-24). The wastewater treatment facility is considered a government general service. The estimated total building value for the wastewater treatment facility is $441,400.

Table 3-24: Occupancy Class and Estimated Contents Value of Buildings

Occupancy Class	Contents Value % (as a percentage of building replacement value)
Residential (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 3-25: Total Building Value in Flood Hazard Area

Structure	Building Structure Value in Flood Hazard Area	Building Contents Value in Flood Hazard Area	Total Building Value in Flood Hazard Area
Wastewater Treatment Facility	$220,700	$220,700	$441,400

Source: 2011 Orange Assessors data.

Table 3-26 displays potential loss estimates for significant structures in the floodplain. A flood resulting in 1% damage to the wastewater treatment facility would cause approximately $4,414 in damages, while a flood resulting in damages to 10% of the facility would result in roughly $44,140 in damages.

Table 3-26: Potential Estimated Loss for Buildings Located in Flood Hazard Area

Structure	Total Building Value in Flood Hazard Area	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Wastewater Treatment Facility	$441,400	$4,414	$22,070	$44,140

Source: Derived from 2011 Orange Assessors data.

Table 3-27 identifies the average assessed value of all residential, commercial, and industrial land uses located in the floodplain in Orange and the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a major flooding event.

Table 3-27: Potential Estimated Loss in Flood Hazard Area by Land Use

	Average Assessed Value in Floodplain	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	$6,219,057	$62,191	$310,953	$621,906
Commercial	$1,658,019	$16,580	$82,901	$165,802
Industrial	$1,888,535	$18,885	$94,427	$188,854
Total	**$9,765,612**	**$97,656**	**$488,281**	**$976,561**

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

Repetitive Loss Properties

Repetitive loss properties are those for which two or more losses of at least $1000 each have been paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978. According to information obtained from MEMA (and the NFIP), as of June 30, 2013 there are three repetitive loss structures in Franklin County; none in Orange. See pages 120-122 for more information on NFIP.

Population Impacts

The Town should be aware that senior and low income segments of Orange'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 3-28 displays the number of senior and low income residents in Orange. It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table. However the town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Table 3-28: Senior and Low Income Populations in Orange Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	1,023	13.1%
Low Income (Persons with annual incomes less than $25,000)*	2,201	28.1%
Total	**3,224**	**41.2%**

* Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than $25,000 (953) by 2005-2009 American Community Survey Average Household Size (2.31).
Source: 2010 U.S. Census; 2005-2009 American Community Survey

Overall Vulnerability Assessment

Flooding is common in New England, often causing significant impacts to the roads, structures, facilities, utilities, and population of Orange. Existing and future mitigation efforts should continue to be developed and employed that will enable Orange 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 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 Orange from flood hazards, the following data deficiencies were identified:

- 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 due to outdated FEMA floodplain maps.
- Lack of updated floodplain maps. The current floodplain maps for Orange were created in 1982.
- Records of damages to the built and natural environment and costs to the town due to flooding events in Orange could be more consistently maintained. A more formal system of data collection and maintenance would help improve the Town's hazard mitigation planning, and could also increase the Town's chance of qualifying for various grants.

SEVERE WINTER STORMS

Severe snow and ice storms are common in Orange, often impacting 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 Orange 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. This data was used to support an evaluation of exposure and potential impacts associated with this hazard. Available historic data are presented in Table 3-26. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 was also reviewed for information on severe winter storm hazard data and mitigation measures.

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 and 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, resulting 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

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

According to the National Climatic Data Center (NCDC), there have been a total of 115 snow and ice events reported in Franklin County between 1993 and 2013, including heavy snow, snow, ice storms, snow squalls, freezing rain and winter storms. The NCDC web site has more detailed information about each of the listed storms. An average of 5 such events occurs each year. Over 21 years, winter storms have caused an average of $3.9 million in damages per year in Franklin County.

Table 3-29: Severe Winter Storms in Franklin County (Heavy Snow/Ice)

Year	# of Heavy Snow/Ice Events	Annual Property Damage	Annual Crop Damage
2013	0	$0	$0
2012	2	$0	$0
2011	2	$1.01 million	$0
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
# of Years	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
21	**115**	**$3,925,238**	**$0**

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

The entire built environment of Orange is vulnerable to a severe winter storm. Table 3-30 identifies the assessed value of all residential, commercial, and industrial land uses in Town, and the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a severe winter storm.

Table 3-30: Potential Estimated Loss by Land Use

	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	$454,499,700	$4,544,997	$22,724,985	$45,449,970
Commercial	$42,572,988	$425,730	$2,128,649	$4,257,299
Industrial	$19,986,495	$199,865	$999,325	$1,998,650
Total	**$517,059,183**	**$5,170,592**	**$25,852,959**	**$51,705,918**

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

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 3-31 summarizes the population in Orange over the age of 65 or living in households with an income below $25,000 per year.

Table 3-31: Senior and Low Income Populations in Orange Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	1,023	13.1%
Low Income (Persons with annual incomes less than $25,000)*	2,201	28.1%
Total	**3,224**	**41.2%**

* Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than $25,000 (953) by 2005-2009 American Community Survey Average Household Size (2.31).
Source: 2010 U.S. Census; 2005-2009 American Community Survey

Overall Vulnerability Assessment

Severe winter storms are common in New England, often causing significant impacts to the roads, structures, facilities, utilities, and population of Orange. Existing and future mitigation efforts should continue to be developed and employed that will enable Orange to be prepared for these events when they occur. The cascade effects of severe winter storms include utility losses, transportation accidents, and flooding. Losses associated with flooding 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 Orange from severe winter storms, the following data deficiencies were identified:

- Records of damages to the built and natural environment and costs to the town due to severe winter storm events in Orange could be more consistently maintained. A more formal system of data collection and maintenance would help improve the Town's hazard mitigation planning, and could also increase the Town's chance of qualifying for various grants.

HURRICANES AND TROPICAL STORMS

Hazard Summary

Hurricanes and tropical storms are estimated to occur anywhere from once in every 5 years to once in every 50 years (having a 2 – 20% chance of occurring in any given year) in Orange 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.

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 Microbursts section below). Inland, hurricanes mainly bring heavy rains that can cause flooding.

Data Collected and Used

National weather databases and Town of Orange 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. Available historic data are presented in Table 3-32. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 was also reviewed for information on hurricane and tropical storm hazard data and mitigation measures.

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 3-32, historic data for hurricane and tropical storm events indicate one hurricane and 17 tropical storms have been recorded in Franklin County. Hurricane Bob in 1991 caused over $5.5 million in property damage in the county, and over $500,000 in crop damage. In 2011, Tropical Storm Irene caused over $25 million in property damage. Overall, tropical storms and hurricanes have caused an average annual property damage of just $1.3 million over the last 24 years.

Table 3-32: Hurricane and Tropical Storm Events in Franklin County

Year	# of Hurricane/Tropical Storm Events	Annual Property Damage	Annual Crop Damage
2013	0	$0	$0
2012	0	$0	$0
2011	1	$25,325,000	$0
2010	0	$0	$0
2009	0	$0	$0
2008	0	$0	$0
2007	0	$0	$0
2006	5	$277,861	$0
2005	1	$33,889	$0

Year	# of Hurricane/Tropical Storm Events	Annual Property Damage	Annual Crop Damage
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**
24	**18**	**$1,373,746**	**$26,455**

Source: Spatial Hazard Events and Losses Database for the United States (SHELDUS): http://webra.cas.sc.edu/hvri/products/sheldus.aspx.
http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=08&endDate_dd=31&endDate_yyyy=2013&eventType=%28Z%29+Tropical+Storm&county=FRANKLIN&zone=WESTERN%2BFRANKLIN&submitbutton=Search&statefips=25%2CMASSACHUSETTS

The entire built environment of Orange is vulnerable to the high winds and/or flooding from a hurricane or tropical storm. Table 3-33 identifies the assessed value of all residential, commercial, and industrial land uses in Orange, and 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 3-33: Potential Estimated Loss by Land Use

	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	$454,499,700	$4,544,997	$22,724,985	$45,449,970
Commercial	$42,572,988	$425,730	$2,128,649	$4,257,299
Industrial	$19,986,495	$199,865	$999,325	$1,998,650
Total	**$517,059,183**	**$5,170,592**	**$25,852,959**	**$51,705,918**

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

Population Impacts

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

Populations considered most vulnerable to hurricane and tropical storm impacts in Orange 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 3-34 summarizes the population over the age of 65 or living in households with an annual income below $25,000.

Table 3-34: Senior and Low Income Populations in Orange Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	1,023	13.1%
Low Income (Persons with annual incomes less than $25,000)*	2,201	28.1%
Total	**3,224**	**41.2%**

* Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than $25,000 (953) by 2005-2009 American Community Survey Average Household Size (2.31).
Source: 2010 U.S. Census; 2005-2009 American Community Survey

Overall Vulnerability Assessment

Hurricanes and tropical storms are uncommon in Franklin County, but can cause significant damage when they do occur. Existing and future mitigation efforts should continue to be developed and employed that will enable Orange to be prepared for these events. 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 Orange from hurricanes and tropical storms, the following data deficiencies were identified:

- Records of damages to the built and natural environment and costs to the town due to hurricane and tropical storm events in Orange could be more consistently maintained. A more formal system of data collection and maintenance would help improve the Town's hazard mitigation planning, and could also increase the Town's chance of qualifying for various grants.

TORNADOS

Hazard Summary

Like hurricanes, tornados are relatively rare in Orange 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.

Data Collected and Used

National weather databases and Town of Orange 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 can cause damage to utilities, structures, roads, trees (potentially causing vehicle accidents) and injuries and death.

Property Damage

As presented in Table 3-35, historic data for tornado events indicate that between 1991 and 2013, 4 tornados were recorded in Franklin County. Over 23 years, tornados have caused an average of $14,130 in property damages yearly.

Table 3-35: Tornado Events in Franklin County

Year	# of Tornado Events	Annual Property Damage	Annual Crop Damage
2013	0	$0	$0
2012	0	$0	$0
2011	0	$0	$0
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

Year	# of Tornado Events	Annual Property Damage	Annual Crop Damage
1992	1	$25,000	$0
1991	0	$0	$0
# of Years	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
23	**4**	**$14,130**	**$0**

Source: National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center Storm Events Database website: http://www.ncdc.noaa.gov/stormevents/.

WIND STORMS

Hazard Summary

Microbursts and thunderstorms are common in western Massachusetts and can cause significant damage. 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. Additional data were available for hail and lightning events, which are generally associated with thunderstorms.

Data Collected and Used

National weather databases and Town of Orange 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 severe thunderstorms and microburst hazard data and mitigation measures.

Impact on the Community

Exposure and Loss Estimation

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

Property Damage

Severe thunderstorms, and their associated hail and lightning events, brought about significant property wreckage in Franklin County in recent years. Thunderstorms with associated wind damage, 169 of them in the last 24 years, caused an average annual property loss of more than $81,938 and an average annual crop damage of $5,208 (Table 3-36). 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 2010, NOAA recorded an average of 8.9 storms per year, more than two times the previous decade. From 2007 through 2010, the most recent years with data available, 61 storms were recorded countywide for an average number of 15 storms over four years.

Table 3-36: Thunderstorm Events in Franklin County

Year	# of Thunderstorm Events	Annual Property Damage	Annual Crop Damage
2013	8	$149,000	$0
2012	8	$34,000	$0
2011	9	$77,000	$0
2010	30	$590,500	$0
2009	2	$17,000	$0
2008	21	$602,000	$1,250,000
2007	19	$0	$0
2006	6	$315,000	$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
# of Years	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
24	**169**	**$81,938**	**$5,208**

Source: National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center Storm Events Database website: http://www.ncdc.noaa.gov/stormevents/. http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=08&endDate_dd=31&endDate_yyyy=2013&eventType=%28C%29+Thunderstorm+Wind&county=FRANKLIN&zone=WESTERN%2BFRANKLIN&submitbutton=Search&statefips=25%2CMASSACHUSETTS

Four thunderstorms over the last five years produced high winds in Orange that caused damage to trees and power lines (Table 3-37). In 2005, $10,000 in damages was recorded due to one storm. A storm in July, 2010, resulted in a tree falling on a house on Main Street. The amount of damage due to this event is unknown. No property damage was recorded for three of the four events, resulting in an average annual property damage of $2,000 over five years.

Table 3-37: Severe Thunderstorm Events in Orange

Year	# of Thunderstorm Events	Annual Property Damage	Annual Crop Damage
2005	1	$10,000	$0
2007	1	$0	$0
2010	2	$0	$0
# of Years	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
5	**4**	**$2,000**	**$0**

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

As Table 3-38 shows, 84 hail storms in Franklin County between 1991 and 2013 have caused an average of approximately $217 in property damage per year, and an average of $2,174 of crop damage. The total amount of crop damage during this period resulted from a single incident on June 16, 2008 that caused $50,000 in damage. Pea to marble size hail fell in a swath from Colrain to Shelburne damaging apple and peach orchards from Colrain to Shelburne to Deerfield. An estimated 45 acres of apples and two to three acres of peaches were damaged by the hail. This storm was also accompanied by lightning and thunderstorm winds. It is important to note that each reported hail event is counted in the total, even if they occurred in multiple towns on the same date.

Table 3-38: Hail Events in Franklin County

Year	# of Hail Events	Annual Property Damage	Annual Crop Damage
2013	7	$0	$0
2012	2	$0	$0
2011	9	$0	$0
2010	4	$0	$0
2009	2	$0	$0
2008	14	$0	$50,000
2007	15	$0	$0
2006	0	$0	$0
2005	3	$5,000	$0
2004	2	$0	$0
2003	1	$0	$0
2002	0	$0	$0
2001	3	$0	$0
2000	1	$0	$0
1999	0	$0	$0
1998	9	$0	$0
1997	1	$0	$0
1996	3	$0	$0
1995	4	$0	$0
1994	4	$0	$0

Year	# of Hail Events	Annual Property Damage	Annual Crop Damage
1993	0	$0	$0
1992	0	$0	$0
1991	0	$0	$0
# of Years	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
23	**84**	**$217**	**$2,174**

Source: National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center Storm Events Database website: http://www.ncdc.noaa.gov/stormevents/.
http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=08&endDate_dd=31&endDate_yyyy=2013&eventType=%28C%29+Hail&county=FRANKLIN&zone=WESTERN%2BFRANKLIN&submitbutton=Search&statefips=25%2CMASSACHUSETTS

Three hail events have been recorded in Orange since 1995 (Table 3-39). Damage estimates from these storms is unknown.

Table 3-39: Hail Events in Orange

Year	# of Hail Events	Annual Property Damage	Annual Crop Damage
1995	1	$0	$0
1996	1	$0	$0
2008	1	$0	$0
# of Years	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
14	**3**	**$0**	**$0**

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

Fifteen (15) lightning events (Table 3-40) have caused an average of more than $354,800 in property damage per year over the last 20 years in Franklin County. These events include the lightning strike that occurred in Rowe on August 4, 2012 that resulted in the complete destruction of the Rowe Elementary School, for a property loss with an insurance value of $6,900,000. The average property damage per year during this period excluding that event in 2012 is $9,800.

Table 3-40: Lightning Events in Franklin County

Year	# of Lightning Events	Annual Property Damage	Annual Crop Damage
2013	3	$48,000	$0
2012	1	$6,900,000	$0
2011	0	$0	$0
2010	1	$15,000	$0
2009	0	$0	$0
2008	1	$10,000	$0
2007	0	$0	$0
2006	0	$0	$0
2005	1	$50,000	$0

Year	# of Lightning Events	Annual Property Damage	Annual Crop Damage
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	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
20	**15**	**$354,800**	**$0**

Source: National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center Storm Events Database website: http://www.ncdc.noaa.gov/stormevents/.

Six lightning events were recorded in Orange since 1992. Three of these events, in 1992, 1996, and 1997, impacted the Orange Police Station, causing significant damage to the radio, telephone, and computer systems. In July, 1997, a chicken coop was struck by lightning in Orange and caught fire. In July, 2010, lightning struck a house, resulting in $10,000 in damages. Over 18 years, the average annual property damage due to lightning in Orange was approximately $2,360 (Table 3-41).

Table 3-41: Lightning Events in Orange

Year	# of Lightning Events	Annual Property Damage	Annual Crop Damage
1992	1	$15,748	$0
1995	1	$0	$0
1996	1	$13,089	$0
1997	2	$3,650	$0
2010	1	$10,000	$0
# of Years	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
18	**6**	**$2,360**	**$0**

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

The entire built environment of Orange is vulnerable to the high winds and/or flooding from a tornado, thunderstorm or microburst. Table 3-42 identifies the assessed value of all residential, commercial, and industrial land uses in Orange, and 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 3-42: Potential Estimated Loss by Land Use

	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	$454,499,700	$4,544,997	$22,724,985	$45,449,970
Commercial	$42,572,988	$425,730	$2,128,649	$4,257,299
Industrial	$19,986,495	$199,865	$999,325	$1,998,650
Total	**$517,059,183**	**$5,170,592**	**$25,852,959**	**$51,705,918**

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

Population Impacts

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

Populations considered most vulnerable to tornado and microburst impacts in Orange 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 or living in households with an annual income below $25,000.

Table 3-43: Senior and Low Income Populations in Orange Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	1,023	13.1%
Low Income (Persons with annual incomes less than $25,000)*	2,201	28.1%
Total	**3,224**	**41.2%**

* Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than $25,000 (953) by 2005-2009 American Community Survey Average Household Size (2.31).
Source: 2010 U.S. Census; 2005-2009 American Community Survey

Overall Vulnerability Assessment

Thunderstorms and microbursts are common in New England, and can impact property, crops, utilities and the population of Orange. Tornados are less common, but can cause significant damage when they do occur. Existing and future mitigation efforts should continue to be developed and employed that will enable Orange to be prepared for these events. 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 Orange from tornados, microbursts and thunderstorms and associated storms events such as hail and lightning, the following data deficiencies were identified:

- Lack of available information on crop damages.

WILDFIRES/BRUSHFIRES

Hazard Summary

According to data from Massachusetts Fire Incident Reporting System of the Massachusetts Department of Fire Services, the Orange Fire Department responded to 25 wildfires between 2004 and 2009. 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. Orange is vulnerable to these conflagrations, especially in times of drought. 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 Orange 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 Climactic 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), 25 brushfires were reported in Orange 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 Orange's 25 fires between 2004 and 2009.

Because Orange is heavily wooded and has so many historic wooden structures, the entire built environment of the Town is vulnerable to a wildfire. Table 3-44 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 3-44: Potential Estimated Loss by Land Use

	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	$454,499,700	$4,544,997	$22,724,985	$45,449,970
Commercial	$42,572,988	$425,730	$2,128,649	$4,257,299
Industrial	$19,986,495	$199,865	$999,325	$1,998,650
Total	**$517,059,183**	**$5,170,592**	**$25,852,959**	**$51,705,918**

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

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 3-45 summarizes the population over the age of 65 or living in households with an income below $25,000 per year.

Table 3-45: Senior and Low Income Populations in Orange Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	1,023	13.1%
Low Income (Persons with annual incomes less than $25,000)*	2,201	28.1%
Total	**3,224**	**41.2%**

* Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than $25,000 (953) by 2005-2009 American Community Survey Average Household Size (2.31).
Source: 2010 U.S. Census; 2005-2009 American Community Survey

Overall Vulnerability Assessment

While wildfires have caused minimal damage, injury and loss of life to date in Orange, 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 Orange 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 Orange from wildfire hazards, no data deficiencies were identified.

DAM FAILURE

Hazard Summary

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 Committee, no dam failures have occurred in Orange 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 each of the dams in Orange are vulnerable to a dam failure. Table 3-46 identifies the building type and valuation for all residential, commercial, and industrial uses in Town, 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 3-46: Potential Estimated Loss by Land Use

	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	$454,499,700	$4,544,997	$22,724,985	$45,449,970
Commercial	$42,572,988	$425,730	$2,128,649	$4,257,299
Industrial	$19,986,495	$199,865	$999,325	$1,998,650
Total	**$517,059,183**	**$5,170,592**	**$25,852,959**	**$51,705,918**

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 3-47 summarizes the population over the age of 65 or living in households with an income below $25,000 per year.

Table 3-47: Senior and Low Income Populations in Orange Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	1,023	13.1%
Low Income (Persons with annual incomes less than $25,000)*	2,201	28.1%
Total	**3,224**	**41.2%**

* Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than $25,000 (953) by 2005-2009 American Community Survey Average Household Size (2.31).
Source: 2010 U.S. Census; 2005-2009 American Community Survey

Overall Vulnerability Assessment

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

Data Deficiencies

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

- Dams in town do not have inundation mapping, making it difficult to determine what populations would be impacted by a dam failure.

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.[57] 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.[58]

[57] Northeast States Emergency Consortium web site: www.nesec.org/hazards/earthquakes.cfm
[58] Federal Emergency Management Agency web site: www.fema.gov/hazards/earthquakes/quake.shtm.

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.

Impact on the Community

Exposure and Loss Estimation

A major earthquake could cause severe damage to buildings in Orange, including older structures that were built before a 1975 law requiring new buildings to withstand earthquakes.

Property Damage

Historic data for earthquake events indicate that between 1991 and 2010, no earthquakes were recorded in Franklin County during this period, causing no damage to property.[59]

The entire built environment of Orange is vulnerable to earthquakes. Table 3-48 identifies the assessed value of all residential, commercial, and industrial land uses in Orange, and the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of an earthquake.

Table 3-48: Potential Estimated Loss by Land Use

	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	$454,499,700	$4,544,997	$22,724,985	$45,449,970
Commercial	$42,572,988	$425,730	$2,128,649	$4,257,299
Industrial	$19,986,495	$199,865	$999,325	$1,998,650
Total	**$517,059,183**	**$5,170,592**	**$25,852,959**	**$51,705,918**

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

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 3-49 summarizes the population over the age of 65 or living in households with an income below $25,000 per year.

Table 3-49: Senior and Low Income Populations in Orange Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	1,023	13.1%
Low Income (Persons with annual incomes less than $25,000)*	2,201	28.1%
Total	**3,224**	**41.2%**

* Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than $25,000 (953) by 2005-2009 American Community Survey Average Household Size (2.31).

[59] NOAA National Climatic Data Center. http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

Source: 2010 U.S. Census; 2005-2009 American Community Survey

Overall Vulnerability Assessment
Earthquakes, while rare, could cause significant impacts and losses to the roads, structures, facilities, utilities, and population of Orange. Existing and future mitigation efforts should continue to be developed and employed that will enable Orange 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. According to members of the Local Natural Hazard Mitigation Team, no earthquakes have impacted Orange in the last 20 years.

Data Deficiencies
In assessing the risks to Orange from earthquakes, no data deficiencies were identified.

LANDSLIDES

Hazard Summary
Landslides rarely occur in Franklin County, though a 2011 landslide in Greenfield caused significant damage to four homes. 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.

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, particularly on steep slopes or unstable soils, 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.

Table 3-50 identifies the assessed value of all residential, commercial, and industrial uses in Town, 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 3-50: Potential Estimated Loss by Land Use

	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	$454,499,700	$4,544,997	$22,724,985	$45,449,970
Commercial	$42,572,988	$425,730	$2,128,649	$4,257,299
Industrial	$19,986,495	$199,865	$999,325	$1,998,650
Total	**$517,059,183**	**$5,170,592**	**$25,852,959**	**$51,705,918**

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 3-51 summarizes the population over the age of 65 or living in households with an income below $25,000 per year.

Table 3-51: Senior and Low Income Populations in Orange Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	1,023	13.1%
Low Income (Persons with annual incomes less than $25,000)*	2,201	28.1%
Total	**3,224**	**41.2%**

* Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than $25,000 (953) by 2005-2009 American Community Survey Average Household Size (2.31).
Source: 2010 U.S. Census; 2005-2009 American Community Survey

Overall Vulnerability Assessment

Landslides, while rare in Franklin County, can destroy roads, structures, facilities, utilities, and impact the population of Orange. Existing and future mitigation efforts should continue to be developed and employed that will enable Orange 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

In assessing the risks to Orange from landslides, the following data deficiencies were identified:

- Lack of data on what areas in town are vulnerable to landslides.

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. The structures and people most at risk from an ice jam are those within the floodplain.

Data Collected and Used

The National Oceanic and Atmospheric Administration's National Climatic Data Center website shows no ice jam events or damage in Orange 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.

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.

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.

The built environment in the floodplain of Orange is vulnerable to ice jam events. The average assessed values of the residential, commercial, and industrial land uses located within the floodplain are displayed in Table 3-52, along with damage loss estimates for 1%, 5% and 10% of the land uses in the event of flooding caused by an ice jam. The total average assessed value for the three land uses within the floodplain is $9,765,612, with the largest assessed value falling within the residential land use category at $6,219,057. If 10% of the buildings within the floodplain were damaged due to an ice jam, an estimated $976,561 in damages might occur.

Table 3-52: Potential Estimated Loss in Flood Hazard Area by Land Use

	Average Assessed Value in Floodplain	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	$6,219,057	$62,191	$310,953	$621,906
Commercial	$1,658,019	$16,580	$82,901	$165,802
Industrial	$1,888,535	$18,885	$94,427	$188,854
Total	**$9,765,612**	**$97,656**	**$488,281**	**$976,561**

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

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 3-53 summarizes the population over the age of 65 or living in households with an income below $25,000 per year.

Table 3-53: Senior and Low Income Populations in Orange Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	1,023	13.1%
Low Income (Persons with annual incomes less than $25,000)*	2,201	28.1%
Total	**3,224**	**41.2%**

* Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than $25,000 (953) by 2005-2009 American Community Survey Average Household Size (2.31).
Source: 2010 U.S. Census; 2005-2009 American Community Survey

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 Orange 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

In assessing the risks to Orange from ice jams, the following data deficiencies were identified:

- 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.
- Lack of updated floodplain maps.
- Records of damages to the built and natural environment and costs to the town due to ice jam events in Orange could be more consistently maintained. A more formal system of data collection and maintenance would help improve the Town's hazard mitigation planning, and 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 – particularly transportation related, given the proximity of Route 2 and the railroad tracks to the Millers River and to more densely populated areas of Town, as well as the recharge area for two of the town's wells. 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 on the Millers River, on drinking water supply, and on public health.

Development Trends Analysis

In assessing development trends for the Town of Orange - 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 number of construction permits issued, change in population, current zoning bylaws and the acres of developable land was considered.

The population of Orange is estimated to have grown by 321 people or 4.3% between 2000 and 2010, from 7,518 to 7,839. This is a higher rate of increase than the county, which experienced a slight decrease in population of -0.2% during the same period (see Table 3-54).

Table 3-54: 1990, 2000, 2010 Census Data, Total Population

	Census Data			10 Year Trend		20 Year Trend	
Area Name	**1990 Census**	**2000 Census**	**2010 Census**	**2000-2010 *Difference***	**2000-2010 *Change***	**1990-2010 *Difference***	**1990-2010 *Change***
Orange	7,312	7,518	7,839	321	4.3%	527	7.2%
Franklin County	70,092	71,535	71,372	-163	-0.2%	1,280	1.8%

Source: 1990, 2000, 2010 U.S. Census.

Infrastructure plays a vital role in current and future development patterns. Drinking water supplies can be a constraint to future growth in Orange. According to the 2008 Orange Open Space and Recreation Plan, a lack in pipe size (and thus fire protection) had limited commercial development along the eastern portion of Route 2A in Orange. However a recent replacement of the pipe in this area has removed that constraint. The waste water treatment plant and sewer collection system also play an important role in determining the location of dense residential development and future industrial and commercial development. Extending sewer lines without careful planning can increase residential development, reduce farming and forest acreage, and increase hydraulic flows to the wastewater treatment facility due to both.

Orange is located along highways that connect different portions of the north central Massachusetts to other regions. Route 2 is the major east/west highway in Northern Massachusetts. The road is going through a significant upgrade both to improve safety and access for commercial and industrial users. When this project is completed, it could have major implications for land use in Orange.

The nearest passenger rail service is located in Fitchburg. If commuter service is extended westward, Orange could see an increase in residential and commercial development as people take advantage of an additional link to metropolitan Boston.

The airport provides the local community with access to the national air transportation system, and likewise, provides communities and businesses throughout the United States with access to Orange. Although the airport is still utilized largely for recreational purposes, recent trends have

changed the airport's role much more toward corporate use. The airport currently has about 38,000 aircraft operations annually and about 60 percent of those operations are non-recreational in nature.[60]

Between 1971 and 2006 the predominant land use change in the Town of Orange has been the construction of residential development on frontage lots and in subdivisions. Most of the residential development is in the form of approval-not-required lots that have occurred in the village districts as well as the more rural districts. From 1990 to 2003, there had not been a single subdivision approved. However, in recent years (since 2004), the Town has approved three subdivisions – Evergreen Acres (thirty-one building lots off Tully Road in the northern part of Town), Doubleday Fields (nineteen lots on South Main Street), and Pioneer Place (thirty-two duplexes) on New Athol Road (Route 2A). A fourth subdivision – Millers Landing with fifty-one building lots along the Millers River on East River Street – was approved but fell into bankruptcy. It has since been purchased by a new developer who is working with the Planning Board on moving forward with the project. One home has been built and is currently occupied.

According to data provided by the Orange Building Inspector, between 2000 and 2009, building permits were issued for 287 new residential housing units in Orange, representing an 8.7 percent increase in all the housing units in Town. It is important to note that building permits issued have decreased in the last few years due to the recession. For example, in 2006, 51 building permits were issued for new housing units in Orange, while in 2009, only 6 permits were issued. Although growth has slowed recently, it is not unreasonable to assume that residential construction will begin to increase in the future when the financial situation in the country has improved.

Orange has six zoning districts, all of which contain portions of the 100-year floodplain. The districts have different minimum lot size requirements in areas with and without public sewer service (see Table 3-55). In parts of downtown, the minimum lot size is 10,000 square feet, less than one-quarter acre, per unit for homes served by water and sewer. In the downtown, there are a number of former multi-storied mill buildings that are currently vacant or underutilized and could potentially be redeveloped. In the center of downtown, the Commercial Area Redevelopment District (CARD district) is approximately 10 blocks in size, spanning the Millers River, and was created to encourage high-density development and redevelopment in downtown. Within the CARD district, there are no onsite parking requirements, buildings can occupy 100% of a lot area and can be up to five stories in height, and multi-family homes over two units are allowed by right.

The largest zoning district in Orange is the rural residential district, which covers an estimated 75% of the town, and has a minimum lot size of 2 acres. In recent years, new single-family homes have been increasingly built outside of the village centers.

[60] Orange Open Space and Recreation Plan, 2008.

Table 3-55: Zoning Districts in Orange

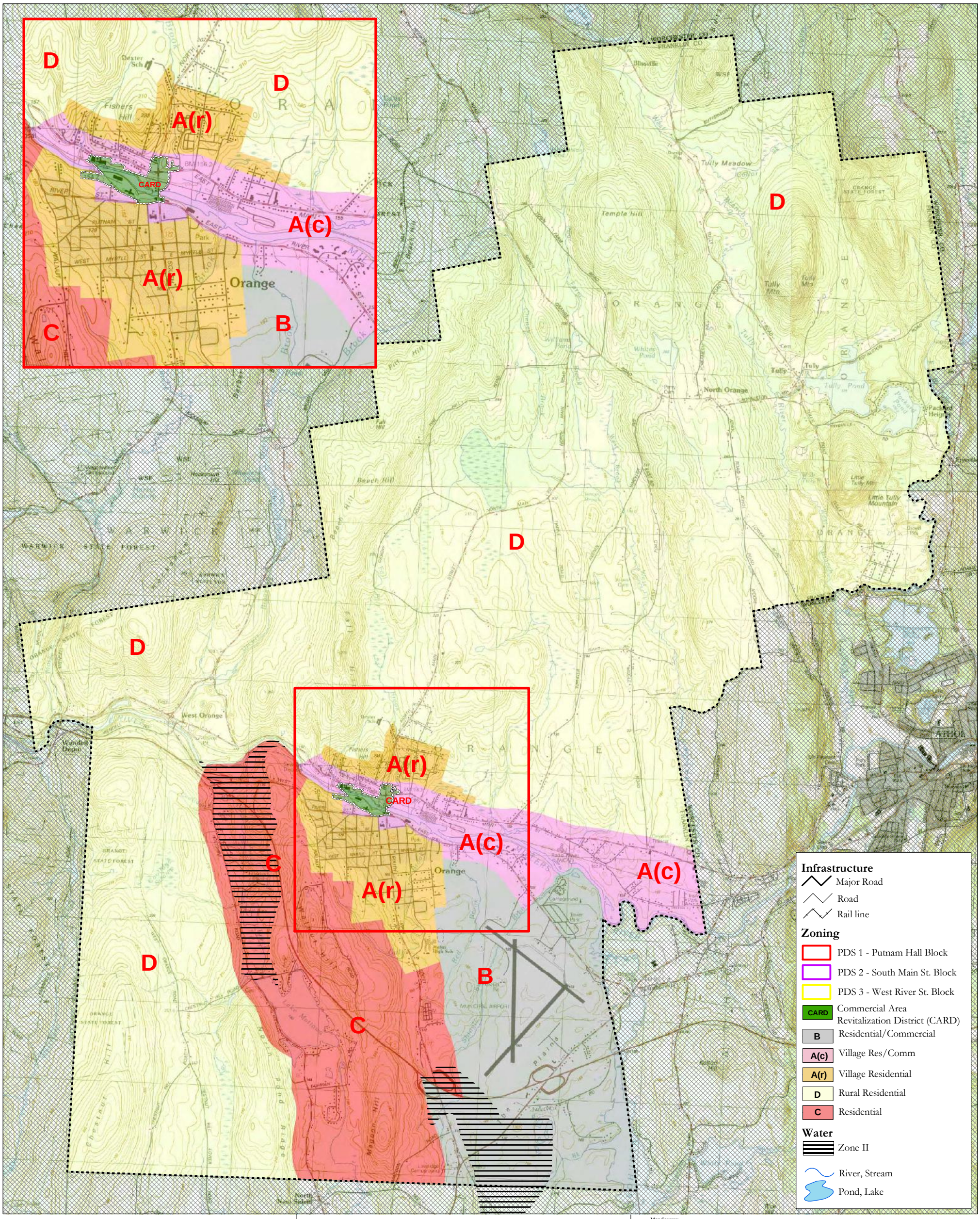
District	Lot Size, total or for first housing unit (sq ft)1	Area for each additional housing unit (sq ft)
Village Residential/Commercial (A(c)) and Village Residential (A(r))	10,000 with sewer; 21,780 without sewer	10,000 with sewer; 20,000 without sewer
Commercial Area Revitalization District (CARD)	5,000	5,000
Residential/Commercial (B)	21,780 with sewer; 43,560 without sewer	20,000 with sewer; 40,000 without sewer
Residential (C)	43,560	20,000 with sewer; 40,000 without sewer
Rural Residential (D)	87,120	40,000 with sewer[2]; 80,000 without sewer

1. 21,780 square feet equals a half-acre; 43,560 square feet equals one acre; 87,120 square feet equal two acres.
2. There are currently no parts of the Rural Residential District that have sewer access.
Source: Town of Orange Zoning Bylaw, October 2010.

Development within the 100-year floodplain is regulated by the Floodplain Overlay District, and is allowed only by Special Permit after meeting certain requirements. Development within the floodplain that would result in any increase in flood levels during a 100-year flood is prohibited. Uses such as agriculture, forestry, outdoor recreation, and conservation are encouraged, provided they are allowed in the underlying district and do not require structures, fill, or storage of materials or equipment.

As discussed in the Vulnerability Assessment Section of this plan, current development in the floodplain includes approximately 20.5 acres of commercial, public/institutional and industrial uses and 24.5 acres of residential use. Most of these uses within the floodplain appear to be located in the downtown area and on Route 2A, along the Millers River. In addition to the Millers River floodplain, the 100-year floodplain extends north and south along the Town's smaller brooks and rivers. The majority of the land in and along the floodplain in Orange is in agricultural use or forested. Further GIS analysis beyond the scope of the current project would be necessary to determine the number of developable acres in and along the floodplain.

Town of Orange
Official Zoning Map
April 28, 2010



FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS
Main Office: 413-774-3167
425 Main Street
Greenfield, Massachusetts 01301

N W E S

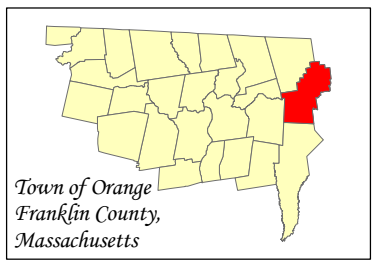
100 Acres 50 Acres

0 0.5 1 2 Miles

Map Sources:

Map Produced by the Franklin Regional Council of Governments Planning Department. GIS data sources include the FRCOG Planning Department, the Massachusetts Highway Department and MassGIS. Digital Data obtained from MassGIS represent the efforts of the Massachusetts Executive Office of Environmental Affairs and its agencies to record information from the sources cited in the associated documentation. EOEA maintains an ongoing program to record and correct errors in the GIS data that are brought to or as to the implied validity of any uses of the GIS data. EOEA maintains records regarding all methods used to collect and process these digital data and will provide this information on request. Executive Office of Affairs, MassGIS EOEA Data Center, 251 Causeway St., Suite 900, Boston, MA, 617-626-1000.
Note: Depicted boundaries are approximate and are intended for planning purposes only. Portions of the source data were obtained from 1:100,000 scale maps, therefore the accuracy of the line work on this map in +/- 100 feet.

1999 MacConnel Land Use created by Resource Mapping, Forestry and Wildlife Department, UMASS: Amherst
Roads data provided by Massachusetts Highway Department 1:5000.
Town line, water, rail, zone II, aquifer and wetlands data provided by MASSGIS.
Water line, sewer line and prime farmland data created by FRCOG planning staff. Potentially developable land created with .aml in ArcInfo that removed absolute constraints to development.(FRCOG planning staff)

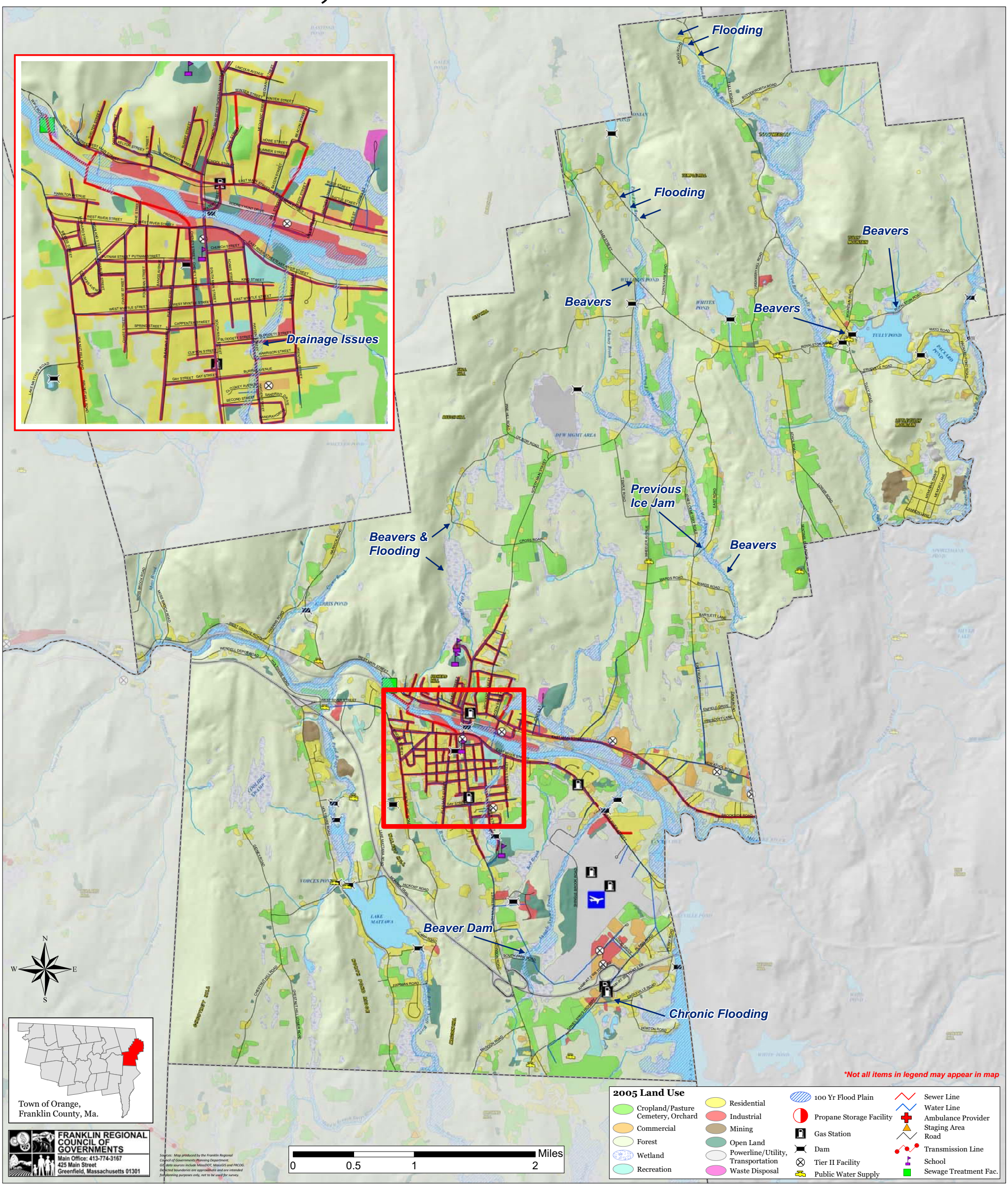


Town of Orange
Franklin County,
Massachusetts

map composed by Ryan Clary, FRCOG Planning Department, 04/10 c:\a_projects\Updated_zoning\orange\new\zoning_new_4_28_10_official.mxd

Critical Facilities & Infrastructure, 2010

Town of Orange



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 and Infrastructure map for the Town of Orange 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. The floodplain comprises approximately 1,132 acres in Orange. The map also shows the areas in Orange that are subject to localized flooding problems.

The major floods recorded in Orange during the 20th century have been the result of rainfall alone or rainfall combined with snowmelt. 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 Orange 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 Orange is enrolled in the National Flood Insurance Program (NFIP). See pages 120-122 for more information on NFIP
- 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 works are in good operating condition at all times.
- Natural water storage areas should be preserved.
- Maintain plans for managing all flood emergency response activities including addressing potentially hazardous dams.

The Comprehensive Emergency Management (CEM) Plan for Orange 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.

Evacuation Options

The majority of land subject to the 100-year floodplain in Orange is forest or non-forested wetlands. However, there are approximately 45 developed acres that would be subject to flooding during a 100-year flood event, including residential, commercial and industrial areas, especially along the Millers River. There is a population concentration along East River Street that, while not directly in the floodplain, is located adjacent to the floodplain and could be impacted during a major flooding event. The designated local shelters are the Armory, Fisher Hill Elementary School, and Ralph C. Mahar Regional School.

The following evacuation routes for floods and hurricanes are listed in the 2010 CEM Plan:

- South Main Street to Route 2
- North Main Street to Warwick
- East Main Street to Athol
- West River Street to Route 2
- East River Street to Route 202
- West Main Street west to Route 2 (on Route 2A)

Also of concern is the potential for flooding due to dam failure. Emergency management personnel should assess existing floodplain and dam failure data to determine an appropriate evacuation plan for different possible scenarios.

In addition, there are streams that run through populated areas that have the potential to cause flooding in town. Orange also has a number of bridges situated either in or near the 100-year floodplain, which could make evacuation efforts as a result of flooding or dam failure more difficult. Some of the roads that residents would most likely take to reach safety travel through flood-affected areas.

Note should also be taken of the fact the Town of Orange wastewater treatment facility and the transfer station, as well as several junkyards lie within or near the 100-year floodplain. There is potential for the release of hazardous waste from these facilities during a flood.

Flood Control Structures

FEMA has identified no flood control structures within the Town of Orange.

Land Use Regulations that Mitigate Impacts from Flooding[61]

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

Subdivision Rules and Regulations – See Appendix 1 for complete language.

- Section 210-3.2 B Definitive Plan – Contents.
- Section 210-3.2 F Performance Guaranty Required.
- Section 210-4.2 B 6 Street Standards – Street Grade.
- Section 210-4.3 Design Standards – Easements.
- Section 210-4.4 Design Standards – Open Spaces.
- Section 210-4.5 Design Standards – Protection of Natural Features.
- Section 210-5.3 Required Improvements - Curb and Gutter.
- Section 210-5.5 Required Improvements – Grass Plots and Trees.
- Section 210-5.6 Required Improvements – Utilities.

Orange Zoning Bylaws – See Appendix 1 for complete language.

- Section 2230 Dimensional Schedule - Maximum Lot Coverage.
- Section 2350 Special Permit for Lot Coverage Increase.
- Section 3310 Erosion Control.
- Section 3320 Flood Plains.

[61] All bulleted items and direct quotes in the Orange Local Natural Hazards Mitigation Plan are taken from the Town of Orange's zoning and subdivision regulations. Other references to those documents contained herein are paraphrases of the same.

- Section 4100 Earth Removal.
- Section 4400 Water Resource District.
- Section 4600 Performance Standards.
- Section 5300 Special Permits.
- Section 5400 Site Plan Review.
- Section 5700 Open Space Development.

River and Stream Protection

The Town of Orange follows the standards established by the Wetlands Protection Act, which protects water bodies and wetlands through the town Conservation Commission. Towns can elect to institute local bylaws that are stricter than the standards set forth in the Wetlands Protection Act. Orange does not have specific wetlands bylaws.

Orange Open Space and Recreation Plan

Recent efforts in the Town of Orange have resulted in the creation of municipal plans that are useful for flood hazard mitigation purposes. In 2008, the town completed an update of its Open Space and Recreation Plan. The intent of the document is not to address hazard mitigation or flood control in a direct or comprehensive way. However, it inventories the natural features and environments in the town, many of which, such as wetlands, aquifer recharge areas, farms, rivers, streams, and brooks, contain floodplain, dam failure inundation or localized flooding areas.

The plan highlights the importance of balancing future development with the preservation of the community's natural and scenic resources. The preservation of open space and farmland will provide flood storage capacity which reduces the amount of impervious surfaces in an area, as well as other benefits not directly related to natural hazard mitigation.

National Flood Insurance Program

The Town of Orange participates in the National Flood Insurance Program (NFIP). As of June 2013, there were 12 policies in effect in Orange for a total of $2,564,600 worth of insurance. The Town's floodplain management program consists of regular enforcement of the relevant sections of the State Building Code (780 CMR) and the Massachusetts Wetlands Protection Regulations (310 CMR 10.00), as well as the required biennial reporting to the NFIP. The Town 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. In the next five years, the town should consider joining the Community Rating System, in addition to continuing its ongoing activities associated with membership in the NFIP. See pages 120-122 for more information on the NFIP.

Table 4-1
Existing Flood Hazard Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness	Proposed Changes	Status
Subdivision Rules and Regulations					
Section 210-3.2 B Definitive Plan – Contents.	Requires a Definitive Plan for new subdivisions, including topography, location of natural systems, waterways and natural drainage courses.	Entire Town	Somewhat effective for mitigation or preventing localized flooding of roads and other infrastructure.	Consider adding Flood Prevention and Mitigation to purpose section of the Subdivision Rules and Regulations.	Recommended in 2005 plan, still relevant. A comprehensive revision to the Orange Subdivision Rules and Regulations is scheduled to begin in 2013.
				Definitive Plan should identify impacts and include flooding mitigation measures.	Recommended in 2005 plan, still relevant. A comprehensive revision to the Orange Subdivision Rules and Regulations is scheduled to begin in 2013.
Section 210-3.2 F Performance Guaranty Required	Performance guaranty ensures that subdividers cover the cost of construction and improvements for projects.	Entire Town	Somewhat effective for mitigation or preventing localized flooding of roads and other infrastructure.	None.	None identified.
Section 210-3 Street Standards; Section 210-4 Design Standards	Design standards include road grades by street class (6%, 9%, 12%) as well as water course easements, open spaces, and the protection of natural features.	Entire Town	Somewhat effective for mitigation or preventing localized flooding of roads and other infrastructure. Somewhat effective for controlling impacts from stormwater runoff.	Consider implementing standards to require temporary and permanent erosion control measures for surface waters.	Recommended in 2005 plan, still relevant. A comprehensive revision to the Orange Subdivision Rules and Regulations is scheduled to begin in 2013.
Section 210-5 Required Improvements	Required improvements include grass plots and trees and the adequate disposal of surface water.	Entire Town.	Somewhat effective for mitigation or preventing localized flooding of roads and other infrastructure. Somewhat effective for controlling	Consider requiring Impact Statements for construction beyond a certain number of lots.	Recommended in 2005 plan, still relevant. A comprehensive revision to the Orange Subdivision Rules and Regulations is scheduled to begin in 2013.

Type of Existing Protection	Description	Area Covered	Effectiveness	Proposed Changes	Status
			impacts from stormwater runoff.		
				Consider updating subdivision regulations to prohibit permanent alterations of watercourses or streams.	Recommended in 2005 plan, still relevant. A comprehensive revision to the Orange Subdivision Rules and Regulations is scheduled to begin in 2013.
Zoning Bylaws					
Section 2230 Dimensional Schedule - Maximum Lot Coverage	Based on the district, the dimensional schedule allows for the maximum percentage of the total lot that can be covered with impervious surfaces. The percentage can be increased via a Special Permit process (see below).	Entire Town	Somewhat effective for ensuring that permitted projects do not increase flooding potential.	None.	None identified.
Section 2350 Special Permits to Increase Maximum Lot Coverage	In Zone B, an additional 35% lot coverage beyond the maximum 35% may be granted providing certain criteria are met. Site design, materials and construction processes shall be designed to avoid erosion damage, sedimentation or uncontrolled surface runoff.	Zone B	Somewhat effective for ensuring that permitted projects do not increase flooding potential.	None.	None identified.
Section 3310 Erosion Control	Grading or construction on, or which result in slopes of 25% or greater on 50% or more of lot area, or on 43,560 sq. feet or more on a single parcel, shall be allowed only under Special Permit from the Planning Board, which shall be granted only upon demonstration that adequate	Entire Town	Somewhat effective for ensuring that permitted projects do not increase flooding potential. Effective for mitigating or preventing localized flooding of roads and other infrastructure.	None.	None identified.

Type of Existing Protection	Description	Area Covered	Effectiveness	Proposed Changes	Status
	provisions have been made to protect against erosion, soil instability, uncontrolled surface water runoff, or other environmental degradation. A Special Permit is required for grading or construction on slopes greater than 25%. The Building Inspector may require that design of proposed development be modified to prevent erosion or uncontrolled surface water runoff.		Effective for controlling impacts from stormwater runoff.		
Section 3320 Floodplain Overlay District	All development in the district, including structural and non-structural activities, whether permitted by right or by Special Permit, must be in compliance with wetlands laws.	All special flood hazards areas designated on the Town of Orange Flood Insurance Rate Map.	Somewhat effective for minimizing impacts of development on flood levels within the floodplain.	Consider mapping Fluvial Erosion Hazard (FEH) areas in town that are susceptible to erosion during major flooding events, but that might be outside of the 100-year floodplain, and add a Fluvial Erosion Hazard Area Overlay District to the zoning bylaw to limit development in these areas.	New recommendation included in the Action Plan.
Section 4100 Earth Removal	Removal from any premises of more than 50 cubic yards of sand, gravel, stone, topsoil, or similar materials within any twelve month period shall be allowed only by Special Permit from the Planning Board.	Entire Town	Effective for controlling impacts from stormwater runoff	None.	None identified.
Section 4400 Water Resource Overlay District	Restricts the removal of soil, loam, sand or gravel within four feet of the historical high groundwater table elevation except where the substances	Zones I and II Aquafer Protection Areas.	Somewhat effective for ensuring that permitted projects do not increase flooding potential.	None.	None identified.

Type of Existing Protection	Description	Area Covered	Effectiveness	Proposed Changes	Status
	are redeposited within 45 days of removal to achieve a grading greater than four feet above the historical high water mark (requires a Special Permit) or for building foundations, excavations, or utility works (requires a Special Permit). Requires a Special Permit for land uses that result in impervious surfaces covering more than 15% or 2500 square feet of any lot, whichever is greater.		Effective for controlling impacts from stormwater runoff		
Section 4600 Performance Standards	Increase in stormwater runoff to neighboring properties or roads is prohibited.	Zones A, B, and CARD	Effective for controlling impacts from stormwater runoff for specified industrial and commercial projects.	None.	None identified.
Section 5300 Special Permit	Special Permits shall be granted only upon a determination that the proposed use will not have adverse effects which outweigh its beneficial effect on either the neighborhood or the Town.	Entire Town	Somewhat effective for ensuring that permitted projects do not increase flooding potential.	Consider adding impact on the potential for flooding as a criterion for a Special Permit.	Recommended in 2005 plan, still relevant.
Section 5400 Site Plan Review	Ensures that new development is designed in a manner which reasonably protects public safety, the environment, and the visual character of the neighborhood and the town. Requires the plan to include	Entire Town	Somewhat effective for ensuring that permitted projects do not increase flooding potential. Effective for controlling impacts from stormwater	None.	None identified.

Type of Existing Protection	Description	Area Covered	Effectiveness	Proposed Changes	Status
	existing built and natural features on the site, a surface drainage strategy that prevents pollution and increased drainage off-site, and existing vegetation that will be left undisturbed and proposed planting areas.		runoff.		
Section 5700 Open Space Development	At a minimum, at least 35% of the total parcel shall be set aside as common open space. The minimum required common open space shall not include wetlands, floodplains, and slopes greater than 25%.	Entire Town	Somewhat effective for ensuring that some permitted projects provide for increase flooding prevention capacity.	None.	None identified.
Other Protections					
Town of Orange Open Space and Recreation Plan	Inventories natural features and promotes natural resource preservation in the town, including areas in the floodplain; such as wetlands, aquifer recharge areas, farms and open space, rivers, streams and brooks.	Entire Town	Effective in identifying sensitive resource areas, including floodplains. Encourages open space and farmland preservation to provide flood storage capacity.	Continue to implement the Five-Year Action Plan strategies, particularly those dealing with protection of forests, farmland and floodplain forests.	Recommended in 2005 plan. The Orange Open Space and Recreation Plan will expire in 2014. When updating the plan, applicable natural hazard mitigation measures from the Local Multi-Hazard Mitigation Plan should be included in the action plan.
Participation in the National Flood Insurance Program (NFIP)	As of June 2013, 12 property owners in Orange have flood insurance policies.	Areas identified by the FEMA maps.	Somewhat effective, provided that the town remains enrolled in the NFIP.	Orange should evaluate whether to become part of FEMA's Community Rating System.	Recommended in 2005 plan, still relevant.

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.62

Management Plans

The CEM Plan for Orange 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 Orange 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.

[62] Comprehensive Emergency Management Plan for the Town of Orange, March 1999.

- 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

There are no restrictions on development that are directly related to severe winter storms. The Town of Orange Subdivision Rules and Regulations set grade limits on streets (Section 210-4.2 B 6) and provide for the adequate disposal of surface water (Section 210-5), both of which are described in more detail in Appendix 1.

Other Mitigation Measures

Severe snowstorms or ice storms can often result in a small or widespread loss of electrical service. The Orange Water Department's primary public water supply wells are equipped with a propane-fired engine (Well #3) and a propane-fired generator (Wells #2/2A) as standby power sources. The engine at Well #3 will allow the well to pump at approximately half-capacity during an outage, but is anticipated to be replaced with a generator in the coming years to improve capacity and allow power to flow to other pump house equipment. The Orange Wastewater Treatment Facility has a backup generator with the capacity to pump wastewater into the treatment plant and to run the influent pumps, chlorination equipment (for disinfection), lighting, some of the electrical outlets, HVAC systems and air handling (ventilation) systems in the event of primary power failure. However, the generator would not be able to run all components of the treatment plant. Therefore, in an extended power outage, the Orange Wastewater Treatment Facility would likely exceed their National Pollution Discharge Elimination System (NPDES) permit by discharging untreated wastewater to the Millers River. According to the Wastewater Treatment Facility Chief, the facility will be upgraded in the next few years and a new generator will be acquired that can run the entire facility in the event of a power outage.

State Building Code

For new or recently built structures, the primary protection against snow-related damage is constructing according to the State Building Code, which addresses designing buildings to withstand snow loads. The Town of Orange has its own building inspection program.

Table 4-2
Existing Severe Winter Storm Hazard Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness	Proposed Changes	Status
Subdivision Regulations					
Section 210-4.2 B 6 Design Standards for Streets	Standards include street grade regulations (six to twelve percent maximum).	Entire town.	Effective.	None.	None.
Section 210-5.6 Required Improvements - Utilities	Requires adequate disposal of surface water. Catch basins shall be built on both sides of the roadway on continuous grades at intervals of not more than 400 feet, at low points and sags in the roadway and near the corners of the roadway at intersecting streets.	Entire town.	Somewhat effective for ensuring that utility service is uninterrupted by severe storms in new areas of residential development.	Consider requiring utility lines be placed underground in all new subdivisions.	Recommended in 2005 plan. Still Relevant. A comprehensive revision to the Orange Subdivision Rules and Regulations is scheduled to begin in 2013.
				Work with utility companies to underground existing utility lines in locations where repetitive outages occur.	Recommended in 2005 plan. Still Relevant. A comprehensive revision to the Orange Subdivision Rules and Regulations is scheduled to begin in 2013.
State Building Code					
	The Town has adopted the Massachusetts State Building Code.	Entire town.	Effective.	None.	None.

HURRICANES AND TROPICAL STORMS

Of all the natural disasters that could potentially impact Orange, 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). 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 and tropical storms can also damage buildings and infrastructure.

Town of Orange personal wireless communications facilities regulations, restrictions on development and mobile home and State Building Code regulations, as listed below, are equally applicable to wind events such as hurricanes and tropical storms.

Management Plans

The CEM Plan for Orange includes the following generic mitigation measures for hurricane and tropical storm planning and response:

- Develop and disseminate emergency public information and instructions concerning hurricane preparedness and safety.
- Community leaders should ensure that Orange is enrolled in the National Flood Insurance Program (NFIP). See pages 120-122 for more information on the NFIP.
- 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 Orange includes the following generic preparedness and response measures for hurricanes and tropical storms:

- 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.
- 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 designated local shelters are the Ralph C. Mahar Regional School, the Fisher Hill Elementary School, and the Armory. Hurricane prone areas in Orange listed in the 2010 CEM Plan are from the center to North Orange, and Walnut Hill and the Orange Municipal Airport. Hurricane evacuation routes identified in the plan are:

- South Main Street to Route 2
- North Main Street to Warwick
- East Main Street to Athol
- West River Street to Route 2
- East River Street to Route 202
- West Main Street west to Route 2 (on Route 2A)

Zoning Bylaws – See Appendix 1 for complete language.

The Town of Orange's Zoning Bylaws include regulations that help mitigate the impacts of wind-related natural hazards including those related to mobile homes and personal wireless service facilities. Orange zoning prohibits mobile homes and mobile home parks as listed in Section 2230, the Use Regulation Schedule. Section 4500 – Personal Wireless Service Facilities – is intended "to minimize the visual and environmental impacts of personal wireless service facilities . The Bylaw enables the review and approval of personal wireless service facilities by the Town's Planning Board in keeping with the Town's existing bylaws and historic development patterns, including the size and spacing of structures and open spaces. The bylaw is intended to be used in conjunction with other regulations adopted by the Town, including historic district regulations, site plan review, and other local bylaws designed to encourage appropriate land use, environmental protection, and provision of adequate infrastructure development."

Subdivision Regulations – See Appendix 1 for complete language.

- Section 210-5.6 Required Improvements – Utilities. The Town does not identify any restrictions on the location of electric and telephone utilities.

Restrictions on Development

The only restrictions on development that are wind-related are the provisions in the zoning bylaw related to personal wireless communications facilities and mobile homes.

Mobile Homes

According to the Town of Orange Zoning Bylaws, new mobile homes and mobile home parks are not an allowed use. However existing mobile homes may be replaced with new mobile homes.

State Building Code

For new or recently built structures, the primary protection against wind-related damage is constructing according to the State Building Code, which addresses designing buildings to withstand high winds. The Town of Orange has its own building inspection program.

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

Type of Existing Protection	Description	Area Covered	Effectiveness	Proposed Changes	Status
Zoning Bylaws					
Section 4500 Personal Wireless Communications Facilities (WCFs)	WCFs shall be no higher than ten feet above the average height of buildings within 300 feet of the proposed facility. WSFs of up to 150 feet in height may be permitted by Special Permit. In order to ensure public safety, the minimum distance from the base of any ground-mounted WSF to any property line, road, habitable dwelling, business or institutional use, or public recreational area shall be the height of the facility/mount, including any antennas or other appurtenances.	Entire town.	Effective.	Consider assigning safety and prevention of wind-related damage as a stated purpose.	Recommended in 2005 plan. No longer relevant.
Section 2230 Use Regulation Schedule - mobile homes	Town of Orange Zoning Bylaw prohibits new mobile homes and mobile home parks.	Entire Town	Does not address potential damage to existing mobile homes.	None.	None.
Subdivision Regulations					
Section 210-5.6 Required Improvements – Utilities	The Town does not identify any restrictions on the location of electric and telephone utilities.	Entire Town	Not effective in ensuring that utility service is uninterrupted by severe storms in new areas of residential development.	Consider requiring utility lines be placed underground in all new subdivisions.	Recommended in 2005 plan. Still Relevant. A comprehensive revision to the Orange Subdivision Rules and Regulations is scheduled to begin in 2013.
				Encourage utility companies to underground existing utility lines in locations	Recommended in 2005 plan. Still Relevant.

Type of Existing Protection	Description	Area Covered	Effectiveness	Proposed Changes	Status
				where repetitive outages occur.	
				Encourage utility companies to continue to implement five-year actions plans, which include regular tree maintenance to reduce the number of limbs near overhead power lines.	Recommended in 2005 plan. Still Relevant.
Other Protections					
State Building Code	The Town of Orange has adopted the Massachusetts State Building Code	Entire Town	Effective.	None.	None.
Debris Management Plan	A debris management plan could be developed.	Entire Town	Effective.	Consider participation in the creation of a Regional Debris Management Plan.	Recommended in 2005 plan. Still Relevant. Also consider debris management alternatives on a sub-regional scale.
Shelters	No shelters for victims of hurricanes and tropical storms have been identified in Orange.	Entire Town	Not Effective.	Ensure that identified shelters have sufficient back-up utility service in the event of primary power failure.	Recommended in 2005 plan. All designated shelters now have a back-up power supply.
				Ensure that back-up generators are maintained properly and ready to be used during an emergency.	New recommendation. Included in Action Plan.

TORNADOS, MICROBURSTS AND THUNDERSTORMS

According to the *Institute for Business and Home Safety*, the wind speeds in most tornados are at or below design speeds that are used in current building codes.[63] Like earthquakes, the location and extent of potential damaging impacts of tornados, microbursts, and thunderstorms - and associated storm events including hail and lightning - are completely unpredictable. Most damage from these events comes from high winds which can fell trees and electrical wires, generate hurtling debris and, possibly, hail.

Management Plans

The CEM Plan for Orange includes the following generic mitigation measures for tornado and microburst 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 Orange includes the following generic preparedness and response measures for tornadoes and microbursts:

- 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.
- 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.

Evacuation Plans

[63] Institute for Business & Home Safety. www.ibhs.org.

The designated local shelters are the Ralph C. Mahar Regional School, the Fisher Hill Elementary School, and the Armory.

Zoning Bylaws – See Hurricanes and Tropical Storms, previous section.

Subdivision Regulations – See Hurricanes and Tropical Storms, previous section.

Restrictions on Development – See Hurricanes and Tropical Storms, previous section.

Mobile Homes – See Hurricanes and Tropical Storms, previous section.

State Building Code – See Hurricanes and Tropical Storms, previous section.

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

WILDFIRES AND BRUSHFIRES

Franklin County has approximately 356,174 acres of forested land, which accounts for 77% of total land area. Forest fires, therefore, are a potentially significant problem. In Orange, there are 16,688 acres of forest (approximately 72% of the town), which is at risk of fire.

Management Plans and Regulatory Measures

The CEM Plan for Orange 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 Orange 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.

Burn Permits

Burn permits for the Town of Orange are issued from the Town of Orange Fire Department. Approximately 573 permits were issued in 2010**.** The burn permits are good for one year for burning brush and cooking food, however, brush burning can occur only during the designated burning season. The rules and regulations for burning are on the permit itself, and one must call to notify the Orange Fire Department on the day one wishes to burn. 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.

Subdivision Review

The Orange Fire Department reviews subdivision plans to ensure that their trucks will have adequate access and that the water supply is adequate for firefighting purposes.

Public Education/Outreach

The Orange Fire Department has an ongoing educational program in the schools to teach fire safety. Students also visit the fire station for educational programming. Pamphlets and videos are available to residents and officials are available to assist with family evacuation planning. Recent budget cuts have made it difficult for the Fire Department to sustain or expand its public education and outreach efforts.

Restrictions on Development

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

Table 4-5
Existing Wildfire and Brushfire Hazard Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness	Proposed Changes	Status
Burn Permits					
	Residents are permitted to obtain burn permits over the phone. Fire Department personnel provide information on safe burn practices.	Entire town.	Effective.	None.	None.
Subdivision Review					
	The Fire Department is involved in the review of subdivision plans.	Entire town.	Effective.	None.	None.
Public Education and Outreach					
	The Fire Department has an ongoing educational program in the schools.	Entire town.	Effective.	Participate in the Firewise Communities/USA Program, which encourages and acknowledges actions that minimize home loss to wildfire, and teaches how to prepare for a fire before it occurs.	Recommended in 2005 plan. Still Relevant.

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 to plan for. Most buildings and structures in the state were constructed without specific earthquake resistant design features.

Management Plans

The Orange CEM Plan lists the following generic mitigation measures for earthquakes:

- 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 Orange CEM Plan 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.

Evacuation Options

The Orange CEM lists three shelters for victims of earthquakes. They are the Ralph C. Mahar Regional School, the Fisher Hill Elementary School, and the Armory.

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, it may be assumed that many of these buildings and structures were not built with specific earthquake resistant design features. According to the 2000 U.S. Census, 62 percent of the housing in Orange was built before 1970. 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.

Table 4-6
Existing Earthquake Hazard Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness	Proposed Changes	Status
State Building Code					
	The Town of Orange has adopted the 8th Edition of the State Building Code.	Entire Town but applies to new construction or substantial renovations only.	Effective for new buildings or substantial renovations only.	Continue to 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.	Recommended in 2005 plan. Still Relevant.
Debris Management Plan					
	A debris management plan could be developed.	Entire town.	Effective.	Consider participation in the creation of a Regional Debris Management Plan.	Recommended in 2005 plan. Still Relevant. Also consider debris management alternatives on a sub-regional scale.
Shelters					
	Shelters have been identified for victims of earthquakes in Orange.	Entire town.	Effective.	Ensure that back-up generators are maintained properly and ready to be used during an emergency.	New recommendation. All designated shelters have a back-up power supply.

DAM FAILURES

The only mitigation measures in place are the State regulations that control the construction and inspection of dams. The Orange CEM Plan states that there are three categories of dam failure or overspill 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.

In addition to these actions, emergency personnel should notify the owner of the dam of the failure, and review the Emergency Action Plan for that dam if one exists.

Management Plans and Regulatory Measures

The Orange 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 Orange. 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 Orange 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.

Evacuation Options

The following table lists the dams located in Orange, the hazard rating of the dam according to the DCR Office of Dam Safety, and the estimated peak population affected in the event of a catastrophic failure of the dam. An action item has been added to the Action Plan for the Committee to complete the peak population affected estimates for all dams in town.

Table 4-6: Estimated Peak Population Affected in the Event of a Dam Failure in Orange

Name of Dam	Owner	MA DCR Office of Dam Safety Hazard Rating	Estimated Peak Population Affected
Lake Mattawa Dam South	Town of Orange	Significant	100
Lake Mattawa Dam North	Town of Orange	Significant	10
Tully Pond Dam	Town of Orange	Significant	6
Packard Pond Dam	Privately owned	Significant	20
Haskins Pond Dam	Privately Owned	Significant	
Orange Water District Reservoir Dam	Town of Orange	Significant	5
Vorces Pond Dam	Town of Orange	Significant	10
Mahar Regional School Dam	Mahar Regional School District	Significant	
Gale Brothers Dam	Town of Orange	Significant	
New Home Sewing Machine Co. Dam	Privately Owned	Low	100
Whites Pond Dam	Unknown	Low	
Johnsonian Pond Dam	Privately owned	Low	
Williams Pond Dam	Town of Orange	Low	
North Pond Brook Dam	Town of Orange	N/A	0
Pumping Station Dam	Town of Orange	N/A	0
Plazas Pond Dam	Mass Department of Fish and Game	N/A	0
Minute Tapioca Upper Pond Dam	Unknown	N/A	
Minute Tapioca Lower Pond Dam	Unknown	N/A	
Boston Fiber Co. Dam	Privately owned	N/A	
Diversion Dam	Privately owned	N/A	
Eagleville Dam	Unknown	N/A	
Fire Pond Dam	Privately owned	N/A	
Randall Pond Dam	Orange Economic Development Commission	N/A	

Source: MA Department of Conservation and Recreation, Office of Dam Safety, 2011.

Permits Required for New Dam Construction

Massachusetts State Law (M.G.L. Chapter 253 Section 45) regulates the construction of new dams. A permit must be obtained from the Department of Conservation and Recreation (DCR) before construction can begin. One of the permit requirements is that all local approvals or permits must be obtained.

Dam Inspections

The DCR requires that dams rated as Low Hazard Potential be inspected every ten (10) years, dams rated as Significant Hazard Potential be inspected every five (5) years, and dams rated as

High Hazard Potential be inspected every two (2) years. Owners of dams are responsible for hiring a qualified engineer to inspect their dams and report the results to the DCR. Owners of High Hazard Potential dams and certain Significant Hazard Potential dams are also required to prepare, maintain, and update Emergency Action Plans. Potential problems may arise if the ownership of a dam is unknown or contested. Additionally, the cost of hiring an engineer to inspect a dam or to prepare an Emergency Action Plan may be prohibitive for some owners.

Zoning

There is no mention made regarding the construction of new dams in the Town of Orange's Zoning or subdivision regulations.

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.

Table 4-7
Existing Dam Failure Hazard Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness	Proposed Changes	Status
Permits					
	State law requires a permit for the construction of any dam.	Entire town.	Effective. Ensures dams are adequately designed.	None.	None.
Inspections					
	DCR has an inspection schedule that is based on the hazard rating of the dam (low, significant, high hazard).	Entire town.	Low. The DCR does not have adequate staff and resources to inspect dams according to the required schedule.	Map inundation areas for all significant hazard dams. Educate owners of dams of their inspection responsibilities.	Modified recommendation from 2005 plan. Still Relevant. Since 2005, 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 certain Significant Hazard Potential dams are also responsible for preparing Emergency Action Plans.
Evacuation Plans					
	Evacuation plans would ensure the safety of the citizens in the event of dam failure.	Inundation areas in town.	None.	Owners of Significant Hazard dams should prepare up-to-date evacuation plans in cooperation with the town.	Recommended in 2005 plan. Still Relevant.

LANDSLIDES

Regulating land use and development to avoid construction on steep slopes and ensuring that construction does not reduce slope stability is one way to mitigate the hazard potential of landslides. 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 summary of the above Land Use Regulations and Appendix A detailed Land Use Regulations.

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. Refer to Table 4-1 as well as Appendix A for complete language for the same measures.

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 Orange's citizens. With the frequency of transportation of hazardous materials via Route 2, the railroad, and other routes through town, 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 A for complete language.

- (Section 2350) Special Permit for Lot Coverage Increase.
- (Section 4400) Water Resource District.

While the existence of these Bylaws, in and of themselves, will not prevent hazardous materials accidents, they could potentially minimize the possibility of such accidents occurring in an area containing a drinking water source.

Table 4-7
Existing Manmade Hazard Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness	Proposed Changes
Zoning Bylaws				
Section 2350 - Special Permit for Lot Coverage Increase	Ensures that runoff from impermeable surfaces drain into catchment areas or structures designed to trap pollutants.	Zone B	Effective for all new construction, reconstruction, or expansion of existing buildings and new or expanded uses.	None identified.
Section 4400 - Water Resource Overlay District	Prohibits uses that could contaminate the ground and surface water resources providing water supply for the Town of Orange.	Zones I and II Aquifer Protection Areas	Effective for preventing groundwater contamination from land uses.	None identified.

Future Mitigation Strategies

Hazard Mitigation Goal Statements and Action Items

As part of the natural hazards mitigation planning process undertaken by the Orange Natural Hazards Mitigation 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.

2014 Action Plan

Prioritization of Hazards

The Committee prioritized Mitigation Action Items by examining the results of the All Hazards Risk Assessment completed by the Committee (see Section 3, page 55). 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 probability 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 Orange'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 4-8: Weighted Hazard Index Priority Level

Weighted Hazard Index	Priority Level
> 4.5	High
3.5 – 4.5	Medium
< 3.5	Low

Table 4-9: Hazard Priority Level Rating

Natural Hazard	Weighted Hazard Index	Priority Level
Hurricane & Tropical Storm	**5.6**	**High**
Severe Winter Storm	**5.2**	**High**
Tornado	**4.7**	**High**
Earthquake	**4.6**	**High**
Wildfire & Brushfire	**4.1**	**Medium**
Flooding	**3.8**	**Medium**
Dam Failure	**3.8**	**Medium**
Microburst	**3.7**	**Medium**

Ice Jam	**3.3**	**Low**
Landslide	**2.8**	**Low**

Identification of Most Important Hazards

To identify the hazards most important to the Town of Orange and to develop a range of mitigation actions for the most important hazards, the Committee discussed the hazard prioritization information (Table 4-10), assessed which hazards most often impact Western Massachusetts and considered the results of the Risk Assessment (Section 3). The Committee also discussed damages from recent hazard events, including Tropical Storm Irene, and determined that the hazards most important to Orange are hurricanes and tropical storms, severe winter storms, tornados, and earthquakes.

In addition, the Committee realized that some Action Items could mitigate several hazards and thus created a category labeled "Multiple Hazards". This category of Multiple Hazards is among the hazards considered most important to the town.

Table 4-10: Hazards Most Important to Orange

Natural Hazard	Priority Level from Weighted Hazard Index	Hazard Most Important to Orange
Hurricane & Tropical Storm	High	✓
Severe Winter Storm	High	✓
Tornado	High	✓
Earthquake	High	✓
Wildfire & Brushfire	Medium	
Flooding	Medium	
Dam Failure	Medium	
Microburst	Medium	
Ice Jam	Low	
Landslide	Low	
Multiple Hazards	Not Applicable	✓
Manmade Hazards	Not Applicable	✓

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 Route 2 and the railroad to the Millers River, the Town's Water Supply Protection District, and 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. Because of 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 environments; and the lack of available and well-analyzed data, the Committee suggested a number of Action Items relating to this hazard that are included on the Preparedness and Response Action Plan (Table 4-13), although it was not assigned a Hazard Priority Level Rating. Manmade Hazards are among the hazards considered to be most important to the town.

Goal Statements and Action Items

As part of the natural hazards mitigation planning process undertaken by the Orange Multi-Hazard Mitigation 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, including the hazards most important to Orange.

Action items from the 2005 plan were evaluated by the Committee and, if still relevant, were carried forward to the 2014 plan, with some modifications where necessary. Those action items that have been completed since the last plan are listed below in the following table.

Table 4-11: 2005 Action Items Completed

Action Item	Responsible Department / Board	Estimated Completion Date	Status
Examine current notification system including feasibility of Reverse 911 or purchase of weather alert radios. Develop a preliminary project proposal and cost estimate.	Police Department, Fire Department, Emergency Management Director	2006	Complete. The Town has Reverse 911 through the Worcester County Sheriff's Office.

Some of the 2005 action items were identified as preparedness or response actions and were, therefore, separated from the mitigation action items in the 2014 plan and added to any new preparedness or response actions identified by the Committee for the plan update (see Table 4-12).

Prioritization of Action Items

The Committee worked to prioritize the mitigation Action Items for the hazards identified as the most important to Orange. For most, if not all, of the Action Items, project costs are not specifically known so only a generalized estimate could be used during the prioritization process. Due to the lack of detailed cost information for the mitigation Action Items, a more detailed prioritization process such as STAPLEE could not be used. However, Action Items may be reprioritized by the town once a cost is developed and a Benefit Cost Analysis is conducted on specific projects.

The Committee used a qualitative ranking system of High, Medium or Low to prioritize the mitigation Action Items for the hazards most important to Orange.

High	71-100 points
Medium	31-70 points
Low	0-30 points

The ranking system consists of the following criteria, each assigned a points value. The maximum number of points = 100:

1. What are the anticipated benefits (including avoided costs such as loss of life and the costs incurred to repair damaged infrastructure, buildings and natural resources) from the implementation of the action item to the town's population (10 points), infrastructure (10 points), and to the built (10 points) and natural environment (10 points)?

2. Can the town provide the necessary maintenance (future costs that must be included in the town's budget) when the mitigation measure is completed? Yes (10 points); No (0 points).

3. Does the town have the technical and administrative capability (staff costs and in-kind costs of volunteer boards and committee members) to carry out the mitigation measures? Yes (10 points); No (0 points).

4. Based on the evaluation of the above criteria, do the costs (if known or can be reasonably estimated) seem reasonable when considering the size of the problem and likely benefits from mitigation? Yes (20 points); No (0 points).

5. Is there political support and public support to implement the mitigation measures? Yes (20 points); No (0 points).

Even when the political will exists to implement the Action Items, the fact remains that Orange is a small town that relies heavily on a small number of paid staff, many of whom have multiple responsibilities, and a dedicated group of volunteers who serve on town boards. However, some Action Items, when implemented by Town staff and volunteers, result in a large benefit to the community for a relatively small cost.

For larger construction projects, the town has limited funds to hire consultants and engineers to assist them with implementation. For these projects, the Town will seek assistance through the Franklin Regional Council of Governments (FRCOG) or other funding sources such as those listed in Table 5-1 on page 140-142 of this document. Limited technical assistance is available from the FRCOG. However, the availability of FRCOG staff can be constrained by the availability of grant funding.

The final 2014 Orange Multi-Hazards Mitigation Prioritized Action Plan is shown in Table 4-12. Potential funding sources for mitigation action items are listed in Table 4-12. Other potential funding sources are listed in Table 5-1 on page 118 of this document. The town should request assistance from MEMA and/or FRCOG to explore which of these funding sources might supplement or replace town funding for the mitigation action items in Table 4-12. When Town

funds are listed as a source to fund hazard mitigation projects or activities, either in part (match) or in full, these funds would be obtained from the town's "general fund".

The timeframe for implementation of the mitigation action items are listed as Year 0-1, which is the first year following plan adoption, and subsequent years after plan adoption through the 5 year life of the plan (Year 2, Year 3, Year 4 and Year 5). The Committee recognized that many mitigation action items have a timeframe that is ongoing due to either funding constraints that delay complete implementation and/or the action item should be implemented each of the five years of the plan, if possible. Therefore, a category of *Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate* was added.

The 2005 Orange Local Natural Hazards Mitigation Plan did not prioritize Action Items, so it is not possible to evaluate any change in priorities since the last plan. The 2014 action plan is prioritized so in future updates to the plan it will be possible to document any changes in priorities. The 2005 planning process did include a vulnerability assessment that rated hazards according to the risk to the Town from each hazard (the 2005 plan did not evaluate landslides or ice jams). The methodology of the 2005 assessment differs greatly from the methodology used in the 2014 All Hazards Vulnerability Assessment, making it difficult to compare the two.

Table 4-12: 2014 Orange Multi-Hazard Mitigation Prioritized Action Plan

Goal	Action Item	Responsible Department / Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Priority for Implementation / Status
HAZARDS IDENTIFIED AS MOST IMPORTANT TO THE TOWN OF ORANGE The priority for implementation of each Action Item is ranked as High, Medium or Low						
MULTIPLE HAZARDS						
To provide adequate shelter, water, food and basic first aid to displaced residents in the event of a natural disaster and to provide adequate notification and information regarding evacuation procedures, etc., to residents in the event of a natural disaster.						
	Assess existing shelters and key municipal facilities to determine the level of risk to each structure from different hazards. Disseminate this information to appropriate town departments. Implement improvements to mitigate these risks when feasible.	Building Inspector, Emergency Management Director	P	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	**Medium** / Ongoing from 2005 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.	Emergency Management Director, Fire Department, Police Department, Board of Health	P	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	**High** / Ongoing from 2005 plan. Still relevant.
	The town should consider updating its current zoning and subdivision regulations, paying particular attention to flooding mitigation and prevention. Special consideration should be given to restricting or limiting new development within the 100-year floodplain and areas prone to localized or catastrophic flooding events.	Planning Board	B, N, P, I	Department of Housing and Urban Development, Town, Volunteers	Year 1 (subdivision regulations), Year 3 (zoning bylaw)	**High** / Carried over from 2005 plan. Still relevant. The Town will receive assistance from the FRCOG Planning Department, through a grant from HUD, to revise the subdivision regulations in 2013.
	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.	Emergency Management Director, Highway Department, Fire Chief, Police Chief	B, N, P, I	Town, Volunteers	Year 2	**High** / New Action Item.
HIGH PRIORTY (> 4.5 Weighted Hazard Index)						
HURRICANES AND TROPICAL STORMS						
To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to hurricanes and tropical storms.						
	Ensure that utility companies implement five-year action plans, which include regular tree maintenance to reduce the number of limbs near overhead power lines, to reduce risk to infrastructure from high winds associated with hurricanes and tropical storms.	Highway Department	P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	**High** / Ongoing from 2005 plan. Still relevant.
	Request FEMA to update the Flood Insurance Rate Maps (FIRM), which depict the 100-year floodplain, for Orange and other Franklin County towns. The current map for Orange was developed in 1982.	Emergency Management Director, Board of Selectmen	B, N, P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	**Medium** / New Action Item.
	Implement a continuous tree cutting plan along town roadways to reduce the risk to infrastructure from high winds associated with hurricanes and tropical storms.	Highway Department	N, P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	**High** / New Action Item.
	To reduce the risk to infrastructure from high winds associated with hurricanes and tropical storms, consider amending the Subdivision Rules and Regulations to require utility lines be placed underground in all new subdivisions.	Planning Board, Highway Department	P, I	Department of Housing and Urban Development, Town, volunteers	Year 1	**High** / New Action Item to be considered as part of the broader revision to the Subdivision Regulations occurring in 2013.
	Identify feasible options, such as placing main feeder lines underground, to reduce risk to critical municipal facilities and infrastructure in areas where repetitive outages occur.	Board of Selectmen, Planning Board, utility company	P, I	Town	Year 2	**High** / New Action Item.

Goal	Action Item	Responsible Department / Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Priority for Implementation / Status
	Develop and implement a record management plan to digitize and/ or duplicate important records housed in town facilities to mitigate the potential loss of information from a hazard event.	Board of Selectmen, Orange Historical Society, Emergency Management Director	P	Town, Volunteers	Year 2	**High** / New Action Item.
SEVERE WINTER STORMS						
	Ensure that utility companies implement five-year action plans, which include regular tree maintenance to reduce the number of limbs near overhead power lines, to reduce risk to infrastructure from severe winter storms.	Highway Department	I	Volunteer Time	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	**Medium**/New Action Item.
TORNADOS						
	Ensure that utility companies implement five-year action plans, which include regular tree maintenance to reduce the number of limbs near overhead power lines, to reduce risk to infrastructure from high winds associated with tornados.	Highway Department	I	Volunteer Time	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	**Medium**/New Action Item.
	Participate in trainings, as needed, to ensure new buildings are designed and constructed to reduce the risk of damage from high winds. Encourage the construction of new homes with basements or crawl spaces to provide shelter during a tornado, hurricane or other storm event with high winds.	Building Inspector	B, P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	**High**/Carried over and modified from the 2005 plan.
	Improve public awareness of the risk of high wind events. Provide information to property owners on how to properly install temporary window coverings before a storm and appropriate wind retrofits for existing buildings.	Emergency Management Director	B, P, I	Town, Volunteer Time	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	**Medium**/New Action Item.
EARTHQUAKES						
	Inspect municipal buildings and structures to determine if they are particularly vulnerable to earthquake damage (built prior to 1975) and determine if any retrofitting measures could mitigate this vulnerability.	Building Inspector, Emergency Management Director, Select Board	B, P	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	**Medium** / Carried over from 2005 plan.
	Conduct education and outreach to schools, businesses, and residents about proper procedures to follow during and after an earthquake. Conduct earthquake drills in schools, businesses, special care facilities and other public gathering places.	Emergency Management Director, Building Inspector, Select Board	P	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	**Medium** / New Action Item.
	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	Year 1	**High /** New Action Item.
	Ensure Compliance with the Massachusetts State Building Code. Participate 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.	Building Inspector, Emergency Management Director	B, P	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	**High /** New Action Item.
MEDIUM PRIORTY (3.5 – 4.5 Weighted Hazard Index)						
WILDFIRE AND BRUSHFIRE						
To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to wildfires and brushfires.						
	Conduct ongoing education on fire safety, such as the Firewise Communities/USA Program, which encourages and acknowledges actions that minimize home loss to wildfire.	Fire Department	B, N, P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	**High** / Carried over from 2005 plan. Still relevant.
	Incorporate the National Fire Protection Association's "Firewise" standards into the Town Zoning Bylaws and Subdivision Regulations to reduce the impact of wildfire and brushfires on the built environment.	Fire Department, Planning Board	B, P, I	Department of Housing and Urban Development, Town, volunteers	Year 1 (subdivision regulations), Year 3 (zoning bylaw)	**Medium** / New Action Item to be considered as part of the broader revision to the Subdivision Regulations.

Goal	Action Item	Responsible Department / Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Priority for Implementation / Status
FLOODING						
To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to flooding.						
	Continue to implement the Orange Open Space and Recreation Plan's Five-Year Action Plan strategies, particularly those dealing with the protection of farmland, forestland, and floodplain forests.	Planning Board, Board of Selectmen, Conservation Commission, Agricultural Commission	N	Town, volunteers	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	**Medium** / Ongoing from 2005 plan. Still relevant.
	Consider hiring a consultant to map Fluvial Erosion Hazard (FEH) areas in town, and adding a Fluvial Erosion Hazard Area Overlay District bylaw to the zoning bylaws to limit development in FEH areas along rivers and streams that are highly susceptible to flood-related erosion.	Planning Board	B, N, P, I	Town, FRCOG, volunteers	Year 2	**Medium** / New Action Item. The Vermont Agency of Natural Resources has developed a model Fluvial Erosion Hazard Area Overlay District bylaw.[64]
	Revise the Definitive Plan requirements in the Subdivision Rules and Regulations to include identification of impacts and flooding mitigation measures.	Planning Board	B, N	Department of Housing and Urban Development, Town, volunteers	Year 1	**High** / Carried over from 2005 plan. Still relevant. To be considered as part of the broader revision to the Subdivision Regulations.
	Consider implementing standards to require temporary and permanent erosion control measures for streams and surface water bodies and prohibiting permanent alterations of watercourses or streams.	Planning Board	N	Department of Housing and Urban Development, Town, volunteers	Year 1	**High** / Carried over from 2005 plan. Still relevant. To be considered as part of the broader revision to the Subdivision Regulations.
	Develop a culvert management plan that identifies the locations of culverts in town, existing and potential issues and the extent of flooding caused at each location, and possible solutions. The plan should prioritize projects in the locations that require intervention, including South Park, Town Farm Road, and West River Street.	Highway Department, Conservation Commission	B, N, I	Town	Year 2	**Medium** / New Action Item.
	Determine the feasibility of either replacing the oldest, western-most water main crossing the Millers River in order to mitigate the potential of the pipe being destroyed by flooding in the river, or finding a back-up drinking water supply on the north side of the Millers River.	Water Department	P, I	Town	Year 2	**Medium** / New Action Item.
	The town should evaluate whether to join FEMA's Community Rating System.	Board of Selectmen, Conservation Commission	B, P	Town, volunteers	2015	**Medium** / Carried over from 2005 plan. Still relevant.
DAM FAILURE						
To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to dam failures.						
	Educate private dam owners of their inspection responsibilities, and work with significant hazard dam owners to prepare up-to-date evacuation plans.	Board of Selectmen, Emergency Management Director, Water Department	B, N, P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	**Medium** / Carried over from 2005 plan. Still relevant.
	Develop a culvert management plan that identifies the locations of culverts in town, existing and potential issues and the extent of flooding caused at each location, and possible solutions. The plan should prioritize projects in the locations that require intervention, including South Park, Town Farm Road and West River Street. Blocked culverts can act like dams, and can pose a serious hazard if breached.	Highway Department, Conservation Commission	B, N, I	Town	Year 2	**Medium** / New Action Item.

[64] See http://www.anr.state.vt.us/dec/waterq/rivers/docs/rv_municipalguide.pdf for more information.

Goal	Action Item	Responsible Department / Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Priority for Implementation / Status
	Assess the ownership and maintenance needs for municipally-owned dams, and the potential for dam removal.	Board of Selectmen, Emergency Management Director, Water Department	B, N, P, I	Town	Year 2	**Medium** / New Action Item.
MICROBURSTS *(see also mitigation action items for FLOODING)*						
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 microbursts.						
	Ensure that utility companies implement five-year action plans, which include regular tree maintenance to reduce the number of limbs near overhead power lines, to reduce risk to infrastructure from high winds associated with microbursts.	Highway Department	I	Volunteer Time	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	**Medium**/New Action Item.
	Participate in trainings, as needed, to ensure new buildings are designed and constructed to reduce the risk of damage from high winds. Encourage the construction of new homes with basements or crawl spaces to provide shelter during a microburst or other storm event with high winds.	Building Inspector	B, P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	**High**/Carried over and modified from the 2005 plan.
	Improve public awareness of the risk of high wind events. Provide information to property owners on how to properly install temporary window coverings before a storm and appropriate wind retrofits for existing buildings.	Emergency Management Director	B, P, I	Town, Volunteer Time	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	**Medium**/New Action Item.
LOW PRIORTY (< 3.5 Weighted Hazard Index)						
ICE JAM						
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.						
	See Action Items for Flooding.	N/A	N/A	N/A	N/A	N/A
LANDSLIDES						
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 a landslide.						
	Identify areas in town that might be susceptible to landslides, and determine if there are any mitigation measures that could be implemented to reduce the impacts if a landslide were to occur.	Emergency Management Director	B, N, P, I	Town	Year 3	**Medium** / New Action Item.
	Provide training to volunteer board members and the Building Inspector about the risk of landslides and mitigating the risk through the enforcement of existing land use regulations (zoning bylaws, subdivision regulations, building codes) that direct development to stable slopes and soils to reduce the risk of landslides. Reduce the risk of landslides at existing development by requiring that surface water and groundwater are properly managed as part of the permit process.	Building Inspector, Conservation Commission, Planning Board, Zoning Board of Appeals	B, N, P, I	Town, Volunteer time	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	**Medium**/New Action Item.
	Encourage forest stewardship practices that produce more stable, successional forested landscapes to reduce the risk of landslides.	Conservation Commission, Planning Board, Fire Department	N	Town, Volunteer time	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	**Medium**/New Action Item.
	Integrate regional landslide mapping (when completed by others) into town land use regulations.	Planning Board	B, N, P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	**Low**/New Action Item.

Table 4-13: Orange Local Multi-Hazard Mitigation Preparedness and Response Action Plan

Action Item	Responsible Department / Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Status
MULTIPLE HAZARDS					
Implement a maintenance plan for town-owned back-up generators to ensure they are ready to be used during an emergency. Equip all critical municipal facilities with the proper electrical capability to plug into a back-up generator.	Building Inspector, Emergency Management Director	B, P, I	Town	This Action will be implemented and continued over the next five years.	New Action Item.
Create, maintain, and train a volunteer base for assisting town emergency management staff during and after emergencies. Encourage Orange residents to join the Franklin County Citizen Emergency Response Team (CERT) or Medical Reserve Corps (MRC).	Emergency Management Director, Fire Department, Police Department, Board of Health	B, N, P, I	Town, Western Region Homeland Security Advisory Council, FRCOG	This Action will be implemented and continued over the next five years.	New Action Item.
Acquire large-scale wall maps with acetate overlays showing floodplains, dams, special needs facilities, shelters, inundation areas and other spatial information for multiple locations throughout town.	Planning Board, Emergency Management Director	B, N, P, I	Town, FRCOG	2013	Carried over from 2005 plan. Still relevant.
Consider debris management alternatives, including the identification of sites in town for temporary debris collection, and the possibility of sharing equipment for debris disposal with surrounding towns.	Board of Selectmen, Planning Board, Board of Health, Department of Public Works, REPC	N, I	Town, FRCOG, volunteers	2014	Revised from 2005 plan. Still relevant.
MANMADE HAZARDS					
Review the Hazardous Facilities identified in the Orange CEM Plan. Determine the appropriate Hazardous Chemical threshold for facilities to be included in the inventory, and add any facilities, both public and private, that meet this threshold but are currently not listed in the inventory.	Emergency Management Director	B, N, P, I	Town	2012	New Action Item.
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, REPC	B, N, P, I	FEMA	2012	New Action Item.
FLOODING					
Review evacuation procedures for the flood prone and inundation areas in town (identified on the Critical Facilities and Infrastructure map) and update.	Police Department, Fire Department, and Emergency Management Director, Board of Health	P	Town	This Action has been implemented and will continue over the next five years.	Ongoing from 2005 plan. Still relevant.
DAM FAILURE					
The Town and Emergency Action Plan coordinators of upstream dams (Birch Hill, Tully Lake, and Lake Rohunta (Athol) Dams) should coordinate efforts to ensure that appropriate municipal officials and departments are properly informed of potential impacts to the town of a dam failure.	Police Department, Fire Department, Board of Selectmen, Emergency Management Director, and Highway Department	B, N, P, I	Town	This Action has been implemented and will continue over the next five years.	Ongoing from 2005 plan. Still relevant.
Review the list of dams in Orange on page 102 and add the estimated population that would be impacted by a failure of each dam, where this information is missing.	Emergency Management Director, Water Department, Board of Health	P	Town	2013	New Action Item.

National Flood Insurance Program Compliance

The U.S. Congress established the National Flood Insurance Program (NFIP) in 1968, with the passage of the National Flood Insurance Act of 1968. "For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, seawalls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses, nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

"In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection."[65]

The State of Massachusetts, through its local communities,[66] complies with the NFIP in part by enforcing the Wetlands Protection Act (WPA), which helps restrict development in flood-prone areas, enforcing the State Building Code, which regulates building specifications and additional related zoning bylaws, such as a floodplain overlay district. At the local level, Orange's compliance with the NFIP is enforced through the building inspector and building code, the Conservation Commission and wetland and floodplain regulations, and the zoning bylaws and subdivision regulations related to flooding. While the local building code cannot be more restrictive than the state building code, the local Conservation Commission can restrict development above and beyond the requirements in the WPA. The ability of the Conservation Commission to further regulate development in flood prone areas could be a crucial tool in flood mitigation. In addition, the ability of the Select Board to adopt further bylaws such as a floodplain overlay district could also mitigate flooding.

The Town of Orange 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 June 2013, there were 12 policies in effect in Orange for a total of $2,564,600 worth of insurance.

NFIP Community Rating System (CRS)[67]

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

[65] http://www.fema.gov/library/viewRecord.do?id=1404

[66] Massachusetts is a Home Rule state, the local communities have significant power and authority to implement state regulations and many towns adopt their own wetland and floodplain regulations that are more stringent than state requirements.

[67] http://training.fema.gov/EMIWeb/CRS/

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.
- 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 maintaining 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 Orange 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 Points[68]

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:

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).

[68] FEMA Local Multi-Hazard Mitigation Planning Guidance, July 1, 2008.

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 Orange Local Natural Hazards Mitigation Planning Committee as they underwent the planning process. Town officials such as the Emergency Management Director and Town Administrator 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 Orange 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. The committee was asked to submit any further comments before the final draft was submitted to the Orange Board of Selectmen.

Copies of the Final Draft Local Multi-Hazard Mitigation Plan for the Town of Orange 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. Once reviewed and approved by MEMA, the plan was sent to the Federal Emergency Management Agency (FEMA) for their approval. On _____, the Board of Selectmen voted to adopt the plan.

Plan Maintenance Process

The implementation of the Orange Local Natural Hazards Mitigation Plan will begin following its approval by MEMA and FEMA and formal adoption by the Orange Board of Selectmen. Specific Town departments and boards will be responsible for ensuring the development of policies, bylaw revisions, and programs as described in Section 4 of this plan. The Orange Natural Hazards Planning Committee will oversee the implementation of the plan.

Monitoring, Evaluating, and Updating the Plan

The measure of success of the Orange Local Natural Hazards Mitigation Plan will be the number of identified mitigation strategies implemented. In order for the Town to become more disaster resilient and 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 Orange Natural Hazards Planning 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 spring of 2015. The meetings of the committee will be organized and facilitated by the staff of the Orange Town Administrator. Increasing committee membership to include entities such as the Conservation Commission could help improve the completion rate of action items.

As is the case with many Franklin County towns, Orange's government relies on few public servants filling many roles, upon citizen volunteers and upon limited budgets. The implementation of the recommendations of this plan could be a challenge to the committee and the Town. As the committee meets to assess progress, it should strive to identify shortfalls in staffing and funding and other issues which may hinder Plan implementation. The committee can seek technical assistance from the Franklin Regional Council of Governments to help alleviate some of the staffing shortfalls. The committee could also seek assistance and funding from sources listed in Table 5-1.

Table 5-1: Potential Funding Sources for Hazard Mitigation Plan Implementation

Program	Type of Assistance	Availability	Managing Agency	Funding Source
National Flood Insurance Program	Pre-disaster insurance	Any time (pre & post disaster)	DCR Flood Hazard Management Program	Property Owner, FEMA
Community Assistance Program	State funds to provide assistance to communities in complying with NFIP requirements	Annually	DCR	FEMA/NFIP
Community Rating System (Part of the NFIP)	Flood insurance discounts	Any time (pre & post disaster)	DCR Flood Hazard Management Program	Property Owner
Flood Mitigation Assistance Program	Cost share grants for pre-disaster planning & projects	Annual pre-disaster grant program	MEMA	75% FEMA/ 25% non-federal
Hazard Mitigation Grant Program	Post-disaster cost-share Grants	Post disaster program	MEMA	75% FEMA/ 25% non-federal
Pre-Disaster Mitigation Program	National, competitive grant program for projects & planning	Annual, pre-disaster mitigation program	MEMA	75% FEMA/ 25% non-federal
Severe Repetitive Loss	For SRL structures insured under the NFIP.	Annual	MEMA	Authorized up to $40 million for each fiscal year 2005 through 2009
Small Business Administration Mitigation Loans	Pre- and post- disaster loans to qualified applicants	Ongoing	MEMA	Small Business Administration

Program	Type of Assistance	Availability	Managing Agency	Funding Source
Public Assistance	Post-disaster aid to state and local governments	Post Disaster	MEMA	FEMA/ plus a non-federal share
Dam Safety Program	Provides funding to state to promote dam safety through emergency action plans and exercises	Annual	DCR	FEMA
Homeland Security Grants	Multiple grant sources provide funding for homeland security activities, including THIRA development, planning, and training at the state and local levels	Annual	MEMA	DOJ, DHS, FEMA
National Fire Plan	Provides pre-disaster funds for wildfire mitigation and planning for all-hazards.	Annual	DCR	U.S. Land Management Agencies
Clean Water Act Section 319 Grants	Provides grants for wide variety of activities related to non-point source pollution runoff mitigation	Annual	MassDEP	EPA
Economic Development Administration Grants and Investment	Provides grants for community construction projects, including mitigation activities	Annual	Massachusetts Office of Business Development	U.S. Department of Commerce, Economic Development Administration
Emergency Watershed Protection	Provides funding and technical assistance for emergency measures, e.g., floodplain easements in impaired watersheds	Annual	DCR	USDA NRCS
Forest Land Enhancement Program	Provides educational, technical, and financial assistance to help landowners implement sustainable forest management objectives.	Annual	DCR	U.S. Forest Service
Housing and Urban Development	Provides various grant programs related to safe-housing initiatives	Annual	Department of Housing and Community Development	U.S. Dept. of Housing and Urban Development
Reclamation and Development Grants Program	Provides funding for water-related projects, studies, etc.	Annual	MassDEP and others	EPA
National Wildlife Wetland Refuge System	Provides funding for acquisition of lands into federal wildlife refuge system	Annual	U.S. Fish and Wildlife Service	U.S. Fish and Wildlife Service

Program	Type of Assistance	Availability	Managing Agency	Funding Source
North American Wetland Conservation Fund	Provides funding for wetland conservation projects	Annual	U.S. Fish and Wildlife Service	U.S. Fish and Wildlife Service
Rural Development Grants	Provides grants and loans for infrastructure and public safety development and enhancement in rural areas	Annual	Department of Housing and Community Development	USDA, Rural Development
Rural Fire Assistance Grants	Funds fire mitigation activities in rural communities	Annual	DCR	National Interagency Fire Center
Chapter 90 Program	Funds maintaining, repairing, improving and constructing town and county ways and bridges which qualify under the State Aid Highway Guidelines	Annual	Mass DOT	State Transportation Bond
2013 MassWorks Infrastructure Program	Funds targeted investments in infrastructure such as roadways, streetscapes, water, and sewer	Annual	Executive Office of Housing and Economic Development (EOHED),	State Appropriation-Section 11 of Chapter 238 of the Acts of 2012
Accelerated Bridge Program	Funds bridge rehabilitation, replacement, preservation, maintenance, painting and cleaning projects	Rolling basis (bridges are pre-selected)	MassDOT and DCR	State Appropriation - Chapter 233 of the Acts of 2008
Dam, Levee and Coastal Infrastructure Repair and Removal Program	Funds grants and loans for the repair and removal of dams, levees, seawalls, and other forms of inland and coastal flood control.	Annual	Executive Office of Energy and Environmental Affairs (EEA)	State Revolving Loan
Conservation Partnership	Funds assist not-for-profit corporations in acquiring land and interests in lands suitable for conservation or recreation.	Annual	Executive Office of Energy and Environmental Affairs (EEA)	Executive Office of Energy and Environmental Affairs (EEA)
PARC - Parkland Acquisitions and Renovations for Communities	Provides grant assistance to cities and towns to acquire parkland, develop new parks, or renovate existing outdoor public recreation facilities (formerly the Urban Self-Help Program).	Annual	Executive Office of Energy and Environmental Affairs (EEA)	State Appropriations

Other Sources:
www.grants.gov a source for federal government grants
www.grants.com a source for private funding opportunities
www.epa.gov/ogd/grants/funding_opportunities U.S. Environmental Protection Agency
www.corporateservices.noaa.gov/grantsonline National Oceanic and Atmospheric Administration
www.mass.gov/eea/agencies/massdep/water/grants/watersheds-water-quality.html for 604b and s.319 grants

Incorporating the Plan into Existing Planning Mechanisms

Upon approval of the Orange Local Multi-Hazard 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 Department
- Emergency Management Director
- Police Department
- Highway Department
- Water Department
- Planning Board
- Zoning Board of Appeals
- Conservation Commission
- Franklin County Regional Emergency Planning Committee (REPC)
- Building Inspector
- Board of Selectmen

Some possible planning mechanisms could include:

- Incorporation of relevant Hazards Mitigation information into the Open Space and Recreation Plan. There are opportunities to discuss findings of the hazard mitigation plan and incorporate them into the Environmental Inventory and Analysis section of the OSRP and to include appropriate action items from the hazard mitigation plan in the OSRP Action Plan.
- Any future updates of master plans and scenic byway plans, such as the Route 2 Scenic Byway Plan or Route 122 Scenic Byway Plan, could incorporate relevant material from this plan into sections such as the Natural Resources section and any action plans.
- When the Final Draft Local Multi-Hazard Mitigation Plan for the Town of Orange is distributed to the Town boards for their review, a letter asking each board to endorse any action item that lists that board as a responsible party would help to encourage completion of action items.
- The Planning Board could include discussions of the Multi-Hazard Mitigation Plan Action Items in one meeting annually and assess progress.
- The scheduled revision of the Orange Subdivision Rules and Regulations in 2013 should incorporate the relevant action items from the Multi-Hazard Mitigation Plan.

Continued Public Involvement

The Town of Orange 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.

6 – APPENDICES

Appendix 1: Zoning Bylaws and Subdivision Regulations

ORANGE ZONING BYLAWS RELEVANT TO HAZARD MITIGATION

The Town of Orange has established a set of bylaws in part "to promote the general welfare of the Town of Orange, to protect the health and safety of its inhabitants, to encourage the most appropriate use of land within the town, to increase the amenities of the town, to minimize confusion and congestion, and to conserve the value of property within the town, all as authorized by the provisions of the Zoning Act, Chapter 40A of the General Laws, as amended, and by Article 89 of the Amendments of the Constitution." The Zoning By-Laws include several provisions that mitigate the potential for flooding, including Maximum Lot Coverage, Special Permit for Lot Coverage Increase, Erosion Control, Flood Plains, Earth Removal, Special Permit, Water Resource District, Performance Standards, and Open Space Development.

- (Section 2230) Dimensional Schedule. Maximum Lot Coverage.

District	A	B	C	D	CARD
Maximum Lot Coverage	70%	35%	25%	25%	100%

Based on the district, the dimensional schedule allows for the maximum percentage of the total lot that can be covered with impervious surfaces. The percentage can be increased via a Special Permit process (see Section 2350 below).

- (Section 2350) Special Permit for Lot Coverage Increase. In Zone B an additional thirty-five percent (35%) lot coverage beyond the maximum thirty-five percent (35%) may be granted providing that certain criteria are met, including:

  2352. Permeable Area Criteria
  - A. An area of permeable gravel, pea stone or other like material acceptable to the Board shall be placed adjacent to all structures. This permeable surface must extend from the building and must also extend at least six feet (6') from the dripline of all roofs. The permeable area shall not be less than 15% of the footprint of the structure.
  - B. No parking, storage, or snow stacking or any other use that may inhibit or pollute groundwater recharge may occur at any time on the permeable area, as identified in item "A" above. All access points to structures such as but not limited to walks and loading areas and other paved areas such as but not limited to parking and driveways shall direct runoff away from the permeable area.
  - C. Vegetation disturbance and or removal on any portion of the site shall be limited as much as possible.

2353. Parking, Loading, and Outside Storage Area Criteria for Lot Coverage Increase.

A. The area of lot covered by driveways, roadways, parking areas and walkways shall not exceed twenty-five percent (25%) lot coverage, inclusive of any bonus lot coverage.
B. All parking, loading, and outside storage areas shall drain into catchment areas or structures. These areas or structures shall be designed so as trap pollutants defined by hazardous materials Section 4431 herein.
C. The applicant shall provide the Planning Board with a maintenance agreement specifically stipulating the maintenance procedures, schedule, and person or firms responsible for removal of pollutants from the catchment areas or structure.
D. If in the opinion of the Planning Board monitoring wells are necessary then that shall be installed by the applicant. The Town of Orange Zoning By-law applicant shall assume all costs for installation and maintenance for monitoring the wells. The monitoring wells shall be for the purpose of monitoring the effectiveness of the catchment areas or structures in containing hazardous materials, in addition to monitoring of areas where there is potential for a spill or discharge into the ground of hazardous materials. An Agreement acceptable to the Planning Board for the monitoring of these wells must be provided by the applicant.
E. Where drainage is directed off site the applicant may also be required to provide monitoring wells at interval acceptable to the Planning Board along the drainage structures and provide that the off-site catchment areas or structures are sufficient to meet the above criteria.

- (Section 3310) Erosion Control. Site design and materials and construction processes shall be designed to avoid erosion damage, sedimentation or uncontrolled surface runoff.

3311. Grading or construction on, or which result in slopes of 25% or greater on 50% or more of lot area, or on 43,560 sq. feet or more on a single parcel, even if less than half the lot area, shall be allowed only under Special Permit from the Planning Board, which shall be granted only upon demonstration that adequate provisions have been made to protect against erosion, soil instability, uncontrolled surface water runoff, or other environmental degradation. Applications and plans for such Special Permits shall be referred to the Conservation Commission for their advisory review.

3312. All slopes exceeding 15% resulting from site grading shall be either covered with topsoil to a depth of 4 inches and planted with vegetative cover sufficient to prevent erosion or be retained by a wall constructed of masonry, reinforced concrete, or other suitable materials.

3313. The Inspector of Buildings shall require information of the applicant in addition to that specified in Section 5400, as necessary for him to ensure compliance with these requirements, including, if necessary, elevations at key locations,

descriptions of vegetative cover, and the nature of impoundment basins proposed, if any.

3314. Where the resultant site grades shall exceed 15%, the Town Shall require a performance bond or a deposit of money or negotiable securities sufficient in the opinion of the Planning Board to secure compliance with Section 3310-3314 of this By-Law. If a deposit of money or negotiable securities is provided, an agreement shall be executed by the applicant, a lender, if any, and the Town, and shall provide for the retention by the lender or Town of funds sufficient in the opinion of the Planning Board and otherwise due the applicant to secure compliance with the requirements of Section 3310-3314 of the Orange Zoning By-Law. Said agreement shall also provide for a schedule of disbursements which may be made to the applicant upon completion of various stages of the work, and shall further provide that in the event the work is not completed within the time set forth by the parties, any funds remaining unused shall be available for completion.

- (Section 3320) Flood Plains. The purposes of the Floodplain District are to:
  1) Ensure public safety through reducing the threats to life and personal injury.
  2) Eliminate new hazards to emergency response officials;
  3) Prevent the occurrence of public emergencies resulting from water quality, contamination, and pollution due to flooding;
  4) Avoid the loss of utility services, which if damaged by flooding would disrupt or shut down the utility network and impact regions of the community beyond the site of flooding;
  5) Eliminate costs associated with the response and cleanup of flooding conditions;
  6) Reduce damage to public and private property resulting from flooding waters.

  The Floodplain District is herein established as an overlay district. The District includes all special flood hazards areas designated on the Town of Orange Flood Insurance Rate Map (FIRM) issued by the Federal Emergency Management Agency (FEMA) for the administration of the NFIP dated July 5, 1982 as Zone A, AH, AO, A1-30, and the FEMA Flood Boundary & Floodway Map dated 7/5/82, both maps which indicate the 100-year base flood elevations shown on the FIRM and further defined by the Flood Insurance study booklet dated 7/5/82. The FIRM, Floodway Maps and Flood Insurance Study booklet are incorporated herein by reference and are on file with the Town Clerk, Planning Board, Building Official, and Conservation Commission.

  Development within the 100 year flood plain (land subject to a one percent or greater chance of flooding in any given year), shall be allowed only if authorized by a Special Permit from the Planning Board, after finding that the proposed development meets all other applicable requirements, and will constitute no hazard to either site occupants or others. Where base flood plain elevation is not provided on the above map, the applicant shall obtain any existing base flood elevation data, and it shall be reviewed by the Building Inspector for its reasonable utilization toward meeting the evaluation of flood proofing requirements, as appropriate, of the State Building Code.

Section B. Base Flood Elevation and Floodway Data

1. Floodway Data. In Zone A, and A1-30, along watercourses that have not had a regulatory floodway designated, the best available Federal, State, local, or other floodway data shall be used to prohibit encroachments in floodways which would result in any increase in flood levels within the community during the occurrence of the base flood discharge.
2. Base Flood Elevation Data. Base flood elevation data is required for subdivision proposals or other developments greater than 50 lots or 5 acres, whichever is the lesser, within unnumbered A zones.

Article 4, Section A. Reference to Existing Regulations.

The Floodplain District is established as an overlay district to all other districts. All development in the district, including structural and nonstructural activities, whether permitted by right or by special permit must be in compliance with Chapter 131, Section 40 of the Massachusetts General Laws and with the following:

- Section of the Massachusetts State Building Code, which addresses floodplain and costal high hazard areas (currently 780 CMR 3107.0 "Flood Resistant Construction")
- Wetlands Protection Regulations, Department of Environmental Protection (DEP) (currently 310 CMR 10.00);
- Inland Wetlands Restriction, DEP (currently 302 CMR 6.00);
- Minimum Requirements for the Subsurface Disposal of Sanitary Sewage, DEP (currently 310 CMR 15, Title 5);
- Any variances from the provisions and requirements of the above referenced state regulations may only be granted in accordance with the required variance procedures of these state regulations.

Article 4, Section B. Other Use Regulations.

1) In Zones A1-30 and AE, along watercourses that have a regulatory floodway designated on the Town of Orange FIRM or Flood Boundary & Floodway Map encroachments are prohibited in the regulatory floodway which would result in any increase in flood levels within the community during the occurrence of the base flood discharge.
2) Existing contour intervals of site and elevations of existing structures must be included on plan proposal.
3) There shall be established a "routing procedure" which will circulate or transmit one copy of the development plan to the Conservation Commission, Planning Board, Board of Health, Building Inspector, for comments which will be considered by the appropriate permitting board prior to issuing applicable permits.

Article 5. Permitted Uses.

The following uses of low flood damage potential and causing no obstructions to flood flows are encouraged provided they are permitted in the underlying district and they do not require structures, fill, or storage of materials or equipment:

1) Agricultural uses such as farming, grazing, truck farming, horticulture, etc.
2) Forestry and nursery uses.
3) Outdoor recreational uses, including fishing, boating, play areas, etc.
4) Conservation of water, plants, wildlife.
5) Wildlife management areas, foot, bicycle, and/or horse paths.
6) Temporary non-residential structures used in connection with fishing, growing, harvesting, storage, or sale of crops raised on the premises.
7) Buildings lawfully existing prior to the adoption of these provisions.

- (Section 4100) Earth Removal. The removal from any premises of more than 50 cubic yards of sand, gravel, stone, topsoil, or similar materials within any twelve month period shall be allowed only on Special Permit from the Planning Board, unless such removal is incidental to construction of the premises under a current building permit. A Special Permit for earth removal shall be granted only subject to the following:

  4110 Plan. The application shall be accompanied by a plan or plans indicating existing topography, base grades below which no excavation shall take place, proposed topography upon completion, and existing and proposed cover vegetation.

  4120 Screening and Noise. Excavation areas and processing equipment shall be screened by buffer strips or other means, and noise and dust shall be controlled to meet the requirements of Section 3330.

  4130 Restoration. Following removal, all excavation areas shall be restored by grading to provide for drainage and for slopes not to exceed one foot vertical to two feet horizontal, and by covering with four inches of topsoil, and by planting with cover vegetation, which shall have been established prior to release of the bond.

  4140 Bond. A performance bond, a deposit of money or negotiable securities shall be provided in an amount sufficient to secure compliance with the requirements detailed in Sections 4100-4140 of this By-Law.

- (Section 4400) Water Resource District. The purpose of the Water Resource Districts is to protect the public health by preventing contamination of the ground and surface water resources providing water supply for the Town of Orange. The Water Resource Districts are herein established as overlay districts. The First Water Resource District includes land shown as Zones I and II on the map entitled "Zone II APA for PWS #3, dated March 1994 as approved by DEP, prepared by Horsley & Witten, Inc." The Second Water Resource District includes the land shown as Zones I & II on the map entitled "Conceptual Zone II delineation of PWS #1 & 2, as approved by DEP dated July 1994, prepared by Horsley & Witten, Inc."

  4441 Principle Uses.

Removal of soil, loam, sand or gravel within four feet of the historical high groundwater table elevation is not permitted except for:

a. where the substances are redeposited within 45 days of removal to achieve a grading greater than four feet above the historical high water mark (requires a Special Permit); or
b. building foundations, excavations, or utility works (requires a Special Permit).

4443 Other Uses.

Land uses that result in impervious surfaces covering more than15% or 2500 square feet of any lot, whichever is greater, require a Special Permit.

- (Section 4600) Performance Standards. The Performance Standards section provides an alternative to the Special Permit process and should save applicants time and expense. Manufacturing Uses, Bulk Storage, or Warehousing with 10,000 square feet or less of enclosed floor area or Retail or Commercial Office Space Uses with greater than 2,000 square feet but with 5,000 square feet or less of enclosed floor area, may be allowed by right in certain districts provided that they comply with the requirements of this Section 4600. Such uses must meet all the Performance Standards of this section and the Review and Submission requirements unless a waiver is granted by the Planning Board. Performance standards that help mitigate flooding include:

  4620 Performance Standards.

  (j) No increase in stormwater runoff to neighboring properties or roads.

- (Section 5300) Special Permits.

  5330 Criteria. Except as designated under Section 4450 herein (Water Resource Districts), Special Permits shall be granted by the Special Permit Granting Authority only upon its written determination that the proposed use will not have adverse effects which outweigh its beneficial effect on either the neighborhood or the Town, in view of the particular characteristics of the site and the proposal in relation to that site. The determination shall indicate consideration of each of the following:

  a. Social, economic, or community needs which are served by the proposals;
  b. Traffic flow and safety;
  c. Adequacy of utilities and other public services;
  d. Neighborhood character and social structures;
  e. Qualities of the natural environment;
  f. Potential fiscal impact.

- (Section 5400) Site Plan Review. The purpose of Site Plan Review is to further the purposes of this By-law and to ensure that new development is designed in a manner which reasonably protects public safety, the environment, and the visual character of the neighborhood and the town.

  5420 Applicability. Site Plan Review shall be required:

  1. For permits for construction if creating 20 or more parking spaces;

2. When a non-residential or non-agricultural development on a single lot or contiguous lots under common ownership will create more than 10,000 square feet of enclosed floor area;
3. For an Open Space Development (see Section 5700); or
4. For residential subdivisions of 10 or more lots.

5440 Required Contents of a Site Plan. The site plan shall be prepared by a registered professional engineer, registered landscape architect, or registered land surveyor and must contain the following information that may aid in mitigating flooding:

8. Location and use of all existing and proposed buildings and structures, including approximate height and floor area;
9. Location of wetlands on site and within 300 feet of the property line;
13. Existing and proposed topography at a two-foot contour interval for the proposed grading and landscape plan;
15. The location of existing and proposed parking and loading areas, driveways, walkways, access and egress points;
16. The location and a description of proposed open space or recreation areas.
18. Proposed landscape features, including the location and a description of screening, fencing and plantings;
19. Surface drainage strategy that prevents pollution and increased drainage off-site;
24. Existing vegetation that will be left undisturbed and proposed planting areas.

- (Section 5700) Open Space Development. An Open Space Development shall mean a residential development in which the houses are sited together into one or more groups within the development, and separated from adjacent properties and other groups by undeveloped land. This type of development is optional and may occur as either a subdivision or as lots created on an existing public way. Either single family homes or two family homes may be located in an Open Space Development.

  The purpose of an Open Space Development plan is to:

  a) encourage the permanent preservation of common open space or open land for conservation, agriculture, open space, forestry, wildlife habitat, and passive recreational use which maintains the land in an undeveloped condition. Common Open Space for the purposes of Section 5700 is defined as land owned by a corporation or trust owned by the owners of lots within the development, the municipality, a suitable State Agency, or a non-profit land trust. Open Land for the purposes of Section 5700 is defined as land retained by a private individual or trust owned by private individuals which are not the owners of the residential lots within the development;
  b) encourage a less sprawling form of development that preserves open land and preserves the natural features of the site;
  c) promote the efficient provision of municipal services and protect existing and potential water supplies;
  d) maintain the rural character of the Town;

e) promote the siting of buildings that is sensitive to existing natural and historic features;
f) protect public health by siting septic systems on the most suitable soils; and
g) protect the value of real property.

5727 Site Analysis/Development Plan. The plan shall be prepared by a professional architect, engineer, landscape architect, or registered land surveyor, and must include the information required by Section 5400 Site Plan Review. The plan must also include the following information that may help to mitigate flooding:

5728 Narrative Statement.
a) capability of soils to support the proposed development without danger of groundwater or surface water pollution and proposed measures to prevent such pollution;
b) measures to prevent soil erosion, increased runoff, and flooding;
c) proposed design features intended to integrate the proposed development into the existing landscape and enhance aesthetic assets;
d) preliminary drainage calculations (definitive calculations to be included with definitive subdivision plan);
e) projected traffic flow patterns;
f) the total number of building lots.

5729 Additional Information.
d) if necessary to determine compliance with the requirements of this provision, the Planning Board may require further engineering or environmental analysis.

5740 Minimum Requirements.
e) Each lot shall be of size and shape to provide a building site which shall be in harmony with the natural terrain and other features of the land.
h) Design of roads, utilities, and drainage shall be functionally equivalent to the standards contained in the Planning Board's Subdivision Regulations insofar as reasonably applicable, but the Board may vary those standards to meet the particular needs of the Open Space Development and natural features.
i) The amount of Open Space set aside must meet the requirements of Massachusetts General Laws (MGL) Chapter 40A, Section 9, "Cluster Developments"; not withstanding the above, at a minimum, at least thirty-five percent (35%) of the total parcel shall be set aside as Common Open Space or Open Land. The minimum required Common Open Space or protected Open Land shall not include wetlands, floodplains, existing permanently protected open space, land with slopes greater than 25%, roadways or accessory uses.

5760 Required Conservation Land.
5761. The required Common Open Space or Open Land shall be set aside for passive recreation, conservation, forestry, or agricultural uses which preserve the land essentially in its undeveloped condition.

5762. Further subdivision of Common Open Space or Open Land or its use for other than the above listed uses, except for easements for underground utilities and septic systems, shall be prohibited. To insure this, a Conservation Restriction in accordance with M.G.L. Chapter 184 shall be imposed on the Common Open Space or Open Land. Structures or buildings accessory to recreation, conservation, or agricultural uses may be erected but shall not exceed 2% coverage of such Common Open Space or Open Land. The purpose of the Conservation Restriction will be to clearly identify the uses and restrictions which apply to the Common Open Space or Open Land in the Open Space Development. Uses should include passive recreation, easements for utilities, easements for existing or future septic systems, and easements for private drinking water wells.

5763. Such Common Open Space or Open Land shall be either:

a) Conveyed to a corporation or trust owned or to be owned by the owners of lots within the development. If such a corporation or trust is utilized, title to the Common Open Space shall pass with conveyance of the lots in perpetuity.

b) Conveyed to a non-profit conservation land trust or a suitable State Agency, the principal purpose of which is the conservation or preservation of open space.

c) Conveyed to the Town of Orange, at no cost, and be accepted by it for passive recreation or open space use. Such conveyance shall be at the option of the Town and shall require the approval of the voters at a Town Meeting.

d) Retained by a private individual or a trust owned by private individuals provided that the interests of the residents of the Open Space Development will be protected as outlined in the requirements of the Conservation Restriction.

5764. In any case where such Common Open Space or Open Land is not conveyed to the Town, a conservation restriction enforceable by the Town, a suitable State Agency, or a non-profit land trust shall be recorded to ensure that such land shall be kept in a natural or undeveloped state and not be built for residential use or developed for accessory uses such as parking or roadways. Such restrictions shall further provide for maintenance of the Common Open Space or Open Land in a manner which will ensure its suitability for its function, appearance, cleanliness and proper maintenance of drainage, utilities and the like. The Conservation Restriction placed on such Common Open Space or Open Land shall be held by the Conservation Commission of the Town of Orange, a suitable State Agency, or by a non-profit conservation land trust the principal purpose of which is the conservation or preservation of open space.

5765. If the Common Open Space is to be conveyed to the owners within the development, ownership and maintenance of such Common Open Space shall be permanently assured through a corporation or trust owned or to be owned by the owners of the lots within the development. If such a corporation or trust is utilized, title to the Common Open Space shall pass with conveyances of the lots in perpetuity. Each owner is subject to a charge for a share of the maintenance expenses which binds all owners to maintain the Common Open Space in a manner consistent with the agricultural, recreational, or conservation restriction. Such land agreement documents shall be submitted with the Site Analysis/ Development Plan and shall be subject to approval by the Planning Board and Town Counsel.

- (Section 4500) Personal Wireless Service Facilities – is intended "to minimize the visual and environmental impacts of personal wireless service facilities . The Bylaw enables the review and approval of personal wireless service facilities by the Town's Planning Board in keeping with the Town's existing bylaws and historic development patterns, including the size and spacing of structures and open spaces. The bylaw is intended to be used in conjunction with other regulations adopted by the Town, including historic district regulations, site plan review, and other local bylaws designed to encourage appropriate land use, environmental protection, and provision of adequate infrastructure development."

  The bylaw requires a Special Permit from the Plannign Board before such a facility can be erected in any location in town dependent on the facility meeting the conditions as outlined in the bylaw. These conditions include:

  03.3 Dimensional Requirements. Personal wireless service facilities shall comply with the following requirements:

  03.3.1 Height, General. Regardless of the type of mount, personal wireless service facilities shall be no higher than ten feet above the average height of buildings within 300 feet of the proposed facility. In addition, the height of a personal wireless service facility shall not exceed by more than ten feet the height limits of the zoning district in which the facility is proposed to be located, unless the facility is completely camouflaged such as within a flagpole, steeple, chimney, or similar structure. Personal wireless service facilities may locate on a building that is legally non-conforming with respect to height, provided that the facilities do not project above the existing building height.

  03.3.2 Height, Ground-Mounted Facilities. Ground-mounted personal wireless service facilities shall not project higher than ten feet above the average building height or, if there are no buildings within 300 feet, these facilities shall not project higher than ten feet above the average tree canopy height, measured from ground level (AGL). If there are no buildings within 300 feet of the proposed site of the facility, all groundmounted personal wireless service facilities shall be surrounded by dense tree growth to screen views of the facility in all directions. These trees may be existing on the subject property or planted on site.

  03.3.3 Height, Side- and Roof-Mounted Facilities. Side- and roof-mounted personal wireless service facilities shall not project more than ten feet above the height of an existing building nor project more than ten feet above the height limit of the zoning district within which the facility is located. Personal wireless service facilities may locate on a building that is legally non-conforming with respect to height, provided that the facilities do not project above the existing building height.

  03.3.4 Height, Existing Structures. New antennas located on any of the following structures existing on the effective date of this by-law shall be exempt from the height restrictions of this by-law provided that there is no increase in height of the existing

structure as a result of the installation of a personal wireless service facility: Water towers, guyed towers, lattice towers, fire towers and monopoles.

03.3.5 Height, Existing Structures, (Utility). New antennas located on any of the following existing structures shall be exempt from the height restrictions of this by-law provided that there is no more than a twenty foot (20') increase in the height of the existing structure as a result of the installation of a personal wireless service facility: electric transmission and distribution towers, telephone poles and similar existing utility structures. This exemption shall not apply in Historic Districts, within 150 feet of the right-of-way of any scenic roadway, or in designated scenic view sheds.

03.3.6 Height, Wireless Facility Overlay Districts. Where the town establishes Wireless Facility Overlay Districts (as designated on the town zoning map), personal wireless service facilities of up to 150 feet in height may be permitted by Special Permit. Monopoles are the preferred type of mount for such taller structures. Such structures shall comply with all setback and Special Permit Regulations set forth in this By-law.

03.3.7 Setbacks. All personal wireless service facilities and their equipment shelters shall comply with the building setback provisions of the zoning district in which the facility is located. In addition, the following setbacks shall be observed:

03.3.7.1 In order to ensure public safety, the minimum distance from the base of any ground-mounted personal wireless service facility to any property line, road, habitable dwelling, business or institutional use, or public recreational area shall be the height of the facility/mount, including any antennas or other appurtenances. This setback is considered a "fall zone".

03.3.7.2 In the event that an existing structure is proposed as a mount for a personal wireless service facility, a fall zone shall not be required, but the setback provisions of the zoning district shall apply. In the case of pre-existing non-conforming structures, personal wireless service facilities and their equipment shelters shall not increase any nonconformities, except as provided in Section 03.3.8 below.

03.3.8 Flexibility. In reviewing a Special Permit application for a personal wireless service facility, the Planning Board (SPGA) may reduce the required fall zone and/or setback distance of the zoning district by as much as 50% of the required distance, if it finds that a substantially better design will result from such reduction. In making such a finding, the Planning Board shall consider both the visual and safety impacts of the proposed use.

ORANGE SUBDIVISION RULES AND REGULATIONS RELEVANT TO HAZARD MITIGATION

Orange's Subdivision Rules and Regulations were adopted to "protect the safety, convenience and welfare of the inhabitants of the Town of Orange in the laying out and construction of ways with subdivisions, to provide adequate access to all lots, and to assure sound construction of roadways, good drainage and sanitary conditions." The Subdivision Rules and Regulations contain several provisions that mitigate the potential for flooding, including:

- (Section 210-3.2 B) Definitive Plan – Contents. Requires the proponent, in part, to identify:
    - (11) Existing and proposed topography at a suitable contour interval.
    - (12) The location of natural objects and surfaces such as waterways, natural drainage courses, ledge outcroppings, stone walls, and the location and species of all trees in excess of eight inches in diameter within the required front yard of each lot.
    - (13) Proposed construction plan of roadways, sidewalks, planting strips and curbs; including a typical cross-section plan.
    - (14) Proposed layout of storm drainage, water supply and sewage disposal system, including profiles and layouts of all underground utilities all appurtenances.

- (Section 210-3.2 F) Performance Guaranty Required. Before endorsement of the Board's approval of a definitive plan of a subdivision, the subdivider shall agree to complete the required improvements specified in the subdivision rules and regulations for any lots in a subdivision. To secure the completion of the improvements, the Board shall require a performance guarantee in the amount of 150% of the estimated cost of completing the required improvements for any lots in a subdivision. The Board reserves the right to increase the required amount deposited as necessary over time to insure sufficient performance guarantee.

- (Section 210-4.2 B 6) Street Standards – Street Grade. The maximum grade of streets shall be:
    1. Major streets: 6%.
    2. Secondary streets: 9%.
    3. Minor streets: 12%.

- (Section 210-4.3) Design Standards – Easements.
    B. Where a subdivision is traversed by a watercourse, drainageway, channel or stream, the Board may require that there be provided a stormwater easement or drainage right-of-way of adequate width to conform substantially to the lines of such watercourse, drainageway, channel or stream, and to provide for construction or other necessary purposes.

- (Section 210-4.4) Design Standards – Open Spaces. Before approval of a plan the Board may also, in proper cases, require the plan to show a park or parks suitably located for playground or recreation purposes or for provided light and air.

- (Section 210-4.5) Design Standards – Protection of Natural Features. Due regard shall be shown for all natural features, such as large trees, watercourses, scenic points, historic spots, and similar community assets, which, if preserved, will add attractiveness and value to the subdivision and the community.

- (Section 210-5.3) Required Improvements - Curb and Gutter.
  A. Curbing shall be installed in accordance with the following specifications:
     (1) Major streets: curb throughout, granite at intersections, remainder bituminous concrete.
     (2) Secondary streets: granite or bituminous concrete curbs at intersections and steep grades.
     (3) Minor streets: special situations only.
  B. Curbing at an intersection shall include the full length of the curve, plus six feet of tangent in each direction; curbing on steep grades shall mean on all grades in excess of 6%. Curbing may be required on minor streets where the Planning Board deems that special conditions of topography, drainage, alignment, or unusually high densities so require.
  C. In all situations where curbing is not required, the roadway edge and adjoining grass plot or shoulder shall be so treated as to provide adequately for the carrying of surface water run-off. This may require special treatment of gutters, shoulders, ditches, etc. All curb inlets shall be granite, of standard design.

- (Section 210-5.5) Required Improvements – Grass Plots and Trees.
  A. The entire width of the right-of-way, except for roadway, curb and gutter, and sidewalk, shall be devoted to grass plot, consisting of at least six inches of good-quality loam, rolled and seeded.
  C. Where, in the opinion of the Planning Board, existing or proposed trees on the adjacent lot are not adequate, provision of two or more street trees per lot may be required in the planting strip or in adjacent portions of the lot. Species, size, and planting procedure for such trees shall conform to current practice of the Town in planting roadside trees.

- (Section 210-5.6) Required Improvements - Utilities:
  B. Adequate disposal of surface water shall be provided. Catch basins shall be built in conformity with specifications with specifications of the Town of Orange on both sides of the roadway on continuous grades at intervals of not more than 400 feet, at low points and sags in the roadway and near the corners of the roadway at intersecting streets.

Appendix 2: Orange Board of Selectmen Approval Memorandum

Appendix 3: Meeting Agendas, Sign-In Sheets, Publicity & Correspondence

AGENDA

Town of Orange
Local Natural Hazards Mitigation Planning Committee Meeting
Orange Town Hall
6 Prospect Street, Orange MA 01364
April 6, 2011
1:00 p.m. – 3:00 p.m.

1. Introductions – Rick Kiatkowski, Town Administrator (1:00 p.m.)

2. Overview of the 2011 planning process from MEMA and the changes to the Orange Natural Hazards Mitigation Plan – Alyssa Larose, FRCOG (1:05 p.m.)

3. Review of Draft Chapter 4: Mitigation Strategies – Alyssa Larose, FRCOG (1:10 p.m.)

4. Completion of Hazard Risk Assessment table – Alyssa Larose, FRCOG (2:10 p.m.)

5. Review of Draft Critical Facilities Map – Alyssa Larose, FRCOG (2:50 p.m.)

6. Next Steps (2:55 p.m.)

MEMA Natural Hazards Mitigation Project

Orange Meeting

Attendance Sheet for Wednesday, April 6, 2011

Name	Email Address	Affiliation
ROBERT W MALLET	[illegible]	BOARD OF HEALTH
Dennis M Annear	fire@townoforange.org	FIRE.
Brian Spear	police_chief@townoforange.org	Police
KATHY REINIG	KATHY.ORANGE@EARTHLINK.NET	Selectman
David T Frye	highway@Town of Orange.org	Highway & Tree DEPT
Rick Kwiatkowski	Admin@townoforange.org	Town Admin.
JOHN G. VANBOBO	ORE.EMD@GMAIL.COM	EMERG. MANAGMNT. DIR.
Steven Boudreau		Orange Water Dept.
Mike Heidorn	watersuper@townoforange.org	"
PHILIP J. SHERIDAN	f.redeputychief@townoforange.org	ORANGE FIRE DEPT
PRISCILLA CURTIS	sanit@townoforange.org	Sanitation Dept

AGENDA

Town of Orange
Local Multi-Hazard Mitigation Planning Committee Meeting
Tully Fire Station
50 Mill Yard Road, Orange MA 01364
November 17, 2011
10:00 a.m. – 12:00 p.m.

7. Introductions – Dennis Annear, Orange Fire Chief, Emergency Management Director (10:00 a.m.)

8. Review of outstanding information needed to complete the update – Alyssa Larose, FRCOG (10:05 p.m.)

9. Review results of the All Hazards Vulnerability Assessment – Alyssa Larose, FRCOG (10:45 a.m.)

10. Review of Action Plan – Alyssa Larose, FRCOG (11:15 a.m.)

11. Review Draft Critical Facilities Map – Alyssa Larose, FRCOG (11:45 a.m.)

12. Next Steps (11:55 a.m.)

MEMA Multi-Hazards Mitigation Project

Orange Meeting

Attendance Sheet for Thursday, November 17, 2011

Name	Email Address/Phone		Affiliation
Priscilla Curtis	sanit@townoforange.org	9785441118	Sanitation Dept
KATHY REINIG	KATHY.ORANGE@EARTHLINK.NET	9785442194	Planning Bd/Bd of Health
Mike Heidorn	watersuper@townoforange.org	544-1115	OWD
Dennis Annear	fire@townoforange.org	575-0410	EMD/Fire Chief
Alyssa Larose	alarose@frcog.org	413-774-1194 x120	FRCOG

Press Release, sent to The Recorder and the Athol Daily News

Orange Hazard Mitigation Plan Update Underway

The Orange Hazard Mitigation Local Planning Committee is currently updating the Hazard Mitigation Plan for Orange, 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 Massachusetts 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 Orange 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 April 6, 2011 at 1 p.m. at the Orange Town Hall, 6 Prospect Street, Orange, MA 01364. All meetings of the Committee are open to the public; meeting notices and agendas can be found on-line at http://www.townoforange.org/Pages/index and at the Town Hall. The draft plan is expected to be ready for public review in June 2011, and will be made available on the Town website, as well as at the Town Hall and both town libraries.

Orange 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 Rick Kwiatkowski, at (978) 544-1100 x107 or admin@townoforange.org, or Alyssa Larose, Land Use Planner, Franklin Regional Council of Governments, at (413) 774-1194 x120 or alarose@frcog.org.

Orange Local Natural Hazard Mitigation Plan – Memo to Committee

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

Hazard Identification and Profile

Page 15 – 18: Flooding events in Orange
- How was the town impacted by Tropical Storm Irene? Provide damage estimates if available.
- Provide damage estimates for past flooding events if available.
- Review key areas of concern and add/revise as necessary.

Page 26 – 27: Dams in Orange
- Gather information on the Lake Rohunta dam in Athol – hazard level and inundation area in Orange, if available. *Update: EMD is looking into this.*

Page 32: Ice Jams
- How often do ice jams occur at the East Road Bridge? Does it cause flooding?

Risk Assessment

Page 40-42: All Hazards Vulnerability Assessment
- Review the results of the assessment. These are compiled results from the three assessments received from the committee.

Vulnerability Assessment

Page 62: Wildfire and Brushfire
- Confirm whether this statement is accurate: **"**No property damage, injuries or deaths have been recorded for Orange's 25 fires between 2004 and 2009."

Page 67 - 69: Development Trends Analysis
- Confirm whether this statement is still true: "According to the 2008 Orange Open Space and Recreation Plan, a lack in pipe size (and thus fire protection) has limited commercial development along the eastern portion of Route 2A in Orange." *Update: Water Department is checking on this.*

SECTION 4:

Current Mitigation Strategies tables: *Update: All zoning and subdivision regulation related items have been provided to the Planning Board for review and comment.*

Page 75: Flooding
- Review the peak population and special needs facilities information and update if needed. *Update: EMD is checking into this.*

Page 103: Table 4-6 Dams in Orange
- Review the table. Make sure it is consistent with the information on dams in Section 3.

Action Items

Pages 113-116:
- Review action items, responsible departments, and proposed completion dates and update as needed.

- Add any new action items.

Please send comments and updates to Alyssa Larose, Land Use Planner, Franklin Regional Council of Governments, alarose@frcog.org, 413-774-1194 x120.

Questions for Orange Highway Department (sent by email on 11/18/2011):

Please provide damage estimates/ costs for these past events:

- Tropical Storm Floyd (1999): damage to Flagg Road and Town Farm Road.
- Tropical Storm Irene: damage to several culverts.
- October 2011 snowstorm: costs for clean up and damages.
- Ice jams at the East Road bridge over the West Brook:
    - How often do ice jams occur here?
    - Do they cause flooding?
    - Provide any costs for damages or break up of the jams.