

**HAZARD MITIGATION PLAN UPDATE
ANNEX FOR THE TOWN OF WINDHAM**

**Southeastern Connecticut Council of Governments
Multi-Jurisdictional Mitigation Plan Update**

DECEMBER 2017

ADOPTED

MMI #3570-09



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1.0 INTRODUCTION

1.1 Purpose of Annex

The purpose of this hazard mitigation plan (HMP) annex is to provide an update to the natural hazard risk assessment and capability assessment provided in the previous HMP, and to evaluate potential hazard mitigation measures and prioritize hazard mitigation projects specific to mitigating the effects of natural hazards in Windham. Background information and the regional effects of pertinent natural hazards are discussed in the main body of the Southeastern Connecticut Council of Governments (SCCOG) Multi-Jurisdictional Hazard Mitigation Plan Update (the "Regional HMP"). Thus, this annex is designed to supplement the information presented in the Multi-Jurisdictional HMP with more specific detail for the Town of Windham and is not to be considered a standalone document.

The goal of the Town of continues to be "to reduce the loss of life and property and economic consequences as a result of natural disasters". The Town identified four objectives in its initial HMP and HMP Update to meet this goal:

- To reduce the likelihood of flooding by improving existing natural and artificial drainage systems.
- To reduce the likelihood of flooding and natural disaster related damages by improving bridge conditions.
- To reduce the likelihood of flooding and icy conditions by improving existing road conditions.
- Expand activities related to emergency preparedness and improve natural hazard response capabilities.

These objectives remain applicable for this HMP Update.

1.2 Setting

The Town of Windham is a partially urbanized community in southwestern Windham County that was founded in 1692. The town contains an urbanized area comprising the former town of Willimantic which was consolidated with the town in 1983. The community grew to a population of 22,857 as of the 2000 census. Additional growth over the next decade brought the total population of the town to 25,268 as of the 2010 census, a 10.5% increase. According to the 2011-2015 American Community Survey estimates conducted by the U.S. Census Bureau, the median age in Windham is 30.9 years and 42.7% of the housing units were single family homes.

The town is approximately 27.9 square miles in area and consists of the borough of Willimantic as well as the villages of Windham Center, North Windham, and South Windham. The town is bordered by Columbia to the west, Coventry to the northwest, Mansfield and Chaplin to the north, Scotland to the east, Sprague to the southeast, Franklin to the south, and Lebanon to the southwest.

Windham is located at the focus of several major transportation corridors. Major roads and bus lines allow access to Windham and include Route 6, Route 14, Route 32, Route 66, Route 195, Route 203, and Route 289. Rail lines include the Providence/Worcester line. The rail line allows goods to travel from Windham to other communities throughout southeastern Connecticut and the eastern seaboard. The Windham Airport, a local general aviation facility is located in northern Windham and averages approximately 80 aircraft operations per day.

Willimantic is located at the confluence of the Willimantic River and the Natchaug River, which join to form the Shetucket River. The Willimantic River drains from Mansfield and Coventry. The Natchaug River drains from Mansfield Hollow Reservoir in Mansfield and Windham, which is located at the confluence of the Fenton River, Mount Hope River, and the Natchaug River. The Willimantic Reservoir, an impoundment of the Natchaug River, is the source of fire protection water for Windham and southern Mansfield. The Shetucket River drains to Sprague, and it is impounded just upstream of Sprague for hydroelectric purposes.

1.3 Plan Development

A HMP was originally prepared for the Town of Windham in 2006 by the former Windham Region Council of Governments (WinCOG). Following the dissolution of WinCOG in 2014, the Town of Windham joined SCCOG. The WinCOG HMP was updated in 2015 by SCCOG and the Capitol Region Council of Governments, with the expectation that information for the Town of Windham would be consolidated into the next SCCOG HMP Update.

The 2006 HMP was developed by WinCOG under the guidance of WinCOG's Regional Emergency Planning Workgroup. The workgroup committee contributed in gathering historical accounts of natural disaster impacts, determining critical areas of concern, providing existing mitigation strategies, reviewing the risk and vulnerability assessment, and determining mitigation strategies. Workgroup members participated in a series of meetings and the completion of written questionnaires, personal interviews, and workshops as described in the 2006 HMP.

The plan update process for the WinCOG HMP began in 2012. WinCOG met with the Town of Windham and regionally to perform data collection including identifying new risks and vulnerabilities and updating strategies and actions. A draft plan update was issued for comment in 2013, and a two-hour public meeting to review the draft plan was held on February 20, 2014 in Windham. Following receipt of comments from FEMA, the draft plan update was revised and resubmitted to FEMA in May 2015, with approval issued on September 8, 2015.

Since 2006, the HMP and HMP Update for the Town of Windham have been available in local governmental offices and available to emergency personnel. Residents were encouraged to contact the Emergency Management Director with any concerns regarding emergency response or potential projects related to natural hazard damage.

Based on the existing plan, existing information, and hazards that have occurred since 2015, SCCOG determined that the following data collection program would be sufficient to collect data to update the HMP and each annex:

- ❑ SCCOG issued a flyer to municipal chief elected officials on September 13, 2016 announcing the HMP Update process and requesting assignment of a Local Coordinator by September 30, 2016.
- ❑ The SCCOG issued a press release in early November 2016 announcing two public information meetings on the HMP update. This press release was published in the *Windham Bulletin* and *The Day*. This notice was also posted on the SCCOG website and the *Patch* (a popular internet newspaper). A public information meeting was held at the Town of Groton Library on November 28, 2016 to attract input from residents in the southern portion of the SCCOG region, and a public information meeting was held at SCCOG on December 1, 2016 to attract input from residents in the northern portion of the SCCOG region. An internet survey was also hosted by SCCOG to collect data directly from residents. Results of the survey are presented in Section 1.4.4 of the regional HMP, although no respondents were from Windham.
- ❑ Phone interviews were held with the Windham Town Planner on December 5, 2016 and December 15, 2016 to discuss flooding and critical facilities.
- ❑ A meeting was held with the Emergency Management Director on December 15, 2016 to discuss the scope and process for updating the plan and to collect information. The Emergency Management Director coordinated the local planning team which included the Town Planner. The meeting focused on reviewing each section of the existing natural hazard mitigation plan and annex, critical facilities, and various types of hazards that have affected the town and that should be addressed in the update.
- ❑ The draft that is sent for State review will be posted on the Town of Windham website (<http://www.windhamct.com/>) as well as the SCCOG website (<http://www.seccog.org>) for public review and comment. In addition, a hard copy will be made available in the SCCOG office in Windham. A press release will announce the availability of the HMP for review. This will provide residents, business owners, and other stakeholders throughout the SCCOG region the opportunity to review and comment on a relatively complete draft with all annexes. Comments received from the public will be incorporated into the final draft where applicable following State and Federal comments.

The adoption of this HMP update by the Town of Windham will be coordinated by SCCOG and the Emergency Management Director. The HMP update must be adopted within one year of conditional approval by FEMA, or the Town will need to update the HMP and resubmit it to FEMA for review. The adoption resolution is located in Appendix A of this annex.

1.4 Progress Monitoring

Following adoption, the Emergency Management Director will continue to administer this HMP under the authority of the Town Manager and will be the local coordinator of the HMP. The Emergency Management Director will coordinate with responsible departments as listed in Table 11-1 and ensure that the recommendations of this HMP are considered or enacted. Refer to Section 1.8 of the Multi-Jurisdictional HMP (Regional HMP) for a description of how the local

coordinator will perform progress monitoring. The majority of recommendations in this annex can be accomplished within or with only a slight increase in the operating budgets of the various departments. Projects that require capital improvements or additional funding will need to be approved by the Town Council.

The HMP will be on file with the Emergency Management Director and at the Planning Department to assist in guiding growth decisions. See Section 2.5 for recommendations related to integrating the findings of this HMP into other Town planning documents. The Town will encourage residents to contact the Emergency Management Director with concerns related to natural hazards or emergency response via the Town's website. Such announcements will also state that the HMP is available for public review at the Planning Department as well as available on the Town's and the SCCOG's website.

The Town of Windham will review the status of plan recommendations each year. The Emergency Management Director will be in charge of overseeing recommended projects and coordinating an annual meeting with applicable departments (those listed in Table 11-1) and other interested departments. Refer to Section 1.8 of the Multi-Jurisdictional HMP (Regional HMP) for a list of matters to be discussed at the annual meeting, including a review of each recommendation and progress achieved to date, or reasons for why the recommendation has not been enacted. The Emergency Management Director will keep a written record of meeting minutes and the status of the recommendations. These records of progress monitoring will form the basis for the next HMP update.

The Town of Windham understands that the multi-jurisdictional HMP and this annex will be effective for five years from the date of FEMA approval of the first SCCOG jurisdiction regardless of the date of adoption by the Town. The Emergency Management Director will coordinate with SCCOG for the next HMP update which is expected to occur in 2021-2022.

2.0 COMMUNITY PROFILE

2.1 Physical Setting

The Town of Windham is located in the northwestern corner of the SCCOG region. Elevations range from approximately 100 feet along the Shetucket River to just over 650 feet on Obwebetuck Hill in the southwestern section of the town. The western area of town along the Willimantic River known as Willimantic is the most densely developed area, while outlying areas, particularly in the southeastern portion of the town, are relatively rural.

Geology is important to the occurrence and relative effects of natural hazards such as earthquakes. Thus, it is important to understand the geologic setting and variation of bedrock and surficial formations in lands underlying the Town of Windham.

The Town of Windham lays above several bedrock formations which trend southwest to northeast across the area, except in northwestern Windham where the formations are more circular in nature associated with the Willimantic Dome. The Willimantic Dome is bounded by the Willimantic Window, described¹ as a window or inlier through the upper plate of the thrust fault. Each of these formations consist primarily of gneiss and schist which are relatively hard metamorphic rocks.

The town's different surficial geologic formations include glacial till and stratified drift. Refer to the Multi-Jurisdictional HMP for a generalized view of surficial materials. The majority of the town is underlain by glacial till. Till contains an unsorted mixture of clay, silt, sand, gravel, and boulders deposited by glaciers as a ground moraine. Areas adjacent to the Willimantic River, the Natchaug River, and the Shetucket River, and Indian Hollow Brook have fairly extensive areas underlain by sand and gravel or floodplain alluvium. The amount of stratified drift present is important as areas of stratified materials are generally coincident with floodplains. These materials were deposited at lower elevations by glacial streams, and these valleys were later inherited by the larger of our present day streams and rivers. However, the smaller glacial till watercourses can also cause flooding. The amount of stratified drift also has bearing on the relative intensity of earthquakes and the likelihood of soil subsidence in areas of fill.

The Town of Windham is considered to be at risk of damage from inland flooding, hurricanes and tropical storms, summer storms and tornadoes, winter storms, earthquakes, wildfires, and dam failure. Windham is not a coastal community and is therefore not susceptible to coastal flooding, coastal erosion, or sea level rise. As discussed in its 2015 HMP, Windham is not considered to be susceptible to, or at significant risk from, avalanches, expansive soils, extreme heat, land subsidence, landslides, tsunamis, or volcanoes.

¹ Rodgers, John. 1985. "Bedrock Geological Map of Connecticut". Connecticut Geological and Natural History Survey.

2.2 Land Use and Development Trends

Windham was an important county seat in the 18th and 19th centuries. Early industry in Windham consisted of water-powered sawmills, gristmills, and blacksmith shops, while farmers raised livestock and planted crops such as wheat, rye, corn, barley, flax, and hemp. Most mills developed along the Willimantic River in Willimantic and in Windham Center. Population boomed in Willimantic during the industrial revolution in the early 19th century, particularly related to the textile industry. The introduction of rail lines in the 19th century further spurred industrial development, as well as residential development as Willimantic was one of only a handful of stops between Boston and New York in the late 19th century. Residences were constructed to house the workers to these industries, and fine homes were built on hillsides (such as Prospect Hill) overlooking the commercial and industrial areas. Several notable historic structures including the former American Thread Company, the Jillson House Museum, the Windham Textile and History Museum, the town hall, and several historic homes are dispersed throughout town. The Town made a concerted effort to develop utilities (water, sewer) to provide service to the residents and businesses of the town of Willimantic beginning in the late 19th century.

The textile industry began to decline following World War II as many larger industries moved south, the primary railroad line between Boston and New York was relocated through New London, and the nation became less reliant on shipping goods via rail. In addition, Willimantic was never connected to the interstate highway system, with only a short section of Route 6 becoming a limited access highway. Following a major downtown revitalization effort in the 1970s, the Town of Windham is again undertaking a major downtown revitalization and riverfront reclamation effort by adding parks and converting distressed factory buildings into residential space for artists and small technology startups.

According to the 2006 land cover data from the University of Connecticut's Center for Land Use Education and Research (CLEAR), 21% of the community is considered developed. Largely forested, Windham is made up of approximately 42% deciduous forest, 7% coniferous forest and 3% forested wetlands. Other land cover in the town includes: agricultural and other grasses (11%), turf and grass (7%), barren land (4%), water (4%), non-forested wetlands (<1%) and utility rights-of-way (<1%). The approximate 633 acres of the town occupied by water bodies includes: Beaver Brook Pond, Big Pond, Frog Pond, Lake Marie, Mansfield Hollow Lake and the Willimantic Reservoir.

Today, Windham is primarily a service center rather than an industrial hub. In particular, Willimantic is home to Eastern Connecticut State University (ECSU) and a branch of the Quinebaug Valley Community College. Education, including the Windham Public School system and ECSU, is one of the top employment sectors for town residents, and Windham Hospital is another major employer. Commercial corridors with restaurants and shops are located along Route 32, Route 66, and other State roads in the town, as well as in downtown areas. Manufacturing and construction jobs employ less than 1,000 people, with most such remaining jobs being in Willimantic or at locations along the Shetucket River.

In general, any influx of population and residential and non-residential development increases the town's overall vulnerability to natural hazards. According to the 2010 census, approximately 48.7% of all housing units in Windham are renter-occupied. Many were built during the housing boom of the 1960's to 1990s, but most housing structures pre-date these decades and as such do not meet current or even recent building codes. The low percentage of owner occupancy can lead to increased susceptibility to natural hazards, as owners may not be present on a daily basis to secure their properties. However, new buildings are constructed to more recent building codes (and generally away from floodplains) and are considered to be less vulnerable to natural hazards than older buildings.

In the time since the last HMP was written in 2015, there has been little development on new land (requiring clearing) in Town. Most development is demolition/rebuild projects, and renovations. The lack of developer-friendly space remaining in the town has generally slowed new development. According to the Connecticut Department of Economic and Community Development, only 9 new housing units were netted in Windham in 2015.

2.3 Drainage Basins and Hydrology

The Shetucket River is a significant river in Eastern Connecticut. It flows south from Willimantic approximately 16 miles to its confluence with the Quinebaug River in Windham. All land in Windham eventually drains to the Shetucket River, although approximately one-quarter of the town drains to the Willimantic or Natchaug River first. Additional sub-regional watersheds are associated with Beaver Brook (which drains to the Shetucket River in Sprague), Indian Hollow Brook (which drains to the Shetucket River in South Windham), and Sawmill Brook (which drains to the Natchaug River in Willimantic). Other notable bodies of water found throughout Windham include Big Pond, Frog Pond, Lake Marie, Mansfield Hollow Lake, and the Willimantic Reservoir.

The headwater streams of the Shetucket River are heavily flood controlled such that widespread flooding is no longer an issue along this watercourse. In particular, the Mansfield Hollow Dam in Mansfield and Windham is managed by the United States Army Corps of Engineers for flood protection purposes. The Willimantic River is also dammed in its headwaters for public water supply purposes which may reduce flooding risk. Other significant dams are located on the Natchaug River at Willimantic Reservoir, the Shetucket River at Scotland Dam, and on Big Pond in South Windham, but they do not offer any flood abatement capacities.

2.4 Governmental Structure

The Town of Windham is governed by a Council/Manager form of government. The Mayor is the chief elected official for the Town, presides over the Town Council, and with the Council appoints a Town Manager who serves as the chief executive officer of the Town and is directly responsible for the administration of all departments, agencies, and offices. Together, Mayor and the Town Council review and approve all Town business.

The Town of Windham has several departments and commissions that provide municipal services. Authorities in the Town of Windham who play advisory, supervisory, or direct roles in hazard mitigation for the Town include the following:

**Table 2-1
Authorities and Roles in Windham**

Authorities	Role			Hazard Mitigated
	Advisory	Supervisory	Direct	
Building Department	X		X	All
Code Enforcement and Zoning Office	X		X	Flooding
Conservation, Open Space, and Agriculture Commission	X			Flooding
Fire Department			X	Wildfire
Fire Marshal / Emergency Management Director (under supervision of Town Manager)	X	X	X	All
Inland Wetlands & Watercourses Commission			X	Flooding
Mayor / Town Council	X	X	X	All
Planning	X		X	Flooding
Planning and Zoning Commission	X		X	Flooding
Public Works Department	X	X	X	All
Town Engineer	X	X	X	Flooding
Water Commission / Windham Water Works	X	X		Wildfire
Zoning Board of Appeals			X	Flooding

The roles of Town departments have not changed since the time of the previous HMP. Thus, the Town of Windham continues to be technically, financially, and legally capable of implementing mitigation projects for natural hazards. As discussed in the next section and the historic record throughout this annex, the Town of Windham is densely developed in certain areas (e.g. Willimantic) but practically rural in outlying areas, presenting a range of vulnerability to certain types of natural hazards.

2.5 Review of Existing Plans and Regulations

The Town has several plans and regulations that suggest or create policies related to natural hazard mitigation. These policies and regulations are outlined in the Emergency Operations Plan, *Plan of Conservation and Development*, Zoning Regulations, and Inland Wetland Regulations.

Emergency Operations Plan

The Town has an Emergency Operations Plan (EOP) that is updated and certified by the Town Manager annually. This document provides general procedures to be instituted by the Town Manager and/or designee, Emergency Management Department, Police Department, and Fire

Department in case of an emergency. Emergencies can include but are not limited to natural hazard events such as hurricanes and nor'easters as noted in the Severe Weather Annex of the EOP. The EOP is directly related to providing emergency services prior to, during, and following a natural hazard event. The EOP was being updated as of December 2016 to revise some language without any content change. The Town plans to switch to the new state-designated EOP format by 2019.

Plan of Conservation and Development (2007)

The *Plan of Conservation and Development* (POCD) was adopted in 2007 with contributions from local boards and commissions, citizens, and citizen groups. The current plan was developed prior to the initial HMP and its first update but includes many strategies pertinent to natural hazard mitigation. The Town is currently in the process of updating the Plan through 2027, and the Town plans to include information from the HMP Update within the POCD update. The purpose of the plan is promote economic development through smart growth and forward thinking while meeting the needs of multiple stakeholders and interested parties. The plan identifies 7,582 potentially developable vacant acres remaining in the town. Recommendation strategies were noted as being long-term policies or specific actions, and those related to hazard mitigation include:

Long-Term Policies

- ❑ Reduce environmental impact of commercial development by requiring adherence to Best Management Practices (BMPs) for stormwater management; reduce the amount of impervious pavement whenever possible. *These are now included in the Zoning Regulations.*
- ❑ Continue to increase open space by: increasing the amount of open space required in subdivisions, seeking grants to acquire valuable open space; budget funds annually.
- ❑ Support Willimantic Housing Authority efforts to maintain and upgrade their properties.
- ❑ Ensure adequate public safety services are provided to all areas of town and for all residents of town.
- ❑ Support needs of Fire and Police Chiefs and Fire Marshals in their efforts to ensure the safety of our townspeople.

Specific Tasks

- ❑ Form a committee to inventory trees, recommend planting and maintenance program.
- ❑ Rezone the area between Riverside Drive and the river to permit recreational park use.
- ❑ In light of build-out analysis, review current density requirements for residential zones.
- ❑ Modify residential zoning regulations where applicable to protect water quality and water supply
- ❑ Revise subdivision regulations to require conservation subdivisions in appropriate residential zones.
- ❑ Develop regulations that will protect natural resources while Windham develops. Support development that protects our natural resources.
- ❑ Protect major aquifers and public water supply areas (i.e. Mansfield Hollow) from impacts

- from inappropriate development; consider overlay zone
- ❑ Consider increasing the upland review area to 200 feet; continue to require appropriate buffer zones for important water resources
- ❑ Continue to protect important water resources to maintain water quality, water supply, habitats, and ecological balance; consider a river overlay zone for the three major rivers
- ❑ Tie existing and new open space and recreation areas together into a green infrastructure to buffer natural areas and to provide a community trail system.
- ❑ Fund Public Works Department so they can efficiently maintain our streets, sidewalks, trees, and parks.
- ❑ Fund in-house Geographic Information System (GIS) to facilitate future land use planning decisions.

Based on the above, the Windham POCD is considered somewhat consistent with the current goals and actions of the hazard mitigation plan, as it does not directly address several of the hazards such as emergency hazard response and specific flood mitigation plans, among others. The next update to the POCD (currently underway) will continue to reference and incorporate the elements of the hazard mitigation plan.

Zoning Regulations

The Zoning Regulations of the Town of Windham, Connecticut were last revised September 12, 2013. These regulations are applied during the permitting process for new construction and during substantial improvement of existing structures. Many of the regulations are specific to mitigating flooding damage, as noted below:

- ❑ Article I, Section 3.10.7(iv) requires permittees extending or enlarging a non-conforming use to conform to the provisions of Article V, Section 52 for Special Flood Hazard Areas (SFHA).
- ❑ Article I, Section 3.13 states that there shall be no encroachment upon any floodplain, or other area subject to potential flooding as designated by the State of Connecticut, by filling or by buildings or other structures. This requirement is likely specific to the Stream Channel Encroachment Lines formerly established by the State of Connecticut for certain areas along the Willimantic River and Shetucket River. However, areas in the Special Flood Hazard District may be utilized in accordance with Section 52.
- ❑ Article IV, Section 43.9.1 states that no buildings, structure, parking facility, or loading area may be located closer than 50 feet to the Willimantic River except with a Special Exception from the commission.
- ❑ Article V, Section 52 discusses the requirements for the Special Flood Hazard Area. The Town has adopted the FIS and FIRM released by FEMA dated November 6, 1998 and any revisions thereto with the accompanying Flood Insurance Rate Maps adopted by reference.
 - Chapter 52.7 notes that where substantial development or disturbance is proposed (i.e. disturbance of one acre or more, or removal or addition of between 1,000 cubic yards and 5,000 cubic yards of material), the commission may require more detailed

information on the likely impacts on flood flow and the effect on abutting properties in the SFHA. A Special Permit is required when the proposed development may result in a substantial change in conditions (i.e. greater than 5,000 cubic yards of material or disturbance of more than five acres).

- Chapter 52.7.3 requires that all new construction and substantial improvements have the lowest floor, including the basement, elevated to or above the base flood level. Non-residential structures may be floodproofed provided all attendant utilities and sanitary facilities and the area of the structure below the base flood elevation is watertight with walls substantially impermeable to the passage of water. Living space is not allowed below the base flood elevation. All public utilities and drainage must be located and designed to be consistent with the need to minimize flood damage.
- Chapter 52.8 requires developments within floodways to meet certain requirements. For mapped floodways, encroachments are not allowed unless the encroachment does not result in any rise in the base flood elevation. For Zone A where a floodway has not been mapped, no encroachments are permitted unless the applicant demonstrates that the cumulative effect of the development, when combined with all other existing and anticipated development, will not increase the base flood elevation more than one foot at any point in town. The Town may request that an applicant determine the floodway if one is not present, and shall adopt such floodway.
- Chapter 52.9.2 specifies that variances will not be issued within any designated floodway if any increase in the base flood elevation would result.
- Article VII, Section 71.9 specifies design standards for stormwater management (no net runoff) and best management practices.

Inland Wetland and Watercourses Regulations

The Inland Wetlands and Watercourses Regulations in the Town of Windham were last amended on May 13, 2004. The regulations require a permit for certain regulated activities which take place within 100 feet of a wetland or watercourse, within 150 feet for any proposed subsurface disposal system, and within 200 feet of the Willimantic, Natchaug, and Shetucket Rivers, the North Atlantic White Cedar Bog, and any vernal pool. These regulations build on the preventative flood mitigation provided by the Zoning regulations by preventing fill and sedimentation that could lead to increased flood stages.

Under Section 4.1 and 4.2 of the proposed regulations dated April 2017, withdrawals of water for fire emergency purposes are exempt from permitting, including the installation of dry hydrants by or under the authority of a municipal fire department, provided the dry hydrant is only used for firefighting purposes and there is no reasonable alternative access to a public water supply.

2.6 Critical Facilities, Sheltering Capacity, and Evacuation

The Town of Windham considers several facilities to be critical to ensure that emergencies are addressed while day-to-day management of the Town continues. In addition, locations with populations that may be at additional risk during an emergency are also considered to be critical. Critical facilities are presented on figures throughout this annex and summarized in Table 2-1.

As shown on Table 2-2, only one critical facility (the water pollution control facility) is located within the 1% annual chance floodplain, and no critical facilities are located within potential hurricane surge zones. These facilities are described in more detail below.

Fire Departments

The Town has four fire stations; three are volunteer companies (Windham Center, South Windham, and North Windham) while one houses career fire fighters (on Bank Street in Willimantic). The four fire departments provide excellent fire and rescue response to the town and have pump trucks, brush trucks, and boats to provide fire response and rescue services.

Municipal Facilities

Windham Water Works draws water from the Willimantic Reservoir to provide public water service throughout most of Windham and southern Mansfield. The Town of Windham provides sewer service throughout Willimantic and parts of Windham. Electrical and natural gas service is provided by regional utilities.

The Town's Emergency Operations Center (EOC) operates out of the Town Hall and has a generator for emergency power. The Town's water pollution control facility on (at the confluence of the Willimantic River and the Natchaug River) is located within the 1% annual chance floodplain. Other municipal facilities, including public works, the senior center, and the police department are not floodprone. The two police departments include one on Meadow Street in Willimantic and one on the ECSU campus.

Literature is an important means of conveying and educating the public. Located in the main lobby of Town Hall are several pamphlets describing emergency checklists, home emergency plans, wildfires, evacuation routes, etc. This information will also be distributed to the Library once renovations are completed.

Health Care Facilities

The Windham Hospital on Mansfield Avenue is not floodprone. This facility provides emergency, advanced outpatient, and inpatient services to the Town of Windham and the surrounding region. Three convalescent homes are also located in Windham on Club Road, North Road, and Valley Street. In addition, there are five elderly and special needs housing areas.

**TABLE 2-2
Critical Facilities**

Facility	Address or Location	Emergency Power?	Shelter?	In 1% Annual Chance Floodplain?	In Surge Zones?
<i>Emergency Services</i>					
Windham Center Fire Department	18 Windham Center Road				
South Windham Fire Department	41 Machine Shop Hill Road				
North Windham Fire Department	603 Boston Post Road				
Willimantic Fire Department	13 Bank Street				
Police Department	22 Meadow Street				
ECSU Police Department	44 Charter Oak Road				
Emergency Operations Center / Town Hall	979 Main Street	X			
<i>Municipal Facilities</i>					
Windham Senior Center	47 Crescent Street				
Public Works Headquarters	8 Industrial Park Road	X			
Windham Water Works (Public Water)	174 Storrs Road, Mansfield	X			
Water Pollution Control Facility	2 Main Street			X	
<i>Health Care Facilities & Senior Living</i>					
Windham Hospital	112 Mansfield Avenue	X			
<i>Windham Public Schools</i>					
Windham Early Childhood Center	322 Prospect Street				
Natchaug Elementary School	123 Jackson Street				
North Windham Elementary	112 Jordan Lane				
Windham Center Elementary	45 North Road Route 14				
Sweeney Elementary	60 Oak Hill Drive	X			
Charles H. Barrows STEM Academy	141 Tuckie Road				
Windham Middle School	123 Quarry Street	X			
Windham High School	355 High Street	X	X		
Windham Technical High School	210 Birch Street	X	X		
Arts at the Capitol Theater Performing Arts Magnet High School	896 Main Street				
Path Academy	832 Main Street				
<i>Other Public Schools</i>					
Eastern Connecticut State University	83 Windham Street	X	X		
Quinebaug Valley Community College (Branch)	729 Main Street				
<i>Private Schools</i>					
Saint Mary - Saint Joseph School	35 Valley Street				
Maranatha Sda Regional School	126 Quarry Street				
<i>Other Facilities</i>					
Windham Airport	15 Airport Road				

Windham contains populations of people who are elderly and/or possess disabilities. Not surprisingly, the more populated areas include a higher percentage of individuals who may require special assistance or different means of notification before and during natural hazards.

Schools

The Town of Windham has a large school system that encompasses eight elementary schools (two of which are private) and one middle school. These facilities are considered to be critical facilities because they house a large student population who may not be as prepared for emergencies to the same extent as an adult. Windham has five high schools, including a high school education program, a technical high school, a secondary arts magnet school, and a charter high school. The high school and the technical high school are shelters and both are equipped with generators. Several private schools are also located in the town.

With the largest individual population concentration in town, ECSU's campus, located in Willimantic, had over 4500 undergraduates and several hundred graduates enrolled in the 2012 school year. ECSU's housing facilities allow the campus to accommodate approximately two-thirds of the entire student body while the university is in session. The seasonal increase in population in this area creates an elevated concern. It should be noted that the University has its own police protection, but given a disaster of a large enough scale the University would require further assistance besides that which they can provide for themselves.

Shelters

The Town of Windham has two primary shelters for residents. The primary shelters (two high schools) are listed in Table 2-3. The high school has two co-generators, while the Trade school has a diesel generator. The Town completed a micro-grid project in early 2017 to create an off-grid power island for Sweeney School and the Middle School. Additional sheltering space would be needed if New London or Fishers Island, NY evacuated due to an accident at the Millstone Nuclear Facility in Waterford. Under that scenario, the Town has agreements in place to provide large-scale short-term sheltering with the assistance of ECSU.

Communications

The Town is in the process of updating its Emergency Operations Center (EOC) Communication System which will allow for direct communications between ECSU, Windham Hospital, and the EOC. All departments can communicate by cell phone and email. In addition, one communication facility (operated by Frontier) providing internet and telephone service is located on High Street.

The Town has subscribed to the CodeRED Reverse 9-1-1 system to provide emergency notification and response to areas affected by a natural hazard or other emergency. This system is separate from the Reverse 9-1-1 system utilized by ECSU. The backup method of disseminating information is to drive along streets making announcements over public address systems. Residents can communicate issues either by directly calling municipal departments.

The Town also provides educational pamphlets and literature on natural disasters at the Town Hall and Library.

Evacuation Routes

The Emergency Management Director has a coastal evacuation plan on file that can be activated because of an emergency at the Millstone Nuclear Power Plant in Waterford. The evacuation map includes evacuation routes connected to the shelters in the Windham. If the Town of Windham needed to evacuate, residents would utilize Route 6, Route 14, Route 32, Route 66, Route 195, Route 203, or Route 289 to leave the town. However, several bridges could be a concern during severe flooding events.

Additional Groups and Facilities

In addition to Town offices, The American Red Cross and the Salvation Army help provide shelter and vital services during disasters and participate in public education activities. The Windham Airport is also considered a critical facility as supplies could be airlifted to this facility following a natural disaster. Two manufactured home parks off Route 6 and other mobile homes throughout town are also of concern due to their heightened risk of being damaged by natural hazards. Other commercial and industrial facilities are also a concern for emergency responders due to their size and use of propane gas.

3.0 INLAND FLOODING

3.1 Setting / Historic Record

The Town of Windham is at risk of flooding because of a number of streams, brooks and ponds in the town. According to the 1998 Federal Emergency Management Agency's (FEMA's) updated Flood Insurance Study (FIS) for the town:

"Floods in the Town of Windham can occur in any season of the year. Spring floods are common due to a combination of rainfall and snowmelt. Floods in late summer are usually the result of hurricanes or other storms moving northeast along the Atlantic coast. Winter floods result from occasional thaws, particularly in years of heavy snowfall.

Major floods of the past 50 years have occurred in March 1936 (a 20-year frequency event), September 1938, and August 1955 (in excess of a 100-year event). The operation of Mansfield Hollow Lake aided the downstream basin in avoiding serious flooding. The Shetucket River at the USGS gaging station (No. 01122500, with 70 years of operation), located at Plains Road, recorded a peak discharge of 52,200 cubic feet per second (cfs) on September 21, 1938. This same quantity of runoff, occurring today, would produce a significantly lower flow at the gage, due to the operation of the Mansfield Hollow Dam.

The Willimantic River, at the USGS gaging station No. 0111950, just upstream of State Route 31 in Coventry, Connecticut, recorded a peak discharge of 24,200 cfs on August 19, 1955. The recurrence interval of the flood, at this gaging station, was in excess of a 200-year flood."

3.2 Existing Capabilities

The Town of Windham has consistently participated in the NFIP since February 3, 1982. The most recent FIRM was published on November 6, 1998. The current Town of Windham FIS was published on November 6, 1998. The original FIS and FIRMs for flooding sources in the Town are based on work completed in June 1980 (Town), July 1980 (City of Willimantic), and May 1996 (Willimantic River update). Many of the local flooding problems are consistent with the floodplains mapped by FEMA.

Flood Control Structural Projects

As noted in Section 3.4.4 of the Multi-Jurisdictional HMP, the Mansfield Hollow Dam was constructed by the USACE upstream of Windham on the Natchaug River. This flood protection project was completed and greatly reduces the incidence and severity of flooding in Windham. The dam is designed to reduce the volume of the 1938 flood by one-half.

Bridge Replacements, Drainage, and Maintenance

Stormwater runoff can significantly exacerbate flooding; therefore, managing stormwater runoff is a priority mitigation measure. Residential and commercial development increases impervious land area, reduces the infiltration of stormwater runoff into the ground, and increases the volume and velocity of stormwater runoff causing flooding. Enforcing appropriate maintenance programs for stormwater facilities will therefore help reduce the impact of these events and subsequently reduce the damage caused by flooding. The Town currently contracts out silt removal services for its catch basins.

The town has performed several maintenance programs recently, with more in the works. The Plains Road Bridge over Shetucket was resurfaced in 2015/2016, while DOT plans to replace the Route 66 Bridge in 2017. The Town of Windham monitors scour critical bridges such as the Plains Road Bridge that crosses the Willimantic River.

Regulations, Codes, and Ordinances

Section 52 of the Town of Windham's current zoning regulations are the Town's Special Flood Hazard Area regulations which were most recently updated on June 23, 2011. These include, but are not limited to, the following limitations in the flood zone²:

- Where disturbance of one acre or more, or removal or addition of more than 1,000 cubic yards but less than 5,000 cubic yards, the Commission may require more detailed information on the likely impacts of the proposed development on flood flow and the effect on abutting properties (Section 52.7(b)). When the proposed development may result in disturbance of more than five acres or the removal or addition of more than 5,000 cubic yards of material, the Commission shall process the application as a Special Permit in accordance with Section 62 (Section 52.7(c)).
- All new construction and substantial improvements, including prefabricated or manufactured buildings or structures shall have the lowest floor, including the basement, elevated to or above the base flood level (100 year flood level) (Section 52.7.3.b).
- Non-residential structures located in all A-Zones may be flood-proofed in lieu of being elevated provided that together with all attendant utilities and sanitary facilities, the areas of the structure below the required elevation are water tight with walls substantially impermeable to the passage of water, and structural components are used which have the capability of resisting hydrostatic and hydrodynamic loads and the effect of buoyancy (Section 52.7.3.c).
- Any new construction, including prefabricated buildings and manufactured homes, and substantial improvements shall be designed and anchored to prevent flotation collapse or

² The flood zone being the Area of Special Flood Hazard, designated as the land in the flood plain within a community subject to a one percent or greater chance of flooding in any given year. The areas of Special Flood Hazard contain all A Zones (areas of the 100-year flood) as designated on the Flood Insurance Rate Map. (Windham Zoning Regulations Section 52.5.1)

lateral movement and constructed with flood-resistant materials and methods. The placement of manufactured homes or manufactured home parks and subdivisions shall be prohibited within any Special Flood Hazard Area of an 'A' or 'B' zone. New construction and substantial improvements shall be constructed using methods and practices that minimize flood damage (Section 52.7.3.g).

- Any development or activity within the floodway must be capable of conveying the base flood without increasing the water surface elevation more than one foot at any point (Section 52.8.a).
- Encroachments, including fill, new construction, substantial improvements and any other development is prohibited unless certification (with supporting technical data) is provided by a Registered Professional Engineer demonstrating that such encroachments will not result in any increase in flood levels during occurrence of the base flood discharge (Section 52.8.b).
- If the proposal involves development within an 'A' Zone, and a floodway has not been identified, no new construction, substantial improvements to existing structures, or other development (including fill) shall be permitted unless it is demonstrated by the applicant that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point in the town (Section 52.8.1).

Windham's regulations prohibit manufactured (mobile) homes within any special flood hazard area of an 'A' or 'B' zone. Other proposed structures within the flood plain are required to meet elevation requirements and strict construction demands. Structures may be required to be constructed with certain materials, elevated, flood proofed, watertight or anchored. It must be shown with not only proposed structures, but with any activity in the 100-year flood plain that encroachment will not alter the flood levels in the floodway. Also any development or activity within the floodway must not increase the water surface elevation more than one foot at any point. These types of regulations help to keep structures out of areas at risk of flooding. Structures that are allowed in the flood plain must meet requirements put in place to greatly reduce the risk of damage to property and the loss of life, should a flood occur.

The degree of flood protection established by the variety of regulations in the Town meets the minimum reasonable for regulatory purposes under the NFIP. The Town plans to remain compliant with the NFIP and will continue to participate in the NFIP.

Acquisitions, Elevations, and Property Protection

No property acquisitions, elevations or protection projects have been recently completed nor are currently proposed by the town.

Flood Watches and Warnings

The Emergency Management Director, Fire Department, and Police Department access weather reports through the National Weather Service, and utilize Reverse 9-1-1 systems to telephone warnings into affected areas when flooding is imminent.

Summary

The Town's capabilities are considered to be effective in regards to response to flood damage, and the Town's capability to mitigate flood hazard damage is also considered effective for preventing damage to new development and substantial improvements.

3.3 Vulnerabilities and Risk Assessment

This section discusses specific areas at risk to inland flooding within the town. Overall, the Town of Windham's capability to mitigate for flooding and prevent loss of life and property is slightly improved since the initial hazard mitigation plan was adopted. This is because new flooding problems were not identified and the CodeRED emergency notification system was enacted by the Town. Mitigation response has also improved slightly since 2015 through recent communication and backup power improvements.

Areas studied for vulnerability, as noted in FEMA's 1998 FIS for the town, are as follows:

"For the 1981 Windham FIS, the Natchaug and Shetucket Rivers were studied by detailed methods for their entire lengths within the town.

For the 1982 Willimantic FIS, the Natchaug, Shetucket, and Willimantic Rivers were studied for their entire lengths within the town.

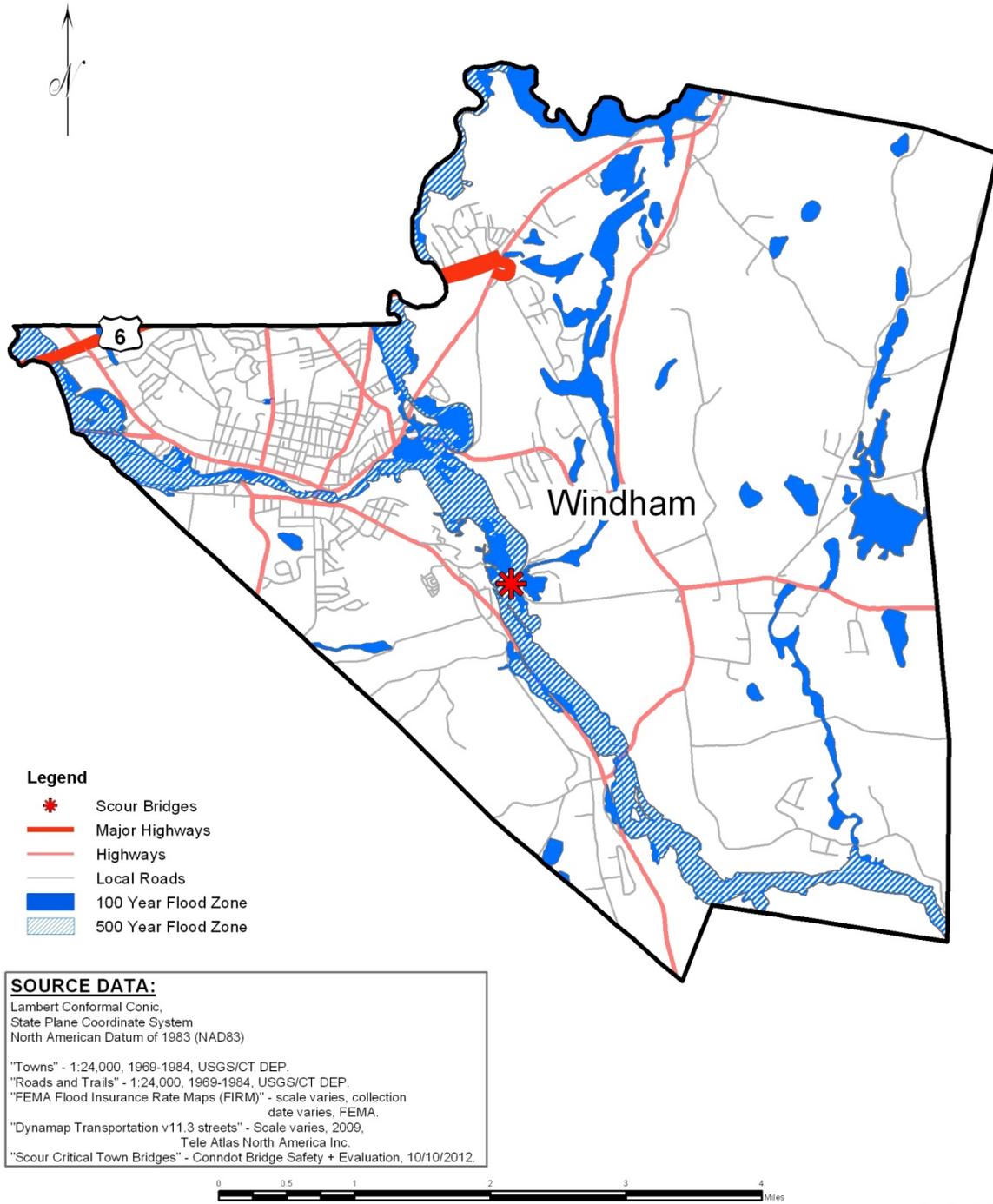
All or portions of the following streams were studied by approximate methods; Willimantic Reservoir, Potash Brook, Ballymark Brook, Beaver Brook, Lake Marie, Bibbins Pond, Lyman's Pond, Chestnut Hill Brook, Frog Pond, Jordan Brook, Indian Hollow Pond, Big Pond, a swamp east of Main Street, a swamp east of State Route 289, and a small pond west of Chestnut Hill Brook.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through June 1985. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA."

Figure 45, reprinted from the 2015 HMP, depicts the Special Flood Hazard Areas and scour critical bridges in Windham. These areas have not changed since the time of the previous HMP.

Flood Risk Zones of Windham

Figure 45



October 2012

Prepared for: The Windham Region Council of Governments Hazard Mitigation Plan.

FOR ADVISORY PURPOSES ONLY

3.3.1 Vulnerability Analysis of Areas along Watercourses

Tyler Square is a small shopping center that experiences parking lot flooding. Property managers and leasers are aware of the problem, and have emergency plans in place. The property has a pump to remove water, a good drainage system, and a flood warning system that gives tenants time to move cars and prepare for floods. The property contains important federal offices (Social Security, among others), so although the site is well-equipped to deal with flooding, important resources are not available while the site is inaccessible.

Other areas of concern in the town include bridges over the Willimantic River, commercial development in North Windham, and the railroad.

- ❑ The Bridge Street bridge is a low-lying bridge with frequent structural damage. This bridge could easily become impassible in a high water event or potentially in any disaster. A study is currently underway to determine whether the bridge should be upgraded, or the channel blasted and dredged. Thread Town Crossing (known locally as The Frog Bridge) off Route 32 is a newer, better-built structure over the River that is not floodprone. However, should a disaster reduce its functionality, traffic crossing the Shetucket River could be greatly hampered.
- ❑ Along Route 6 in North Windham there is an area of concern near the Windham Airport, where there is commercial development and an upward-lying dam.
- ❑ In addition, Old Brooklyn Turnpike is an area of concern. The dead-end road includes a stone box culvert which crosses a brook, and the road elevation is relatively low to the brook. Up to six homes could be accessible if the culvert washed out.

3.3.2 Vulnerability Analysis of Private Properties

Lovers Lane is an area with poor drainage. Catch basins in the area are directed to dry wells as opposed to a storm drainage system, and these often overflow. The Town continues to evaluate options for this area, but are concerned that the installation of a storm drainage system may require elevation of the road.

According to records maintained by the NFIP, Windham does not contain any repetitive loss properties or severe repetitive loss properties. Based on information presented in Section 3.5.2 of the regional HMP, a total of \$33,651 has been paid out to NFIP-insured properties since 1978. The annualized loss due to flooding based on the NFIP data is \$862.85.

Public Assistance reimbursements have been obtained by the Town of Windham related to Hurricane Sandy in 2012, Tropical Storm Irene in 2011, and the October 2005 heavy rainfall. Public Assistance reimbursements were also obtained by non-profits such as ECSU. As noted in the regional HMP, In the case of Sandy and Irene, it was assumed that 1/3 of the damage was related to flooding. The total estimated damage from these floods to Windham is \$48,090.20 since 1999, representing an annualized loss of \$2,671.68.

The 2014 Connecticut Natural Hazard Mitigation Plan Update provides estimates of annualized loss by county for flooding in Table 2-44. Based on the data provided in Table 2-44 of the State Plan, the annualized loss for Windham County based on the historic record through the National Climatic Data Center through the past 20 years is \$53,168.

The ratio of the Town's population to the county population was utilized to attribute a portion of the county-wide annualized loss to Windham. Based on the 2010 Census data in Section 2.5 of the regional HMP, Windham has approximately 21.3% of the population of Windham County. Based on this percentage, the annualized loss in the Town of Windham for flooding is estimated at \$11,344.

As noted in the regional HMP, the NFIP data (which typically represents private damages) and the Public Assistance Reimbursements (which typically represents municipal and non-profit damages) can be combined to estimate annualized losses due to flooding. Based on this data, the annualized loss in Windham due to flooding is \$3,535. Given the lack of widespread flooding damage in Windham, this estimate is considered more reasonable than the annualized loss estimate of \$11,344 based on county-wide flooding damages. The annualized loss estimate of \$3,535 for flooding is considered reasonable for the Town of Windham.

3.3.3 Vulnerability Analysis of Critical Facilities

As noted in Table 2-2, the only critical facility in Windham at risk of flooding is the waste water treatment plant located at the confluence of the Willimantic and Natchaug Rivers. This facility is located in the 1% annual chance floodplain, but has not been flooded recently in part due to the flood protection provided by the Mansfield Hollow Dam upstream on the Natchaug River.

3.4 Potential Mitigation Strategies and Actions

General potential mitigation measures that can be taken to reduce the effects of inland flooding were discussed in Section 3.7 and in Section 11.2.2 of the Multi-Jurisdictional HMP. General recommendations pertinent to all natural hazards that could affect the Town are listed in Section 11 of this annex along with general and specific measures pertinent to reducing inland flooding in the Town of Windham under the categories of prevention, property protection, emergency services, public education and awareness, natural resource protection, and structural projects.

A good stormwater management system promotes groundwater recharge and controls peak flows, while reducing local flooding and maintaining stream bank integrity. An example of a good stormwater management system would be one that calls for removing sediment accumulation from catch basins yearly. This may make the difference in whether or not flooding occurs. All towns within the region are also encouraged to consider the effects of proposed future development on stormwater runoff.

Additional projects related to flood mitigation which may be considered by the Town of Windham include:

- Educating the public on:
 - Risks of flooding,
 - Risks of building in hazard-prone areas,
 - Federal Emergency Management Agency (FEMA) floodplain maps (and making these maps easily available to the public);
- Implementing a maintenance program to clear debris from storm water drainage areas;
- Developing sediment control to prevent clogged drainage systems, such as street sweeping, curb and gutter cleaning, paving dirt roads, and planting vegetation on bare ground;
- Investigating the use of flood-prone areas as open spaces;
- Encouraging individuals in flood-prone areas to purchase flood insurance;
- Elevating structures above the 100-year flood level; and
- Considering the conservation of open space by acquisition of repetitive loss structures.

4.0 COASTAL FLOODING

4.1 Setting / Historic Record

Windham is not located along the coastline nor is it located in a potential hurricane surge zone. As such, no coastal flooding or storm surge has affected the town since the last HMP. Therefore, the town is not considered to be affected by coastal flooding and storm surge.

4.2 Existing Capabilities

Due to the town not being on the coast, it does not have and/or need regulations to restrict development due to coastal flooding hazards.

4.3 Vulnerabilities and Risk Assessment

No areas of the town are vulnerable to coastal flooding or storm surge.

4.4 Potential Mitigation Strategies and Actions

No mitigation measures for reducing the impact of coastal flooding or storm surge in the town are necessary or are proposed.

5.0 HURRICANES AND TROPICAL STORMS

5.1 Setting / Historic Record

Several types of hazards may be associated with tropical storms and hurricanes including heavy or tornado winds, heavy rains, and flooding. Flooding hazards are discussed in Section 3 of this annex. Wind hazards are widespread and can affect any part of the town. However, some buildings in the town are more susceptible to wind damage than others.

Hurricane Sandy in 2012 and Tropical Storm Irene in 2011 were the last two events to impact Windham. The Town of Windham and non-profits received \$50,652.92 in wind damages due to Hurricane Sandy, and \$30,788.28 in damages from Tropical Storm Irene.

5.2 Existing Capabilities

Wind loading requirements are addressed through the state building code. The Connecticut State Building Code was most recently adopted with an effective date of October 1, 2016. The code specifies the design wind speed for construction in all the Connecticut municipalities. The ultimate design wind speed for Windham ranges from 120 to 140 miles per hour depending on the building use (for example, hospitals must be designed to the higher wind speed). Note that changes in design wind speed figures since the previous HMP are largely the result of a shift from "nominal" to "ultimate" wind speeds, for compatibility purposes; see the Connecticut Building Code or the American Society of Civil Engineers website for more information. Windham has adopted the Connecticut Building Code as its building code.

Parts of trees (limbs) or entire tall and older trees may fall during heavy wind events, potentially damaging structures, utility lines, and vehicles. Utility lines are located underground in only a couple areas of the town. The Tree Warden posts notification and schedule tree removal. Most tree services are contracted out of town and the budget of tree removal is built into the Public Works Department budget and is not stand-alone. Since the previous HMP, CL&P has been acquired by Eversource. In response to the major power-outages caused by Tropical Storm Irene and Hurricane Sandy, as well as significant winter storm events, Eversource has taken an aggressive approach to tree maintenance and has improved communication and coordination with municipalities. Municipal staff report that Eversource has enhanced its tree clearing efforts, has updated its facilities, and has been working to strengthen the power grid and build in redundancies. Communication and coordination has improved due to Eversource's liaison program.

Warning is one of the best ways to prevent damage from hurricanes and tropical storms, as these storms often are tracked well in advance of reaching Connecticut. Windham can access National Weather Service forecasts via the internet as well as listening to local media outlets (television, radio) to receive information about the relative strength of the approaching storm. This information provides the resources needed to determine whether or not to implement its EOP and encourage residents to take protective or evacuation measures if appropriate.

As noted previously, Windham subscribes to a Reverse 9-1-1 system. Residents are able to sign up to receive warnings through CodeRED as well as from the statewide CT Alert "Everbridge" Emergency Notification System and receive critical information from the town.

Although hurricanes that have impacted Windham have historically passed in a day's time, additional regional shelters could be outfitted following a storm with the assistance of the American Red Cross on an as-needed basis for long-term evacuees.

Summary

The Town maintains shelter facilities and performs debris management through Public Works with the assistance of the local electrical utility when necessary. The Town's capabilities are considered to be effective with regard to mitigating hurricane damage. Overall, the Town of Windham's capability to mitigate for hurricanes and prevent loss of life and property was slightly improved between the 2006 and 2015 editions of the HMP. Capabilities have not changed between 2015 and 2017.

5.3 Vulnerabilities and Risk Assessment

The overall risk of Windham to hurricanes is considered to be high. The entire town is vulnerable to hurricane and tropical storm wind damage and from any tornadoes (Section 6) accompanying the storm, as well as inland flooding (Section 3). Of particular concern are the blockage of roads and the damage to the electrical power supply from falling trees and tree limbs. The town is concerned that relatively extensive outages could occur in some areas because of tree damage to utility lines.

Direct wind damage to newer buildings from hurricane or tropical storm-level winds is rare in the town since the new buildings were constructed to meet or exceed current building codes. Many buildings in the town were built in the 1970s and 1980s and do not meet current building codes. Older buildings in the town and mobile homes are particularly susceptible to roof and window damage from high wind events, particularly in the many historic districts in the town. This risk will be reduced with time as these buildings are remodeled or replaced with buildings that meet current codes.

The strength of a large hurricane could cause a significant economic impact to the Town. The potential economic effect of wind damage to the SCSOG region was evaluated in Section 5.5.1 of the Multi-Jurisdictional HMP. The ratio of the Town's population to the regional population (Section 2.5 of the regional HMP) was used to attribute a portion of this region-wide damage to Windham. Based on this analysis, an estimated annualized loss of \$1,818,356 is expected for wind damage in Windham.

Note that this estimate does not take into account site specific details or particular hurricane wind damages that may have affected the Town of Windham in the historic record. Therefore, this number should be used with caution. Nevertheless, it provides a useful planning number to consider the overall vulnerability of the Town to hurricane wind damage.

The Town of Windham did not report any specific losses due to hurricanes, although total damages related to wind damage totaled \$81,441.20 according to Public Assistance reimbursements since 1999. The annualized loss based on the Public Assistance reimbursements is \$4,524.51. This is much less than the HAZUS-MH damage estimate, and does not take into account private losses which are expected to have been incurred by property owners on some scale during these strong wind events. Therefore, an annualized loss due to wind damage of \$1,818,356 is considered appropriate for Windham.

5.4 Potential Mitigation Strategies and Actions

General potential mitigation measures that can be taken to reduce the effects of wind damage from hurricanes and tropical storms were discussed in Section 5.7 and in Section 11.2.3 of the Multi-Jurisdictional HMP. General recommendations pertinent to all natural hazards that could affect the town are listed in Section 11 of this annex along with general and specific measures pertinent to reducing wind damage to the town of Windham under the categories of prevention, property protection, emergency services, and public education and awareness.

Some of the greatest damage from hurricanes is caused by flooding, high winds and tornadoes. Mitigation measures for these events are looked at separately in the flooding and tornado/wind damage sections. Other mitigation efforts that should be considered include:

- ❑ Providing emergency shelters;
- ❑ Implementing a tree hazard management program, which would encourage responsible planting practices and minimize future storm damage to buildings, utilities, and streets;
- ❑ Practicing a tree trimming maintenance program; and
- ❑ Relandscaping with native species.

6.0 SUMMER STORMS AND TORNADOES

6.1 Setting / Historic Record

Similar to hurricanes and winter storms, wind damage associated with summer storms and tornadoes has the potential to affect any area of the Town. Furthermore, because these types of storms and the hazards that result (flash flooding, wind, hail, and lightning) might have limited geographic extent, it is possible for a summer storm to harm one area within the town without harming another. Such storms occur in the town each year, although hail and direct lightning strikes to the town are rarer. No tornadoes have occurred in the town since the last HMP.

A selection of summer storm damage in the Town of Windham as reported to the NCDC is presented below:

- ❑ June 22, 2012: A cold front moved through a hot and humid southern New England producing showers and thunderstorms. Many of these storms became severe, resulting in damaging winds, large hail, and some flash flooding. Trees and wires near a school in Windham were downed by thunderstorm winds. Approximately \$15,000 in property damage was reported.
- ❑ August 10, 2012: A series of upper level disturbances rotated around a vertically stacked low pressure system in the Great Lakes. These provided a focus for showers and thunderstorms to develop across southern New England. Southerly winds drew tropical moisture over the area, resulting in very heavy rain in showers and thunderstorms that developed. In addition, strong winds in the upper levels and 30-40 knots of deep layer shear resulted in wind damage with the strongest of these storms. Trees and wires on Washington Street in Windham were downed by thunderstorm winds, resulting in approximately \$15,000 in property damage.

6.2 Existing Capabilities

Warning is the most viable and therefore the primary method of existing mitigation for tornadoes and thunderstorm-related hazards. The NOAA National Weather Service issues watches and warnings when severe weather is likely to develop or has developed, respectively. The Town can access National Weather Service forecasts via the internet as well as listen to local media outlets (television, radio) to receive information about the relative strength of the approaching storm. This information allows the Town to activate its EOP and encourage residents to take protective measures if appropriate.

Aside from warnings, several other methods of mitigation for wind damage are employed by the Town as explained in Section 5.2 within the context of hurricanes and tropical storms. In addition, the Connecticut Building Code includes guidelines for the proper grounding of buildings and electrical boxes to protect against lightning damage.

The Town performs debris management through Public Works with the assistance of the local electrical utility when necessary. The Town's capabilities are considered to be effective in regards to response to thunderstorms, although the Town's capability to mitigate thunderstorm damage is relatively limited to town-owned facilities and right-of-ways. Overall, the Town of Windham's capability to mitigate for thunderstorms and prevent loss of life and property is slightly improved since the initial hazard mitigation plan was adopted because the local electrical utility has performed an intensive trimming program near electrical lines following the severe storms in 2011.

Summary

The Town's policies for mitigating tornado damage are response-oriented and include maintaining shelters and debris cleanup equipment. The Town's capabilities are considered to be effective in regards to response to tornadoes. Overall, the Town of Windham's capability to mitigate for tornadoes is essentially unchanged from the initial 2006 HMP to the 2015 HMP, as mitigation measures were not completed that would mitigate the effects of a tornado event.

The Town performs debris management through Public Works with the assistance of the local electrical utility when necessary. The Town's capabilities are considered to be effective in regards to response to thunderstorms, although the Town's capability to mitigate thunderstorm damage is relatively limited to town-owned facilities and right-of-ways. Overall, the Town of Windham's capability to mitigate for thunderstorms is slightly improved between the 2006 and 2015 editions of the HMP because the electrical utility conducts an intensive trimming program near electrical lines since the severe storms in 2011.

Capabilities for tornado and thunderstorm mitigation have not changed between 2015 and 2017.

6.3 Vulnerabilities and Risk Assessment

Summer storms are expected to occur each year and are expected to at times produce heavy winds, heavy rainfall, lightning, and hail. All areas of the Town are equally likely to experience the effects of summer storms. The density of damage is expected to be greater near the more densely populated area of the Town.

Most thunderstorm damage is caused by straight-line winds exceeding 100 mph. Experience has generally shown that wind in excess of 50 miles per hour (mph) will cause significant tree damage during the summer season as the effects of wind on trees is exacerbated when the trees are in full leaf. The damage to buildings and overhead utilities due to downed trees has historically been the biggest problem associated with wind storms. Heavy winds can take down trees near power lines, leading to the start and spread of fires. Such fires can be extremely dangerous during the summer months during dry and drought conditions. Fortunately, most fires are quickly extinguished due to the Town's strong fire response.

Lightning and hail are generally associated with severe thunderstorms and can produce damaging effects. All areas of the Town are equally susceptible to damage from lightning and

hail, although lightning damage is typically mitigated by warnings and proper grounding of buildings and equipment. Hail is primarily mitigated by warning, although vehicles and watercraft can often not be secured prior to the relatively sudden onset of a hailstorm. Lightning and hail are considered likely events each year, but typically cause limited damage in the Town. Older buildings are most susceptible to lightning and hail damage since many are renter occupied and they were constructed prior to current building codes.

Although tornadoes pose a threat to all areas of Connecticut, their occurrence is less frequent in Windham County as compared with western and northern parts of the state. Thus, while the possibility of a tornado striking the Town exists, it is considered to be an event with a very low probability of occurrence. The Town of Windham did not report any recent damages due to tornadoes.

The 2014 Connecticut Natural Hazard Mitigation Plan Update provides estimates of thunderstorm losses by county in Table 2-19. This data was developed based on damages reported in the NCDRC database. Based on the data provided in Table 2-19 of the State Plan, the predicted annualized loss for Windham County due to thunderstorm damage is \$47,026.

The ratio of the Town's population to the county population was utilized to attribute a portion of the county-wide annualized loss to Windham. Based on the 2010 Census data, Windham has approximately 21.3% of the population of Windham County. Based on this percentage, the annualized loss in the Town of Windham for thunderstorm damage is estimated at \$10,034.

Note that this estimate does not take into account site specific details or particular thunderstorm damages that may have affected the Town of Windham in the historic record. Therefore, this number should be used with caution. Nevertheless, it provides a useful planning number to consider the overall vulnerability of the Town to thunderstorm damage.

The Town of Windham did not report any recent losses due to severe thunderstorms. Recent private losses were not reported by the Town, but are expected to be incurred by property owners on some scale during severe thunderstorm events.

The 2014 Connecticut Natural Hazard Mitigation Plan Update provides estimates of tornado losses for a variety of events by county. This data was developed based on damages reported in the NCDRC database. Based on the data provided in the State Plan, the predicted annualized loss for Windham County due to tornado damage is \$84,862.

The ratio of the Town's population to the county population was utilized to attribute a portion of the county-wide annualized loss to Windham. Based on the 2010 Census data, Windham has approximately 21.3% of the population of Windham County. Based on this percentage, the annualized loss in the Town of Windham for tornado damage is estimated at \$18,068.

Note that this estimate does not take into account site specific details or particular tornado damages that may have affected the Town of Windham in the historic record. Therefore, this number should be used with caution. Nevertheless, it provides a useful planning number to consider the overall vulnerability of the Town to tornado damage.

6.4 Potential Mitigation Strategies and Actions

General potential mitigation measures that can be taken to reduce the effects of wind damage were discussed in Section 5.7 and in Section 11.2.3 of the Multi-Jurisdictional HMP. No additional recommendations are available specific to reducing damage from summer storms and tornadoes. Refer to Section 11 of this annex for recommendations related to wind damage and general recommendations related to emergency services. General recommendations pertinent to all natural hazards that could affect the Town are also listed in Section 11 of this annex.

Some of the greatest damage from thunderstorms is caused by fires, flooding, high winds, and (on occasion) tornadoes. Mitigation measures for such hazards are discussed under those headings.

The National Weather Service's Early Warning System is an important mitigation measure for thunderstorms. Other hazard-specific mitigation efforts that should be considered include:

- Educating the public on how to minimize risk of injury both indoors and outdoors (more specifically);
 - When to turn off gas, electricity, and water; and
 - When and how to avoid contact with water and metal.
- Clearing dead or rotting tree branches;
- Securing outdoor objects that could become projectiles; and
- Installing lightning rods.

While the region has a very low risk of experiencing a tornado with great destructive potential, basic measures to minimize damage from high winds can be implemented and public education efforts can help to prepare residents. Owners of older mobile homes should be particularly aware of mitigation measures that could protect their homes from damage.

The National Weather Service's Early Warning System is an important mitigation measure for tornado/wind damage events. Other hazard-specific mitigation efforts that should be considered include:

- Being aware of, and educating the public through pamphlets and web-based information on
 - The warning signs for a tornado,
 - The importance of securing outdoor objects that could become projectiles,
 - What kinds of buildings are most vulnerable to damage from tornadoes or high winds (such as manufacture housing),
 - Structural alterations to protect against wind damage,
 - When and where to seek shelter;
- Encouraging upgrading of existing buildings to meet current building codes;
- Enforcing and updating building code standards for light frame construction, especially wind resistant roofs. FEMA articles on bracing for gable trussed roofs and bracing for doors and windows are available for review. Information is also available on placement of HVAC systems and electrical utilities to resist both wind and flood damage; and
- Encouraging underground utility wires.

7.0 WINTER STORMS AND NOR'EASTERS

7.1 Setting / Historic Record

Similar to hurricanes and summer storms, winter storms have the potential to affect any area of the Town. However, unlike summer storms, winter storms and the hazards that result (wind, snow, and ice) have more widespread geographic extent. In general, winter storms are considered highly likely to occur each year (major storms are less frequent), and the hazards that result (nor'easter winds, snow, and blizzard conditions) can potentially have a significant effect over a large area of the town.

Winter storms and nor'easters have affected the town since the last HMP, as reported to the NCDC and reported by town officials. According to Public Assistance reimbursement data, the January Blizzard of 2015 (\$217,886.07), the February Blizzard of 2013 (\$151,454.09), Winter Storm Alfred in October 2011 (\$7,089.12), the February 2006 snowstorm (\$100,156.13), the January 2005 snowstorm (\$84,849.49), the December 2003 snowstorm (\$60,780.77), and the February 2003 snowstorm (\$31,775.11) each caused significant damages in Windham.

According to the Town, the City of Willimantic has not had a significant power outage over the last decade. Winter Storm Alfred in late October 2011 caused significant tree damage and additional power outages for several days in outlying areas but not in Willimantic. Trees which were able to withstand the heavy winds of Irene were not able to withstand both wind and snow load during Storm Alfred.

Key risks associated with winter storms are the relative isolation of rural areas from emergency services; loss of electrical power to large areas from ice accumulation or high winds, and fire from improper use of alternative heating sources, candles and gas stoves. The leading cause of death is from automobile and other transportation accidents. Property damage can also occur from frozen water pipes and falling trees or branches from ice accumulation and/or wind. The overall risk of Windham to severe winter storms is considered to be high.

7.2 Existing Capabilities

Existing programs applicable to winter storm winds are the same as those discussed in Sections 5.2 and 6.2. Programs that are specific to winter storms are generally those related to preparing plows and sand and salt trucks; tree trimming and maintenance to protect power lines, roads, and structures; and other associated snow removal and response preparations.

As it is almost guaranteed that winter storms will occur annually in Connecticut, it is important to locally budget fiscal resources toward snow management. Snow is the most common natural hazard requiring additional overtime effort from town staff, as parking lots and roadways need constant maintenance during storms. The Public Works Department oversees snow removal in the Town. Salt and sand is stored at the Public Works facility. The town has established plowing routes that prioritize access to and from critical facilities. The Connecticut Department of Transportation (DOT) plows State roads.

The Connecticut Building Code specifies that a pressure of 30 pounds per square foot be used as the base "ground snow load" for computing snow loading for roofs. The Town monitored and shoveled the roofs of municipal buildings, and most residents and businesses also shoveled or plowed their roofs.

The Town maintains shelters and provides plowing services through Public Works. The Public Works Department installed a new generator in 2016, increasing their resiliency to winter storm events.

Summary

The Town's capabilities are considered to be effective in regards to response to severe winter storms, although the Town's capability to mitigate severe winter storm damage is relatively limited to town-owned facilities. Overall, the Town of Windham's capability to mitigate for severe winter storms is slightly improved between the 2006 and 2015 editions of the HMP because of recent intensive tree-trimming work along electrical lines conducted by the local electrical utility, and is slightly improved between 2015 and 2017 due to new communication equipment as well as the new generator at the Public Works facility.

7.3 Vulnerabilities and Risk Assessment

Severe winter storms can produce an array of hazardous weather conditions, including heavy snow, blizzards, freezing rain and ice pellets, flooding, heavy winds, and extreme cold. Further "flood" damage could be caused by flooding from frozen water pipes. Often, tree limbs on roadways are not suited to withstand high wind and snow or ice loads.

This section focuses on those effects commonly associated with winter storms, including those from blizzards, ice storms, heavy snow, freezing rain, and extreme cold. Warning and education can prevent most injuries from winter storms. Most deaths from winter storms are indirectly related to the storm, such as from traffic accidents on icy roads and hypothermia from prolonged exposure to cold. Damage to trees and tree limbs and the resultant downing of utility cables are a common effect of these types of events. Secondary effects can include loss of power and heat.

The majority of Town buildings were constructed relatively recently and therefore not particularly susceptible to damage from heavy snow. While some Town buildings could be susceptible to heavy snow loads, they will be cleared quickly if safety is a concern. Many buildings in the Town have flat roofs which are more susceptible to damage from heavy snow than sloped roofs.

Icing is not an issue anywhere in the Town. According to Town staff, there are few steep slopes such that extra sanding and salting of the roadways in necessary locations alleviates any trouble spots.

The 2014 Connecticut Natural Hazard Mitigation Plan Update provides estimates of severe winter storm losses for a variety of events by county. This data was developed based on

damages reported in the NCDC database. Based on the data provided in the State Plan, the predicted annualized loss for Windham County due to severe winter storm damage is \$432,441.

The ratio of the Town's population to the county population was utilized to attribute a portion of the county-wide annualized loss to Windham. Based on the 2010 Census data, Windham has approximately 21.3% of the population of Windham County. Based on this percentage, the annualized loss in the Town of Windham for severe winter storm damage is estimated at \$92,266.

Note that this estimate does not take into account site specific details or particular severe winter storm damages that may have affected the Town of Windham in the historic record. Therefore, this number should be used with caution. Nevertheless, it provides a useful planning number to consider the overall vulnerability of the Town to severe winter storm damage.

Based on the Public Assistance reimbursements received by the Town and local non-profits, winter storms have caused a total of \$653,990.79 in damages in town since 1999. The annualized loss based on this information is \$36,332.82. However, this estimate does not take into account damages to private property, such that the annualized loss estimate based on the county-wide NCDC data in the 2014 State HMP is considered to be more appropriate. Therefore, the annualized loss estimate of \$92,266 due to winter storm damage based on the county-wide losses is considered appropriate.

The Town of Windham did not report any recent damages due to severe winter storms. Private losses were not reported by the Town, but were expected to have been incurred by property owners on some scale during these severe winter storm events.

7.4 Potential Mitigation Strategies and Actions

General recommendations pertinent to all natural hazards that could affect the Town are listed in Section 11 of this annex. Potential mitigation measures for flooding caused by nor'easters include those appropriate for flooding that were discussed in Section 3.7 of the Multi-Jurisdictional HMP and Section 11 of this annex. General potential mitigation measures that can be taken to reduce the effects of wind damage were discussed in Section 5.7 and in Section 11.2.3 of the Multi-Jurisdictional HMP. However, winter storm mitigation measures must also address blizzards, snow, and ice hazards. General and specific measures pertinent to reducing damage from winter storms in the Town of Windham under the categories of prevention, property protection, emergency services, and public education and awareness are presented in Section 11.

Some of the greatest damage from winter storms is caused by flooding and high winds, and mitigation measures for such hazards are discussed under those headings. It is particularly important to encourage people to stay indoors and out of harm's way when severe winter weather threatens. Such conditions increase the frequency of traffic accidents and emergency responders take longer to reach accident scenes because of vehicles unnecessarily on the roads.

Power outages can cause a number of problems, from loss of heat and the risk of frozen pipes to fire hazards. Tree-trimming programs can lessen the risk of power outages to some extent. Putting utility wires underground can lessen the risk even further. In any event, the municipality should develop a plan to restore power as quickly as possible.

The National Weather Service's Early Warning System is an important mitigation measure for winter storms. Other hazard-specific mitigation efforts that should be considered include:

- ❑ Educating the public on
 - The risks of hypothermia,
 - The risks of carbon monoxide poisoning in motor vehicles and from portable heaters and power generators in homes,
 - The risk of fires from portable heaters and candles,
 - The importance of staying off the roads,
 - Landscaping practices that encourage the planting of species that are less susceptible to damage from ice storms to reduce the risk of damage to structures;
- ❑ Implementing a tree trimming maintenance program;
- ❑ Encouraging underground utility wires; and
- ❑ Providing emergency shelters before, during, and after the event.

8.0 EARTHQUAKES

8.1 Setting / Historic Record

An earthquake is a sudden rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse; disrupt gas, electric, and telephone lines; and often cause landslides, flash floods, fires, avalanches, and tsunamis. Earthquakes can occur at any time and often without warning. Detailed descriptions of earthquakes, scales, and effects can be found in Section 8 of the Multi-Jurisdictional HMP. Despite the low probability of an earthquake occurrence, earthquake damage presents a potentially catastrophic hazard to the Town. However, it is very unlikely that the Town would be at the epicenter of such a damaging earthquake. No major earthquakes have affected the Town since the last HMP.

8.2 Existing Capabilities

The Connecticut Building Codes include design criteria for buildings specific to each region as adopted by Building Officials and Code Administrators (BOCA). These include the seismic coefficients for building design in the Town. The Town has adopted these codes for new construction, and they are enforced by the Zoning and Building Department.

Due to the infrequent nature of damaging earthquakes, Town land use policies do not directly address earthquake hazards. However, the potential for an earthquake and emergency response procedures is addressed in the Town's EOP.

Summary

The Town does not specifically mitigate for earthquake hazards. Overall, the Town of Windham's capability to mitigate for earthquakes and prevent loss of life and property is limited and generally unchanged since the initial hazard mitigation plan was adopted in 2006, mainly because it is not a high priority because earthquake damage is so infrequent.

8.3 Vulnerabilities and Risk Assessment

Surficial earth materials behave differently in response to seismic activity. Unconsolidated materials such as sand and artificial fill can amplify the shaking associated with an earthquake. As noted in Section 2.1, very few areas of the Town are underlain by stratified drift. These areas are potentially more at risk of earthquake damage than the areas of the Town underlain by glacial till. The best mitigation for future development in areas of sandy material is the application of the most stringent standards in the Connecticut Building Code, exceeding the building code requirements, or, if the Town deems necessary, the possible prohibition of new construction. The areas that are not at increased risk during an earthquake due to unstable soils are the areas underlain by glacial till.

Windham lies partially on the Willimantic Window, which is a bedrock formation surrounded by a thrust fault. Unlike seismic activity in California, earthquakes in Connecticut are not

associated with specific known active faults. However, bedrock in Connecticut and New England in general is typically formed from relatively hard metamorphic rock that is highly capable of transmitting seismic energy over great distances. For example, the relatively strong earthquake that occurred recently in Virginia was felt in Connecticut because the energy was transmitted over a great distance through such hard bedrock.

The built environment in the Town primarily includes some more recent construction that is seismically designed. However, most buildings were built in the 1970s and 1980s or before and therefore are not built to current building codes. Thus, it is believed that most buildings would be at least moderately damaged by a significant earthquake. Those Town residents who live or work in older, non-reinforced masonry buildings are at the highest risk for experiencing earthquake damage.

Areas of steep slopes can collapse during an earthquake, creating landslides. The Town has a few areas of steep slopes and bluffs particularly overlooking the Shetucket River. Thus, landslides are a concern in the town.

The Town of Windham did not report any municipal or private damages or losses due to recent earthquakes. Seismic activity can also break utility lines such as water mains, gas mains, electric and telephone lines, and stormwater management systems. Damage to utility lines can lead to fires, especially in electric and gas mains. Dam failure can also pose a significant threat to developed areas during an earthquake. For this HMP, dam failure has been addressed separately in Section 10.0. As noted previously, several types of utility infrastructure in the Town is located above ground. A quick and coordinated response with local utilities will be necessary to inspect damaged utilities following an earthquake, to isolate damaged areas, and to bring backup systems online. This is covered in the Town's and EOP.

A *HAZUS-MH* analysis of the potential economic and societal impacts to the SCCOG region from severe earthquake damage is detailed in the Multi-Jurisdictional HMP. The analysis addresses a range of potential impacts from any earthquake scenario, estimated damage to buildings by building type, potential damage to utilities and infrastructure, predicted sheltering requirements, estimated casualties, and total estimated losses and direct economic impact that may result from various earthquake scenarios. Based on the analysis in Section 8.5 of the regional HMP, a significant amount of damage could occur in the SCCOG region due to a severe earthquake.

FEMA utilized *HAZUS-MH* to determine the annualized loss for Connecticut as presented in Section 8.5 of the regional HMP. Based on this data, apportioned based on the ratio of the 2010 census population of Windham's to the 2010 census statewide population, the estimated annualized loss for Windham due to earthquake damage is \$47,756. This estimate is reasonable for Windham as the potential damage caused by a significant earthquake could be devastating, damaging earthquakes have a low probability of occurrence in the area.

8.4 Potential Mitigation Strategies and Actions

Due to the low probability of occurrence, potential mitigation measures related to earthquake damage primarily include adherence to building codes and emergency response services. Both of these are mitigation measures common to all hazards as noted in Section 11 of this annex. The Multi-Jurisdictional HMP also includes additional recommendations for mitigating the effects of earthquakes and the pertinent recommendations for the Town are presented in Section 11.

Occurrences of large earthquakes in the region are infrequent. While many mitigation measures may not be cost-effective, the community should consider the following:

- Enforcing effective building codes and local ordinances;
- Encouraging emergency facilities such as hospitals to be constructed to withstand seismic events; and
- Encouraging a low-cost earthquake rider for homeowners and businesses.

9.0 WILDFIRES

9.1 Setting / Historic Record

Wildfires are considered to be highly destructive, uncontrollable fires. The most common causes of wildfires are arson, lightning strikes, and fires started from downed trees hitting electrical lines. Thus, wildfires have the potential to occur anywhere and at any time in both undeveloped and lightly developed areas of the Town. Structural fires in higher density areas of the Town are not directly addressed herein. No wildfires have occurred in the Town since the last HMP.

Table 2-61 of the 2014 State Plan indicates that Windham County experienced 564 wildfire events that burned an average of 2.08 acres per fire from 1991 to 2013. The number of annualized events is therefore 25.6, and the average acres burned in Windham County is therefore 53.2 acres per year. The Town of Windham did not report any recent losses due to wildfires, although it is expected that small fires may have occurred.

9.2 Existing Capabilities

Monitoring of potential fire conditions is an important part of mitigation. The Connecticut DEEP Forestry Division uses the rainfall data recorded to compile forest fire probability forecasts. This allows the DEEP to monitor drier areas to be prepared for forest fire conditions. The Town can access this information over the internet. The Town also receives "Red Flag" warnings via local media outlets.

Existing mitigation for wildland fire control is typically focused on building codes, public education, Fire Department training, and maintaining an adequate supply of equipment. The Fire Department goes to fires as quickly as possible in the Town. Windham Water Works provides fire protection water. Fire pumps are tested weekly and are considered to provide excellent pressure. Coordination between Windham Water Works and the fire departments occurs such that responders know how much pressure is available. The Town also has several dry hydrants in outlying areas that are not connected to public water service.

The Connecticut DEEP has recently changed its Open Burning Program. It now requires individuals to be nominated and designated by the Chief Executive Officer in each municipality that allows open burning and to take an online training course and exam to become certified as an "Open Burning Official." Permit template forms were also revised that provide permit requirements so that the applicant/permittee is made aware of the requirements prior to, during, and after burn activity. The regulated activity is then overseen by the Town.

Summary

The Town uses a variety of regulatory, preparedness, and public information programs to mitigate the effect of wildfires, including the Open Burning Program, maintenance of hydrants, dry hydrants and cisterns, and educational programs on fire safety. The Town's capabilities are considered to be effective in regards to response to wildfires. Overall, the Town of Windham's

capability to mitigate for wildfires is slightly improved between the 2006 and 2015 editions of the HMP. The Town implemented Connecticut DEEP's updated Open Burning Program recently, increasing capabilities between 2015 and 2017.

9.3 Vulnerabilities and Risk Assessment

The risk for wildlife in the town is considered low for most areas for several reasons. First, the Town has widespread development such that there are few outlying areas where a wildfire could advance undetected. As such, there have been no major fires in recent history. Secondly, most developed areas of the Town have public water service provided by Windham Water Works. This public water service provides sufficient water volume and pressure to fight nearly any fire. Outlying areas have dry hydrants that provide additional fire fighting water. Secondly, the Willimantic, Natchaug, and Shetucket Rivers are near most developed areas if additional firefighting water was necessary. Fourth, there are few notable dead ends or one-way roads that are difficult to access in the Town, and emergency vehicles can typically turn around in private driveways on these roads. Finally, the Town has agreements with its neighbors to provide assistance in case of an emergency. Thus, if a wildfire did occur, it would likely be contained to within only a few acres.

The Town of Windham did not report any recent losses due to wildfires. According to Section 9.5.1 of the regional HMP, annualized losses due to wildfires has been estimated at \$10,057.28 for Windham. This information is based on the frequency of occurrence, an estimated response cost of \$2,000 per acre, and other factors. This estimate is considered reasonable for Windham given the significant outlying areas away from the public water system which are located at the wildland/urban interface.

9.4 Potential Mitigation Strategies and Actions

Long periods of drought are one of the primary natural causes of wildfires. Mitigation measures for drought are discussed under that heading. Other mitigation efforts that should be considered include:

- Educating the public on safe fire practices;
- Using fire-resistant material when renovating, building, and retrofitting structures;
- Moving shrubs and other landscaping away from structures;
- Periodically clearing brush and dead grass from property; and
- Acquiring land susceptible to wildfires to maintain it as open space.

The Town of Windham is generally a low-risk area for wildfires. Potential mitigation measures for wildfires include a combination of prevention, education, and emergency planning as presented in Section 11.

10.0 DAM FAILURE

10.1 Setting / Historic Record

Dam failures can be triggered suddenly with little or no warning and often in connection with natural disasters such as floods and earthquakes. Dam failures can occur during flooding when the dam breaks under the additional force of floodwaters. In addition, a dam failure can cause a chain reaction where the sudden release of floodwaters causes the next dam downstream to fail. While flooding from a dam failure generally has a limited geographic extent, the effects are potentially catastrophic depending on the downstream population.

There are 27 dams in Windham ranging from Hazard Class AA (negligible hazard) to Hazard Class C (high hazard). A total of 13 dams in the town are classified as negligible or low hazard (Class AA or Class A); failure of any of these dams would hardly be of concern. Two dams are classified as moderate hazard (Class BB) and their failure would cause some damage, but no major disruptions.

A dam failure affecting the Town of Windham is considered a possible event each year with potentially critical effects. No dam failures affected the Town since the time of the last HMP.

10.2 Existing Capabilities

Dams in the region whose failure could impact the Town of Windham are under the jurisdiction of the Connecticut DEEP. The dam safety statutes are codified in Section 22a-401 through 22a-411 inclusive of the Connecticut General Statutes. Sections 22a-409-1 and 22a-409-2 of the Regulations of Connecticut State Agencies have been enacted, which govern the registration, classification, and inspection of dams. Dams must be registered by the owner with the DEEP according to Connecticut Public Act 83-38. The Connecticut DEEP administers the Dam Safety Section and designates a classification to each state-registered dam based on its potential hazard as detailed in the regional plan. Owners of high and significant hazard dams are required to maintain EAPs for such dams.

While the state is assuming less responsibility for routine inspection of dams, DEEP will continue recommending measures to lessen the risk of dam failure, and the municipality can take the following mitigation actions:

- For municipally-owned dams, make sure that EAPs are in place and current, and implement recommendations resulting from state inspections; and
- For privately-owned dams, encourage each dam owner to have an EAP in place and current, and implement recommendations resulting from inspections; monitor compliance as possible.

Windham Water Works maintains an EAP for its dam, as does the USACE. The status of EAPs for private dams is not known.

The Town of Windham has limited policies, programs, and resources dedicated to dam failure since most of these efforts are performed at the State level. The Town of Windham owns one dam (Hosmer Mountain Reservoir Dam) that is rated Class B.

Summary

The Town's ability to mitigate dam failure is considered to be good for the town-owned dam but limited for privately owned dams. Overall, the Town of Windham's capability to mitigate for dam failure and prevent loss of life and property has increased between the 2006 and 2015 editions of the HMP and the again between 2015 and 2017, mainly as a result of recent statewide legislative actions described above and in Section 10.4 of the regional HMP.

10.3 Vulnerabilities and Risk Assessment

The failure of any of the seven dams classified as significant hazard (Class B), or the two high hazard (Class C) dams could cause serious damage. The failure of the significant hazard (Class B) dams could cause severe damage and is of great concern in the town; however the greatest concern would be the failure of the high hazard dams in the town, Big Pond Dam or Scotland Dam, or the Mansfield Hollow dam upstream. There are also three unassigned dams in the town, but the fact that close watch is kept over significant and high hazard dams suggests that these structures are either moderate, low, or negligible hazards. These dams are listed on Table 10-1.

**TABLE 10-1
High and Significant Hazard Dams Within and Upstream of the Town of Windham**

Dam	Hazard Class	Location	Owner	River System
Scotland Dam	C	Windham	First Light	Shetucket River
Potash Pond Dam	B	Windham	Private	Potash Brook
Big Pond	C	Windham	Private (Non-Profit)	Unnamed Stream
Frog Pond Dam	B	Windham	Private	Indian Hollow Brook
Lake Marie Dam	BB	Windham	Land Trust	Indian Hollow Brook
Bibbins Pond Dam	BB	Windham	Connecticut DEEP	Beaver Brook
Robinson Pond Dam (3 dams)	B	Windham	Three Private Owners	Indian Hollow Brook
Willimantic Reservoir Dam	C	Mansfield	Windham Water Works	Natchaug River
Mansfield Hollow Lake Dam	C	Mansfield	USACE	Natchaug River

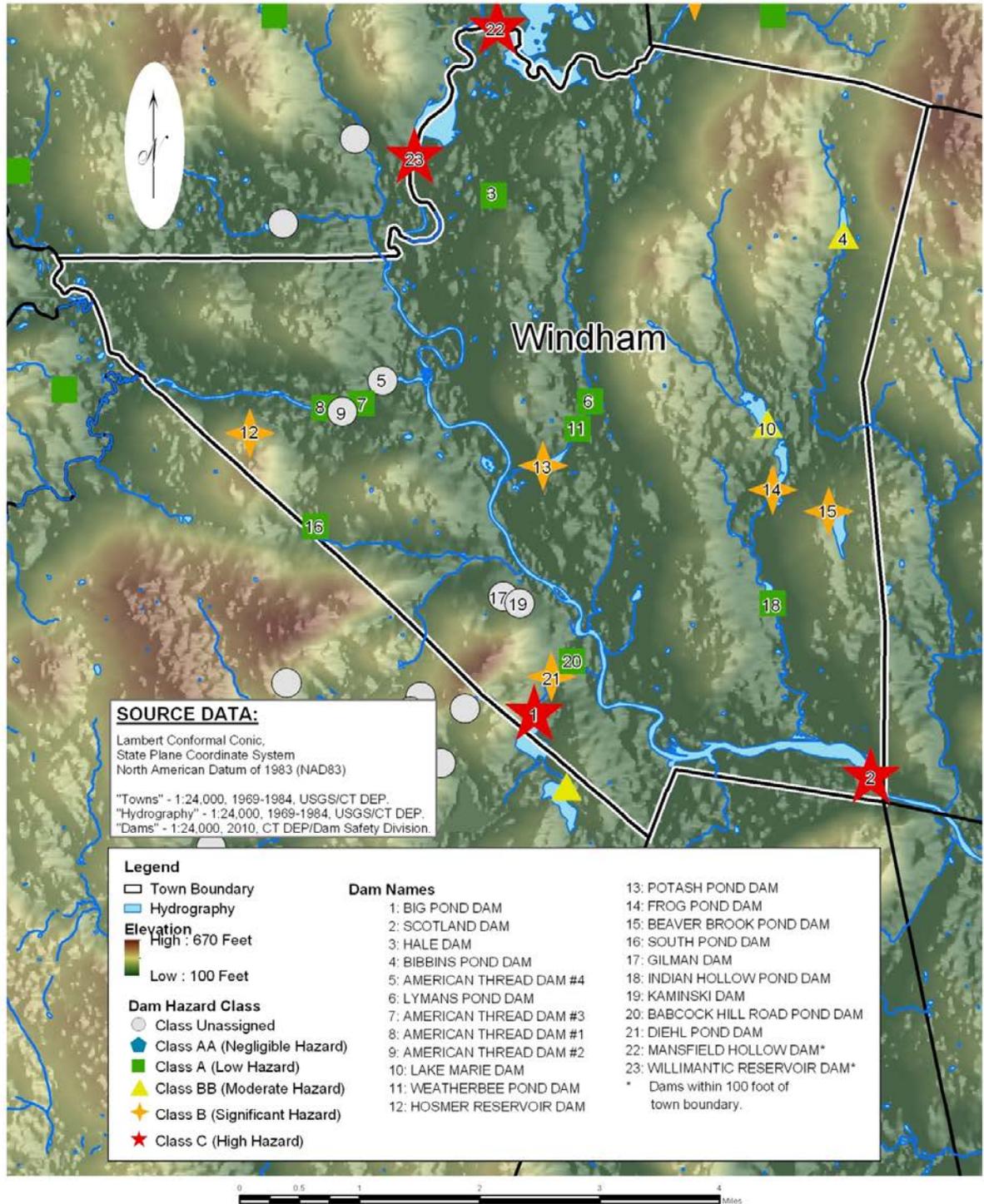
A total of 24 privately-owned dams are in Windham. Private owners of dams are generally reluctant to make repairs, which tend to be costly. In these instances, needed repairs may not be done in a timely manner. Two state-owned dams are located in Windham. These are the Hale Dam owned by Connecticut DOT (Class A), and the Bibbins Pond Dam owned by Connecticut DEEP (Class BB). State-owned dams are typically maintained in good condition.

The potential impacts related to the failure of Class C and Class B dams within and upstream of Windham are described below. Where information was available, the descriptions below are based on information available at the Connecticut DEEP Dam Safety Section. For dams without a formal dam failure analysis, a qualitative assessment was prepared for this HMP. Refer to Figure 44 reprinted from the 2015 HMP for a location map showing locations of the dams.

- ❑ The Scotland Dam is a Class C dam located on the Shetucket River near the Windham, Scotland, and Franklin boundary that is privately owned and used for hydroelectric power generation. Failure of this dam would likely result in an inundation area similar to the 0.2% annual chance flood event for areas downstream along the Shetucket River, with minimal damages in Windham. More details regarding potential damage are provided in the Sprague and Norwich annexes. The Town has encouraged the dam owner to develop an EAP and share it with the Town. Town personnel plan to continue to coordinate with FirstLight on this. However, the downstream hazard area is not within the Town of Windham, so this is not a top priority.
- ❑ Big Pond is a Class C dam located in southwestern Windham that impounds an unnamed tributary to the Shetucket River. Failure of this dam could potentially cause flooding damage along Pigeon Swamp Road and Machine Shop Road, and cause the failure of two additional small downstream dams. Additional damage would likely occur along Babcock Hill Road, Type Road, Route 32, and the railroad tracks.
- ❑ The Willimantic Reservoir is a run-of-the-river impoundment on the Natchaug River that is used for Water Supply Purposes. The dam was built in the late 19th century. According to the dam failure inundation area for this dam on file at Connecticut DEEP, failure of this dam could cause damages along Route 195, North Frontage Road, Route 6, and Riverview Road in Mansfield. Further downstream in Windham, damages could occur to Lauter Park, to properties on Gordon Avenue, along Boston Post Road (Route 66), Natchaug Street, the Windham Heights area, Fire School Road, Brick Top Road (Route 14), and Union Avenue. Damaging floodwaters are expected to be attenuated to being within the banks of the Natchaug River downstream of Route 14.
- ❑ Mansfield Hollow Lake Dam is a Class C dam used for flood control. It is managed by the USACE. Failure of this dam would be expected to cause widespread flood damage in Mansfield and Windham, including potential failure of the Willimantic Reservoir Dam. It is likely that floodwaters would continue down the Shetucket River to the vicinity of Scotland Dam.

Town of Windham Dams

Figure 44



Prepared for: The Windham Region Council of Governments Hazard Mitigation Plan

FOR ADVISORY PURPOSES ONLY

The failure of any Class B or Class C dam brings with it damages, economic loss and the potential for loss of life. The high hazard (Class C) classification means that in the event of their failure, besides the definite loss of property and economic losses, the loss of life is probable.

As noted in Table 10.1, Class B and Class BB dams in Windham are associated with downstream brooks. While a minor failure of any of the Class B dams would likely cause relatively minor flooding downstream, a complete failure could cause more significant flooding along these downstream brooks which could cause significant damage to bridge crossings, cars, and potentially private properties.

Note that this estimate does not take into account site specific details or particular dam failure damages that may have affected the Town of Windham in the historic record. For example, Bibbins Pond Dam (Class BB) was estimated by the Connecticut DEP (now DEEP) to have experienced \$2,000 in damage from the June 1982 flood. Therefore, this number should be used with caution. Nevertheless, it provides a useful planning number to consider the overall vulnerability of the Town to dam failure.

Town staff did not indicate that there has not been any damage to municipal and private structures and infrastructure due to dam failure in recent memory. Given the condition and classification of dams within and upstream of Windham, as well as the structures and infrastructure located downstream, it is likely that the actual annualized loss for dam failure is consistent with the estimated annualized loss from the State Plan.

10.4 Potential Mitigation Strategies and Actions

The Town of Windham is generally a low-risk area for dam failure since the majority of dams are well-maintained with active EOPs. Potential mitigation measures for dam failure include a combination of prevention, education, and emergency planning, as well as dam removal projects as presented in Section 11.

The Town is interested in attending periodic dam inspections required by Connecticut DEEP, and hopes to do begin in spring or summer of 2017. The Town also intends to continuing requesting the development of, or a copy of, the EAP for Scotland Dam.

Current statewide mitigation measures are described on a regional level on in Section 10.4 of the regional HMP. Among these mitigation measures are periodic dam inspections required to be conducted by dam owners. Periodic inspections help to determine if dams are structurally sound. If a dam's structural integrity is questioned, recommendations made to ensure the safety of the structure may include:

- Any emergency measures or actions, if required to assure the immediate safety of the structure;
- Remedial measures and actions related to design, construction, operation, maintenance and inspection of the structure; additional detailed studies, investigations and analyses; or
- Recommendations for routine maintenance and inspection by the owner.

11.0 MITIGATION STRATEGIES AND ACTIONS

11.1 Status of Mitigation Strategies and Actions

The Former WINCOG HMP listed nine mitigation actions for Windham. These actions, along with commentary regarding the status of each, are listed in the tables in this section. It is important to note that the limited amount of time since the Former WINCOG HMP (adopted 2015) has limited some of the progress of actions.

New actions were developed in the process of developing this HMP update. These are listed at the end of each hazard section below.

Action	Status	Notes
Procure Silt Removal Equipment to Remove Silt from the Town's Storm Drainage Systems	Carry Forward	This was originally identified in the 2006 HMP but has not yet been completed due to lack of funding. In the meantime, the service is contracted.
Upgrade Stone Box Culvert on Old Brooklyn Turnpike	Carry Forward	This was originally identified in the 2015 HMP but has not yet been completed due to lack of funding. This is still desired but is a low priority as only six homes could be affected by a washout on this dead-end street.
Improve Low-Lying Bridge Street Bridge Crossing Over the Willimantic River	Carry Forward	This was originally identified in the 2006 HMP but has not yet been completed due to lack of funding. This bridge is an important structure that floods numerous times per year. A study is underway to determine whether the bridge should be upgraded or the channel blasted and dredged. It is a low priority as the Frog Bridge (Jackson Street) is not floodprone.
Upgrade Dry Wells on Lovers Lane to Larger Capacity, or Upgrade Drainage System	Complete	This project was completed in 2017.
Upgrade or Acquire Generators at Critical Facilities	Complete / Carry Forward	Some progress has been made as funding allows. Public Works, Windham Water Works, the Police/Fire Complex, and all Windham public schools were previously identified as areas of need, and projects are underway. Public Works installed a new generator in 2016. A micro-grid project was completed in early 2017 for Sweeney School and the Middle School including cogenerators and solar panels. The remaining facilities that need new generators include Windham Water Works, the Police/Fire Complex, and several Windham Public Schools.
Install roller doors to protect windows in Town EOC	Carry Forward	This was originally identified in the 2015 HMP but has not yet been completed due to lack of funding.
Continue to improve and upgrade communication system between the EOC and other service providers, including Eastern Connecticut State University	Complete	A new base station and equipment has been purchased. ECSU and the Police Department can communicate directly to the EOC. In addition, a new radio tower has been installed atop Windham Hospital allowing direct communication with the EOC (e.g. such as advance warning about incoming patients). Complete; will become a capability

Action	Status	Notes
Use a multitude of communications methods to inform and update town residents on what to prepare for before, during, and after an emergency event	Partly Complete / Carry Forward	The use of social media, the Town website, government and local media channels, and radio stations were previously suggested. This is underway. The Town has implemented the CodeRED Reverse 9-1-1 call system to disseminate warnings, and also performs loudspeaker announcements along streets by vehicle. In addition, see below regarding pamphlets and literature. These are now capabilities. The next planned step is to provide more educational materials and links on the Town website.
Provide pamphlets and literature on natural disasters and preparedness at the Town Hall and Library	Complete	Complete; has now become a capability

Other actions or strategies developed during the HMP update include:

- ❑ Encourage Development of an EAP and/or Acquire a Copy of the EAP for Scotland Dam. The Town does not have a copy of the EAP for Scotland Dam, which is necessary to ensure adequate emergency response in case of a dam failure event. The Town will continue to reach out to FirstLight and Connecticut DEEP regarding this issue.

11.2 Prioritization of Specific Actions

As explained in Section 11.3 of the Multi-Jurisdictional HMP, the STAPLEE method was utilized in this annex to prioritize actions. Table 11-1 presents the STAPLEE matrix for the Town of Windham. Each action includes the Town department responsible for implementing the action, a proposed schedule, and whether or not the action is new or originally from the previous HMP.

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Action or Strategy #	Table 11-1: Mitigation Actions and Strategies for Windham 2016-2021	Status	Responsible Department ¹	Fiscal Year					Cost	Potential Funding Sources ²	Weighted STAPLEE Criteria ³										Total STAPLEE Score	Priority for Community									
				7/2018-6/2019	7/2019-6/2020	7/2020-6/2021	7/2021-6/2022	7/2022-6/2023			Benefits					Costs															
				Social	Technical (x2)	Administrative	Political	Legal			Economic (x2)	Environmental	STAPLEE Subtotal	Social	Technical (x2)	Administrative	Political	Legal	Economic (x2)	Environmental			STAPLEE Subtotal								
				1	0.5	1	1	1			0.5	1	7.0	0	0	0	0	0	-1	0			-2.0								
1	Upgrade or Acquire Generators at Critical Facilities	Carried Forward	EM	x	x	x	x	x	Mod. each, High overall	CIB	1	0.5	1	1	1	0.5	1	7.0	0	0	0	0	0	0	-1	0	-2.0	5.0	Medium		
2	Install Roller Doors to Protect Windows in Town EOC from Damage	Carried Forward	EM	x	x	x	x	x	Moderate	CIB, EOC	1	1	1	1	1	0.5	0	7.0	0	0	0	0	0	0	0	0	0	0	0.0	7.0	Medium
3	Provide Educational Materials and Links Regarding Natural Hazard Preparedness on Town Website	Carried Forward	EM	x	x	x	x	x	Low	OB	1	1	1	1	1	0.5	0	7.0	0	0	0	0	0	0	0	0	0	0.0	7.0	High	
4	Procure Silt Removal Equipment to Remove Silt from the Town's Storm Drainage Systems	Carried Forward	DPW				x		High	CIB	1	0.5	1	1	1	0.5	1	7.0	0	0	0	0	0	0	-1	0	-2.0	5.0	Medium		
5	Upgrade Stone Box Culvert on Old Brooklyn Turnpike	Carried Forward	DPW			x			High	CIB	1	0.5	1	1	1	0.5	0	6.0	-0.5	0	0	0	0	0	-1	0	-2.5	3.5	Low		
6	Improve Low-Lying Bridge Street Bridge Crossing Over the Willimantic River	Carried Forward	DPW	x	x	x	x	x	High	CIB	0.5	1	1	1	1	1	0	7.5	0	0	-0.5	0	-0.5	-1	-0.5	-3.5	4.0	Low			
7	Encourage Development of an EAP and/or Acquire a Copy of the EAP for Scotland Dam	New	EM	x	x	x	x	x	Minimal	OB	0.5	1	1	1	1	1	0	7.5	-1	0	0	0	0	0	0	0	-1.0	6.5	High		

¹Notes
DPW = Department of Public Works
EM = Emergency Management

²Notes
CIB = Capital Improvement Budget
EOC = EOC Grants
HMA = FEMA Grant Programs
OB = Operating Budget

³Notes
Beneficial or favorable ranking = 1
Neutral or Not Applicable ranking = 0
Unfavorable ranking = -1

Technical and Economic Factors have twice the weight of the remaining categories (i.e. their values are counted twice in each subtotal).

APPENDIX A

ADOPTION RESOLUTION

CERTIFICATE OF ADOPTION
TOWN OF WINDHAM TOWN COUNCIL

A RESOLUTION ADOPTING THE HAZARD MITIGATION PLAN UPDATE, 2017

WHEREAS, the Town of Windham has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of those natural hazards profiled in the plan (e.g. *flooding, high wind, thunderstorms, winter storms, earthquakes, dam failure, and wildfires*), resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Windham Town Council approved the previous version of the Plan in 2015; and

WHEREAS, the Southeastern Connecticut Council of Governments, of whom the Town of Windham is a member, has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its Hazard Mitigation Plan Update, 2017 under the requirements of 44 CFR 201.6; and

WHEREAS, committee meetings were held and public input was sought in 2016 and 2017 regarding the development and review of the Hazard Mitigation Plan Update, 2017; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedures for the Town of Windham; and

WHEREAS, the Plan recommends several hazard mitigation actions that will provide mitigation for specific natural hazards that impact the Town of Windham, with the effect of protecting people and property from loss associated with those hazards; and

WHEREAS, adoption of this Plan will make the Town of Windham eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Town Council:

1. The Plan is hereby adopted as an official plan of the Town of Windham;
2. The respective officials identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them;
3. Future revisions and Plan maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as a part of this resolution for a period of five (5) years from the date of this resolution.
4. An annual report on the progress of the implementation elements of the Plan shall be presented to the Town Council.

Adopted this _____ day of _____, 201_ by the Town Council of Windham, Connecticut

Mayor

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Windham this _____ day of _____, 201_.

Town Clerk

