Litchfield Hills
Natural Hazard Mitigation Plan
2016 Update

Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update

August 2016

Prepared by the Northwest Hills Council of Governments, this plan is an update to the 2006 Litchfield Hills Natural Hazard Mitigation Plan. This report serves the following municipalities: Barkhamsted, Colebrook, Goshen, Hartland, Harwinton, Litchfield, Morris, New Hartford, Norfolk, Torrington, and Winchester.

FOR USE BY

The citizens and municipal governments of the Litchfield Hills region,

The Federal Emergency Management Agency of the United States Department of Homeland Security;

The Division of Emergency Management and Homeland Security of the Connecticut Department of Emergency Services and Public Protection

PREPARED BY

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With assistance from the Central Connecticut Regional Planning Agency

ACKNOWLEDGEMENTS

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(a Subcommittee of the Northwest Hills Public Safety Task Force)

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- Rick Tillotson, Colebrook Emergency Management Director
- Jim O'Leary, Goshen Emergency Management Director
- Theodore Jansen, Hartland Emergency Management Director
- Vincent Wheeler, Harwinton Emergency Management Director
- David Rogers, Litchfield Emergency Management Director
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Acronym	Definition
ALERT	Connecticut Automated Flood Warning System
BFE	Base Flood Elevation
CEO	Council of Elected Officials
CFR	Code of Federal Register
CIRCA	CT Institute for Resilience and Climate Adaptation
CT	Connecticut
DEMHS	CT Department of Emergency Management & Homeland Security
DEEP	CT Department of Energy and Environmental Protection)
DESPP	Department of Emergency Services and Public Protection
DMA 2000	Disaster Mitigation Act of 2000
DOT	CT Department of Transportation
DPH	Connecticut Department of Public Health
EAS	Emergency Alert System
EMD	Emergency Management Director
EMPG	Emergency Management Performance Grant
ENS	Emergency Notification System
EOC	State Emergency Operations Center
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
FMP	Flood Management Program
GIS	Geographic Information System
GPS	Global Positioning System
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMGRC	Hazard Mitigation Grant Review Committee
IPCC	United Nations Intergovernmental Panel on Climate Change
LHCEO	Litchfield Hills Council of Elected Officials
LOCIP	Local Capital Improvement Program
MOU	Memorandum of Understanding
NECIA	Northeast Climate Impacts Assessment group
NFIA	National Flood Insurance Act
NFIP	National Flood Insurance Program
NFIRS	National Fire Incident Reporting System
NGVD	National Geodetic Vertical Datum of 1929
NHCOG	Northwest Hills Council of Governments
NHMP	Natural Hazard Mitigation Plan
NOAA	National Oceanic & Atmospheric Administration
NRCS	National Resources Conservation Service
OPM	Connecticut Office of Policy and Management
PDM	Pre-Disaster Mitigation Program
PDSI	Palmer Drought Severity Index
PSTF	Public Safety Task Force
RFC	Repetitive Flood Claims Grant Program
RLP	Repetitive Loss Property
RPI	Regional Performance Incentive
STEAP	Small Town Economic Assistance Program
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDHS	U.S. Department of Homeland Security
USGS	U.S. Geological Survey


I. Introduction

What can be done today to lessen the severity of a natural hazard that may strike tomorrow in the Litchfield Hills Region of Connecticut? This is the fundamental question addressed by this report.

The Litchfield Hills Region consists of the following eleven towns in the Greater Torrington area of Northwest Connecticut: Barkhamsted, Colebrook, Goshen, Hartland, Harwinton, Litchfield, Morris, New Hartford, Norfolk, Torrington, and Winchester (see Figure 1.1). Each of these eleven municipalities participates in this Plan and seeks approval of this multi-jurisdictional Natural Hazard Mitigation Plan.

In recent years, the Litchfield Hills Region has been hard hit by severe winter storms, high winds, and flooding. These three types of events represent the major natural hazards of concern in the region. All three events can pose a threat to public safety, and the buildings and infrastructure in the regional area. Other natural hazards of concern include drought, forest fires, and earthquakes.

Each town in the Litchfield Hills Region has developed a local emergency operations plan to guide their efforts in contending with these natural disasters with provisions for preparedness, response, and recovery. In 2006, the Litchfield Hills Council of Elected Officials (LHCEO) initiated a concerted effort to identify mitigating measures that could lessen the severity of a natural hazard. This effort resulted in the preparation of the "Litchfield Hills Natural Hazard Mitigation Plan" which was endorsed by FEMA and subsequently adopted by the LHCEO. Since that time, the LHCEO merged with a neighboring regional planning organization to form a new 21-town regional planning organization known as the Northwest Hills Council of Governments (NHCOG). The new organization began operation in January of 2014 and now represents the organization responsible for the preparation of this report. The Litchfield Hills Region now represents a sub-region of the Northwest Hills Council of Governments service area consisting of the eleven towns identified above.

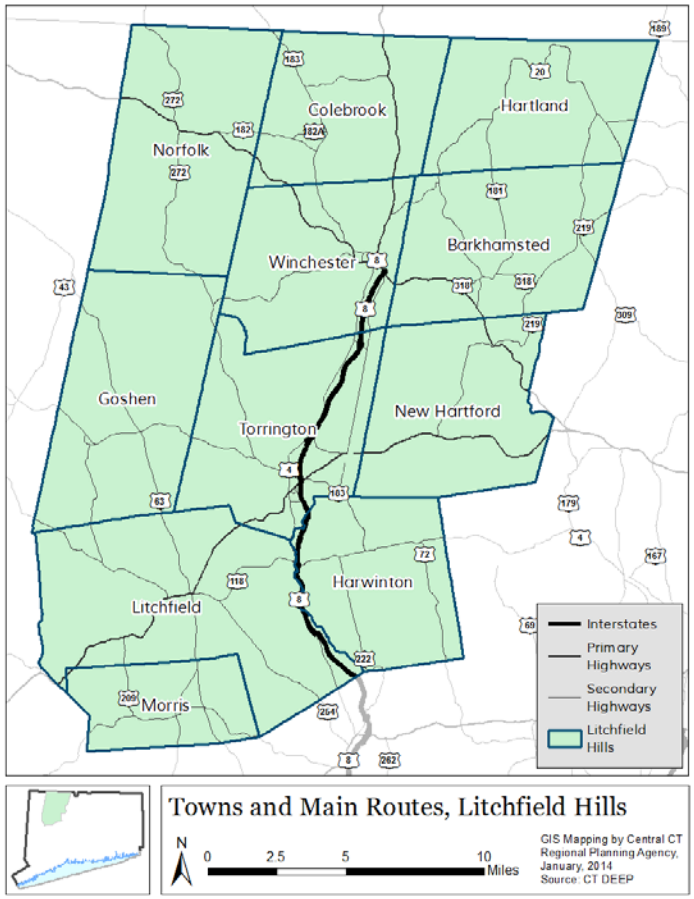

Figure I.1: Towns and roads in the Litchfield Hills Region.

The purpose of this "Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update" is to reconsider the major natural hazards within the region, assess the municipal vulnerability to these hazards, and propose various mitigation strategies that will reduce the loss of life and property, economic disruption, and disaster assistance costs resulting from these hazards. Overall, the plan's major goal is to reduce or eliminate the long-term risk to human life and property resulting from natural hazards to the extent practicable.

In addition to identifying appropriate mitigation projects that will serve

to benefit the Region, an added incentive for LHCEO (and now NHCOG) to prepare this Plan is to enable area towns to qualify for federal mitigation grant program funding. The federal Disaster Mitigation Act of 2000 (DMA) amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act to specifically promote natural hazard mitigation planning. The DMA requires all local governments to have an approved "Hazard Mitigation Plan" in place to be eligible to receive Hazard Mitigation Assistance grants.

Hazard Mitigation Assistance is available under a number of specific FEMA programs including the Hazard Mitigation Grant Program (HMGP) for post-disaster mitigation activities, the Pre-Disaster Mitigation (PDM) program, and the Flood Mitigation Assistance (FMA) program.

Table I.1, as available from the FEMA Hazard Mitigation Assistance Mitigation Activity Chart, describes eligible projects under each program.

Implementation of mitigation projects prior to a disaster event can serve to reduce the risks to the population and structures, while also reducing reliance on funding from actual disaster declarations.

A. Overview of Planning Process and Report Contents

The planning process followed in preparing this "Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update" was based to a large extent on the process followed in preparing the 2006 Plan. The Litchfield Hills Council of Elected Officials (now, NHCOG) appointed the Northwest Hills Public Safety Task Force (Table I.3) to serve as the Hazard Mitigation Planning Committee for the Plan Update. The Task Force is a broad based advisory committee to the LHCEO and includes representatives from the area's Fire Departments, Emergency Management Directors, Public Health Departments, Hospitals, and Police Departments. Unlike the 2006 Plan, however, the NHCOG contracted with the Central Connecticut Regional Planning Agency for technical assistance in preparing the Plan Update.

Following the discussion of the Plan update at NHCOG meetings, an in-

Table I.1: Eligible activities by program

Eligible Activities	HMGP	PDM	FMA
Mitigation Projects	X	X	X
Property Acquisition and Structure Demolition	X	X	X
Property Acquisition and Structure Relocation	X	X	X
Structure Elevation	X	X	X
Mitigation Reconstruction	X	X	X
Dry Floodproofing of Historic Residential Structures	X	X	X
Dry Floodproofing of Non-residential Structures	X	X	X
Generators	X	X	
Localized Flood Risk Reduction Projects	X	X	X
Non-Localized Flood Risk Reduction Projects	X	X	
Structural Retrofitting of Existing Buildings	X	X	X
Non-structural Retrofitting of Existing Buildings and Facili-	X	X	X
Safe Room Construction	X	X	
Wind Retrofit for One- and Two-Family Residences	X	X	
Infrastructure Retrofit	X	X	X
Soil Stabilization	X	X	X
Wildfire Mitigation	X	X	
Post-Disaster Code Enforcement	X		
5 Percent Initiative Projects	X		
Advance Assistance	X		
5 Percent Initiative Projects	X		
Miscellaneous/Other (1)	X	X	X
Climate Resilient Mitigation Activities	X		
Hazard Mitigation Planning	X	X	X
Management Costs	X	X	X

Source: FEMA

troductory discussion on the Plan Update process, and role of the Hazard Mitigation Planning Committee, occurred at the June 25, 2013 meeting of the Northwest Hills Public Safety Task Force. This introductory meeting resulted in consensus on how to proceed with plan preparation and local input. A survey was developed first and sent to all municipal Public Works Departments, Planning and Zoning Commissions, Emergency Management Directors, and Chief Elected Officials (see Appendix A). The survey was designed to secure updated information from the various stakeholders. An outreach email was also sent to all abutting communities and regional planning organizations seeking their input for the Plan update (see Appendix A) on shared resource protection and improved coordination. This outreach effort was followed by scheduling individual meetings with each municipality to review public participation opportunities, critical facilities, areas of concern, existing mitigation measures implemented from previous plan, additional mitigation measures needed since the preparation of the 2006 Plan, and municipal policies that relate to hazards. The individual meeting dates for each municipality participating in the Plan update process are shown below in Table I.2. These individual meeting dates were held at municipal town halls or via teleconference and coordinated by the chief elected official or emergency management director. A table in Appendix A describes these and additional regional meetings that were held during the update process. A standardized "Municipal Worksheet" (see Appendix A) was prepared to facilitate input at the meetings with the individual towns and the results are shown in the individual community sections of this report. The final version of this plan includes meeting agendas and minutes, the sign-in sheet for the informational session, and documentation of notice and solicitation for participation in Appendix A.

Public participation during plan development was encouraged and offered through meetings of the Northwest Hills Public Safety Task Force, which served as the Hazard Mitigation Planning Committee. All meetings of the Committee were open to the public and notices of the meetings were posted in municipal offices prior to the meetings. Public participation and awareness of the planning process was also encouraged through

Table I.2: Dates and locations of meetings

Date	Municipality	Number Attending
7/31/2013	Goshen	3
8/30/2013	Norfolk	4
9/24/2013	Torrington	2
11/6/2013	Barkhamsted	3
12/6/2013	Harwinton	4
12/16/2013	Colebrook	2
5/15/2014	Litchfield	3
5/15/2014	Morris	4
5/22/2014	Winchester	3
6/5/2014	Hartland	3 (teleconf. mtg)
6/5/2014	New Hartford	2 (teleconf. mtg)

discussion of the Plan Update at meetings of the former Litchfield Hills Council of Elected Officials. An opportunity for public comment was provided at all meetings of the LHCEO, (and eventually, the NHCOG). A listing of the regional planning meetings held on the Natural Hazard Mitigation Plan is presented in Appendix A along with attendance by participating jurisdictions and illustrative meeting minutes.

Recognizing that input from the general public and business community was limited at these public meetings, a public information survey was prepared to encourage residents on the plan preparation process. A companion survey was also prepared for use in soliciting input from the business community. A press release was prepared to encourage response by residents and businesses and the NHCOG webpage provided a link to the surveys and encourage public input. Municipalities were also encouraged to advertise the link on their municipal websites. NHCOG specifically solicited the Northwest Chamber of Commerce, Planning and Zoning Commissions, chief elected officials (and Fire and EMS chiefs through the elected officials), public works directors, road supervisors,

and emergency management directors to distribute and complete the survey. Copies of the surveys used and a summary of the survey results can be found in Appendix A. NHCOG also conducted specific outreach to adjoining regional councils of government. Any responses were considered in preparation of this plan.

On January 20, 2016, NHCOG hosted a public information session for the draft plan. NHCOG issued a press release in early January to area newspapers. Additionally, the town clerks were asked to post a flyer (provided by NHCOG) to their town website and public board in the town hall. Chief elected officials were also asked to distribute notice to their constituents. A draft of the plan was available for review on the NHCOG website as well as in hard copy at the office. One request for a hard-copy mailing was received and honored. Attendees to the workshop had an opportunity to review the draft plan, make comments, and attend a brief presentation on the purpose and contents of the plan.

In addition to the above, research was also conducted through the review of various technical publications and planning reports (see Appendix D). NHCOG reviewed numerous local, state, and federal documents. Local ordinances, regulations, procedures pertaining to hazard mitigation, and town histories were reviewed. NHCOG maintains a file with municipal plans of conservation and development, zoning regulations, and inland-wetland regulations for each of the municipalities in the Litchfield Hills Region. State ordinances, regulations, hazard procedures, and state-level plans, notably the 2014 Connecticut Natural Hazards Mitigation Plan Update, were reviewed for this report for meteorology, regulatory requirements, hazard response, hazard events, and cross-scale consistency. Recently completed Natural Hazard Mitigation Plans for jurisdictions in Connecticut were also reviewed for format and content. Resources at federal agencies including but not limited to FEMA, NOAA, and the National Interagency Coordination Center were reviewed for meteorology, regulatory requirements, hazard response, hazard events, and funding opportunities.

A draft of the Plan Update was completed in December 2014 and provided to the Hazard Mitigation Planning Committee and Chief Elected Official from each participating town for review and comment. The draft Plan was also provided to the CT Department of Energy and Environmental Protection for comment. The comments and recommendations received on the December 2014 draft were subsequently addressed in this current draft.

The report begins with a brief description of the 11-town Litchfield Hills Region. Basic information on demographics, geology, and land use are presented. This is followed by a description of the major natural hazards of concern in the regional area, including flooding, severe winter storms, and high winds. A summary of this natural hazard assessment is then presented along with a list of potential mitigation measures for the region. Individual town assessments are then presented, with a listing of specific hazard mitigation strategies for each community. As indicated above, the primary goal of such hazard mitigation planning is the prevention of loss of life, the reduction of damages associated with natural disasters, and the restoration of public services after each disaster.

Figure I.2: Flooded home on Litchfield Turnpike after Hurricane Irene.

The report concludes with provisions for plan maintenance and appendices which includes report references, a list of public outreach efforts, the results of the public outreach surveys, draft plan adoption text for the municipalities, and the details of the HAZUS analysis for the region.

Although this plan was prepared by a regional entity, implementation of the plans will occur in each jurisdiction through a resolution by the chief elected official or body of each jurisdiction. Draft text of the adoption resolution as well as signed resolutions for each municipality are included in Appendix C. The 5-year timeframe for this plan begins when the first jurisdiction officially adopts the plan. Each municipality will then be responsible for adopting the plan and integrating it into their operations. The chief elected officials will be responsible for the implementation of the plan within their communities and among their departments. Since the 2006 Natural Hazard Mitigation Plan was not incorporated into municipal comprehensive plans produced after 2006, NHCOG will stress to the municipalities that the plan should be incorporated into their future Plans of Conservation and Development.

An on-going effort will be made through meetings of the Northwest Hills Public Safety Task Force to seek public participation after the Plan Update has been approved and during the plan's implementation, monitoring and evaluation. This will be done through adding this item to the agenda and through the Northwest Hills COG website (www.northwesthillscog.org). Municipal representatives to the Northwest Hills Public Safety Task Force for the Litchfield Hills Region will continue to serve as the Hazard Mitigation Planning Committee and local community Point of Contact for additional public input and questions on plan implementation. The municipal Points of Contact and planning team members for this plan update are provided in Table I.3.

In addition to this on-going plan implementation, monitoring, and evaluation, the Northwest Hills Public Safety Task Force shall seek to create the next plan update at the required 5-year frequency. In anticipation that this Plan Update will be approved in 2016, the Task Force shall apply for FEMA funding to initiate the next Plan Update in 2019 in anticipation that it may require 2 years to secure funding and complete the 2021 Plan Update. A specific list of activities for monitoring and updating the Plan is included in Section VI of this report.

Table I.3: Planning Committee (applicable members of PSTF)	
Municipality	**Point of Contact**
Barkhamsted	Jim Shanley (EMD)
Colebrook	Rick Tillotson (EMD)
Goshen	Jim O'Leary (EMD)
Hartland	Ted Jansen (EMD)
Harwinton	Vincent Wheeler (EMD)
Litchfield	David Rogers (EMD)
Morris	Tony Gedraitis (EMD)
New Hartford	Kevin Parsell (EMD)
Norfolk	Richard Byrne (EMD)
Torrington	Gary Brunoli (Fire Chief)
Winchester	Steve Williams (EMD)
DEHMS	Tom Vannini
Torrington Area Health District	Leslie Polito
Charlotte Hungerford Hospital	Paul Rabeuf
Consultant	Paul Gibb

II. Regional Description

The Litchfield Hills Region encompasses eleven municipalities, and 402.71 square miles of land in northwestern Connecticut. The State highway network serving the regional area is shown in Figure I.1. The region has an estimated population of 83,174 persons according to the 2010 Census and an average population density of 206.54 persons per square mile (see Table II.1 below).

Table II.1. Population density by municipality, region, and state

Town	Total Population	Area (Sq mi)	Population Density (people / sq mi)
Barkhamsted	3,799	36.21	104.92
Colebrook	1,485	31.49	47.16
Goshen	2,967	43.65	68.18
Hartland	2,114	33.02	64.02
Harwinton	5,642	30.74	183.54
Litchfield	8,466	56.04	151.07
Morris	2,388	17.19	138.92
New Hartford	6,970	37.02	188.28
Norfolk	1,709	45.3	37.73
Torrington	36,383	39.78	914.61
Winchester	11,242	32.27	348.37
Region	83,174	402.71	206.54
State	3,574,097	4,845.10	737.67

Source: US Census 2010, DEEP

The Region's landscape consists of rural, suburban and urban areas with population densities ranging from 915 persons per square mile in Torrington to 38 persons per square mile in Norfolk. Since the 2000 US Census (data used in the 2006 NHMP), the overall population density increased by 5% for both the region and the state. Over the same time period, population densities in the Litchfield Hills increased for all municipalities with the exception of Colebrook. Goshen and New Hartford experienced the greatest increases in population density with increases of 10% and 14.5%, respectively. Overall housing units for the region increased by 9% between the 2000 and 2010 censuses, only slightly higher than the state increase of 7%. According to the Connecticut State Data Center, the region is expected to grow from 83,174 persons in 2010 to 86,714 persons in 2025, only a 4.2% increase. These changes are not expected to increase the vulnerability of the region. Local vulnerabilities are discussed within each jurisdiction's section.

The Region is generally rural with an urban center of Torrington, a micropolitan located in the center of the Region surrounded by the rural or semi-suburban communities. The Town of Winchester serves a sub-regional urban center for communities in the northern portion of the Region. Approximately 8.3% of the Region consists of federal, state or municipal forest and parkland. An additional 5% of the Region consists of privately owned open space reserves. Approximately 4.4% of the Region consists of water bodies. Roughly 86% of the region's landscape is predominantly undeveloped, with much of this land presenting severe limitations for development due to wetlands and steep slopes (see Figures II.1 and II.2).

The climate of Connecticut is moderate with annual rainfall averaging between 44 - 52 inches, and snowfall averaging between 30 inches at the south coast up to 100 inches in the Litchfield Hills. Temperatures range from highs in the 80's and 90's (F) during the summer months, down to below zero during the winter months. Transcontinental storms (low pressure systems), and storms that form near the Gulf of Mexico and along the East Coast deliver most of the annual rain and snowfall to the State (source: CT Hazard Mitigation Plan, 2014).

An understanding of the region's diverse landscape and cultural history helps to better appreciate the natural hazards of concern in the regional area, and is discussed below. This is followed by a brief description of Region's highway network and infrastructure, and institutional structure for emergency operations management.

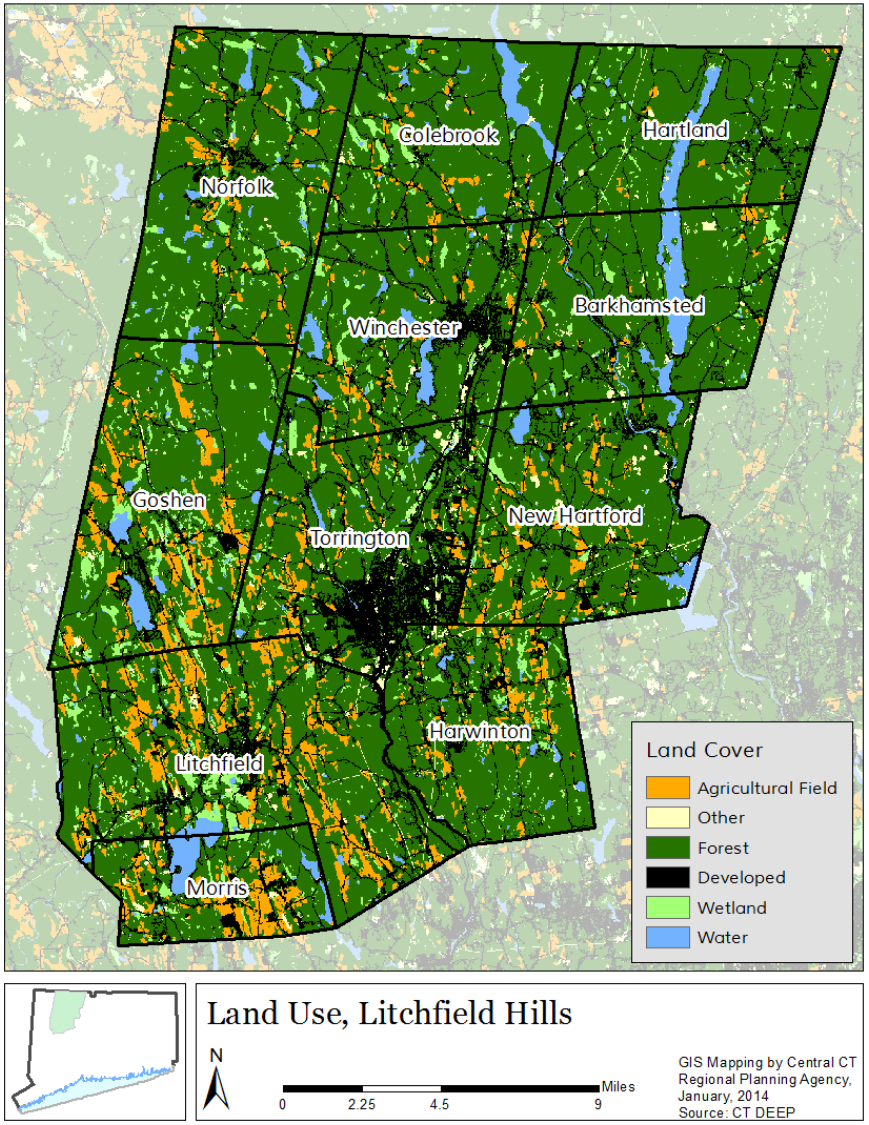

Figure II.1. Land use in the Litchfield Hills Region

A. The Regional Landscape

The Region's diverse landscape was caused by great glaciers, which covered the land approximately 10,000 years ago. The glaciers left the Litchfield Hills Region with a tremendously varied landscape consisting of plateaus, narrow valleys, rolling and rugged hills, and local areas of mountain-like terrain. The glaciers were also responsible for the surficial geologic materials (glacial till, stratified drift, and layers of soil) which blanket the Region today, and the abundant number of naturally occurring lakes, ponds, wetlands, rivers, and streams in the area.

The northernmost communities in the Region (i.e. Colebrook, Hartland, and Norfolk) are characterized by a rugged and forested landscape with mountain-like terrain, plateaus of comparatively high elevations, and patches of wetlands. Typical tree species include sugar maple, beech, yellow birch, white pine, and hemlock. The seasonal snowfall accumulation in this area is the highest in the State. Major water bodies include the Barkhamsted Reservoir in Hartland and Barkhamsted, and the Colebrook River Reservoir and Goodwin Reservoir in Colebrook.

The communities of Barkhamsted, New Hartford, Torrington, Winchester, Goshen, and northwestern Litchfield are also characterized by a heavily forested and hilly landscape of comparatively high elevation. Major tree species include those found in the northernmost communities in the Region along with red oak, white ash, and black birch. Intermixed with these forested lands are numerous streams, wetlands, roads, and developed properties. Major water bodies include the Barkhamsted Reservoir in Barkhamsted and Hartland, the Farmington River in Barkhamsted and New Hartford, Highland Lake and Lake Winchester in Winchester, Nepaug Reservoir in New Hartford, and Woodridge Lake in Goshen.

The southern portion of Litchfield and the towns of Morris and Harwinton are characterized by a moderately hilly and forested landscape of intermediate elevation, with local areas of steep and rugged topography. Characteristic tree species include red oak, white oak, hickory, white pine and hemlock. Bantam lake, the largest natural lake in Connecticut, is located astride the Litchfield and Morris town line.

An inventory of Litchfield Hills regional resources is displayed in Figures II.3 to Figure II.6 showing existing protected open space, important habitats, sewer coverage, and hydrography.

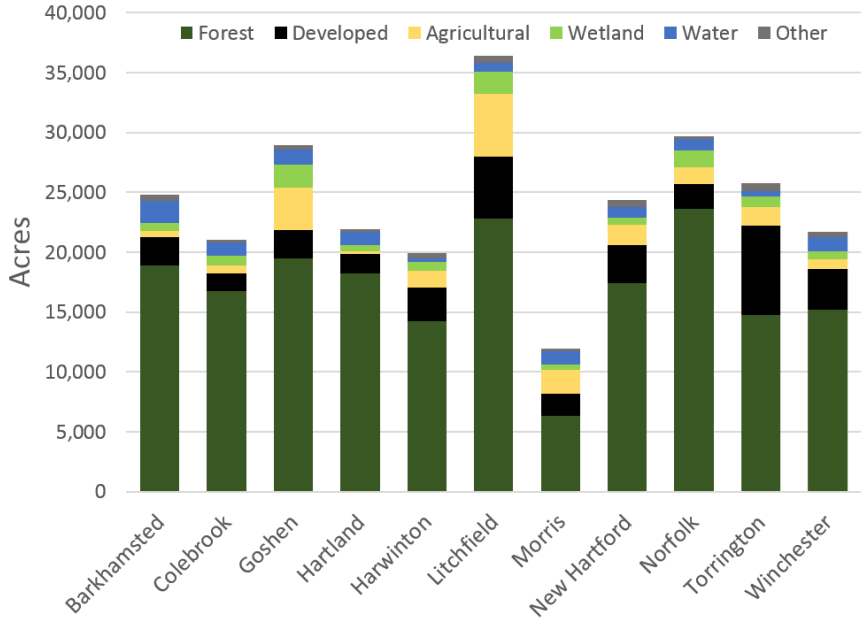

Figure II.2. Town area and land cover

Table II.2. Town area and land cover

Town	Occupied Housing Units	Owner-Occupied Units	Median Value
Barkhamsted	1,424	1,320	$274,500
Colebrook	591	541	$293,300
Goshen	1,288	1,162	$387,000
Hartland	769	708	$285,800
Harwinton	2,131	1,998	$303,700
Litchfield	3,326	2,604	$337,700
Morris	967	817	$345,400
New Hartford	2,680	2,459	$271,800
Norfolk	624	457	$321,000
Torrington	15,335	10,300	$183,200
Winchester	4,620	3,015	$195,400
Region	33,755	25,381	$293,300
State	1,360,184	929,560	$285,900

Source: American Community Survey 2012

B. Cultural Heritage

Colonists first journeyed to the Litchfield Hills area to live in the mid 1600's. They came primarily from the previously developed central valley area of Connecticut and established small farming communities atop the Region's broadest hilltops. Litchfield, in 1719, was the first town to incorporate in the Region. By 1779 all of the other towns in the Region had incorporated with the exception of Morris, which was part of Litchfield until 1859.

By 1800, Litchfield was the most populous community in the Region with a population of 4,285 persons. Torrington and the other towns in the Region had resident populations varying from 1,000 to 2,000 persons at this time. This development pattern persisted through 1850 with no dramatic shifts in the population base of any community. By 1900, however, the population of Winchester and Torrington had soared (to 7,763 and 12, 453 persons, respectively), Harwinton and New Hartford increased slightly, and the communities of Barkhamsted, Colebrook, Hartland, Goshen, Litchfield, and Norfolk had declined in population.

Typical of much of Connecticut, the period of 1850 to 1900 was marked by an exodus from the family farm to either the more productive farmlands of the Midwest or the growing employment bases being established in the industrializing communities of the area. These new growth communities were primarily located along major rivers where waterpower could be tapped to support new industry (e.g. the Naugatuck River in Torrington and Mad River in Winchester).

The rapid growth of Winchester and Torrington over the more rural communities in the Region persisted through 1950. By this time the Region had evolved into the pattern we know today where Torrington func-

tions as the principal urban area, Winchester as a sub-urban area, and the other towns are characterized by a low-density rural or suburban development pattern. Population density values can be seen in Table II.1.

Since 1950, yet another shift in the pattern of land use in the Region has developed. With the improvement of transportation corridors and the widespread availability of the automobile, people began moving back to the country. This trend has raised a wide variety of "growth management" issues at both the local and regional level.

As shown in Table II.3 and II.4, population and employment in the Litchfield Hills Region is projected to continue to grow over the next 20 years, although at a slower rate than the preceding 20 years.

C. Transportation Network and Infrastructure

Figure I.2 in Section I shows the State highway network in the Litchfield Hills Region. The major travel corridors in the area are Routes 4, 8, 44 and 202. Route 8 bisects the region and is the area's only limited access expressway. The major roadway convergences in the Region are found in Torrington (Route 8, 202, and 4) and Winchester (Routes 8 and 44).

In addition to the 252 miles of state highway shown in Figure I.2, there are 891 miles of roadway that are maintained by the towns.

The region has one railroad, the Torrington-Waterbury branch line, which is a Class 2 railroad owned by CTDOT and operated by the Railroad Museum of New England and its subsidiary Naugatuck Railroad Company. The railroad is only marginally active. There are no freight runs being made on the line, but tourist passenger service has been offered recently on a seasonal basis.

Some areas of the region have sewer access as shown in Figure II.6. The areas with sewer service reflect higher density population centers.

D. Institutional Structure for Emergency Management

Within Connecticut, the primary responsibility for the formulation of hazard mitigation actions and dissemination of severe weather warnings issued by the National Weather Service (NWS), rests with the Depart-

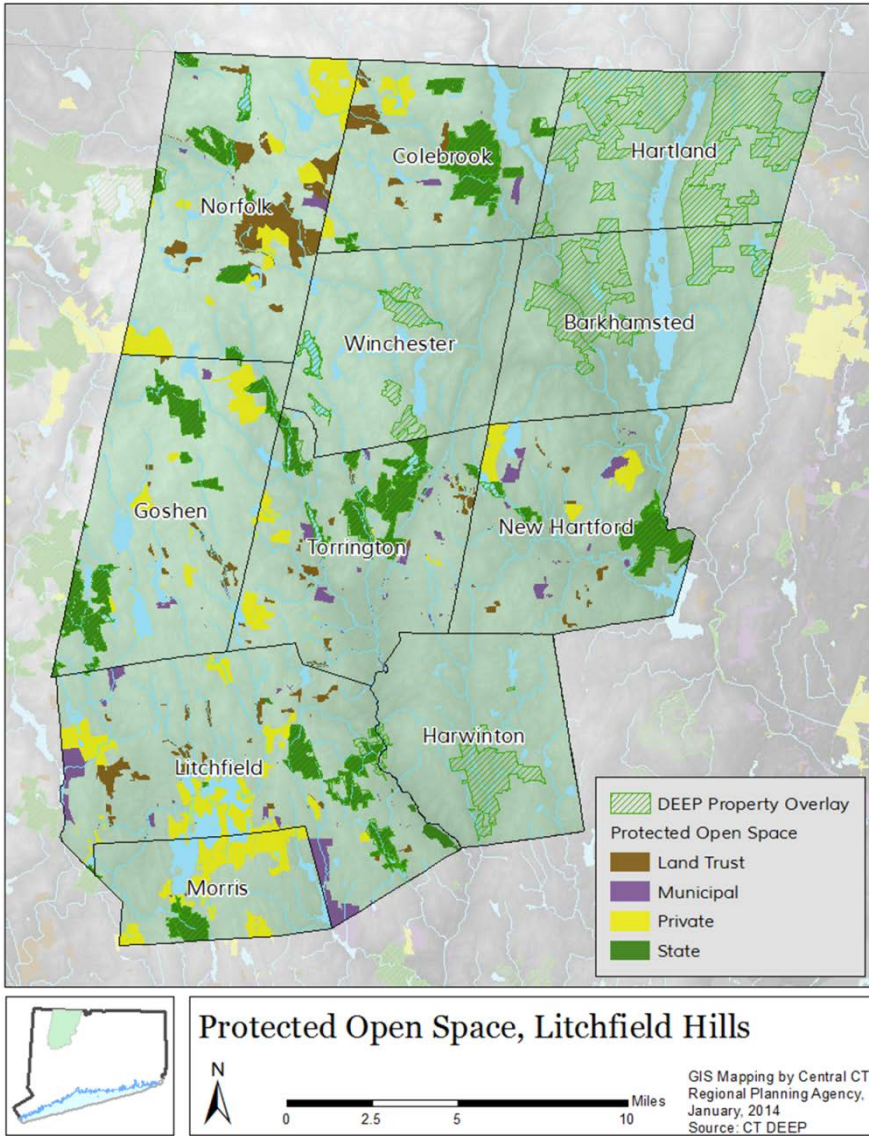

Figure II.3. Protected open space in the Litchfield Hills Region

ment of Energy and Environmental Protection (DEEP), CT Department of Emergency Services and Public Protection (DESPP), and the Office of Policy and Management (OPM). Several additional State and Federal agencies such as the Natural Resources Conservation Service (NRCS), the U.S. Army

Corps of Engineers (ACOE) and the Federal Emergency Management Agency (FEMA) assist in long term planning, and construction of damage reduction measures (Source: DEEP Hazard Mitigation Plan).

The CT Area 5 Office of DESPP (based in Waterbury) serves as the liaison between the Region's municipalities and the CT DESPP and the Federal Emergency Management Agency (FEMA). The Coordinator of the Area 5 Office routinely works with municipal officials in preparing and updating local Emergency Operation Plans. The CT DESPP is also the principal State contact in the event of a natural disaster, and has worked with area towns in requesting federal aid in response to natural disasters. The Area 5 office also facilitates FEMA-approved training for emergency response personnel in the area, and monitors and transmits severe weather forecasts for the local area.

Each municipality in the area has a structure in place for responding to a natural disaster. This structure is outlined in the municipal Emergency Operations Plan. Most communities rely on volunteers for emergency response. The local Volunteer Fire Department and Emergency Medical Service typically form the foundation of this emergency response capacity. The local Fire Chief frequently serves as the Incident Commander in the event of an emergency. Torrington and Winchester are served by a paid Police Department, and Torrington also has a paid Fire Department.

All communities rely on mutual aid agreements in the event of a major disaster or incident. Most of these mutual aid agreements are voluntary and un-written. While Winchester has its own dispatch service, all other towns in the regional area rely on a regional dispatch center, Litchfield County Dispatch, for 911 calls and emergency notification.

The Northwest Hills Public Safety Task Force also serves the area. This broad-based group meets on a regular basis and provides a forum for discussion of emergency management issues.

Additionally, each community relies on institutional systems to reduce or manage possible damages from natural hazards through ordinances, regulations, and plans. Please see Table II.5 for a description of these tools.

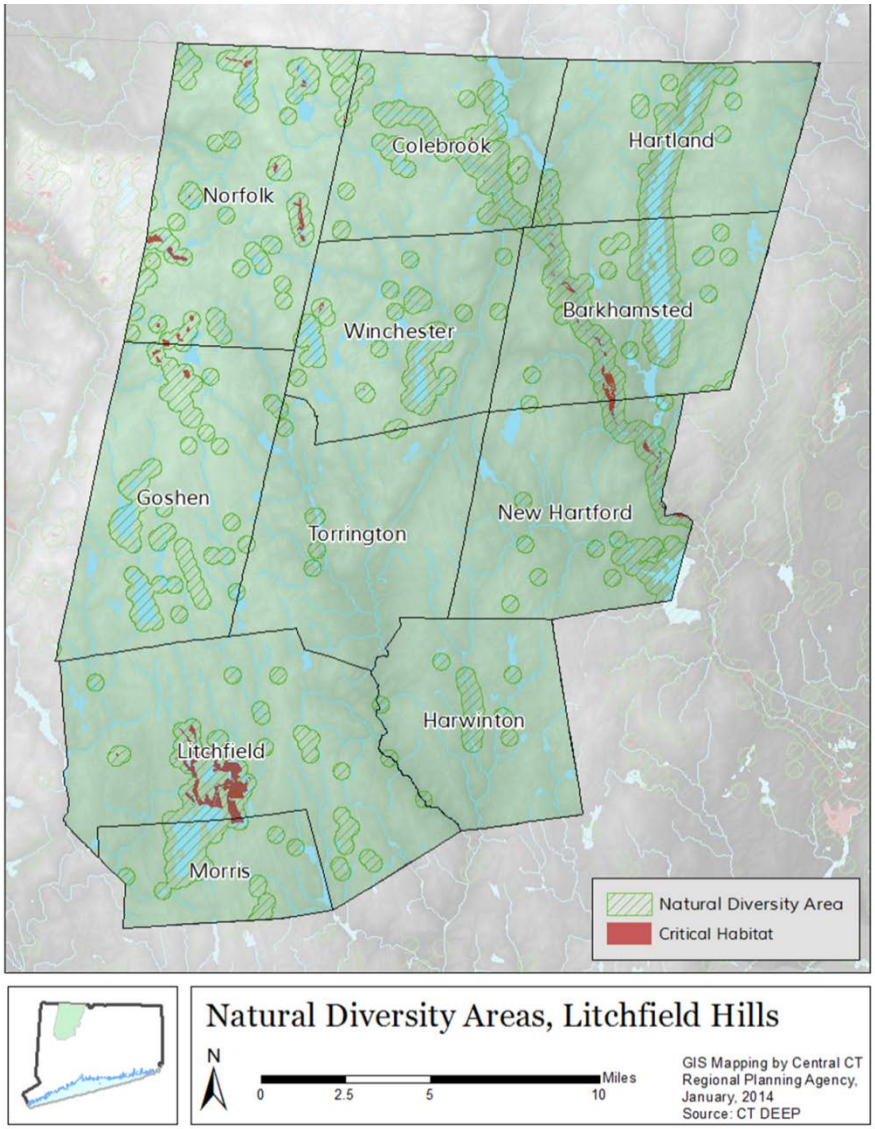

Figure II.4.Natural diversity areas in the Litchfield Hills Region

Table II.3. Population projections					
Town	**2010**	**2015**	**2020**	**2025**	**% annual Change 2010-2025**
Barkhamsted	**3,799**	3,881	3,935	3,969	**0.29%**
Colebrook	**1,485**	1,480	1,467	1,443	**-0.19%**
Goshen	**2,976**	3,095	3,177	3,241	**0.57%**
Hartland	**2,114**	2,104	2,065	2,008	**-0.34%**
Harwinton	**5,642**	5,742	5,776	5,787	**0.17%**
Litchfield	**8,466**	8,465	8,411	8,293	**-0.14%**
Morris	**2,388**	2,435	2,461	2,474	**0.24%**
New Hartford	**6,970**	7,294	7,554	7,775	**0.73%**
Norfolk	**1,709**	1,711	1,699	1,674	**-0.14%**
Torrington	**36,383**	36,936	37,392	37,683	**0.23%**
Winchester	**11,242**	11,503	11,693	11,813	0.33%
Region	**83,174**	**84,600**	**90,450**	**93,400**	**0.78%**

Source: US Census 2010; UCONN Connecticut State Data Center 2012

Table II.4. Employment projections					
TOWN	2010	2020	2030	2040	% annual Change 2010-2040
Barkhamsted	1,439	1,437	1,445	1,449	0.02%
Colebrook	176	191	205	218	0.80%
Goshen	348	383	415	445	0.93%
Hartland	139	139	152	163	0.58%
Harwinton	561	624	688	749	1.12%
Litchfield	3,227	3,299	3,365	3,427	0.21%
Morris	403	423	439	452	0.41%
New Hartford	1,439	1,437	1,445	1,449	0.02%
Norfolk	406	410	413	415	0.07%
Torrington	15,267	15,369	15,464	15,559	0.06%
Winchester	3,358	3,409	3,458	3,524	0.16%
Region	**26,763**	**27,121**	**27,489**	**27,850**	**0.14%**

Source: US Census 2010; UCONN Connecticut State Data Center 2012

Table II.5. Institutional tools at municipal level		
Plan or Regulations	**Significance to Hazard Mitigation**	**Effective for Hazard Mitigation**
Emergency Operations Plans	Assist local communities in the preparation and implementation of resources prior to and during an emergency, including natural hazard events. The plans are updated annually and help local communities assess the locations of vulnerable areas within their communities and how to handle these areas during an emergency. This plan may be a good source of information for local risk assessment activities.	Not directly used for hazard mitigation, but the process of updating the local EOP will help inform vulnerability and risk assessments, and will help identify gaps in capabilities at the local level.
Floodplain Management Regulations/ Ordinance or Flood Damage Prevention Regulations/Ordinance	These regulations assist a community in effectively manage its floodplain areas and are typically organized similar to the NFIP regulations. These regulations are usually part of a community's land use regulations (described below). However, depending on the community, they may be a part of the municipal code of ordinances. These regulations may require specific minimum design/construction/or development elements which must be complied with for health and safety reasons.	Typically very effective. Some communities may benefit from updating these regulations and more strongly linking the municipal code and zoning regulations (when they are found in both). Local hazard mitigation plans typically recommend these types of modifications.
Zoning Regulations	Primary tool for community for shaping the character and development of a community. Zoning regulations may restrict particular uses or structures from being located in vulnerable areas in a community. These regulations may also require specific minimum design/construction/or development elements which must be complied with for health and safety reasons. If the flood damage prevention regulations are not in the municipal code of ordinances, they are typically in the Zoning Regulations.	Zoning Regulations are typically very effective for mitigating several hazards (flooding, geologic hazards, and wind hazards) because they guide development in flood zones, on slopes, and near sensitive resources; and because they regulate structures and accessories (such as signs) that can be damaged or cause damage during events.
Subdivision Regulations	Important tool for community for shaping the character and development of a community through subdivisions. These regulations often describe how flood prone areas must be addressed, specify minimum and maximum roadway dimensions, specify where utilities may be placed (underground vs. above-ground), and specify how fire protection will be provided. Some elements of the flood damage prevention regulations are often repeated in the Subdivision Regulations.	Subdivision Regulations are typically very effective for mitigating several hazards because they specify how roads and lots should be arranged and appropriately sized for safe access and egress. They may also specify how fire protection should be provided, which helps mitigate for wildfires and wildland fires.
Stormwater Regulations	Some communities have developed stormwater regulations or ordinances that are separate than the Zoning and Subdivision Regulations. Stormwater regulations provide requirements for addressing stormwater in connection with development, redevelopment, and road projects.	When available, these regulations are often very effective. Not all communities follow the same principles for managing stormwater. Therefore, local hazard mitigation plans typically include discussion about how to best manage stormwater.
Wetland Regulations	In Connecticut, all wetland regulations describe wetlands as necessary for a number of functions including flood management. These regulations help a community maintain and protection the integrity of its wetland resources. Wet-	Wetland regulations are most effective for mitigation of flood hazards when setbacks and review areas are very wide. Many communities enforce wide review areas, such

	land areas often coincide with FEMA delineated floodplain areas in a community.	as 100 feet or greater, which aids mitigation.
Local Adoption of CT State Building Code	Critical to maintain adequate safety and building integrity factors in construction. In addition, these codes may limit structure size, type or place additional requirements in the construction of structures located in an identified hazard area (i.e., high wind, coastal, floodplain, wildland/urban interface area, etc.).	Very effective. All local communities must adopt the state codes.
Local Plan of Conservation and Development	Primary plan that helps guide a community in its land use and management decisions with regard to development and conservation and/or preservation of open space.	These plans are effective when communities use them to modify zoning districts and regulations, acquire open space, and actively guide development and infrastructure expansions. Because the plans are updated once per decade, many communities are now incorporating discussions about natural hazards and climate change for the first time in the updated plans.

Modified from: 2014 Connecticut Natural Hazards Mitigation Plan Update

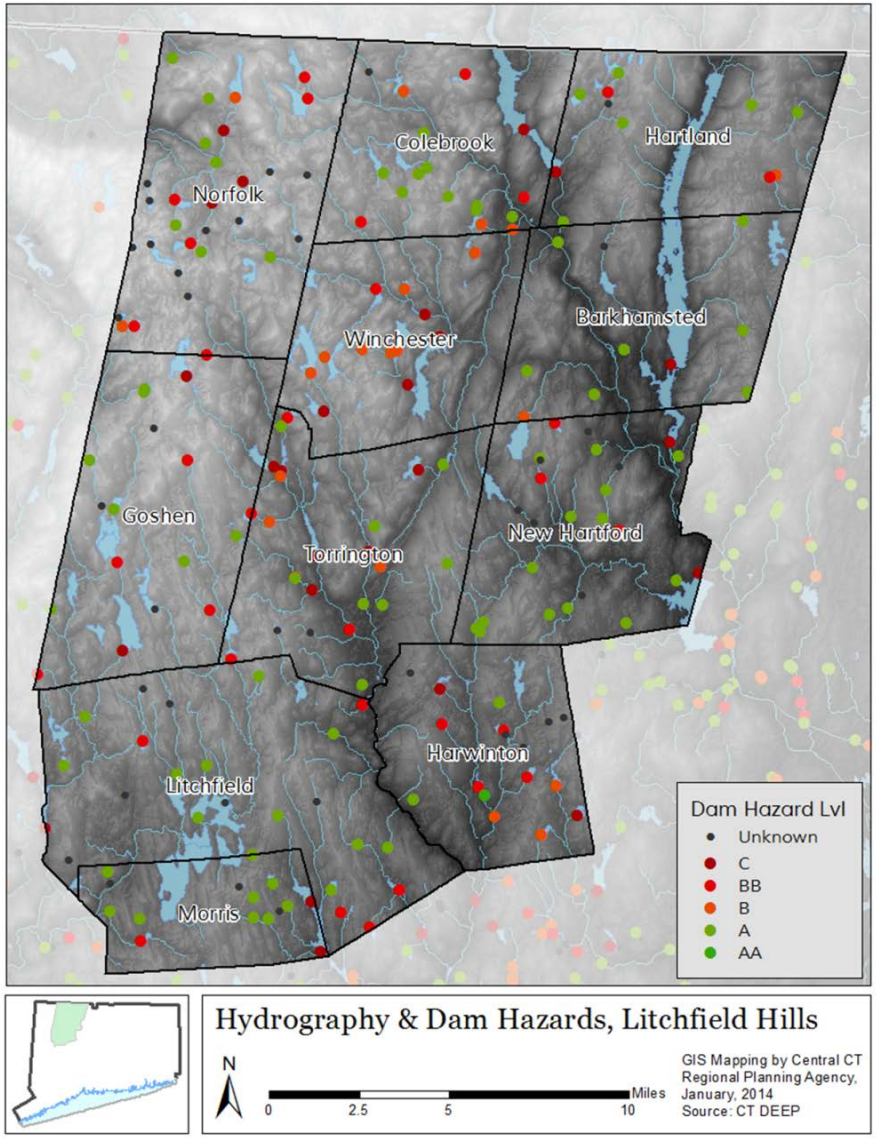

Figure II.5. Hydrography and dams in the Litchfield Hills Region

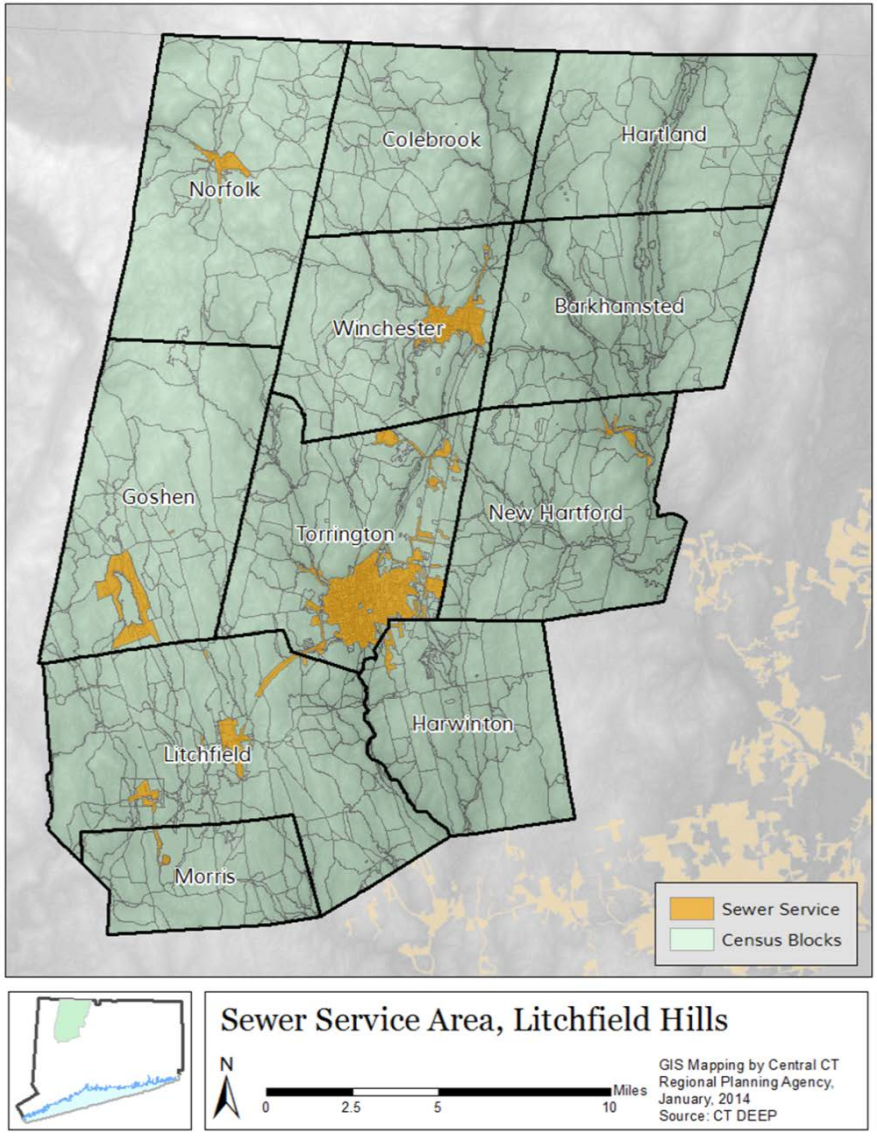

Figure II.6: Sewer service areas in the Litchfield Hills Region

III. Natural Hazards of Concern and Regional Vulnerability

One of the most important early tasks in the planning process was identifying which hazards may impact the region, and which of those are of the greatest concern. To accomplish this task, a list of potential hazards was determined through an analysis of previous Natural Hazards Mitigation Plans for the region and the state. That review indicated that the following were potential hazards for the region: winter weather, flooding, hurricanes, thunderstorms, tornados, wildfires, dam or levee failure, drought, and earthquakes.

The 2014 Connecticut Natural Hazards Mitigation Plan Update analyzed each potential hazard based on probability of future events, annualized property damage, total injuries and deaths, geographic extent (hazard specific), and local plan average for county. The rankings were broken down by each county. The portion of that analysis that is relevant to the Litchfield Hills Region is reproduced at right. As the table makes clear, even though a disaster may be highly likely to occur, it may not pose a significant risk to life and property.

This initial list of potential hazards was further developed through a review of data regarding past disasters (from FEMA, the National Oceanic and Atmospheric Administration, the United States Geological Survey, and the National Weather Service), and meetings with municipal public works and emergency management staff. A review of news reports and interviews with town officials did not turn up any additional hazards of note.

The list of potential hazards, as well as the state's rankings (see Table III.1) for those hazards, was then reviewed by municipal and regional staff to determine which of these hazards were significant enough to warrant further analysis. The result was a list of major natural hazards of concern in the Litchfield Hills Region, which included **flooding, hurricanes, severe wind storms, and severe winter storms.** This plan also considers dam failure as a flood-related hazard. Additionally, this plan considers, but to a lesser extent, tornados, drought, forest fires, and earthquakes. Of the six natural hazards of concern in the regional area, drought has the lowest potential for loss of life and property.

Economic loss is closely tied to the potential impacts of a natural disaster. Again, floods, severe winter storms, and high winds would have the most costly direct and indirect economic consequences, including repair and replacements costs, business disruption and clean-up costs. The Region's municipalities would benefit the most from mitigation strategies that address these natural hazards. The anticipated economic loss from minor earthquakes and drought, by contrast, is relatively low in the regional area.

Table III.1. Potential events and their rankings for Litchfield County

Event	Probability	Property damage	Injuries/ Death	Geographic extent	Average
Winter Weather	H	ML	H	H	ML
Flooding	H	MH	L	ML	ML
Hurricane	ML	H	L	MH	L
Thunderstorms	H	ML	H	MH	ML
Tornado	ML	H	H	H	L
Wildfire	H	L	L	ML	L
Dam/Levee Failure	L	L	H	L	L
Drought	ML	L	L	ML	L
Earthquake	ML	L	L	L	L

Source: 2014 Connecticut Natural Hazards Mitigation Plan Update, Table 2-78

During discussions of which disasters to include as "major concerns", a few factors that were used in the State of Connecticut's Hazard Mitigation Plan, stood out as good differentiators. They were probability of occurring, level of expected property damage, likelihood of injuries or death occurring, and the geographic extent. All of these factors were considered. For example, wildfires have a high probability of occurring (at least one will probably occur every year), but they have relatively narrow geographic impacts and have traditionally caused low levels of damage. Hurricanes on the other hand, have relatively long return periods, but cause high levels of damage and have wide ranging impacts.

This section of the report provides an overview of each of the above listed natural hazards of concern. Much of the information is taken directly from the "2014 Connecticut Natural Hazard Mitigation Plan Up-

date". Under each hazard is a description of the hazard, a review of past occurrences, a discussion of potential impacts from an event (including HAZUS MH analysis where possible), and a discussion of the probability of the hazard occurring. In an effort to quantify impacts from natural disasters, simulations, using HAZUS software, were performed for potential floods, hurricanes, and earthquakes. Information on the HAZUS methodology can be found in Appendix B. Variations among the municipalities are discussed in the individual town risk assessments later in this document. The following probability categories (indicating the probability that the event will happen in a given year) are used throughout:

Highly likely: Indicates that the probability of an event occurring within a two-year period is nearly 100%.

Likely: Indicates a hazard that will occur every three to five years, on average.

Unlikely: Indicates an event that will only recur every five to ten years.

Highly unlikely: Indicates an event that will only recur every ten years or longer.

Table III.2. Potential events, categories, sources of information, and potential impacts

Event	Major Concern?	Sources of information	Impacts	Notes
Winter Weather	Yes	State NHMP; NOAA; Municipal staff; Eversource	High probability of occurring; impacts entire region; high number of previous events leading to injury and property damage	Includes blizzards, Nor'easters, ice storms, and chained snow events
Flooding	Yes	State NHMP; Federal Disaster Declarations; NFIP records; Municipal staff	High probability of occurring; relatively high levels of property damage have occurred; broad geographic impacts	Uneven impacts and probability
High winds (includes: hurricanes, tornados, and thunderstorms)	Yes	State NHMP; Federal Disaster Declarations; NOAA; National Weather Service; Municipal staff; Eversource	High probability of occurring; high levels of damage recorded in past events; broad geographic extent of damage	Impacts from hurricanes, tornados, and thunderstorms are very similar
Wildfire	No	State NHMP; NOAA; Municipal staff; Eversource	High probability of occurring, but low levels of property damage and loss of life/injury recorded; does not have broad geographic extent	Impacts are concentrated in more heavily forested towns
Dam or Levee Failure	No	State NHMP; State CT DEEP	Low probability of occurring; low levels of damage recorded in previous events	Low probability of occurring; low levels of damage recorded in previous events
Drought	No	State NHMP; NOAA; National Weather Service; National Drought Mitigation Center	Low probability of occurring; low levels of damage recorded and expected	Low probability of occurring; low levels of damage recorded and expected
Earthquake	No	State NHMP; U.S. Geological Survey	Moderately high probability of occurring; very low levels of damage recorded and expected	Moderately high probability of occurring; very low levels of damage recorded and expected

Source: 2014 Connecticut Natural Hazards Mitigation Plan Update

A. Flooding

Most of the natural disasters that have affected Connecticut in the past 100 years have involved flooding. Connecticut's vulnerability to this natural hazard is evidenced by the property damage, loss of utilities, and loss of life that has resulted from major flooding events. Figure III.1 shows a flooding event in downtown Torrington.

Description

There is no distinct flood season in Connecticut, and major riverine flooding has occurred in every month of the year. There are however, two seasons when riverine flooding is more likely: the spring snowmelt, and late summer/early autumn hurricanes. Flooding is perhaps of greatest concern when heavy rains fall on frozen ground in early spring, resulting in substantial snowmelt and stormwater runoff. During summer months, when the ground is not frozen, rain can be absorbed into the soil, which serves to reduce stormwater runoff and the associated flooding potential. The frequency of severe flooding in Connecticut is approximately once every 5 years. Major flooding of Connecticut's larger rivers (e.g. Farmington), with some loss of life and significant property damage can be expected once every 30 years on average according to the DEEP. Historically, major flood events have occurred in March 1936, August 1955, June 1982, June 1984, 1992, and September 2011. All of these events impacted towns within the Litchfield Hills Region.

Past occurrences

The infamous Flood of 1955 is the most memorable flooding event to occur in the Litchfield Hills Region. From August 12-19 torrential rains from Hurricane's "Connie" and "Diane" resulted in devastating flood damage with many road and bridge washouts, loss of drinking water, destruction of power lines, and loss of communication networks. The State was declared a disaster area, with seventy persons killed and 4,700 injured. This devastating flood permanently transformed the landscape of the Region, most notably in downtown Winsted.

According to the NOAA Storm Events webpage (www4.ncdc.noaa.gov), 31 flood events were reported in Litchfield County over the past twelve years, resulting in $6.5 million in property damage. A sampling of the impacts of these flood events, as described on the NOAA webpage, is presented below.

Figure III.1. Flooding on Main Street in Torrington

December 17, 2000. Rainfall amounts were in the 2 to 4 inch range, with Bakersville (New Hartford) specifically receiving 2.75 and Colebrook 3.50 inches respectively. The bulk of the rainfall was in a short interval of time, with some localities receiving an inch per hour. The excessive rainfall combined with melting snow and frozen ground, to produce massive runoff. In Torrington, street flooding was reported, and construction equipment washed downstream on the Naugatuck River. Widespread street flooding was also reported in Litchfield. September 16, 1999. The remnants of Hurricane Floyd moved up the eastern seaboard on September 16 and during the early hours on September 17. The storm brought both high winds and exceptionally heavy rain-

fall to northwestern Connecticut, which included a large swath of 5 to 8 inch amounts. The rain produced widespread flooding across the region, which proved very destructive. The rains not only flooded many roadways but washed our portions of them. The combination of the wind and very saturated ground, produced widespread downing of trees and powerlines across much of Litchfield County. Some of the trees fell on vehicles and houses. The rain and wind produced power outages across the region with as many as 5,000 left in the dark.

April 15, 2007. Heavy rain led to widespread flooding across Litchfield County. Several streams and creeks exceeded bankful as a result of this heavy rain, including the Still River in Winsted, and the Nepaug Brook and River in New Hartford. This led to numerous road closures across the county, as well as some evacuations. Some of the roads that were closed included Carpenter Road in new Hartford, where a foot of water was reported covering the bridge just north of Route 202, South Main Street and Highland Lake Road in Torrington, where some debris also covered portions of Highland Lake Road, Route 47 and Weekeepeemee Road in Woodbury, Torrington Road between Torrington and Winsted, Cross Road and Youngsfield Road in New Milford, as well as several roads in Washington and Winsted that were washed out. In addition, several evacuations also occurred, including residents on Standard Avenue in Winsted, as well as at a 40 unit apartment complex in Winsted. A mudslide also was reported at Grove Street in New Milford by an Emergency Manager. This resulted in the evacuation of 5 homes. The runoff from this heavy rainfall also led to moderate flooding on the Housatonic River. At Falls Village, the Housatonic River crested at 11.14 feet, while at Gaylordsville, the river crested at 12.97 feet. Further south, the Housatonic River at Stevenson Dam crested at 19.96 feet.

August 28, 2011. Tropical Storm Irene tracked north northeast across eastern New York and western New England during Sunday, August 28th, producing widespread flooding, and damaging winds across the region. The greatest impact from Irene across Litchfield County was due to heavy to extreme rainfall, which resulted in widespread flash flooding. Rainfall amounts generally averaged 5 to 10 inches. Much of the rain which fell occurred within a 12 hour period, beginning early Sunday morning, and ending Sunday evening. This heavy to extreme rainfall resulted in widespread flash flooding and river flooding across Litchfield County. Numerous road closures were reported due to flooding and downed trees and power lines, along with some evacuations.

On September 2nd, 2011 a Major Disaster Declaration was declared, FEMA-4023-DR. Numerous roads were reported closed due to flooding in Harwinton including but not limited to Plymouth Road.

Extent

The Federal Emergency Management Agency (FEMA) has prepared Flood Insurance Studies for flood-prone communities throughout the country. Within the Litchfield Hills Region, Flood Insurance Studies have been prepared by FEMA for all eleven towns.

These Flood Insurance Studies contain information on local flood history, local flood problems, and other flood studies that have been done for the town. Of particular significance are the Flood Insurance Rate Maps (FIRM) that have been created by FEMA for over 19,000 communities in the country as part of the national Flood Insurance Study. In addition to the 100-year floodplain, which is the area of the community with a 1% chance of flooding in any given year, the FIRMs also illustrates the floodway, and the 500-year floodplain, which is the area of the community with a 0.2% chance of flooding in any given year. Notably, FIRM data for the region was created in 1974 and last updated in 1994. Table III.3 lists each municipality's history in the National Flood Program. Specific information on the flooding risk and vulnerability in each town in the regional area is presented in the next section of this report. See Figure III.2 for a map of flood zones in the Litchfield Hills region.

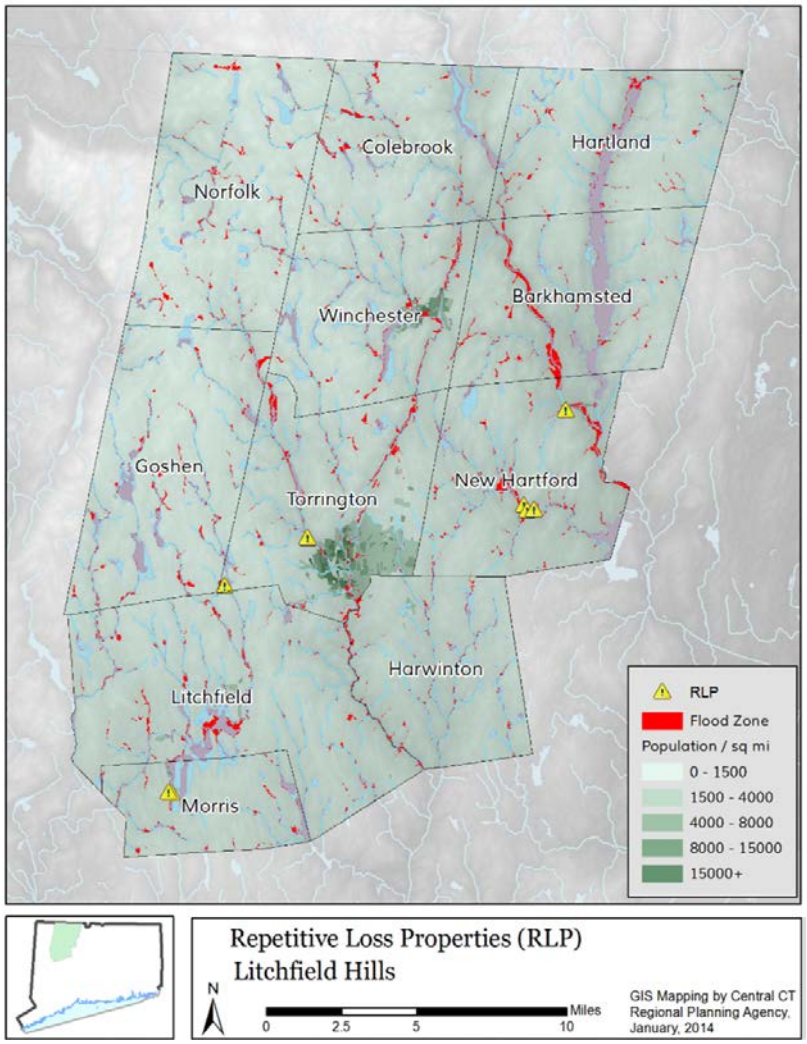

Figure III.2. Repetitive loss properties (RLP) in the Litchfield Hills Region

Impacts

Since the passage of flood regulations in 1968, and the creation of the Federal Emergency Management Agency (FEMA) in 1978, flood vulnerability in Connecticut has continued to increase according to the CT DEEP.

Table III.3 Communities Participating in the National Flood Program

Municipality	Initial FHBM Identified	Initial FIRM Identified	Current Eff Map Date	Reg-Emer Date
Barkhamsted	08/30/74	02/17/82	02/17/82	02/17/82
Colebrook	11/29/74	03/20/79	06/06/86 (M)	06/03/86
Goshen	02/21/75	11/16/90	11/16/90	11/16/90
Hartland	06/28/74	12/16/80	09/26/08	12/16/80
Harwinton	06/28/74	02/17/82	02/17/82	02/17/82
Litchfield	06/21/74	06/15/82	01/02/92	06/15/82
Morris	01/31/75	09/30/81	09/30/81	09/30/81
New Hartford	09/13/74	02/03/82	02/03/82	02/03/82
Norfolk	02/14/75	12/03/87	12/03/87	12/03/87
Torrington	07/01/70	05/19/72	04/04/83	05/19/72
Winchester	08/02/74	07/17/78	07/17/78	07/17/78

Source: FEMA

This increase in vulnerability is due primarily to urban flooding, which has become more prevalent in recent years as urban and suburban areas continue to grow and stormwater runoff exceeds the capacity of older under-designed drainage systems. Urban flooding strikes most cities on an annual basis and is most often caused by slow moving and intense thunderstorms, which can drop 4 - 8 inches of rain over a small area in a matter of hours. This urban flood risk will likely continue to increase because the factors that affect urban flooding cannot be effectively mitigated. These include the creation of additional impervious areas, and older, undersized drainage systems that are so extensive that the cost to upgrade them is prohibitive.

The most hazard-prone areas in the Region are the flood zones. These areas are the most susceptible to loss of life and property damage from floods, nor'easters, and dam failure. The potential impact of dam failure

Table III.4: Repetitive Loss Properties		
Town	Number of RLPs	Property Type
Litchfield	1	Residential
Morris	1	Residential
New Hartford	4	Residential
Torrington	3	Commercial

Source: CT DEEP

is greatest in the dam inundation zones of the large capacity Class C dams (e.g. Goodwin Dam, Saville Dam, and Colebrook River Dam).

All 11 municipalities of the Litchfield Hills region participate in the National Flood Insurance Program's (NFIP) requirements and therefore conduct floodplain management in compliance with minimum NFIP standards (as outlined in 44 CFR §60) and additional State standards in Public Act 04-144. The municipalities use a variety of tools to maintain compliance with NFIP, including the Connecticut State Building Code, a code of ordinances, wetland regulations, zoning regulations, and/or subdivision regulations. All communities intend to continue participation in the program. Specific enforcement measures for each community are described in Section V.

Litchfield Hills when compared to other regions in the state, does not have many repetitive loss properties (RLP) or severe repetitive loss (SRL) properties with only 9 RLPs (0.3% of the properties in CT) as shown in Table III.4. New Hartford has 4 RLPs one of which is the only SRL property in the region. Torrington has 3 RLPs, and Morris and Litchfield each have one as well. These properties can be seen in Figure III.2. Within the last 10 years there have been 24 flood claims issued with $405,154 paid out.

It should be noted that even small floods can inconvenience many people and result in economic consequences. In addition to street closures, floods often result in property damage, basement flooding, and fallen trees. Related to flooding potential from large storm events is the potential for dam failure. In the event that heavy rains or excessive snowmelt result in the failure of a dam, downstream flooding will be exacerbated along with the potential for flood related damage. Dams in Connecticut are categorized into three hazard categories. Class A dams are low hazard potential dams that upon failure might result in damage to agricultural land and minor roadways, but with minimal economic impact. Class B dams are moderate hazard potential dams whose inundation zone includes normally unoccupied storage structures and low volume roadways. Class C dams are high potential hazard dams that upon failure could result in loss of life and major damage to habitable structures and major highways. Dam failures can be triggered suddenly by other natural disasters such as flooding or earthquakes.

Table III.5: Natural disaster annual probabilities	
Previous Class Names	Annual Chance of Occurrence
25 -Year	4%
100 Year	1%
500-Year	0.20%

The Dam Safety Section of the DEEP's Inland Water Resources Division is responsible for the administration and enforcement of Connecticut's dam safety laws. One such requirement is that owners of Class C dams prepare and maintain emergency operations plans. These regulatory provisions exist because the potential impacts of a major dam failure can be dire due to the high population densities and development along many of Connecticut's waterways. The location of existing dams and their hazard class can be viewed in Figure II.5 above. Table III.21 (at the end of Section III) is a list of all existing Class C hazard dams.

Another flood related natural hazard is ice jams. An ice jam is an accumulation of ice in a river that restricts water flow and may cause backwater that floods low-lying areas upstream from the jam. Areas below the ice jam can also be affected when the jam releases, sending water and ice downstream. According to the DEEP, ice jam damages can affect homes, buildings, roads, bridges, and the environment (e.g. through erosion, sedimentation, bank scouring or tree scarring). The federal

government maintains a database of ice jam history. This database includes 132 records of jams in Connecticut dating back to 1902. Since 1961, there have been twelve well-documented ice jams in Connecticut. None of these twelve ice jams occurred on rivers within the Litchfield Hills Region. As a result, none of the rivers considered by DEEP to be most susceptible to ice jams in Connecticut are located within the Litchfield Hills Region.

To conclude, flooding can destroy buildings, roadways, bridges, forests, and personal property. It can also result in the loss of human life. Also of concern is the loss of electric power, isolation from emergency services, and general impact on local commerce. Given the assumption that Connecticut suffers flood losses of $70- 90 million dollars annually, the State will continue to bear these losses until sufficient or significant action is taken to reduce damages. Since 1978, the National Flood Insurance Program has paid out over $92 million in flood claims in Connecticut according to the DEEP. Based upon DEEP's estimate of annual flood losses, it appears clear that only a small fraction of properties suffering flood damages are insured through the NFIP.

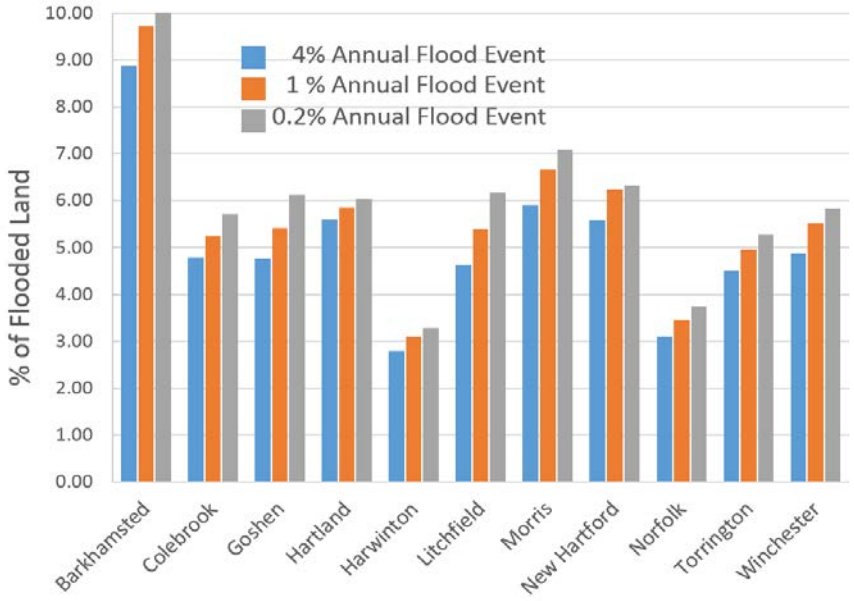

Figure III.3: Percentage of flooded land by town.

HAZUS-MH Flood Results

Potential impacts from flooding events were evaluated using HAZUS-MH loss estimation program. HAZUS-MH can be performed at three levels of analysis each with an increasing level of detail but at the cost of user effort and data sophistication. The scope of this analysis is a level 1 analysis which uses the default HAZUS-MH data. In future updates to this plan, it may be possible to use a higher level of analysis if digital parcel data and building footprints are available.

This section of the plan focuses on a flood even with a 1% annual chance of occurring. The percentage represents the likeliness of a flood occurring in a given year. HAZUS-MH was used to simulate such an event. Simulations of other events (4% and 0.2% annual events) were also performed, but the 1% event was chosen to be the focus of this analysis. This event was chosen because recent climate data suggests that 1% events are becoming increasingly common, and because the difference between the 1% and the 0.2% simulations was not large enough to make the comparison meaningful to readers of this plan. As shown below, the amount of land flooded by a 4%, 1%, and 0.2% annual event is very similar in the Litchfield Hills region.

It should be noted that previous plans for this region used different terms for these events. The terms "100 year flood" and "500 year flood" have been replaced with 1% and 5% events, respectively, because they were often confused as flood events that occur once every 100 or 500 years but in fact probabilities were higher than this. Table III.5 displays these terms with their corresponding annual occurrence values.

The flood plains for the flood scenarios were manually created because FEMA's digital flood insurance maps (DFIRMS) only cover 1 of the 11 towns in the Litchfield Hills region. The built in flood delineation tools within HAZUS provides a more realistic picture of flood zones as well as flood depths.

Figure III.3 shows the percentage of flooded area for each town in Litchfield Hills. In a 1% annual flood simulation 5.54% of the region is flood-

Table III.6: Level of building damage (1% flood scenario) by # of buildings						
Towns	1-10	11-20	21-30	31-40	41-50	Substantially
Barkhamsted	0	0	0	0	1	6
Colebrook	0	0	0	0	0	0
Goshen	0	0	0	0	0	0
Hartland	0	0	0	0	0	0
Harwinton	0	0	0	0	0	0
Litchfield	0	0	0	0	2	10
Morris	0	0	0	0	0	0
New Hartford	0	0	0	1	6	86
Norfolk	0	0	0	0	0	0
Torrington	0	1	1	2	9	43
Winchester	0	0	0	5	10	60
Region	*0*	*1*	*1*	*8*	*28*	*199*

Source: HAZUS analysis

ed. The total area of flooded land per town in acres is displayed in in Appendix B along with the number of acres of "Developed Land that were impacted by floods". Developed land includes suburban and urban land cover.

Table III.17 at the end of Section III shows the total estimated replacement value of all buildings in the region. Results are broken down by occupancy: residential, commercial, industrial, agricultural, religious, government, and education. The total exposure of the region is $7,845,553,000. Table III.19 shows the estimated value of all buildings that are within the impact area of a 1% annual flood event. Again, results are broken down by occupancy and by town. Total exposure under the 1% event is $4,949,858,000, or 63% of the total value of the building stock.

The HAZUS simulation estimates that 237 buildings will be damaged throughout the region. Of that total, 36 buildings will be moderately damaged (damage will cost at least 20%, but less than 50%, of the building's value). HAZUS also estimates that 199 buildings will be substantially damaged (damage will cost at least 50% of the building's value to repair). Table III.5 shows a town-by-town breakdown of where the damage will occur.

Damage to essential facilities is presented in Table III.8. Essential facilities include fire stations, hospitals, police stations, and schools. Three categories of damage are shown: moderate, substantial, and loss of use. For the region as a whole, HAZUS estimates that total loss of use will occur in eight facilities, the majority of which are fire stations. Fire stations, which are often the first emergency service to respond to an event, are vitally important during an emergency. The individual town sections include a discussion of which essential facilities will be impacted in that town.

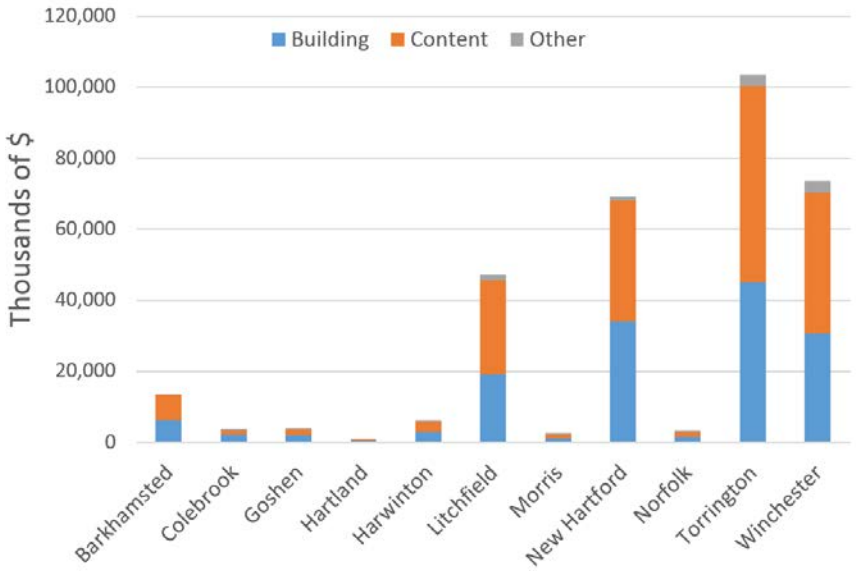

Figure III.4: Damage under a 1% annual flood event.

Table III.7: Economic losses by building type (millions of dollars)					
	Residential	Commercial	Industrial	Other	Total
Business interruptions					
Income	0.00	0.19	0.00	0.03	0.22
Relocation	0.03	0.04	0.00	0.01	0.08
Rental Income	0.01	0.02	0.00	0.00	0.02
Wages	0.00	0.22	0.00	0.74	0.96
Subtotal	0.04	0.46	0.01	0.78	1.29
Building loss					
Building	105.73	35.79	30.05	8.25	179.81
Content	51.53	65.82	60.50	21.40	199.26
Inventory	0.00	1.58	9.07	0.11	10.76
Subtotal	157.26	103.19	99.62	29.76	389.83
Grand Total	157.30	103.65	99.63	30.54	391.12

Source: HAZUS analysis

Damage estimates, which were calculated for a worst case scenario, meaning that no warning or preventative measures were taken to alleviate flood effects, are shown in Table III.7. Total estimated damage to the region was $391 million for a 1% annual flood event. As shown in Table III.7, the majority of damage is expected to occur to the building itself. Significant damage to the content of buildings, and, in the case of commercial and industrial buildings, the inventory, may also occur. As would be expected, inventory damage is primarily concentrated in the largest towns, such as Torrington, where the majority of commercial and industrial buildings are located.

Table III.7 shows economic losses by building type for the region. The first part of the table shows business interruption losses. These are losses that occur due to relocation expenses, income not received due to the interruption, loss of rental income, and wage-related losses. Again, the majority of these losses are expected to occur in the region's larger municipalities. Total business interruption losses are estimated at $1,290; the majority of these losses are in the commercial and "other" sectors. Economic losses due to building and building content damage, by building occupancy type (residential, commercial, industrial, etc.) are also shown in Figure III.3. Total building-related losses are estimated to be $389,830. Of that, 50.8% of this damage is to the buildings themselves and 47.5% is to the contents within the buildings. The vast majority of damage is expected to occur in residential and commercial structures.

In any flood scenario, a considerable amount of debris is expected to be generated. Debris generation estimates for the 1% scenario is 48,196 tons. Cleanup costs will vary based on contractor estimates (labor, time,

Table III.8: Damage to essential facilities (1% flood event)				
Classification	Total	At least Moderate	At least Substantial	Loss of use
Fire Station	20	4	0	4
Hospitals	1	0	0	0
Police Stations	5	0	1	1
Schools	50	2	1	3

Source: HAZUS analysis

equipment etc.), the type of debris (construction/demolition, electronic, hazardous waste, mud/sand, vehicles, infectious waste etc.), where it is located, and how difficult it is to access. Debris generation, and thus cost, is estimated to be greatest in the larger municipalities of Torrington, Winchester, and Litchfield. Results for each town are found in Table III.9.

Towns with larger areas of flooded and developed land observed greater amounts of damage during simulations, as expected. For example, while more land would be flooded in Goshen, more damage would occur in New Hartford, where a greater percentage of the flooded land is developed.

Flooding also takes a toll on the human population. In a 1% annual event, an estimated 3,696 people, or 1,232 households, will be displaced in the region. Short term sheltering needs (extending beyond the immediate disaster) will be necessary for 1,688 people. Results for each town can be seen in Table III.9.

Table III.9: Debris generation and cost by town for a 1% flood event

Towns	Total debris (tons)
Barkhamsted	4219
Colebrook	1597
Goshen	1307
Hartland	395
Harwinton	2106
Litchfield	6571
Morris	808
New Hartford	4136
Norfolk	1231
Torrington	18593
Winchester	7232
Region	*48196*

Probability

It is highly likely that flooding of some magnitude will occur during a given year. Urban flooding, which occurs as a result of heavy rain that cannot be absorbed into the ground due to impervious surfaces, occurs more frequently than riverine flooding. Localized flooding, therefore, is more likely to occur in urbanized areas of the region, specifically Torrington and Winchester. More severe floods, which are generally riverine and occur due to sever rain that causes rivers to overflow, are highly unlikely and are expected to occur only once every twenty-five years or more.

Level of Concern

Floods have been identified as a major concern. While flooding in the Litchfield Hills Region is not as severe as it is in the coastal areas of Connecticut, past floods have caused high levels of damage. They also occur relatively frequently, especially in the more urbanized parts of the region, such as Torrington and Winchester.

B. Hurricanes

Hurricanes are large tropical storms characterized by winds in excess of 74 miles per hour. The Saffir-Simpson hurricane scale is used to measure a hurricane's intensity at a given time based on a 1-5 rating. For example, a category one hurricane is characterized by having winds of 74-95 mph with storm surges generally 4-5 feet above normal. A category five hurricane has winds greater than 155 mph with storm surges generally greater than 18 feet above normal. The scale is useful in estimating the potential property damage and flooding that may be expected from a hurricane.

Past occurrences

Hurricanes occur less frequently than other types of disasters, but previous events have caused heavy and widespread damage. Recorded hurricanes occurred in 1938, 1944, 1954, 1955, 1985, 1991, 1999 (Hurricane Floyd), 2011 (Irene), and 2013 (Sandy, though no longer a hurricane when it hit Connecticut). Hurricanes "Connie" and Diane" were responsible for the torrential rains that the Litchfield Hills region experienced in 1955 resulting in the infamous Flood of 1955. While the CT River valley and coastal areas are more vulnerable to hurricanes, damage from hurricanes is frequently experienced in all sections of Connecticut, including the Litchfield Hills.

Extent

In general, municipalities with greater levels of development are more at risk of damage caused by a hurricane (or any high wind event). See Figure III.9 below for a map of developed areas in the Litchfield Hills region. Within a municipality, areas most vulnerable to hurricanes are those with houses built before 1990 and the latest BOCA building codes, mobile home parks, seasonal structures without foundations, poorly constructed signs, and areas with unsecured structures or trees. According to DEEP, Connecticut will have increased vulnerability to hurricanes in the future due to global warming trends, increases in population, and increased dependence of the Internet and mobile communications for commerce and day to day living. The disruptions caused by power outages and damaged communication lines have a greater impact on workplace productivity and everyday living than they did years ago.

Table III.10: Displaced population and shelter needs by town (1% flood event)

Towns	Displaced people	Displaced households	Short-term shelter needs
Barkhamsted	163	54	51
Colebrook	80	27	1
Goshen	97	32	8
Hartland	23	8	0
Harwinton	105	35	7
Litchfield	331	110	53
Morris	52	17	1
New Hartford	550	183	331
Norfolk	55	18	1
Torrington	1589	530	837
Winchester	651	217	398
Region	*3696*	*1232*	*1688*

Impacts

As noted below, one of the biggest impacts from hurricanes in the Litchfield Hills region is flooding. Because of this, areas adjacent to rivers are vulnerable to flooding caused by hurricanes. See the section above on flooding for a discussion of vulnerability. As noted in that section, all of the region's repetitive loss properties are located in just four towns: Litchfield, Morris, New Hartford, and Torrington.

Hurricanes produce dangerous winds and torrential rain, which can lead to flooding, property damage, and loss of life. According to the 2014 Connecticut Natural Hazards Mitigation Plan Update, "Hurricanes have the greatest destructive potential of all natural disasters in Connecticut. A moderate Category 2 hurricane can be expected to make landfall in Connecticut once every ten years". The Atlantic hurricane season begins

on June 1st and ends on December 1st each year. The most intense hurricane to strike Connecticut occurred on September 21, 1938. According to the 2014 Connecticut Natural Hazards Mitigation Plan Update, "Flooding, 130 mph hurricane force winds and a coastal storm surge up to 12 feet high combined to cause the greatest disaster (in terms of lives lost) in the State's history. The damages in Connecticut were estimated to be $53 million and 125 lives were lost in Connecticut.

The following is brief description of how Hurricane/Tropical Storm Irene impacted the region as reported on NOAA's Storm Events webpage.

> *August 28, 2011. The greatest impact from Irene across Litchfield County was due to heavy to extreme rainfall, which resulted in widespread flash flooding. Rainfall amounts generally averaged 5 to 10 inches. Much of the rain which fell occurred within a 12 hour period, beginning early Sunday morning, and ending Sunday evening. This heavy to extreme rainfall resulted in widespread flash flooding and river flooding across Litchfield County. Numerous road closures were reported due to flooding and downed trees and power lines, along with some evacuations. In addition, moderate flooding was reported on the Housatonic River at Falls Village and at Gaylordsville. The Gaylordsville gage was damaged by flood waters .Strong winds also occurred across Litchfield County, with frequent wind gusts of 35 to 55 mph, along with locally stronger wind gusts exceeding 60 mph. The strongest winds occurred from the north to northeast during the morning hours, then from the west to northwest during Sunday evening. The combination of strong winds, and extremely saturated soil led to numerous downed trees and power lines across the region. This also resulted in widespread long duration power outages. In particular, the approximate number of customers affected by power outages included: Litchfield County, 25000.On September 2nd, 2011 a Major Disaster Declaration was declared, FEMA-4023-DR.*

HAZUS-MH Hurricane Results

Hurricane simulations were performed for probabilistic 1% & 5% annual hurricane events as well as the historic 1938 Hurricane, the latter representing a worst case scenario storm and the impacts it would have if a similar hurricane occurred today. The 1938 hurricane has less than a 0.2% chance to occur in any given year. A summary of damage for the entire region under each of the three scenarios is shows in Table III.11. As can be seen in the table, the 1938 Hurricane scenario is estimated to cause significantly more damage than either the 1% or 5% scenarios. As Litchfield County is located far north of Connecticut's coastline, only the most intense events (such as a 1% annual event or an event similar to the 1938 hurricane) are expected to cause significant damage.

The storm tracks for the three hurricane simulations are shown on Figure III.5. The damage totals increase dramatically with increasingly intense hurricane scenarios as seen in Table III.11.

In the 1938 Hurricane scenario, HAZUS estimated $121 million of damage with 6,736 buildings suffering at least minor damage. A total of 17 buildings were completely destroyed. The hurricane scenario assumed sustained winds of 85 mph and a max wind gust of 105mph. In this scenario, 95 households would be displaced. As observed from Table III.11 much of this damage is done to residential buildings. The 1938 hurricane is also predicted to generate 273,164 tons of debris. Table III.12 shows damage totals (in thousands of dollars) by occupancy type by town.

Table III.11: Loss summaries for 5%, 1%, and 1938 hurricane simulations				
Hurricane Simulation	Total Loss	Buildings with at least minor damage	Buildings completely damaged	Debris in Tons
5% Annual Hurricane	$267,030	20	0	3,407
1% Annual Hurricane	$20,112,106	86	0	81,190
1938 Hurricane	$121,183,919	6,736	17	273,164

Source: HAZUS analysis

In the 1% annual hurricane scenario, the damage total came to $20 million. This is 6 times less than the 1938 hurricane scenario. Only 86 buildings received at least minor damage with no buildings being completely damaged. Debris totals were a third of the 1938 Hurricane scenario. Maximum wind gusts reach 85mph. Damage breakdowns for each town for each scenario are shown in the tables below.

The 5% annual hurricane scenario has a total economic impact of $0.26 million, this is eighty times less damage than what is observed in the 1% annual hurricane scenario. Twenty buildings observed minor damage and only 3,407 tons of debris is generated. Maximum wind gusts reach 54mph in this scenario. The majority of damage is expected to occur to residential buildings. This scenario, which features a more frequently occurring, and less intense hurricane, is expected to cause little damage in Litchfield County, far north of the Connecticut coast. Damage breakdowns for each town are shown in Table III.13.

As with flooding, a hurricane is anticipated to generate a significant amount of debris. Table III.15 below shows debris totals for each of the simulations. HAZUS estimates that an event similar to the 1938 hurricane would generate 273,164 tons of debris. The majority would be from downed trees and tree limbs. A 1% event would result in 81,190 tons of debris and a 5% event would result in 3,407 tons of debris. In all scenarios, the majority of debris is from trees. The only significant accumulations of non-tree debris are expected to occur in Torrington and Winchester.

Probability

Hurricanes occur relatively frequently in Connecticut, though few make it to the Litchfield Hills Region with enough energy to cause significant damage. Each category of hurricane has a different “return period”, which is the number of years that are predicted to pass between occurrences. According to the 2014 Connecticut Hazard Mitigation Plan, the weakest hurricanes, or category 1, the return period is fifteen years. For category 2 hurricanes, the period is 23 to 36 years. For category 3 hurricanes, the period is 46 to 74 years.

Recent experience indicates that return periods may be shortening as storms increase in power. For example, in 2008, the Northeast Regional Climate Center analyzed climatological records and found that since the 1960s rainfall from extreme storms had increased in Connecticut by 15-25%. They note that storms that had been considered to be “100 year events” should now be considered “50 year events”. This means that it is highly probable that the region will be experiencing impacts for more hurricanes in the future.

Level of Concern

Connecticut's Natural Hazard Mitigation Plan (2014 Update) notes that hurricanes are the natural hazard with the most potential for destructive impacts in Connecticut. Given this, and the region's past experience (both historic and more recent), we must conclude that hurricanes are a major concern for the region. While hurricanes do not typically impact the region to the same magnitude as they do in the state's coastal counties, increased precipitation and storm intensity are likely to cause greater impacts in the region.

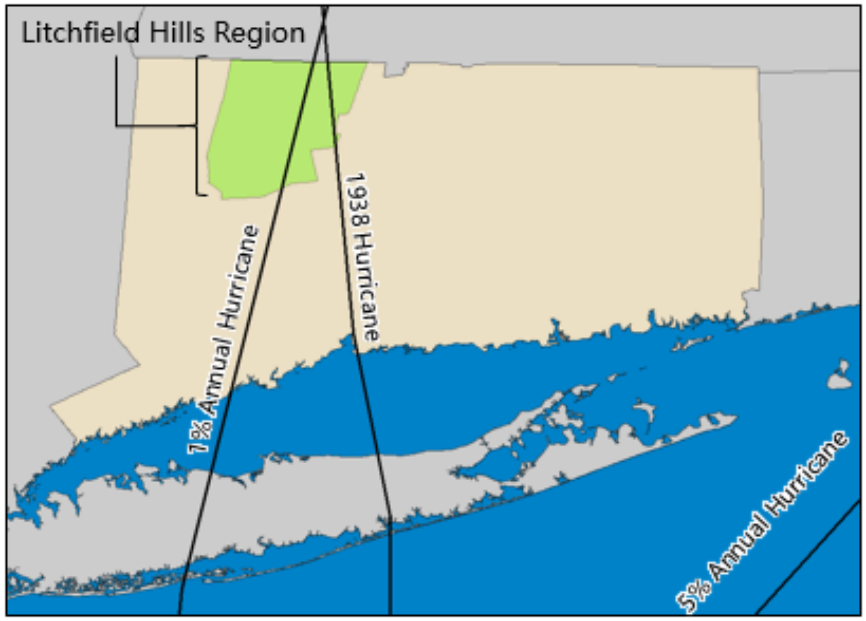

Figure III.5: Storm tracks for the three simulated hurricanes

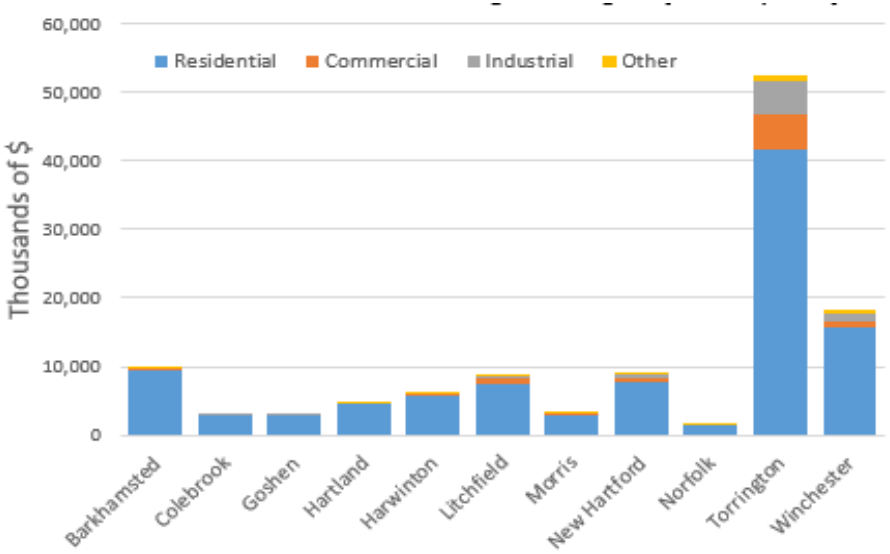

Figure III.6: 1938 Hurricane building damage by occupancy

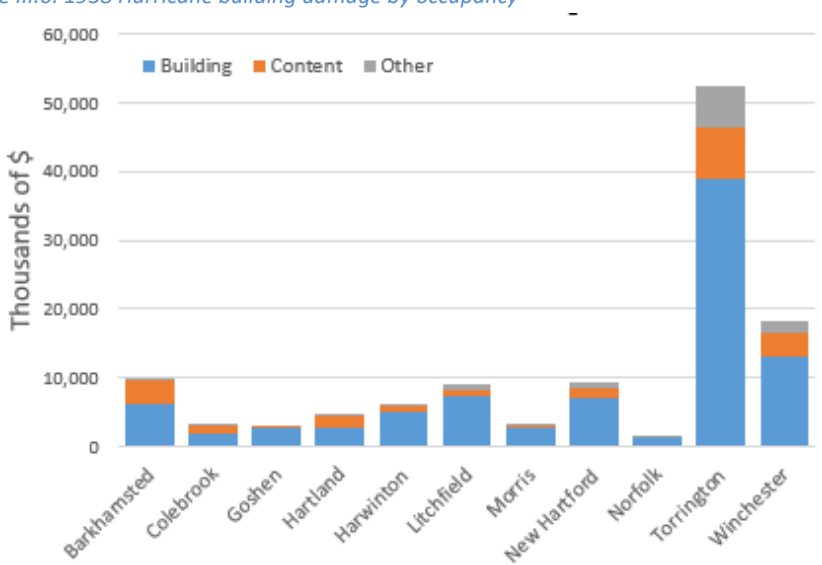

Figure III.7: 1938 Hurricane damage by town

Table III.12: 1938 Historical Annual Hurricane Event Damage by Town by Type (thousands of dollars)								
Towns	Residential	Commercial	Industrial	Agricultural	Religious/NGO	Education	Government	Total
Barkhamsted	9,457	162	266	17	21	17	106	10,046
Colebrook	3,020	33	20	3	7	5	3	3,092
Goshen	2,927	112	34	20	20	6	56	3,176
Hartland	4,488	105	43	9	20	10	5	4,680
Harwinton	5,725	276	119	77	76	23	18	6,315
Litchfield	7,550	677	378	72	106	168	61	9,012
Morris	2,958	175	86	27	13	2	10	3,271
New Hartford	7,750	589	606	63	84	23	112	9,228
Norfolk	1,411	98	26	10	17	10	43	1,615
Torrington	41,697	4,955	5,026	82	359	127	225	52,471
Winchester	15,712	829	1,163	36	101	303	135	18,279
Region	*102,695*	*8,012*	*7,768*	*417*	*824*	*695*	*772*	*121,184*

Source: HAZUS analysis

Table III.13: 1% Annual Hurricane Event Damage by Town by Building Type								
Towns	Residential	Commercial	Industrial	Agricultural	Religious/NGO	Education	Government	Total
Barkhamsted	2,843	13	16	1	1	1	2	2,878
Colebrook	734	2	1	0	0	0	0	737
Goshen	511	6	2	1	1	0	1	522
Hartland	1,397	10	4	1	2	1	0	1,413
Harwinton	1,159	16	6	3	3	1	0	1,190
Litchfield	1,460	42	23	2	5	10	2	1,543
Morris	542	8	4	1	1	0	0	555
New Hartford	1,621	40	30	3	5	2	2	1,703
Norfolk	207	4	1	0	0	0	0	214
Torrington	6,242	208	154	2	15	5	4	6,630
Winchester	2,651	29	32	1	3	11	1	2,727
Region	*19,366*	*378*	*273*	*15*	*35*	*32*	*12*	*20,112*

Source: HAZUS analysis

Table III.14 5% Annual Hurricane Event Damage by Town by Building Type								
Towns	Residential	Commercial	Industrial	Agricultural	Religious/NGO	Education	Government	Total
Barkhamsted	99	0	0	0	0	0	0	99
Colebrook	42	0	0	0	0	0	0	42
Goshen	0	0	0	0	0	0	0	0
Hartland	53	0	0	0	0	0	0	53
Harwinton	0	0	0	0	0	0	0	0
Litchfield	0	0	0	0	0	0	0	0
Morris	0	0	0	0	0	0	0	0
New Hartford	0	0	0	0	0	0	0	0
Norfolk	0	0	0	0	0	0	0	0
Torrington	0	0	0	0	0	0	0	0
Winchester	72	0	0	0	0	0	0	72
Region	*267*	*0*	*0*	*0*	*0*	*0*	*0*	*267*

Source: HAZUS analysis

Table III.15: Debris generated (tons) under various hurricane scenarios									
			1938			1%			5%
Towns	Tree	Bldg.	Total	Tree	Bldg.	Total	Tree	Bldg.	Total
Barkhamsted	38,444	562	39,006	18,602	102	18,704	1,240	0	1,240
Colebrook	27,338	168	27,506	5,257	17	5,274	1,051	0	1,051
Goshen	20,212	342	20,554	1,444	39	1,483	0	0	0
Hartland	33,122	243	33,365	16,561	44	16,605	1,104	0	1,104
Harwinton	19,429	708	20,137	8,504	98	8,602	0	0	0
Litchfield	24,330	1,148	25,478	5,579	153	5,732	0	0	0
Morris	7,173	411	7,584	1,196	55	1,251	0	0	0
New Hartford	25,579	1,068	26,647	13,398	173	13,571	0	0	0
Norfolk	23,715	193	23,908	1,482	18	1,500	0	0	0
Torrington	19,088	7,410	26,498	3,800	1,009	4,809	12	0	12
Winchester	20,435	2,046	22,481	3,418	241	3,659	0	0	0
Region	*258,865*	*14,299*	*273,164*	*79,241*	*1,949*	*81,190*	*3,407*	*0*	*3,407*

Source: HAZUS analysis

C. Tornados and Severe Windstorms

Tornados are violent windstorms characterized by a twisting funnel-shaped cloud. They are produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The fast moving air can quickly leave a path of destruction in its wake.

Past occurrences

Connecticut has experienced 96 tornado incidents in the period from 1950-2013, about three tornadoes every two years. Nine of these tornadoes have occurred in the Litchfield Hills Region. Most of these incidents in Connecticut have occurred in the months from April through October. Following is a brief description of one of these events, as reported on NOAA's Storm Events webpage.

June 23, 2001. A warm front, moving into Connecticut, produced a line of showers and isolated thunderstorms during the afternoon of June 23. One cell developed into a supercell which then spawned two tornados in Litchfield County. One tornado, ranked on the Fujita scale as an F2 with winds estimated between 100 and 130 mph touched down near the Torrington Middle School, over the Midget Football Field, cutting a swath two hundred yards wide and a half a mile in length. The tornado destroyed an 8,000 dollar shed that had recently been completed by the Midget Football League. The twister also demolished the bleachers and part of a roof at the Torrington Middle School. In addition, hundreds of large trees were uprooted. Powerlines were also destroyed. One person was injured when a portion of the blown off rood fell on him, resulting in bone fractures.

The deadliest tornado on record to strike Connecticut occurred August 9, 1878 in central Connecticut. Although damage along its two-mile path was limited, it left 34 persons dead and injured over 100. Another deadly tornado occurred in Connecticut on May 24, 1962, in which one person was killed and 34 injured. The 1962 tornado destroyed 70 structures and heavily damaged 175 others along its 12-mile path. Total damages exceeded $5 million (Source: CT DEEP Natural Hazard Mitigation Plan, 2004).

The most recent deadly tornado in Connecticut occurred on July 10, 1989. The tornado cut a path through Western Connecticut, from Salisbury to New Haven in less than 1 hour. Two persons were killed and 67 homes were destroyed. Damages totaled $125 million (1989) dollars, and a Presidential Disaster (FEMA-837-DR-CT) was declared.

Thunderstorms have been frequent occurrences in the Litchfield Hills region. According to the NOAA Storm Events webpage, there were 59 days which observed thunderstorm or high wind events in Litchfield Hills region since 1996, resulting in property damage of $833,500. Following are brief descriptions of some of these events, as drawn from the NOAA webpage.

August 20, 2004. Downburst resulting in four-to-five inch diameter trees down along a 1 to 1.5 mile stretch of Route 202 in Litchfield and large limbs down in Northfield.

June 9, 2004. Thunderstorms and high winds resulted in trees blown down in Goshen.

May 31, 2002. One inch hail, along with some wind damage of trees and power lines, took place in Torrington. The storm knocked out power to about 37,000 Eversource customers, 3,300 of those in the town of Litchfield.

July 21, 2010. A supercell that moved across Litchfield County and produced a tornado that made brief touchdowns in East Litchfield, Thomaston and Terryville. Hail ranging from a half an inch up to golf ball size was reported during a thunderstorm throughout the towns of Litchfield and Torrington.

November 1, 2013. A powerful storm system moved from the Great Lakes region towards southern Canada on the early morning of Friday, November 1st. As the storm's cold front moved across the region during the morning hours, a line of convective heavy rain showers and embedded thunderstorms and gusty winds accompanied the boundary. Although the extent of thunder was rather limited, the line produced damaging winds to trees and power lines across portions of Litchfield County. The threat for severe thunderstorms ended by the late morning as the front pushed east of the area. Wires were reported down in Harwinton as a result of thunderstorm winds.

Wind damage can occur not only from tornados and hurricanes, but also from other weather events such as blizzards, nor'easters, and other high wind events. According to the National Climatological Data Center, wind events with speeds in excess of 50 mph have occurred on 23 occasions in Connecticut since 1975.

Figure III.8: Storm Damage repairs in Torrington Area after Heavy Rain, Winds, and Power Outages

Extent

Identifying vulnerability within the region for tornados is difficult due to the unpredictable nature of these storm events, which can occur at any location and any time of year. It is significant to note, however, that the frequency of tornadoes is greater in the northwestern area of Connecticut than elsewhere in the state according to the DEEP. While DEEP acknowledges that tornadoes pose a real threat to public safety, their occurrence is not considered frequent enough in Connecticut to justify construction of tornado shelters. According to the DEEP, the pattern of occurrence and locations for tornadoes in Connecticut is expected to remain unchanged in the twenty-first century.

If a tornado, or any other natural disaster, were to strike the Region with the same magnitude, the loss of life and property would largely depend upon the number of people and structures in a particular area. Hence, areas with high concentrations of population and buildings have the greatest potential for loss. Torrington has by far the greatest population density in the regional area, followed by Winchester. Within both municipalities, the greatest population density is found in the developed town centers.

Impacts

Tornados and other severe wind storms cause damage in a variety of manners. They can cause blackouts, leading to disruptions in services, heating, employment, and cause the spoilage of frozen goods. They can also damage structures, either through their shear force or by propelling objects into structures.

Probability

Tornados are highly unlikely to occur in a given year. Generally, they occur roughly every 25 years. Severe thunderstorms, on the other hand, are highly likely, generally occurring at least once a year. Hurricanes that impact the Litchfield Hills region are have previously been highly unlikely to occur, but recent experience has indicated that Connecticut will continue to experience strong winds on a highly likely occurrence according to the 2014 Connecticut Natural Hazard Mitigation Plan Update.

Level of Concern

Severe windstorms are considered a major concern in the region, though tornados are not. Thunderstorms that include high winds impact much of the region and have previously caused injury and death. While tornados are not a major concern in and of themselves, as they occur infrequently and have historically caused little damage in the region,

many of the impacts and mitigation strategies that are relevant to severe windstorms are also relevant to tornados.

D. Severe Winter Storms

Major snowstorms in New England occur when a low pressure system (a warm moist mass of air spinning counterclockwise) from the south meets a mass of cold dry air swirling clockwise (a high pressure system) from the north. As the cold air meets the warm air, it slides under the warm moist air, pushing the warm air to a higher and colder altitude where it condenses to snow and falls to earth.

The region is also prone to "Nor'easters", particularly =from December to April. A nor'easter will occur when a coastal warm front from the south meets with a mass of polar air from the north. These storms may last 12-24 hours or more and drop considerable amounts of snow. The Northeaster derives its name from the strong northeast winds that are characteristic during the storm. Ice storms are another major natural hazard of concern in the Litchfield Hills region, and are one of the natural hazards of greatest concern to the Connecticut Light and Power Company (a subsidiary of Eversource) that provides electric service in the regional area. There are four major substations in the region, located in the Campville section of Harwinton, Franklins Street in Torrington, South Main Street in Torrington, and Canton. Maintaining customer reliability is one of the top priorities of Eversource, and significant efforts have been made to build redundancy into the electrical network to minimize power outages. In addition, routine trimming of vegetation along power lines, and annual infra-red inspections of lines to identify incipient locations of line failure, help to maintain the system in operation. Despite these mitigating measures, according to Eversource's "Emergency Plan Operating Procedure", "Severe weather, such as storms, ice, heavy snow, or high winds, or other abnormal events can cause extensive damage to the NU distribution lines and equipment causing wide spread power outages."

Ice storms occur when warm air overrides cold air (below 32 F or colder) at the surface during a winter storm. The warmer air typically above 1,000 feet changes the precipitation to rain. However, the rain freezes on contact when it reaches the ground because the surfaces are below freezing. Ice storms occur every year in Connecticut. Major ice storms are rarer because they require three factors: 1) temperatures well below freezing (28 F or colder), 2) cold temperatures for an extended duration (over 12 hours), and 3) greater than ½ inch of rain.

Ice jams are another concern with winter in the Litchfield Hills region, as discussed above under the "flooding" section of this chapter. While there are no rivers in the Litchfield Hills region that are highly susceptible to ice jams according to the DEEP, it is still an area of concern, since the possibility exists for ice jams to occur, on the rivers within the Litchfield Hills region.

Table III.16: Miles of local roads

Town	Miles of local roads
Barkhamsted	65.35
Colebrook	36.97
Goshen	68.49
Hartland	44.31
Harwinton	69.39
Litchfield	129.72
Morris	38.86
New Hartford	96.63
Norfolk	59.80
Torrington	189.76
Winchester	92.22
Region	891.47

Source: CTDOT

Past occurrences

Severe winter storms are frequent events in the regional area, and can cause significant damage. While area towns and utility companies are well equipped to handle smaller scale winter storms, major ice storms and snowstorms have caused millions of dollars of damage in the regional area in recent years. Severe winter storms, with over a foot of

snowfall, or ice storms have occurred in 1973, 1978, 1988, 1992, 1996, 2001, 2003, 2005, 2006, 2010, 2011, 2012, and 2013. A listing of recent disaster or emergency declaration requests for Litchfield County, many resulting from severe snow storms or ice storms, is presented in Table III.22.

Extent

All towns in the region consider winter storms one of the natural hazards of greatest concern for emergency management. Impacts tend to be felt throughout the region, though, as with most events, impacts are greatest in urbanized areas (Torrington and Winchester) where there are more roads, more people, and more infrastructure. Figure III.5 above shows the areas of the region that are developed and are thus susceptible to damage from ice and snow accumulation. These areas are also where the greatest number of people and jobs are, and thus where the greatest potential for disruptions exist. Table III.16 shows the number of miles of local roads in a given town. Torrington and Litchfield have the most extensive local road systems, and thus the greatest potential for high snow removal costs. Figure III.10 shows the local and state road systems in the region.

Impacts

Adverse impacts include the loss of electrical power and heat, isolation of houses within rural areas from emergency services, downed electric wires and tree limbs, and highway safety. Property damage from winter storms can also occur from frozen water pipes, and falling trees and limbs from snow and ice accumulation and high winds.

These major winter storms can be as intense as a Category II hurricane, both in their low central pressure and the flooding they cause. These storms have claimed nearly a dozen lives during the past 25 years, and injured dozens of persons while causing millions of dollars in damages. The winter storm of 1996 brought up to 27 inches of snow to Connecticut and forced the state to shut down for 24 hours. In terms of snowfall, this was the largest winter storm on the U.S. East Coast since 1888 according to the DEEP Natural Hazards Mitigation Plan. The winter storm of 2003 was a very slow moving low-pressure system that dropped up to 3 feet of snow from Washington to Boston and shut down most air travel for 24-36 hours. Meteorologists recorded 22 inches of snow in Litchfield from this storm during a 24-hour period, 17 inches in Torrington, and 15 inches in Winchester, making it one of the worst storms in 20 years. More recently, the blizzard of 2013 dropped 28 inches of snow in Torrington. That storm shutdown much of the state, forcing people to miss work and preventing them from reaching stores and essential services.

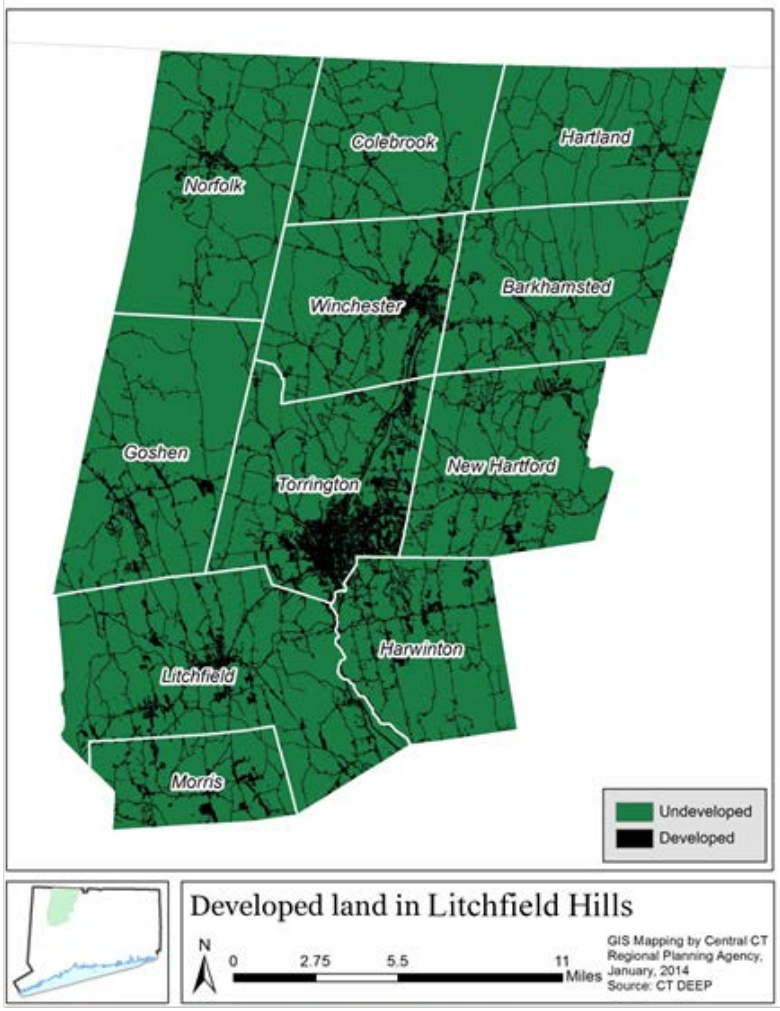

Figure III.9: Developed land in the Litchfield Hills Region

Ice storms can cause comparable levels of damage. Litchfield Hills Connecticut's most severe ice storm occurred on December 18, 1973. This ice storm, dubbed "Felix", resulted in two deaths caused widespread power outages that lasted several days. More recently a significant ice storm hit the Litchfield Hills region in November 2002, which resulted in downed power lines, extensive tree damage, and expensive clean-up costs. The 2002 ice storm resulted in 98% of the City of Torrington without power, approximately 61 road closures, opening of emergency shelters, and deployment of the National Guard. Total costs to the City of Torrington alone totaled nearly $400,000 according to City records.

Even greater impacts have been felt in nearby areas. In January 1998, Connecticut narrowly missed the worst ice storm ever recorded in New England. A slow moving low pressure system pushed into cold air over Northern New England on January 7. Freezing rain developed and continued for 4 days. Damage was catastrophic in upstate New York, Vermont, New Hampshire, Maine and Southeastern Canada. Eleven persons were killed in Canada. Ice coated power lines and trees to a thickness of 4 inches in some areas resulting in total destruction of power lines and forests. Even heavy duty steel transmission towers were crushed under the weight of the ice on the power lines. This was widely considered to be a once in a thousand year event. An ice storm of the magnitude of the 1998 Northern New England storm is not considered possible in Southern New England due to the proximity of the warmer waters of Long Island Sound and the Atlantic Ocean.

Probability

A severe winter storm is highly likely to occur in a given year. Nor'easters are less common, but are likely to occur once every five years. The likelihood of these events occurring has increased, and is going to continue to increase during the next 20 years due to the growing population, increased urbanization, the dependence on power and communication equipment, and the heavy dependence on the roadway network. The vulnerability to these storms is not easily mitigated, but improved communication back-up systems, increased state aid for local road maintenance, and effective tree trimming programs along roadways can help.

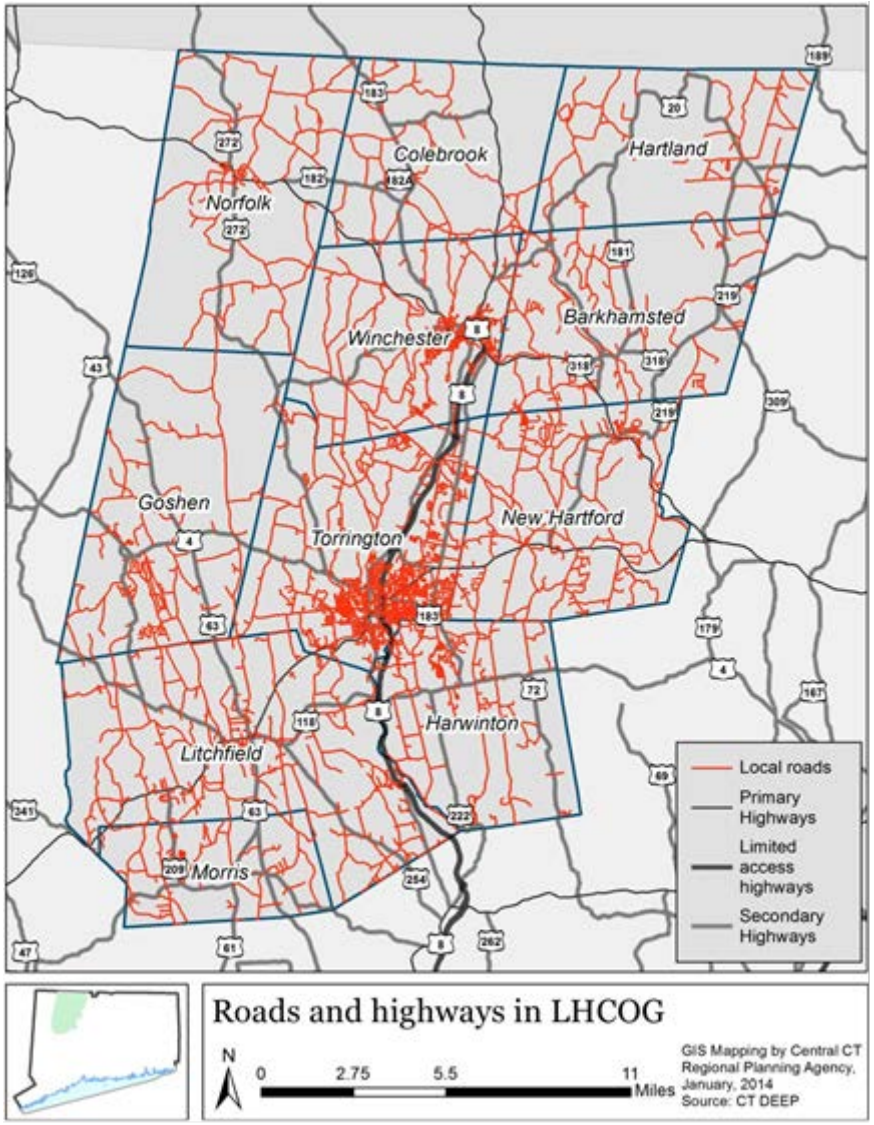

Figure III.10: Local roads in the Litchfield Hills Region

Level of Concern

Severe winter storms are included as hazards of major concern. While they generally do not cause severe property damage, the slick road conditions they can create, and the cold weather, have led to loss of life and injury. Unlike most natural hazards in the region, they occur every year and impact the entire region relatively uniformly. They are also significant strains on municipal budgets due to the necessity of clearing roads of ice and snow.

Figure III.11: Snowy roadway in New Hartford

E. Drought

According to DEEP's Natural Hazard Mitigation Plan, there are four basic approaches to measuring drought: meteorological, agricultural, hydrological, and socioeconomic. The first three approaches deal with ways to measure drought as a physical phenomenon. The last deals with drought in terms of supply and demand, tracking the effects of water shortfall as

it ripples through socioeconomic systems. Each of the four basic categories of drought is discussed below.

Meteorological drought is usually an expression of precipitation's departure from normal over some period of time. These definitions are usually region-specific, and are the first indicators of drought. In Connecticut basic measures of meteorological drought include precipitation deficits and the Palmer drought severity index.

Agricultural drought occurs when there isn't enough soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought happens after meteorological drought but before hydrological drought. Agriculture is usually the first economic sector to be affected by drought. The key to agricultural drought is not only its severity but also its timing. In Connecticut, agricultural droughts tend to be most serious when the plants are forming or filling their seeds, generally in mid-summer.

Hydrological drought refers to deficiencies in surface and ground water supplies. It is measured as streamflow and as lake, reservoir, and groundwater levels. There is a time lag between lack of rain and less water in streams, rivers, lakes, and reservoirs, so hydrological measurements are not the earliest indicators of drought. When precipitation is reduced or deficient over an extended period of time, this shortage will be reflected in declining surface and subsurface water levels.

Although climate is a primary contributor to hydrological drought, other factors such as changes in land use (e.g., deforestation), land degradation, and the construction of dams all affect the hydrological characteristics of a basin. Land use change is one of the ways human actions alter the frequency of water shortage even when no change in the frequency of meteorological drought has been observed. For instance as the degree of imperviousness increases due to development, recharge of groundwater is lessened and low-flows in streams which depend upon this groundwater infiltration are reduced.

Past occurrences

The Litchfield Hills Region enjoys relatively abundant precipitation, ranging from about 48 to 52 inches per year according to the DEEP. Droughts have occurred periodically in Connecticut, most recently during 1957, 1964-1968, 1981, 1987, 1988, 1998, 1999, 2002, and 2012. The Litchfield Hills Region is vulnerable to drought because a large number of its residences and businesses rely upon wells as a source of potable water supply. Agriculture use is an important sector of the economy in the Litchfield Hills, and agriculture is often the hardest hit business sector during a drought.

While the agricultural drought of 1957 was the most disastrous to the State's agricultural interests it was also a severe meteorological drought for small reservoirs in the State. Other meteorological droughts of June 1929 through July 1932 and the mid 60's were also very serious. Connecticut experienced its drought of record during the 1960's. This drought severely restricted the ability of a number of water utilities throughout the State to continue to provide unlimited service to their customers. The forecasting of long-term (over 10 years in duration) droughts is still in the research phase and is not reliable. Short term (1 - 3 years) drought forecasts rely on such factors as El Nino and La Nina, although these forecasts are not entirely reliable either. Droughts with 1 - 3 year durations occurred four times during the 20th century in Connecticut and this seems likely for the 21st century.

Extent

As discussed below, different kinds of drought will impact different parts of the region, but they are all vulnerable. Agricultural drought is most likely to affect rural towns with large agricultural sectors. Figure II.1 on above shows land development throughout the region and indicates where concentrations of agricultural land are. The agricultural sector is generally the first to feel the impacts, but an extended event (lasting longer than three to six months) will begin to affect other areas of the region. As the drought period lengthens, ground water supplies begin to dry up, which will impact residential areas of the region. Finally, an extended drought will deplete supplies in reservoirs and other surface water sources, which will extend the area of impact into the urban areas of Torrington and Winchester.

Impacts

Droughts can vary widely in duration, severity and local impact. Unlike many other natural hazards, droughts rarely pose an immediate threat to life and property. Nevertheless, droughts can cause significant economic hardship through failed crops, adverse impacts on water dependent businesses, increased risk of forest fires, and public health concerns if ground water quality degrades or becomes unavailable for residents using wells.

The sequence of impacts associated with meteorological, agricultural, and hydrological drought further emphasizes their differences. When drought begins, the agricultural sector is usually the first to be affected because of its heavy dependence on stored soil water. Soil water can be rapidly depleted during extended dry periods. If precipitation deficiencies continue, then people dependent on other sources of water will begin to feel the effects of the shortage. Those who rely on surface water (i.e., reservoirs and lakes) and subsurface water (i.e., ground water), for example, are usually the last to be affected. A short-term drought that persists for 3 to 6 months may have little impact on these sectors, depending on the characteristics of the hydrologic system and water use requirements.

When precipitation returns to normal and meteorological drought conditions have abated, the sequence is repeated for the recovery of surface and subsurface water supplies. Soil water reserves are replenished first, followed by streamflow, reservoirs and lakes, and ground water. Drought impacts may diminish rapidly in the agricultural sector because of its reliance on soil water, but linger for months or even years in other sectors dependent on stored surface or subsurface supplies. Ground water users, often the last to be affected by drought during its onset, may be last to experience a return to normal water levels. The length of the recovery period is a function of the intensity of the drought, its duration, and the quantity of precipitation received as the episode terminates.

Socioeconomic drought refers to the situation when water shortages begin to effect people and their lives. It associates economic good with the elements of meteorological, agricultural, and hydrological drought. For example, when a hydrological drought requires use restriction or prohibition against non-essential uses, some businesses may be adversely affected. Some economic goods such as hydropower are dependent upon the weather and resultant stream flow. Due to variations in climate, some years have high supplies of water, but other years the supply is very low. A socioeconomic drought takes place when the supply of an economic good cannot meet the demand for that production, and the cause of this shortfall is weather related (water supply).

Probability

A drought is unlikely to occur in a given year due to Connecticut's abundance of rainy days. On average, a drought will occur every seven years, generally impacting the agricultural sector. Severe droughts (lasting more than a year) are highly unlikely events, occurring only once every 25 years.

Level of Concern

Droughts are not included as hazards of major concern. The region enjoys a healthy amount of rain fall and, while droughts do occur, they are of limited duration. Unlike the arid western states, the Litchfield Hills Region does not experience prolonged droughts that threaten major crops. The vast majority of the region also relies on ground water, not surface water, lowering the probability of major impacts.

F. Forest Fires

A forest fire is an uncontrolled fire occurring in a wooded area. Forest fires can occur as a result of lightning strikes, accidents, arson, and other natural occurrences. As a forest fire spreads, it may transition from forest land to populated rural areas and ultimately to heavily settled areas.

Connecticut's system of programs and policies for the control of forest fires has been evolving over the past 100 years. The State has created a Forest Fire Warden system, established a network of fire lookout towers, instituted a system regulating open burning, and established forest fire patrols. Connecticut also is a member of a regional mutual aid organization for forest fire protection known as the Northeastern Interstate Forest Fire Protection Compact. As discussed in the CT Natural Hazard Mit-

igation Plan, the technology of forest fire fighting and the capabilities of firefighting equipment have changed dramatically over the years. Advances in gear, equipment, training, and technology have progressed. For instance, the use of radio and cell phone communication has greatly improved firefighting command capabilities.

Figure III.12: Brush fire in Norfolk

Past occurrences

The National Interagency Coordination Center, based out of Idaho, maintains a database of fire incidents. This system has historical records dating back to 2002. According to those records, wildland fires generally consume around 250 acres of land in Connecticut on an annual basis. Connecticut does experience occasional years with heavy forest fire activity, such as 2008 when 893 acres burned. Annually, less than three one hundredths of a percent of the total forested acreage in Connecticut is burned. Connecticut forest fire experience indicates that fires are small and detected early. During the last ten years only one forest fire occurred of slightly greater than 300 acres. The vast majority of wildfires are less than 10 acres in size. Arson is the number one known cause of forest fires. Almost one-half of all forest fires are intentionally set.

During the past ten years, the worst forest fire year in terms of both number of fires and total acreage burned occurred during 1999, which was the fourth hottest year of the past 100 years. One thousand seven hundred and thirty three (1733) acres burned and over 345 separate fires marked this hot and dry summer of 1999. This again points to the small and contained nature of most forest fires in Connecticut. The annual acreage of forests lost through wildfires has been declining dramatically over the past generation. Societal changes are leading to less backyard debris burning, and less uncontrolled or unsupervised interaction with forests and the natural environment as a whole. Statistics indicate that while Connecticut has an increasing urban/wildfire interface, there is not a large resultant forest fire problem.

Connecticut traditionally experiences high forest fire danger in the spring from mid-March through May. DEEP's Division of Forestry continually monitors the danger of forest fire to help protect Connecticut's 1.8 million acres of forestland. Throughout the spring forest fire season, DEEP sends daily advisories on forest fire danger levels to DEEP's state park forest field staff, municipalities, fire departments and the media. Forest fire danger levels are classified as low, moderate, high, very high or extreme.

The DEEP Forestry Division is now utilizing precipitation and soil moisture data provided through the Connecticut Automated Flood Warning System to compile forest fire probability forecasts during the spring fire season. This allows the Division to watch only the driest areas and has resulted in a reduction of both costs (measured in the thousands of dollars) and risk.

Extent

While the regional area is not considered at high risk for forest fires, incidents have occurred within area towns that generate concern. As described above, the Litchfield Hills region is characterized by extensive areas of State Park and Forest Land. During periods of drought, these areas become particularly vulnerable to fire hazard. The limited access to portions of this land exacerbates the forest fire hazard. Those com-

munities with the most State Park and Forest Land, and thus having increased vulnerability to forest fire hazards, include Barkhamsted, Colebrook, and Hartland. Figure II.1 shows land development throughout the region and indicates where concentrations of forest land are. As discussed below, the greatest impacts would be felt in areas where developed land abuts forest land.

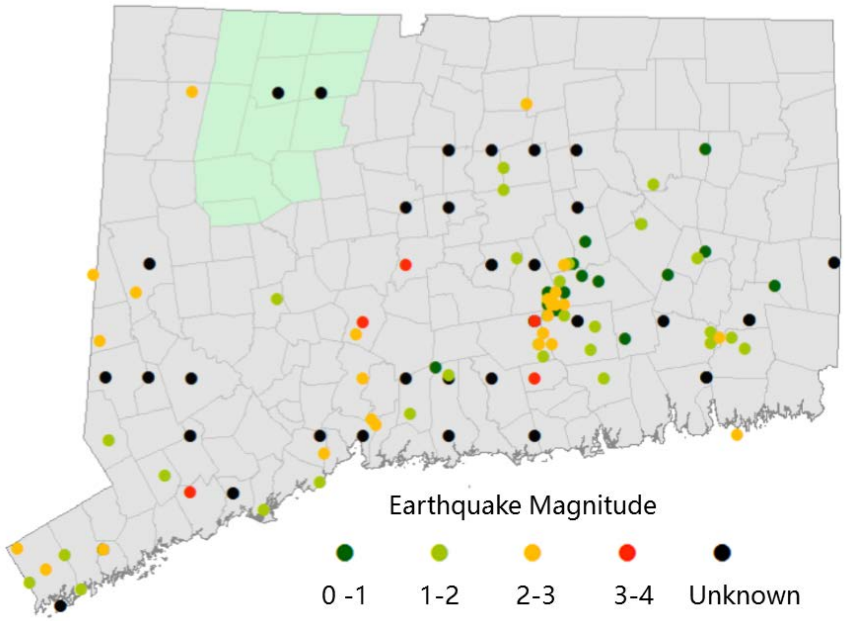

Figure III.13: Earthquake epicenters in Connecticut since 1678

As more farmland in Connecticut reverts back to forest and as the existing forests continue to age, tree density and fire danger will continue to slowly increase. The problem of the urban/forest interface is also present, although not to the degree that it exists in Western States. The urban/forest interface (homes and buildings constructed in and on the borders of forests) is muted somewhat in Connecticut by the large number of lakes and streams and roads which provide natural fire breaks.

Impacts

Forest fires cause significant damage to one of the region's greatest resources: the natural environment. Much of the region's attraction lies in its natural beauty, which a large-scale forest fire could detract from. Forest fires can also spread to agricultural land, damaging crops, and settled areas, threatening homes and businesses. Connecticut, and Litchfield Hills, have been fortunate in this regard as forest fires have been put out before they threaten settled areas. As urbanization increases, the threat to human populations will also increase.

Probability

A forest fire is unlikely to occur in a given year in this region. A forest fire that negatively impacts human settlements is highly unlikely to occur. As noted above, only one forest fire that consumed more than 300 acres has occurred during the last ten years. Small forest fires occur every year in Connecticut, but they are of limited extent.

Level of Concern

Wild fires are not included as hazards of major concern. While they are relatively high-frequency events (occurring every year), they have a limited geographic scope. Generally, the forest fires that occur in the Litchfield Hills Region are small-scale forest fires that are quickly put out. They have not caused any significant damage or loss of life in this region. Due to the low levels of urbanization (wild fires are most dangerous in the transition zone between urbanization and forest land) they are unlikely to as well.

G. Earthquakes

Earthquakes are caused by the shifting of sections of the Earth's crust along faults, which are fractures that break up large sections of bedrock into separate units. There are many more inactive faults than active ones. Most of the faults in Connecticut were made millions and millions of years ago. Connecticut is considered to be a moderate seismic risk as defined by the Federal Emergency Management Agency. However, the term, "moderate" relates to the fact that earthquakes in the State have a relatively long reoccurrence interval and not that the earthquake magnitudes or impact on the population is necessarily moderate.

The magnitude of an earthquake is a measure of the amount of energy

released. Each earthquake has a unique magnitude assigned to it. This is based on the amplitude of seismic waves measured at a number of seismograph sites, after being corrected for distance from the earthquake. The Richter scale is used to measure earthquake magnitude and has a scale of 1-10. The intensity of an earthquake varies greatly from site to site depending on the distance from the earthquake epicenter, ground conditions, and other factors.

Past occurrences

According to Weston Observatory at Boston College a total of 151 recorded earthquakes in Connecticut occurred from 1678 – 2013.The earthquakes in Connecticut have occurred in all parts of the State with some local clustering in the central and coastal parts of the State as seen in Figure III.13. The most severe earthquakes to occur in Connecticut (including aftershocks) were found to be of intensity 5.0 on the Richter scale. Connecticut experiences a magnitude 4.0 or greater earthquake once every 25 years on average. The chances of an earthquake greater than a 6.0 magnitude occurring in Connecticut are once in every 300 years. Figure III.13 shows the epicenters of past earthquakes in Connecticut.

Earthquakes originating in other areas can also impact the Regional area. Due to the interconnectivity of bedrock, a moderate quake originating in Quebec or Nova Scotia could be felt in Connecticut in less than 10 minutes. Earthquake epicenters in northern New York and other New England states have recently been felt in Connecticut.

Extent

Many of the structures in the region date back to colonial days, and consist of old, non-reinforced masonry. These structures are particularly vulnerable to earthquakes, although they have obviously held up well over the years. There is also vulnerability associated with the numerous dams with in the region, particularly the older masonry and earth dams. While they too have generally maintained their integrity during previously occurring earthquakes, the vulnerability of these dams in the event of a larger earthquake is an area of concern.

There is somewhat less concern with the vulnerability of modern-day structures since Connecticut updated its building codes to include the new BOCA codes for seismic activity in 1992.

Impacts

According to the DEEP's Natural Hazard Mitigation Plan, the USGS has determined that Connecticut has a 1 in 10 chance that at some point during a 50-year period an earthquake would cause ground shaking of 4 to 8 percent of the force of gravity. This amount of shaking may cause minor damage resulting from items falling from shelves and very minor damage to buildings (broken windows, doors jamming shut).

If the state should be struck by a 5.0 quake, it is assumed the damage caused would be similar to the 5.1 quake that occurred in upstate New York in 2002. "In upstate New York, items were tossed off shelves, plaster was cracked, windows broken and chimneys were also cracked, with a few chimneys collapsing. Landslides also occurred which closed one state road, and a power substation suffered minor damage temporarily cutting power to 3,500 customers."

HAZUS-MH Earthquake Results

Two earthquake simulations were performed for the Litchfield Hills Region: a probabilistic earthquake of magnitude 5.2 with a return period of 100 years and the same earthquake but with its epicenter located directly over the Litchfield Hills Region.

The results from the probabilistic earthquake predicted that damage was negligible with no buildings being damaged, no economic losses, no loss of life, and no debris.

This second scenario, which is a worst-case scenario, is extremely unlikely to occur but does display substantial damage to the region. A 5.2 earthquake with its epicenter centered over Litchfield Hills would impact 4,118 buildings out of approximately 35,700 buildings within the region. Of these buildings, 11.6% received moderate or worse damage. The second scenario was used to point out the significance of the location of the epicenter.

An earthquake's toll on human lives will depend on when it strikes. During the day, an estimated 88 people would either die or require medical

Table III.17: Buildings damaged in the earthquake simulation					
Moderate damage	Extensive damage	Destroyed	Total damaged	Total Buildings	% of building stock damaged
3,377	648	93	4,118	35,652	11.6

Source: HAZUS analysis

aid. At night, that number drops to 81. An estimated three people would die during a daytime event and two would die during a nighttime event. Table III.18 shows a breakdown of casualties. An earthquake would impact people in other ways as well, displacing them from their homes. Displaced homes totaled 367 with only 213 people requiring shelter services. Of the remaining households 17,911 households are without power.

Infrastructure would suffer significant damage from an earthquake as well. Total transportation damage came to $2.5 billion with 9 out of 189 bridges receiving at least moderate damage. Leaks would form in an estimated 53 waste water pipes and 106 drinking water pipes. Breaks would form in 13 and 26 of those pipes, respectively.

Total economic losses totaled $578 million. The earthquake would also generate 117,000 tons of debris, costing an estimated $7.02 million to clear.

Probability

As noted above, an earthquake that is severe enough to cause damage to buildings and their contents is highly unlikely. Small earthquakes originating outside of the region may be felt in Litchfield Hills more frequently, but will not be large enough to cause damage.

To conclude, the earthquakes felt in the Litchfield Hills region have been small events with little or no damage. As a result, the Region is considered to have a comparatively low vulnerability to earthquakes.

Table III.18: Casualties in a simulated earthquake event.					
Time	Medical Aid	Hospital treatment	Life Threatening	Death	Total
Day	69	14	2	3	88
Night	67	11	1	2	81

Source: HAZUS analysis

Level of Concern

Earthquakes are not included as a hazard of major concern. They are relatively low-frequency events with limited geographic scope. They rarely cause any significant damage or loss of life. The magnitude of earthquakes that are likely to occur in Connecticut are already mitigated by the enforcement of modern building codes.

Table III.19: Exposure under a 1% event by town and use (thousands of dollars)								
Towns	Residential	Commercial	Industrial	Agricultural	Religious	Government	Education	Total
Barkhamsted	$263,869	$23,715	$18,285	$1,183	$2,555	$4,268	$3,183	$317,058
Colebrook	$109,116	$7,895	$3,687	$385	$1,280	$560	$1,830	$124,753
Goshen	$279,294	$29,712	$10,371	$2,732	$3,945	$4,341	$1,930	$332,325
Hartland	$135,329	$12,133	$6,242	$670	$1,939	$382	$1,511	$158,206
Harwinton	$358,781	$41,434	$15,158	$5,693	$9,542	$1,559	$4,395	$436,562
Litchfield	$623,415	$163,384	$108,331	$8,070	$18,773	$7,674	$50,606	$980,253
Morris	$197,604	$31,756	$19,367	$1,970	$2,012	$1,136	$389	$254,234
New Hartford	$429,748	$81,980	$67,278	$3,934	$9,832	$6,186	$4,040	$602,998
Norfolk	$145,061	$29,253	$10,787	$1,623	$3,527	$4,010	$3,668	$197,929
Torrington	$2,338,438	$641,670	$300,577	$5,404	$44,044	$14,141	$21,238	$3,365,512
Winchester	$752,153	$121,123	$127,754	$2,592	$13,670	$5,888	$52,543	$1,075,723
Region	*$5,632,808*	*$1,184,055*	*$687,837*	*$34,256*	*$111,119*	*$50,145*	*$145,333*	*$7,845,553*

Table III.20: Exposure in the flood area under a 1% event by town and use (thousands of dollars)								
Towns	Residential	Commercial	Industrial	Agricultural	Religious	Government	Education	Total
Barkhamsted	$266,266	$217,414	$21,026	$17,143	$1,068	$2,164	$4,268	$3,183
Colebrook	$112,503	$99,849	$6,731	$3,604	$312	$858	$560	$589
Goshen	$256,659	$209,425	$25,794	$8,567	$2,657	$3,945	$4,341	$1,930
Hartland	$126,241	$109,102	$9,850	$4,080	$456	$999	$243	$1,511
Harwinton	$288,428	$225,645	$34,459	$11,682	$5,041	$6,023	$1,559	$4,019
Litchfield	$816,863	$505,827	$130,733	$105,778	$6,960	$14,151	$5,539	$47,875
Morris	$185,979	$136,553	$26,085	$18,215	$1,815	$2,012	$1,136	$163
New Hartford	$477,635	$328,938	$74,071	$52,887	$3,759	$8,582	$6,186	$3,212
Norfolk	$146,317	$113,552	$17,325	$9,871	$1,623	$1,790	$0	$2,156
Torrington	$1,664,710	$1,085,536	$384,976	$149,886	$3,101	$22,460	$9,909	$8,842
Winchester	$608,257	$392,423	$79,595	$114,851	$1,925	$5,602	$4,040	$9,821
Region	*$4,949,858*	*$3,424,264*	*$810,645*	*$496,564*	*$28,717*	*$68,586*	*$37,781*	*$83,301*

Table III.21: Class C dams					
CT Dam #	Dam Name	Town	Downstream Water Course	Hazard Class	Owner
501	SAVILLE DAM	BARKHAMSTED	East Branch Farmington River	C	BARKHAMSTED
2912	COLEBROOK RIVER DAM	COLEBROOK	West Branch Farmington River	C	COLEBROOK
5501	NORTH POND DAM	GOSHEN	Hart Brook	C	Private
5504	WOODBRIDGE LAKE DAM	GOSHEN	Marshepaug River	C	Private
6501	HOGBACK DAM	HARTLAND	West Branch Farmington River	C	HARTLAND
6603	BRISTOL RESERVOIR DAM #5	HARWINTON	Poland River	C	HARWINTON
6604	LAKE HARWINTON DAM	HARWINTON	Catlin Brook	C	Private
8701	MORRIS RESERVOIR DAM	MORRIS	Wigwam Reservoir	C	MORRIS
8702	PITCH RESERVOIR DAM	MORRIS	Morris Reservoir	C	MORRIS
9201	NEPAUG RESERVOIR DAM	NEW HARTFORD	Nepaug River	C	NEW HARTFORD
9202	COMPENSATING RESERVOIR DAM	NEW HARTFORD	East Branch Farmington River	C	NEW HARTFORD
9807	WEST SIDE DAM #5	NORFOLK	Spaulding Brook	C	DEEP
9808	NORFOLK BROOK DAM #6	NORFOLK	Norfolk Brook	C	DEEP
9810	WOOD CREEK DAM SITE #9	NORFOLK	Wood Creek	C	DEEP
14301	HALL MEADOW BROOK DAM	TORRINGTON	West Branch Naugatuck River	C	DEEP
14302	RUBEN HART RESERVOIR DAM	TORRINGTON	Hart Brook	C	Private
14303	CRYSTAL LAKE DAM	TORRINGTON	Nickel Mine Brook	C	Private
14304	STILLWATER POND	TORRINGTON	West Branch Naugatuck River	C	DEEP
14308	BURR POND	TORRINGTON	Still River	C	DEEP
14322	EAST BRANCH DAM	TORRINGTON	East Branch Naugatuck River	C	DEEP
16201	MAD RIVER DAM	WINCHESTER	Mad River	C	DEEP
16205	PARK POND	WINCHESTER	East Branch Naugatuck River	C	DEEP
16207	HIGHLAND LAKE DAM	WINCHESTER	N/A	C	WINCHESTER
16211	SUCKER BROOK RESERVOIR DAM	WINCHESTER	N/A	C	DEEP

Source: DEEP

Table III.22: Connecticut Disaster Declarations since 1954			
Declaration Number	Declaration Date	Incident Description	Declaration Type
4106	3/21/2013	Severe Winter Storm and Snowstorm	Major Disaster Declaration
3361	2/10/2013	Severe Winter Storm	Emergency Declaration
4087	10/30/2012	Hurricane Sandy	Major Disaster Declaration
3353	10/28/2012	Hurricane Sandy	Emergency Declaration
4046	11/17/2011	Severe Storm	Major Disaster Declaration
3342	10/31/2011	Severe Storm	Emergency Declaration
4023	9/2/2011	Tropical Storm Irene	Major Disaster Declaration
3331	8/27/2011	Hurricane Irene	Emergency Declaration
1958	3/3/2011	Snowstorm	Major Disaster Declaration
1904	4/23/2010	Severe Storms and Flooding	Major Disaster Declaration
1700	5/11/2007	Severe Storms and Flooding	Major Disaster Declaration
3266	5/2/2006	Snow	Emergency Declaration
1619	12/16/2005	Severe Storms and Flooding	Major Disaster Declaration
3246	9/13/2005	Hurricane Katrina Evacuation	Emergency Declaration
3200	2/17/2005	Snow	Emergency Declaration
3192	1/15/2004	Snow	Emergency Declaration
3176	3/11/2003	Snowstorm	Emergency Declaration
1302	9/23/1999	Tropical Storm Floyd	Major Disaster Declaration
1092	1/24/1996	Blizzard	Major Disaster Declaration
3098	3/16/1993	Severe Winds and Blizzard, Record Snowfall	Emergency Declaration
972	12/17/1992	Coastal Flooding, Winter Storm	Major Disaster Declaration
916	8/30/1991	Hurricane Bob	Major Disaster Declaration
837	7/17/1989	SEVERE STORMS, TORNADOES	Major Disaster Declaration
747	10/11/1985	HURRICANE GLORIA	Major Disaster Declaration

Table III.22: Connecticut Disaster Declarations since 1954

Declaration Number	Declaration Date	Incident Description	Declaration Type
711	6/18/1984	SEVERE STORMS, FLOODING	Major Disaster Declaration
661	6/14/1982	SEVERE STORMS, FLOODING	Major Disaster Declaration
608	10/4/1979	TORNADO, SEVERE STORMS	Major Disaster Declaration
3060	2/7/1978	Blizzards and Snowstorms	Emergency Declaration
42	8/20/1955	Hurricane, Torrential Rain, Floods	Major Disaster Declaration
25	9/17/1954	HURRICANES	Major Disaster Declaration

Source: FEMA

IV. List of Potential Mitigation Measures

As discussed in the previous section, floods, high winds (such as hurricanes), and severe winter storms are the natural hazards of greatest concern in the Litchfield Hills Region. Also of some concern, but to a lesser extent, are forest fires, drought, and earthquakes. Table III.2 summarizes the frequency, potential impacts, vulnerable locations, and economic loss for each of these hazards based upon historical events, local input, and DEEP estimates as presented in the "2014 Connecticut Natural Hazards Mitigation Plan Update".

All three major natural hazards of concern, along with forest fires, have significant potential for loss of life and property damage in the Region. These events may result in road closures, power outages, business disruption, property and content damage, bodily harm and death. The region has a comparatively low vulnerability to earthquakes. Of the six natural hazards of concern in the regional area, drought has the lowest potential for loss of life and property.

The most hazard-prone areas in the Region are the flood zones. These areas are the most susceptible to loss of life and property damage from floods, nor'easters, and dam failure. The potential impact of dam failure is greatest in the dam inundation zones of the large capacity Class C dams (e.g. Goodwin Dam, Saville Dam, and Colebrook River Dam).

Economic loss is closely tied to the potential impacts of a natural disaster. Again, floods, severe winter storms, and high winds would have the most costly direct and indirect economic consequences, including repair and replacements costs, business disruption and clean-up costs. The Region's municipalities would benefit the most from mitigation strategies that address these natural hazards. The anticipated economic loss from minor earthquakes and drought, by contrast, is relatively low in the regional area.

In an effort to quantify impacts from natural disasters, simulations were performed for potential floods, hurricanes, and earthquakes. HAZUS MH software was utilized for the simulations and information on the methodology can be found in Appendix B.

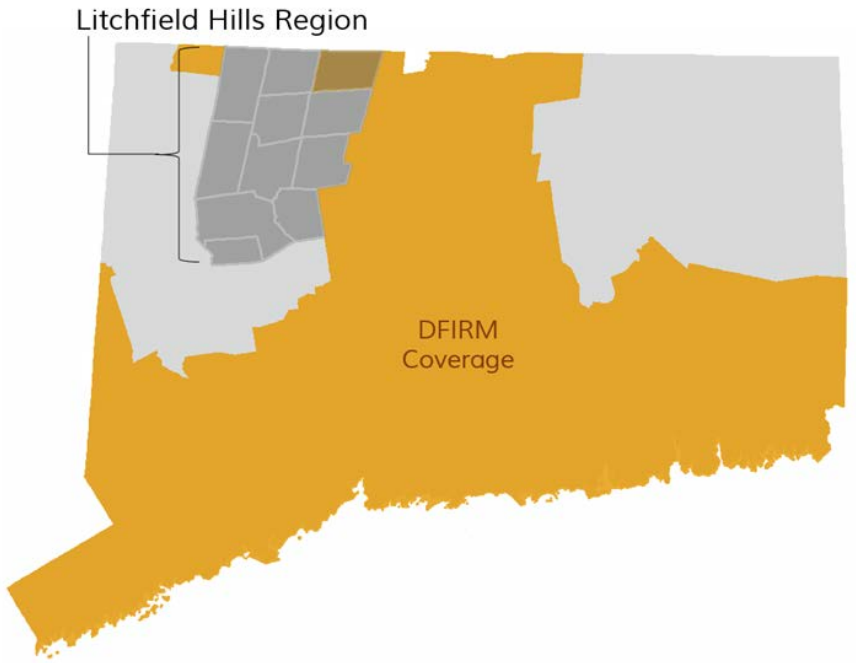

Figure IV.1: Digital FIRM maps only extend into one town within the Litchfield Hills Region

A. List of Potential Natural Disaster Mitigation Measures in the Litchfield Hills Region

Below is a list of potential mitigation measures that can be considered by municipalities in the region to address the natural hazards of greatest concern in the community. These measures were developed from CT DEEP listing of potential mitigation measures, FEMA mitigation planning guidebooks, local interviews, and other references. This list is organized based on specific natural hazards. Each municipality chose their respective mitigation measures based on the STAPLEE review, political willingness, local knowledge, and feasibility. They are presented by municipality in the next section of this report.

1. All Hazards

- Educate school children and the general public about disaster preparedness and the benefit of mitigation measures.
- Establish and support Community Emergency Response Teams to assist in natural hazard planning and mitigation.
- Implement a municipal public notification system for emergencies, such as the Wide Area Rapid Notification (WARN) System.
- Encourage that all buildings be improved to meet current building codes. Updated building codes apply only to new construction and renovations.
- Routinely inspect emergency response equipment, and train for response to natural disasters.
- Acquire additional emergency response equipment as needed.
- Promote the use of interoperable communication equipment, written mutual aid agreements, and the development of standard operating procedures for response to major disasters.
- Take an active role in siting new housing for vulnerable populations such as seniors and the elderly. Encourage housing developers to discuss proposed actions with the town prior to submitting applications.
- Selectively pursue conservation recommendations listed in the POCD and other studies and documents.

2. Flooding / Dam Failure

- Retrofit buildings as needed for adequate floodproofing. Techniques include elevating the lowest floor above the 100-year flood level; wet floodproofing (allowing water to enter uninhabited areas of the structure); dry floodproofing (sealing the structure to prevent flood waters from entering); demolition (tearing down the structure and rebuilding with appropriate floodproof techniques or relocating the structure); and elevating the main breaker or fuse box out of the potential flooded area.
- Implement municipal stormwater maintenance program to clear debris from drainage facilities.
- Provide information to contractors and homeowners on the risks of building in hazard-prone areas and appropriate mitigation measures.
- Have copies of Federal Emergency Management Agency (FEMA) floodplain maps (where applicable) readily available for public distribution.
- Develop and distribute a list of techniques for homeowner self-inspection of their homes and implementation of mitigation activities.
- Incorporate a “hazard disclosure” requirement for deed transfers, leases, or other contracts for sale or exchange of property in flood hazard areas.
- Develop and implement a municipal sediment control plan to prevent clogged drainage systems such as routine street sweeping, curb and gutter cleaning, paving dirt roads, and planting vegetation on bare ground.
- Investigate the feasibility of acquiring flood prone areas for open space protection.
- Promote the purchase of flood insurance in flood-prone areas.
- After a flood, inspect foundations of buildings in impacted areas for cracks and other damage.

- Prepare emergency operation plans for municipally owned dams and implement recommendations resulting from state inspections.
- For privately owned dams, encourage each dam owner to have a maintenance plan and an Emergency Operations Plan. Also encourage them to implement recommendations resulting from state inspections.
- Include dam failure inundation areas in the CT Alert emergency contact database.
- Develop a long-term beaver management plan that includes: control measures to mitigate localized flooding created by beavers; consideration of the use of beaver deterrent devices such as beaver stops or beaver bafflers and consideration replacing culverts frequently impacted by beavers with free span bridges.
- Review floodplain regulations and ordinances and update as necessary based on DEEP's "Model Floodplain Management Regulations".
- Identify the location of structures that are susceptible to flooding to better define vulnerability and potential control measures.
- Consider requiring new buildings constructed in flood prone areas to be protected to the highest recorded flood level regardless of being within a defined Special Flood Hazard Area (SFHA).
- Consider more stringently regulating or preventing certain types of landscaping and retaining walls located in SFHAs, because these can become debris during floods.
- Identify potential sites for green infrastructure such as bio-retention basins and vegetated swales, potentially using Hazard Mitigation Grant Program (HMGP) funding under climate resilient activities.
- Consider requiring green infrastructure as a consideration for all public works projects and significant residential and/or commercial construction, potentially using HMGP funding under climate resilient activities.
- Consider conducting a watershed study to identify appropriate methods of reducing flood risks.
- Conduct a comprehensive evaluation of infrastructure (bridges, roads, water diversion, etc.) at major watercourses to determine appropriate flood mitigation and stabilization measures.
- Provide technical assistance regarding floodproofing measures to interested residents. Pursue funding for home elevations should any residents become interested.
- Consider constructing a flood wall or berm around critical facilities.
- Compile a checklist that cross-references the bylaws, regulations, and codes related to flood damage prevention that may be applicable to a proposed project and make this list available to potential applicants.
- Provide outreach regarding home elevation and relocation, flood barriers, dry floodproofing, wet floodproofing, and other home improvement techniques to private homeowners and businesses with flooding problems.
- Pursue the acquisition of additional municipal open space inside SFHAs and set it aside as greenways, parks, or other nonresidential, noncommercial, or nonindustrial use.
- Consider riverine floodplain and stream restoration and stabilization project to mitigate erosion and flood risk following a disruptive event, potentially using HMGP funding under climate resilient activities.
- Pursue riverbank stabilization along major watercourses, potentially utilizing HMGP funding.
- Review culvert conveyances based on existing hydrology and Northeast Regional Climate Center guidance.
- When replacing or upgrading culverts, work with CT DOT to incorporate findings of the climate change pilot study and work with HVA to incorporate findings of the stream crossing assessment training.
- Ensure adequate barricades are available to block flooded areas in flood prone areas of the town.

3. Drought

- Create a drought contingency plan for implementation during pe-

riods of water shortage. This should include an emergency water allocation strategy to be implemented during severe drought
- Develop an early warning system to notify the general public about water shortages.
- Evaluate the current use of ground water.
- Organize drought information meetings for the public and media.
- Implement water conservation awareness programs.
- Assist water agencies in developing contingency plans.
- Support stronger economic incentives for private investment of water conservation.
- Implement water metering and leak detection programs.
- Conduct an inventory of potential groundwater supplies, potentially using HMGP funding under climate resilient activities.

4. Tornado / Wind Damage

- Develop a list of techniques for homeowner self-inspection of their homes and recommended mitigation activities.
- Develop a comprehensive emergency sheltering system.
- Implement a Tree Hazard Management Program to encourage responsible planting practices and minimize future storm damage to buildings, utilities, and streets.
- Invest in a comprehensive tree trimming maintenance program
- Re-landscape vulnerable areas with native species.
- Distribute hurricane preparedness information, including pet sheltering plans.
- Clear dead or rotting trees and branches in vulnerable areas.
- Secure outdoor objects that could become projectiles.
- Install lighting rods.
- Retrofit critical structures to comply with current building codes and develop a reinforced “safe room”.
- Install power lines underground where possible.
- The Building Department should have funding available to provide literature regarding appropriate design standards for wind.
- Encourage the use of structural techniques related to mitigation of wind damage in new residential and commercial structures to protect new buildings to a standard greater than the minimum building code requirements. Require such improvements for new municipal critical facilities.
- Require the location of utilities underground in new developments or during redevelopment whenever possible.

5. Winter Storms

- Educate the public on the risks of hypothermia, carbon monoxide poisoning in motor vehicles, importance of staying off local roads, and landscaping practices that reduce the potential for damage to structures.
- Implement or expand a municipal tree trimming maintenance program.
- Encourage underground utility wires.
- Develop emergency shelter services to address municipal needs before, during, and after an event.
- Provide information on the dangers of cold-related hazards to people and property.
- Consider posting the snow plowing routes in Town buildings each winter to increase public awareness.
- Emergency personnel should continue to identify areas that are difficult to access during winter storm events and devise contingency plans to access such areas during emergencies.
- The Building Department should have funding available to provide literature regarding appropriate design standards for mitigating icing, insulating pipes, and retrofits for flat-roofed buildings such as heating coils.
- Provide landscaping along sections of State and local roadways that are prone to drifting snow and high winds

6. Wildfire Hazards

- Remove combustible debris from around structures
- Clean brush and dead grass from property
- Provide public information on safe fire practices (build away from nearby trees or bushes, fire extinguisher availability)

- Encourage the use of fire-resistant materials when renovating, building, and retrofitting buildings.
- Keep trees trimmed so there is no contact with power lines or other wires
- Cut back tree limbs that overhang structures
- Map vulnerable areas and distribute information about hazard mitigation strategies.
- The Town should continue to require the installation of fire protection water in new developments.

V. Individual Town Risk Assessments and Hazard Mitigation Strategies

This portion of the document provides a general town description, an analysis of risks and vulnerabilities, and a hazard mitigation plan for each municipality in the region. Also included is a list of hazard mitigation actions and a map illustrating critical facilities and flood zones.

A STAPLEE cost benefit review was also performed for the towns' chosen hazard mitigation actions. The STAPLEE criteria and their cost benefit definitions can be found on Table V.1. Each criteria's cost and benefit is given a score ranging from 1-5. The totals for costs and benefits are then reviewed as a ratio. The scoring system scale is listed in Table V.2.

This cost benefit review was performed at the planning level and is not a comprehensive analysis. Detailed cost benefit analyses may be required for some actions, but they are beyond the scope of this report.

Table V.3 displays the actions included for all the towns in the region along with their cost benefit scores. Table V.4 displays which actions each town has adopted. Cost estimates and potential funding sources are included in each town's section.

A regional map of critical facilities can be found in Figure V.1 and a table showing an example of critical facilities within a municipality (Barkhamsted) can be found in Table V.5.

Table V.1: STAPLEE criteria definitions for municipal hazard mitigation actions

STAPLEE Factors	Benefits	Costs
Social	The action socially acceptable and compatible with community values.	The action may result in unfair treatment of some or be disruptive to a neighborhood or group.
Technical	The action is technically feasible.	The action may create more problems than it will solve.
Administrative	The community has the capacity to implement the action. Implementation is likely to result in improved processes.	The community may not have the staff, expertise or funding to implement or maintain the action.
Political	The action will have public and stakeholder support.	The action is not likely to have public and/or stakeholder support.
Legal	The community has the legal authority to implement the action.	The community may face liability or legal challenges.
Economic	There are likely and available funding sources. The action could bring positive economic benefits to the community.	There will be a high burden placed on the tax base or local economy. The action does not appear to be cost effective: the costs seem unreasonable for the size of the project and its likely benefits.
Environmental	The action will restore or positively benefit the environment.	There are likely to be negative environmental impacts. The action may not be able to comply with environmental laws, regulations and permit requirements.

Table V.2: Cost benefit score descriptions for STAPLEE criteria review

Class	Score	Benefits	Costs
Low	0-1	Little benefit; the impacts being addressed are not severe; benefits may be short term.	Likely to be done by existing personnel with little impact on budget; Not complicated to accomplish; Costs to implement are likely < $10,000.
Medium	2-3	Benefits may be felt by many in the community; the action may solve a problem or otherwise benefit for multiple years	May need additional funding or studies; May require change in practices; Costs to implement may be between $10,000 and $100,000
High	4-5	Benefits would accrue for many in community; benefits may accrue to the most vulnerable or those not able to recover on their own; benefits would be long term and may permanently protect from damages.	Likely cost >$100,000 and require obtaining funding outside of operating budget; complicated, lengthy process to implement

Table V.3: Objectives, actions, and B/C ratios

Category of Strategy	Action Type	STAPLEE Factors:	SOCIAL	TECHNICAL	ADMINISTRATIVE	POLITICAL	LEGAL	ECONOMIC	ENVIRONMENTAL	TOTAL	B/C Ratio
Objective 1: Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness. Natural Hazard Addressed: All hazards.	Hazard education at schools	Benefits	4	4	4	5	4	4	4	29	4.8
		Costs	0	1	1	1	2	1	0	6	
	Hazard materials via town website	Benefits	4	4	4	5	4	4	4	29	4.8
		Costs	0	1	1	1	2	1	0	6	
	Maintain local emergency operation plan	Benefits	4	4	4	3	4	4	4	27	1.8
		Costs	2	2	3	3	2	2	1	15	
	Maintain public notification system	Benefits	4	4	4	4	4	4	0	24	1.8
		Costs	3	1	3	1	2	3	0	13	
	Outreach to target seasonal populations	Benefits	4	4	4	5	4	4	4	29	4.8
		Costs	0	1	1	1	2	1	0	6	
	Provide hazard updates via social media	Benefits	4	4	4	5	4	4	4	29	4.8
		Costs	0	1	1	1	1	1	1	6	
	Provide information on the dangers of cold-related hazards to people and property.	Benefits	3	3	3	3	3	3	0	18	6
		Costs	0	0	2	0	0	1	0	3	
	Consider posting the snow plowing routes in Town buildings each winter to increase public awareness.	Benefits	3	2	2	3	3	3	0	16	8
		Costs	0	1	1	0	0	0	0	2	
	The Building Department should provide literature regarding appropriate design standards for mitigating icing, insulating pipes, and retrofits for flat-roofed buildings such as heating coils.	Benefits	4	3	3	3	3	3	2	21	2.3
		Costs	2	2	3	0	0	1	1	9	
Objective 2: Ensure proper functioning of critical facilities during emergency response. Natural Hazard Addressed: All hazards.	Routinely inspect emergency equipment and train for disasters	Benefits	4	4	4	4	4	4	0	24	4.0
		Costs	2	1	1	0	1	1	0	6	
	Acquire Additional Emergency Response Equipment	Benefits	3	4	4	3	4	3	3	24	1.1
		Costs	4	3	4	3	3	3	2	22	
	Cooperate with the Metropolitan District Commission in emergency response training and update the Goodwin Dam Emergency Action Plan.	Benefits	4	4	4	4	4	4	0	24	3.4
		Costs	1	1	2	1	1	1	0	7	
	Promote the use of interoperable communication equipment, and the development of standard operating procedures for emergency response in the regional area.	Benefits	4	4	4	4	4	4	0	24	1.8
		Costs	3	1	3	1	2	3	0	13	

Table V.3: Objectives, actions, and B/C ratios												
Category of Strategy	Action Type	STAPLEE Factors:	SOCIAL	TECHNICAL	ADMINISTRATIVE	POLITICAL	LEGAL	ECONOMIC	ENVIRONMENTAL	TOTAL	B/C Ratio
	Develop basic GIS capabilities as needed for access to aerial photos showing the number and location of properties and structures that could be affected by a natural disaster.	Benefits	4	4	4	4	4	4	0	24	1.8
		Costs	3	1	3	1	2	3	0	13	
	Pursue a verbal agreement with schools or school bus company to utilize school buses for mass transportation during an emergency.	Benefits	4	4	4	4	4	4	0	24	3.4
		Costs	1	1	2	1	1	1	0	7	
	Develop a stand-alone EOC	Benefits	3	4	4	3	4	3	3	24	1.1
		Costs	4	3	4	3	3	3	2	22	
	Pursue funding for an elevator or ramp at the Armory to move emergency equipment to and from the basement, and to facilitate public access	Benefits	3	3	3	3	2	3	3	20	0.9
		Costs	4	3	3	3	3	3	3	22	
Objective 3: Expand maintenance activities and implement specific projects that address known drainage issues within the town. Natural Hazard Addressed: flooding	Implement control measures to mitigate the flooding created by beavers. Evaluate feasibility of replacing culverts frequently impacted by beavers with free space bridges. Evaluate the use of beaver deterrent devices such as beaver stops or beaver bafflers at problem locations.	Benefits	3	4	4	3	4	3	4	25	1.3
		Costs	3	2	3	3	2	3	3	19	
	Develop clean-out schedules for all catch basins and drainage facilities.	Benefits	3	4	4	3	4	3	3	24	1.1
		Costs	4	3	4	3	3	3	2	22	
	Review floodplain regulations and ordinances and update as necessary based on guidance from DEEP.	Benefits	4	3	4	4	4	4	4	27	4.5
		Costs	1	1	1	1	1	1	0	6	
	Identify the location of structures that are susceptible to flooding to facilitate risk assessment and potential control measures.	Benefits	4	4	3	3	4	3	0	21	1.9
		Costs	0	1	3	3	1	3	0	11	
	Maintain appropriate funding to augment the municipal tree trimming program.	Benefits	3	4	3	3	3	4	4	24	1.3
		Costs	3	3	3	3	3	2	2	19	
	Implement drainage improvements at flood prone locations.	Benefits	3	4	4	3	4	3	4	25	1.3
		Costs	3	2	3	3	2	3	3	19	
	Relocate municipal buildings that are within flood zones.	Benefits	2	4	3	2	4	3	4	22	0.9
		Costs	4	3	4	3	4	4	2	24	
	Perform roadside tree inventory to better document the health and condition of trees to facilitate their removal if hazardous.	Benefits	4	4	4	3	4	4	4	27	1.8
		Costs	2	2	3	3	2	2	1	15	
	Establish a brush disposal area	Benefits	3	4	3	3	3	4	4	24	1.3
		Costs	3	3	3	3	3	2	2	19	
	Install river gauges to monitor flood events	Benefits	4	4	4	3	4	4	4	27	1.8
		Costs	2	2	3	3	2	2	1	15	
	Provide landscaping along sections of State and local roadways that are prone to drifting snow and high winds	Benefits	4	4	4	3	4	4	3	26	2.0
		Costs	2	1	2	2	2	2	2	13	

Table V.3: Objectives, actions, and B/C ratios												
Category of Strategy	Action Type	STAPLEE Factors:	SOCIAL	TECHNICAL	ADMINISTRATIVE	POLITICAL	LEGAL	ECONOMIC	ENVIRONMENTAL	TOTAL	B/C Ratio
	Develop list of vulnerable populations for quick disaster response.	Benefits	4	4	3	3	4	3	0	21	1.9
		Costs	0	1	3	3	1	3	0	11	
	Pursue the purchase and placement of standardized house number signs to facilitate effective emergency response	Benefits	4	4	4	4	4	3	2	25	2.8
		Costs	2	1	2	1	1	1	1	9	
	Undertake stormwater drainage study to address localized flooding problems	Benefits	4	4	3	3	4	3	2	23	2.1
		Costs	0	1	3	3	1	3	0	11	
	Generators for Fire Department	Benefits	3	4	4	3	4	3	3	24	1.1
		Costs	4	3	4	3	3	3	2	22	
	Take an active role in siting new housing for vulnerable populations such as seniors and the elderly. Encourage housing developers to discuss proposed actions with the town prior to submitting applications.	Benefits	5	4	3	2	3	4	0	21	2.1
		Costs	1	3	0	2	2	1	1	10	
	Discuss requiring new buildings constructed in flood prone areas to be protected to the highest recorded flood level regardless of being within a defined Special Flood Hazard Area (SFHA).	Benefits	5	5	4	3	4	3	4	28	7
		Costs	0	1	0	1	2	0	0	4	
	Require green infrastructure as a consideration for all public works projects and significant residential and/or commercial construction, potentially using HMGP funding under climate resilient activities.	Benefits	4	3	2	3	3	3	5	23	2.3
		Costs	3	1	3	0	2	1	0	10	
	Acquire a cost-estimate to conduct a watershed study to identify appropriate methods of reducing flood risks. (Benefits would vary based on watershed size and flooding risk.)	Benefits	5	4	3	4	5	4	5	30	4.3
		Costs	0	1	3	1	0	2	0	7	
	Conduct a comprehensive evaluation of infrastructure at major watercourses to determine appropriate flood mitigation and stabilization measures.	Benefits	4	4	4	4	5	4	1	26	4.3
		Costs	0	3	2	1	0	0	0	6	
	Compile a checklist that cross-references the bylaws, regulations, and codes related to flood damage prevention that may be applicable to a proposed project and make this list available to potential applicants.	Benefits	4	4	4	5	5	1	1	24	4.8
		Costs	0	1	1	0	2	1	0	5	
	Pursue the acquisition of additional municipal open space inside SFHAs and set it aside as greenways, parks, or other nonresidential, noncommercial, or nonindustrial use.	Benefits	3	4	3	2	3	4	4	23	1.2
		Costs	3	2	2	2	5	4	0	18	
	Selectively pursue conservation recommendations listed in the POCD and other studies and documents.	Benefits	5	5	3	4	4	3	4	28	4
		Costs	0	2	2	0	0	2	1	7	
	Review existing groundwater maps and conduct an inventory of potential groundwater supplies, potentially using HMGP funding under climate resilient activities.	Benefits	5	5	3	3	3	4	4	27	2.7
		Costs	0	3	5	0	0	2	0	10	
	Review culvert conveyances based on existing hydrology and Northeast Regional Climate Center guidance.	Benefits	5	4	1	4	3	3	3	23	2.5
		Costs	0	2	4	0	0	3	0	9	

Table V.3: Objectives, actions, and B/C ratios												
Category of Strategy	Action Type	STAPLEE Factors:	SOCIAL	TECHNICAL	ADMINISTRATIVE	POLITICAL	LEGAL	ECONOMIC	ENVIRONMENTAL	TOTAL	B/C Ratio
	When replacing or upgrading culverts, work with CT DOT to incorporate findings of the climate change pilot study and work with HVA to incorporate findings of the stream crossing assessment training.	Benefits	5	2	3	3	4	2	3	22	2.5
		Costs	0	2	2	1	0	3	1	9	
	Ensure adequate barricades are available to block flooded areas in flood prone areas of the town.	Benefits	3	4	2	3	5	2	0	19	2.1
		Costs	0	4	2	1	1	1	0	9	
	Require the location of utilities underground in new developments or during redevelopment whenever possible.	Benefits	3	3	3	3	2	3	0	17	1.4
		Costs	1	1	1	2	3	2	2	12	
	Emergency personnel should continue to identify areas that are difficult to access during winter storm events and devise contingency plans to access such areas during emergencies.	Benefits	4	4	3	4	3	2	0	20	5
		Costs	0	1	2	0	0	1	0	4	
	Include dam failure inundation areas in the CTAlert emergency contact database.	Benefits	5	5	5	5	5	3	0	28	9.3
		Costs	1	1	1	0	0	0	0	3	
	Develop a plan to coordinate with the owners of privately owned dams to ensure proper maintenance.	Benefits	4	2	4	4	2	3	4	23	1.9
		Costs	2	2	2	2	3	1	0	12	
	The Town should continue to require the installation of fire protection water in new developments.	Benefits	3	3	1	2	2	4	1	16	1.4
		Costs	3	1	2	2	1	1	1	11	

Table V.4: Actions by participating/implementing municipality											
	Barkhamsted	Colebrook	Goshen	Hartland	Harwinton	Litchfield	Morris	New Hartford	Norfolk	Torrington	Winchester
Hazard education at schools	X	X	X		X	X	X	X	X	X	X
Hazard materials via town website	X	X	X	X	X	X	X	X	X	X	X
Maintain local emergency operation plan	X	X	X	X	X	X	X	X	X	X	X
Maintain public notification system	X	X	X		X	X	X	X	X	X	X
Outreach to target seasonal populations			X								
Provide hazard updates via social media									X		
Provide information on the dangers of cold-related hazards to people and property									X		
Consider posting the snow plowing routes in Town buildings each winter to increase public awareness									X		
The Building Department should provide literature regarding appropriate design standards for mitigating icing, insulating pipes, and retrofits for flat-roofed buildings such as heating coils.									X		
Routinely inspect emergency equipment and train for disasters	X	X	X	X	X	X	X	X	X	X	X
Acquire Additional Emergency Response Equipment	X	X	X	X	X	X	X	X	X	X	X
Cooperate with the Metropolitan District Commission in emergency response training and update the Goodwin Dam Emergency Action Plan.	X	X		X				X			
Promote the use of interoperable communication equipment, and the development of standard operating procedures for emergency response in the regional area.	X	X	X	X	X	X	X	X	X	X	X
Develop basic GIS capabilities as needed for access to aerial photos showing the number and location of properties and structures that could be affected by a natural disaster.	X	X	X		X	X		X	X	X	X
Pursue a verbal agreement with schools or school bus company to utilize school buses for mass transportation during an emergency.	X	X	X	X	X	X		X	X	X	X

Table V.4: Actions by participating/implementing municipality	Barkhamsted	Colebrook	Goshen	Hartland	Harwinton	Litchfield	Morris	New Hartford	Norfolk	Torrington	Winchester
Develop a stand-alone EOC					X						
Pursue funding for an elevator or ramp at the Armory to move emergency equipment to and from the basement, and to facilitate public access										X	
Implement control measures to mitigate the flooding created by beavers. [Evaluate feasibility of replacing culverts frequently impacted by beavers with free space bridges. Evaluate the use of beaver deterrent devices such as beaver stops or beaver bafflers at problem locations.]	X								X		
Develop clean-out schedules for all catch basins and drainage facilities.	X	X	X	X	X	X	X	X	X	X	X
Review floodplain regulations and ordinances and update as necessary based on guidance from DEEP.	X	X	X	X	X	X	X	X	X	X	X
Identify the location of structures that are susceptible to flooding to facilitate risk assessment and potential control measures.	X				X	X	X	X		X	X
Maintain appropriate funding to augment the municipal tree trimming program	X	X	X		X	X	X		X	X	
Implement drainage improvements at flood-prone locations								X			X
Relocate municipal buildings that are within flood zones								X			
Perform roadside tree inventory to better document the health and condition of trees to facilitate their removal if hazardous to ensure that the potential for downed power lines is diminished.	X									X	
Establish a brush disposal area								X		X	
Install river gauges to monitor flood events										X	
Provide landscaping along sections of State and local roadways that are prone to drifting snow and high winds									X		
Develop list of vulnerable populations for quick disaster response.						X					
Pursue the purchase and placement of standardized house number signs to facilitate effective emergency response			X								
Undertake stormwater drainage study to address localized flooding problems			X								

Table V.4: Actions by participating/implementing municipality											
	Barkhamsted	Colebrook	Goshen	Hartland	Harwinton	Litchfield	Morris	New Hartford	Norfolk	Torrington	Winchester
Generators for Fire Department	X										
Take an active role in siting new housing for vulnerable populations such as seniors and the elderly. Encourage housing developers to discuss proposed actions with the town prior to submitting applications.	X								X		
Discuss requiring new buildings constructed in flood prone areas to be protected to the highest recorded flood level regardless of being within a defined Special Flood Hazard Area (SFHA).							X				
Require green infrastructure as a consideration for all public works projects and significant residential and/or commercial construction, potentially using HMGP funding under climate resilient activities.									X		
Acquire a cost-estimate for a watershed study to identify appropriate methods of reducing flood risks.									X		
Conduct a comprehensive evaluation of the infrastructure at major watercourses to determine appropriate flood mitigation and stabilization measures.									X		
Compile a checklist that cross-references the bylaws, regulations, and codes related to flood damage prevention that may be applicable to a proposed project and make this list available to potential applicants.									X		
Pursue the acquisition of additional municipal open space inside SFHAs and set it aside as greenways, parks, or other nonresidential, noncommercial, or nonindustrial use.											
Selectively pursue conservation recommendations listed in the POCD and other studies and documents.									X		
Review existing groundwater maps and conduct an inventory of potential groundwater supplies, potentially using HMGP funding under climate resilient activities.									X		
Review culvert conveyances based on existing hydrology and Northeast Regional Climate Center guidance.							X		X		
When replacing or upgrading culverts, work with CT DOT to incorporate findings of the climate change pilot study and work with HVA to incorporate findings of the stream crossing assessment training.									X		
Ensure adequate barricades are available to block flooded areas in flood prone areas of the town.	X								X		
Require the location of utilities underground in new developments or during redevelopment whenever possible.	X						X		X		

Table V.4: Actions by participating/implementing municipality											
	Barkhamsted	Colebrook	Goshen	Hartland	Harwinton	Litchfield	Morris	New Hartford	Norfolk	Torrington	Winchester
Emergency personnel should continue to identify areas that are difficult to access during winter storm events and devise contingency plans to access such areas during emergencies.	X						X		X		
Include dam failure inundation areas in the CTAlert emergency contact database.	X										
Develop a plan to coordinate with the owners of privately owned dams to ensure proper maintenance.	X										
The Town should continue to require the installation of fire protection water in new developments.	X						X		X		

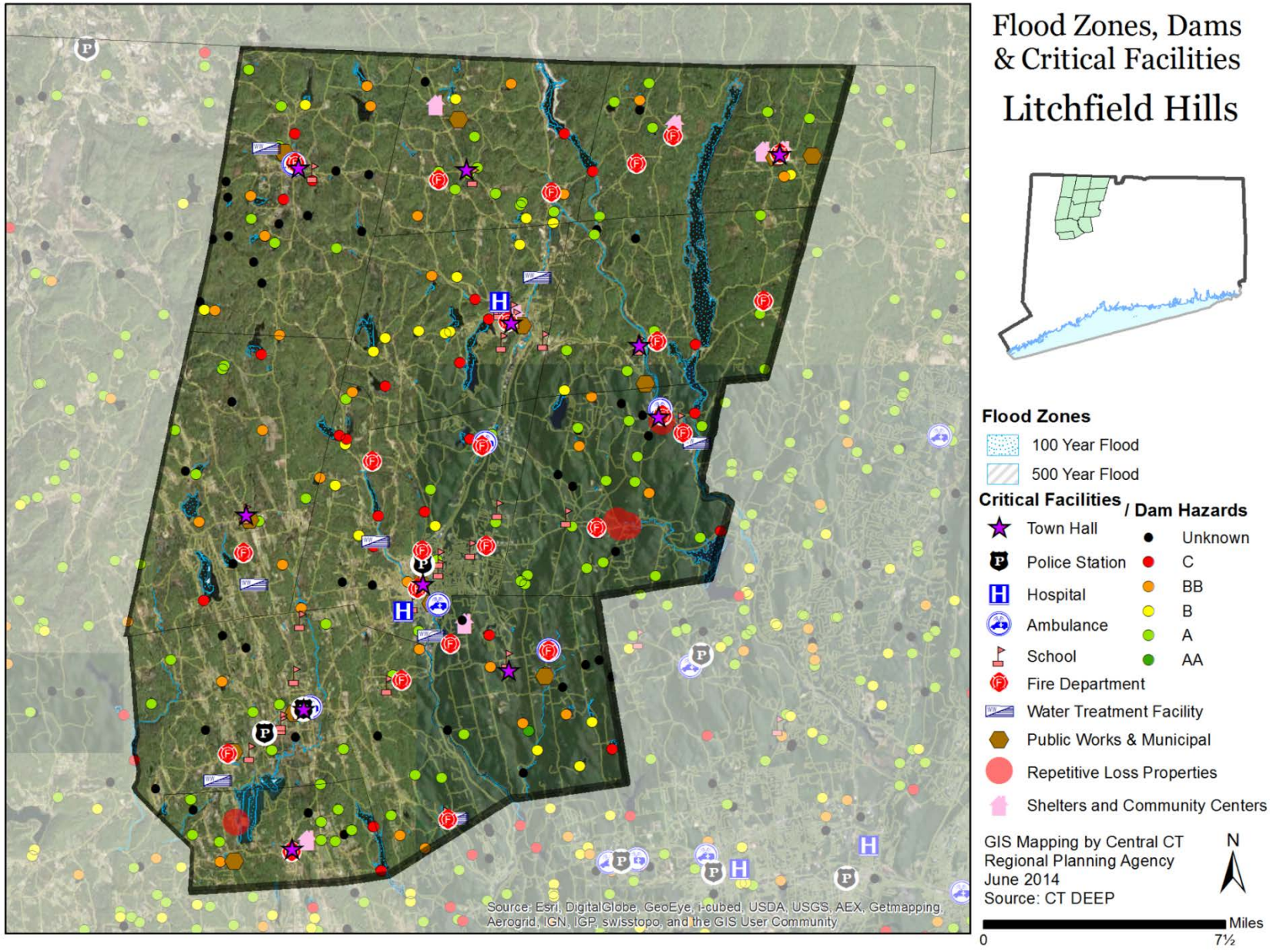

Figure V.1. Flood zones, dams, and critical facilities.

Table V.5: Example of Critical Facilities – Barkhamsted	
Type	Name
Dam	Elmer Beebe Dam
Dam	Hitchcock Dam
Dam	Isabelle Pond Dam
Dam	West Center Pond Dam
Dam	Sczgiel Dam
Dam	New Pond Dam
Dam	Saville Dam
Dam	Micro Ball Lake Dam
Dam	Sweeton Pond Dam
Dam	Eddy Pond Dam
Dam	West Hill Pond Dam
Fire	Barkhamsted Fire Department
Fire	Barkhamsted East Volunteer Fire Company
Fire	Pleasant Valley Firehouse
Fire	Riverton Volunteer Fire Co.
Public Works	Barkhamsted Highway Garage
School	Barkhamsted School
Town Hall	Barkhamsted Town Hall

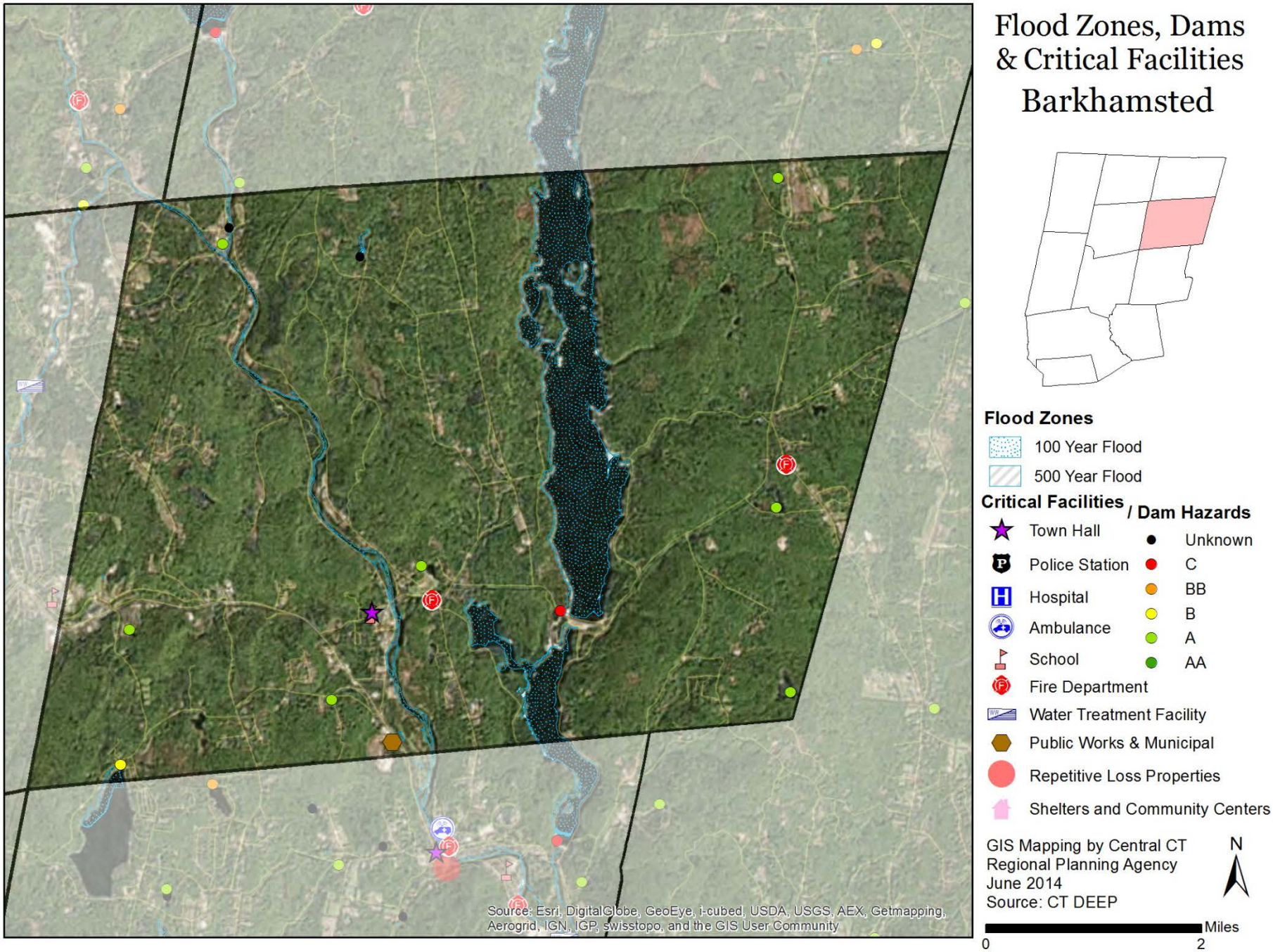

Figure V.2. Flood zones, dams, and critical facilities in Barkhamsted

A. Town of Barkhamsted Risk Assessment and Hazard Mitigation Plan

1. General Town Description

The Town of Barkhamsted is located in the northeastern part of Litchfield County in northwestern Connecticut. It is bordered on the north by Hartland, on the west by Winchester, on the east by Granby and Canton and on the south by New Hartford (see Figure V.3 below).

Barkhamsted was incorporated in October of 1779 and has a total area of 38.8 square miles with a land area of 36.2 square miles. It has a population of 3,831 persons in 2011, and is run by a Selectmen/Town Meeting form of government.

Barkhamsted is part of the Northeastern Highlands Ecoregion, which is characterized by "hills and mountains, a mostly forested land cover, nutrient-poor frigid and cryic soils (mostly Spodosols), and numerous high-gradient streams and glacial lakes" (as described on the map "Ecoregions of New England"). Other notable characteristics of the municipality include a forested and hilly landscape, the Farmington River, Barkhamsted Reservoir, and Lake McDonough. The bedrock is primarily metamorphic gneisses and schists. Soils consist of glacial till in the uplands and stratified drift in the valleys.

The Metropolitan District Commission, a quasi-public water company serving the metropolitan Hartford area, owns about a quarter of the land in Barkhamsted adjacent to the Barkhamsted Reservoir and Lake McDonough. This reservoir is a major source of water supply for the MDC. The Saville Dam, located at the southern end of Barkhamsted Reservoir, was completed in 1940. This dam holds a 30 billion gallon reservoir that is 8.5 miles long with a water surface of 3.63 square miles and a maximum depth of 120 feet. The Richards Corner Dam at Lake McDonough was completed twenty years earlier in 1920 and provides recreational opportunities for boaters, swimmers, and fishermen.

Another quarter of the land in Barkhamsted consists of State Forests. These include People's Forest, American Legion Forest, Tunxis Forest, and Enders Forest.

Barkhamsted has a history of agricultural and timber land use in the 1700's, followed by diverse water powered industries in the 1800's. Land use today is characterized by the aforementioned water company and state forest land, along with large lot residential development and two village/community centers – Pleasant Valley and Riverton. Route 44 is the principal arterial highway serving the town, with other state routes serving as major collectors.

According to the US Census data, the population of the town has increased an average of 49 persons per year over the past 50 years, from a population 1,370 persons in 1960 to a population of 3,799 persons in 2010. The population is projected to increase to 3,935 persons by 2020, an increase of 3.5%. The median age in 2010 was 45. Most housing is owner occupied, with approximately 5% of the housing stock held for seasonal, recreational or occasional use (second homes). There are 1,589 existing housing units in town as of 2010.

Barkhamsted, according to the Connecticut Economic Resource Center (CERC), had a resident labor force of 2,213 people in 2013, with 597 jobs located in town. About a quarter of these jobs are manufacturing jobs, with the remainder being service related jobs. There has been very little employment growth in town since 1970, when there were 510 jobs in town. The unemployment rate was 6.5% in 2013.

According to CERC, Barkhamsted has an equalized net grand list of $531,437,283 in 2010 with commercial and industrial uses comprising 4.8% of this grand list. The equalized net grand list is an estimate of the market value of all taxable property in the municipality, and gives some indication of the value of property at risk in the event of a major natural disaster. There are 76 business firms in the community according to CERC as of 2013.

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the municipality has experienced limited development. Specifically, the housing stock increased by 153 units between 2000 and 2010,

and there has been no significant commercial or industrial development. According to the land use official, no development has occurred in flood-prone areas since the previous plan so development has not increased the community's vulnerability in flood-prone areas.

2. Evaluation of Risks and Vulnerability

Table V.6: Building Exposure by Occupancy Type for Scenario (Barkhamsted)

Occupancy	Exposure ($1000)	Percent of Total
Residential	217,414	81.7%
Commercial	21,026	7.9%
Industrial	17,143	6.4%
Agricultural	1,068	0.4%
Religion	2,164	0.8%
Government	4,268	1.6%
Education	3,183	1.2%
Total	266,266	100.00%

Source: HAZUS analysis

The major natural hazards of concern in Barkhamsted are flooding, high winds, and severe winter storms. Forest fires, drought, and earthquakes occur much less frequently in the community, and are therefore of somewhat lesser concern. The general risk and vulnerability posed by each of these six hazards is discussed in the preceding Section III of this report. More specific information on the flood vulnerability and critical facilities in the town of Barkhamsted is presented below.

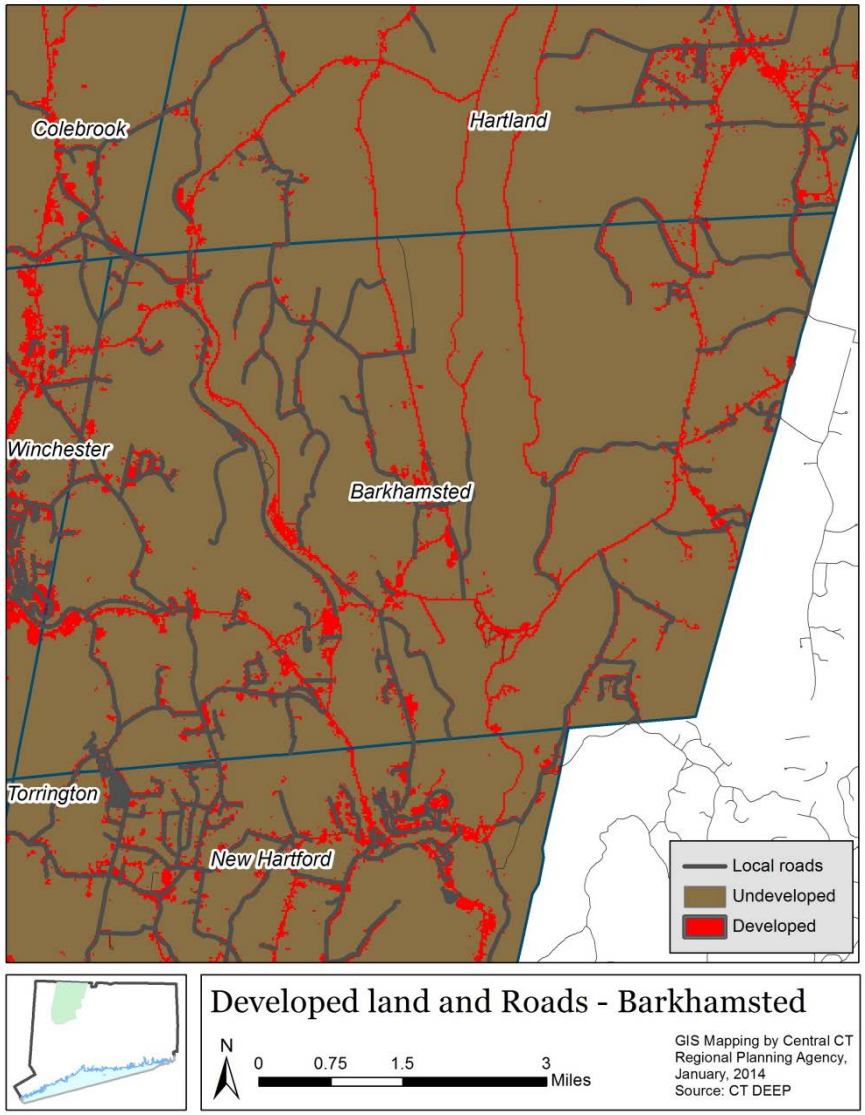

Figure V.3. Developed land and local roads in Barkhamsted

Table V.7: Building Exposure by Occupancy Type for the Study Region		
Occupancy	Exposure ($1000)	Percent of Total
Residential	263,869	83.2%
Commercial	23,715	7.5%
Industrial	18,285	5.8%
Agricultural	1,183	0.4%
Religion	2,555	0.8%
Government	4,268	1.3%
Education	3,183	1.0%
Total	317,058	100.00%

Source: HAZUS analysis

Table V.8: Impacts from 1% annual flood scenario (Barkhamsted)	
Type of impact	Value
Building related losses	$17,480,000
Business interruption losses	$170,000
Total economic losses (thousands of dollars)	$17,654,000
Damaged essential facilities	1
Buildings substantially damaged	6
Tons of debris	4,219
Displaced households	54
Shelter needs	51
Acres of land flooded	2,408

Flooding

There has long been a history of flooding in Barkhamsted. According to the publication "Barkhamsted Heritage – Culture and Industry in a Rural Connecticut Town" edited by Richard G. Wheeler and George Hilton in 1975, "the Long Bridge at Pleasant Valley washed away in the 1938 hurricane" and there is also a history of ice jams at the current bridge location. The publication also states "Water causing haphazard floods has often caused the relocation of Barkhamsted highways".

Flood prone areas in the community today, as mapped by FEMA, are presented in Figure V.2. The most significant flood prone area shown in Figure V.2 is along the Farmington River. The town has recently questioned the accuracy of the FEMA mapping along the Farmington River, particularly with regard to the flood control protection afforded by the Colebrook River Dam and the Goodwin Dam located upstream. According to the MDC, no water has passed over the spillway of the Colebrook River Dam since its construction in 1969.

According to FEMA's website, "Policy Statistics", the Town of Barkhamsted has 16 flood insurance policies in force as of 8/31/20145 with an insurance value of $4,546,600. An attempt was made to estimate the number of structures located within the FEMA floodplain boundaries using available GIS data for Connecticut, however the data is not considered precise enough for an accurate assessment.

Hurricanes and Strong Winds

As with the rest of the Litchfield Hills region, Barkhamsted is vulnerable to high winds from a hurricane or tropical storm. As the town is located far inland, coastal flooding is not a concern, but riverine flooding caused by heavy rain during a hurricane is (see above). Due to the lack of coastal flooding vulnerability, the entire town is equally vulnerable to wind damage from hurricanes or other strong storms.

Impacts will be greatest in densely settled areas, where power outages will be more widespread. See the map in the next section, which shows where developed land is located.

Severe Winter Storms

Vulnerability to the effects of severe winter storms is primarily limited to developed areas, where snow and ice accumulations can cause buildings to collapse. In Barkhamsted, 9% of the land is developed (see Figure V.3). Another factor in the town's vulnerability is the road network. Municipalities are only required to clear local roads, so this will be the primary source of their cleanup costs. Barkhamsted has 65 miles of local

roads to clear, or 7% of the region's total. In comparison, Torrington has 190 miles of roads to clear. The cost to clear a mile of road varies considerably, depending on the width of the road, the depth of snow, and the density of intersections, making cost estimates difficult. This does, however, give an idea of relative vulnerability.

Vulnerable assets

The major facilities at risk in the event of a natural hazard are shown in Figure V.2. These facilities include the State highway network, Barkhamsted Town Hall, Barkhamsted Elementary School, Northwest Regional Middle School, three Fire Stations, MDC's Supply Headquarters, and the town's Public Works Garage. These are considered critical facilities in the event of a natural disaster because they might be needed for effective emergency response. All are potentially vulnerable to tornados, winter storms, wildfire, and earthquakes. The Riverton Fire Station, Barkhamsted Town Hall, and Barkhamsted School are located along the Farmington River and are therefore somewhat more subject to flooding in the event of a major storm event or dam break at Goodwin Dam. In addition to these essential facilities, the lifeline utility systems (electric and communication) and two bridges over the Farmington River are also considered critical facilities. With the exception of the town's class C dams, there are no high potential loss facilities that could cause substantial loss of property and life. There are also no significant hazardous material facilities.

There are ten dams in Barkhamsted. Nine of these dams are privately owned. The Saville Dam at Barkhamsted Reservoir, by contrast, is owned by the Metropolitan District Commission. The Saville Dam is rated as Hazard Type C. Of the remaining dams, one is rated B (West Hill Pond Dam), seven dams are rated A, and one dam is unrated. The Metropolitan District Commission prepared a report in 2007 entitled "Emergency Action Plan – Goodwin Dam". The purpose of this Plan is to define responsibilities and procedures in the event of a possible, impending, or actual failure of the dam. The plan also serves to facilitate "notification to appropriate authorities when flood releases may create major flooding downstream". While the Goodwin Dam is located two miles upstream from Riverton, it is classified as a "high hazard dam" which is a dam whose failure may pose hazards to human health or property. According to the MDC report, the term "high hazard" is not an assessment of the condition of a dam, only its potential for damage and injuries should it fail. The dam is an earth and rockfill embankment that impounds the 200-acre West Branch Reservoir. Hydroelectric power is generated 24-hours per day when sufficient water is available from the Goodwin Powerhouse located just downstream from the Goodwin Dam.

According to the MDC report, a breach at Goodwin Dam could increase the normal river elevation in Riverton by 28 feet in 15-20 minutes time. In a little over an hour, the elevation at the Route 318 Bridge would be 22 feet above normal. Inundation maps are included in the MDC report that show areas flooded by both a fair weather Goodwin Dam Break and a wet weather Goodwin Dam Break. Major portions of Riverton and Pleasant Valley would be flooded under either scenario. The report states that the inundated areas shown on the map reflect events of an "extremely remote nature".

There is no comparable study for a dam failure of the Saville Dam, which is not a hydroelectric facility and therefore not subject to the requirements of the Federal Energy Regulatory Commission. Tables V.6 & V.7 above show the "total exposure" of all structures in Barkhamsted, under a 1% flood scenario. The first table shows that $317,058,000 worth of buildings could potentially be impacted by a 1% flood event. The second table shows that over two-thirds of that, $266,266,000 worth of build-

Table V.9: Estimated hurricane-related damage (thousands of dollars) by building occupancy (Barkhamsted)

	Residential	Commercial	Industrial	Agricultural	Religious	Educational	Government	Total
1938	41.54	1.49	1.78	0.47	0.05	0.03	0.07	45.44
1%	2.15	0.11	0.11	0.03	0.00	0.00	0.00	2.40
5%	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01

ings are likely to be impacted by such an event.

3. Potential Impacts

The HAZUS simulation of a 1% annual flood event shows that extensive flooding could occur in Barkhamsted. In the simulation, 9.7% of the town's land area, 2,408 acres, was flooded. Of that, 177 acres of developed land was flooded. This flooding would displace 54 households and require 51 people to seek temporary sheltering.

Tables V.8 and V.9 provide detailed damage and cost estimates from the HAZUS simulations of a 1% annual flood and three hurricane scenarios. A hurricane comparable to the one occurred in 1938 would cause $45,440 in wind-related damage. Flooding is also likely to occur (see the previous paragraph for a discussion of that damage).

High winds are also expected to have impacts on electricity distribution. During Hurricane Irene, for example, 56% of the town was without power (at the peak). Winter storms can also cause power outages, as seen in October of 2011. During that storm, 100% of the town was without power. Over half the town had no power for five days.

4. Major Concerns

- The long bridge at Pleasant Valley has a history of ice jams.
- Power outages are a consistent problem during heavy winds and sever winter storms.
- Saville Dam lacks a dam failure study, making the risk from the dam unknown.

5. Hazard Mitigation Plan

Since the last plan, the general geography, demography, and built environment have not changed significantly in this community. Nor have the hazards become significantly more or less severe. This update, unlike the previous plan, utilizes HAZUS methodology to gain a deeper understanding of the impacts from significant natural hazards. Additionally, this plan utilizes the state's most recent hazard mitigation plan. As such, the plan priorities remain the same with the addition of mitigation actions to protect the built environment.

Mitigation Goals and Objectives

The principal goals of Barkhamsted's natural hazard mitigation plan update are:

1. To minimize the risks to life and property from natural hazards, and
2. To prevent losses from natural hazards to the extent practicable

In addition to these over-arching goals, the town has also established the following objectives to help the town become more disaster resistant:

1. Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness.
2. Ensure proper functioning of critical facilities during emergency response, including outfitting all town and fire department buildings with new generators.
3. Expand maintenance activities and implement specific projects that address known drainage issues within the town.
4. Expand the volunteer network to assist residents in the case of an extended power outage caused by a major storm or other event.
5. Enhance the capabilities of the Emergency Operations Center by moving it to the new town maintenance facility, equipping it with new two-way radio equipment and 24/7 internet access.

Potential Mitigation Measures

Table V.3 in the previous section of this report presents a listing of potential mitigation measures that can be taken to reduce the impacts of the major natural hazards of concern in the Litchfield Hills Region. In the context of Barkhamsted's risk and vulnerability analysis presented above, and the existing mitigation strategies in the town, only some of these measures will be both needed and cost-effective according to input received from the municipality. The purpose of this Natural Hazards Mitigation Plan is to identify reasonable and appropriate mitigation measures for each hazard from the Table V.3 listing and other sources, and to develop an implementation strategy for the priority mitigation measures.

Existing Mitigation Strategy

The Town of Barkhamsted has a number of existing authorities, policies, programs and regulations that serve to mitigate the impact of natural hazards. Existing local authorities include the Barkhamsted Board of Selectmen, Planning and Zoning Commission, Inland Wetlands Commission, Emergency Management Director, Fire Department, and Department of Public Works.

Barkhamsted uses a variety of tools to maintain compliance with NFIP, including the Connecticut State Building Code, a code of ordinances, wetland regulations, zoning regulations, and subdivision regulations. Barkhamsted expects to continue participation in NFIP.

Land use regulations exist to protect natural resources, including erosion and sediment control regulations for new development, stormwater control regulations to minimize drainage problems, and a floodplain overlay district to control development in flood prone areas.

The floodplain overlay district provides that any new construction or substantial improvement of any residential structure shall have the lowest floor, including the basement, elevated to at least the base flood elevation. Nonresidential construction is required to have the lowest floor, including basement, elevated to at least one foot above the base flood level or be flood-proofed to one foot above the base flood elevation. A registered professional engineer or architect is required to design and certify the construction of structures in the floodplain in order to minimize flood damage. Additionally all attendant utilities or sanitary facilities should be located or designed to avoid infiltration or impairment by flood waters. Manufactured homes and recreational vehicles are prohibited or highly restricted within the floodplain overlay zone, respectively.

Barkhamsted's subdivision regulations have detailed standards for the planning, design and construction of storm drainage systems in order to minimize adverse impacts with new construction activity. The Barkhamsted Inland Wetlands Commission enforces regulations to direct development away from wetlands, watercourses and floodplains. These regulations also direct development and subdivision away from inland wetlands, water courses, and stream-belt protection areas. In addition to these regulations, the Barkhamsted Public Works Department routinely examines and clears public storm drains and catch basins of debris following periods of rainfall, snowfall, or windstorms. The town's DPW also monitors weather reports and maintains loaded trucks in preparation of winter storm events.

Barkhamsted's three Volunteer Fire Departments, operating under the Barkhamsted Fire District, Department of Public Works, two volunteer EMS organizations and Emergency Management Director all possesses emergency equipment that can be deployed as needed in the event of an emergency. Procedures are also in place to open and maintain the Emergency Operations Center in the Highway Garage and emergency shelter in the Elementary School.

Barkhamsted has also been working with other towns in the Litchfield Hills Region through the Northwest Hills Public Safety Task Force to enhance communication and coordination. This has included efforts to standardize communication equipment and the equipment in local emergency operation centers, to upgrade supplies at emergency shelters, and to implement a coordinated public notification system, a badging registration system for emergency responders, and improved training opportunities.

In addition to these local and regional mitigation programs, the municipality also benefits from numerous federal and state mitigation programs such as the USGS WaterWatch, Report of the Two Storm Panel, CT DEEP Forest Fire Danger Report, the "Connecticut Drought Preparedness and Response Plan", the "National Weather Service Early Warning System", the University of Connecticut's Center for Land Use Education and Research (CLEAR), and the annual tree trimming maintenance program by Eversource (formerly Northeast Utilities and Connecticut Light & Power or CL&P).

Recommended Hazard Mitigation Measures

The existing mitigation measures in the Town of Barkhamsted provide a significant level of protection for the community from natural hazards. Additional strategies to further the attainment of the Barkhamsted's goals and objectives (see also Tables V.10, V.11, and V.12) include:

Objective 1: Educate the public regarding natural hazards of concern,

mitigation activities, and community preparedness.

Natural Hazard Addressed: *All hazards.*

Objective 2: Ensure proper functioning of critical facilities during emergency response.

Natural Hazard Addressed: *All hazards.*

Objective 3: Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Natural Hazard Addressed: *Flooding.*

The priority assigned to the above strategies was based on cost-benefit discussions with local officials and an evaluation using the STAPLEE criteria defined in FEMA's "How to Guide #3: Developing the Mitigation Plan". STAPLEE is short for the Social, Technical, Administrative, Political, Legal, Economic, and Environmental criteria used in the evaluation process. It is anticipated that the low-cost strategies will be implemented during the first year after plan adoption. The higher-cost projects will be implemented as funding becomes available.

High priority projects are those that are considered critically important in order to minimize the risks to life and property from natural hazards. Medium priority projects are important to the community in order to mitigate the impacts of natural disasters but are not considered as critical to the community as high priority projects. Low priority projects are supportive of hazard mitigation goals and objectives, but are not considered essential to effective hazard mitigation in the community.

Changes in Mitigation Priorities from Previous Plan

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the Town of Barkhamsted has pursued implementation of a number of mitigation measures. Of particular note is the implementation of a public notification system (Everbridge System), establishment of a new and more robust Emergency Operations Center at the Public Works Garage, and acquisition of generators for emergency use. The major municipal priorities remain unchanged from the previous Plan with a focus on community preparedness, maintenance and enhancement of response resources, and effective floodplain/drainage management. No significant changes or data reanalysis were made from the 2006 with the exception of the inclusion of HAZUS and several mitigation strategies for the built environment. The following table describes the hazard mitigation strategies of medium or high priority for this community and their associated responsibilities, timeframe, priority, funding source, etc. Projects included in the previous plan are italicized. All of the mitigation actions listed in the 2006 plan have also been included here. These actions are either on-going due to their nature (education, equipment maintenance) or were not completed due to the economic recession. Unless otherwise noted, all Local Mitigation Actions, once budgeted for, are able to be accomplished within the 2016 Plan Update five year timeframe. At this time, the municipality is unable to expand or improve their existing capabilities to reduce key vulnerabilities without additional capacity in the form of training, staff, and/or funding.

The municipality's current comprehensive plan (Plan of Conservation Development) does not reference the 2006 Litchfield Hills Natural Hazard Mitigation Plan or natural hazards with the exception of stormwater management or floodplains as applicable. The NHCOG will discuss the incorporation of the new 2016 Natural Hazard Mitigation Plan into local planning documents with each municipality.

Table V.10: Objective 1 Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Visit schools and educate children about natural hazards and how to prepare for them.	Volunteer Fire Dept. and Emergency Management Director	Annually, efforts to be reviewed at annual planning meeting	Medium	4.8	Volunteers	Municipal budget; EMPG	All hazards
2. Make literature available on natural hazards and preparedness at Barkhamsted Town Hall. Provide email notifications/links on town website.	Emergency Management Director and First Selectman	On-going	High	4.8	Volunteers	Municipal budget; EMPG	All hazards
3. Maintain local Emergency Operations Plan and continue to coordinate with the Regional Public Safety Task Force and Red Cross on community planning, preparedness, response, and training.	Emergency Management Director and First Selectman	On-going, efforts to be reviewed at annual planning meeting	Medium	1.8	Volunteers	Municipal budget; EMPG	All hazards
4. *Maintain a Public Notification System (i.e. Everbridge system) to provide emergency information to residents in the entire town or in a specific geographic area. This notice can provide not only warning of an impending situation but also information regarding how to prepare for a particular event.*	Emergency Management Director and First Selectman	On-going, efforts to be reviewed at annual planning meeting	Medium	1.8	LCD and/or ENS dues	LCD; Municipal budget	All hazards

Italicized items were included in the 2006 plan.

Table V.11: Objective 2 Ensure proper functioning of critical facilities during emergency response							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard mitigated**
1. Routinely inspect emergency response equipment, and train for response to natural disasters.	Volunteer Fire Dept. and Emergency Management Director	On-going basis per Dept. procedure	High	4	Volunteers	Municipal budget; EMPG	All hazards
2. Cooperate with the Metropolitan District Commission in emergency response training exercises and updates of the Goodwin Dam Emergency Action Plan.	Emergency Management Director and First Selectman	As requested by MDC and DEEP	Medium	3.4	Volunteers	Municipal budget	All hazards
3. Acquire additional emergency response equipment such as communication equipment as needed.	Emergency Management Director, Fire Chief	On-going, efforts to be reviewed at annual planning meeting and after each disaster	High	1.1	$180/radio	Municipal budget; FEMA; DEHMS; LOCIP; STEAP	All hazards
4. Promote the use of interoperable communication equipment, and the development of standard operating procedures for emergency response in the regional area.	Emergency Management Director, Fire Chief, and First Selectman	On-going, efforts to be reviewed at annual planning meeting	High	1.8	Volunteers	Municipal budget; EMPG	All hazards
5. Develop a Memorandum of Understanding with schools or bus companies to utilize school buses for mass transportation during an emergency.	Emergency Management Director and First Selectman	2016	Medium	3.4	In-kind	Municipal/school budget; EMPG	All hazards
6. Develop basic GIS capabilities as needed for access to aerial photos showing the number and location of properties and structures that could be affected by a natural disaster.	Emergency Management Director, Fire Chief, and First Selectman	2016	Medium	1.8	In-kind	OPM RPI; Municipal budget	All hazards

Italicized items were included in the 2006 plan.

Table V.12: Objective 3 Expand maintenance activities and implement specific projects that address [illegible]							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Implement control measures to mitigate the flooding created by beavers.	Public Works Dept.	On-going, efforts to be reviewed at annual planning meeting	Medium	1.3	$1,500/culvert	FEMA; Municipal budget	Flooding
2. Develop clean-out schedules for all catch basins and drainage facilities	Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.1	$5,300/year	Municipal budget	Flooding
3. Review floodplain regulations and ordinances and update as necessary based on DEEP's "Model Floodplain Management Regulations" and FEMA Guidelines	Planning and Zoning and Inland Wetland Commissions	2016	Medium	4.5	$2,500	Municipal budget	Flooding
4. Identify the location of structures that are susceptible to flooding to facilitate risk assessment and potential control measures	DEMHS or DEEP	2016	Medium	1.9	$55,000	FEMA; DEEP/DEMHS	Flooding
5. Pursue additional funding to supplement the municipal tree trimming program and enhance the Eversource tree program.	Public Works Dept., First Selectman	2016	Medium	1.3	$45,000	ConnDOT; Eversource; Municipal budget; FEMA HMGP	Power outages due to high wind and winter storms
6. Maintain new generators in all town buildings, including the three firehouses	First Selectman	Ongoing	High	1.1	In-kind	Municipal budget	All hazards
7. Take an active role in siting new housing for vulnerable populations such as seniors and the elderly. Encourage housing developers to discuss proposed actions with the town prior to submitting applications.	First Selectmen, Planning & Zoning Department	Annually, efforts to be reviewed at annual planning meeting	High	2.1	Volunteer	Municipal budget	All hazards
8. Ensure adequate barricades are available to block flooded areas in flood prone areas of the town.	Public Works	2016	High	2.1	~$125/ft^2 metal barrier	Municipal budget; HGMP; DEHMS	Flooding

9. Require the location of utilities underground in new developments or during redevelopment whenever possible.	Building Department; Planning & Zoning; Public Works	2016	High	1.4	In-kind	Municipal budget	All hazards
10. Emergency personnel should continue to identify areas that are difficult to access during winter storm events and devise contingency plans to access such areas during emergencies.	Emergency personnel; Public works	On-going, as identified	High	5	In-kind	Municipal budget; DEHMS	Winter storms
11. Include dam failure inundation areas in the CTAlert emergency contact database.	Emergency personnel; DEEP	On-going, as identified	High	9.3	In-kind	Municipal budget; DEHMS; EMPG	Flooding
12. Develop a plan to coordinate with the owners of privately owned dams to ensure proper maintenance.	First Selectmen; Emergency personnel; DEEP	On-going, to be reviewed annually	High	1.9	In-kind	Municipal budget; DEEP	Flooding
13. The Town should continue to require the installation of fire protection water in new developments.	Building Department; Planning & Zoning	On-going, to be reviewed annually	Medium	1.4	In-kind	Municipal budget	Forest fires

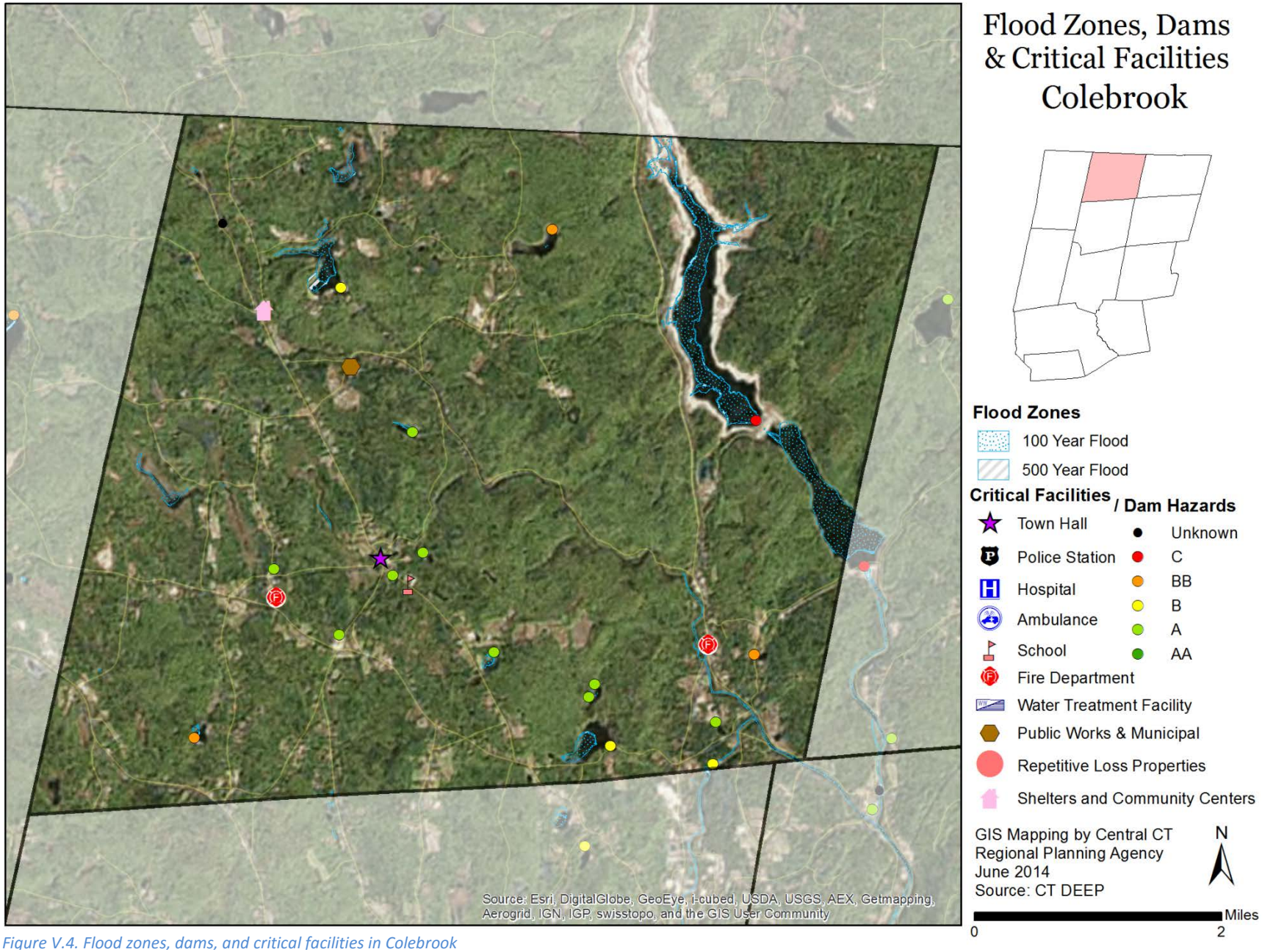

Figure V.4. Flood zones, dams, and critical facilities in Colebrook

B. Town of Colebrook Risk Assessment and Mitigation Strategy

1. General Town Description

The Town of Colebrook is a rural, residential located along the northern border of the Litchfield Hills Region. It is bordered on the east by Hartland, on the south by Winchester, on the west by Norfolk, and on the north by Massachusetts (Figure V.4).

Colebrook was incorporated in October of 1779 and has a total area of 32.9 square miles with a land area of 31.5 square miles. It has a population of 1,479 persons in 2011, and is run by a Selectman/Town Meeting form of government.

Colebrook is part of the Northeastern Highlands Ecoregion, which is characterized by "hills and mountains, a mostly forested land cover, nutrient-poor frigid and cryic soils (mostly Spodosols), and numerous high-gradient streams and glacial lakes" (as described on the map "Ecoregions of New England"). Other notable characteristics of the municipality include a hilly and forested landscape, numerous brooks and streams, Colebrook River Reservoir, Goodwin Dam Reservoir, Algonquin State Forest, and the quintessential New England village of Colebrook Center.

Major highways serving the town include State Routes 44, 8, 182, 182A, and 183. The bedrock is primarily metamorphic and granite, and the surficial material consists predominantly of fertile, stony glacial till soils.

Colebrook has a rich history of iron forges, lumbering, agriculture, and cotton mills during the 18th and 19th centuries. The floods of 1927, 1938, and 1955 impacted Colebrook as they did other towns in the Litchfield Hills Region. Town historian Robert Grigg has compiled vivid descriptions by residents of each of these storm events and their deadly and destructive impact on local residents.

The Metropolitan District Commission, established to provide water and other services to towns in the Greater Hartford area, began purchasing land in the eastern section of Colebrook in the 1930's. This ultimately led to the construction of the Goodwin Dam (originally known as the "Hogback Dam") in Hartland and the creation of the West Branch Reservoir in 1960 in order to augment the MDC's source of water supply.

Table V.13: Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	109,116	87.5%
Commercial	7,895	6.3%
Industrial	3,687	3.0%
Agricultural	385	0.3%
Religion	1,280	1.0%
Government	560	0.4%
Education	1,830	1.5%
Total	*317,058*	*100.00%*

Source: HAZUS analysis

Another major dam, the Colebrook River Dam, which is located about 2 miles upstream from the Goodwin Dam, was completed in 1969 by the U.S. Army Corps of Engineers. The Army Corps cited the damage caused by the 1938 and 1955 floods as the reason that this structure was necessary for flood control purposes. This Colebrook River Dam created the Colebrook River Reservoir, which is approximately double the size of the Goodwin Reservoir and has a maximum water surface area of 1,210 acres. The historic village of Colebrook River, with over 100 dwellings and commercial structures, was inundated with the creation of this new reservoir.

According to the US Census data, the population of Colebrook has increased an average of 14 persons per year over the past 50 years, from a population of 791 people in 1960 to 1,485 in 2010. The population is projected to decrease to 1,467 persons by the year 2020, a decrease of 1.2%. The median age in 2010 was 46. Most housing is owner occupied, with about 12% of the housing stock held for seasonal, recreational or occasional use (second homes). There are 698 existing housing units in town as of 2009.Colebrook, according to the Connecticut Economic Resource Center (CERC), has a resident labor force of 789 persons in 2013.

Most of these jobs are in service producing industries. The unemployment rate was 5.4% in 2013.

Table V.14: Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	99,849	88.8%
Commercial	6,731	6.0%
Industrial	3,604	3.2%
Agricultural	312	0.3%
Religion	858	0.8%
Government	560	0.5%
Education	589	0.5%
Total	*112,503*	*100.00%*

Source: HAZUS analysis

Table V.15: Impacts from 1% annual flood scenario (Colebrook)

Type of impact	Value
Building related losses	$410,000
Business interruption losses	$0
Total economic losses (thousands of dollars)	$4,097,000
Damaged essential facilities	0
Buildings substantially damaged	0
Tons of debris	41,597
Displaced households	27
Shelter needs	1
Acres of land flooded	1,104

Source: HAZUS analysis

Table V.16: Estimated hurricane-related damage (thousands of dollars) by building occupancy

	Res	Com	Ind	Agr	Rel	Edu	Gov	Total
1938	11.24	0.33	0.29	0.09	0.02	0.01	0.01	11.98
1%	0.10	0.01	0.01	0.00	0.00	0.00	0.00	0.12
5%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: HAZUS analysis

According to CERC, Colebrook has an equalized net grand list of $260,445,069 in 2010 with commercial and industrial uses comprising 1.1% of this grand list. The equalized net grand list is an estimate of the market value of all taxable property in the municipality, and gives some indication of the value of property at risk in the event of a major natural disaster. There are zero business firms in the community according to CERC as of 2013.

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the municipality has experienced limited development. Specifically, the housing stock increased by 66 units between 2000 and 2010, and there has been no significant commercial or industrial development. According to the land use official, no development has occurred in flood-prone areas since the previous plan so development has not increased the community's vulnerability in flood-prone areas.

2. Evaluation of Risks and Vulnerability

The major natural hazards of concern in Colebrook are flooding, high winds, and severe winter storms. Forest fires, drought, and earthquakes occur much less frequently in the community, and are therefore of

somewhat lesser concern. The general risk and vulnerability posed by each of these six hazards is discussed in the preceding Section III of this

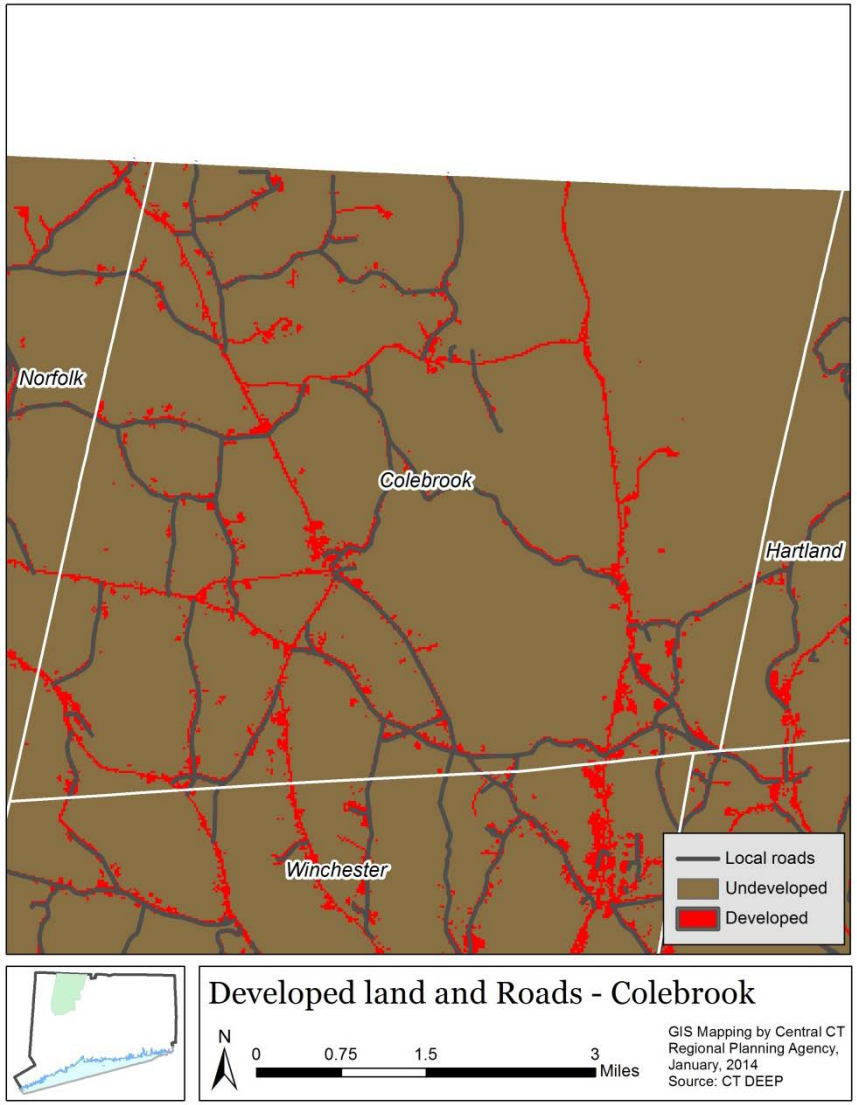

Figure V.5. Developed land and local roads in Colebrook

report. More specific information on the flood vulnerability and critical facilities in the town of Colebrook is presented below.

Flooding

Floodprone areas in Colebrook, as mapped by FEMA, are shown in Figure V.4. The hazard of flooding has been greatly reduced in the community through the construction of the Colebrook River Dam and the Goodwin Dam. According to FEMA's website, "Policy Statistics", 12 flood insurance policies are in force as of 8/31/2015 with an insurance value of $2,753,900. An attempt was made to estimate the number of structures located within the FEMA floodplain boundaries using available GIS data for Connecticut, however the data is not considered precise enough for an accurate assessment. Colebrook's First Selectman stated in a 2014 interview that the lower end of Sandy Brook near Riverton Road is the most flood prone area in town and that basement pump-outs are common during major storm events.

Hurricanes and Strong Winds

As with the rest of the Litchfield Hills region, Colebrook is vulnerable to high winds from a hurricane or tropical storm. As the town is located far inland, coastal flooding is not a concern, but riverine flooding caused by heavy rain during a hurricane is (see above). Due to the lack of coastal flooding vulnerability, the entire town is equally vulnerable to wind damage from hurricanes or other strong storms.

As high winds often cause power outages, the greatest impacts are expected in areas with relatively high levels of development. Figure V.5 below shows developed areas, as well as locations of local roads. The town would be responsible for clearing any debris caused by high winds from these roads.

Severe Winter Storms

Snow storms generally impact the entire town, meaning all of Colebrook is vulnerable. Areas that are heavily developed are more vulnerable, however, as there are more buildings (which can collapse under the heavy load of snow and ice) and more roads (which need to be cleared). Figure V.5, is a map of developed land and local roads, showing the areas with the highest relative vulnerability to damage from snow storms. The town has 37 miles of local roads to maintain, the lowest in the region. Because of this, Colebrook's vulnerability is lower than other towns

in the Litchfield Hills region.

Vulnerable Assets

There are sixteen dams in Colebrook. All of these dams are private dams with the exception of the Colebrook River Dam and the town-owned Metro Dam located at the Town Pond in Colebrook Center. The Colebrook River Dam is rated as Hazard Type C. Of the remaining dams, six are rated B or BB, and nine dams are rated A. For a description of these dam ratings, see "Flooding: Impacts" in Section III.

The major facilities at risk in the community in the event of a natural hazard are shown in Figure V.4. These facilities include the Colebrook Town Hall, Colebrook Elementary School, the Town Garage, Center Fire House, Forge Fire House, Camp Jewell (back-up shelter), and Colebrook hydro facility retro-fit. These are considered critical facilities in the event of a natural disaster because they might be at risk or needed for effective emergency response. All are potentially vulnerable to tornados, winter storms, wildfire, and earthquakes. None of the facilities are located within a floodplain.

Tables V.13 & V.14 above show the "total exposure" of all structures in Colebrook, under a 1% flood scenario. The first table shows that $317,058,000 worth of buildings could potentially be impacted by a 1% flood event. The second table shows that about 1⁄3 of that total, $112,503,000 worth of buildings are likely to be impacted by such an event.

3. Potential Impacts

The HAZUS simulation of a 1% annual flood event shows that extensive flooding could occur in Colebrook. In the simulation, 9.7% of the town's land area, 2,408 acres, was flooded. Of that, 177 acres of developed land was flooded. This flooding would displace 54 households and require 51 people to seek temporary sheltering.

Tables V.15 and V.16 below provide detailed damage and cost estimates from the HAZUS simulations of a 1% annual flood and three hurricane scenarios.

High winds are also expected to have impacts on electricity distribution. During Hurricane Irene, for example, 56% of the town was without power (at the peak).

4. Major Concerns

- The lower end of Sandy Brook near Riverton Road commonly floods, sending water into people's basements.
- The town is home to numerous dams that could fail during a flood event.

5. Hazard Mitigation Plan

Since the last plan, the general geography, demography, and built environment have not changed significantly in this community. Nor have the hazards become significantly more or less severe. This update, unlike the previous plan, utilizes HAZUS methodology to gain a deeper understanding of the impacts from significant natural hazards. Additionally, this plan utilizes the state's most recent hazard mitigation plan. As such, the plan priorities remain the same with the addition of mitigation actions to protect the built environment.

Mitigation Goals and Objectives

The principal goals of Colebrook's natural hazard mitigation plan update are:

1. To minimize the risks to life and property from natural hazards, and
2. To prevent losses from natural hazards to the extent practicable.

In addition to these over-arching goals, the town has also established the following objectives to help the town become more disaster resistant:

1. Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness
2. Ensure proper functioning of critical facilities during emergency response.
3. Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Potential Mitigation Measures

Table V.3 in the previous section of this report presents a listing of potential mitigation measures that can be taken to reduce the impacts of the major natural hazards of concern in the Litchfield Hills Region. In the context of Colebrook's risk and vulnerability analysis presented above, and the existing mitigation strategies in the town, only some of these measures will be both needed and cost-effective. The purpose of this Natural Hazards Mitigation Plan is to identify reasonable and appropriate mitigation measures for each hazard from the Table V.3 listing and other sources, and to develop an implementation strategy for the priority mitigation measures.

Existing Mitigation Strategy

The Town of Colebrook has a number of existing authorities, policies, programs and regulations that serve to mitigate the impact of natural hazards. Existing local authorities include the Colebrook Board of Selectmen, Planning and Zoning Commission, Inland Wetlands Commission, Emergency Management Director, Fire Department, and Department of Public Works.

Land use regulations exist to protect natural resources, including erosion and sediment control regulations for new development, stormwater control regulations to minimize drainage problems, and a flood hazard area overlay district to control development in flood prone areas.

The flood hazard area overlay district provides that any new construction or substantial improvement of any residential structure shall have the lowest floor, including the basement, elevated to at least one foot above the base flood elevation. Nonresidential construction is required to have the lowest floor, including basement, elevated to at least one foot above the base flood level or be flood-proofed to one foot above the base flood elevation. A registered professional engineer or architect is required to design and certify the construction of structures in the floodplain in order to minimize flood damage. Additionally all attendant utilities or sanitary facilities should be located or designed to avoid infiltration or impairment by flood waters. Manufactured homes and recreational vehicles are prohibited or highly restricted within the flood hazard overlay district, respectively.

Colebrook's Subdivision regulations have detailed standards for the planning, design and construction of storm drainage systems in order to minimize adverse impacts with new construction activity. The Colebrook Inland Wetlands and Watercourses Agency enforces regulations to direct development away from wetlands and floodplains. These regulations also encourage development and subdivision to implement low impact development strategies to manage stormwater and drainage.

In addition to these regulations, the Colebrook Public Works Department routinely examines and clears public storm drains and catch basins of debris following periods of rainfall, snowfall, or windstorms. The town's DPW also monitors weather reports and maintains loaded trucks in preparation of winter storm events.

The Colebrook Volunteer Fire Department, Department of Public Works, and Emergency Management Director all possesses emergency equipment that can be deployed as needed in the event of an emergency. Procedures are also in place to open and maintain the Emergency Operations Center and emergency shelter in town. Recently, the town purchased a generator for the Town Hall and Senior Center for back-up power during an emergency.

Colebrook has also been working with other towns in the Litchfield Hills Region through the Northwest Hills Public Safety Task Force to enhance communication and coordination. This has included efforts to standardize communication equipment and the equipment in local emergency operation centers, and also the upgrading of supplies at emergency shelters. Other activities that have been implemented include participation in a regionally coordinated public notification system, a badging registration system for emergency responders, and improved training opportunities.

In addition to these local and regional mitigation programs, the municipality also benefits from numerous federal and state mitigation programs such as the USGS WaterWatch, Report of the Two Storm Panel, CT DEEP Forest Fire Danger Report, the "Connecticut Drought Preparedness and Response Plan", the "National Weather Service Early Warning System", the University of Connecticut's Center for Land Use Education and Research (CLEAR), and the annual tree trimming maintenance program by Eversource.

Recommended Hazard Mitigation Measures

Objective 1: Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness.

Natural Hazard Addressed: *All hazards*

Objective 2: Ensure proper functioning of critical facilities during emergency response.

Natural Hazard Addressed: *All hazards.*

Objective 3: Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Natural Hazard Addressed: *flooding.*

The priority assigned to the above strategies was based on cost-benefit discussions with local officials and an evaluation using the STAPLEE criteria defined in FEMA's "How To Guide #3: Developing the Mitigation Plan". STAPLEE is short for the social, technical, administrative, political, legal, economic, and environmental criteria used in the evaluation process. It is anticipated that the low-cost strategies will be implemented during the first year after plan adoption. The higher-cost projects will be implemented as funding becomes available.

High priority projects are those that are considered critically important in order to minimize the risks to life and property from natural hazards. Medium priority projects are important to the community in order to mitigate the impacts of natural disasters but are not considered as critical to the community as high priority projects. Low priority projects are supportive of hazard mitigation goals and objectives, but are not considered essential to effective hazard mitigation in the community.

Changes in Mitigation Priorities from Previous Plan

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the Town of Colebrook has pursued implementation of a number of mitigation measures. Of particular note is the participation in a regional public notification system (Everbridge System) coordinated through Litchfield County Dispatch and support for an increased role by Eversource in tree trimming maintenance practices along roadsides. The major municipal priorities remain unchanged from the previous Plan with a focus on community preparedness, maintenance and enhancement of response resources, and effective floodplain/drainage management. No significant changes or data reanalysis were made from the 2006 with the exception of the inclusion of HAZUS. The following table describes the hazard mitigation strategies of medium or high priority for this community and their associated responsibilities, timeframe, priority, funding source, etc. Projects included in the previous plan are italicized. All of the mitigation actions listed in the 2006 plan have also been included here. These actions are either on-going due to their nature (education, equipment maintenance) or were not completed due to the economic recession. Unless otherwise noted, all Local Mitigation Actions, once budgeted for, are able to be accomplished within the 2016 Plan Update five year timeframe.

At this time, the municipality is unable to expand or improve their existing capabilities to reduce key vulnerabilities without additional capacity in the form of training, staff, and/or funding.

The municipality's current comprehensive plan (Plan of Conservation Development) does not reference the 2006 Litchfield Hills Natural Hazard Mitigation Plan or natural hazards with the exception of stormwater management or floodplains as applicable. The NHCOG will discuss the incorporation of the new 2016 Natural Hazard Mitigation Plan into local planning documents with each municipality.

Table V.17: Objective 1 Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Continue to visit schools and educate children about natural hazards and how to prepare for them.	Volunteer Fire Dept. and Emergency Management Director	Annually, efforts to be reviewed at annual planning meeting	Medium	4.8	Volunteers	Municipal budget; EMPG	All hazards
2. Make literature available on natural hazards and preparedness at Colebrook Town Hall.	Emergency Management Director and First Selectman	On-going, information/needs reviewed annually	High	4.8	Volunteers	Municipal budget; EMPG	All hazards
3. Maintain local Emergency Operations Plan and continue to coordinate with the Regional Public Safety Task Force and Red Cross on community planning, preparedness, response, and training.	Emergency Management Director and First Selectman	On-going, to be reviewed annually	Medium	1.8	Volunteers	Municipal budget; EMPG	All hazards
4. *Participate in regional Emergency Notification System coordinated through Litchfield County Dispatch (i.e. Everbridge system) to provide emergency information to residents in the entire town or in a specific geographic area. This notice can provide not only warning of an impending situation but also information regarding how to prepare for a particular event.*	Emergency Management Director and First Selectman	On-going, to be reviewed annually	Medium	1.8	$8,000/year	LCD; Municipal budget	All hazards

Table V.18: Objective 2 Ensure proper functioning of critical facilities during emergency response							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Routinely inspect emergency response equipment, and train for response to natural disasters.	Volunteer Fire Dept. and Emergency Management Director	On-going basis per Dept. procedure	High	4	Volunteers	Municipal budget; EMPG	Response to all hazards
2. Cooperate with the Metropolitan District Commission in emergency response training exercises and updates of the Goodwin Dam Emergency Action Plan.	Emergency Management Director and First Selectman	As requested by MDC and DEEP	Medium	3.4	Volunteers	Municipal budget	Flooding
3. Acquire additional emergency response equipment and supplies for the emergency shelter and emergency operations center.	Emergency Management Director, Fire Chief	On-going, efforts to be reviewed at annual planning meeting, supplies replenished as needed.	Medium	1.1	$1,000/year	Municipal budget; FEMA; EMPG; DEMHS; LOCIP; STEAP	All hazards
4. Acquire replacement all-terrain vehicle and trailer to support emergency response services.	Emergency Management Director, Fire Chief	2016	Medium	1.1	$12,000	Municipal budget; FEMA; LOCIP	All hazards
5. Promote the use of interoperable communication equipment, written mutual aid agreements, and the development of standard operating procedures for emergency response in the regional area.	Emergency Management Director, Fire Chief, and First Selectman	On-going, efforts to be reviewed at annual planning meeting	High	1.8	Volunteers	Municipal budget; OPM RPI; EMPG	All hazards
6. Develop a Memorandum of Understanding with schools or bus companies to utilize school buses for mass transportation during an emergency.	Emergency Management Director and First Selectman	2016	Medium	3.4	$1,200	Municipal/school budgets; EMPG	All hazards
7. Develop basic GIS capabilities as needed for access to aerial photos showing the number and location of properties and structures that could be affected by a natural disaster.	Emergency Management Director, Fire Chief, and First Selectman	2016	Medium	1.8	$3,000/year	OPM RPI; Municipal budget	All hazards

Table V.19: Objective 3 Expand maintenance activities and implement specific projects that address known drainage issues within the town							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Pursue additional funding for control measures to mitigate the flooding created by beavers.	Public Works Dept.	On-going, efforts to be reviewed at annual planning meeting	Medium	1.3	$1,500/culvert	FEMA; Municipal budget	Flooding
2. Develop clean-out schedules for all catch basins and drainage facilities and implement with region's catch basin cleaner	Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.1	$3,500/year	Municipal budget	Flooding
3. Review floodplain regulations and ordinances and update as necessary based on DEEP's "Model Floodplain Management Regulations" and FEMA Guidelines	Planning and Zoning Commission	2016	Medium	4.5	$2,500	Municipal budget	Flooding
4. Pursue additional funding to supplement the municipal tree trimming program and support increased role by Eversource in tree trimming maintenance activities along roadsides.	First Selectman, Public Works Dept.	2016	High	1.3	$25,000	State; Eversource; Municipal budget; FEMA HMGP	Outages due to high winds and snow

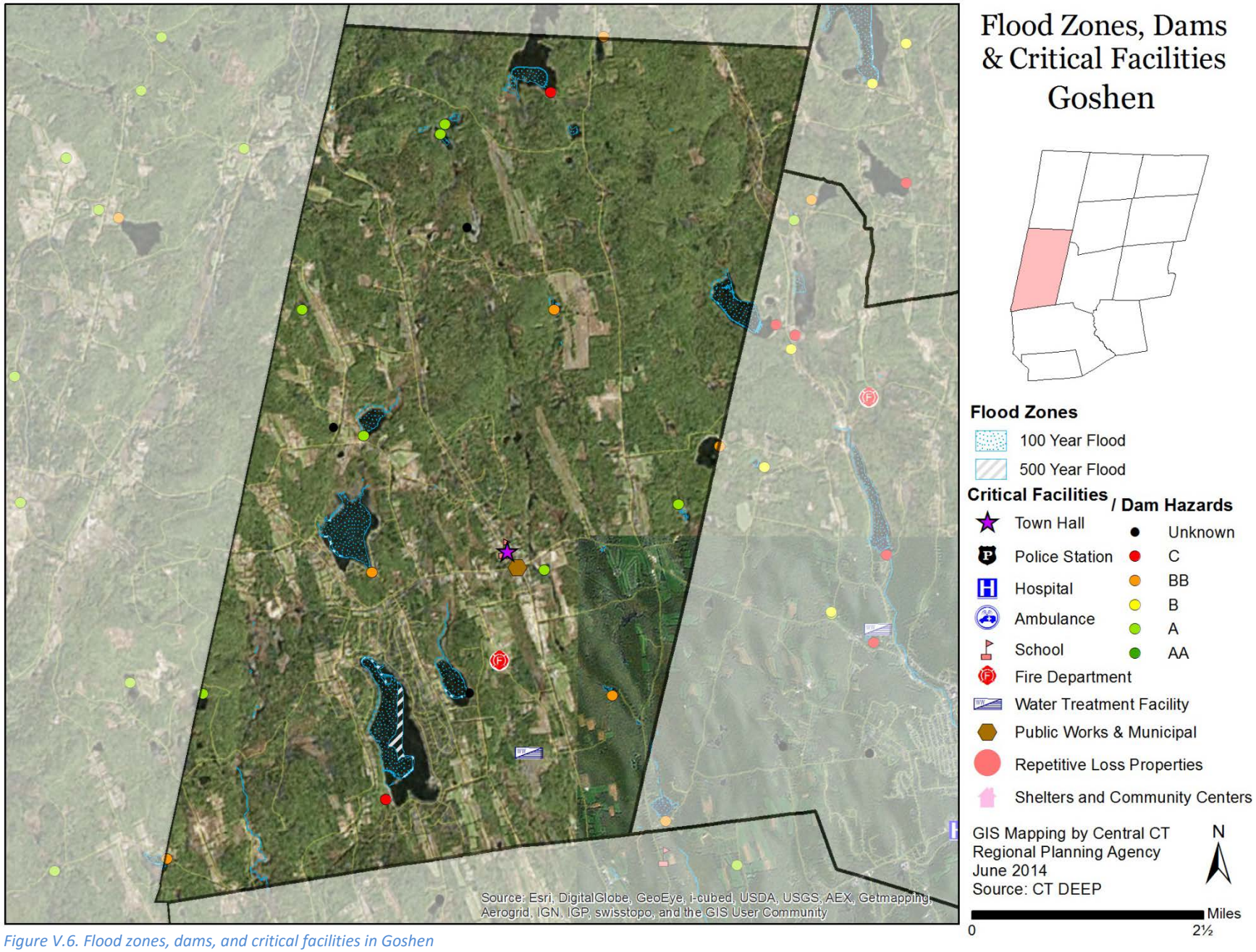

Figure V.6. Flood zones, dams, and critical facilities in Goshen

C. Town of Goshen Risk Assessment and Hazard Mitigation Plan

1. General Town Description

The Town of Goshen is a rural residential town in the Litchfield Hills Region bordered on the east by Torrington, on the south by Litchfield, on the west by Cornwall, and on the north by Norfolk (Figure V.6).

Goshen was incorporated in October of 1739 and has a total area of 45.2 square miles with a land area of 43.7 square miles. It has a population of 3,044 persons in 2011, and is run by a Selectman/Town Meeting form of government.

Goshen is part of the Northeastern Highlands Ecoregion, which is characterized by "hills and mountains, a mostly forested land cover, nutrient-poor frigid and cryic soils (mostly Spodosols), and numerous high-gradient streams and glacial lakes" (as described on the map "Ecoregions of New England"). Other notable characteristics of the municipality include farmland, rolling hills, numerous lakes, and State forestland. The many bodies of water in Goshen include 385-acre Woodridge Lake, Tyler Lake, Dog Pond, West Side Pond, North Pond, Whist Pond and Rueben Hart Reservoir. Ivy Mountain State Park and nearly 1400 acres of Mohawk State Forest are located in Goshen. Major highways serving the town include State Routes 4 and 63. The bedrock is primarily metamorphic and granite, and the surficial material consists predominantly of fertile, stony glacial till soils.

Goshen's history is described in "Goshen Connecticut, a Town Above all Others" written by the Quadrimillennium Editorial Committee in 1990. The book describes the first settlers coming to Goshen in the 1700's, and a lively history of farms, water-powered mills, blacksmith shops, clockmakers, sawmills, gristmills, creameries, and cotton mills through the 18th and 19th century.

According to the US Census data, the population of Goshen has increased an average of 34 persons per year over the past 50 years, from a population of 1288 people in 1960 to 2,976 in 2010. The population is projected to continue to increase to 3,175 persons by the year 2020 an increase of 6.6% from 2010. The median age in 2010 was 48.

Most housing is owner occupied, with about 23% of the housing stock held for seasonal, recreational or occasional use (second homes). There are 1,795 existing housing units in town as of 2009.

Table V.20: Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	279,294	84.0%
Commercial	29,712	8.9%
Industrial	10,371	3.1%
Agricultural	2,732	0.8%
Religion	3,945	1.2%
Government	4,341	1.3%
Education	1,930	0.6%
Total	332,325	100.00%

Table V.21: Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	209,425	81.6%
Commercial	25,794	10.0%
Industrial	8,567	3.3%
Agricultural	2,657	1.0%
Religion	3,945	1.5%
Government	4,341	1.7%
Education	1,930	0.8%
Total	256,659	100.00%

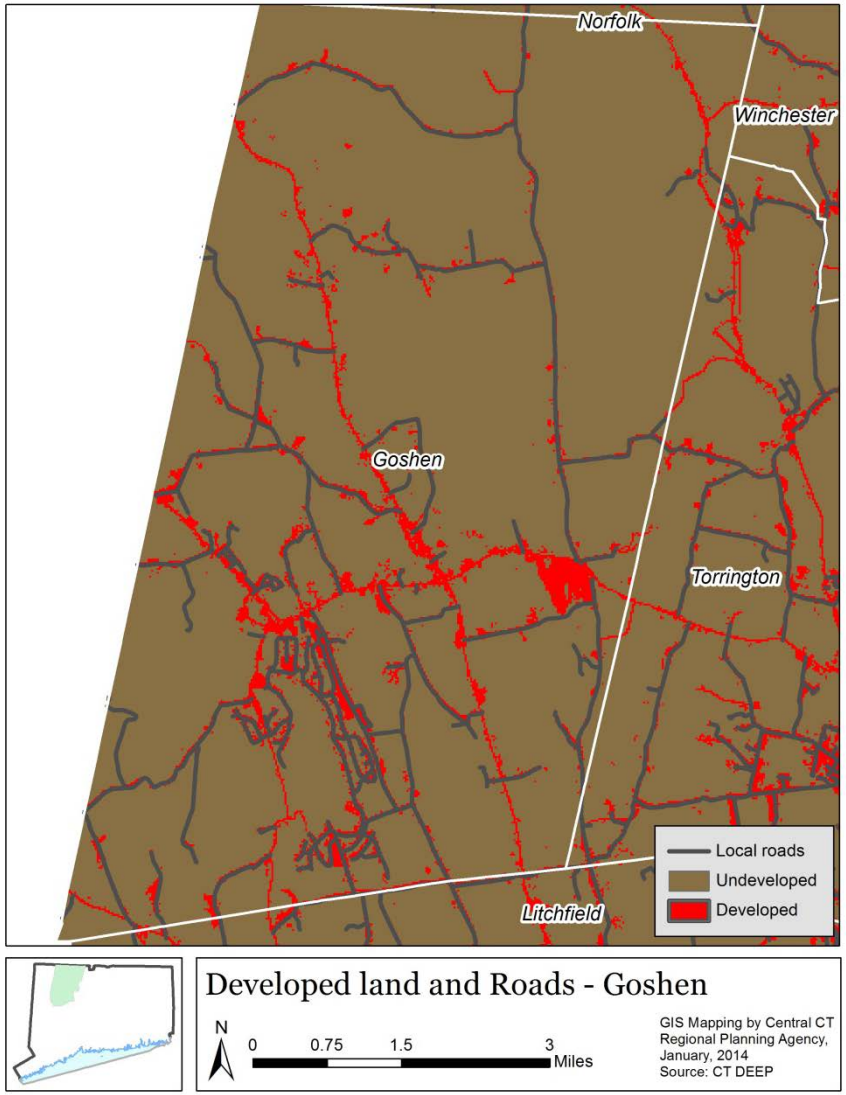

Figure V.7. Developed land and local roads in Goshen

Goshen, according to the Connecticut Economic Resource Center (CERC), had a resident labor force of 1,564 persons in 2011, with 379 jobs located in the town. Most of these jobs are in service producing industries and construction. The unemployment rate was 6% in 2013.

According to CERC, Goshen has an equalized net grand list of $788,916,770 in 2010 with commercial and industrial uses comprising 3.7% of this grand list. The equalized net grand list is an estimate of the market value of all taxable property in the municipality, and gives some indication of the value of property at risk in the event of a major natural disaster. There are 96 places of work in the community according to CERC as of 2013.

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the municipality has experienced limited development. Specifically, the housing stock increased by 182 units between 2000 and 2010, and there has been no significant commercial or industrial development. According to the land use official, no development has occurred in flood-prone areas since the previous plan so development has not increased the community's vulnerability in the flood-prone areas.

2. Evaluation of Risks and Vulnerability

The major natural hazards of concern in Goshen are localized flooding, high winds, and severe winter storms. Forest fires, drought, and earthquakes occur much less frequently in the community, and are therefore of somewhat lesser concern. The general risk and vulnerability posed by each of these six hazards is discussed in the preceding Section III of this report. More specific information on the flood vulnerability and critical facilities in the town of Goshen is presented below.

Flooding

Flooding in Goshen is a slightly lesser concern compared to other communities because there are no major rivers flowing through the community (see Figure V.6 above). Isolated flooding still occurs, however, due to inadequate drainage systems and beaver dams.

Increased flooding as a result of beavers is also of growing local concern. As stated in the aforementioned history book of Goshen, "Beavers were dropped into ponds by helicopters as part of a state project, and have increased so greatly in numbers that their damming streams and flooding roads has become a problem"(p 10).

Severe Winter Storms

Table V.22: Impacts from 1% annual flood scenario (Goshen)	
Type of impact	Value
Building related losses	$4,720,000
Business interruption losses	$60,000
Total economic losses (thousands of dollars)	$4,776,000
Damaged essential facilities	0
Buildings substantially damaged	0
Tons of debris	1,307
Displaced households	32
Shelter needs	8
Acres of land flooded	1,568

Winter storms can impact the entire town and occur relatively frequently. A severe snowstorm occurred in March of 1978 that brought close to three feet of heavy snow, and Goshen was without power for five days. In 2002, Goshen suffered another major ice storm that resulted in downed power lines, extensive tree damage, and expensive clean-up costs. The period of 2011-2013 brought several severe storm events: Tropical Storm Irene, Hurricane Sandy, and a severe winter storm in 2013.

Areas with heavy development are more vulnerable due to the potential for roof collapses caused by heavy snow. Areas where local roads, which are maintained by the town, are located are also more vulnerable, as clearing the roads can cost the town a considerable amount of money. Figure V.7 below shows where these areas are located. The town maintains 68 miles of local roads, or 8% of the regional total.

Hurricanes and High Winds

While not frequently occurring, tornados are a concern in Goshen. In 1979, a year after a major winter storm, a tornado touched down, causing substantial tree damage. Another tornado on July 10, 1989, caused limited damage in Goshen, but substantial damage in neighboring communities.

As noted above, areas of with heavy development are more vulnerable as they are home to a greater number of buildings. These areas can be impacted by power outages and debris from trees. The map above shows these areas.

Vulnerable assets

Floodprone areas in Goshen, as mapped by FEMA, are shown in Figure V.6. There are, according to FEMA's website, "Policy Statistics", 26 flood insurance policies in force as of 8/31/2015 with an insurance value of $8,667,700. An attempt was made to estimate the number of structures located within the FEMA floodplain boundaries using available GIS data for Connecticut, however the data is not considered precise enough for an accurate assessment.

There are sixteen dams in Goshen (see Figure V.6 above). Ten of these dams are private dams, two are state owned, and four dams are not classified. The Woodridge Lake Dam and North Pond Dam are rated as Hazard Type C. Of the remaining dams, four are rated BB, five dams are rated A, and five dams are not rated. For a description of these dam ratings, see "Flooding: Impacts" in Section III.

The major facilities at risk in the community in the event of a natural hazard are shown in Figure V.6. These facilities include the Goshen Town Hall, Goshen Elementary School, the Town Garage, Goshen Fire House, fuel storage tanks for Goshen Oil, and the Goshen Gas Station/Store. These are considered critical facilities in the event of a natural disaster because they might be needed for effective emergency response. All are potentially vulnerable to tornados, winter storms, wildfire, and earthquakes. None of the facilities are located within a floodplain.

Tables V.20 & V.21 above show the "total exposure" of all structures in Goshen, under a 1% flood scenario. The first table shows that $332,325,000 worth of buildings could potentially be impacted by a 1% flood event. The second table shows that about 2/3 of that total, $256,658,000 worth of buildings are likely to be impacted by such an event.

Table V.23: Estimated hurricane-related damage (thousands of dollars) by building occupancy								
	Res	Com	Ind	Agr	Rel	Edu	Gov	Total
1938	18.78	1.14	0.48	0.44	0.02	0.01	0.03	20.90
1%	0.23	0.04	0.01	0.01	0.00	0.00	0.00	0.29
5%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3. Potential Impacts

While flooding is not as common in Goshen as in the rest of the region (due to the lack of major rivers), the Flood of 1955 did have a limited impact on Goshen. According to the Goshen history book mentioned above, "When the disastrous flood of 1955 hit Torrington, Goshen too had some flooded roads and damp cellars, and the old Torrington creamery building in West Goshen was so damaged by water that the Grange could no longer use it for meetings." (p. 11). Hurricane Diane, which spawned the flood of 1955 brought fourteen and a half inches of rain on August 18 and 19.

Results of the HAZUS 1% flood simulation are shown in Table V.22. In Goshen, $4.776 million worth of economic losses are estimated. Of that, $4.72 million are due to building damage while $60,000 is from business interruptions. Such an event would displace 32 households and cause eight people to seek temporary shelter. The flood would cover 1,568 acres of land. Full results from this simulation are in Appendix B.

As noted above, tornados have caused significant tree damage in the past, but had limited impacts on buildings. Hurricanes have caused wide-spread power outages and could cause significant damage. Hurricane Irene left 46% of the town without power at its peak (879 households). The results of three HAZUS hurricane simulations are presented in Table V.23. An event similar to the 1938 hurricane could cause $20,900 in damage from the wind. Such an event would likely cause a flood as well, which would increase the amount of damage dramatically (see above). Winter storms are a perennial concern with wide-ranging impacts. Snow covered roads take time and money to clear. Heavy snow, especially when accompanied by ice can cause roofs to collapse. Ice storms can also bring down power lines, causing outages.

4. Major Concerns

- The high percentage of seasonal homes in Goshen may pose an additional challenge for emergency response in the community. Specifically, the municipal monitoring of natural hazard impacts, and timely emergency response, may prove more problematic due to the periodic occupancy of the units. For example, flooding of a residence could go undetected and unreported for several days with no one living there. Lengthy power outages may leave homes with frozen, broken water pipes and interior flooding in severely cold weather.
- The drainage area at Woodridge Lake is particularly of concern according to the town road supervisor due to the increased density of development in this area. Road flooding has occurred in this area in recent years and there is a need for a comprehensive stormwater drainage study of this part of town to better define drainage improvement needs.

5. Hazard Mitigation Plan

Since the last plan, the general geography, demography, and built environment have not changed significantly in this community. Nor have the hazards become significantly more or less severe. This update, unlike the previous plan, utilizes HAZUS methodology to gain a deeper understanding of the impacts from significant natural hazards. Additionally, this plan utilizes the state's most recent hazard mitigation plan. As such, the plan priorities remain the same with the addition of mitigation actions to protect the built environment.

Mitigation Goals and Objectives

The principal goals of Goshen's natural hazard mitigation plan update are:

1. To minimize the risks to life and property from natural hazards, and
2. To prevent losses from natural hazards to the extent practicable.

In addition to these over-arching goals, the town has also established the following objectives to help the town become more disaster resistant:

1. Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness
2. Ensure proper functioning of critical facilities during emergency response.
3. Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Overview of Potential Mitigation Measures

Table V.3 in the previous section of this report presents a listing of potential mitigation measures that can be taken to reduce the impacts of the major natural hazards of concern in the Litchfield Hills Region. In the context of Goshen's risk and vulnerability analysis presented above, and the existing mitigation strategies in the town, only some of these measures will be both needed and cost-effective. The purpose of this Natural Hazards Mitigation Plan is to identify reasonable and appropriate mitigation measures for each hazard from the Table V.3 listing and other sources, and to develop an implementation strategy for the priority mitigation measures.

Existing Mitigation Strategy

The Town of Goshen has a number of existing authorities, policies, programs and regulations that serve to mitigate the impact of natural hazards. Existing local authorities include the Goshen Board of Selectmen, Planning and Zoning Commission, Inland Wetlands Commission, Emergency Management Director, Fire Department, and Department of Public Works.

Goshen, through town ordinance, achieves compliance with NFIP requirements with the following ordinances: adoption of the Connecticut State Building code (Title 26), assurance of town compliance with the National Flood Insurance requirements and empower town and regional officials with appropriate duties (Title 30), Floodplain Management Ordinance (Title 52) and its amendment (Title 53). Goshen expects to continue participation in NFIP. Land use regulations exist to protect natural resources, including erosion and sediment control regulations for new development, stormwater control regulations to minimize drainage problems, and a flood hazard area to control development in flood prone areas.

The flood hazard area provides that any new construction or substantial improvement of any residential structure shall have the lowest floor, including the basement, elevated to at least the base flood elevation. Nonresidential construction is required to have the lowest floor, including basement, elevated to at least the base flood elevation or be floodproofed to the base flood elevation. Additionally all attendant utilities or sanitary facilities should be located or designed to avoid infiltration or impairment by flood waters.

Goshen's subdivision regulations have detailed standards for the planning, design and construction of storm drainage systems in order to minimize adverse impacts associated with new construction activity. The Goshen Inland Wetlands and Water Course Commission enforces regulations to direct development away from wetlands, watercourses and floodplains. In addition to these regulations, the Goshen Public Works Department routinely examines and clears public storm drains and catch basins of debris following periods of rainfall, snowfall, or windstorms. The town's DPW also monitors weather reports and maintains loaded trucks in preparation for winter storm events.

The Goshen Volunteer Fire Department, Department of Public Works, and Emergency Management Director all possesses emergency equipment that can be deployed as needed in the event of an emergency. Procedures are also in place to open and maintain the Emergency Operations Center and emergency shelter in town. Goshen also has a local CERT Team to enhance emergency response. Goshen has also been working with other towns in the Litchfield Hills Region through the Northwest Hills Public Safety Task Force and Region 5 of the CT Department of Emergency Services and Public Protection to enhance emergen-

cy management, communication and coordination. This has included efforts to standardize communication equipment and the equipment in local emergency operation centers, and also the upgrading of supplies at emergency shelters. Other activities that have been implemented include a public notification system, a badging registration system for emergency responders, and improved training opportunities in emergency management.

In addition to these local and regional mitigation programs, the municipality also benefits from numerous federal and state mitigation programs such as the USGS WaterWatch, Report of the Two Storm Panel, CT DEEP Forest Fire Danger Report, the "Connecticut Drought Preparedness and Response Plan", the "National Weather Service Early Warning System", the University of Connecticut's Center for Land Use Education and Research (CLEAR), and the annual tree trimming maintenance program by Eversource.

Recommended Hazard Mitigation Measures

Objective 1: Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness.
Natural Hazard Addressed: *All hazards.*

Objective 2: Ensure proper functioning of critical facilities during emergency response. ***Natural Hazard Addressed:*** *All hazards.*

Objective 3: Expand maintenance activities and implement specific projects that address known drainage issues within the town.
Natural Hazard Addressed: *flooding.*

The priority assigned to the above strategies was based on cost-benefit discussions with local officials and an evaluation using the STAPLEE criteria defined in FEMA's "How To Guide #3: Developing the Mitigation Plan". STAPLEE is short for the social, technical, administrative, political, legal, economic, and environmental criteria used in the evaluation process. It is anticipated that the low-cost strategies will be implemented during the first year after plan adoption. The higher-cost projects will be implemented as funding becomes available. High priority projects are those that are considered critically important in order to minimize the risks to life and property from natural hazards. Medium priority projects are important to the community in order to mitigate the impacts of natural disasters but are not considered as critical to the community as high priority projects. Low priority projects are supportive of hazard mitigation goals and objectives, but are not considered essential to effective hazard mitigation in the community.

Changes in Mitigation Priorities from Previous Plan

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the Town of Goshen has pursued implementation of a number of mitigation measures. Of particular note is the implementation of a public notification system (Everbridge System), and establishment of a new and more robust Emergency Operations Center at the Town Hall. The major municipal priorities remain largely unchanged from the previous Plan with a focus on community preparedness, enhancement of response resources, and floodplain/drainage management. One noteworthy addition to the municipal priorities is advocacy for improved floodplain mapping by federal and state authorities in order to more accurately identify floodplains for flood insurance purposes.

The following table describes the hazard mitigation strategies of medium or high priority for this community and their as-associated responsibilities, timeframe, priority, funding source, etc. Projects included in the previous plan are italicized. Nearly all of the mitigation actions listed in the 2006 plan have also been included here. These actions are either ongoing due to their nature (education, equipment maintenance) or were not completed due to the economic recession. Unless otherwise noted, all Local Mitigation Actions, once budgeted for, are able to be accomplished within the 2016 Plan Update five year timeframe.

At this time, the municipality is unable to expand or improve their existing capabilities to reduce key vulnerabilities without additional capacity in the form of training, staff, and/or funding. The municipality's current comprehensive plan (Plan of Conservation Development) does not reference the 2006 Litchfield Hills Natural Hazard Mitigation Plan or natural hazards with the exception of stormwater management or floodplains as applicable. The NHCOG will discuss the incorporation of the new 2016 Natural Hazard Mitigation Plan into local planning documents with each municipality.

Table V.24: Objective 1 Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Visit schools and educate children about natural hazards and how to prepare for them.	Volunteer Fire Dept. and Emergency Management Director	Annually, efforts to be reviewed at annual planning meeting	Medium	4.8	Volunteers	Municipal budget; EMPG	All hazards
2. Make literature available on natural hazards and preparedness at Goshen Town Hall.	Emergency Management Director and First Selectman	On-going, efforts to be reviewed at annual planning meeting	High	4.8	Volunteers	Municipal budget; EMPG	All hazards
3. Provide outreach to seasonal home-owners on how to protect against frozen pipes and water damage during the winter with the loss of electricity, including information on automatic shut-off switches or alarms.	Emergency Management Director and First Selectman	2016	Medium	4.8	Volunteers	Municipal budget; utilities	Winter storms; High winds
4. Maintain local Emergency Operations Plan and continue to coordinate with the Regional Public Safety Task Force and DEMHS Region 5 on planning, preparedness, response, recovery, and training.	Emergency Management Director and First Selectman	On-going, efforts to be reviewed at annual planning meeting	Medium	1.8	Volunteers	Municipal budget; EMPG; DEMHS	All hazards
5. *Continue to provide an Emergency Notification System to provide emergency information to residents in the town or in a specific geographic area. This System can warn of an impending situation and also provide information regarding how to prepare or respond to a particular event.*	Emergency Management Director and First Selectman	On-going	Medium	1.8	LCD and/or ENS dues	LCD; Municipal budget	All hazards

Table V.25: Objective 2 Ensure proper functioning of critical facilities during emergency response							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Routinely inspect emergency response equipment, and train for response to natural disasters.	Volunteer Fire Dept., CERT Team, and Emergency Management Director	Quarterly and after every response	High	4	Volunteers	Municipal budget; EMPG	All hazards
2. Acquire additional emergency response equipment including a wood chipper and 500-gallon portable water tank to enhance response capabilities	Emergency Management Director, Fire Chief	2016	High	1.1	$40,000 – 50,000(wood chipper); $1,000 (water tank)	FEMA; Municipal budget; LOCIP; STEAP	All hazards
3. Promote the use of interoperable communication equipment, and the development of standard operating guidelines for emergency response in the regional area.	Emergency Management Director, Fire Chief, and First Selectman	On-going, to be reviewed annually	High	1.8	Volunteers	Municipal budget; EMPG	All hazards
4. Consider developing a Memorandum of Understanding with schools or school bus company to utilize school buses for mass transportation during an emergency.	Emergency Management Director and First Selectman	2016	Medium	3.4	In-kind	Municipal/school budget; EMPG	All hazards
5. Develop basic GIS capabilities as needed for access to aerial photos showing the number and location of properties and structures that could be affected by a natural disaster.	Emergency Management Director, Fire Chief, and First Selectman	2017	Medium	1.8	$3,000/year	OPM RPI; Municipal budget	All hazards

Table V.26: Objective 3 Expand maintenance activities and implement specific projects that address known drainage issues within the town							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard mitigated
1. Pursue funding to implement control measures to mitigate the flooding created by beavers.	Public Works Dept.	On-going, with each project and/or as needed	Medium	1.3	$1,500/culvert	FEMA; Municipal budget	Flooding
2. Develop and implement clean-out schedules for all catch basins and drainage facilities	Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.1	$7,800/year	Municipal budget	Flooding
3. Review floodplain regulations and ordinances and update as necessary based on guidance from DEEP.	Planning and Zoning Commission	Annually, efforts to be reviewed at annual planning meeting	Medium	4.5	$2,500	Municipal budget	Flooding
4. Pursue improved floodplain mapping in cooperation with federal and state authorities in order to more accurately identify the location of structures that are susceptible to flooding.	FEMA , DEEP, First Selectman, EMD	2016	Medium	1.9	$200,000	FEMA	Flooding
5. Pursue additional funding to supplement the municipal tree trimming program.	First Selectman, Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.3	$47,000	State; Eversource; Municipal budget	Power outages due to high winds and snow storms
6. Pursue the purchase and placement of standardized house number signs to facilitate effective emergency response to 911calls.	Emergency Management Director, Fire Chief, and First Selectman	2016	Medium	2.8	$10/sign	Municipal budget	All hazards
7. Undertake comprehensive stormwater drainage study at Woodridge Lake to address localized flooding problems.	First Selectman, Public Works Dept.	2017	Medium	2.1	$40,000 (rough estimate)	Municipal budget; State; FEMA	Flooding

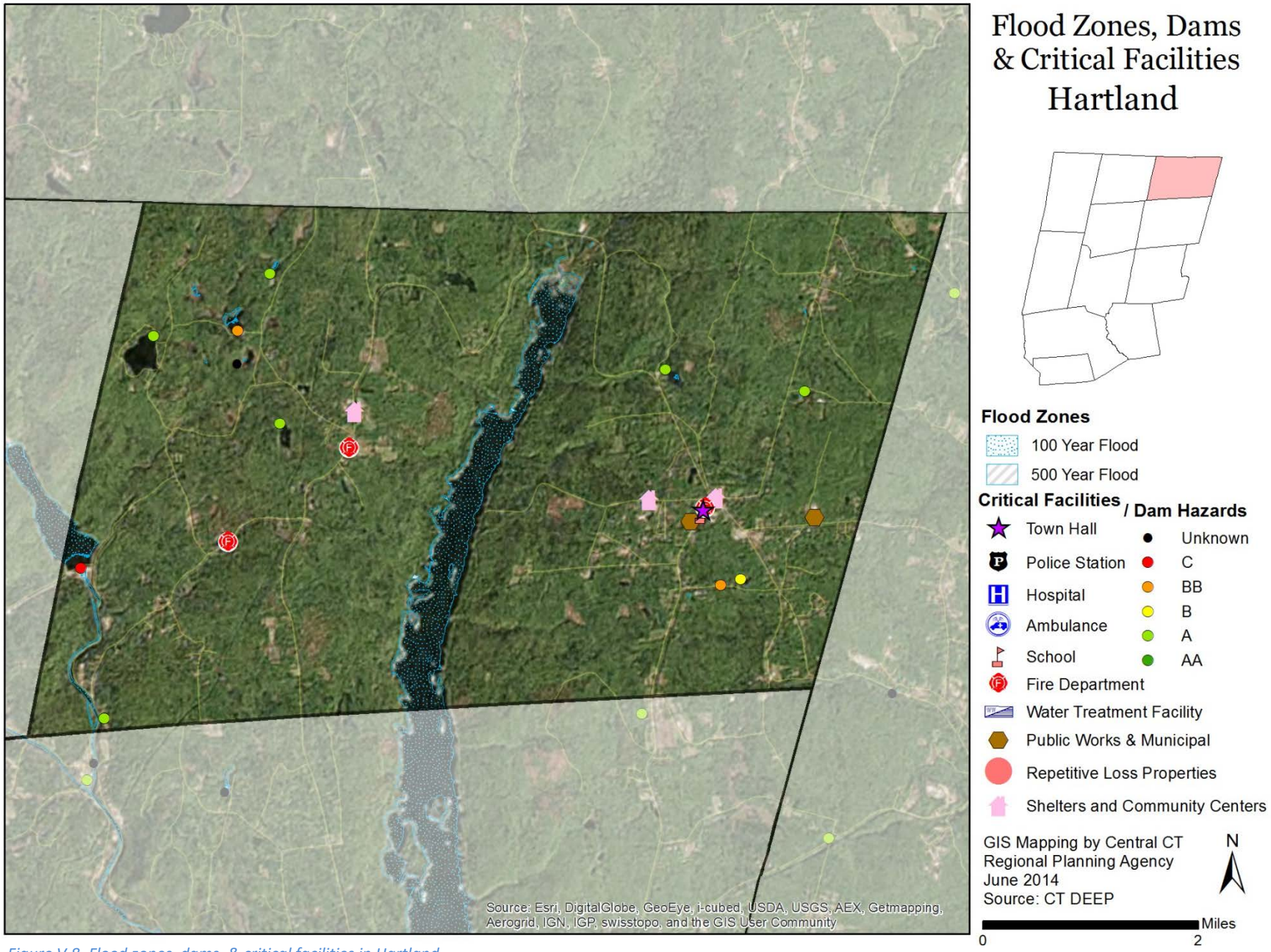

Figure V.8. Flood zones, dams, & critical facilities in Hartland

D. Town of Hartland Risk Assessment and Hazard Mitigation Plan

1. General Town Description

The Town of Hartland is a lightly developed, rural town in the Litchfield Hills Region. The town is bordered on the east by Granby, on the south by Barkhamsted, on the west by Colebrook, and on the north by Massachusetts (see Figure V.8).

Hartland was incorporated in May of 1761 and has a total area of 34.6 square miles and a land area of 33.0 square miles. It has a population of 2,073 persons in 2011, and is run by a Selectman/Town Meeting form of government.

The Barkhamsted Reservoir divides the town into East Hartland and West Hartland. The Tunxis State Forest Reserve, with 8,638 acres, and Water Company owned land (Metropolitan District Commission) around Barkhamsted Reservoir comprise about 2⁄3 of the land area of Hartland. A portion of People's State Forest is also located in Hartland. Hartland is part of the Northeastern Highlands Ecoregion, which is characterized by "hills and mountains, a mostly forested land cover, nutrient-poor frigid and cryic soils (mostly Spodosols), and numerous high-gradient streams and glacial lakes" (as described on the map "Ecoregions of New England"). Other notable characteristics of the municipality include moderately to steeply sloping wooded land, scattered wetlands and ponds, Barkhamsted Reservoir, and the West Branch of the Farmington River. Major highways serving the town include State Routes 20, 179 and 181. The bedrock is primarily metamorphic and granite, and the surficial material consists predominantly of fertile, stony glacial till soils.

A publication entitled "History of Hartland" was compiled by Stanley A. Ransom in 1961. According to this book, "Agriculture has been the dominant occupation of Hartland's inhabitants especially during the first 150 years" (p. 120), although Hartland "could never have been chosen by the early settlers as an utopia for agriculture purposes, The rock-ribbed hillsides offered little incentive to settlement and it taxes our imagination to comprehend how so many farms and homesteads were eventually carved out of the rough terrain and virgin forests which confronted the first inhabitants." (p. 1). These farms were supplemented with various industries in the 1800's including a calico factory (the largest industry ever to operate in Hartland with nearly 50 employees), coach and wagon factories, a tannery, boot manufacturer, lumber yard, and numerous sawmills, cider mills, and grist mills.

As stated on page 136 of the "History of Hartland", "The need for an additional water supply by Hartford and the towns which later joined in the formation of the Metropolitan District was first voiced in the mid 1920's. The MDC formally proposed legislation to construct a dam and reservoir in 1929, and legislation was ultimately approved in 1931 to enable construction of the Barkhamsted Reservoir and the Saville Dam. By this time, much of the land in "Hartland Hollow" had been purchased by the MDC. As stated by Mr. Ransom, "The ultimate result was the town being split into two separate communities having a reservoir occupying the entire breadth of the town and lying between the two sections called the East and the West Mountains" (p. 138).

According to the US Census data, the population of Hartland has increased an average of 21 persons per year over the past 50 years, from a population of 1,040 people in 1960 to 2,009 in 2010. The population is projected to slightly increase to 2,066persons by the year 2020, an increase of 2.8% from 2010. The median age in 2010 was45. The vast majority of housing is owner occupied, with about 8% of the housing stock renter occupied, and 4% held for seasonal, recreational or occasional use (second homes). There are 805 existing housing units in town as of 2009.

Hartland, according to the Connecticut Economic Resource Center (CERC), had a labor force of 1,201 persons in 2013, but only 129 jobs are actually located within the town. Most of these jobs are in service producing industries. The unemployment rate was 655% in 2013.

According to CERC, Hartland has an equalized net grand list of $261,420,906 in 2010 with commercial and industrial uses comprising 0.3% of this grand list. The equalized net grand list is an estimate of the market value of all taxable property in the municipality, and gives some indication of the value of property at risk in the event of a major natural disaster. There are 38 business firms in the community according to

CERC as of 2013.

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the municipality has experienced limited development. Specifically, the housing stock increased by 97 units between 2000 and 2010, and there has been no significant commercial or industrial development. According to the land use official, no development has occurred in flood-prone areas since the previous plan so development has not increased the community's vulnerability in the flood-prone areas.

2. Evaluation of Risks and Vulnerability

The major natural hazards of concern in Hartland are flooding, high winds, and severe winter storms. Forest fires, drought, and earthquakes occur much less frequently in the community, and are therefore of somewhat lesser concern. The general risk and vulnerability posed by each of these six hazards is discussed in the preceding Section III of this report. More specific information on the flood vulnerability and critical facilities in the town of Hartland is presented below.

Flooding

Floodprone areas, although few, as mapped by FEMA, are shown in Figure V.8. According to FEMA's website, "Policy Statistics", as of 8/31/2015, no flood insurance policies are in force in Hartland. An attempt was made to estimate the number of structures located within the FEMA floodplain boundaries using available GIS data for Connecticut, however the data is not considered precise enough for an accurate assessment.

Hurricanes and Strong Winds

Tornados, though rare, are a concern in Hartland. In 2001 the town also experienced a microburst of wind that destroyed a number of trees in town. The town is also vulnerable to flooding (see above) caused by hurricanes. As the town is located very far inland, damage from hurricane-force winds is not a major concern, except for power outages. Hartland suffered Hurricane related damage from Storm Irene in August 2011 and Storm Sandy in October 2012. Both of these events caused significant power outages and the storms received Presidential Disaster Declarations. Areas that are most vulnerable are those with greater levels of development.

Table V.27: Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	135,329	85.5%
Commercial	12,133	7.7%
Industrial	6,242	3.9%
Agricultural	670	0.4%
Religion	1,939	1.2%
Government	382	0.2%
Education	1,511	1.0%
Total	158,206	100.00%

Table V.28: Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	109,102	86.4%
Commercial	9,850	7.8%
Industrial	4,080	3.2%
Agricultural	456	0.4%
Religion	999	0.8%
Government	243	0.2%
Education	1,511	1.2%
Total	126,241	100.00%

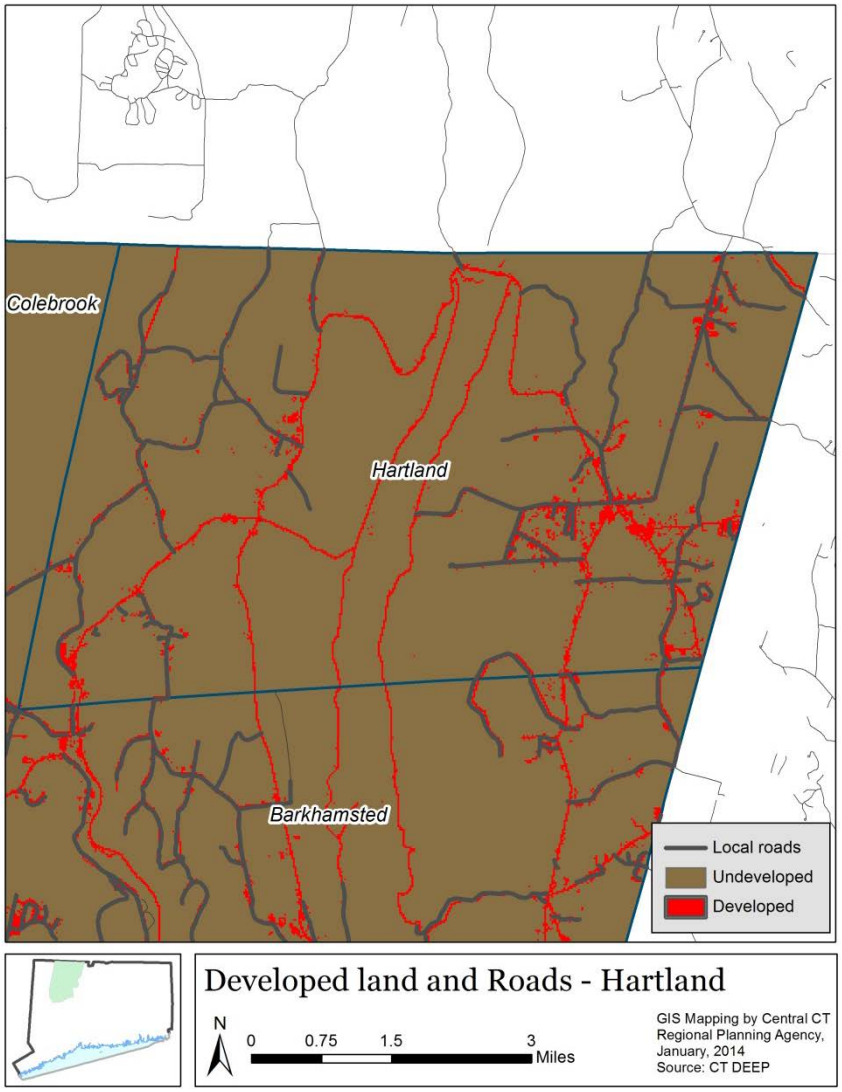

Figure V.9. Developed land and local roads in Hartland

Severe Winter Storms

A severe snowstorm occurred in March of 1978 that brought close to three feet of heavy snow, and Hartland was without power for several days. In 2002, Hartland suffered another major ice storm that resulted in downed power lines, extensive tree damage, and expensive clean-up costs. During the snow storm of 2011, at the peak of electrical outages, all but one customer was without power in Hartland. At least half the town was without power for six days during that storm.

Areas with heavy development are more vulnerable due to the potential for roof collapses caused by heavy snow. Areas where local roads, which are maintained by the town, are located are also more vulnerable, as clearing the roads can cost the town a considerable amount of money. Figure V.9 below shows where these areas are located. The town maintains 44 miles of local roads, or 5% of the regional total.

Vulnerable Assets

There are eleven dams in Hartland (see Figure V.8). Four of these dams are private dams, four are state owned, two are water company dams, and one dam is not classified. The Hogback Dam is rated as Hazard Type C. Of the remaining dams, three are rated B or BB, six dams are rated A, and one dam is not rated. Descriptions of dam ratings are provided earlier in this report (Section III).

The major facilities at risk in the community in the event of a natural hazard are shown in Figure V.8. These facilities include the Hartland Town Hall (which functions as the Town Emergency Operations Center), Hartland Elementary School (which serves as the town's emergency shelter), the Town Garage, the East Hartland Fire Station, and the West Hartland Fire Station. These are considered critical facilities in the event of a natural disaster because they might be needed for effective emergency response. All are potentially vulnerable to tornados, winter storms, wildfire, and earthquakes. None of the facilities are located within a floodplain.

Table V.29: Impacts from 1% annual flood scenario (Hartland)	
Type of impact	Value
Building related losses	$1,080,000
Business interruption losses	$4,000
Total economic losses (thousands of dollars)	$1,084,000
Damaged essential facilities	0
Buildings substantially damaged	0
Tons of debris	395
Displaced households	8
Shelter needs	0
Acres of land flooded	1,285

Tables V.27 & V.28 above show the "total exposure" of all structures in Hartland, under a 1% flood scenario. The first table shows that $158,206,000 worth of buildings could potentially be impacted by a 1% flood event. The second table shows that most of that total, $126,241,000 worth of buildings are likely to be impacted by such an event.

3. Potential Impacts

Hartland has had little experience with natural disasters, but some impacts from floods have been recorded. For example, one eyewitness, Alfred T. Lilliendahl, recounted that all roads out of town were effectively blocked by the Flood of 1955 and that the flood washed out several roads and dams in town.

There have also been instances of winter storms wreaking havoc in the community. As noted above, Hartland experienced sever power outages during the October snowstorm of 2011. At least half the town was without power for six days, and at its peak, all but one customer had no power.

Results of the HAZUS 1% flood simulation are shown in Table V.29 above. In Hartland, $1.084 million worth of economic losses are estimated. Of that, $1.08 million are due to building damage while $4,000 is from business interruptions. Such an event would displace 8 households. The flood would cover 1,285 acres of land. Full results from this simulation are in Appendix B.

As noted above, tornados have caused significant tree damage in the past, but had limited impacts on buildings. Hurricanes have caused wide-spread power outages and could cause significant damage. Hurricane Irene left 26% of the town without power at its peak (224 households). The results of three HAZUS hurricane simulations are presented in Table V.30. An event similar to the 1938 hurricane could cause $18,740 in damage from the wind. Such an event would likely cause a flood as well, which would increase the amount of damage dramatically (see above). Other scenarios show much lower damage estimates from wind alone.

4. Major Concerns

- Winter storms have the potential to close roads, making travel difficult for residents and commuters

Table V.30: Estimated hurricane-related damage (thousands of dollars) by building occupancy								
	Res	Com	Ind	Agr	Rel	Edu	Gov	Total
1938	16.54	1.20	0.59	0.33	0.03	0.03	0.04	18.74
1%	0.70	0.12	0.03	0.03	0.00	0.00	0.00	0.87
5%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5. Hazard Mitigation Plan

Mitigation Goals and Objectives

The principal goals of Hartland's natural hazard mitigation plan update are:

1. To minimize the risks to life and property from natural hazards, and
2. To prevent losses from natural hazards to the extent practicable.

In addition to these over-arching goals, the town has also established the following objectives to help the town become more disaster resistant:

1. Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness
2. Ensure proper functioning of critical facilities during emergency response.
3. Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Potential Mitigation Measures

Table V.3 in the previous section of this report presents a listing of potential mitigation measures that can be taken to reduce the impacts of the major natural hazards of concern in the Litchfield Hills Region. In the context of Hartland's risk and vulnerability analysis presented above, and the existing mitigation strategies in the town, only some of these measures will be both needed and cost-effective. The purpose of this Natural Hazards Mitigation Plan is to identify reasonable and appropriate mitigation measures for each hazard from the Table V.3 listing and other sources, and to develop an implementation strategy for the priority mitigation measures.

Existing Mitigation Strategy

The Town of Hartland has a number of existing authorities, policies, programs and regulations that serve to mitigate the impact of natural hazards. Existing local authorities include the Hartland Board of Selectmen, Planning and Zoning Commission, Inland Wetlands Commission, Emergency Management Director, Fire Department, and Department of Public Works.

Land use regulations exist to protect natural resources, including erosion and sediment control regulations for new development, stormwater control regulations to minimize drainage problems, and a floodplain district to control development in flood prone areas.

New construction or substantial improvement of any structure shall be prohibited within the floodplain district without special exception from the Planning and Zoning Commission. Where exceptions are granted, the lowest floor, including the basement, a structure shall be elevated at or above the base flood elevation.

Hartland's subdivision regulations have detailed standards for the planning, design and construction of storm drainage systems in order to minimize adverse impacts associated with new construction activity. The Hartland Wetlands Commission enforces regulations to direct development away from wetlands, watercourses and floodplains. In addition to these regulations, the Hartland Public Works Department routinely examines and clears public storm drains and catch basins of debris following periods of rainfall, snowfall, or windstorms. The town's DPW also monitors weather reports and maintains loaded trucks in preparation of winter storm events.

The Hartland Volunteer Fire Departments and Department of Public Works all possesses emergency equipment that can be deployed as needed in the event of an emergency. Procedures are also in place to open and maintain the Emergency Operations Center and emergency shelters in town.

Hartland has also been working with other towns in the Litchfield Hills Region through the Northwestern CT/Litchfield Hills Public Safety Task Force to enhance communication and coordination. This has included efforts to standardize communication equipment and the equipment in local emergency operation centers, and also the upgrading of supplies at emergency shelters. Other activities being pursued are a regionally coordinated public notification system, a badging registration system for emergency responders, improved training opportunities, and the development of written mutual aid agreements.

In addition to these local and regional mitigation programs, the municipality also benefits from numerous federal and state mitigation programs such as the USGS WaterWatch, Report of the Two Storm Panel, CT DEEP Forest Fire Danger Report, the "Connecticut Drought Preparedness and Response Plan", the "National Weather Service Early Warning System", the University of Connecticut's Center for Land Use Education and Research (CLEAR), and the annual tree trimming maintenance program by Eversource.

Recommended Hazard Mitigation Measures

Objective 1: Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness.

Natural Hazard Addressed: *All hazards.*

Objective 2: Ensure proper functioning of critical facilities during emergency response.

Natural Hazard Addressed: *All hazards.*

Objective 3: Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Natural Hazard Addressed: *flooding.*

The priority assigned to the above strategies was based on cost-benefit discussions with local officials and an evaluation using the STAPLEE criteria defined in FEMA's "How To Guide #3: Developing the Mitigation Plan". STAPLEE is short for the social, technical, administrative, political, legal, economic, and environmental criteria used in the evaluation process. It is anticipated that the low-cost strategies will be implemented during the first year after plan adoption. The higher-cost projects will be implemented as funding becomes available.

High priority projects are those that are considered critically important in order to minimize the risks to life and property from natural hazards. Medium priority projects are important to the community in order to mitigate the impacts of natural disasters but are not considered as critical to the community as high priority projects. Low priority projects are supportive of hazard mitigation goals and objectives, but are not considered essential to effective hazard mitigation in the community.

Changes in Mitigation Priorities from Previous Plan

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the Town of Hartland has pursued implementation of a number of mitigation measures. Of particular note is the establishment of a more robust Emergency Operations Center with the acquisition of a generator and enhancement of radio communication equipment. The major municipal priorities remain unchanged from the previous Plan with a focus on community preparedness, maintenance and enhancement of response resources, and effective floodplain/drainage management. No significant changes or data reanalysis were made from the 2006 with the exception of the inclusion of HAZUS. The following table describes the hazard mitigation strategies of medium or high priority for this community and their associated responsibilities, timeframe, priority, funding source, etc. Projects included in the previous plan are italicized. Nearly all of the mitigation actions listed in the 2006 plan have also been included here. These actions are either on-going due to their nature (education, equipment maintenance) or were not completed due to the economic recession. Unless otherwise noted, all Local Mitigation Actions, once budgeted for, are able to be accomplished within the 2016 Plan Update five year timeframe.

At this time, the municipality is unable to expand or improve their existing capabilities to reduce key vulnerabilities without additional capacity in the form of training, staff, and/or funding.

The municipality's current comprehensive plan (Plan of Conservation Development) does not reference the 2006 Litchfield Hills Natural Hazard Mitigation Plan or natural hazards with the exception of stormwater management or floodplains as applicable. The NHCOG will discuss the incorporation of the new 2016 Natural Hazard Mitigation Plan into local planning documents with each municipality.

Table V.31: Objective 1 Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Make literature available on natural hazards and preparedness at Hartland Town Hall.	Emergency Management Director and First Select-man	On-going, update as information be-comes available	High	4.8	Volunteers	Municipal budget; EMPG	All hazards
2. Maintain local Emergency Operations Plan and continue to coordinate with the Regional Public Safety Task Force on community planning, preparedness, response, and training.	Emergency Management Director and First Select-man	On-going, to be reviewed annually	Medium	1.8	Volunteers	Municipal budget; EMPG	All hazards

Table V.32: Objective 2 Ensure proper functioning of critical facilities during emergency response							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Routinely inspect emergency response equip-ment, and train for response to natural disasters.	Volunteer Fire Depts. And Emergency Management Director	Quarterly and after every response	High	4	Volunteers	Municipal budget; EMPG	All hazards
2. Cooperate with the Metropolitan District Commission (MDC) in emergency response train-ing exercises and updates of the Goodwin Dam Emergency Action Plan.	Emergency Management Director and First Select-man	Coordinated with MDC and DEEP	Medium	3.4	Volunteers	Municipal budget	Flooding
3. Acquire additional emergency response equipment such as needed communication equipment. Also acquire additional sleeping cots for use at the EOC and at the Fire Stations.	Emergency Management Director, Fire Chief	2017	High	1.1	$500; varies	Municipal budget; FEMA; DEHMS; LO-CIP; STEAP	All hazards
4. Promote the use of interoperable communica-tion equipment, and the development of stand-ard operating procedures for emergency re-sponse in the regional area.	Emergency Management Director, Fire Chief, and First Selectman	2017	High	1.8	Volunteers	Municipal budget; OPM RPI; FEMA; EMPG	All hazards
5. Develop a Memorandum of Understanding with schools or bus companies to utilize school buses for mass transportation during an emer-gency.	Emergency Management Director and First Select-man	2016	Medium	3.4	In-kind	Municipal/school budgets; EMPG	All hazards

Table V.33: Objective 3 Expand maintenance activities and implement specific projects that address known drainage issues within the town

Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Implement control measures to mitigate the flooding created by beavers.	Public Works Dept.	On-going, with each project and/or as needed	Medium	1.3	$1,500/culvert	FEMA; Municipal budget	Flooding
2. Develop and implement clean-out schedules for all catch basins and drainage facilities.	Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.1	$3,600/year	Municipal budget	Flooding
3. Review floodplain regulations and ordinances and update as necessary based on DEEP's "Model Floodplain Management Regulations" and FEMA Guidelines.	Planning and Zoning Commission	Annually, efforts to be reviewed at annual planning meeting	Medium	4.5	$2,500	Municipal budget	Flooding

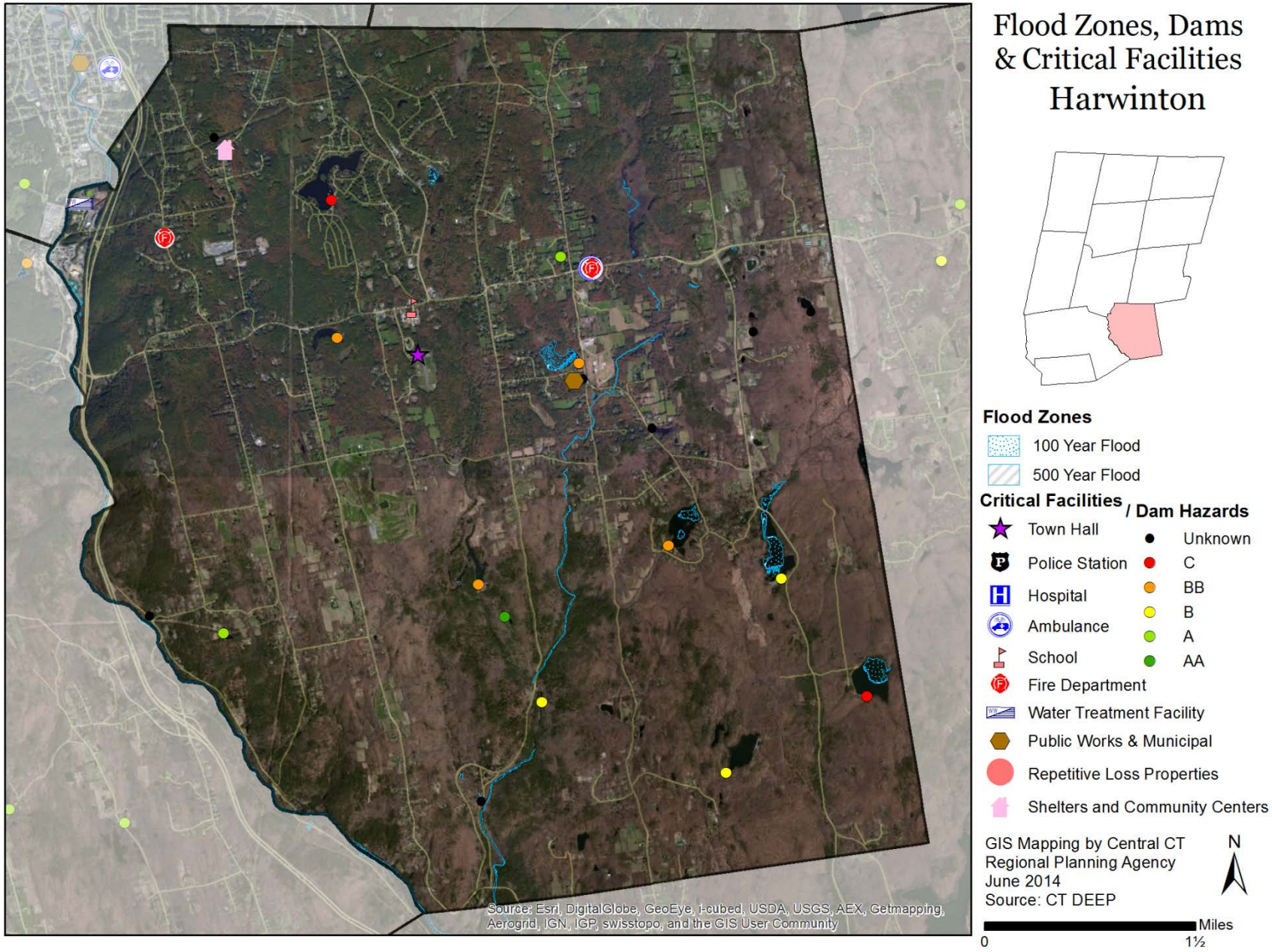

Figure V.10. Flood zones, dams, & critical facilities in Harwinton

E. Town of Harwinton Risk Assessment and Hazard Mitigation Plan

1. General Town Description

The Town of Harwinton is a mostly rural town in the Litchfield Hills Region bordered on the east by Burlington, on the south by Plymouth and Thomaston, on the west by Litchfield and Torrington, and on the north by New Hartford and Torrington (see Figure V.10).

Harwinton was incorporated in October of 1737 and has a total area of 31.1 square miles with a land area of 30.8 square miles. It has a population of 5,603 persons in 2011, and is run by a Selectman/Town Meeting form of government.

According to the "History of Harwinton" written by Raymond George Bentley in 1970, "Agriculture was probably the most important activity during the first one hundred years" of the town's history. According to Mr. Bentley, "It is probable that, when the town was settled, it was covered with forests and the first task must have been the clearing of land so that they could raise food for their own use. As the years passed and more land was cleared they eventually produced more than was needed and it was sold to people living in cities (p. 108)". Mr. Bentley continues "This continued until the building of improved highways and the development of the automobiles and trucks brought the farmers in competition with the large market garden, dairy, and poultry farms. Then it was found that only the larger, more efficient farms could survive, and Harwinton became what it is today, a place where people live but earn their living in the surrounding cities (p. 110)".

Although Harwinton was primarily an agricultural community, there were also a considerable number of industries, including six mills on the Naugatuck River, a clock shop, hat shop, tanners and shoemakers, tin shops, wagon shops, blacksmiths, coopers, cutlery shops, creameries, and other supportive businesses during the 1800's according to the "History of Harwinton".

Harwinton is part of the Northeastern Highlands Ecoregion, which is characterized by "hills and mountains, a mostly forested land cover, nutrient-poor frigid and cryic soils (mostly Spodosols), and numerous high-gradient streams and glacial lakes" (as described on the map "Ecoregions of New England"). Other notable characteristics of the municipality include y rolling hills, forested land, patches of wetlands, scattered ponds, Lake Harwinton, and the Naugatuck River on the western border of the town. The DEEP's Roraback Wildlife Area covers a large area (2200 acres) in the south-central part of Harwinton, and the Bristol Water Company owns three reservoirs in the southeastern portion of town. Major highways serving the town include State Routes 4, 8, 72, 118, and 222.

According to the US Census data, the population of Harwinton has increased an average of 46 persons per year over the past 50 years, from a population of 3,344 people in 1960 to 5,642 in 2010. The population is projected to continue to increase to 5,779 persons by the year 2020, an increase of 2.4% since 2010. The median age in 2010 was 46. Over 90% of the housing is owner occupied, with about 8% of the housing stock occupied by renters and 1% held for seasonal, recreational or occasional use (second homes). There are 2,197 existing housing units in town as of 2009.

Harwinton, according to the Connecticut Economic Resource Center (CERC), had a labor force of 3,098 persons in 2013, with 608 jobs in the community. About one-third of these jobs are in goods producing industries and two-thirds are in service producing industries. The unemployment rate was 6.1% in 2013. According to CERC, Harwinton has an equalized net grand list of $748,162,896 in 2010 with commercial and industrial uses comprising 2.5% of this grand list. The equalized net grand list is an estimate of the market value of all taxable property in the municipality, and gives some indication of the value of property at risk in the event of a major natural disaster. There are 106 business firms in the community according to CERC as of 2013.

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the municipality has experienced limited development. Specifically, the housing stock increased by 260 units between 2000 and 2010, and there has been no significant commercial or industrial development.

Table V.34: Building Exposure by Occupancy Type for the Study Region		
Occupancy	Exposure ($1000)	Percent of Total
Residential	358,781	82.2%
Commercial	41,434	9.5%
Industrial	15,158	3.5%
Agricultural	5,693	1.3%
Religion	9,542	2.2%
Government	1,559	0.4%
Education	4,395	1.0%
Total	436,562	100.00%

Table V.35: Building Exposure by Occupancy Type for the Scenario		
Occupancy	Exposure ($1000)	Percent of Total
Residential	225,645	78.2%
Commercial	34,459	11.9%
Industrial	11,682	4.1%
Agricultural	5,041	1.7%
Religion	6,023	2.1%
Government	1,559	0.5%
Education	4,019	1.4%
Total	288,428	100.00%

In 2012, the town had one application for a 24' x 32 addition to an existing home in the Flood Zone. The Zoning Commission approved the application as it did not exceed 50% of the home's value and did not qualify as a Substantial Improvement. Since this project involved only one residence and did not qualify as a Substantial Improvement, it is not expected to have increased the town's vulnerability to the flood hazard in flood-prone areas.

2. Evaluation of Risks and Vulnerability

The major natural hazards of concern in Harwinton are flooding, high winds, and severe winter storms. Forest fires, drought, and earthquakes occur much less frequently in the community, and are therefore of somewhat lesser concern. The general risk and vulnerability posed by each of these six hazards is discussed in the preceding Section III of this report. More specific information on the flood vulnerability and critical facilities in the town of Harwinton is presented below.

Flooding

While there is no extensive discussion of natural disasters in the "History of Harwinton", there is a description of the Flood of 1867 that flooded Birge Park Road (Rte 4) when the West Branch of Lead Mine Brook overflowed its banks. There were also a number of roads washed out by the Naugatuck River and Leadmine Brook in the Flood of 1955, according to the local road foreman (pers. Communication).

Floodprone areas in Harwinton, as mapped by FEMA, are shown in Figure V.10. According to FEMA's website, "Policy Statistics", 11 flood insurance policies are in force as of 8/31/2015 with an insurance value of $2,286,700. An attempt was made to estimate the number of structures located within the FEMA floodplain boundaries using available GIS data for Connecticut, however the data is not considered precise enough for an accurate assessment. The area of greatest concern locally is Leadmine Brook, which continues to flood periodically resulting in the closing of Lead Mine Brook Road. Flooding of the Naugatuck River is not of significant local concern at the present time due to the flood control projects constructed upstream after the Flood of 1955. The Army Corps of Engineers also now owns much of the land, or has flood control easements, along the flood prone areas of the Naugatuck River in Harwinton.

Beaver contribute to localized flooding problems in the town periodically with the construction of dams on private property that are difficult to remove. Beaver have also plugged culverts on local streets such as South Road, which require routine maintenance by town forces to remove.

Hurricanes and Strong Winds

The town is also vulnerable to flooding (see above) caused by hurricanes. As the town is located very far inland, damage from hurricane-

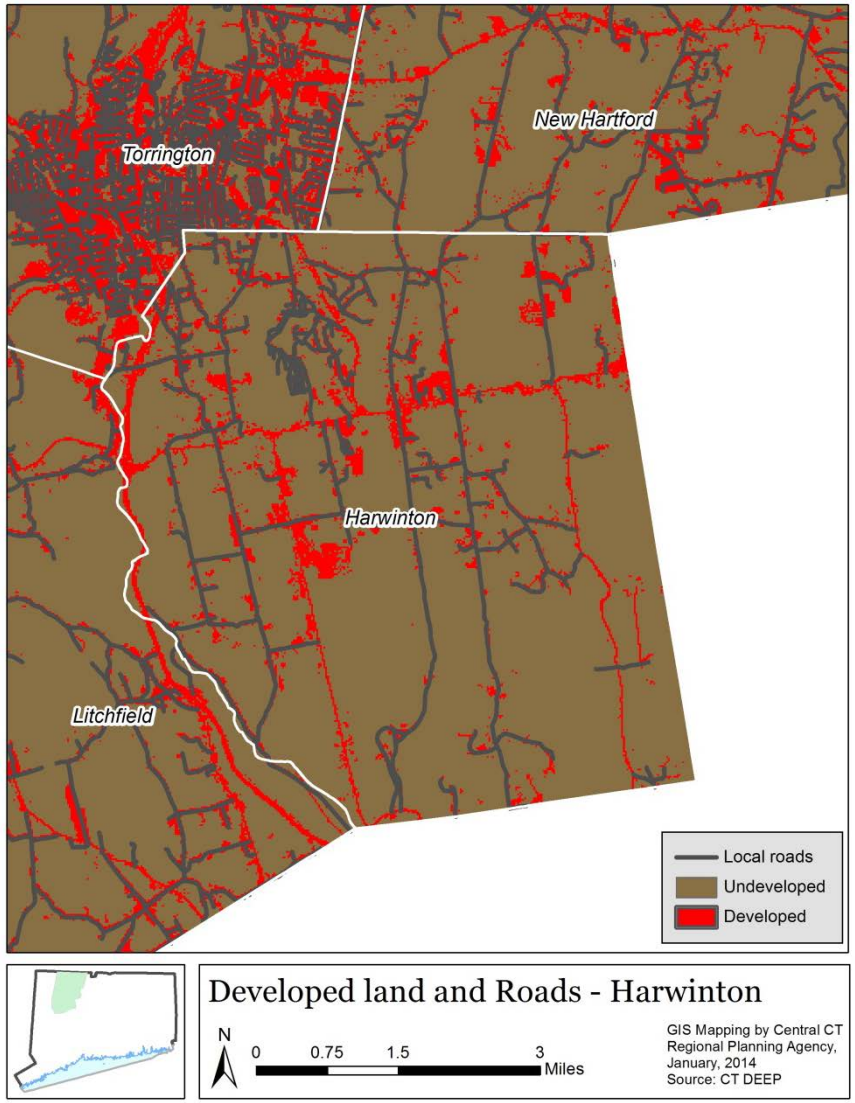

Figure V.11. Developed land and local roads in Harwinton

force winds is not a major concern. The hurricanes of 1955 caused extensive flooding in town, as did the 1938 hurricane. Areas that are most vulnerable are those with greater levels of development. See the Figure V.11 for locations of these areas.

Table V.36: Impacts from 1% annual flood scenario (Harwinton)	
Type of impact	**Value**
Building related losses	$7,220,000
Business interruption losses	$15,000
Total economic losses (thousands of dollars)	$7,235,000
Damaged essential facilities	0
Buildings substantially damaged	0
Tons of debris	2,106
Displaced households	35
Shelter needs	7
Acres of land flooded	615

Severe Winter Storms

The natural hazard of greatest concern in Harwinton is winter ice storms with power outages. A severe snowstorm occurred in March of 1978 that brought close to three feet of heavy snow, and Harwinton was without power for five days. The town suffered another major ice storm in 2002 that resulted in downed power lines, extensive tree damage, and expensive clean-up costs. The October 2011 snow storm caused extensive power outages and tree damage. At one point, 99% of town residents were without power.

Winter storms cause road blockages and roof collapses (from heavy snow and ice). The most vulnerable parts of town, therefore, are those with dense development and lots of roads. From the town's perspective, the greatest vulnerability is town-maintained roads. Figure V.11 below shows areas of development and the locations of town-maintained roads. In total, Harwinton maintains 69 miles of local roads.

Vulnerable Assets

There are nineteen dams in Harwinton (see Figure V.10). Twelve of these dams are private dams, three are state owned, three are owned by the Bristol Water Company, and one dam is not classified. The Lake Harwin-

ton Dam and Bristol Reservoir Dam #5 are rated as Hazard Type C. Of the remaining dams, six are rated BB or B, two dams are rated A, and nine dams are not rated. For a description of these dam ratings, see "Flooding: Impacts" in Section III. Lake Harwinton Dam is the facility of greatest concern to local officials, and this dam is scheduled to be improved in the near future. Most of the other dams in town are small and do not pose a significant threat in the event of failure.

The major facilities at risk in the community in the event of a natural hazard are shown in Figure V.10. These facilities include the Harwinton Town Hall, Harwinton Elementary School (which serves as the town's emergency shelter), the Town Garage, Harwinton Fire House, Harwinton Westside Fire House, Torrington Water Pollution Control Plant (which is located in Harwinton), Harwinton Ambulance Association, and the Harwinton Senior Center (which serves as a secondary emergency shelter facility for the town). These are considered critical facilities in the event of a natural disaster because they might be needed for effective emergency response. All are potentially vulnerable to tornados, winter storms, wildfire, and earthquakes. None of the facilities are located within a floodplain. The Town Garage is particularly important, as it is available to serve as a regional drop-off point for emergency equipment and supplies. There is off-loading capability and storage space available at the site, and air drop-off is possible at the adjacent Harwinton Fairgrounds.

Tables V.34 & V.35 above show the "total exposure" of all structures in Harwinton, under a 1% flood scenario. The first table shows that $436,562,000 worth of buildings could potentially be impacted by a 1% flood event. The second table shows that over half of that total, $288,428,000 worth of buildings are likely to be impacted by such an event.

3. Potential Impacts

Results of the HAZUS 1% flood simulation are shown in Table V.36 above. In Harwinton, $7.235 million worth of economic losses are estimated. Of that, $7.22 million are due to building damage while the remainder is from business interruptions. Such an event would displace 35 households and cause seven people to seek temporary shelter. The flood would cover 615 acres of land. Full results from this simulation are in Appendix B.

Hurricanes have caused wide-spread power outages and could cause significant damage. Hurricane Irene left 58% of the town without power at its peak (1455 households). The results of three HAZUS hurricane simulations are presented in Table V.37. An event similar to the 1938 hurricane could cause $53,440 in damage from the wind. Such an event would likely cause a flood as well, which would increase the amount of damage dramatically (see above).

Winter storms are a perennial concern with wide-ranging impacts. Snow covered roads take time and money to clear. Heavy snow, especially when accompanied by ice can cause roofs to collapse. Ice storms can also bring down power lines, causing outages. The snow storm of October 2011 left 99% of the town without power at its peak. At least half the town had no power for six days.

4. Major Concerns

- The area of greatest concern locally is Leadmine Brook, which continues to flood periodically resulting in the closing of Lead Mine Brook Road

Table V.37: Estimated hurricane-related damage (thousands of dollars) by building occupancy

	Res	Com	Ind	Agr	Rel	Edu	Gov	Total
1938	48.21	2.42	1.44	1.14	0.14	0.04	0.05	53.44
1%	1.04	0.12	0.04	0.05	0.00	0.00	0.00	1.26
5%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

- Lake Harwinton Dam is the facility of greatest concern to local officials, and this dam is scheduled to be improved in the near future.

5. Hazard Mitigation Plan

Since the last plan, the general geography, demography, and built environment have not changed significantly in this community. Nor have the hazards become significantly more or less severe. This update, unlike the previous plan, utilizes HAZUS methodology to gain a deeper understanding of the impacts from significant natural hazards. Additionally, this plan utilizes the state's most recent hazard mitigation plan. As such, the plan priorities remain the same with the addition of mitigation actions to protect the built environment.

Mitigation Goals and Objectives

The principal goals of Harwinton's natural hazard mitigation plan update are:

1. To minimize the risks to life and property from natural hazards, and
2. To prevent losses from natural hazards to the extent practicable.

In addition to these over-arching goals, the town has also established the following objectives to help the town become more disaster resistant:

1. Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness
2. Ensure proper functioning of critical facilities during emergency response.
3. Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Potential Mitigation Measures

Table V.3 in the previous section of this report presents a listing of potential mitigation measures that can be taken to reduce the impacts of the major natural hazards of concern in the Litchfield Hills Region. In the context of Harwinton's risk and vulnerability analysis presented above, and the existing mitigation strategies in the town, only some of these measures will be both needed and cost-effective. The purpose of this Natural Hazards Mitigation Plan is to identify reasonable and appropriate mitigation measures for each hazard from the Table V.3 listing and other sources, and to develop an implementation strategy for the priority mitigation measures.

Existing Mitigation Strategy

The Town of Harwinton has a number of existing authorities, policies, programs and regulations that serve to mitigate the impact of natural hazards. Existing local authorities include the Harwinton Board of Selectmen, Planning and Zoning Commission, Inland Wetlands Commission, Emergency Management Director, Fire Department, and Department of Public Works.

Harwinton maintains compliance with NFIP through its use of the Connecticut State Building Code and its zoning regulations. Harwinton expects to continue participation in NFIP.

Land use regulations exist to protect natural resources, including erosion and sediment control regulations for new development, stormwater control regulations to minimize drainage problems, and a flood hazard overlay zone to control development in flood prone areas.

The flood hazard overlay zone provides that any new construction or substantial improvement of any residential structure shall have the lowest floor, including the basement, elevated to at least the base flood elevation. Nonresidential construction is required to have the lowest floor, including basement, elevated to at least the base flood level and all construction below base flood elevation shall be flood-proofed. A registered professional engineer or architect is required to design and certify the construction of structures in the floodplain in order to minimize flood damage. Additionally all attendant utilities or sanitary facilities should be located or designed to avoid infiltration or impairment by flood waters.

Harwinton's subdivision regulations have detailed standards for the planning, design and construction of storm drainage systems in order to minimize adverse impacts associated with new construction activity. The Harwinton Inland Wetlands and Watercourses Commission enforces

regulations to direct development away from wetlands and watercourses. In addition to these regulations, the Harwinton Public Works Department routinely examines and clears public storm drains and catch basins of debris following periods of rainfall, snowfall, or windstorms. The town's DPW also monitors weather reports and maintains loaded trucks in preparation of winter storm events.

The Harwinton Volunteer Fire Department, Department of Public Works, and Emergency Management Director all possesses emergency equipment that can be deployed as needed in the event of an emergency. Procedures are also in place to open and maintain the Emergency Operations Center and emergency shelter in town.

Harwinton has also been working with other towns in the Litchfield Hills Region through the Northwest Hills Public Safety Task Force to enhance communication and coordination. This has included efforts to standardize communication equipment and the equipment in local emergency operation centers, and also the upgrading of supplies at emergency shelters. Other activities being pursued are a regionally coordinated public notification system, a badging registration system for emergency responders, improved training opportunities, and the development of written mutual aid agreements.

In addition to these local and regional mitigation programs, the municipality also benefits from numerous federal and state mitigation programs such as the USGS WaterWatch, Report of the Two Storm Panel, CT DEEP Forest Fire Danger Report, the "Connecticut Drought Preparedness and Response Plan", the "National Weather Service Early Warning System", the University of Connecticut's Center for Land Use Education and Research (CLEAR), and the annual tree trimming maintenance program by Eversource.

Recommended Hazard Mitigation Measures

Objective 1: Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness.

Natural Hazard Addressed: *All hazards.*

Objective 2: Ensure proper functioning of critical facilities during emergency response.

Natural Hazard Addressed: *All hazards.*

Objective 3: Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Natural Hazard Addressed: *flooding.*

The priority assigned to the above strategies was based on cost-benefit discussions with local officials and an evaluation using the STAPLEE criteria defined in FEMA's "How To Guide #3: Developing the Mitigation Plan". STAPLEE is short for the social, technical, administrative, political, legal, economic, and environmental criteria used in the evaluation process. It is anticipated that the low-cost strategies will be implemented during the first year after plan adoption. The higher-cost projects will be implemented as funding becomes available.

High priority projects are those that are considered critically important in order to minimize the risks to life and property from natural hazards. Medium priority projects are important to the community in order to mitigate the impacts of natural disasters but are not considered as critical to the community as high priority projects. Low priority projects are supportive of hazard mitigation goals and objectives, but are not considered essential to effective hazard mitigation in the community.

Changes in Mitigation Priorities from Previous Plan

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the Town of Harwinton has pursued implementation of a number of mitigation measures. Of particular note is the implementation of a public notification system (Everbridge System), establishment of a new Emergency Operations Center at a stand-alone location, and advocacy for an increased role by Eversource in tree trimming maintenance practices along roadsides. The major municipal priorities remain unchanged from the previous Plan with a focus on community preparedness, maintenance and enhancement of response resources, and effective floodplain/drainage management. No significant changes or data reanalysis were made from the 2006 with the exception of the inclusion of HAZUS. The following table describes the hazard mitigation strategies of medium or high priority for this community and their associated responsibilities, timeframe, priority, funding source, etc. Projects included in the previous plan are italicized. All of the mitigation actions listed in

the 2006 plan have also been included here. These actions are either ongoing due to their nature (education, equipment maintenance) or were not completed due to the economic recession. Unless otherwise noted, all Local Mitigation Actions, once budgeted for, are able to be accomplished within the 2016 Plan Update five year timeframe.

At this time, the municipality is unable to expand or improve their existing capabilities to reduce key vulnerabilities without additional capacity in the form of training, staff, and/or funding.

The municipality's current comprehensive plan (Plan of Conservation Development) does not reference the 2006 Litchfield Hills Natural Hazard Mitigation Plan or natural hazards with the exception of stormwater management or floodplains as applicable. The NHCOG will discuss the incorporation of the new 2016 Natural Hazard Mitigation Plan into local planning documents with each municipality.

Table V.38: Objective 1 Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Visit schools and educate children about natural hazards and how to prepare for them.	Volunteer Fire Dept. and Emergency Management Director	Annually, efforts to be reviewed at annual planning meeting	Medium	4.8	Volunteers	Municipal budget; EMPG	All hazards
2. Make literature available on natural hazards and preparedness at Harwinton Town Hall. Provide email notifications/links on town website.	Emergency Management Director and First Selectman	On-going, update as information becomes available	High	4.8	Volunteers	Municipal budget; EMPG	All hazards
3. Maintain local Emergency Operations Plan and continue to coordinate with the Regional Public Safety Task Force and Red Cross on community planning, preparedness, response, and training.	Emergency Management Director and First Selectman	On-going, to be reviewed annually	Medium	1.8	Volunteers	Municipal budget; EMPG	All hazards
4. *Maintain a Public Notification System (i.e. Everbridge system) to provide emergency information to residents in the entire town or in a specific geographic area. This notice can provide not only warning of an impending situation but also information regarding how to prepare for a particular event.*	Emergency Management Director and First Selectman	On-going, to be reviewed annually	Medium	1.8	LCD and/or ENS dues	LCD; Municipal budget	All hazards

Table V.39: Objective 2 Ensure proper functioning of critical facilities during emergency response							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Routinely inspect emergency response equipment, and train for response to natural disasters.	Volunteer Fire Dept. and Emergency Management Director	Quarterly and after every response	High	4	Volunteers	Municipal budget; EMPG	All hazards
2. Augment establishment of the stand-alone Emergency Operations Center in cooperation with the Harwinton Ambulance Association by acquiring additional emergency response equipment, including a generator.	Emergency Management Director, Fire Chief, First Selectman	2016	High	1.1	$500,000	FEMA; State; Municipal budget; LOCIP; STEAP; DEHMS	All hazards
3. Promote the use of interoperable communication equipment, written mutual aid agreements, and the development of standard operating procedures for emergency response in the regional area.	Emergency Management Director, Fire Chief, and First Selectman	2016-2017	High	1.8	Volunteers	Municipal budget; DEMHS; EMPG	All hazards
4. Develop a Memorandum of Understanding with schools or bus companies to utilize school buses for mass transportation during an emergency.	Emergency Management Director and First Selectman	2016	Medium	3.4	In-kind	Municipal/school budget; EMPG	All hazards
5. Consider developing basic GIS capabilities for access to aerial photos showing the number and location of properties and structures that could be affected by a natural disaster.	Emergency Management Director, Fire Chief, and First Selectman	2017	Medium	1.8	$3,000/year	Municipal budget; OPM RPI	All hazards

Table V.40: Objective 3 Expand maintenance activities and implement specific projects that address known drainage issues within the town							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Implement control measures to mitigate the flooding created by beavers.	Public Works Dept.	On-going, with each project and/or as needed	Medium	1.3	$1,500/culvert	FEMA; Municipal budget	Flooding
2. Continue to implement established clean-out schedule for all catch basins and drainage facilities.	Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.1	$6,600/year	Municipal budget	Flooding
3. Review floodplain regulations and ordinances and update as necessary based on DEEP's "Model Floodplain Management Regulations".	Planning and Zoning Commission	Annually, efforts to be reviewed at annual planning meeting	Medium	4.5	$2,500	Municipal budget	Flooding
4. Identify the location of structures that are susceptible to flooding to facilitate risk assessment and potential control measures.	DEMHS or DEEP	Annually, efforts to be reviewed at annual planning meeting	Medium	1.9	$55,000	FEMA	Flooding
5. Pursue funding to enhance the municipal tree trimming program and support expansion of the Eversource tree trimming program.	First Selectman, Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.3	$48,000	State; Eversource; Municipal budget	Power outages due to high winds and winter storms

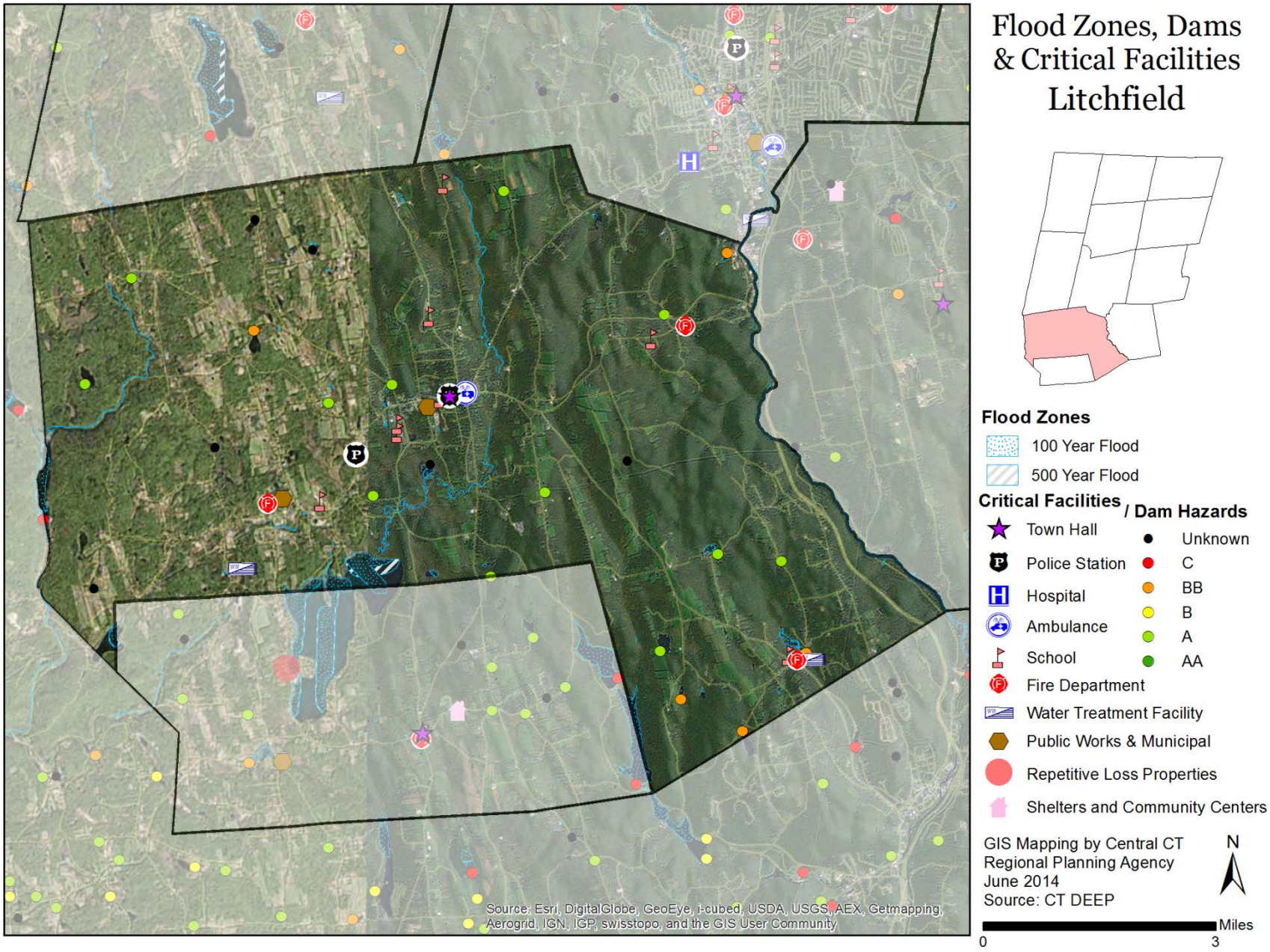

Figure V.12. Flood zones, dams, & critical facilities in Litchfield

F. Town of Litchfield Risk Assessment and Hazard Mitigation Plan

1. General Town Description

The Town of Litchfield is a mostly rural town in the Litchfield Hills Region bordered on the east by Harwinton, on the south by Morris and Thomaston, on the west by Warren and Washington, and on the north by Goshen and Torrington (see Figure V.12).

As described in the "Town of Litchfield Vision Plan, 1994-2004", Litchfield was incorporated in 1719 and thrived during the Revolution because the main roads from Hartford and southern Connecticut to the Hudson River Valley ran through Litchfield. According to the Vision Plan "The fifty years between 1784 and 1834 are now known as Litchfield's "Golden Age". During these years, the town was an active, growing urban center that, by 1810, had grown to be the fourth largest town in the state of Connecticut. Local merchants made fortunes in the China trade, small industries were developed and by 1810 the central village contained 125 houses, shops and public buildings. The town had an active artisan community with goldsmiths, carpenters, hatters, carriage makers, joiners, cabinet makers, saddlers, blacksmiths, potters, and other craftsmen all located within the central village."

The Vision Plan continues, "By the 1840's, water power and railroads became increasingly important for the growth of American manufacturing. However, early railroads by-passed Litchfield's hilltop location and the Bantam River could not supply sufficient water power for most industry. Unable to participate in the development of the Industrial Revolution, the industry, and later the population, of Litchfield steadily declined." Between 1800 and 1900, Litchfield's population declined from 4,285 persons to 3,214 persons.

According to the US Census data, the population of Litchfield rebounded in the early 1900's, and by 1960 had increased to 6,264 persons, thus eclipsing the population during Litchfield's "Golden Age". Population growth between 1960 and 2010 has been slow and steady with an average annual increase in population of 44 persons per year. As of 2010, the

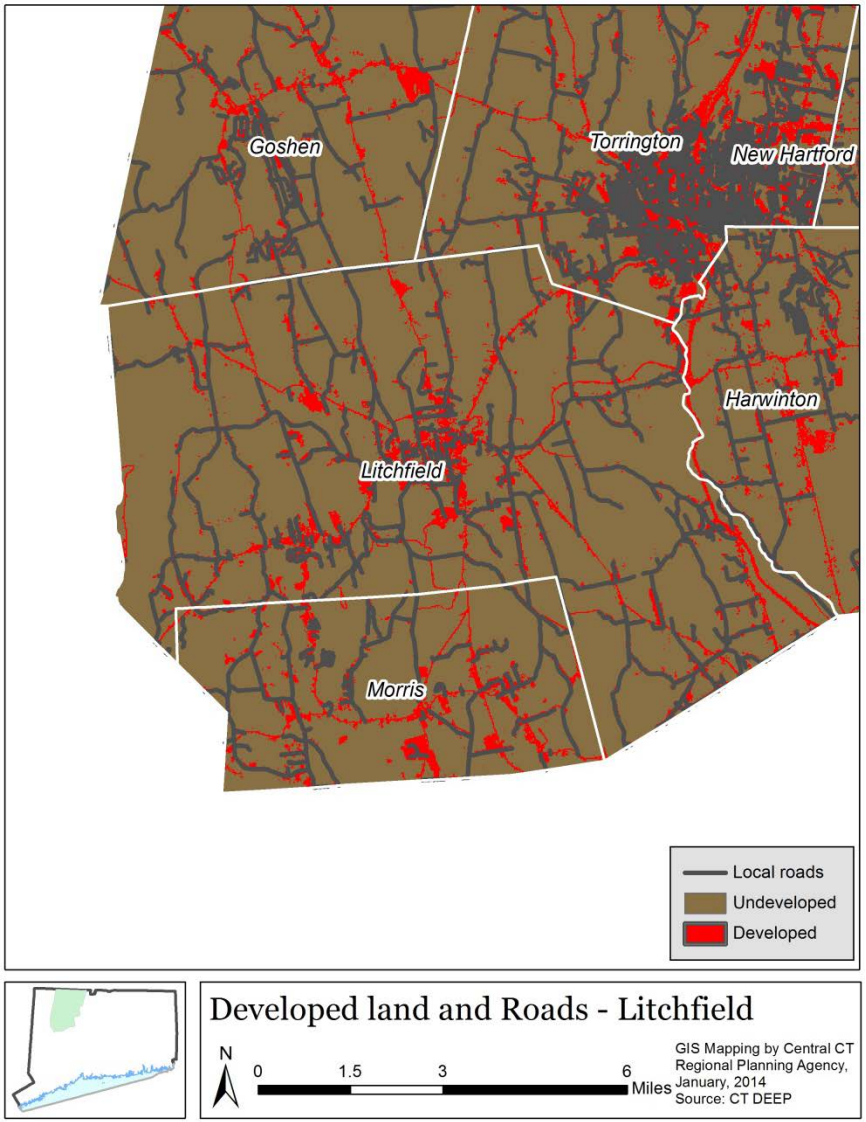

Figure V.13. Developed land and local roads in Litchfield

population of Litchfield was 8,466 persons.

Litchfield's population density of 151 persons per square mile is significantly below the average State density of 721 persons per square mile,

which is reflective of Litchfield's rural character. The density of Litchfield nevertheless increased by 26% between 1960 and 2010, from 112 persons to 151 persons per square mile.

According to the Connecticut Data Center, The population is projected to decrease to 8,409 persons by the year 2020, a decrease of 1.2% since 2010. The median age in 2010 was 47.

The total area of Litchfield is 56.8 square miles with a land area of 56.1 square miles. In addition to the central Borough of Litchfield, there are several other community centers in the town including the Borough of Bantam, Northfield, and Milton. There are four state parks or forests in Litchfield including Topsmead State Forest, Mt. Tom State Park, Mattatuck State Forest, and Humaston Brook State Park. A portion of Bantam Lake, the largest natural body of water in the State, is also in Litchfield.

Litchfield is part of the Northeastern Highlands Ecoregion, which is characterized by "hills and mountains, a mostly forested land cover, nutrient-poor frigid and cryic soils (mostly Spodosols), and numerous high-gradient streams and glacial lakes" (as described on the map "Ecoregions of New England"). Other notable characteristics of the municipality include a quintessential New England green, rolling hills, forested land, patches of wetlands, scattered ponds, Bantam Lake, and the Naugatuck River on the eastern border of the town. Major highways serving the town include State Routes 8, 63, 118, 202 and 254.

About 70% of the housing is owner occupied in Litchfield, with about 22% of the housing stock occupied by renters and 5% held for seasonal, recreational or occasional use (second homes). There are 3,882 existing housing units in town as of 2009.

Litchfield, according to the Connecticut Economic Resource Center (CERC), has a labor force of 4,204 persons in 2013, with 3,462 jobs located in the community. About 20% of these jobs are in goods producing industries, with 80% in service producing industries. The unemployment rate was 6.5% in 2013.

According to CERC, Litchfield has an equalized net grand list of $1,425,528,147 in 2010 with commercial and industrial uses comprising 9.2% of this grand list. The equalized net grand list is an estimate of the market value of all taxable property in the municipality, and gives some indication of the value of property at risk in the event of a major natural disaster. There are 373 business firms in the community according to CERC as of 2013.

Table V.41: Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	623,415	63.6%
Commercial	163,384	16.7%
Industrial	108,331	11.1%
Agricultural	8,070	0.8%
Religion	18,773	1.9%
Government	7,674	0.8%
Education	50,606	5.2%
Total	980,253	100.00%

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the municipality has experienced limited development. Specifically, the housing stock increased by 346 units between 2000 and 2010, and there has been no significant commercial or industrial development. According to the land use official, no development has occurred in flood-prone areas since the previous plan so development has not increased the community's vulnerability in flood-prone areas.

2. Evaluation of Risks and Vulnerability

The major natural hazards of concern in Litchfield are flooding, high winds, and severe winter storms. Forest fires, drought, and earthquakes occur much less frequently in the community, and are therefore of somewhat lesser concern. The general risk and vulnerability posed by each of these six hazards is discussed in the preceding Section III of this report. More specific information on the flood vulnerability and critical facilities in the town of Litchfield is presented below.

Table V.42: Building Exposure by Occupancy Type for the Scenario		
Occupancy	Exposure ($1000)	Percent of Total
Residential	505,827	61.9%
Commercial	130,733	16.0%
Industrial	105,778	12.9%
Agricultural	6,960	0.9%
Religion	14,151	1.7%
Government	5,539	0.7%
Education	47,875	5.9%
Total	816,863	100.00%

Source: HAZUS analysis

Flooding

Floodprone areas in Litchfield, as mapped by FEMA, are shown in Figure V.12. According to FEMA's website, "Policy Statistics", there are 37 flood insurance policies in force as of 8/31/2015 with an insurance value of $10,000,600. An attempt was made to estimate the number of structures located within the FEMA floodplain boundaries using available GIS data for Connecticut, however the data is not considered precise enough for an accurate assessment. The area of greatest concern locally is along the Bantam River, particularly in the vicinity of Camp Dutton Road south of the center of town. Flooding of the Naugatuck River is not of significant local concern due to the flood control projects constructed upstream after the Flood of 1955. The Army Corps of Engineers also now owns much of the land, or has flood control easements, along the floodprone areas of the Naugatuck River in Litchfield.

The Flood of 1955 impacted Litchfield as it did other communities in the region. The flood took out a number of dams and the bridge on Rte 63 near Camp Dutton Road.

Today, beaver contribute to localized flooding problems in the town periodically with the construction of dams on private properties that are difficult to remove. Beaver have also plugged culverts on local streets such as Brooks Road, which require routine maintenance by town forces to remove.

Hurricanes and Strong Winds

Litchfield also suffered Hurricane related damage from Storm Irene in August 2011 and Storm Sandy in October 2012. Both of these events caused significant power outages and the storms received Presidential Disaster Declarations. See Figure V.13 above for a map of development patterns.

Severe Winter Storms

The natural hazard of greatest concern in Litchfield is winter ice storms with high winds and power outages. A severe snowstorm occurred in March of 1978 that brought close to three feet of heavy snow. The town suffered a major ice storm in 2002 that resulted in downed power lines, extensive tree damage, and expensive clean-up costs. Over 100 people required use of the emergency shelter in town during this storm event.

Winter storms cause road blockages and roof collapses (from heavy snow and ice). The most vulnerable parts of town, therefore, are those with dense development and lots of roads. From the town's perspective, the greatest vulnerability is town-maintained roads. Figure V.13 above shows areas of development and the locations of town-maintained roads. In total, Litchfield maintains 130 miles of local roads.

Vulnerable Assets

There are twenty two dams in Litchfield (see Figure V.12). Fourteen of these dams are private dams, one is state owned (Northfield Pond Dam), one is owned by a water company (Nystrom Pond Dam), and six dams are not classified. Five of the dams are rated BB (including the above referenced dams), eleven dams are rated A, and six dams are not rated. For a description of these dam ratings, see "Flooding: Impacts" in Section III.

Table V.43: Impacts from 1% annual flood scenario (Litchfield)	
Type of impact	Value
Building related losses	$56,710,000
Business interruption losses	$120,000
Total economic losses (thousands of dollars)	$56,820,000
Damaged essential facilities	1
Buildings substantially damaged	10
Tons of debris	6,571
Displaced households	110
Shelter needs	53
Acres of land flooded	1,965

Source: HAZUS analysis

The major facilities at risk in the community in the event of a natural hazard are shown in Figure V.12. These facilities include the Litchfield Town Hall, Town Hall Annex in Bantam, Litchfield Elementary School, Litchfield Middle School, Litchfield High School, the Town Public Works Department, Litchfield Fire House, Bantam Fire House (which serves as the town's emergency shelter), East Litchfield Fire House, Northfield Fire House (which serves as the town's emergency shelter), and the Litchfield Sewage Treatment Plant. These are considered critical facilities in the event of a natural disaster because they might be needed for effective emergency response. All are potentially vulnerable to tornados, winter storms, wildfire, and earthquakes. None of the facilities are located within a floodplain.

Tables V.41 & V.42 above show the "total exposure" of all structures in Litchfield, under a 1% flood scenario. The first table shows that $980,253,000 worth of buildings could potentially be impacted by a 1% flood event. The second table shows that nearly all of that total, $816,863,000 worth of buildings are likely to be impacted by such an event.

3. Potential Impacts

Results of the HAZUS 1% flood simulation are shown in Table V.43 above. In Litchfield, $56.82 million worth of economic losses are estimated. Of that, $56.71 million are due to building damage while the remainder is from business interruptions. Such an event would displace 110 households and cause 53 people to seek temporary shelter. The flood would cover 1,965 acres of land. Full results from this simulation are in Appendix B.

Hurricanes have caused wide-spread power outages and could cause significant damage. Hurricane Irene left 72% of the town without power at its peak (3364 households). The results of three HAZUS hurricane simulations are presented in Table V.44. An event similar to the 1938 hurricane could cause $69,110 in damage from the wind. Such an event would likely cause a flood as well, which would increase the amount of damage dramatically (see above).

Winter storms are a perennial concern with wide-ranging impacts. Snow covered roads take time and money to clear. Heavy snow, especially when accompanied by ice can cause roofs to collapse. Ice storms can also bring down power lines, causing outages. The snow storm of Octo-

Table V.44: Estimated hurricane-related damage (thousands of dollars) by building occupancy								
	Res	Com	Ind	Agr	Rel	Edu	Gov	Total
1938	61.53	4.30	1.67	1.24	0.18	0.12	0.08	69.11
1%	1.82	0.17	0.03	0.05	0.00	0.00	0.00	2.07
5%	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.04

ber 2011 left 99% of the town without power at its peak. Most of the town had no power for three days, with a quarter having no power for six days.

4. Major Concern

- Beavers plug culverts on local streets such as Brooks Road, which require routine maintenance by town forces to remove.

5. Hazard Mitigation Plan

Since the last plan, the general geography, demography, and built environment have not changed significantly in this community. Nor have the hazards become significantly more or less severe. This update, unlike the previous plan, utilizes HAZUS methodology to gain a deeper understanding of the impacts from significant natural hazards. Additionally, this plan utilizes the state's most recent hazard mitigation plan. As such, the plan priorities remain the same with the addition of mitigation actions to protect the built environment.

Mitigation Goals and Objectives

The principal goals of Litchfield's natural hazard mitigation plan update are:

1. To minimize the risks to life and property from natural hazards, and
2. To prevent losses from natural hazards to the extent practicable.

In addition to these over-arching goals, the town has also established the following objectives to help the town become more disaster resistant:

1. Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness.
2. Ensure proper functioning of critical facilities during emergency response.
3. Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Potential Mitigation Measures

Table V.3 in the previous section of this report presents a listing of potential mitigation measures that can be taken to reduce the impacts of the major natural hazards of concern in the Litchfield Hills Region. In the context of Litchfield's risk and vulnerability analysis presented above, and the existing mitigation strategies in the town, only some of these measures will be both needed and cost-effective. The purpose of this Natural Hazards Mitigation Plan is to identify reasonable and appropriate mitigation measures for each hazard from the Table V.3 listing and other sources, and to develop an implementation strategy for the priority mitigation measures.

Existing Mitigation Strategy

The Town of Litchfield has a number of existing authorities, policies, programs and regulations that serve to mitigate the impact of natural hazards. Existing local authorities include the Litchfield Board of Selectmen, Planning and Zoning Commission, Inland Wetlands Commission, Emergency Management Director, Fire Department, and Department of Public Works.

Litchfield maintains compliance with NFIP through its use of the Connecticut State Building Code, subdivision regulations, and zoning regulations. Litchfield expects to continue participation in NFIP.

Land use regulations exist to protect natural resources, including erosion and sediment control regulations for new development, stormwater control regulations to minimize drainage problems, and a floodplain overlay zone to control development in flood prone areas.

The floodplain overlay zone provides that any new construction or substantial improvement of any residential structure shall have the lowest floor, including the basement, elevated to at least one foot above base flood elevation where base flood elevation is known. Nonresidential construction is required to have the lowest floor, including basement, elevated to at least one foot above the base flood elevation or where the structure is located below base flood elevation be flood-proofed to base flood elevation. A registered professional engineer or architect is required to certify the construction of structures in the floodplain in order to minimize flood damage. Additionally all attendant utilities or sani-

tary facilities should be located or designed to avoid infiltration or impairment by flood waters. Manufactured homes and recreational vehicles are prohibited or highly restricted, respectively.

Litchfield's subdivision regulations have detailed standards for the planning, design and construction of storm drainage systems in order to minimize adverse impacts associated with new construction activity. The Litchfield Conservation and Inland Wetland Commission enforces regulations to direct development away from wetlands, watercourses, floodplains and stream-belts. In addition to these regulations, the Litchfield Public Works Department routinely examines and clears public storm drains and catch basins of debris following periods of rainfall, snowfall, or windstorms. The town's DPW also monitors weather reports and maintains loaded trucks in preparation of winter storm events.

The Fire Departments in the town of Litchfield, Department of Public Works, and Emergency Management Director all possesses emergency equipment that can be deployed as needed in the event of an emergency. Procedures are also in place to open and maintain the Emergency Operations Center and emergency shelters in town.

Litchfield has also been working with other towns in the Litchfield Hills Region through the Northwestern CT/Litchfield Hills Public Safety Task Force to enhance communication and coordination. This has included efforts to standardize communication equipment and the equipment in local emergency operation centers, and also the upgrading of supplies at emergency shelters. Other activities being pursued are a regionally coordinated public notification system, a badging registration system for emergency responders, improved training opportunities, and the development of written mutual aid agreements.

In addition to these local and regional mitigation programs, the municipality also benefits from numerous federal and state mitigation programs such as the USGS WaterWatch, Report of the Two Storm Panel, CT DEEP Forest Fire Danger Report, the "Connecticut Drought Preparedness and Response Plan", the "National Weather Service Early Warning System", the University of Connecticut's Center for Land Use Education and Research (CLEAR), and the annual tree trimming maintenance program by Eversource.

Recommended Hazard Mitigation Measures

Objective 1: Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness.

Natural Hazard Addressed: *All hazards.*

Objective 2: Ensure proper functioning of critical facilities during emergency response.

Natural Hazard Addressed*: All hazards*.

Objective 3: Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Natural Hazard Addressed: *flooding*.

The priority assigned to the above strategies was based on cost-benefit discussions with local officials and an evaluation using the STAPLEE criteria defined in FEMA's "How To Guide #3: Developing the Mitigation Plan". STAPLEE is short for the social, technical, administrative, political, legal, economic, and environmental criteria used in the evaluation process. It is anticipated that the low-cost strategies will be implemented during the first year after plan adoption. The higher-cost projects will be implemented as funding becomes available.

High priority projects are those that are considered critically important in order to minimize the risks to life and property from natural hazards. Medium priority projects are important to the community in order to mitigate the impacts of natural disasters but are not considered as critical to the community as high priority projects. Low priority projects are supportive of hazard mitigation goals and objectives, but are not considered essential to effective hazard mitigation in the community.

Changes in Mitigation Priorities from Previous Plan

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the Town of Litchfield has pursued implementation of a number of mitigation measures. Of particular note is the implementation of a public notification system (Everbridge System), upgrading the outlet control structure at Bantam Lake, and advocacy for an increased role by Eversource in tree trimming maintenance practices along roadsides. The major municipal priorities remain unchanged from the previous Plan

with a focus on community preparedness, maintenance and enhancement of response resources, and effective floodplain/drainage management. No significant changes or data reanalysis were made from the 2006 with the exception of the inclusion of HAZUS. The following table describes the hazard mitigation strategies of medium or high priority for this community and their associated responsibilities, timeframe, priority, funding source, etc. Projects included in the previous plan are italicized. Nearly all of the mitigation actions listed in the 2006 plan have also been included here. These actions are either on-going due to their nature (education, equipment maintenance) or were not completed due to the economic recession. Unless otherwise noted, all Local Mitigation Actions, once budgeted for, are able to be accomplished within the 2016 Plan Update five year timeframe.

At this time, the municipality is unable to expand or improve their existing capabilities to reduce key vulnerabilities without additional capacity in the form of training, staff, and/or funding.

The municipality's current comprehensive plan (Plan of Conservation Development) does not reference the 2006 Litchfield Hills Natural Hazard Mitigation Plan or natural hazards with the exception of stormwater management or floodplains as applicable. The NHCOG will discuss the incorporation of the new 2016 Natural Hazard Mitigation Plan into local planning documents with each municipality.

Table V.45: Objective 1 Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Visit schools and educate children about natural hazards and how to prepare for them.	Volunteer Fire Dept. and Emergency Management Director	Annually	Medium	4.8	Volunteers	Municipal budget; EMPG	All hazards
2. Make literature available on natural hazards and preparedness at Litchfield Town Hall and Town Library.	Emergency Management Director and First Selectman	On-going, update as information becomes available	High	4.8	Volunteers	Municipal budget; EMPG	All hazards
3. Maintain local Emergency Operations Plan and continue to coordinate with the Regional Public Safety Task Force and Red Cross on community planning, preparedness, response, and training.	Emergency Management Director and First Selectman	On-going, review annually	Medium	1.8	Volunteers	Municipal budget; EMPG	All hazards
4. *Maintain the Emergency Notification System (e.g. Everbridge system) to provide emergency information to residents in the entire town or in a specific geographic area. This notice can provide not only warning of an impending situation but also information regarding how to prepare for a particular event.*	Emergency Management Director and First Selectman	On-going, review annually	Medium	1.8	LCD and/or ENS dues	LCD; Municipal budget	All hazards

Table V.46: Objective 2 Ensure proper functioning of critical facilities during emergency response							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Routinely inspect emergency response equipment, and train for response to natural disasters.	Volunteer Fire Dept. and Emergency Management Director	Quarterly and after every response	High	4	Volunteers	Municipal budget; EMPG	All hazards
2. Acquire additional emergency response equipment including communication equipment, and portable generators for Town Hall, the High School, and Elementary School.	Emergency Management Director, Fire Chief	2016-2017	High	1.1	Generators: $20,000/generator; Communication equipment: $800/radio	FEMA; Municipal budget; DEHMS; LOCIP; STEAP	All hazards
3. Promote the use of interoperable communication equipment, and the development of standard operating procedures for emergency response in the regional area.	Emergency Management Director, Fire Chief, and First Selectman	On-going, to be reviewed annually	High	1.8	Volunteers	Municipal budget; DEMHS; EMPG	All hazards
4. Consider developing a Memorandum of Understanding with schools or school bus company to utilize school buses for mass transportation during an emergency.	Emergency Management Director and First Selectman	2016	Medium	3.4	In-kind	Municipal/school budget; EMPG	All hazards
5. Develop regional GIS capabilities as needed for access to aerial photos showing the number and location of properties and structures that could be affected by a natural disaster.	Emergency Management Director, Fire Chief, and DEMHS	2017	Low	1.8	$3,000/year	Municipal budget; OPM RPI	All hazards

Table V.47: Objective 3 Expand maintenance activities and implement specific projects that address known drainage issues within the town							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Implement control measures to mitigate the flooding created by beavers.	Public Works Dept.	On-going, with each project and/or as needed	Medium	1.3	$1,500/culvert	FEMA; Municipal budget	Flooding
2. Implement clean-out schedule for all catch basins and drainage facilities.	Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.1	$12,000/year	Municipal budget	Flooding
3. Monitor floodplain regulations and update as necessary based on DEEP's "Model Floodplain Management Regulations" and FEMA Guidelines.	Planning and Zoning Commission	Annually, efforts to be reviewed at annual planning meeting	Medium	4.8	$2,500	Municipal budget	Flooding
4. Identify the location of structures that are susceptible to flooding to facilitate risk assessment and potential control measures (e.g. box culvert needed at Camp Dutton).	DPW, EMD, or DEEP	Annually, efforts to be reviewed at annual planning meeting	Medium	1.9	$55,000	FEMA	Flooding
5. Maintain appropriate funding to augment the municipal tree trimming program.	First Selectman, Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.3	$80,000	State; Eversource; Municipal budget; FEMA HMGP	Power outages due to high winds and winter storms
6. Develop list of vulnerable populations for quick disaster response.	Emergency Management Director, Human Services, First Selectman	2016, to be reviewed annually	High	1.9	Volunteers	Municipal budget	All hazards

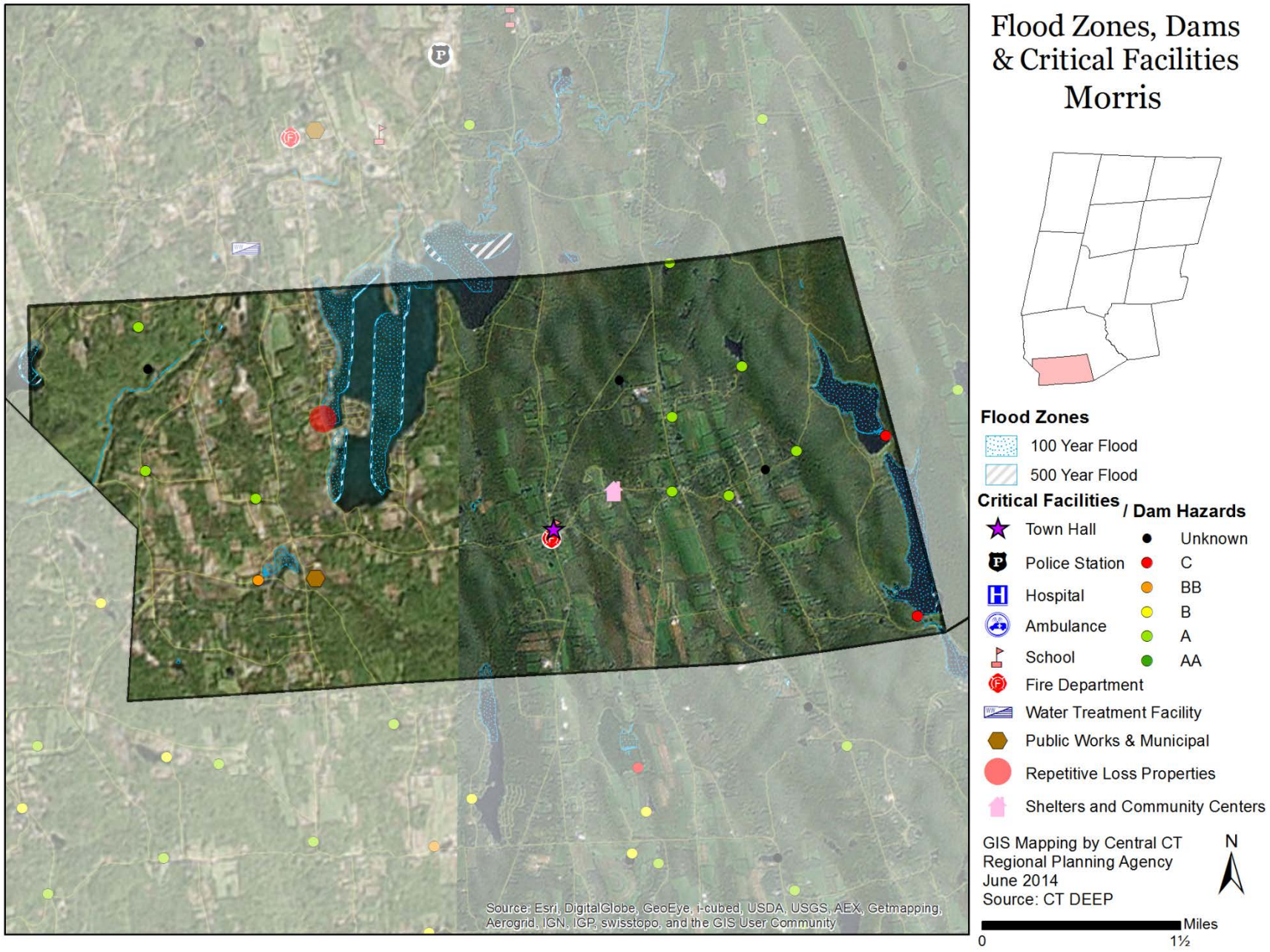

Figure V.14. Flood zones, dams, & critical facilities in Morris

G. Town of Morris Risk Assessment and Hazard Mitigation Plan

1. General Town Description

The Town of Morris is a rural town in the Litchfield Hills Region bordered on the north and east by Litchfield, on the south by Bethlehem and Watertown, and on the west by Washington (see Figure V.14).

At one time, the town was a section of Litchfield, known as Litchfield South Farms, before its independent incorporation in 1859. According to the publication "One Hundred Years – A History of Morris Connecticut, 1859-1959" compiled by Laura Stoddard Weik, Morris developed out of the pioneer settlement of Litchfield. According to Ms. Weik, "It is not known just when or where the first homes were built in South Farms, but it is probably after 1726 when the danger from marauding Indians had subsided….The land in South Farms must have been fertile and productive for by 1810, a time when the economy of the farm family was still largely self-sufficient and self-supplying, it was supporting a population of 1,238….Mills of various kinds were erected at every source of good water power…Cider mills and blacksmiths shops were numerous and scattered throughout the town. There were several small stores…The lake (Bantam Lake), then as now, played an important part in the life of the area."

The publication by Ms. Weik also describes how the late 19th century "brought excitement and destruction from fire and flood". During one storm in 1897, "reports began to come in of highways washed away, bridges carried off, railway traffic stopped and all the concomitants of a severe storm….Bantam river was higher than ever before in the summer, and overflowed the meadows along its course but there were no houses for it to surround. The morning train did not go down because of a culvert washed out at "Griswold's Crossing" between Bantam and West Morris. The washout was 70 feet long and 15 feet deep."

A serious forest fire in the summer of 1914 at Mt. Tom is also described as the "scene of the most stubborn and damaging forest fire ever seen in this town…and all the manpower in town as well as trained forest personnel and equipment of the State Department were engaged in the battle. Fire lines were dug and kept constantly patrolled until finally enough rain fell to wipe out the danger."

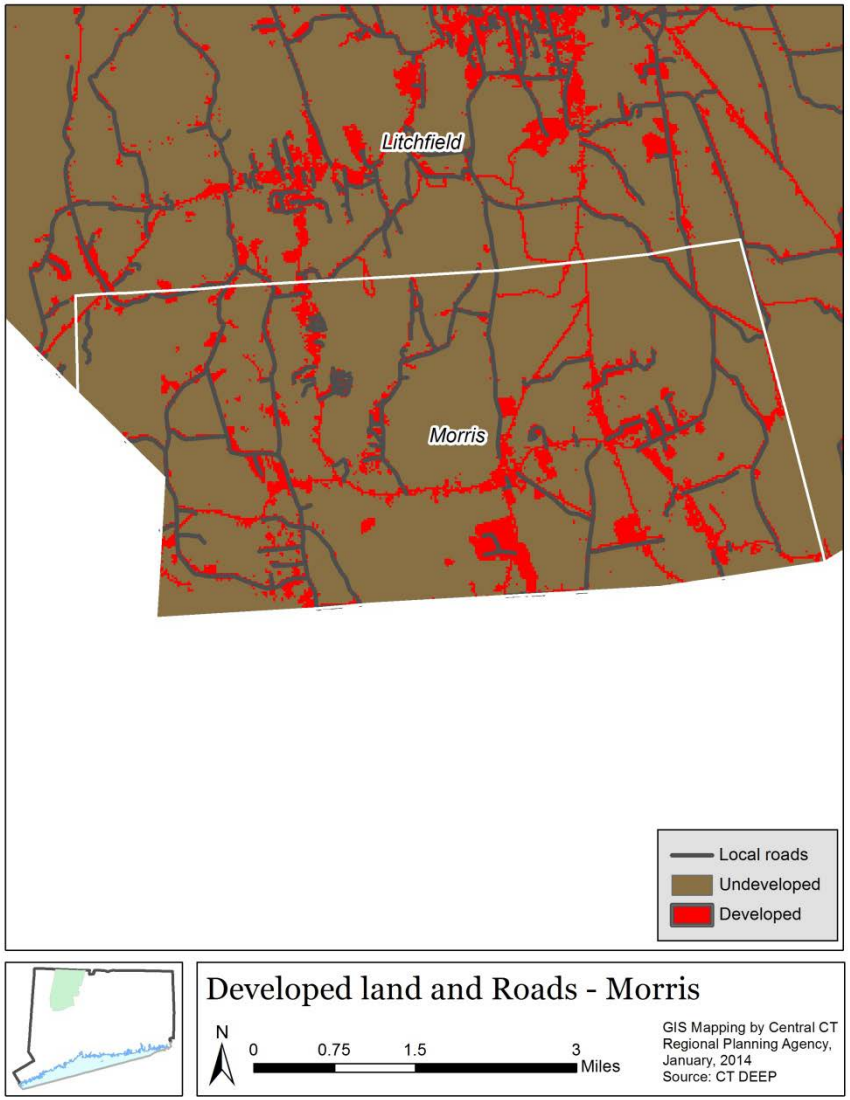

Figure V.15. Developed land and local roads in Morris

A brief account of the Flood of 1955 is also presented as follows: "Torrential rains caused by the passage of Hurricane "Diane" lashed the area. This followed closely the Hurricane "Connie" whose heavy rains had saturated the ground. The roads were flooded so that by Friday afternoon there was only one way, through Lakeside, open to Litchfield. The West Morris bridge was washed away... Bantam Lake was 10 feet above normal, at the peak which was reached by Saturday. The water flooded many cottages of Deer Island and damaged boats and docks."

Morris is part of the Northeastern Highlands Ecoregion, which is characterized by "hills and mountains, a mostly forested land cover, nutrient-poor frigid and cryic soils (mostly Spodosols), and numerous high-gradient streams and glacial lakes" (as described on the map "Ecoregions of New England"). Other notable characteristics of the municipality include Bantam Lake (which at 916 acres, is the largest natural body of water in Connecticut), rolling hills, forested land, farmland, patches of wetlands, scattered ponds, the White Memorial Foundation Preserve, and two reservoirs owned and operated by the City of Waterbury (Pitch Reservoir and the Morris Reservoir). Major highways serving the town include State Routes 61, 63, 109, and 209.

According to the US Census data, the population of Morris has increased an average of 24 persons per year over the past 50 years, from a population of 1,190 people in 1960 to 2,388 in 2010. The population is projected to continue to increase to 2,460persons by the year 2020, an increase of 3%. The median age in 2010 was 46.

Approximately 60% of the housing in town is owner occupied, with about 17% of the housing stock occupied by renters and 20% held for seasonal, recreational or occasional use (second homes). There are 1,239 existing housing units in town as of 2009.

Morris, according to the Connecticut Economic Resource Center (CERC), had a labor force of 1,280 persons in 2013, with 456 jobs actually located within the community. About one-third of these jobs are in goods producing industries and two-thirds are in service producing industries. The unemployment rate was 6.4% in 2013.

According to CERC, Morris has an equalized net grand list of $502,130,423 in 2010 with commercial and industrial uses comprising 3.7% of this grand list. The equalized net grand list is an estimate of the market value of all taxable property in the municipality, and gives some indication of the value of property at risk in the event of a major natural disaster. There are 76 business firms in the community according to CERC as of 2013.

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the municipality has experienced limited development. Specifically, the housing stock increased by 133 units between 2000 and 2010, and there has been no significant commercial or industrial development. According to a previous land use official that served for most of the time period since the 2006 plan, no documented development occurred in flood-prone areas; therefore, the community's vulnerability did not increase as a result of development activity in floodplains.

2. Evaluation of Risks and Vulnerability

The major natural hazards of concern in Morris are flooding, high winds, and severe winter storms. Forest fires, drought, and earthquakes occur much less frequently in the community, and are therefore of somewhat lesser concern. The general risk and vulnerability posed by each of these six hazards is discussed in the preceding Section III of this report. More specific information on the flood vulnerability and critical facilities in the town of Morris is presented below.

Flooding

Floodprone areas in Morris, as mapped by FEMA, are shown in Figure V.14. According to FEMA's website, "Policy Statistics", there are 28 flood insurance policies in force as of 8/31/2015 with an insurance value of $7,017,100. An attempt was made to estimate the number of structures located within the FEMA floodplain boundaries using available GIS data for Connecticut, however the data is not considered precise enough for an accurate assessment. The area of greatest concern locally is around Bantam Lake.

Table V.48: Building Exposure by Occupancy Type for the Study Region		
Occupancy	Exposure ($1000)	Percent of Total
Residential	197,604	77.7%
Commercial	31,756	12.5%
Industrial	19,367	7.6%
Agricultural	1,970	0.8%
Religion	2,012	0.8%
Government	1,136	0.4%
Education	389	0.2%
Total	254,234	100.00%

Table V.49: Building Exposure by Occupancy Type for the Scenario		
Occupancy	Exposure ($1000)	Percent of Total
Residential	136,553	73.4%
Commercial	26,085	14.0%
Industrial	18,215	9.8%
Agricultural	1,815	1.0%
Religion	2,012	1.1%
Government	1,136	0.6%
Education	163	0.1%
Total	185,979	100.00%

As indicated above, the Flood of 1955 impacted Morris as it did other communities in the region. The flood took out a number of dams and bridges in the community, including the outlet control structure to Bantam Lake.

Today, beaver contribute to localized flooding problems in the town periodically with the construction of dams on private properties that are difficult to remove. Beaver have also plugged culverts on local streets such as John Weik Road, which require routine maintenance by town forces to remove.

Hurricanes and Strong Winds

Morris also suffered Hurricane related damage from Storm Irene in August 2011 and Storm Sandy in October 2012. Both of these events caused significant power outages and the storms received Presidential Disaster Declarations. Areas that are most vulnerable are those with greater levels of development.

Severe Winter Storms

The natural hazard of greatest concern in Morris is winter ice storms with high winds and power outages. A severe snowstorm occurred in March of 1978 that brought close to three feet of heavy snow. The town suffered a major ice storm in 1978, and again in 2002, that resulted in downed power lines, extensive tree damage, and expensive clean-up costs.

Winter storms cause road blockages and roof collapses (from heavy snow and ice). The most vulnerable parts of town, therefore, are those with dense development and lots of roads. From the town's perspective, the greatest vulnerability is town-maintained roads. Figure V.15 shows areas of development and the locations of town-maintained roads. In total, Morris maintains 39 miles of local roads.

Vulnerable Assets

There are fifteen dams in Morris (see Figure V.14). Nine of these dams are private dams, three are owned by the Waterbury Water Company (Pitch Reservoir Dam, Morris Reservoir Dam, and Watertown Road Pond Dam), and three dams are not classified. Pitch Reservoir Dam and Morris Reservoir Dam are rated C, one dam (Jones Pond Dam) is rated BB, nine dams are rated A, and three dams are not rated. For a description of these dam ratings, see "Flooding: Impacts" in Section III.

Table V.50: Impacts from 1% annual flood scenario (Morris)	
Type of impact	Value
Building related losses	$2,690,000
Business interruption losses	$0
Total economic losses (thousands of dollars)	$2,690,000
Damaged essential facilities	0
Buildings substantially damaged	0
Tons of debris	808
Displaced households	7
Shelter needs	1
Acres of land flooded	798

The major facilities at risk in the community in the event of a natural hazard are shown in Figure V.14. These facilities include the Morris Town Hall, Morris Elementary School (which serves as the town's emergency shelter), Town Public Works Department, Morris Fire House (which serves as the emergency operations center), and the Morris Senior Center. These are considered critical facilities in the event of a natural disaster because they might be needed for effective emergency response. All are potentially vulnerable to tornados, winter storms, wildfire, and earthquakes. None of the facilities are located within a floodplain.

Tables V.48 & V.49 above show the "total exposure" of all structures in Morris, under a 1% flood scenario. The first table shows that $254,234,000 worth of buildings could potentially be impacted by a 1% flood event. The second table shows that nearly all of that total, $185,979,000 worth of buildings are likely to be impacted by such an event.

3. Potential Impacts

Results of the HAZUS 1% flood simulation are shown in Table V.50 below. In Morris, $2.69 million worth of economic losses are estimated. Of that, all are due to building damage with no losses occurring due to business interruptions. Such an event would displace 7 households and cause at least one person to seek temporary shelter. The flood would cover 798 acres of land. Full results from this simulation are in Appendix B.

Hurricanes have caused wide-spread power outages and could cause significant damage. Hurricane Irene left 100% of the town without power at its peak (1,382 households). The results of three HAZUS hurricane simulations are presented in Table V.51. An event similar to the 1938 hurricane could cause $31,520 in damage from the wind. Such an event would likely cause a flood as well, which would increase the amount of damage dramatically (see above).

Winter storms are a perennial concern with wide-ranging impacts. Snow covered roads take time and money to clear. Heavy snow, especially when accompanied by ice can cause roofs to collapse. Ice storms can also bring down power lines, causing outages. The snow storm of October 2011 left 99% of the town without power at its peak. At least half of the town had no power for five days.

Table V.51: Estimated hurricane-related damage (thousands of dollars) by building occupancy								
	Res	Com	Ind	Agr	Rel	Edu	Gov	Total
1938	28.12	1.97	0.74	0.53	0.08	0.04	0.04	31.52
1%	0.79	0.07	0.01	0.02	0.00	0.00	0.00	0.89
5%	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01

4. Major Concerns

- Some critical facilities, notably town hall, lack sufficient emergency generation capacity.
- Flooding caused by beavers remains a problem.
- Power lines in heavily forested areas are at risk of being downed by falling tree limbs.
- The East Shore Road area experiences periodic flooding due to poor drainage.

5. Hazard Mitigation Plan

Since the last plan, the general geography, demography, and built environment have not changed significantly in this community. Nor have the hazards become significantly more or less severe. This update, unlike the previous plan, utilizes HAZUS methodology to gain a deeper understanding of the impacts from significant natural hazards. Additionally, this plan utilizes the state's most recent hazard mitigation plan. As such, the plan priorities remain the same with the addition of mitigation actions to protect the built environment.

Mitigation Goals and Objectives

The principal goals of Morris's natural hazard mitigation plan update are:

1. To minimize the risks to life and property from natural hazards, and
2. To prevent losses from natural hazards to the extent practicable.

In addition to these over-arching goals, the town has also established the following objectives to help the town become more disaster resistant:

1. Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness
2. Ensure proper functioning of critical facilities during emergency response.
3. Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Overview of Potential Mitigation Measures

Table V.3 in the previous section of this report presents a listing of potential mitigation measures that can be taken to reduce the impacts of the major natural hazards of concern in the Litchfield Hills Region. In the context of Morris's risk and vulnerability analysis presented above, and the existing mitigation strategies in the town, only some of these measures will be both needed and cost-effective. The purpose of this Natural Hazards Mitigation Plan is to identify reasonable and appropriate mitigation measures for each hazard from the Table V.3 listing and other sources, and to develop an implementation strategy for the priority mitigation measures.

Existing Mitigation Strategy

The Town of Morris has a number of existing authorities, policies, programs and regulations that serve to mitigate the impact of natural hazards. Existing local authorities include the Morris Board of Selectmen, Planning and Zoning Commission, Inland Wetlands Commission, Emergency Management Director, Fire Department, and Department of Public Works.

Morris maintains compliance with NFIP through its use of the Connecticut State Building Code, subdivision regulations, and zoning regulations. In fact, its zoning regulations require that the lowest floor in any residential new construction or substantial improvement must be *at least* 6 inches above Base Flood Elevation (BFE). For non-residential, the lowest floor must also be *at least* 6 inches above BFE or flood-proofed to 6 inches above BFE. Morris expects to continue participation in NFIP.

Land use regulations exist to protect natural resources, including erosion and sediment control regulations for new development, stormwater control regulations to minimize drainage problems, and a flood hazard area to control development in flood prone areas.

Within the flood hazard area a development permit shall be obtained for any construction or development.

Morris' subdivision regulations have detailed standards for the planning, design and construction of storm drainage systems in order to minimize adverse impacts associated with new construction activity. The Morris

Inland Wetlands Commission enforces regulations to direct development away from wetlands, watercourses and floodplains. In addition to these regulations, the Morris Public Works Department routinely examines and clears public storm drains and catch basins of debris following periods of rainfall, snowfall, or windstorms. The town's DPW also monitors weather reports and maintains loaded trucks in preparation of winter storm events.

The Morris Volunteer Fire Department, Department of Public Works, and Emergency Management Director all possess emergency equipment that can be deployed as needed in the event of an emergency. Procedures are also in place to open and maintain the Emergency Operations Center and emergency shelter in town.

Morris has also been working with other towns in the Litchfield Hills Region through the Northwestern CT/Litchfield Hills Public Safety Task Force to enhance communication and coordination. This has included efforts to standardize communication equipment and the equipment in local emergency operation centers, and also the upgrading of supplies at emergency shelters. Other activities being pursued are a regionally coordinated public notification system, a badging registration system for emergency responders, improved training opportunities, and the development of written mutual aid agreements.

In addition to these local and regional mitigation programs, the municipality also benefits from numerous federal and state mitigation programs such as the USGS WaterWatch, Report of the Two Storm Panel, CT DEEP Forest Fire Danger Report, the "Connecticut Drought Preparedness and Response Plan", the "National Weather Service Early Warning System", the University of Connecticut's Center for Land Use Education and Research (CLEAR), and the annual tree trimming maintenance program by Eversource.

Recommended Hazard Mitigation Measures

Objective 1: Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness.

Natural Hazard Addressed: *All hazards.*

Objective 2: Ensure proper functioning of critical facilities during emergency response.

Natural Hazard Addressed: *All hazards.*

Objective 3: Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Natural Hazard Addressed*: flooding.*

The priority assigned to the above strategies was based on cost-benefit discussions with local officials and an evaluation using the STAPLEE criteria defined in FEMA's "How To Guide #3: Developing the Mitigation Plan". STAPLEE is short for the social, technical, administrative, political, legal, economic, and environmental criteria used in the evaluation process. It is anticipated that the low-cost strategies will be implemented during the first year after plan adoption. The higher-cost projects will be implemented as funding becomes available.

High priority projects are those that are considered critically important in order to minimize the risks to life and property from natural hazards. Medium priority projects are important to the community in order to mitigate the impacts of natural disasters but are not considered as critical to the community as high priority projects. Low priority projects are supportive of hazard mitigation goals and objectives, but are not considered essential to effective hazard mitigation in the community.

Changes in Mitigation Priorities from Previous Plan

Since the 2007 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the Town of Morris has pursued implementation of a number of mitigation measures. Of particular note is the implementation of a public notification system (Everbridge System) in cooperation with Litchfield County Dispatch, upgrading the outlet control structure at Bantam Lake, and advocacy for an increased role by Eversource in tree trimming maintenance practices along roadsides. The major municipal priorities remain unchanged from the previous Plan with a focus on community preparedness, maintenance and enhancement of response resources, and effective floodplain/drainage management. No significant changes or data reanalysis were made from the 2006 with the exception of the inclusion of HAZUS and several mitigation strategies for the built environment. The following table describes the hazard mitigation strategies

of medium or high priority for this community and their associated responsibilities, timeframe, priority, funding source, etc. Projects included in the previous plan are italicized. Nearly all of the mitigation actions listed in the 2006 plan have also been included here. These actions are either on-going due to their nature (education, equipment maintenance) or were not completed due to the economic recession. Unless otherwise noted, all Local Mitigation Actions, once budgeted for, are able to be accomplished within the 2016 Plan Update five year timeframe.

At this time, the municipality is unable to expand or improve their existing capabilities to reduce key vulnerabilities without additional capacity in the form of training, staff, and/or funding.

The municipality's current comprehensive plan (Plan of Conservation Development) does not reference the 2006 Litchfield Hills Natural Hazard Mitigation Plan or natural hazards with the exception of stormwater management or floodplains as applicable. The NHCOG will discuss the incorporation of the new 2016 Natural Hazard Mitigation Plan into local planning documents with each municipality.

Table V.52: Objective 1 Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Visit schools and educate children about natural hazards and how to prepare for them.	Volunteer Fire Dept. and Emergency Management Director	Annually, efforts to be reviewed at annual planning meeting	Medium	4.8	Volunteers	Municipal budget; EMPG	All hazards
2. Make literature available on natural hazards and preparedness at Morris Town Hall (and website)	Emergency Management Director and First Selectman	On-going, update as information becomes available	High	4.8	Volunteers	Municipal budget; EMPG	All hazards
3. Maintain local Emergency Operations Plan and continue to coordinate with the Regional Public Safety Task Force and Red Cross on community planning, preparedness, response, and training.	Emergency Management Director and First Selectman	On-going, to be reviewed annually	Medium	1.8	Volunteers	Municipal budget; EMPG	All hazards
4. *Continue to participate in LCD's Everbridge Emergency Notification System to provide emergency information to residents in the entire town or in a specific geographic area. This notice can provide not only warning of an impending situation but also information regarding how to prepare for a particular event.*	Emergency Management Director and First Selectman	On-going, to be reviewed annually	Medium	1.8	LCD and/or ENS dues	LCD; Municipal budget	All hazards

Table V.53: Objective 2 Ensure proper functioning of critical facilities during emergency response							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Routinely inspect emergency response equipment, and train for response to natural disasters.	Volunteer Fire Dept. and Emergency Management Director	Quarterly and after every response	High	4	Volunteers	Municipal budget; EMPG	All hazards
2. Acquire additional emergency response equipment including generators for the Town Hall, Elementary School, and Town Garage.	Emergency Management Director, Fire Chief	2016-2017	High	1.1	Generators: $20,000/generator; Communication equipment: $800/radio	Municipal budget; FEMA; DEMHS; LOCIP; STEAP	All hazards
3. Promote the use of interoperable communication equipment and the development of standard operating procedures for emergency response in the regional area.	Emergency Management Director, Fire Chief, and First Selectman	On-going, to be reviewed annually	High	1.8	Volunteers	Municipal budget; DEMHS; EMPG	All hazards

Table V.54: Objective 3 Expand maintenance activities and implement specific projects that address known drainage issues within the town							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Continue to implement control measures to mitigate the flooding created by beavers.	Public Works Dept.	On-going, with each project and/or as needed	Medium	1.3	$1,500/culvert	Municipal budget; FEMA	Flooding
2. Maintain current program of clean-out schedules for all catch basins and drainage facilities	Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.1	$4,200/year	Municipal budget	Flooding
3. Review floodplain regulations and ordinances and update as necessary based on DEEP's "Model Floodplain Management Regulations"	Planning and Zoning Commission	Annually, efforts to be reviewed at annual planning meeting	Medium	4.5	$2,500	Municipal budget; FEMA	Flooding
4. Continue to identify the location of structures that are susceptible to flooding to facilitate risk assessment and potential control measures.	DEMHS or DEEP	Annually, efforts to be reviewed at annual planning meeting	Medium	1.9	$20,000	FEMA; Municipal budget; DEMHS	Flooding
5. Continue to implement the municipal tree trimming program to maintain the road right-of-way.	First Selectman and Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	2	$27,000/year	Municipal budget; Eversource; FEMA HMGP	Power outages due to high winds and winter storms
6. Conduct drainage feasibility study of the East Shore Road area to identify corrective actions for the periodic flooding at this location	First Selectman and Public Works Dept.	2016	Medium	1.9	$40,000	FEMA; DEMHS; Municipal budget; DEEP	Flooding
7. Discuss requiring new buildings constructed in flood prone areas to be protected to the highest recorded flood level regardless of being within a defined Special Flood Hazard Area (SFHA).	Planning & Zoning Commission	2016	Medium	7	In-kind	Municipal budget	Flooding
8. Review culvert conveyances based on existing hydrology and Northeast Regional Climate Center guidance.	Public Works	On-going, with each project and/or as needed	Medium	2.5	In-kind	ConnDOT; CIRCA	Flooding
9. Require the location of utilities underground in new developments or during redevelopment whenever possible.	Building Department; Planning & Zoning; Public Works	2016	High	1.4	In-kind	Municipal budget	All hazards
10. Emergency personnel should continue to identify areas that are difficult to access during winter storm events and devise contingency plans to access such areas during emergencies.	Emergency personnel; Public works	On-going, as identified	High	5	In-kind	Municipal budget; EMPG	Winter storms
11. The Town should continue to require the installation of fire protection water in new developments.	Building Department; Planning & Zoning	On-going, to be reviewed annually	Medium	1.4	In-kind	Municipal budget	Forest fires

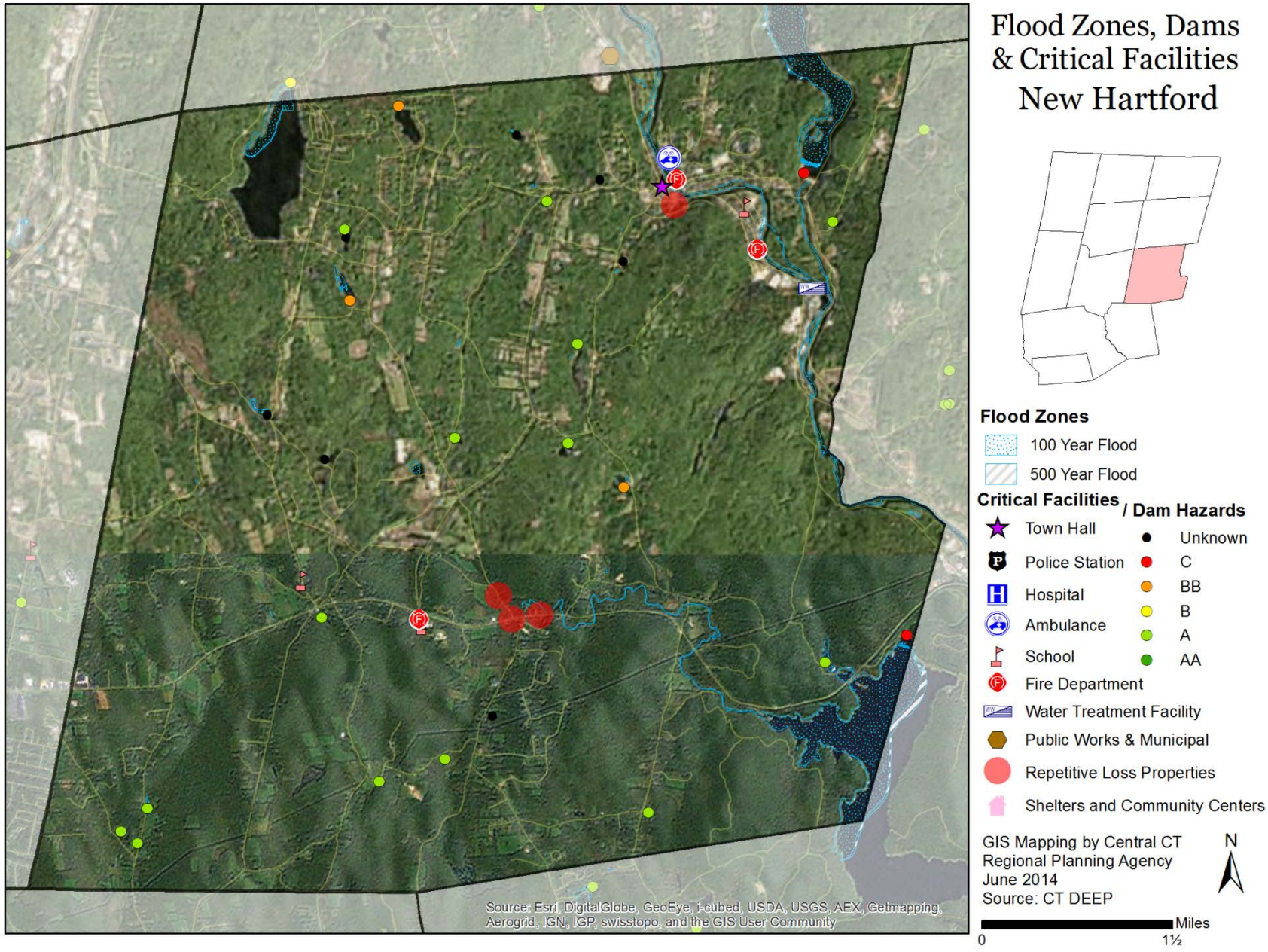

Figure V.16. Flood zones, dams, & critical facilities in New Hartford

H. Town of New Hartford Risk Assessment and Hazard Mitigation Plan

1. General Town Description

The Town of New Hartford is a rural town in the Litchfield Hills Region bordered on the north by Barkhamsted, the east by Canton, the south by Harwinton and Burlington, and on the west by Torrington (see Figure V.16).

The town encompasses 38.1 square miles (37 square miles of land), and was incorporated in October of 1738. The following excerpt from the draft "New Hartford 2005 Plan of Conservation and Development", presents a brief description of the town's history:

"Much of New Hartford's history and physical structure is defined by natural resources (such as rivers) and by transportation (such as the railroads and roads).

The Farmington and Nepaug Rivers and the hills and forests provided intense physical beauty and supported Native American settlements. The soils supported subsistence and commercial agriculture for settlers.

The rivers also powered the mills of early settlers and provided water power for industry. The arrival of railroad service, coupled with the abundance of water power, helped turn New Hartford into a manufacturing center in the late 1800's…..

Around the turn of the century, a drought and the availability of electric power elsewhere diminished the advantage of proximity to the rivers and New Hartford experienced fluctuations in population. Major floods later breached the dam on the Farmington River and vehicular traffic began to compete with railroads. With manufacturing businesses already moving south in search of cheaper labor, New Hartford again became a rural agricultural community.

The importance of local rivers was further illustrated in the 1900's when the Metropolitan District Commission began acquiring land for public water supply reservoirs in New Hartford and other communities.

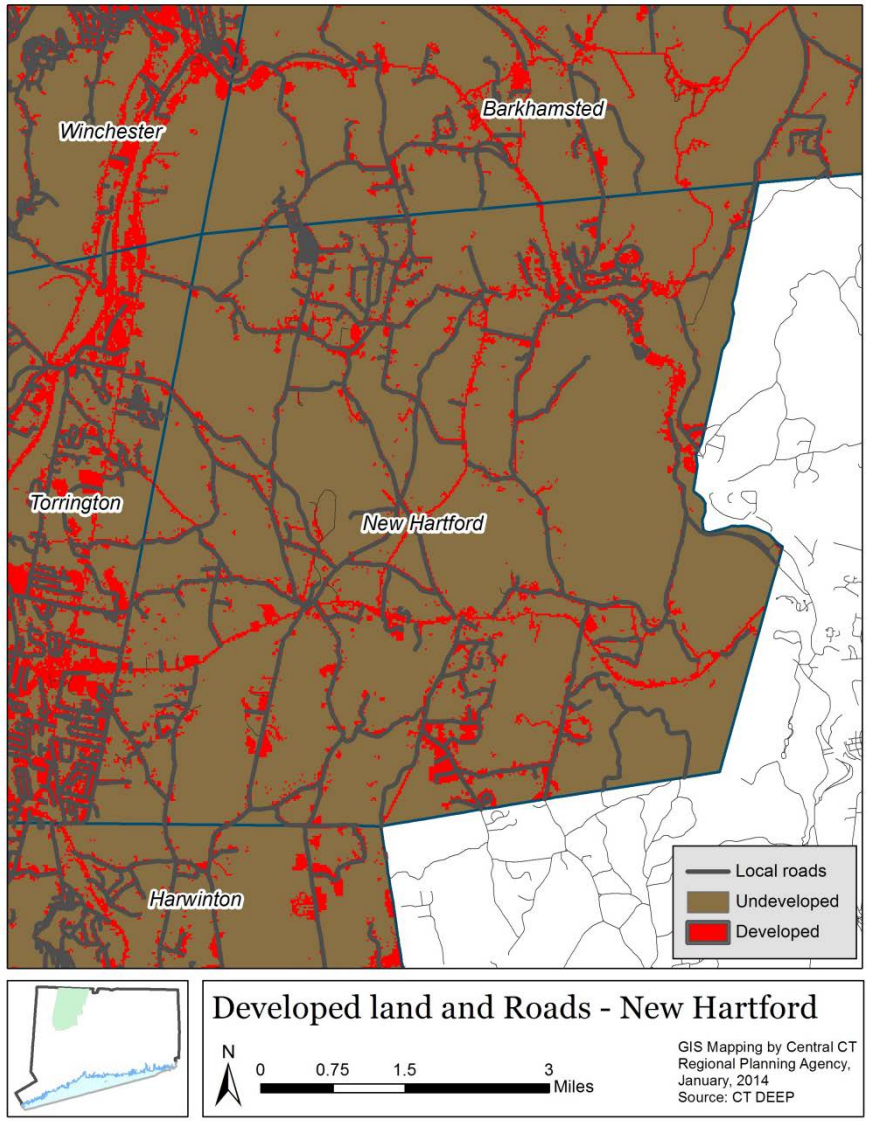

Figure V.17. Developed land and local roads in Morris

After World War II, New Hartford began to experience suburban development although at a slower pace than other communities due to its remoteness from employment centers. However, during the later 1980's

Table V.55: Building Exposure by Occupancy Type for the Study Region		
Occupancy	Exposure ($1000)	Percent of Total
Residential	429,748	71.3%
Commercial	81,980	13.6%
Industrial	67,278	11.2%
Agricultural	3,934	0.7%
Religion	9,832	1.6%
Government	6,186	1.0%
Education	4,040	0.7%
Total	602,998	100.00%

Table V.56: Building Exposure by Occupancy Type for the Scenario		
Occupancy	Exposure ($1000)	Percent of Total
Residential	328,938	68.9%
Commercial	74,071	15.5%
Industrial	52,887	11.1%
Agricultural	3,759	0.8%
Religion	8,582	1.8%
Government	6,186	1.3%
Education	3,212	0.7%
Total	477,635	100.00%

and 1990's, this growth accelerated as people commuted longer distances for community character and quality of life they sought."

New Hartford is part of the Northeastern Highlands Ecoregion, which is characterized by "hills and mountains, a mostly forested land cover, nutrient-poor frigid and cryic soils (mostly Spodosols), and numerous high-gradient streams and glacial lakes" (as described on the map "Ecoregions of New England"). Other notable characteristics of the municipality include the Farmington River, which traverses the northeastern portion of the town, New Hartford Town Center, West Hill Pond, Nepaug Reservoir, Nepaug State Forest, rolling hills, forested land, farmland, patches of wetlands, scattered ponds, and large lot residential development. Major highways serving the town include State Routes 44, 202, and 219.

According to the US Census data, the population of New Hartford has increased an average of 79 persons per year over the past 50 years, from a population of 3,033 people in 1960 to 6,970 in 2010. The population is projected to increase to 7,556 persons by the year 2020, an increase of 8.4%. The median age in 2010 was 44. Over 80% of the housing in town is owner occupied, with about 13% of the housing stock occupied by renters and 6% held for seasonal, recreational or occasional use (second homes). There are 2,653 existing housing units in town as of 2009.

New Hartford, according to the Connecticut Economic Resource Center (CERC), had a labor force of 3,835 persons in 2013, with 1,505 jobs located in the community. Most of these jobs are now in service producing industries, as manufacturing as a percentage of total employment has declined from 72% in 1970 to 30.4% in 2013. The unemployment rate was 7.1% in 2013.

According to CERC, New Hartford has an equalized net grand list of $955,598,367 in 2010 with commercial and industrial uses comprising 5.2% of this grand list. The equalized net grand list is an estimate of the market value of all taxable property in the municipality, and gives some indication of the value of property at risk in the event of a major natural disaster. There are 173 business firms in the community according to CERC as of 2013.

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the municipality has experienced modest development. Specifically, the housing stock increased by 555 units between 2000 and 2010, and there has been no significant commercial or industrial development. According to the land use official, there have been five floodplain permits issued since the previous plan. Most of these permits were the replacement or reconstruction of existing structures with the exception of an additional propane tank and a moveable shed. Due to the

smaller nature of these permitted processes, these changes are not expected to increase the community's vulnerability significantly in flood-prone areas.

2. Evaluation of Risks and Vulnerability

The major natural hazards of concern in New Hartford are flooding, high winds, and severe winter storms. Forest fires, drought, and earthquakes occur much less frequently in the community, and are therefore of somewhat lesser concern. The general risk and vulnerability posed by each of these six hazards is discussed in the preceding Section III of this report. More specific information on the flood vulnerability and critical facilities in the town of New Hartford is presented below.

Flooding

Floodprone areas in New Hartford, as mapped by FEMA, are shown in Figure V.16. According to FEMA's website, "Policy Statistics", there are 194 flood insurance policies in force as of 8/31/2015 with an insurance value of $41,614,700. An attempt was made to estimate the number of structures located within the FEMA floodplain boundaries using available GIS data for Connecticut, however the data is not considered precise enough for an accurate assessment. The area of greatest concern locally is along the Farmington River and Nepaug River.

The Flood of 1955 impacted New Hartford as it did other communities in the region. The flood took out a number of dams and bridges in the community, including the major bridges in the Town Center and at Satan's Kingdom.

Today, beaver contribute to localized flooding problems in the town periodically with the construction of dams on private properties that are difficult to access and remove. Beaver have also plugged culverts on local streets, which require routine maintenance by town forces to remove.

Hurricanes and Strong Winds

New Hartford also suffered Hurricane related damage from Storm Irene in August 2011 and Storm Sandy in October 2012. Both of these events caused significant power outages and the storms received Presidential Disaster Declarations. Areas that are most vulnerable are those with greater levels of development. See the Figure V.17 for locations of these areas.

Table V.57: Impacts from 1% annual flood scenario (New Hartford)

Type of impact	Value
Building related losses	$76,210,000
Business interruption losses	$257,000
Total economic losses (thousands of dollars)	$76,467,000
Damaged essential facilities	0
Buildings substantially damaged	86
Tons of debris	4,136
Displaced households	183
Shelter needs	331
Acres of land flooded	1,521

Severe Winter Storms

A severe snowstorm occurred in March of 1978 that brought close to three feet of heavy snow. The town suffered a major ice storm in 1978, and again in 2002, that resulted in downed power lines, extensive tree damage, loss of electrical power, and expensive clean-up costs. Another severe snow storm in October 2011 caused significant damage from downed tree limbs and extensive power outages. See the section below on *Potential Impacts* for a discussion of these outages.

See Figure V.17 for developed areas of town and locations of town-maintained roads. Areas with higher levels of development are at greater risk of roof collapses due to snow accumulation. Local roads must be plowed by the town and represent a potential cost from a snow storm. In total, New Hartford maintains 97 miles of local roads.

Vulnerable Assets

There are twenty six dams in New Hartford (see Figure V.16), which is

more than any other municipality in the Litchfield Hills Region. Twenty of these dams are private dams, three are owned by the Metropolitan District Commission (Nepaug Reservoir, Compensating Reservoir, and District), and three dams are not classified. Compensating Reservoir Dam and Nepaug Reservoir Dam are rated C, three private dams are rated BB (Laurel Lake, Rizzo Pond, and Atwood Swamp Pond), fourteen dams are rated A, and seven dams are not rated. For a description of these dam ratings, "Flooding: Impacts" in Section III.

The major facilities at risk in the community in the event of a natural hazard are shown in Figure V.16. These facilities include the New Hartford Town Hall (which serves as the emergency operations center and emergency shelter for small incidents), New Hartford Elementary School, Bakerville Consolidated School, Ann Antolini Elementary School (which is proposed to serve as the town's emergency shelter for large incidents), Town Public Works Department, Wastewater Treatment Plant, and the four New Hartford Fire Stations. These are considered critical facilities in the event of a natural disaster because they might be needed for effective emergency response. All are potentially vulnerable to tornados, winter storms, wildfire, and earthquakes. Several of these facilities appear to be located within the 100-year floodplain of the Farmington River according to FEMA mapping (see Figure V.16), including the Town Hall, Public Works Department, Wastewater Treatment Plant, and New Hartford Elementary School. The Town Public Works Department is proposed for relocation to another part of town where it would be outside of the floodplain.

Tables V.55 & V.56 above show the "total exposure" of all structures in New Hartford, under a 1% flood scenario. The first table shows that $602,998,000 worth of buildings could potentially be impacted by a 1% flood event. The second table shows that over two-thirds, $477,635,000 worth of buildings are likely to be impacted by such an event.

3. Potential Impacts

Results of the HAZUS 1% flood simulation are shown in Table V.57. In New Hartford, $76.21 million worth of economic losses are estimated. Of that, $76.467 million are due to building damage with $257,000 in losses occurring due to business interruptions. Such an event would displace 183 households and cause 331 people to seek temporary shelter. The flood would cover 1,521 acres of land. Full results from this simulation are in Appendix B.

Hurricanes have caused wide-spread power outages and could cause significant damage. Hurricane Irene caused significant power outages in town, but full data was not available. The results of three HAZUS hurricane simulations are presented in Table V.58. An event similar to the 1938 hurricane could cause $77,100 in damage from the wind. Such an event would likely cause a flood as well, which would increase the amount of damage dramatically (see above).

Winter storms are a perennial concern with wide-ranging impacts. Snow covered roads take time and money to clear. Heavy snow, especially when accompanied by ice can cause roofs to collapse. Ice storms can also bring down power lines, causing outages. The snow storm of October 2011 left 100% of the town without power at its peak. At least 90% of the town had no power for four days.

4. Major Concerns

- Brush fires pose a problem periodically for local emergency response personnel. These are generally brought under control

Table V.58: Estimated hurricane-related damage (thousands of dollars) by building occupancy

	Res	Com	Ind	Agr	Rel	Edu	Gov	Total
1938	69.23	3.90	2.49	1.07	0.18	0.13	0.10	77.10
1%	3.22	0.21	0.08	0.06	0.00	0.00	0.00	3.58
5%	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01

fairly quickly due to the accessibility provided by woods roads and other natural breaks in the forest cover.

- Emergency shelters are in need of supplies.
- Vulnerability analysis is hampered by a lack of GIS capabilities.
- There is no agreement for providing mass transportation in the event of a major incident.

5. Hazard Mitigation Plan

Since the last plan, the general geography, demography, and built environment have not changed significantly in this community. Nor have the hazards become significantly more or less severe. This update, unlike the previous plan, utilizes HAZUS methodology to gain a deeper understanding of the impacts from significant natural hazards. Additionally, this plan utilizes the state's most recent hazard mitigation plan. As such, the plan priorities remain the same with the addition of mitigation actions to protect the built environment.

Mitigation Goals and Objectives

The principal goals of New Hartford's natural hazard mitigation plan update are:

1. To minimize the risks to life and property from natural hazards, and
2. To prevent losses from natural hazards to the extent practicable.

In addition to these over-arching goals, the town has also established the following objectives to help the town become more disaster resistant:

1. Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness
2. Ensure proper functioning of critical facilities during emergency response.
3. Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Overview of Potential Mitigation Measures

Table V.3 in the previous section of this report presents a listing of potential mitigation measures that can be taken to reduce the impacts of the major natural hazards of concern in the Litchfield Hills Region. In the context of New Hartford's risk and vulnerability analysis presented above, and the existing mitigation strategies in the town, only some of these measures will be both needed and cost-effective. The purpose of this Natural Hazards Mitigation Plan is to identify reasonable and appropriate mitigation measures for each hazard from the Table V.3 listing and other sources, and to develop an implementation strategy for the priority mitigation measures.

Existing Mitigation Strategy

The Town of New Hartford has a number of existing authorities, policies, programs and regulations that serve to mitigate the impact of natural hazards. Existing local authorities include the New Hartford Board of Selectmen, Planning and Zoning Commission, Inland Wetlands Commission, Emergency Management Director, Fire Department, and Department of Public Works.

New Hartford maintains compliance with NFIP through its use of the Connecticut State Building Code, subdivision regulations, and zoning regulations. In fact, its zoning regulations require that the lowest floor in any residential new construction or substantial improvement must be *at least* 1 foot above Base Flood Elevation (BFE). For non-residential, the lowest floor must also be *at least* 1 foot above BFE or flood-proofed to 1 foot above BFE. Where they impose stricter guidelines, the Farmington River Protection Overlay District regulations supersede the Floodplain Overlay District regulations. New Hartford expects to continue participation in NFIP.

Land use regulations exist to protect natural resources, including erosion and sediment control regulations for new development, stormwater control regulations to minimize drainage problems, and a floodplain overlay district area to control development in flood prone areas.

The floodplain overlay district provides that any new construction or substantial improvement of any residential structure shall have the lowest floor, including the basement, elevated to at least one foot above the base flood elevation. Nonresidential construction is required to have the lowest floor, including basement, elevated to at least one foot above the

base flood elevation or be flood-proofed to one foot above the base flood elevation. A registered professional engineer or architect is required to design and certify the construction of structures in the floodplain in order to minimize flood damage. Additionally all attendant utilities or sanitary facilities should be located or designed to avoid infiltration or impairment by flood waters. Recreational vehicles are permitted to remain within the overlay zone for no more than 4 weeks and must be licensed and road ready.

New Hartford's subdivision regulations have detailed standards for the planning, design and construction of storm drainage systems in order to minimize adverse impacts associated with new construction activity. The New Hartford Inland Wetlands Commission enforces regulations to direct development away from wetlands, watercourses and floodplains. In addition to these regulations, the New Hartford Public Works Department routinely examines and clears public storm drains and catch basins of debris following periods of rainfall, snowfall, or windstorms. The town's DPW also monitors weather reports and maintains loaded trucks in preparation of winter storm events.

The New Hartford Volunteer Fire Departments, Department of Public Works, and Emergency Management Director all possesses emergency equipment that can be deployed as needed in the event of an emergency. Procedures are also in place to open and maintain the Emergency Operations Center and emergency shelter in town.

New Hartford has also been working with other towns in the Litchfield Hills Region through the Northwestern CT/Litchfield Hills Public Safety Task Force to enhance communication and coordination. This has included efforts to standardize communication equipment and the equipment in local emergency operation centers, and also the upgrading of supplies at emergency shelters. Other activities being pursued are a regionally coordinated public notification system, a badging registration system for emergency responders, improved training opportunities, and the development of written mutual aid agreements.

In addition to these local and regional mitigation programs, the municipality also benefits from numerous federal and state mitigation programs such as the USGS WaterWatch, Report of the Two Storm Panel, CT DEEP Forest Fire Danger Report, the "Connecticut Drought Preparedness and Response Plan", the "National Weather Service Early Warning System", the University of Connecticut's Center for Land Use Education and Research (CLEAR), and the annual tree trimming maintenance program by Eversource.

Recommended Hazard Mitigation Measures

Objective 1: Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness.

Natural Hazard Addressed: *All hazards.*

Objective 2: Ensure proper functioning of critical facilities during emergency response.

Natural Hazard Addressed*: All hazards.*

Objective 3: Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Natural Hazard Addressed: *flooding.*

The priority assigned to the above strategies was based on cost-benefit discussions with local officials and an evaluation using the STAPLEE criteria defined in FEMA's "How To Guide #3: Developing the Mitigation Plan". STAPLEE is short for the social, technical, administrative, political, legal, economic, and environmental criteria used in the evaluation process. It is anticipated that the low-cost strategies will be implemented during the first year after plan adoption. The higher-cost projects will be implemented as funding becomes available.

High priority projects are those that are considered critically important in order to minimize the risks to life and property from natural hazards. Medium priority projects are important to the community in order to mitigate the impacts of natural disasters but are not considered as critical to the community as high priority projects. Low priority projects are supportive of hazard mitigation goals and objectives, but are not considered essential to effective hazard mitigation in the community.

Changes in Mitigation Priorities from Previous Plan

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the Town of New Hartford has pursued implementation of a number of mitigation measures. Of particular note is the implementa-

tion of a public notification system (Everbridge System) in cooperation with Litchfield County Dispatch, and advocacy for an increased role by Eversource in tree trimming maintenance practices along roadsides. The major municipal priorities remain unchanged from the previous Plan with a focus on community preparedness, maintenance and enhancement of response resources, and effective floodplain/drainage management. No significant changes or data reanalysis were made from the 2006 with the exception of the inclusion of HAZUS. The following table describes the hazard mitigation strategies of medium or high priority for this community and their associated responsibilities, timeframe, priority, funding source, etc. Projects included in the previous plan are italicized. Nearly all of the mitigation actions listed in the 2006 plan have also been included here. These actions are either on-going due to their nature (education, equipment maintenance) or were not completed due to the economic recession. Unless otherwise noted, all Local Mitigation Actions, once budgeted for, are able to be accomplished within the 2016 Plan Update five year timeframe.

At this time, the municipality is unable to expand or improve their existing capabilities to reduce key vulnerabilities without additional capacity in the form of training, staff, and/or funding.

The municipality's current comprehensive plan (Plan of Conservation Development or POCD) does not reference the 2006 Litchfield Hills Natural Hazard Mitigation Plan or natural hazards with the exception of stormwater management or floodplains as applicable. The POCD does refer to the purchase of a generator for the school, listed as a hazard mitigation strategy below, to improve the school’s function as an emergency shelter. The NHCOG will discuss the incorporation of the new 2016 Natural Hazard Mitigation Plan into local planning documents with each municipality.

Table V.59: Objective 1 Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Visit schools and educate children about natural hazards and how to prepare for them.	Volunteer Fire Dept. and Emergency Management Director	Annually, efforts to be reviewed at annual planning meeting	Medium	4.8	Volunteers	Municipal budget; EMPG	All hazards
2. Make literature available on natural hazards and preparedness at New Hartford Town Hall.	Emergency Management Director and First Selectman	On-going, update as information becomes available	High	4.8	Volunteers	Municipal budget; EMPG	All hazards
3. Maintain local Emergency Operations Plan and continue to coordinate with the Regional Public Safety Task Force and Red Cross on community planning, preparedness, response, and training.	Emergency Management Director and First Selectman	On-going, to be reviewed annually	Medium	1.8	Volunteers	Municipal budget; EMPG	All hazards
4. *Maintain Emergency Notification System to provide emergency information to residents in the entire town or in a specific geographic area. This notice can provide not only warning of an impending situation but also information regarding how to prepare for a particular event.*	Emergency Management Director and First Selectman	On-going, to be reviewed annually	Medium	1.8	LCD and/or ENS dues	LCD; Municipal budget	All hazards

Table V.60: Objective 2 Ensure proper functioning of critical facilities during emergency response							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Routinely inspect emergency response equipment, and train for response to natural disasters.	Volunteer Fire Dept. and Emergency Management Director	Quarterly and after every response	High	4	Volunteers	Municipal Budget; EMPG	All hazards
2. Cooperate with the Metropolitan District Commission in emergency response training exercises and updates of the Goodwin Dam Emergency Action Plan.	Emergency Management Director and First Selectman	Coordination with MDC and DEEP	Medium	3.4	Volunteers	Municipal budget; MDC; DEEP	All hazards
3. Acquire additional equipment and supplies for the emergency shelter at Ann Antolini School, including a generator.	Emergency Management Director, Fire Chief	Annually, efforts to be reviewed at annual planning meeting	High	1.1	$20,000/generator	FEMA; DEMHS; Municipal budget; LOCIP; STEAP	All hazards
4. Promote the use of interoperable communication equipment, and the development of standard operating procedures for emergency response in the regional area.	Emergency Management Director, Fire Chief, and First Selectman	On-going, to be reviewed annually	High	1.8	Volunteers	OPM RPI; Municipal budget; DEMHS; EMPG	All hazards
5. Consider developing a Memorandum of Understanding with schools or school bus company to utilize school buses for mass transportation during an emergency.	Emergency Management Director and First Selectman	2016	Medium	3.4	In-kind	Municipal/school budgets; EMPG	All hazards
6. Develop basic GIS capabilities as needed for access to aerial photos showing the number and location of properties and structures that could be affected by a natural disaster.	Emergency Management Director, Fire Chief, and First Selectman	2017	Medium	1.8	$3,000/year	OPM RPI; Municipal budget	All hazards

Table V.61: Objective 3 Expand maintenance activities and implement specific projects that address known drainage issues within the town							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Implement control measures to mitigate the flooding created by beavers.	Public Works Dept.	On-going, with each project and/or as needed	Medium	1.3	$1,500/culvert	FEMA; Municipal budget	Flooding
2. Develop clean-out schedules for all catch basins and drainage facilities.	Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.1	$7,500/year	Municipal budget	Flooding
3. Identify the location of structures that are susceptible to flooding to facilitate risk assessment and potential control measures.	DEMHS or DEEP	2016	Medium	1.9	$20,000	FEMA; Municipal budget; DEEP/DEMHS	Flooding
4. Replace the undersized culvert at Carpenter Road with a larger one to prevent localized flooding in this area.	Public Works Dept.	2016	Medium	1.3	$50,000	ConnDOT; FEMA; Municipal budget	Flooding
5. Establish a designated area for brush disposal following storm related events that generate debris.	First Selectman and Public Works Dept.	2016	Medium	1.3	$8,000	Municipal budget	Wild fire
6. Relocate the New Hartford Public Works Garage out of the Farmington River Floodplain.	First Selectman and Public Works Dept.	2018	High	0.9	$500,000	FEMA; Municipal budget; LOCIP; STEAP	Flooding

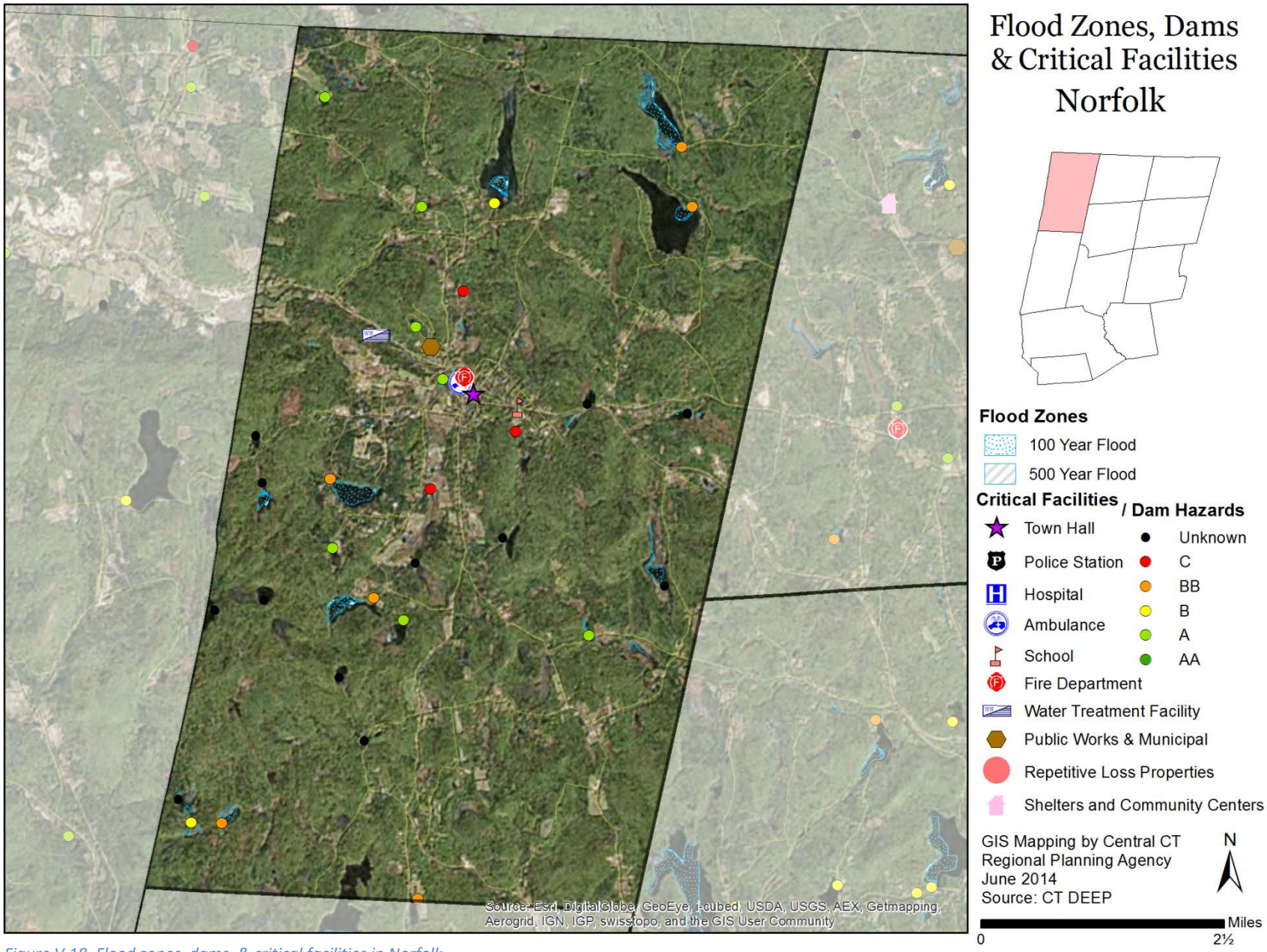

Figure V.18. Flood zones, dams, & critical facilities in Norfolk

I. Town of Norfolk Risk Assessment and Hazard Mitigation Plan

1. General Town Description

The Town of Norfolk is a rural town in the Litchfield Hills Region bordered on the north by Massachusetts, on the east by Colebrook and Winchester, on the south by Goshen, and on the west by North Canaan and Canaan (see Figure V.18). Norfolk is part of the Northeastern Highlands Ecoregion, which is characterized by "hills and mountains, a mostly forested land cover, nutrient-poor frigid and cryic soils (mostly Spodosols), and numerous high-gradient streams and glacial lakes" (as described on the map "Ecoregions of New England").

Incorporated in October of 1758, Norfolk has had a lively and interesting history like so many other towns in the Litchfield Hills Region. According to the publication entitled "Norfolk, Connecticut 1900 – 1975" edited by Alice V. Waldecker, "For many years the settlers of Hartford and Windsor referred to this part of the state as the "western lands", primarily Norfolk as the "Green Woods", because of the vast hemlock forest. Heavy, dense forests abounding in swamps, rock and rock ledges made up the area. Even the Indians had not found it satisfactory land to settle and raise their maize. Considering the condition of the land, it isn't surprising that there wasn't much interest in it when it was offered for sale in April, 1738" (from a speech by Edward R. Stevens in 1958). But settlers came. As stated in Ms. Waldecker's book, the early settlers of Norfolk "were primarily agriculturists, but the basic necessities of life – food, clothing, shelter – prompted the establishment of a saw mill, grist mill, and a cloth finishing shop". In fact, as detailed by Ms. Waldecker, Norfolk was actually known as a manufacturing town during the nineteenth century and produced many items including flour and mill stuffs, wooden bowls, shingles, cheese, clocks, brick, bolts and nuts, military rifles, leather goods, woolen and cotton yarns, and cabinet furniture. Many of the factories were located along the Blackberry River. Despite the construction of a railroad to Norfolk in the late 1800's, where in 1900 there were 6 trains eastbound and 6 westbound passing through Norfolk each day in the summer, manufacturing declined during the twentieth century.

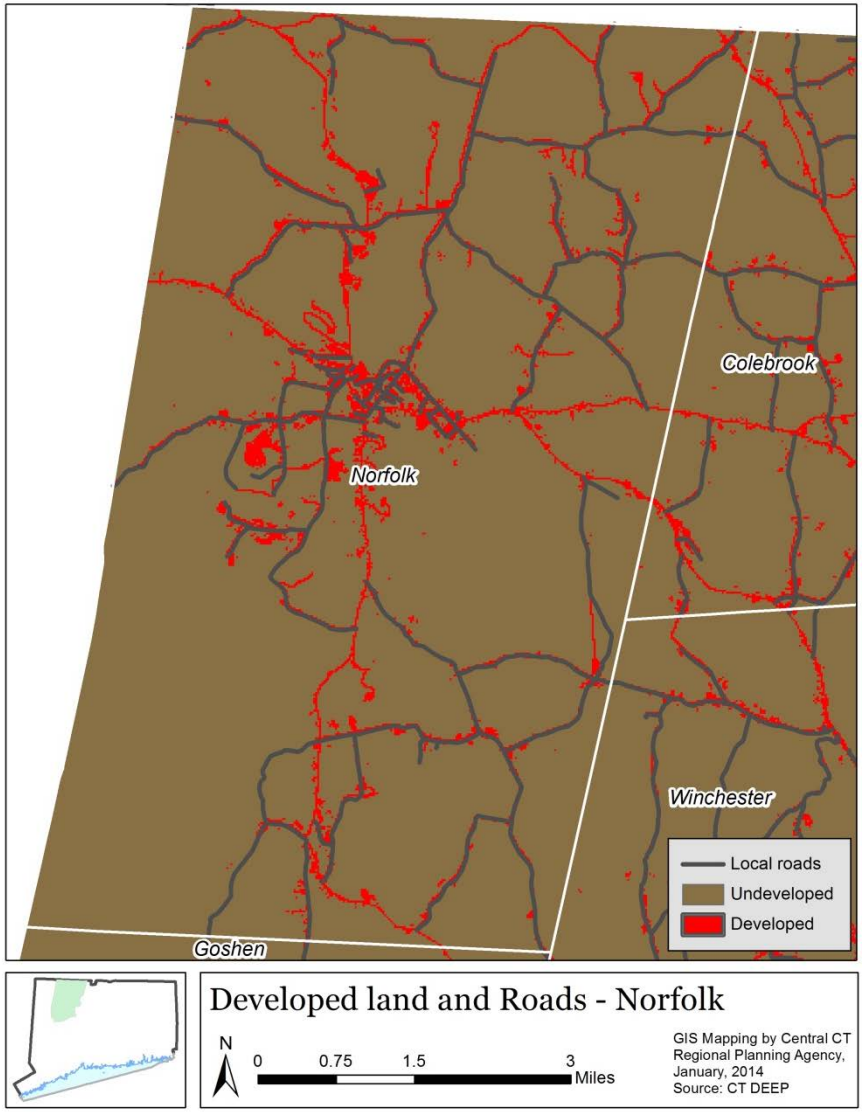

Figure V.19. Developed land and local roads in Norfolk

Today, the town is known for its elegant homes, scenic vistas, charming town center, extensive forestland, and three state parks. Campbell Falls, Haystack Mountain and Dennis Hill provide facilities for fishing, hiking,

Table V.63: Building Exposure by Occupancy Type for the Study Region		
Occupancy	Exposure ($1000)	Percent of Total
Residential	145,061	73.3%
Commercial	29,253	14.8%
Industrial	10,787	5.4%
Agricultural	1,623	0.8%
Religion	3,527	1.8%
Government	4,010	2.0%
Education	3,668	1.9%
Total	197,929	100.00%

picnicking and winter sports. From the stone tower atop Haystack Mountain is a spectacular view of the entire area including New York State and Massachusetts. Major highways serving the town include State Routes 44, 272, and 182.

According to the US Census data, the population of Norfolk has declined somewhat from 50 years ago, decreasing from a population of 1,827 people in 1960 to 1,709 persons in 2010. The population is projected to decrease to 1,698 persons by the year 2020, a slight decrease of 0.6%. The median age in 2010 was 47.

Approximately 57% of the housing in town is owner occupied, with about 20% of the housing stock occupied by renters and another 20% held for seasonal, recreational or occasional use (second homes). There are 895 existing housing units in town as of 2009.

Norfolk, according to the Connecticut Economic Resource Center (CERC), had a labor force of 964 persons in 2013, with 340 jobs actually located in the community. The vast majority of these jobs are in service producing industries. The unemployment rate was 7.3% in 2013.

According to CERC, Norfolk has an equalized net grand list of $434,258,317 in 2010 with commercial and industrial uses comprising 3.3% of this grand list. The equalized net grand list is an estimate of the market value of all taxable property in the municipality, and gives some indication of the value of property at risk in the event of a major natural disaster. There are 71 business firms in the community according to CERC as of 2013.

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the municipality has experienced limited development. Specifically, the housing stock increased by 96 units between 2000 and 2010, and there has been no significant commercial or industrial development. According to municipal officials, no development has occurred in flood-prone areas since the previous plan so development has not increased the community's vulnerability in flood-prone areas.

2. Evaluation of Risks and Vulnerability

The major natural hazards of concern in Norfolk are flooding, high winds, and severe winter storms. Forest fires, drought, and earthquakes occur much less frequently in the community, and are therefore of somewhat lesser concern. The general risk and vulnerability posed by each of these six hazards is discussed in the preceding Section III of this report. More specific information on the flood vulnerability and critical facilities in the town of Norfolk is presented below.

Flooding

Floodprone areas in Norfolk, as mapped by FEMA, are shown in Figure V.18. According to FEMA's website, "Policy Statistics", there are 6 flood insurance policies in force as of 8/31/2015 with an insurance value of $1,628,600. An attempt was made to estimate the number of structures located within the FEMA floodplain boundaries using available GIS data for Connecticut, however the data is not considered precise enough for an accurate assessment. The area of greatest concern locally is along the Blackberry River.

As indicated above, the Flood of 1955 impacted Norfolk as it did other communities in the region. The flood took out a number of dams, structures, and bridges in the community, particularly along the Blackberry River where several rescues were needed. Three flood control dams were built in town following the 1955 flood. These dams were constructed by the Army Corps of Engineers at the Botelle School, West Side

Road, and Wood Creek near Rte 272.

Flooding along the Blackberry River remains an area of concern during major storm events due to properties located within the floodplain, however beaver have recently been found to contribute to localized flooding problems on a more regular basis. Beaver frequently plug culverts on local streets such as Bruey Road, which actually collapsed at one point due to water damage from a beaver dam, that require routine maintenance by town forces to remove. Recently, a breached beaver dam washed out a 60" culvert on South Sandisfield Road. The construction of beaver dams on private properties have proven difficult to remove at times due to the permission that is required from affected property owners.

Another area of concern due to flooding is Parker Hill Road at Hall Meadow Brook. The town is now studying this drainage area to determine why increased flooding is being experienced at this location and what can be done about it.

Hurricanes and Strong Winds

Norfolk also suffered Hurricane related damage from Storm Irene in August 2011 and Storm Sandy in October 2012. Both of these events caused significant power outages and the storms received Presidential Disaster Declarations. Areas that are most vulnerable are those with greater levels of development. See Figure V.19 for locations of these areas.

Severe Winter Storms

The natural hazard of greatest concern in Norfolk is winter ice storms with high winds and power outages. A severe snowstorm occurred in March of 1978 that brought close to three feet of heavy snow. The town also suffered a major ice storm in 1978, and again in 2002, that resulted in downed power lines, extensive tree damage, and expensive clean-up costs.

See the Figure V.19 for developed areas of town and locations of town-maintained roads. Areas with higher levels of development are at greater risk of roof collapses due to snow accumulation. Local roads must be plowed by the town and represent a potential cost from a snow storm.

Table V.63: Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	113,552	77.6%
Commercial	17,325	11.8%
Industrial	9,871	6.7%
Agricultural	1,623	1.1%
Religion	1,790	1.2%
Government	0	0.0%
Education	2,156	1.5%
Total	146,317	100.00%

In total, New Hartford maintains 60 miles of local roads.

Vulnerable Assets

There are thirty dams in Norfolk (see Figure V.18). Fifteen of these dams are private dams, five are owned by the State (Wood Creek Pond Dam, Wood Creek Dam Site #9, Haystack Mountain Dam, Norfolk Brook Dam #6, and West Side Dam #5), and ten dams are not classified. Norfolk Brook Dam #6 and West Side Dam #5 are rated C, eight dams are rated B or BB, seven dams are rated A, and twelve dams are not rated. For a description of these dam ratings, "Flooding: Impacts" in Section III.

The major facilities at risk in the community in the event of a natural hazard are shown in Figure V.18. These facilities include the Norfolk Town Hall (which serves as the town emergency operations center), the Botelle Elementary School (which serves as the town's emergency shelter), Town Garage on Old Colony Road, Norfolk Fire House and Norfolk Ambulance on Shepard Road, the water tank on Laurel Way, the Sewer Treatment Plant, the local gas station which is the only source of gasoline in town, and the phone company building near the town center. These are considered critical facilities in the event of a natural disaster because they might be needed for effective emergency response. In addition to the above facilities, the existing cell towers in the community and radio tower on Loon Meadow Drive are considered critical facilities.

Table V.64: Impacts from 1% annual flood scenario (Norfolk)	
Type of impact	Value
Building related losses	$3,392,000
Business interruption losses	$0
Total economic losses (thousands of dollars)	$3,392,000
Damaged essential facilities	0
Buildings substantially damaged	0
Tons of debris	1,231
Displaced households	18
Shelter needs	1
Acres of land flooded	1,022

3. Potential Impacts

Results of the HAZUS 1% flood simulation are shown in Table V.63 below. In Norfolk, $3.392 million worth of economic losses are estimated. HAZUS estimates that no losses will occur due to business interruptions. Such an event would displace 18 households and cause one person to seek temporary shelter. The flood would cover 1,022 acres of land.

Full results from this simulation are in Appendix B.

Hurricanes have caused wide-spread power outages and could cause significant damage. Hurricane Irene caused significant power outages in town, affecting 99% of customers (1,102 out of 1,108). The results of three HAZUS hurricane simulations are presented in Table V.64. An event similar to the 1938 hurricane could cause $12,380 in damage from the wind. Such an event would likely cause a flood as well, which would increase the amount of damage dramatically (see above).

Table V.65: Estimated hurricane-related damage (thousands of dollars) by building occupancy								
	Res	Com	Ind	Agr	Rel	Edu	Gov	Total
1938	11.28	0.66	0.24	0.17	0.02	0.01	0.01	12.38
1%	0.14	0.02	0.00	0.00	0.00	0.00	0.00	0.16
5%	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01

All are potentially vulnerable to tornados, winter storms, wildfire, and earthquakes. None of the facilities are located within a floodplain.

Tables V.62 & V.63 above show the "total exposure" of all structures in Norfolk, under a 1% flood scenario. The first table shows that $197,929,000 worth of buildings could potentially be impacted by a 1% flood event. The second table shows that over two-thirds of that, $146,317,000 worth of buildings are likely to be impacted by such an event.

Winter storms are a perennial concern with wide-ranging impacts. Snow covered roads take time and money to clear. Heavy snow, especially when accompanied by ice can cause roofs to collapse. Ice storms can also bring down power lines, causing outages. The snow storm of October 2011 left 100% of the town without power at its peak. At least 50% of the town had no power for five days.

4. Major Concerns

- The town experiences periodic flooding on Parker Hill Road at Hall Meadow Brook, possibly due to drainage issues.
- Beaver dams, especially along the Blackberry River, exacerbate

flooding issues.

- Dealing with beaver dams on private property is problematic due to access issues.
- The majority of the town's labor force works in neighboring communities, leaving workers vulnerable to disruptions in their commutes caused by events outside of town.

5. Hazard Mitigation Plan

Since the last plan, the general geography, demography, and built environment have not changed significantly in this community. Nor have the hazards become significantly more or less severe. This update, unlike the previous plan, utilizes HAZUS methodology to gain a deeper understanding of the impacts from significant natural hazards. Additionally, this plan utilizes the state's most recent hazard mitigation plan. As such, the plan priorities remain the same with the addition of mitigation actions to protect the built environment.

Mitigation Goals and Objectives

The principal goals of Norfolk's natural hazard mitigation plan update are:

1. To minimize the risks to life and property from natural hazards, and
2. To prevent losses from natural hazards to the extent practicable.

In addition to these over-arching goals, the town has also established the following objectives to help the town become more disaster resistant:

1. Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness
2. Ensure proper functioning of critical facilities during emergency response.
3. Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Overview of Potential Mitigation Measures

Table V.3 in the previous section of this report presents a listing of potential mitigation measures that can be taken to reduce the impacts of the major natural hazards of concern in the Litchfield Hills Region. In the context of Norfolk's risk and vulnerability analysis presented above, and the existing mitigation strategies in the town, only some of these measures will be both needed and cost-effective. The purpose of this Natural Hazards Mitigation Plan is to identify reasonable and appropriate mitigation measures for each hazard from the Table V.3 listing and other sources, and to develop an implementation strategy for the priority mitigation measures.

Existing Mitigation Strategy

The Town of Norfolk has a number of existing authorities, policies, programs and regulations that serve to mitigate the impact of natural hazards. Existing local authorities include the Norfolk Board of Selectmen, Planning and Zoning Commission, Inland Wetlands Commission, Emergency Management Director, Fire Department, and Department of Public Works.

Norfolk maintains compliance with NFIP through its use of the Connecticut State Building Code, subdivision regulations, town ordinance (Flood Damage Prevention Ordinance #88), and zoning regulations. Norfolk expects to continue participation in NFIP.

Land use regulations exist to protect natural resources, including erosion and sediment control regulations for new development, stormwater control regulations to minimize drainage problems, and a flood hazard area overlay zone to control development in flood prone areas.

The flood hazard area overlay zone provides that any new construction or substantial improvement of any residential structure shall have the lowest floor, including the basement, elevated to at least one foot above the base flood elevation. Nonresidential construction is required to have the lowest floor, including basement, elevated to at least one foot above the base flood elevation or be flood-proofed to one foot above the base flood elevation. Additionally all attendant utilities or sanitary facilities should be located or designed to avoid infiltration or impairment by flood waters.

Norfolk's subdivision regulations have detailed standards for the plan-

ning, design and construction of storm drainage systems in order to minimize adverse impacts associated with new construction activity. The Norfolk Inland Wetlands and Watercourses Commission enforces regulations to direct development away from wetlands, watercourses and floodplains.

In addition to these regulations, the Norfolk Public Works Department routinely examines and clears public storm drains and catch basins of debris following periods of rainfall, snowfall, or windstorms. The town's DPW also monitors weather reports and maintains loaded trucks in preparation of winter storm events.

The Norfolk Volunteer Fire Department, Department of Public Works, and Emergency Management Director all possesses emergency equipment that can be deployed as needed in the event of an emergency. Procedures are also in place to open and maintain the Emergency Operations Center, emergency shelter, and warming center in town. The town has also invested in an emergency management trailer with a STOCS box, Ham Radio, and Repeater/Cross Band communication equipment. It should also be noted that fiber optic cable has been installed at the Fire House recently to enhance emergency management communication and response.

Norfolk has also been working with other towns in the Litchfield Hills Region through the Northwest Hills Public Safety Task Force to enhance communication and coordination. This has included efforts to standardize communication equipment and the equipment in local emergency operation centers, and also the upgrading of supplies at emergency shelters. Other activities in place are a regionally coordinated public notification system (Everbridge), a badging registration system for emergency responders, and improved training opportunities.

In addition to these local and regional mitigation programs, the municipality also benefits from numerous federal and state mitigation programs such as the USGS WaterWatch, Report of the Two Storm Panel, CT DEEP Forest Fire Danger Report, the "Connecticut Drought Preparedness and Response Plan", the "National Weather Service Early Warning System", the University of Connecticut's Center for Land Use Education and Research (CLEAR), and the annual tree trimming maintenance program by Eversource.

Recommended Hazard Mitigation Measures

Objective 1: Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness.

Natural Hazard Addressed: *All hazards.*

Objective 2: Ensure proper functioning of critical facilities during emergency response.

Natural Hazard Addressed: *All hazards.*

Objective 3: Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Natural Hazard Addressed: *flooding.*

The priority assigned to the above strategies was based on cost-benefit discussions with local officials and an evaluation using the STAPLEE criteria defined in FEMA's "How To Guide #3: Developing the Mitigation Plan". STAPLEE is short for the social, technical, administrative, political, legal, economic, and environmental criteria used in the evaluation process. It is anticipated that the low-cost strategies will be implemented during the first year after plan adoption. The higher-cost projects will be implemented as funding becomes available.

High priority projects are those that are considered critically important in order to minimize the risks to life and property from natural hazards. Medium priority projects are important to the community in order to mitigate the impacts of natural disasters but are not considered as critical to the community as high priority projects. Low priority projects are supportive of hazard mitigation goals and objectives, but are not considered essential to effective hazard mitigation in the community.

Changes in Mitigation Priorities from Previous Plan

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the Town of Norfolk has pursued implementation of a number of mitigation measures. Of particular note is the use of social media (Facebook) to enhance local emergency awareness and response, the implementation of a public notification system (e.g. Everbridge) to enhance public notification of emergency events and appropriate emergency response procedures, and advocacy for an increased role by Ever-

source in tree trimming maintenance practices along roadsides. The major municipal priorities remain unchanged from the previous Plan with a focus on community preparedness, maintenance and enhancement of response resources, and effective floodplain/drainage management. No significant changes or data reanalysis were made from the 2006 with the exception of the inclusion of HAZUS and a suite of activities designed to address the built environment. The following table describes the hazard mitigation strategies of medium or high priority for this community and their associated responsibilities, timeframe, priority, funding source, etc. Projects included in the previous plan are italicized. All of the mitigation actions listed in the 2006 plan have also been included here. These actions are either on-going due to their nature (education, equipment maintenance) or were not completed due to the economic recession. Unless otherwise noted, all Local Mitigation Actions, once budgeted for, are able to be accomplished within the 2016 Plan Update five year timeframe.

At this time, the municipality is unable to expand or improve their existing capabilities to reduce key vulnerabilities without additional capacity in the form of training, staff, and/or funding.

The municipality's current comprehensive plan (Plan of Conservation Development or POCD) does not reference the 2006 Litchfield Hills Natural Hazard Mitigation Plan or natural hazards with the exception of stormwater management or floodplains as applicable. The POCD does note that the combined sewer overflow system is inadequate during intense storm events. Several strategies listed for Norfolk under Objective 3 would mitigate this concern. The NHCOG will discuss the incorporation of the new 2016 Natural Hazard Mitigation Plan into local planning documents with each municipality.

Table V.66: Objective 1 Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Visit schools and educate children about natural hazards and how to prepare for them.	Volunteer Fire Dept. and Emergency Management Director; Botelle School Safety and Security Committee	Annually, efforts to be reviewed at annual planning meeting	Medium	4.8	Volunteers	Municipal budget; EMPG	All hazards
2. Make literature available on natural hazards and preparedness at Norfolk Town Hall.	Emergency Management Director and First Selectman	On-going, update as information becomes available	High	4.8	Volunteers	Municipal budget; EMPG	All hazards
3. Maintain local Emergency Operations Plan and continue to coordinate with the Regional Public Safety Task Force and DEMHS Region 5 on community planning, preparedness, response, and training.	Emergency Management Director and First Selectman	On-going, review annually	Medium	1.8	Volunteers	Municipal budget; EMPG	All hazards
4. *Maintain the Emergency Notification System (e.g. Everbridge system) to provide emergency information to residents in the entire town or in a specific geographic area. This notice can provide not only warning of an impending situation but also information regarding how to prepare for a particular event.*	Emergency Management Director and First Selectman	On-going, review annually	Medium	1.8	LCD and/or ENS dues	LCD; Municipal budget	All hazards
5. Continue use of social media to enhance public notification of emergency events and appropriate emergency response procedures.	Emergency Management Director	On-going, review annually	Medium	4.8	Volunteers	Municipal budget; EMPG	All hazards
6. Provide information on the dangers of cold-related hazards to people and property	Emergency Management Director	2016, review annually	High	6	Volunteers	Municipal budget; EMPG	Winter storms
7. Consider posting the snow plowing routes in Town buildings each winter to increase public awareness.	Public Works	2016, review annually	Medium	8	Volunteers	Municipal budget; EMPG	Winter storms
8. The Building Department should provide literature regarding appropriate design standards for mitigating icing, insulating pipes, and retrofits for flat-roofed buildings such as heating coils.	Building Department	2016, review annually	Medium	2.3	Volunteers	Municipal budget; EMPG	Winter storms

Table V.67: Objective 2 Ensure proper functioning of critical facilities during emergency response							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Routinely inspect emergency response equipment, and train for response to natural disasters.	Volunteer Fire Dept.; Emergency Management Director; and Public Works	Quarterly and after every response	High	4	Volunteers; In-kind	Municipal Budget; EMPG	All hazards
2. Acquire additional emergency response equipment and supplies for the emergency shelter, with the purchase of a generator being the top priority for the wastewater treatment plant.	Emergency Management Director, Fire Chief	2016-2017	High	1.1	$20,000 for generator	FEMA; DEMHS; Municipal budget; LOCIP; STEAP	All hazards
3. Promote the use of interoperable communication equipment, written mutual aid agreements, and the development of standard operating procedures for emergency response in the regional area. Integrate DEMHS Region 5 plans into local mitigation plans.	Emergency Management Director, Fire Chief, and First Selectman	On-going, review annually	High	1.8	Volunteers	OPM RPI; Municipal budget; EMPG	All hazards
4. Consider developing a Memorandum of Understanding with the school bus transportation company to utilize school buses for mass transportation during an emergency.	Emergency Management Director and First Selectman	2016	Medium	3.4	In-kind	Municipal/school budgets; EMPG	All hazards
5. Consider developing basic GIS capabilities for access to aerial photos showing the number and location of properties and structures that could be affected by a natural disaster.	Emergency Management Director, Fire Chief, and First Selectman	2017	Medium	1.8	$3,000/year	OPM RPI; Municipal budget	All hazards

Table V.68: Objective 3 Expand maintenance activities and implement specific projects that address known drainage issues within the town							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Implement control measures to mitigate the flooding created by beavers. Evaluate feasibility of replacing culverts frequently impacted by beavers with free-span bridges.	Public Works Dept.	On-going, with each project and/or as needed	Medium	1.3	$1,500/culvert	FEMA; Municipal budget	Flooding
2. Develop clean-out schedules for all catch basins and drainage facilities.	Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.1	$4,900/year	Municipal budget	Flooding
3. Review floodplain regulations and ordinances and update as necessary based on DEEP's "Model Floodplain Management Regulations" and FEMA Guidelines.	Planning and Zoning Commission; Inland Wetlands Commission	Annually, efforts to be reviewed at annual planning meeting	Medium	4.5	$2,500	Municipal budget	Flooding
4. Provide landscaping along sections of State and local roadways that are prone to drifting snow and high winds (e.g. Rte 272 near Dennis Hill State Park).	First Selectmen, Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	2	$10,000/mile	ConnDOT; Municipal budget	High winds and Winter storms
5. Pursue funding to augment the municipal tree trimming program.	First Selectmen, Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.3	$41,000/year	ConnDOT; Municipal budget; Eversource; FEMA HMGP	Power outages due to high winds and winter storms
6. Take an active role in siting new housing for vulnerable populations such as seniors and the elderly. Encourage housing developers to discuss proposed actions with the town prior to submitting applications.	First Selectmen, Planning & Zoning Department	Annually, efforts to be reviewed at annual planning meeting	High	2.1	Volunteer	Municipal budget	All hazards
7. Require green infrastructure as a consideration for all public works projects and significant residential and/or commercial construction, potentially using HMGP funding under climate resilient activities.	First Selectmen, Public Works Dept.,	Annually, efforts to be reviewed at annual planning meeting	High	2.3	In-kind; project dependent	Municipal budget; HGMP	Flooding
8. Acquire a cost-estimate for a watershed study to identify appropriate methods of reducing flood risks.	First Selectmen; Inland Wetlands Commission	2017	Medium	4.3	In-kind	Municipal budget; DEEP	Flooding

Table V.68: Objective 3 Expand maintenance activities and implement specific projects that address known drainage issues within the town							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
9. Conduct a comprehensive evaluation of the infrastructure at major watercourses to determine appropriate flood mitigation and stabilization measures.	First Selectmen; Public Works	2018	Medium	4.3	In-kind	ConnDOT; Municipal budget; DEEP	Flooding
10. Compile a checklist that cross-references the bylaws, regulations, and codes related to flood damage prevention that may be applicable to a proposed project and make this list available to potential applicants.	Building Department; Planning & Zoning	2017	High	4.8	In-kind	Municipal budget; CIRCA	Flooding
11. Selectively pursue conservation recommendations listed in the POCD and other studies and documents.	First Selectmen; Building Department; Planning & Zoning; Inland Wetlands; Conservation Commission	On-going, as appropriate	Medium	4	In-kind; project dependent	Municipal budget; conservation organizations; DEEP	All hazards
12. Review existing groundwater maps and conduct an inventory of potential groundwater supplies, potentially using HMGP funding under climate resilient activities.	First Selectmen; Planning & Zoning; Inland Wetlands	2017	Low	2.7	~$5,000	FEMA HGMP; CIRCA	Flooding
13. Review culvert conveyances based on existing hydrology and Northeast Regional Climate Center guidance.	Public Works	On-going, with each project and/or as needed	Medium	2.5	In-kind	ConnDOT; CIRCA	Flooding
14. When replacing or upgrading culverts, work with CT DOT to incorporate findings of the climate change pilot study and work with HVA to incorporate findings of the stream crossing assessment training.	Public Works	On-going, with each project and/or as needed	High	2.5	In-kind	Municipal budget; ConnDOT; HGMP; CIRCA	Flooding
15. Ensure adequate barricades are available to block flooded areas in flood prone areas of the town.	Public Works	2016	High	2.1	~$125/ft^2 metal barrier	Municipal budget; HGMP; DEHMS	Flooding
16. Require the location of utilities underground in new developments or during redevelopment whenever possible.	Building Department; Planning & Zoning; Public Works	2016	High	1.4	In-kind	Municipal budget	All hazards

Table V.68: Objective 3 Expand maintenance activities and implement specific projects that address known drainage issues within the town							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
17. Emergency personnel should continue to identify areas that are difficult to access during winter storm events and devise contingency plans to access such areas during emergencies.	Emergency personnel; Public works	On-going, as identified	High	5	In-kind	Municipal budget; DEHMS	Winter storms
19. The Town should continue to require the installation of fire protection water in new developments.	Building Department; Planning & Zoning	On-going, review annually	Medium	1.4	In-kind	Municipal budget	Forest fires

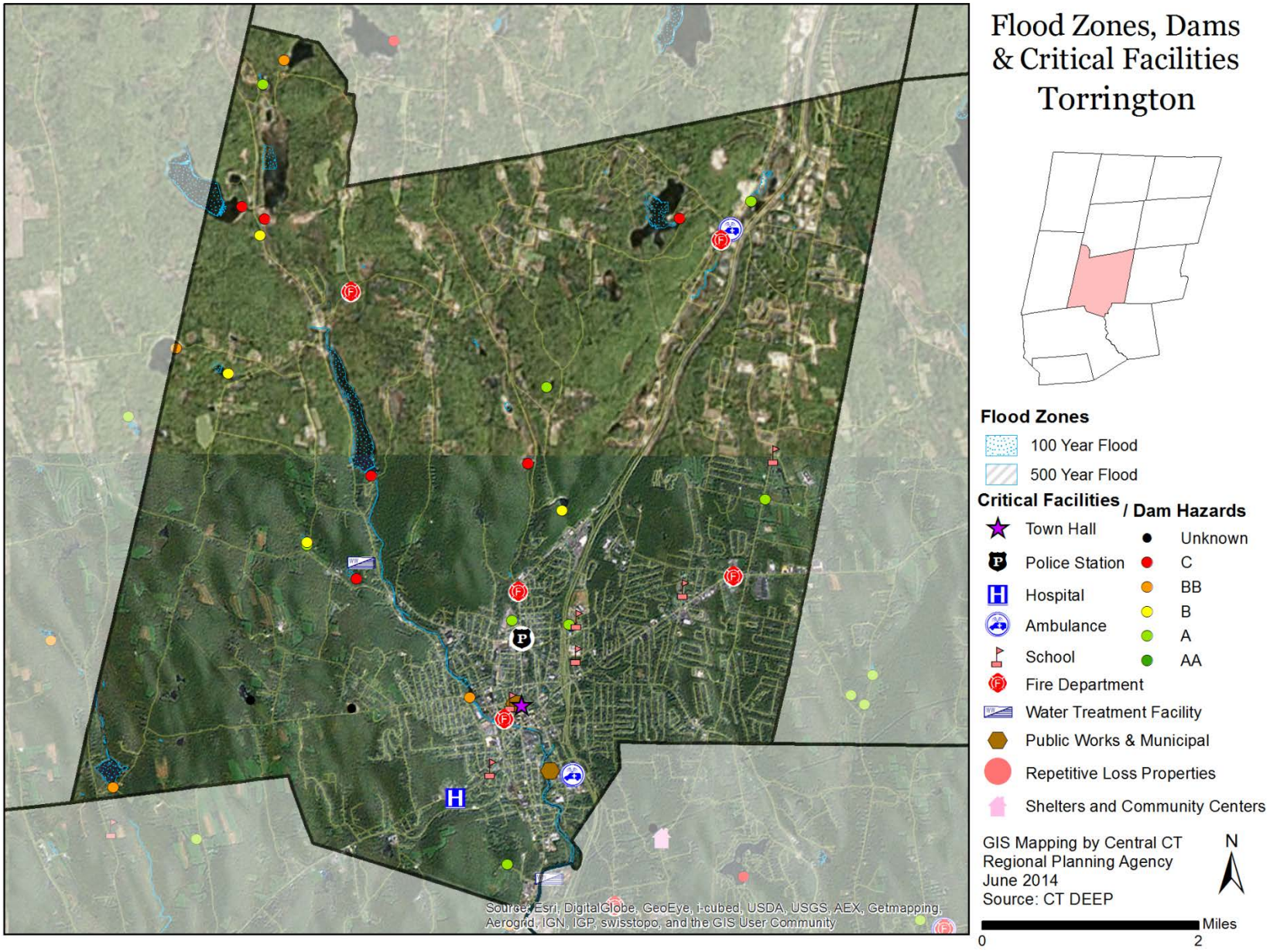

Figure V.20. Flood zones, dams, & critical facilities in Torrington

J. City of Torrington Risk Assessment and Hazard Mitigation Plan

1. General Town Description

The City of Torrington is the regional center of the Litchfield Hills Region and is bordered on the north by Winchester, on the east by New Hartford, on the south by Harwinton and Litchfield, and on the west by Goshen (see Figure V.20). As the industrial and economic hub of northwestern Connecticut, Torrington is Litchfield County's largest city with a population of 36,376. Torrington is part of the Northeastern Highlands Ecoregion, which is characterized by "hills and mountains, a mostly forested land cover, nutrient-poor frigid and cryic soils (mostly Spodosols), and numerous high-gradient streams and glacial lakes" (as described on the map "Ecoregions of New England").

The City was incorporated as a town in 1740. According to the Torrington "Plan of Development", "It was not until 1737 that the first permanent, non-Indian settler arrived. The Town's initial growth occurred on the hills of West Torrington and Torringford. The low lying area surrounding the Naugatuck River was a swamp that acted as a barrier between the eastern and western sections of the town. By 1800, the Town's population had increased to 1,417 persons. It was much smaller than Litchfield with 4,285 persons, and just slightly smaller than the surrounding towns of Harwinton, Goshen, and New Hartford."

In the early 1800's, the Town Plan continues, "The industrialization that began in the U.S. was dependent upon water powered machinery. As this industrialization spread to Torrington, the land along the Naugatuck came to be viewed not as worthless swamp but as a site for factories. In the 1830's, the first brass mill, with equipment and workers imported from England, was established. With the arrival of the railroad in the 1840"s, the Town had a reliable means to ship manufactured products to the markets of the East Coast. By the 1850's, manufacturing rather than farming, had become the dominant factor in the Town's economy."

By 1920, the Town's population had grown to 22,055 and Torrington had become the largest municipality in Litchfield County. In 1923, the Town became a City.

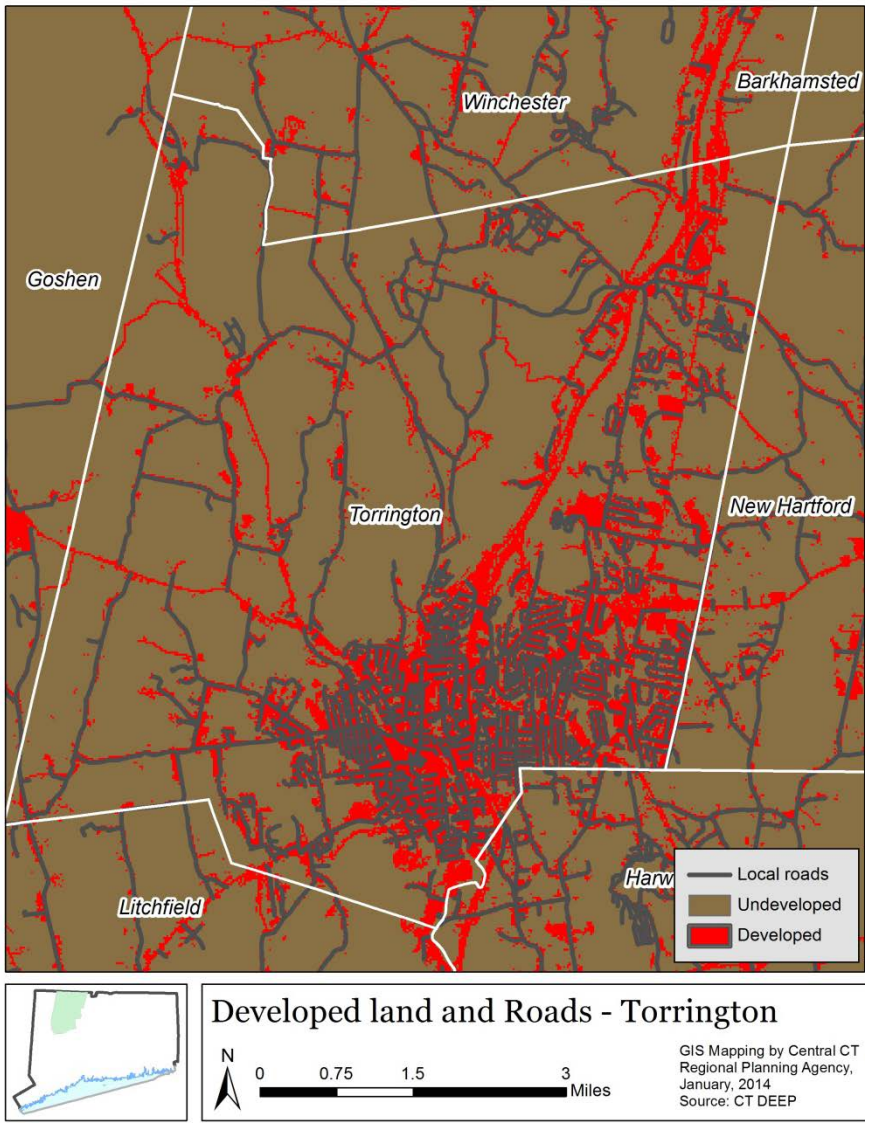

Figure V.21. Developed land and local roads in Torrington

The Flood of 1955 had a devastating impact on the City, with much of the City Center demolished. Slowly, the flood damage along the banks of

the Naugatuck River was addressed however with substantial reconstruction and flood control projects. In the 1960's Route 8 was reconstructed as a limited access highway, enhancing truck movement opportunities. Since the 1970's Torrington, like many other manufacturing centers in the Northeast, has experienced an out-migration of industry to warmer climates where energy and the cost of doing business is less. In 1970, manufacturing comprised 44% of the jobs in Torrington; by 2005, the percentage of manufacturing jobs had declined to 17%. With nearly one in five jobs still being in manufacturing, however, manufacturing continues to represent a major sector of the City's economy.

In addition to the regional hub of Downtown Torrington, major facilities in the City include Charlotte Hungerford Hospital, the Torrington Branch of the University of Connecticut, Burr Pond State Park, Sunnybrook State Park, and Paugnut State Forest. Torrington has a total area of 40.4 square miles with 39.8 square miles of land area.

Major highways serving the town include State Routes 4, 8, 183, 202, and 272.

According to the US Census data, the population of Torrington has increased an average of 127 persons per year over the past 50 years, from a population of 30,045 persons in 1960 to 36,383 persons in 2010. The population is projected to increase to 37,394 in 2020, an increase of 15% The median age in 2010 was 42. Approximately two-thirds of the housing in the City is owner occupied, with about one-third of the housing stock occupied by renters. There are 16,743 existing housing units in the city as of 2009.

Torrington, according to the Connecticut Economic Resource Center (CERC), had a labor force of 19,609 persons in 2013, and has 15, 953 jobs actually located in the City as of 2013. In addition to manufacturing, retail sales and service industries comprise a large percentage of the available jobs. The unemployment rate was 8.5% in 2013.

According to CERC, Torrington has an equalized net grand list of $3,280,718,564 in 2010 with commercial and industrial uses comprising 16.9% of this grand list. The equalized net grand list is an estimate of the market value of all taxable property in the municipality, and gives some indication of the value of property at risk in the event of a major natural disaster. There are 1,027 business firms in the community according to CERC as of 2013.

Table V.69: Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,338,438	69.5%
Commercial	641,670	19.1%
Industrial	300,577	8.9%
Agricultural	5,404	0.2%
Religion	44,044	1.3%
Government	14,141	0.4%
Education	21,238	0.6%
Total	3,365,512	100.00%

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the municipality has experienced limited development. Specifically, the housing stock increased by 614 units between 2000 and 2010, and there has been limited new commercial or industrial development. According to the land use official, no development has occurred in flood-prone areas since the previous plan so development has not increased the community's vulnerability in flood-prone areas.

2. Evaluation of Risks and Vulnerability

The major natural hazards of concern in Torrington are flooding, high winds, and severe winter storms. Forest fires, drought, and earthquakes occur much less frequently in the community, and are therefore of somewhat lesser concern. The general risk and vulnerability posed by each of these six hazards is discussed in the preceding Section III of this report. More specific information on the flood vulnerability and critical facilities in the city of Torrington is presented below.

Flooding

Floodprone areas in Torrington, as mapped by FEMA, are shown in Fig-

Table V.70: Building Exposure by Occupancy Type for the Scenario		
Occupancy	Exposure ($1000)	Percent of Total
Residential	1,085,536	65.2%
Commercial	384,976	23.1%
Industrial	149,886	9.0%
Agricultural	3,101	0.2%
Religion	22,460	1.3%
Government	9,909	0.6%
Education	8,842	0.5%
Total	1,664,710	100.00%

ure V.20. According to FEMA's website, "Policy Statistics", there are 200 flood insurance policies in force as of 8/31/15 with an insurance value of $33,430,000. An attempt was made to estimate the number of structures located within the FEMA floodplain boundaries using available GIS data for Connecticut, however the data is not considered precise enough for an accurate assessment. The area of greatest concern locally continues to be along the Naugatuck River even though a number of flood control projects have been constructed within this watershed since the 1955 Flood. These flood control structures include the Hall Meadow Brook Dam on the West Branch of the Naugatuck River, the Newfield Road Dam on the East Branch of the Naugatuck River, selective channelization of the River through Downtown Torrington, and the construction of a network of dikes along the lower Naugatuck River in Torrington to control flow.

As indicated above, the Flood of 1955 had a devastating impact on Torrington as it did other communities in the region. The flood took out numerous dams, structures, and bridges in the community, particularly in Downtown Torrington along the Naugatuck River.

Flooding along the Naugatuck River remains an area of concern during major storm events due to properties located within the floodplain, however there are a number of other areas that are prone to more frequent flooding. One of these areas is along the Still River, at Machuaga Drive. The location at Pinewoods Road has been repaired since the previous plan. Plans are underway by the City to address both of these flood-prone areas. Seasonal flooding also occurs at Oak Avenue and Albert Street, and at Vista Drive. Funding is needed to design and implement drainage improvements at these locations.

Beaver dams also contribute to localized flooding problems on a regular basis. The construction of beaver dams on private properties have proven difficult to remove at times due to the permission that is required from affected property owners.

Hurricanes and Strong Winds

An F2 tornado occurred on June 23, 2001, that resulted in over $15,000 in storm related damages and $7,000 in clean-up expenses. The tornado cut a path in the northeastern section of the City approximately 200 yards wide and one mile long. Numerous trees and wires were downed, and facility damage occurred at the Vito Colangelo Sports complex located at the Torrington Middle School. According to Torrington's Emergency Management Director, there are typically 2-3 tornado warnings year in Torrington.

Table V.71: Impacts from 1% annual flood scenario (Torrington)	
Type of impact	Value
Building related losses	$129,964,000
Business interruption losses	$246,000
Total economic losses (thousands of dollars)	$130,210,000
Damaged essential facilities	2
Buildings substantially damaged	43
Tons of debris	4,219
Displaced households	530
Shelter needs	837
Acres of land flooded	18,593

Torrington also suffered Hurricane related damage from Storm Irene in August 2011 and Storm Sandy in October 2012. Both of these events caused significant power outages and the storms received Presidential Disaster Declarations. Areas that are most vulnerable are those with greater levels of development. See Figure V.21 for locations of these areas.

Severe Winter Storms

The natural hazard of greatest concern in Torrington is winter ice storms with high winds and power outages. A severe snowstorm occurred in March of 1978 that brought close to three feet of heavy snow. The town also suffered a major ice storm in 1978, and again in November 2002, that resulted in downed power lines, extensive tree damage, and expensive clean-up costs. The 2002 ice storm resulted in 98% of the City without power, continuous operation of the City Emergency Operations Center for 61 hours, approximately 61 road closures, declaration of a state of emergency, opening of emergency shelters for several days, and deployment of the National Guard. Total costs to the City as a result of this storm totaled nearly $400,000 according to City records for debris removal, protective measures, shelter operations, and damage to municipal property.

See Figure V.21 for developed areas of town and locations of town-maintained roads. Areas with higher levels of development are at greater risk of roof collapses due to snow accumulation. Local roads must be plowed by the town and represent a potential cost from a snow storm. In total, Torrington maintains 190 miles of local roads. This is 21% of the region's local roads and represents a significant vulnerability.

Vulnerable Assets

There are twenty four dams in Torrington (see Figure V.20). Seventeen of these dams are private dams, five are owned by the State (Burr Pond, Meadow Lake, Hall Meadow, E. Branch Reservoir, and Stillwater Pond), one dam is owned by the City (Besse Pond Dam), and one dam is not classified. Six dams are rated C (Ruben Hart Reservoir, Burr Pond, Hall Meadow, E. Branch Reservoir, Stillwater Pond, and Crystal Lake), eight dams are rated B or BB, eight dams are rated A, and two dams are not rated. For a description of these dam ratings, see "Flooding: Impacts" in Section III. The small dams along the Naugatuck River (e.g. Brass Mill Pond Dam and Union Hardware Dam) are of some concern should they fail and release a surge of water and sediment downstream.

The major facilities at risk in the community in the event of a natural hazard are shown in Figure V.20. These facilities include the Torrington Fire Department at 11 Water Street (which hosts the Litchfield County Dispatch, City's emergency operations center, and some state E-911 equipment), Torrington Police Department on East Elm Street (which serves as the City's back-up dispatch center and emergency operations center), the City's Middle School (which serves as the City's major emergency shelter), High School and Elementary Schools (which are available for back-up emergency shelters), Torrington City Hall (which hosts the City's computer server), Public Works Garage, Torrington Fire Station on Migeon Avenue, Torrington Senior Center (which serves as a primary emergency shelter for small incidents), the Torrington Armory (which is

Table V.72: Estimated hurricane-related damage (thousands of dollars) by building occupancy

	Res	Com	Ind	Agr	Rel	Edu	Gov	Total
1938	414.84	30.61	15.49	1.90	1.22	0.46	0.32	464.84
1%	20.23	0.85	0.37	0.07	0.01	0.00	0.00	21.54
5%	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.37

Source: HAZUS Analysis

available as a major drop-off location for supplies), the Torrington Water Company Reservoirs, and the Sewer Treatment Plant. These are considered critical facilities in the event of a natural disaster because they might be needed for effective emergency response. All are potentially vulnerable to tornados, winter storms, wildfire, and earthquakes. None of the facilities are located within a floodplain. The high pressure Tennessee Gas Line, which traverses the City below ground, is also considered a critical at-risk facility in the City.

Tables V.69& V70 above show the "total exposure" of all structures in Torrington, under a 1% flood scenario. The first table shows that $3.365 billion worth of buildings could potentially be impacted by a 1% flood event. The second table shows that nearly half of that total, $1.664 billion worth of buildings are likely to be impacted by such an event.

3. Potential Impacts

Results of the HAZUS 1% flood simulation are shown in Table V.71 above. In Torrington, $130.21 million worth of economic losses are estimated. HAZUS estimates that $246,000 of losses will occur due to business interruptions while $129,964,000 worth of losses will occur due to damage to buildings and their contents. Such an event would displace 530 households and cause 837 people to seek temporary shelter. The flood would cover 18,593 acres of land. Full results from this simulation are in Appendix B.

Hurricanes have caused wide-spread power outages and could cause significant damage. While Hurricane Irene cut-off power to just 12% of the city (a relatively low percentage in the region), that 12% represented 2,176 customers, the second highest number in the region. The results of three HAZUS hurricane simulations are presented in Table V.72. An event similar to the 1938 hurricane could cause $464,840 in damage from the wind. Such an event would likely cause a flood as well, which would increase the amount of damage dramatically (see above).

Winter storms are a perennial concern with wide-ranging impacts. Snow covered roads take time and money to clear. Heavy snow, especially when accompanied by ice can cause roofs to collapse. Ice storms can also bring down power lines, causing outages. The snow storm of October 2011 left 99% of the town without power at its peak (18,528 customers). At least 90% of the town had no power for two days and at least 2,000 customers had no power for six days.

4. Major Concerns

- The city contains a dense grid of local roads that must be cleared of snow and ice during winter storms, representing a large potential liability.
- Drainage problems cause seasonal flooding at Oak Avenue and Albert Street, and at Vista Drive.
- Flooding along the Naugatuck River remains a concern despite flood control dams installed after the flood of 1955.
- The city has a large number of properties requiring flood insurance from FEMA. These properties will become increasingly difficult to maintain if flood insurance premiums increase.

5. Hazard Mitigation Plan

Since the last plan, the general geography, demography, and built environment have not changed significantly in this community. Nor have the hazards become significantly more or less severe. This update, unlike the previous plan, utilizes HAZUS methodology to gain a deeper understanding of the impacts from significant natural hazards. Additionally, this plan utilizes the state's most recent hazard mitigation plan. As such, the plan priorities remain the same with the addition of mitigation actions to protect the built environment.

Mitigation Goals and Objectives

The principal goals of Torrington's natural hazard mitigation plan update are:

1. To minimize the risks to life and property from natural hazards, and
2. To prevent losses from natural hazards to the extent practicable.

In addition to these over-arching goals, the town has also established the following objectives to help the town become more disaster resistant:

1. Educate the public regarding natural hazards of concern, mitigation

activities, and community preparedness

2. Ensure proper functioning of critical facilities during emergency response.
3. Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Overview of Potential Mitigation Measures

Table V.3 in the previous section of this report presents a listing of potential mitigation measures that can be taken to reduce the impacts of the major natural hazards of concern in the Litchfield Hills Region. In the context of Torrington's risk and vulnerability analysis presented above, and the existing mitigation strategies in the town, only some of these measures will be both needed and cost-effective. The purpose of this Natural Hazards Mitigation Plan is to identify reasonable and appropriate mitigation measures for each hazard from the Table V.3 listing and other sources, and to develop an implementation strategy for the priority mitigation measures.

Existing Mitigation Strategy

The City of Torrington has a number of existing authorities, policies, programs and regulations that serve to mitigate the impact of natural hazards. Existing local authorities include the Torrington City Council, Planning and Zoning Commission, Inland Wetlands Commission, Emergency Management Director, Fire Department, and Department of Public Works.

Torrington maintains compliance with NFIP through its use of the Connecticut State Building Code, city ordinances, subdivision regulations, and zoning regulations. In fact, its zoning regulations require that the lowest floor in any residential new construction or substantial improvement must be at least one foot above Base Flood Elevation (BFE). For non-residential, the lowest floor must also be at least one foot above BFE or flood-proofed to one foot above BFE. Torrington also maintains a Flood and Erosion Control Board. Torrington expects to continue participation in NFIP.

Land use regulations exist to protect natural resources, including erosion and sediment control regulations for new development, stormwater control regulations to minimize drainage problems, and an area of special flood hazard to control development in flood prone areas.

A registered professional engineer or architect is required to design and certify the construction of structures in the floodplain in order to minimize flood damage. Additionally all attendant utilities or sanitary facilities should be located or designed to avoid infiltration or impairment by flood waters. Manufactured homes that are meant to remain within the flood area for more than 180 days are required have a permanent foundation and have the lowest floor above the base flood elevation.

Torrington's subdivision regulations have detailed standards for the planning, design and construction of storm drainage systems in order to minimize adverse impacts associated with new construction activity. The Torrington Inland Wetlands Commission enforces regulations to direct development away from wetlands, watercourses and floodplains.

In addition to these regulations, the Torrington Public Works Department routinely examines and clears public storm drains and catch basins of debris following periods of rainfall, snowfall, or windstorms. The town's DPW also monitors weather reports and maintains loaded trucks in preparation of winter storm events.

The Torrington Fire Departments, Department of Public Works, and Emergency Management Director all possesses emergency equipment that can be deployed as needed in the event of an emergency. Procedures are also in place to open and maintain the Emergency Operations Center and emergency shelter in town.

Torrington has also been working with other towns in the Litchfield Hills Region through the Northwestern CT/Litchfield Hills Public Safety Task Force to enhance communication and coordination. This has included efforts to standardize communication equipment and the equipment in local emergency operation centers, and also the upgrading of supplies at emergency shelters. Other activities being pursued are a regionally coordinated public notification system, a badging registration system for emergency responders, improved training opportunities, and the development of written mutual aid agreements.

In addition to these local and regional mitigation programs, the munici-

pality also benefits from numerous federal and state mitigation programs such as the USGS WaterWatch, Report of the Two Storm Panel, CT DEEP Forest Fire Danger Report, the "Connecticut Drought Preparedness and Response Plan", the "National Weather Service Early Warning System", the University of Connecticut's Center for Land Use Education and Research (CLEAR), and the annual tree trimming maintenance program by Eversource.

Recommended Hazard Mitigation Measures

Objective 1: Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness.

Natural Hazard Addressed: *All hazards.*

Objective 2: Ensure proper functioning of critical facilities during emergency response.

Natural Hazard Addressed: *All hazards.*

Objective 3: Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Natural Hazard Addressed: *flooding.*

The priority assigned to the above strategies was based on cost-benefit discussions with local officials and an evaluation using the STAPLEE criteria defined in FEMA's "How To Guide #3: Developing the Mitigation Plan". STAPLEE is short for the social, technical, administrative, political, legal, economic, and environmental criteria used in the evaluation process. It is anticipated that the low-cost strategies will be implemented during the first year after plan adoption. The higher-cost projects will be implemented as funding becomes available.

High priority projects are those that are considered critically important in order to minimize the risks to life and property from natural hazards. Medium priority projects are important to the community in order to mitigate the impacts of natural disasters but are not considered as critical to the community as high priority projects. Low priority projects are supportive of hazard mitigation goals and objectives, but are not considered essential to effective hazard mitigation in the community.

Changes in Mitigation Priorities from Previous Plan

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the City of Torrington has pursued implementation of a number of mitigation measures. Of particular note is the establishment of a trained and equipped hazardous materials team for emergency response, the continued implementation of a public notification system to enhance public notification of emergency events and appropriate emergency response procedures, and advocacy for an increased role by Eversource in tree trimming maintenance practices along roadsides. The major municipal priorities remain unchanged from the previous Plan with a focus on community preparedness, maintenance and enhancement of response resources, and effective floodplain/drainage management. No significant changes or data reanalysis were made from the 2006 with the exception of the inclusion of HAZUS. The following table describes the hazard mitigation strategies of medium or high priority for this community and their associated responsibilities, timeframe, priority, funding source, etc. Projects included in the previous plan are italicized. Nearly all of the mitigation actions listed in the 2006 plan have also been included here. These actions are either on-going due to their nature (education, equipment maintenance) or were not completed due to the economic recession. Unless otherwise noted, all Local Mitigation Actions, once budgeted for, are able to be accomplished within the 2016 Plan Update five year timeframe.

At this time, the municipality is unable to expand or improve their existing capabilities to reduce key vulnerabilities without additional capacity in the form of training, staff, and/or funding.

The municipality's current comprehensive plan (Plan of Conservation Development) does not reference the 2006 Litchfield Hills Natural Hazard Mitigation Plan or natural hazards with the exception of stormwater management or floodplains as applicable. The NHCOG will discuss the incorporation of the new 2016 Natural Hazard Mitigation Plan into local planning documents with each municipality.

Table V.73: Objective 1 Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Visit schools and educate children about natural hazards and how to prepare for them.	Fire Depts. And Emergency Management Director	Annually, efforts to be reviewed at annual planning meeting	Medium	4.8	In-kind	Municipal budget; EMPG	All hazards
2. Make literature available on natural hazards and preparedness at Torrington City Hall and the City Library.	Emergency Management Director	On-going, update as information becomes available	High	4.8	In-kind	Municipal budget; EMPG	All hazards
3. Maintain local Emergency Operations Plan and continue to coordinate with the Regional Public Safety Task Force and Red Cross on community planning, preparedness, response, and training.	Emergency Management Director	On-going, review annually	Medium	1.8	In-kind	Municipal budget; EMPG	All hazards
4. Continue to invest in the Emergency Notification System to provide emergency information to residents of the entire City or in a specific geographic area. This notice can provide not only warning of an impending situation but also information regarding how to prepare for a particular event.	Emergency Management Director	On-going, review annually	Medium	1.8	$8,000/year + LCD and/or ENS dues	LCD; Municipal budget	All hazards

Table V.74: Objective 2 Ensure proper functioning of critical facilities during emergency response							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Routinely inspect emergency response equipment, and train for response to natural disasters.	Fire Depts. And Emergency Management Director	Quarterly and after every response	High	4	In-kind	Municipal Budget; EMPG	All hazards
2. Acquire additional emergency response equipment including a generator for City Hall and the Armory, and needed communication equipment.	Emergency Management Director, Fire Chief	Annually, efforts to be reviewed at annual planning meeting	High	1.1	$50,000/generator; $800/radio	FEMA; DEMHS; Municipal budget; LOCIP; STEAP	All hazards
3. Pursue funding for an elevator or ramp at the Armory to move emergency equipment to and from the basement, and to facilitate public access	Emergency Management Director	2016	Medium	0.9	$20,000-$70,000	FEMA; Municipal budget	All hazards
4. Promote the use of interoperable communication equipment, and the development of standard operating procedures for emergency response in the regional area.	Emergency Management Director, Fire Chief, Police Chief, and Mayor	On-going, review annually	High	1.8	In-kind	OPM RPI; Municipal budget; DEMHS; EMPG	All hazards
5. Consider developing a Memorandum of Understanding with schools or school bus company to utilize school buses for mass transportation during an emergency.	Emergency Management Director	2016	Medium	3.4	In-kind	Municipal/school budgets	All hazards
6. Continue GIS capabilities as needed for access to aerial photos showing the number and location of properties and structures that could be affected by a natural disaster.	Emergency Management Director, Fire Chief, Police Chief, and Mayor	2017	Medium	1.8	$3,000/year	OPM RPI; Municipal budget	All hazards

Table V.75: Objective 3 Expand maintenance activities and implement specific projects that address known drainage issues within the town							
Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Implement control measures to mitigate the flooding created by beavers.	Public Works Dept.	On-going, with each project and/or as needed	Medium	1.3	$1,500/culvert	FEMA; Municipal budget	Flooding
2. Develop clean-out schedules for all catch basins and drainage facilities.	Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.1	$17,000/year	Municipal budget	Flooding
3. Identify the location of structures that are susceptible to flooding to facilitate risk assessment and potential control measures.	DEMHS or DEEP	Annually, efforts to be reviewed at annual planning meeting	Medium	1.9	$20,000	FEMA; Municipal budget; DEEP/DEMHS	Flooding
4. Pursue funding to augment the municipal tree trimming program.	Emergency Management Director, Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.3	$100,000/year (total)	ConnDOT; Municipal budget; Eversource	Power outages due to high winds and winter storms
5. Pursue funding to prepare a roadside tree inventory to better document the health and condition of trees and to facilitate their removal if hazardous.	City Tree Warden, Public Works Dept.	2016	Medium	1.8	$20,000	ConnDOT; DEEP; Municipal budget; FEMA HMGP	High winds and Winter storms
6. Establish a 3-5 acre area for the storage of debris resulting from natural hazards such as tornadoes, and for snow from major snowstorms.	Emergency Management Director, Public Works Dept	2016	High	1.3	$15,000	DEEP; Municipal budget	Wild fires
7. Install gauges along the Naugatuck River to better monitor river levels during flooding events.	Emergency Management Director, Public Works Dept.	2016	Medium	1.8	$5,000/gauge	FEMA; DEEP	Flooding

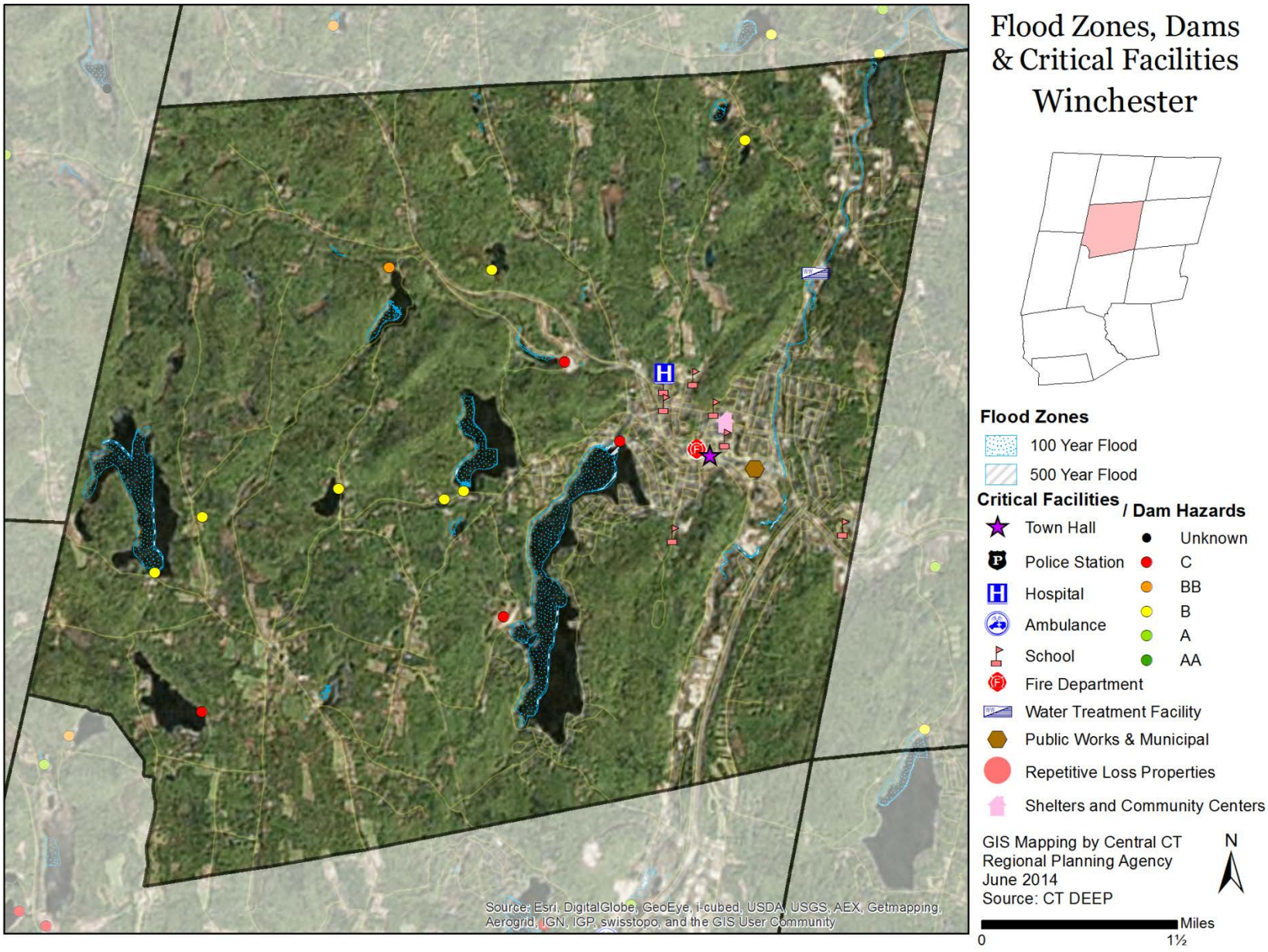

Figure V.22. Flood zones, dams, & critical facilities in Winchester

K. Town of Winchester Risk Assessment and Hazard Mitigation Plan

1. General Town Description

The Town of Winchester is an economic hub for the northern portion of the Litchfield Hills Region. The town is bordered on the north by Colebrook, on the east by Barkhamsted, on the south by Torrington, and on the west by Goshen and Norfolk (see Figure V.22). Winchester is the second largest town in the Litchfield Hills Region with a population of 11,328 persons as of 2011.

Winchester was first settled in 1732 and incorporated as a town in 1771. It shares a similar history with other towns in the regional area with agricultural land use dominating in the 18th and 19th century, and the rise of manufacturing during the late 19th and early 20th century.

The Flood of 1955 had a catastrophic impact on the Town of Winchester, destroying much of the Town Center. According to an illustrated publication entitled "The Great Disaster" by John Slocum and William Simmers Jr. of Winsted, CT, "The 14-inch downpour sent the Mad River flowing over its banks shortly before midnight. In fact, by 1:00 a.m. on August 19, there was already two feet of water coming down Main Street. Shortly thereafter, Still River in the east and north end section of the city went into a rampage." Ultimately, seven people lost their lives in town from the flood, millions of dollars of damage occurred, about 400 families were left homeless, and it "wiped out the establishments of 170 out of 200 merchants and businessmen" according to the above referenced publication.

As stated in the Town Plan of Conservation and Development for Winchester, "The two major land use changing events over the past fifty years have been the 1955 flood which altered forever the face and economy of Winchester and the opening of Route 8 expressway which put Winchester closer to Torrington and Waterbury. The '55 flood left over 400 residents homeless and destroyed 170 retail stores and 90% of the Town's industries…. The expressway changed land use patterns by effecting the economy and the demand for housing and related services."

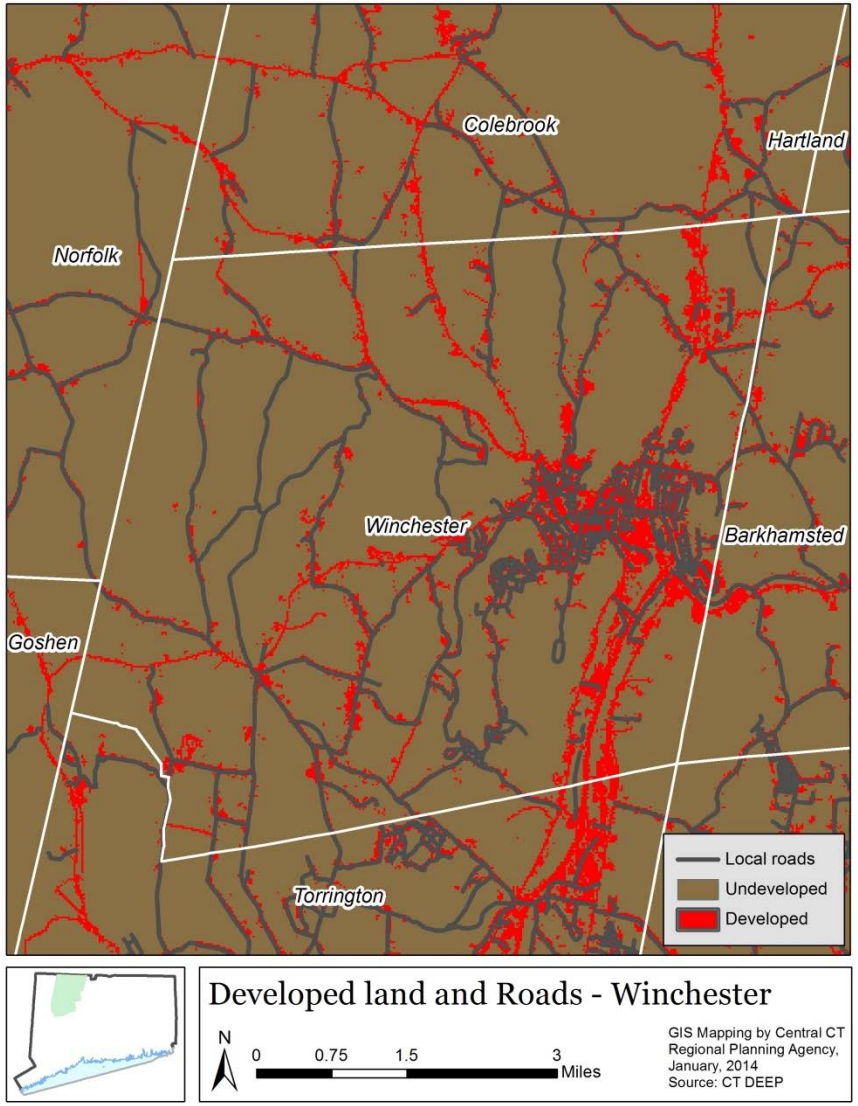

Figure V.23. Developed land and local roads in Winchester

Since the 1970's Winchester, like many other manufacturing centers in the Northeast, has experienced an out-migration of industry to warmer

climates where energy and the cost of doing business is less. In 1970, manufacturing comprised 45% of the jobs in Winchester; by 2005 the percentage of manufacturing jobs had declined to 29%. With nearly one in three jobs still being in manufacturing, however, manufacturing continues to represent a major sector of the town's economy.

In addition to serving as the regional hub of the northern Litchfield Hills Region, major facilities in the City include the Northwestern CT Community College, Platt Hill State Park, and the Winsted Health Center. Winchester is part of the Northeastern Highlands Ecoregion, which is characterized by "hills and mountains, a mostly forested land cover, nutrient-poor frigid and cryic soils (mostly Spodosols), and numerous high-gradient streams and glacial lakes" (as described on the map "Ecoregions of New England"). Other notable characteristics of the municipality include Highland Lake (one of Connecticut's largest lakes at over three miles in length) and the Mad and Still Rivers. Winchester has a total area of 33.8 square miles with a land area of 32.3 square miles. Major highways serving the town include State Routes 8, 20, 44, and 183.

According to the US Census data, the population of Winchester has increased very little over the past 50 years. The population was 10,496 in 1960 and 11,242 in 2010. The population is projected to increase to 11,694 persons by the year 2020, or an average of 45 new residents per year. The median age in 2010 was 44. Just over half of the housing in the town is owner occupied, with about one-third of the housing stock occupied by renters, and six percent held for seasonal, recreational or occasional use (second homes). There are 5,111 existing housing units in town as of 2009.

Winchester, according to the Connecticut Economic Resource Center (CERC), had a labor force of 6,133 persons in 2013, and has 3,380 jobs actually located in the town as of 2013. In addition to manufacturing, retail sales and service industries comprise a large percentage of the available jobs. The unemployment rate was 98.3% in 2013.

According to CERC, Winchester has an equalized net grand list of $1,032,016,716 in 2010 with commercial and industrial uses comprising 9.7% of this grand list. The equalized net grand list is an estimate of the market value of all taxable property in the municipality, and gives some indication of the value of property at risk in the event of a major natural disaster. There are 327 business firms in the community according to CERC as of 2013.

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the municipality has experienced limited development. Specifically, the housing stock increased by 691 units between 2000 and 2010, and there has been limited new commercial or industrial development. According to the land use official, no development has occurred in flood-prone areas since the previous plan so development has not increased the community's vulnerability in flood-prone areas.

2. Evaluation of Risks and Vulnerability

The major natural hazards of concern in Winchester are flooding, high winds, and severe winter storms. Forest fires, drought, and earthquakes occur much less frequently in the community, and are therefore of somewhat lesser concern. The general risk and vulnerability posed by each of these six hazards is discussed in the preceding Section III of this report. More specific information on the flood vulnerability and critical facilities in the town of Winchester is presented below.

Forest fires and brush fires have the potential to create a significant problem for local emergency response personnel. However, past events have generally been brought under control fairly quickly due to the accessibility provided by woods roads and other natural breaks in the forest cover.

Flooding

Floodprone areas in Winchester, as mapped by FEMA, are shown in Figure V.22. According to the Winchester Town Plan, "For a town that experienced significant disaster during the 1955 flood, there are surprisingly few flood hazard areas in Winchester today. The Mad River has been controlled by the construction of the Mad River Dam, a dry reservoir." Additional flood protection has been afforded through the construction of Sucker Brook Dam, another dry reservoir constructed by the Army Corps of Engineers following the 1955 flood. Both of these facilities were tested during Hurricane Gloria in 1985 where heavy rains resulted in a substantial impoundment of water behind the two dams. The two

Table V.76: Building Exposure by Occupancy Type for the Study Region		
Occupancy	Exposure ($1000)	Percent of Total
Residential	752,153	69.9%
Commercial	121,123	11.3%
Industrial	127,754	11.9%
Agricultural	2,592	0.2%
Religion	13,670	1.3%
Government	5,888	0.5%
Education	52,543	4.9%
Total	1,075,723	100.00%

Table V.77: Building Exposure by Occupancy Type for the Scenario		
Occupancy	Exposure ($1000)	Percent of Total
Residential	392,423	64.5%
Commercial	79,595	13.1%
Industrial	114,851	18.9%
Agricultural	1,925	0.3%
Religion	5,602	0.9%
Government	4,040	0.7%
Education	9,821	1.6%
Total	608,257	100.00%

dams functioned as designed, however, and no downstream flooding occurred.

While major flooding of the Mad River no longer appears to be a major concern at the present time due to the flood control structures at Mad River Dam and Sucker Brook Dam, there are still several localized areas which experience flooding on a regular basis due to inadequate drainage facilities. The most significant of these locations is along Pratt Street, where periodic flooding damages yards and the local road on a regular basis. The drainage system in this area needs upgrading.

Another location prone to periodic flooding is the area of Gay Street, Case Avenue and Center Street. Here again, the flooding occurs on a regular basis due to inadequate storm drainage facilities.

Another area of concern with regard to flooding is the Highland Lake outlet control structure. The flood control gates at this facility need replacement according to the Public Works Director in order to ensure adequate control during a large storm event.

Hurricanes and Strong Winds

Impacts from hurricanes and other strong winds have been felt in Winchester, but not to the extent as in other regions. The majority of damage from past events was caused by flooding as a result of hurricanes and tropical storms. For example, Hurricanes Connie and Diane caused the flood of 1955, which caused widespread damage in Winchester. As noted above, significant progress has been made in reducing the town's vulnerability to flooding, and thus to hurricanes.

Winchester also suffered Hurricane related damage from Storm Irene in August 2011 and Storm Sandy in October 2012. Both of these events caused significant power outages and the storms received Presidential Disaster Declarations. Areas that are most vulnerable are those with greater levels of development. See Figure V.23 for locations of these areas.

Severe Winter Storms

The natural hazard of greatest concern in Winchester is localized flooding at the locations discussed above, and winter ice storms with high winds and power outages. A severe snowstorm occurred in March of 1978 that brought close to three feet of heavy snow. The town also suffered major ice and/or snow storms in 1978, 2002, and 2011, that resulted in downed power lines, extensive tree damage, and expensive clean-up costs.

Vulnerability to the effects of severe winter storms is primarily limited to

Table V.78: Impacts from 1% annual flood scenario (Winchester)	
Type of impact	Value
Building related losses	$86,268,000
Business interruption losses	$435,000
Total economic losses (thousands of dollars)	$86,703,000
Damaged essential facilities	4
Buildings substantially damaged	60
Tons of debris	4,219
Displaced households	217
Shelter needs	398
Acres of land flooded	7,232

developed areas, where snow and ice accumulations can cause buildings to collapse. In Winchester, 16% of the land is developed. Another factor in the town's vulnerability is the road network. Municipalities are only required to clear local roads, so this will be the primary source of their cleanup costs. Winchester has 92 miles of local roads to clear, or 10% of the region's total. In comparison, Torrington has 190 miles of roads to clear. The cost to clear a mile of road varies considerably, depending on the width of the road, the depth of snow, and the density of intersections, making cost estimates difficult. This does, however, give an idea of relative vulnerability. See Figure V.23 for locations of development and local roads.

Vulnerable Assets

According to FEMA's webpage, "Policy Statistics", 48 flood insurance policies in force as of 8/31/2015 with an insurance value of $10,178,800. An attempt was made to estimate the number of structures located within the FEMA floodplain boundaries using available GIS data for Connecticut, however the data is not considered precise enough for an accurate assessment.

There are twelve dams in Winchester (see Figure V.22). Four of these dams are private dams, five are owned by the State (Park Pond, Sucker Brook, Winchester Lake, Mad River, and Lost Pond), and three dams are owned by the Town (Crystal Lake, Rugg Brook, and Highland Lake). Four dams are rated C (Park Pond, Highland Lake, Mad River, and Sucker Brook), seven dams are rated B or BB, and one dams is not rated. For a description of these dam ratings, "Flooding: Impacts" in Section III.

The major facilities at risk in the community in the event of a natural hazard are shown in Figure V.22. These facilities include the Winchester Town Hall (which serves as the town emergency operations center), Pearson School (which is the designated local emergency shelter), Gilbert School, Municipal Public Works Garage, Winchester Fire Station, Winchester Police Station (which provides municipal dispatch services), Rugg Brook and Crystal Lake Reservoirs, the Winsted Water Treatment Plant, the Winsted Sewer Treatment Plant. These are considered critical facilities in the event of a natural disaster because they might be needed for effective emergency response. Other critical facilities with regard to emergency response include the Laurel Healthcare Nursing Home, the elderly housing complexes, at Gay Street and Chestnut Street, and the Winchester Area Child Centers. All are potentially vulnerable to tornados, winter storms, wildfire, and earthquakes. None of the facilities are located within a floodplain.

Tables V.76 & V.77 above show the "total exposure" of all structures in Winchester, under a 1% flood scenario. The first table shows that $1.075 million worth of buildings could potentially be impacted by a 1% flood event. The second table shows that over half of that total, $608,257 worth of buildings are likely to be impacted by such an event.

3. Potential Impacts

Floods have wide ranging impacts. They damage buildings, they block roads, they spread debris, and they interrupt businesses. As shown in Table V.77, these impacts can add up to considerable financial costs. In Winchester, a HAZUS simulation of a 1% annual flood event showed a total economic impact of over $86 million. Such an event would send 398 people into shelters, displace 217 households, and damage four essential facilities.

Strong winds primarily cause damage through downed trees and tree limbs. A common result is power outages when tree limbs knock down power lines. As one of the most densely settled municipalities in the region, Winchester is more vulnerable than others. In 2011, at the peak of the impacts felt by Hurricane Irene, nearly 2,000 customers were without power. While that is only 32% of the municipality, it is the third highest number in the region.

A HAZUS simulation of various intensities of hurricane was also performed and is shown in Table V.79. An event similar to the 1938 hurricane would cause $124.7 million in Winchester. Most of that damage would occur in the residential sector. This event is roughly equivalent to a 0.2% annual event.

Winter storms cause damage in a number of ways. They bring down trees and limbs, causing power outages (see above); they block roads, causing delays for travelers and commuters; the roads must be cleared of ice and snow, costing the municipality; and they can cause buildings to collapse when snow and ice accumulate on roofs. Road closures due to snow cover can close businesses, costing them sales, employee time, and in some cases, product. The snow storm of October 2011 left 100% of the town without power at its peak (6,146 customers). At least half of the town had no power for five days and 90% had no power for four days.

4. Major Concerns

- Pratt Street, where periodic flooding damages yards and the local road on a regular basis needs upgrades to its drainage systems.
- Inadequate storm drains on Gay Street, Case Avenue and Center Street result in periodic flooding.
- Flood control gates at the Highland Lake outlet control structure need to be replaced.
- Beaver dams frequently result in plugged culverts on local streets such as along the Old Waterbury Turnpike near Rugg Brook Reservoir. The town has actually needed to close a section of this road due to a recurring problem with water ponding and road washout.

5. Hazard Mitigation Plan

Since the last plan, the general geography, demography, and built environment have not changed significantly in this community. Nor have the hazards become significantly more or less severe. This update, unlike the previous plan, utilizes HAZUS methodology to gain a deeper understanding of the impacts from significant natural hazards. Additionally, this plan utilizes the state's most recent hazard mitigation plan. As such, the plan priorities remain the same with the addition of mitigation actions to protect the built environment.

Mitigation Goals and Objectives

The principal goals of Winchester's natural hazard mitigation plan update are:

1. To minimize the risks to life and property from natural hazards, and
2. To prevent losses from natural hazards to the extent practicable.

In addition to these over-arching goals, the town has also established the following objectives to help the town become more disaster resistant:

Table V.79: Estimated hurricane-related damage (thousands of dollars) by building occupancy

	Res	Com	Ind	Agr	Rel	Edu	Gov	Total
1938	110.89	7.90	4.34	1.08	0.33	0.23	0.09	124.87
1%	4.22	0.26	0.08	0.03	0.00	0.00	0.00	4.59
5%	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.09

1. Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness
2. Ensure proper functioning of critical facilities during emergency response.
3. Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Overview of Potential Mitigation Measures

Table V.3 in the previous section of this report presents a listing of potential mitigation measures that can be taken to reduce the impacts of the major natural hazards of concern in the Litchfield Hills Region. In the context of Winchester's risk and vulnerability analysis presented above, and the existing mitigation strategies in the town, only some of these measures will be both needed and cost-effective. The purpose of this Natural Hazards Mitigation Plan is to identify reasonable and appropriate mitigation measures for each hazard from the Table V.3 listing and other sources, and to develop an implementation strategy for the priority mitigation measures.

Existing Mitigation Strategy

The Town of Winchester has a number of existing authorities, policies, programs and regulations that serve to mitigate the impact of natural hazards. Existing local authorities include the Winchester Board of Selectmen, Planning and Zoning Commission, Inland Wetlands Commission, Emergency Management Director, Fire Department, and Department of Public Works.

Winchester maintains compliance with NFIP through its use of the Connecticut State Building Code and city ordinances. Winchester expects to continue participation in NFIP.

Land use regulations exist to protect natural resources, including erosion and sediment control regulations for new development, stormwater control regulations to minimize drainage problems, and an area of special flood hazard to control development in flood prone areas.

The area of special flood hazard provides that any new construction or substantial improvement of any residential structure shall have the lowest floor, including the basement, elevated to at least the base flood elevation. Nonresidential construction is required to have the lowest floor, including basement, elevated to at least the base flood elevation or be flood-proofed to the base flood elevation. Additionally all attendant utilities or sanitary facilities should be located or designed to avoid infiltration or impairment by flood waters.

Winchester's subdivision regulations have detailed standards for the planning, design and construction of storm drainage systems in order to minimize adverse impacts associated with new construction activity. The Winchester Inland Wetland and Water Course Agency enforces regulations to direct development away from wetlands, watercourses and floodplains. In addition to these regulations, the Winchester Public Works Department routinely examines and clears public storm drains and catch basins of debris following periods of rainfall, snowfall, or windstorms. The town's DPW also monitors weather reports and maintains loaded trucks in preparation of winter storm events.

The Winchester Volunteer Fire Department, the Winsted Fire Department, Department of Public Works, and Emergency Management Director all possesses emergency equipment that can be deployed as needed in the event of an emergency. Procedures are also in place to open and maintain the Emergency Operations Center and emergency shelter in town. Recently the towns invested in the upgrade of their emergency communication system, including the replacement of a single antenna service to a voter repeater system that takes the best signal from multiple locations. The town Public Works, Police, Fire and EMS Departments can all communicate with one another during an emergency. The community also maintains a civil preparedness building on Waldron Street that has an antenna and ham radios to enhance communication capabilities during an emergency.

Winchester has also been working with other towns in the Litchfield Hills Region through the Northwestern CT/Litchfield Hills Public Safety Task Force to enhance communication and coordination. This has included efforts to standardize communication equipment and the equipment in local emergency operation centers, and also the upgrading of supplies at emergency shelters. Other activities being pursued are a regionally coordinated public notification system, a badging registration

system for emergency responders, improved training opportunities, and the development of written mutual aid agreements.

In addition to these local and regional mitigation programs, the municipality also benefits from numerous federal and state mitigation programs such as the USGS WaterWatch, Report of the Two Storm Panel, CT DEEP Forest Fire Danger Report, the "Connecticut Drought Preparedness and Response Plan", the "National Weather Service Early Warning System", the University of Connecticut's Center for Land Use Education and Research (CLEAR), and the annual tree trimming maintenance program by Eversource.

Recommended Hazard Mitigation Measures

Objective 1: Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness.

Natural Hazard Addressed: *All hazards.*

Objective 2: Ensure proper functioning of critical facilities during emergency response.

Natural Hazard Addressed: *All hazards.*

Objective 3: Expand maintenance activities and implement specific projects that address known drainage issues within the town.

Natural Hazard Addressed: *Flooding.*

The priority assigned to the above strategies was based on cost-benefit discussions with local officials and an evaluation using the STAPLEE criteria defined in FEMA's "How To Guide #3: Developing the Mitigation Plan". STAPLEE is short for the social, technical, administrative, political, legal, economic, and environmental criteria used in the evaluation process. It is anticipated that the low-cost strategies will be implemented during the first year after plan adoption. The higher-cost projects will be implemented as funding becomes available.

High priority projects are those that are considered critically important in order to minimize the risks to life and property from natural hazards. Medium priority projects are important to the community in order to mitigate the impacts of natural disasters but are not considered as critical to the community as high priority projects. Low priority projects are supportive of hazard mitigation goals and objectives, but are not considered essential to effective hazard mitigation in the community.

Changes in Mitigation Priorities from Previous Plan

Since the 2006 "Litchfield Hills Natural Hazards Mitigation Plan" was prepared, the Town of Winchester has pursued implementation of a number of mitigation measures. Of particular note is the implementation of a public notification system (e.g. Everbridge) to enhance public notification of emergency events and appropriate emergency response procedures, strengthening of radio communication capacity, and advocacy for an increased role by Eversource in tree trimming maintenance practices along roadsides. The major municipal priorities remain unchanged from the previous Plan with a focus on community preparedness, maintenance and enhancement of response resources, and effective floodplain/drainage management. No significant changes or data reanalysis were made from the 2006 with the exception of the inclusion of HAZUS. The following table describes the hazard mitigation strategies of medium or high priority for this community and their associated responsibilities, timeframe, priority, funding source, etc. Projects included in the previous plan are italicized. All of the mitigation actions listed in the 2006 plan have also been included here. These actions are either ongoing due to their nature (education, equipment maintenance) or were not completed due to the economic recession. Unless otherwise noted, all Local Mitigation Actions, once budgeted for, are able to be accomplished within the 2016 Plan Update five year timeframe.

At this time, the municipality is unable to expand or improve their existing capabilities to reduce key vulnerabilities without additional capacity in the form of training, staff, and/or funding.

The municipality's current comprehensive plan (Plan of Conservation Development) does not reference the 2006 Litchfield Hills Natural Hazard Mitigation Plan or natural hazards with the exception of stormwater management or floodplains as applicable. The NHCOG will discuss the incorporation of the new 2016 Natural Hazard Mitigation Plan into local planning documents with each municipality.

Table V.80: Objective 1 Educate the public regarding natural hazards of concern, mitigation activities, and community preparedness

Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Continue to provide information to schools to help educate children about natural hazards and how to prepare for them.	Volunteer Fire Dept. and Emergency Management Director	Annually, efforts to be reviewed at annual planning meeting	Medium	4.8	Volunteers	Municipal budget; EMPG	All hazards
2. Continue to make literature available on natural hazards and preparedness at Winchester Town Hall.	Emergency Management Director	On-going, update as information becomes available	High	4.8	Volunteers	Municipal budget; EMPG	All hazards
3. Maintain local Emergency Operations Plan and continue to coordinate with the Regional Public Safety Task Force and Red Cross on community planning, preparedness, response, and training.	Emergency Management Director and Mayor	On-going, review annually	Medium	1.8	Volunteers	Municipal budget; EMPG	All hazards
4. *Maintain Emergency Notification System (e.g. Everbridge system) to provide emergency information to residents in the entire town or in a specific geographic area. This notice can provide not only warning of an impending situation but also information regarding how to prepare for a particular event.*	Emergency Management Director and Mayor	On-going, review annually	Medium	1.8	$8,000/year	LCD; Municipal budget	All hazards

Table V.81: Objective 2 Ensure proper functioning of critical facilities during emergency response							
Strategies	**Who**	**When**	**Priority**	**C/B Score**	**Cost**	**Funding Source**	**Hazard Mitigated**
1. Routinely inspect emergency response equipment, and train for response to natural disasters.	Volunteer Fire Dept. and Emergency Management Director	Quarterly and after every response	High	4	Volunteers	Municipal Budget; EMPG	All hazards
2. Acquire additional emergency response equipment such as a generator for the emergency shelter at Pearson School and needed communication equipment.	Emergency Management Director, Fire Chief	Annually, efforts to be reviewed at annual planning meeting	High	1.1	$50,000/generator; $800/radio	FEMA; DEMHS; Municipal budget; LOCIP; STEAP	All hazards
3. Promote the use of interoperable communication equipment, and the development of standard operating procedures for emergency response in the regional area.	Emergency Management Director, Fire Chief, and Mayor	On-going, review annually	High	1.8	Volunteers; in-kind	OPM RPI; Municipal budget; EMPG	All hazards
4. Pursue a verbal agreement with schools or school bus company to utilize school buses for mass transportation during an emergency.	Emergency Management Director and Mayor	2016	Medium	3.4	In-kind	Municipal/school budgets; EMPG	All hazards
5. Develop basic GIS capabilities as needed for access to aerial photos showing the number and location of properties and structures that could be affected by a natural disaster.	Emergency Management Director, Fire Chief, and Mayor	2017	Medium	1.8	$3,000/year	OPM RPI; Municipal budget	All hazards

Table V.82: Objective 3 Expand maintenance activities and implement specific projects that address known drainage issues within the town

Strategies	Who	When	Priority	C/B Score	Cost	Funding Source	Hazard Mitigated
1. Pursue funding to implement control measures to mitigate the flooding created by beavers.	Public Works Dept.	On-going, with each project and/or as needed	Medium	1.3	$1,500/culvert	FEMA; Municipal budget	Flooding
2. Develop and implement clean-out schedules for all catch basins and drainage facilities	Public Works Dept.	Annually, efforts to be reviewed at annual planning meeting	Medium	1.1	$7,800/year	Municipal budget	Flooding
3. Review floodplain regulations and ordinances and update as necessary based on guidance from DEEP.	Planning and Zoning Commission	Annually, efforts to be reviewed at annual planning meeting	Medium	4.5	$2,500	Municipal budget	Flooding
4. Identify the location of structures that are susceptible to flooding to facilitate risk assessment and potential control measures.	DEHMS or CT DEEP	Annually, efforts to be reviewed at annual planning meeting	Medium	1.9	$20,000	FEMA; Municipal budget; DEEP DEHMS	Flooding
5. Implement drainage improvements at flood-prone areas of Lansing Bridge Rd, Pratt St, Gay St, Case Ave., and Center St. to address localized flooding problems.	Public Works Dept.	2016	Medium	1.3	TBD	FEMA; ConnDOT; Municipal budget	Flooding
6. Conduct a feasibility study on relocating the Winchester Public Works Garage to avoid the problems created by the frequent flooding at the current location. Pursue funding for relocation if feasible.	Town Manager, Public Works Dept.	2017	High	0.9	$15,000 for study	CT OPM; DEHMS, FEMA, Municipal budget	Flooding

VI. Plan Maintenance

Plan maintenance is an essential part of implementation. It will take the coordinated effort of multiple departments in every municipality in the Litchfield Hills Region. The Northwest Hills COG will assist the jurisdictions in their plan implementation where possible.

A. Monitoring, Evaluating, and Updating the Plan

The Northwest Hills COG will be responsible for monitoring, evaluating, and updating the plan in cooperation with its member towns, the regional Public Safety Task Force, CT Department of Environmental Protection, and FEMA.

NHCOG staff will review the Plan bi-annually from the date of formal report adoption by the NHCOG. This review will include an assessment of those mitigation measures that have been implemented or addressed by member towns based on telephone conversations with municipal contacts. The assessment will also include consideration of any other potential mitigation projects that should be added to the Plan based on public input or new information. NHCOG staff will also review the plan after each major disaster and maintain a log of any changes provided by the jurisdictions that should be made to the plan during the next formal update of the plan. In this way, the knowledge and experience gained from each disaster event can be integrated into the plan update process.

A discussion of the plan assessment process will be added to the agenda of at least two Public Safety Task Force meetings each year for additional local input, and to provide an opportunity for public participation. The Public Safety Task Force will specifically be asked to review the goals and mitigation projects for their towns and to consider whether they are still relevant in addressing current and expected natural hazards. The Task Force will also be asked to review the risk assessment portion of the plan to determine if this should be updated in any way based on new information. The results of this plan review will be a short written report prepared by NHCOG staff.

A full plan evaluation and updating process will be undertaken by the NHCOG at five year intervals from the date of formal plan acceptance. This five-year plan update will be submitted to the CT DEEP and FEMA for review and acceptance.

Following is a listing of the scheduled activities for updating the plan.

2016

- NHCOG staff review of Plan in cooperation with municipal officials and discuss incorporation of Plan with local comprehensive plan
- Plan to be adopted by jurisdictions.
- Add discussion of NHMP to at least two agendas of PSTF, followed by written summary of conclusions.
- Maintain log of potential changes for next update, as needed.
- Research and apply for necessary funds for planning/projects.

2017

- NHCOG staff review of Plan in cooperation with municipal officials.
- Add discussion of NHMP to at least two agendas of PSTF, followed by written summary of conclusions.
- Maintain log of potential changes for next update, as needed.
- Research and apply for necessary funds for planning/projects.

2018

- NHCOG staff review of Plan in cooperation with municipal officials.
- Add discussion of NHMP to at least two agendas of PSTF, followed by written summary of conclusions.
- Add discussion to NHCOG agenda for authorization to apply to FEMA for funding for update of plan.
- Research and apply for necessary funds for planning/projects.
- Coordinate with DEEP/DEMS on program changes and develop FEMA application for grant funding.
- Maintain log of potential changes for next update, as needed.
- Strategize revision process.

2019

- Start revision process of the plan (early 2019).
- NHCOG staff review of Plan in cooperation with municipal officials.
- Add discussion of NHMP to at least two agendas of PSTF, followed by written summary of conclusions.
- Initiate Plan Update process.
- Research and apply for necessary funds for projects.
- Maintain log of potential changes for next update, as needed.

2020

- NHCOG staff review of Plan in cooperation with municipal officials.
- Add discussion of NHMP to at least two agendas of PSTF, followed by written summary of conclusions.
- Research and apply for necessary funds for projects.
- Maintain log of potential changes for next update, as needed.
- Complete Plan Update process.
- Submit Plan to FEMA and CT DEEP for review.

B. Plan Integration into Existing Programs

Municipalities are asked to integrate the information and recommendations in this plan into other planning or emergency preparedness programs wherever practicable. The chief elected official or body of each jurisdiction is responsible for general oversight of implementation and integration of this plan into their community's other planning efforts by various commissions, emergency management directors, public works department, etc. Such integration will start by the time the final plan is adopted by the community via resolution. Examples of such other programs that may benefit from the incorporation of the recommendations in this plan include the local emergency response plans, regional emergency operations plan (prepared by the Area 5 Office of the CT Department of Emergency Services and Public Protection), town plans of conservation and development, town open space plans, and town zoning regulations. The parties responsible for the preparation of the above plans have been instrumental in the preparation of this report, and will be provided with a copy of the final report to encourage integration of the plan into their programs as appropriate. The 2006 Plan was not incorporated into the comprehensive plans of most of the jurisdictions. Most of the municipalities' comprehensive plans discuss topics that are also covered in this plan such as flooding and stormwater management; however, they do not discuss the mitigation measures from the Natural Hazard Mitigation Plan specifically. NHCOG will work with the municipalities to incorporate this Update into future local comprehensive plans as well as the next Regional Plan of Conservation and Development.

Public participation has been encouraged throughout the preparation of this plan. Future updates of the plan will continue to provide opportunities for public input. This will be done primarily through the public posting of meetings of the regional Public Safety Task Force. In addition, an opportunity for public comment is routinely provided at the monthly meetings of the NHCOG and public input pertaining to the "Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update" can be provided at that time on the NHCOG website (www.northwesthillscog.org).

Draft adoption resolution text used by each municipality after plan approval by FEMA as well as the signed resolutions are provided in Appendix C.

VII. Appendices

APPENDIX A: PUBLIC OUTREACH SURVEY RESULTS & DOCUMENTATION

Survey Results

Two surveys were given to get an idea of public opinion on natural disasters and potential mitigation measures. One survey was created for residents and business owners and another for municipal staff in the region. The resident's survey had 28 responses representing 9 out of 11 towns while the municipal staff survey had 32 responses representing 10 of the 11 towns. Many of the questions in these two surveys overlapped and the statistics below unless stated otherwise represent the combination of the two surveys.

When asked which disasters had a negative impact on the survey participant in the past five years, hurricanes and blizzards had the highest count of responses, 28 and 35, respectively. For both of these disasters the most common impact mentioned was power outages. The other disasters had fewer responses; floods (5/60), earthquakes (0/60), tornados (1/60), wildfires (0/60) and hail (4/60). Low responses were expected though for earthquakes, tornadoes, hail, and wildfires since, historically, these events do not occur often. In the case of floods, which do occur more regularly, a low response was also expected since the majority of residents live outside of flood zones.

In regards to disaster preparedness, municipal staff responses felt more prepared than resident responses with 63% of responses listed as "very prepared" and the remaining percentage as "adequately prepared". Only 23% of residents felt "very prepared" and another 59% felt "adequately prepared". The remaining 18% did not feel prepared for a disaster. Of these resident responses, only 35% of the responses considered the impacts of hazards before choosing to move into the region. Furthermore, the response from residents had shown that they had very few mitigation measures in place with the majority of responses simply having none at all.

When asked "How would you prefer to receive information on hazard mitigation?" the preferred method for residents was through a "Do it Yourself" hazard mitigation work book while municipal staff preferred to have a list of list of agencies which could provide information. When asked for the preferred source for this kind of information, residents preferred information from non-profit agencies and municipal staff preferred information form government sources.

The survey also asked participants to select five mitigation measures from a list that they found to be the most important for hazard mitigation. Ensuring roads are passable quickly after storms and removing/trimming trees that are a threat to power lines were the top measures selected. Other popular choices included assisting the elderly and disabled during disasters, using emergency alert systems, and providing backup power for critical systems.

The public survey only drew in limited responses but did offer some insight into the major disasters which impact the region (hurricanes and floods) as well as the potential mitigation measures deemed most important to address these challenges. The survey also helped produce a few opinions on mitigation measures and concerns recommending retrofitting facilities, infrastructure and utilities, updating existing FIRM maps, requesting expertise in flood mitigation practices, and providing snow removal assistance for seniors.

Municipal hazard mitigation survey response summary table				
Have your department's operations been negatively impacted by any of the following in the past 5 years	**Power Outage**	**Structure Damage**	**Personal Damage**	**(Blank)**
Hurricane or Tropical Storm	17	2	0	13
Severe Winter Storm or Blizzard	18	2	1	11
Hail	1	0	1	30
Flooding	2	3	1	26
Tornado	1	0	0	31
Wildfire	0	0	0	32
Earthquake	0	0	0	32

Municipal hazard mitigation survey response summary table (continued)			
Select the five most important measures your city or town should take or should continue to take in order to prevent or lessen the impacts and damages caused by natural hazards.	**Yes**	**No**	**(Blank)**
Use an emergency alert system to contact residents	9	13	10
Provide back-up power to critical municipal facilities (police & fire stations, town hall, etc)	9	13	10
Support training of municipal staff and volunteers for emergency response	10	12	10
Encourage local gas stations, pharmacies and grocery stores to install back-up generators	3	19	10
Encourage residents to prepare family disaster plans and supply kits	4	18	10
Trim or remove trees which could bring down power lines	11	11	10
Ensure that roads are passable quickly after storms	16	6	10
Undertake a public outreach program on emergency preparedness	6	16	10
Contact and assist the elderly and others with special needs in the event of natural disasters	9	13	10
Encourage utilities to consider burying existing electric and cable lines	0	22	10
Ensure electric and cable lines are installed underground in new development	2	20	10
Encourage nursing homes, senior housing, and group homes to install back-up generators	3	19	10
Fix drainage problems that cause flooding on roads	9	13	10
Keep development out of flood plains and other environmentally sensitive areas	4	18	10
Strengthen regulations to ensure development does not create drainage or ground water problems	1	21	10
Improve local maps to better identify areas vulnerable to natural disasters	1	21	10
Ensure that dams are routinely inspected and maintained	3	19	10
Analyze potential snow load problems on local buildings	2	20	10
Analyze the potential for forest and wild fires in the community	1	21	10
Acquire and remove buildings that flood repeatedly	0	22	10
Identify buildings and structures that might be susceptible to earthquake damage	1	21	10
Encourage residents and businesses to purchase flood insurance	0	22	10
Encourage residents and businesses to flood proof their buildings	0	22	10
Enact a drought ordinance	0	22	10

Municipal hazard mitigation survey response summary table (continued)

What types of projects do you believe government agencies could be doing in order to reduce the impacts of natural disasters in the Litch-field Hills region	Count
Retrofit and strengthen facilities, such as police, fire, and schools	9
Retrofit infrastructure, such as elevating roadways and improving drainage	10
Work on improving the damage resistance of utilities (electricity, water, etc.)	10
Install or improve protective structures, such as floodwalls and levees	0
Replace inadequate or vulnerable bridges and causeways	8
Strengthen codes, ordinances, and plans to require higher risk management standards and/or provide greater control over development in high hazard areas	2
Buy out flood prone properties and maintain them as open space	0
Inform property owner of ways they can mitigate damage to their properties	4
Provide better information about hazard risks and high-hazard areas	1
Assist vulnerable property owners with securing funding to mitigate their properties	1
Other	0

Indicate if your department has engaged in any of the following natural disaster preparedness activities.	Yes	No	N/A	(Blank)
Attended meetings / received written information on preparedness	14	1	1	15
Talked with employees/ volunteers about what to do in an emergency	16	0	1	15
Developed an employee plan about disaster procedures	6	4	1	19
Purchased flood insurance	2	2	5	23
Stored extra fuel / batteries & other emergency supplies	8	5	1	18
Developed a business emergency response plan	3	4	1	23
Developed a business emergency recovery plan	5	4	2	21
Conducted employee disaster drills / exercises	11	3	2	16
Made arrangements for alternate business sites in a natural disaster	5	5	2	20

Obtained an emergency back-up generator for power	14	3	1	13

Municipal hazard mitigation survey response summary table (continued)

Indicate types of information you would like to receive to learn more about reducing the negative effects of natural hazards on your department.	Count
List of organizations, companies, and government agencies that provide mitigation information	11
List of publications on actual mitigation measures and activities	9
Do-it-yourself business disaster continuity plan workbook	6
Self-explanatory CD for business vulnerability assessment and continuity plan development	5
Business to department mentoring, e.g. training by corporate contingency planner	1
Structural audit for mitigation recommendations suitable for your location	2
Cost-effectiveness information on actions recommended by such an audit	3
Technical assistance for structural mitigation implementation	3
Financial assistance for structural mitigation implementation	7
None of the above	0
Other	0

Indicate the source(s) from which you would prefer to receive information about hazard mitigation options for your department.	Count
Contractors	3
Insurance company	6
Government agency	17
Consulting firm	5
Non-profit organization	4

Resident/business hazard mitigation survey response summary table			
Indicate which of the following structural hazard mitigation measures are in place at your home.	**yes**	**no**	**n/a**
No structural mitigation currently in place	8	9	10
Elevation of first floor of structure	1	16	10
Structural flood proofing such as flood shield for door opening	0	17	10
Storm shutters	0	17	10
Shatter-resistant window glass	0	17	10
Hurricane straps	0	17	10
Strengthen roof e.g. hurricane-resistant roof covering	1	16	10
Reinforced entry doors/garage doors	1	16	10
Elevation of electric utility box	4	13	10
Elevation of heating/air conditioning unit	3	14	10
Indicate how much you would be willing to spend to protect your current location from the impacts of potential future hazards.	**yes**	**no**	**n/a**
Nothing	4	13	10
Less than $1,000	3	14	10
Between $1,000 and $4,999	4	13	10
Between $5,000 and $9,999	2	15	10
Over $10,000	0	17	10
Unsure	5	12	10
Indicate types of information you would like to receive to learn more about reducing the negative effects of natural hazards on your home.	**yes**	**no**	**n/a**
List of organizations, companies, and government agencies that provide mitigation information	3	14	10
List of publications on actual mitigation measures and activities	8	9	10
Do-it-yourself disaster plan workbook	9	8	10

Self-explanatory CD for vulnerability assessment and plan development	6	11	10
None of the Above	5	12	10

Resident/business hazard mitigation survey response summary table (continued)

Indicate the source(s) from which you would prefer to receive information about hazard mitigation options for your home	**yes**	**no**	**n/a**
Contractors	2	15	10
Insurance company	4	13	10
Government agency	4	13	10
Consulting firm	2	15	10
Non-profit organization	10	7	10
Other	0	0	0

Select the five most important measures your city or town should take or should continue to take in order to prevent or lessen the impacts and damages caused by natural hazards.	**yes**	**no**	**n/a**
Use an emergency alert system to contact residents	7	10	10
Provide back-up power to critical municipal facilities (police & fire stations, town hall, etc)	7	10	10
Support training of municipal staff and volunteers for emergency response	7	10	10
Encourage local gas stations, pharmacies and grocery stores to install back-up generators	4	13	10
Encourage residents to prepare family disaster plans and supply kits	5	12	10
Trim or remove trees which could bring down power lines	13	4	10
Ensure that roads are passable quickly after storms	7	10	10
Undertake a public outreach program on emergency preparedness	2	15	10
Contact and assist the elderly and others with special needs in the event of natural disasters	8	9	10
Encourage utilities to consider burying existing electric and cable lines	4	13	10
Ensure electric and cable lines are installed underground in new development	1	16	10
Encourage nursing homes, senior housing, and group homes to install back-up generators	3	14	10
Fix drainage problems that cause flooding on roads	6	11	10
Keep development out of flood plains and other environmentally sensitive areas	4	13	10
Strengthen regulations to ensure development does not create drainage or ground water problems	1	16	10
Improve local maps to better identify areas vulnerable to natural disasters	2	15	10

Ensure that dams are routinely inspected and maintained	5	12	10
Analyze potential snow load problems on local buildings	1	16	10
Analyze the potential for forest and wild fires in the community	0	17	10
Acquire and remove buildings that flood repeatedly	0	17	10
Identify buildings and structures that might be susceptible to earthquake damage	0	17	10
Encourage residents and businesses to purchase flood insurance	2	15	10
Encourage residents and businesses to flood proof their buildings	0	17	10
Enact a drought ordinance	0	17	10

Public Outreach Documentation

This section contains the publicity, outreach, and meeting documentation for the Litchfield Hills Hazard Mitigation Plan 2016 Update process.

Regional and municipal meetings to discuss Natural Hazard Mitigation Activities and Plan Update				
Date	**Jurisdiction**	**Number Attending**	**Description**	**Attendees**
4/30/2013	Regional	11	Northwestern CT/Litchfield Hills Public Safety Task Force Meeting	Tom O'Hare, Jim O'Leary, Bill Duquette, Jon Barbagallo, Kevin Webb, Gary Brunoli, Tom Vannini, Paul Rabeuf, Paul Gibb, Rick Lynn, Lois Pinney
6/25/13	Regional	14	Northwestern CT/Litchfield Hills Public Safety Task Force Meeting	Tom O'Hare, Richard Byrne, Ted Jansen, Nevton Dunn, Patrick Elias, Rocky Tomlinson, Jim O'Leary, Bill Duquette, Jon Barbagallo, Kevin Webb, Gary Brunoli, Tom Vannini, Paul Rabeuf, Paul Gibb, Rick Lynn, Jocelyn Ayer, Lois Pinney
7/31/2013	Goshen	3	Municipal meeting with chief elected official and/or emergency management representative	Rick Lynn, Bill Duquette, Jim O'Leary
8/30/2013	Norfolk	4	Municipal meeting with chief elected official and/or emergency management representative	Rick Lynn, Susan Dyer, Richard Byrne, John Allyn
9/24/2013	Torrington	2	Municipal meeting with chief elected official and/or emergency management representative	Rick Lynn, Chief Gary Brunoli
11/6/2013	Barkhamsted	3	Municipal meeting with chief elected official and/or emergency management representative	Rick Lynn, Don Stein, Rich Novak
12/6/2013	Harwinton	4	Municipal meeting with chief elected official and/or emergency management representative	Rick Lynn, Mike Criss, John Fredsall, Vincent Wheeler
12/16/2013	Colebrook	2	Municipal meeting with chief elected official and/or emergency man-	Rick Lynn, Tom McKeon

			agement representative	
5/15/2014	Litchfield	3	Municipal meeting with chief elected official and/or emergency management representative	Rick Lynn, Leo Paul, Jack Healy
5/15/2014	Morris	4	Municipal meeting with chief elected official and/or emergency management representative	Rick Lynn, Barbara Bongiolatti, Steve Brickett, Tony Gedraidis
5/22/2014	Winchester	3	Municipal meeting with chief elected official and/or emergency management representative	Rick Lynn, Dale Martin, Steve Williams
6/5/2014	Hartland	3 (teleconf. mtg)	Municipal meeting with chief elected official and/or emergency management representative	Rick Lynn, Wade Cole, Ted Jansen
6/5/2014	New Hartford	2 (teleconf. mtg)	Municipal meeting with chief elected official and/or emergency management representative	Rick Lynn, Dan Jerram
1/20/2016	Public	6	Public informational/comment session	Richard Byrne, Paul Gibb, Jim O'Leary, Rick Lynn, Joanna Wozniak-Brown, Darlene Krukar

APPENDIX B: HAZUS RESULTS & DOCUMENTATION

Data Description

HAZUS runs using its own inventory data as well as user provided data. The lists below provides a brief description of each data set used in this level 1 HAZUS analysis.

HAZUS Inventory Data:

HAZUS software provides data for census, economic, transportation, utilities and housing which it refers to as its "inventory data". This data is required to run HAZUS simulations. Detailed information of the inventory data set can be found in chapter 3 of any of the HAZUS technical manuals, flood, earthquake, or hurricane.

- General Building Stock (GBS)

Stored by block ID and Tract ID this data describes the amount of buildings, the types of buildings and the materials used in the buildings. These values are estimated for each block or tract.

- Demographics

The 2000 census data is used providing quantitative information on gender, age, race and income at the block and tract levels.

Note: 2000 census data is used due to a number of issues which occurred attempting to update data to 2010 values. Block and tract borders/IDs are not consistent between 2000 and 2010, HAZUS requires the use of the 2000 census block and tract polygons, the built in Comprehensive Data Management System (CDMS) tool currently has bugs preventing users to update census data at the block level. Furthermore the regional population of Litchfield Hills has seen only a 5% increase from 2000 to 2010.

- Essential Facilities

Essential facilities are those facilities that provide services to the community and should be functional after a flood. Essential facilities include hospitals, police stations, fire stations and schools. The damage for essential facilities is determined on a site-specific basis (3.2 HAZUS Technical Manual).

- Transportation Systems

Bridges, tunnels, facilities, and segments are included for highway, railway, light rail, bus, port, ferry, and airport transportation sectors. This data is expressed as point and line features (3.3 HAZUS Technical Manual).

- Utility Systems

Utility systems addressed include potable water, wastewater, oil, natural gas, electric power, and communication systems. (3.4 HAZUS Technical Manual). This data is expressed as point and line features.

- Agriculture Products

Average agricultural products, outputs, and prices are included on the county and sub county level (3.5 HAZUS Technical Manual)

- Vehicles

Vehicle counts have been estimated at the block and tract level (3.6 HAZUS Technical Manual)

User Input Data

Elevation Data

A 10m digital elevation model (DEM) was used to calculate streams, flood depth grids, and potential flood zones. The data was downloaded from USGS National Elevation Dataset (NED).

Flood Depth Grids

The flood depth grids are an output from HAZUS flood analysis. Flood depth grids depict flooding in units of feet in raster format with a cell resolution equal to resolution used for the DEM, 7.13 m. A depth grid is created for each flood simulation performed. In this analysis three scenarios were ran for 25, 100, and 500 year flood scenarios. These raster layer are used to calculate the building flood damage at the block level.

Methods

Flood

HAZUS studies are classified into three levels which describe the level of detail tied supplied by the user. A level 1 analysis uses the predefined HAZUS inventory Data and a 30m DEM data set while a level 2 or 3 analysis requires increasingly detailed user data. This study is classified as a level 1 analysis with an improved DEM data.

10m DEM data from the USGS is input as the user data set. A stream network is delineated with a defined stream drainage area of 0.25 square miles, the highest scale of calculating streams allowed by HAZUS (See HAZUS Flood Technical Manual for more details on stream drainage area.). This was done to capture as many streams within the Litchfield Hills Region as possible. Results were compared to EPA's NHD plus Stream data, a robust and respected stream data set, and the results match up closely. Flood plain data generated using 10m NED and HAZUS stream tools and were delineated at .25km drainage area.

The new stream layer undergoes a hydrologic analysis to solve peak flood discharges and their frequencies of occurrence. This is a built in tool in HAZUS. Once completed user can then delineate a flood plain. In this study flood plains are delineated for 25, 100 and 500 year flood scenarios. The output file is a raster flood depth grid which defines how deep flood zones are in units of feet.

The flood depth grids are then placed in as user data, one for each scenario and are used to calculate flood impacts. HAZUS displays the results as output tables witch can be viewed through the HAZUS software. The technical process used in this study is listed below with steps separated by the ">" symbol.

Input 10m DEM as user data > Develop Stream Network > Create stream network > Calculate Hydrology, one water basin at a time > Delineate Flood Plains for 25yr, 100yr, 500yr simulations (60 hrs) > Mosaic to New Raster Tool for each set, the input is Regions\scenario\Hydraulics\Reaches and the collection of DEMS from each folder. The Output is a Depth Grid for each flood scenario > Output depth grid is inputted in HAZUS as user data > Create a new scenario for each depth grid, selecting only one of the flood simulations at a time. If you combine them you got a mixed result > Delineate Flood Plains using the depth grid. > Run Analysis > Select Results tab, choose the flood event to review > results can now be reviewed.

Hurricane

Only inventory data was used to perform the hurricane simulation. The tracts for only the region were selected. The probabilistic hurricane scenarios for 5% hurricane event, 1% hurricane event, and historic 1938 hurricane were selected and simulated for each scenario. Damage results were imported into an Excel pivot table for analysis.

Earthquake

The earthquake simulation was performed with HAZUS's built-in inventory data. The census tracts for the region were selected and a historic earthquake scenario from 1938 with an epicenter in Pennsylvania was chosen. A second scenario was developed with the same parameters but located the epicenter in the centroid of the region. These simulations were run and damage results were imported into an Excel spread sheet for analysis.

HAZUS Flood Simulation Results

Acres of flooded land by town (1% annual chance flood simulation)					
TOWN	**Acres of Town**	**Acres of 1% Flood**	**Flooded Acres Developed**	**% of town flooded**	**% of flood on developed land**
Barkhamsted	24,775	2,566	146	10.36	5.67
Colebrook	21,047	1,146	58	5.45	5.09
Goshen	28,934	1,621	32	5.60	1.95
Hartland	21,935	1,371	55	6.25	4.02
Harwinton	19,907	625	66	3.14	10.50
Litchfield	36,436	1,999	145	5.49	7.25
Morris	11,963	848	23	7.09	2.76
New Hartford	24,363	1,575	125	6.47	7.96
Norfolk	29,663	1,041	60	3.51	5.75
Torrington	25,793	1,301	284	5.04	21.82
Winchester	21,675	1,243	168	5.74	13.54

HAZUS categories and output definitions	
Category	**HAZUS Output**
Buildings	Cost of building repair or replacement of damaged and destroyed buildings
Contents	Cost of damage to building contents
Inventory	Loss of building inventory as contents related to business activities
Relocation	Relocation expenses (for businesses and institutions)
Income	Capital related income losses as a measure of the loss of productivity, services, or sales
Rental	Loss of rental income to building owners
Wage	Employee wage loss as described in income loss

Flood damage in 1,000s of dollars (1% annual occurrence)								
Town	**Building**	**Contents**	**Inventory**	**Relocation**	**Income**	**Rental**	**Wage**	**Total**
Barkhamsted	8417	8659	407	1	8	0	162	17654
Colebrook	2613	1477	7	0	0	0	0	4097
Goshen	2526	2167	25	0	0	0	58	4776
Hartland	680	404	0	0	0	0	0	1084
Harwinton	3635	3524	61	0	6	0	9	7235
Litchfield	23156	31580	1973	10	24	3	78	56824
Morris	1393	1260	33	0	0	0	0	2686
New Hartford	39910	35284	1014	31	63	11	154	76467
Norfolk	1895	1458	39	0	0	0	0	3392
Torrington	58279	67948	3737	18	68	8	152	130210
Winchester	37308	45497	3463	24	56	2	353	86703

HAZUS Hurricane Simulation Results

4% annual hurricane damage in 1000s dollars

Towns	Residential	Commercial	Industrial	Agricultural	Religious/NGO	Education	Government	Total
Barkhamsted	99	0	0	0	0	0	0	99
Colebrook	42	0	0	0	0	0	0	42
Goshen	0	0	0	0	0	0	0	0
Hartland	53	0	0	0	0	0	0	53
Harwinton	0	0	0	0	0	0	0	0
Litchfield	0	0	0	0	0	0	0	0
Morris	0	0	0	0	0	0	0	0
New Hartford	0	0	0	0	0	0	0	0
Norfolk	0	0	0	0	0	0	0	0
Torrington	0	0	0	0	0	0	0	0
Winchester	72	0	0	0	0	0	0	72
Grand Total	267	0	0	0	0	0	0	267

1% annual hurricane damage in 1000s dollars								
Towns	**Residential**	**Commercial**	**Industrial**	**Agricultural**	**Religious/NGO**	**Education**	**Government**	**Total**
Barkhamsted	2,843	13	16	1	1	1	2	2,878
Colebrook	734	2	1	0	0	0	0	737
Goshen	511	6	2	1	1	0	1	522
Hartland	1,397	10	4	1	2	1	0	1,413
Harwinton	1,159	16	6	3	3	1	0	1,190
Litchfield	1,460	42	23	2	5	10	2	1,543
Morris	542	8	4	1	1	0	0	555
New Hartford	1,621	40	30	3	5	2	2	1,703
Norfolk	207	4	1	0	0	0	0	214
Torrington	6,242	208	154	2	15	5	4	6,630
Winchester	2,651	29	32	1	3	11	1	2,727
0.2% annual hurricane damage in 1000s dollars								
Towns	**Residential**	**Commercial**	**Industrial**	**Agricultural**	**Religious/NGO**	**Education**	**Government**	**Total**
Barkhamsted	9,457	162	266	17	21	17	106	10,046
Colebrook	3,020	33	20	3	7	5	3	3,092
Goshen	2,927	112	34	20	20	6	56	3,176
Hartland	4,488	105	43	9	20	10	5	4,680
Harwinton	5,725	276	119	77	76	23	18	6,315
Litchfield	7,550	677	378	72	106	168	61	9,012
Morris	2,958	175	86	27	13	2	10	3,271
New Hartford	7,750	589	606	63	84	23	112	9,228
Norfolk	1,411	98	26	10	17	10	43	1,615
Torrington	41,697	4,955	5,026	82	359	127	225	52,471

Winchester	15,712	829	1,163	36	101	303	135	18,279

HAZUS Earthquake Simulation Results

Level of building damage					
Moderate	Extensive	Complete	Any damage	Total Buildings	% of moderate or worse
3,377	648	93	4,118	35,652	11.55

Casualties					
Time	Medical Aid	Hospital treatment	Life Threatening	Death	Total
Casualties Day	69	14	2	3	88
Casualties Night	67	11	1	2	81

Bridge and wastewater facility level of damage						
	# of facilities	% no damage	% slight damage	% moderate damage	% extensive damage	% completely destroyed
Bridges	189	94%	2%	2%	2%	1%
Wastewater Facilities	4	28%	35%	26%	9%	2%

Pipe Damage Count			
Pipe Type	Length in km	leaks	breaks
Waste water Pipeline	1,336	53	13
Potable water pipeline	2,226	106	26

Pipe Damage Costs in Thousands of $						
Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
44,526	333,076	NA	17,810	253,000	460	648,872

Transportation Damage in Thousands of $				
	segments	bridges	Rail segments	total
	1,532,719	1,048,283	11,271	2,592,273

Economic Loss in Thousands of $					
Capital Stock Loss					
Cost structural	**cost non structural**	**cost content**	**inventory loss**	**total capital loss**	
51,741	282,534	155,745	6,667	496,687	
Income Losses					
Relocation Costs	**Capital Related Costs**	**Wage Losses**	**Rental Income Loss**	**Total income Loss**	**Total loss**
31,554	13,439	18,669	17,677	81,339	578,026

Shelter Needs	
Displaced Homes	**Shelter Persons**
367	213

Debris in thousands of tons		
Brick wood other	**Concrete steel**	**Total**
58	59	117

APPENDIX C: PLAN ADOPTION RESOLUTION TEXT AND SIGNED RESOLUTIONS

City/Town of _____

Resolution Adopting the *Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update*

WHEREAS, the City/Town of ___ Board of Selectmen/Mayor/Council recognizes the threats that natural hazards pose to people and property with the City/Town of
____; and

WHEREAS, the City/Town of ___ , in collaboration with the Northwest Hills Council of Governments (NHCOG) has prepared a multi-jurisdictional multi-hazard mitigation plan known as the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update in accordance with the disaster Mitigation Act of 2000; and

WHEREAS, the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update has identified mitigation goals and actions to reduce or eliminate long-term risk to people and property from the impacts of future natural hazards and disasters that affect the City/Town of ___ and the region; and

WHEREAS, the Federal Emergency Management Agency/ Department of Homeland Security has approved the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update, on condition of local adoption, enabling the City/Town of ___ to apply for Hazard Mitigation grant funding; and

WHEREAS, adoption by the City/Town of ___ Board of Selectmen/Mayor/Council demonstrates their commitment to achieving the hazard mitigation goals outlined in the City/Town of ___ 's section of the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update,

NOW, THEREFORE, BE IT RESOLVED, that the City/Town of ___ Board of Selectmen/Mayor/Council hereby adopts the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

Date of adoption: _____

Signed:_____

Town of Barkhamsted

Resolution Adopting the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update

WHEREAS, the Town of Barkhamsted Board of Selectmen recognizes the threats that natural hazards pose to people and property with the Town of Barkhamsted; and

WHEREAS, the Town of Barkhamsted, in collaboration with the Northwest Hills Council of Governments (NHCOG) has prepared a multi-jurisdictional multi-hazard mitigation plan known as the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update in accordance with the disaster Mitigation Act of 2000; and

WHEREAS, the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update has identified mitigation goals and actions to reduce or eliminate long-term risk to people and property from the impacts of future natural hazards and disasters that affect the Town of Barkhamsted and the region; and

WHEREAS, the Federal Emergency Management Agency/ Department of Homeland Security has approved the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update, on condition of local adoption, enabling the Town of Barkhamsted to apply for Hazard Mitigation grant funding; and

WHEREAS, adoption by the Town of Barkhamsted Board of Selectmen demonstrates their commitment to achieving the hazard mitigation goals outlined in the Town of Barkhamsted's section of the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update,

NOW, THEREFORE, BE IT RESOLVED, that the Town of Barkhamsted Board of Selectmen hereby adopts the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

Date of adoption: 8/2/16

Signed: _____

Donald S. Stein, First Selectman

_____

Raymond Pech, Selectman

_____

Mark Hemenway, Selectman

Town of Colebrook

Resolution Adopting the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update

WHEREAS, the Town of Colebrook Board of Selectmen recognizes the threats that natural hazards pose to people and property with the Town of Colebrook; and

WHEREAS, the Town of Colebrook , in collaboration with the Northwest Hills Council of Governments (NHCOG) has prepared a multi-jurisdictional multi-hazard mitigation plan known as the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update in accordance with the disaster Mitigation Act of 2000; and

WHEREAS, the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update has identified mitigation goals and actions to reduce or eliminate long-term risk to people and property from the impacts of future natural hazards and disasters that affect the Town of Colebrook and the region; and

WHEREAS, the Federal Emergency Management Agency/ Department of Homeland Security has approved the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update, on condition of local adoption, enabling the Town of Colebrook to apply for Hazard Mitigation grant funding; and

WHEREAS, adoption by the Town of Colebrook Board of Selectmen demonstrates their commitment to achieving the hazard mitigation goals outlined in the Town of Colebrook's section of the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update,

NOW, THEREFORE, BE IT RESOLVED, that the Town of Colebrook Board of Selectmen hereby adopts the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

Date of adoption: July 11, 2016

Signed: Debra L. McKeon

Debra McKeon, Town Clerk

Town of Colebrook CT

Town of Goshen

Resolution Adopting the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update

WHEREAS, the Town of Goshen Board of Selectmen recognizes the threats that natural hazards pose to people and property with the Town of Goshen; and

WHEREAS, the Town of Goshen , in collaboration with the Northwest Hills Council of Governments (NHCOG) has prepared a multi-jurisdictional multi-hazard mitigation plan known as the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update in accordance with the disaster Mitigation Act of 2000; and

WHEREAS, the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update has identified mitigation goals and actions to reduce or eliminate long-term risk to people and property from the impacts of future natural hazards and disasters that affect the Town of Goshen and the region; and

WHEREAS, the Federal Emergency Management Agency/ Department of Homeland Security has approved the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update, on condition of local adoption, enabling the Town of Goshen to apply for Hazard Mitigation grant funding; and

WHEREAS, adoption by the Town of Goshen Board of Selectmen demonstrates their commitment to achieving the hazard mitigation goals outlined in the Town of Goshen's section of the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update,

NOW, THEREFORE, BE IT RESOLVED, that the Town of Goshen Board of Selectmen hereby adopts the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

Date of adoption: 8/9/16

Signed: _____

Robert P. Valentine, First Selectman

Town of Hartland

22 South Road
EAST HARTLAND, CT 06027
860-653-6800
www.munic.state.ct.us/hartland/hartland.htm

Resolution Adopting the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update

WHEREAS, the Hartland Board of Selectmen recognizes the threats that natural hazards pose to people and property with the Town of Hartland; and

WHEREAS, the Town of Hartland, in collaboration with the Northwest Hills Council of Governments (NHCOG), has prepared a multi-jurisdictional multi-hazard mitigation plan known as the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update in accordance with the disaster Mitigation Act of 2000; and

WHEREAS, the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update has identified mitigation goals and actions to reduce or eliminate long-term risk to people and property from the impacts of future natural hazards and disasters that affect the Town of Hartland, and the region; and

WHEREAS, the Federal Emergency Management Agency/ Department of Homeland Security has approved the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update, on condition of local adoption, enabling the Town of Hartland to apply for Hazard Mitigation grant funding; and

WHEREAS, adoption by the Hartland Board of Selectmen demonstrates their commitment to achieving the hazard mitigation goals outlined in the City/Town of Hartland's section of the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update,

NOW, THEREFORE, BE IT RESOLVED, that the Hartland Board of Selectmen hereby adopts the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

Dated this 2nd Day of August, 2016 in Hartland, Connecticut.

Wade E. Cole, First Selectman

Magi Winslow, Selectman

Scott M. Levan, Selectman

Town of Harwinton
Resolution Adopting the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update

WHEREAS, the Town of Harwinton, Board of Selectmen recognizes the threats that natural hazards pose to people with the Town of Harwinton; and

WHEREAS, the Town of Harwinton, in collaboration with the Northwest Hills Council of Governments (NHCOG) has prepared a multi-jurisdictional multi-hazard mitigation plan known as the Litchfield Hills Natural Mitigation Plan: 2016 Update in accordance with the disaster Mitigation Act of 2000; and

WHEREAS, the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update has identified mitigation goals and actions to reduce or eliminate long-term risk to people and property from the impacts of future natural hazards and disasters that affect the Town of Harwinton and the region; and

WHEREAS, the Federal Emergency Management Agency/Department of Homeland Security has approved the Litchfield Hills Natural Mitigation Plan: 2016 Update, on condition of local adoption, enabling the Town of Harwinton to apply for Hazard Mitigation grant funding; and

WHEREAS, adoption by the Town of Harwinton, Board of Selectmen demonstrates their commitment to achieving the hazard mitigation goals outlined in the Town of Harwinton's section of the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update,

NOW, THEREFORE, BE IT RESOLVED, that the Town of Harwinton, Board of Selectmen hereby adopts the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

Date of Adoption: July 19th 2016

Town Clerk: Nancy Eldridge
Nancy Eldridge

Date: July 25, 2016

seal

TOWN OF LITCHFIELD

OFFICE OF THE FIRST SELECTMAN
74 West St. • P.O. Box 488
Litchfield, Connecticut 06759-0488
Phone: (860) 567-7550 • Fax: (860) 567-7552

Town of Litchfield

Resolution Adopting the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update

WHEREAS, the Town of Litchfield Board of Selectmen recognizes the threats that natural hazards pose to people and property with the Town of Litchfield; and

WHEREAS, the Town of Litchfield, in collaboration with the Northwest Hills Council of Governments (NHCOG) has prepared a multi-jurisdictional multi-hazard mitigation plan known as the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update in accordance with the disaster Mitigation Act of 2000; and

WHEREAS, the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update has identified mitigation goals and actions to reduce or eliminate long-term risk to people and property from the impacts of future natural hazards and disasters that affect the Town of Litchfield and the region; and

WHEREAS, the Federal Emergency Management Agency/ Department of Homeland Security has approved the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update, on condition of local adoption, enabling the Town of Litchfield to apply for Hazard Mitigation grant funding; and

WHEREAS, adoption by the Town of Litchfield Board of Selectmen demonstrates their commitment to achieving the hazard mitigation goals outlined in the Town of Litchfield's section of the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update,

NOW, THEREFORE, BE IT RESOLVED, that the Town of Litchfield Board of Selectmen hereby adopts the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

Date of adoption: August 2, 2016

Signed: _____

City/Town of Morris

Resolution Adopting the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update

WHEREAS, the City/Town of Morris Board of Selectmen/Mayor/Council recognizes the threats that natural hazards pose to people and property with the City/Town of Morris; and

WHEREAS, the City/Town of Morris , in collaboration with the Northwest Hills Council of Governments (NHCOG) has prepared a multi-jurisdictional multi-hazard mitigation plan known as the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update in accordance with the disaster Mitigation Act of 2000; and

WHEREAS, the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update has identified mitigation goals and actions to reduce or eliminate long-term risk to people and property from the impacts of future natural hazards and disasters that affect the City/Town of Morris and the region; and

WHEREAS, the Federal Emergency Management Agency/ Department of Homeland Security has approved the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update, on condition of local adoption, enabling the City/Town of Morris to apply for Hazard Mitigation grant funding; and

WHEREAS, adoption by the City/Town of Morris Board of Selectmen/Mayor/Council demonstrates their commitment to achieving the hazard mitigation goals outlined in the City/Town of Morris 's section of the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update,

NOW, THEREFORE, BE IT RESOLVED, that the City/Town of Morris Board of Selectmen/Mayor/Council hereby adopts the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

Date of adoption: 8/2/16

Signed: _____

Tom Weik, First Selectman

Town of New Hartford

Resolution Adopting the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update

WHEREAS, the Town of New Hartford Board of Selectmen recognizes the threats that natural hazards pose to people and property with the Town of New Hartford; and

WHEREAS, the Town of New Hartford, in collaboration with the Northwest Hills Council of Governments (NHCOG) has prepared a multi-jurisdictional multi-hazard mitigation plan known as the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update in accordance with the disaster Mitigation Act of 2000; and

WHEREAS, the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update has identified mitigation goals and actions to reduce or eliminate long-term risk to people and property from the impacts of future natural hazards and disasters that affect the Town of New Hartford and the region; and

WHEREAS, the Federal Emergency Management Agency/Department of Homeland Security has approved the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update, on condition of local adoption, enabling the Town of New Hartford to apply for Hazard Mitigation grant funding; and

WHEREAS, adoption by the Town of New Hartford Board of Selectmen demonstrates their commitment to achieving the hazard mitigation goals outlined in the Town of New Hartford's section of the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

NOW, THEREFORE, BE IT RESOLVED, that the Town of New Hartford Board of Selectmen hereby adopts the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

Date of Adoption: 08.11.2016

Signed: _____

Attested to by Town Clerk Donna N. LaPlante

TOWN OF NORFOLK
OFFICE OF SELECTMEN
NORFOLK - CONNECTICUT
06058

TOWN OF NORFOLK
RESOLUTION ADOPTING THE LITCHFIELD HILLS NATURAL HAZARD MITIGATION PLAN: 2016 UPDATE

WHEREAS, the Town of Norfolk board of selectmen recognizes the threats that natural hazards pose to people and property with the Town of Norfolk; and

WHEREAS, the Town of Norfolk, in collaboration with the Northwest Hills Council of Governments (NHCOG) has prepared a multi-jurisdictional multi-hazard plan known as the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update in accordance with the disaster Mitigation Act of 2000; and

WHEREAS, the Litchfield Hills Natural Mitigation Plan: 2016 Update has identified mitigation goals and actions to reduce or eliminate long-term risk to people and property from the impacts of future natural hazards and disasters that affect the Town of Norfolk and the region; and

WHEREAS, the Federal Emergency Management Agency/Department of Homeland Security has approved the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update, on condition of local adoption, enabling the Town of Norfolk to apply for Hazard Mitigation grand funding; and

WHEREAS, adoption by the Town of Norfolk Board of Selectmen demonstrates their commitment to achieving the hazard mitigation goals outlined in the Town of Norfolk's section of the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

NOW, THERFORE, BE IT RESOLVED, that the Town of Norfolk Board of Selectmen hereby adopts the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

Date of adoption: August 2, 2016

Signed: _____
Susan M. Dyer, First Selectman

City Of Torrington

City & Town Clerk
140 Main Street
Torrington, CT 06790-5245

Tel: (860) 489-2236
Fax: (860) 489-2548

Resolution #143-16-11

City of Torrington

Board of Councilmen

Resolution Adopting the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update

WHEREAS, the City of Torrington Board of Councilmen recognizes the threats that natural hazards pose to people and property with the City of Torrington; and

WHEREAS, the City of Torrington, in collaboration with the Northwest Hills Council of Governments (NHCOG) has prepared a multi-jurisdictional multi-hazard mitigation plan known as the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update in accordance with the disaster Mitigation Act of 2000; and

WHEREAS, the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update has identified mitigation goals and actions to reduce or eliminate long-term risk to people and property from the impacts of future natural hazards and disasters that affect the City of Torrington, and the region; and

WHEREAS, the Federal Emergency Management Agency/ Department of Homeland Security has approved the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update, on condition of local adoption, enabling the City of Torrington to apply for Hazard Mitigation grant funding; and

WHEREAS, adoption by the City of Torrington Board of Councilmen demonstrates their commitment to achieving the hazard mitigation goals outlined in the City of Torrington's section of the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update,

NOW, THEREFORE, BE IT RESOLVED, that the City of Torrington Board of Councilmen hereby adopts the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update.

Date of adoption: 09-01-2016

Signed: Elinor Carbone

Town of Winchester

Office of the Town Clerk and Registrar of Vital Statistics

Sheila S. Sedlack, Town Clerk
Cheryl L. Carriere, Assistant Town Clerk
Phone 860-738-6963

Town Hall
338 Main Street
Winsted, CT 06098-1697

FAX 860-738-6595

CERTIFIED RESOLUTION

I, Sheila S. Sedlack, Town Clerk of the Municipality of Winchester, do hereby certify that the following is a true and correct copy of a resolution duly adopted at a meeting of the Board of Selectmen duly held and convened on the 18TH . day of July 2016, at which a constituted quorum of the Board of Selectmen was present and acting throughout, and further certify that such resolution has not been modified, rescinded, or revoked, and is, at present, in full force and effect.

Motion by Sel. Bourque, seconded by Sel. Sedlack

> **I move that the Board of Selectmen approve Resolution No, 16-07, supporting the Litchfield Hills Natural Hazard Mitigation Plan 2016 Update. UNANIMOUS**

WHEREAS, the Town of Winchester Board of Selectmen recognizes the threats that natural hazards pose to people and property with the Town of Winchester; and,

WHEREAS, the Town of Winchester, in collaboration with the Northwest Hills Council of Governments (NHCOG) has prepared a multi-jurisdictional multi-hazard mitigation plan known as the Litchfield Hills Natural Hazard Mitigation Plan; 2016 Update in accordance with the disaster Mitigation Act of 2000; and,

WHEREAS, the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update has identified mitigation goals and actions to reduce or eliminate long-term risk to people and property from the impacts of future natural hazards and disasters that affect the Town of Winchester and the region; and,

WHEREAS, the Federal Emergency Management Agency/Department of Homeland Security has approved the Litchfield Hills Natural Hazard Mitigation Plan: 2016 Update, on condition of local adoption, enabling the Town of Winchester to apply for Hazard Mitigation grand funding; and,

WHEREAS, adoption by the Town of Winchester Board of Selectmen demonstrates their commitment to achieving the hazard mitigation goals outlined in the Town of Winchester's section of the Litchfield Hills Natural Hazard Mitigation Plan; 2016 Update

NOW, THEREFORE, BE IT RESOLVED, that the Town of Winchester Board of Selectmen hereby adopts the Litchfield Hills Natural Hazard Mitigation Plan; 2016 Update.

IN WITNESS EHEREOF, the undersigned has affixed her signature and the municipal seal of the Town of Winchester, Connecticut, on the 18th. day of July, 2016.

IN WITNESS THEREOF, the undersigned has affixed her signature and the town seal this 21st. day of July, 2016.

Sheila S. Sedlack

Sheila S. Sedlack, CCTC, CMC

SEAL

APPENDIX D: REFERENCES

"2010 Decennial Census". United States Census Bureau via American Factfinder. http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml?_ts=454971206720

"2014 Seismic Hazard Map: Connecticut". United States Geological Survey. http://earthquake.usgs.gov/earthquakes/states/connecticut/hazards.php. Accessed: July 2, 2015.

"2015-2025 Population Projections for Connecticut at State, County, Regional Planning Organization, and Town levels – November 1, 2012 edition." *Connecticut State Data Center at the University of Connecticut Libraries Map and Geographic Information Center – MAGIC*. Web. 1 Nov. 2012. <http://ctsdc.uconn.edu/2015_2025_projections/>."Disaster Declarations", Federal Emergency Management Agency, http://www.fema.gov/disasters

American Community Survey. 2014.

"Barkhamsted Heritage-Culture and Industry in a Rural Connecticut Town." Richard G. Wheeler and George Hilton, editors. 1975.

"CERC Town Profile". Town Profiles for 11 towns in Litchfield Hills Region. October 2014. https://www.cerc.com/TownProfiles/ Accessed November 4, 2015

"Community-Based Pre-Disaster Mitigation: Resource Guide". FEMA. May 2004.

"Community Status Book Report: Connecticut, Communities Participating in the National Flood Insurance Program". FEMA. http://www.fema.gov/cis/CT.html. Accessed: July 1, 2015.

"Connecticut 2014 Hazard Mitigation Implementation Plan", Department of Energy and Environmental Protection and Department of Emergency Services and Public Protection (Division of Emergency Management and Homeland Security), January 2014.

"Connecticut's Changing Landscape". University of Connecticut Center for Land Use Education & Research. http://clear.uconn.edu/projects/landscape/your/town.asp. Accessed: May 20, 2015.

"Daily Forest Fire Danger Report". Connecticut Department of Energy and Environmental Protection, Division of Forestry. http://www.ct.gov/deep/cwp/view.asp?a=2222&q=320740&deepNav_GID=1631

"Ecoregions of New England". (color poster with map, descriptive text, summary tables, and photographs) Griffith, G.E., Omernik, J.M., Bryce, S.A., Royte, J., Hoar, W.D., Homer, J.W., Keirstead, D., Metzler, K.J., and Hellyer, G., 2009,: Reston, Virginia, U.S. Geological Survey (map scale 1:1,325,000)

"Emergency Preparedness & Response Plan". Connecticut Light & Power. December 2012.

"Environmental GIS Data for Connecticut, 2003 Edition", CT Department of Environmental Protection.

"Extreme Precipitation in New York & New England: An Interactive Web Tool for Extreme Precipitation Analysis", Northeast Regional Climate Center and the Natural Resource Conservation Service. http://precip.eas.cornell.edu/

"The Flood in 1955". Alfred T. Lilliendahl. 2004. From "Hartland Remembers". Hartland Historical Society. 2014.

"Goshen Connecticut, a Town Above All Others", Quadrimillenum Editorial Committee, 1990.

"The Great Disaster." John Howard William Summers Jr., Winsted, CT.

"Hazard Mitigation Assistance Mitigation Activity Chart". FEMA. Updated October 15, 2015. < https://www.fema.gov/hazard-mitigation-assistance-mitigation-activity-chart>

"High Hazard & Significant Hazard Dams in Connecticut", Connecticut Department of Energy & Environmental Protection, http://www.ct.gov/deep/cwp/view.asp?a=2720&q=394032&deepNav_GID=1625

"Historical Year-end Fire Statistics by State". National Interagency Coordination Center. http://www.nifc.gov/fireInfo/fireInfo_statistics.html. Accessed: July 1, 2015.

"History of Hartland." Stanley Ransom, editor. 1961.

"History of Harwinton." Raymond George Beastly. 1970.

"The Hundred Years-A History of Morris, CT 1859-1959." Laura Stoddard Weik. 1959.

"Litchfield Hills Council of Elected Officials Plan of Conservation and Development". Litchfield Hills Council of Elected Officials. 2009.

"Local Mitigation Planning Handbook". FEMA. March 2013.

"Local Multi-Hazard Mitigation Planning Guidance". FEMA. July 2008.

National Climatic Data Center. National Oceanic and Atmospheric Administration. http://www.ncdc.noaa.gov

"National Flood Insurance Program Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials". FEMA (FEMA 480). February 2005.

"A Natural Hazards Mitigation Plan". Connecticut River Estuary Planning Region, 2001.

"Norfolk, Connecticut, 1900-1975." Alice V. Waldecker, editor.

"Pre-disaster Mitigation Strategy Document, Connecticut's Southwestern Region", SWRPA, November 19, 2004 draft.

"Severe Weather 101". National Severe Storm Laboratory. http://www.nssl.noaa.gov/education/svrwx101/. Accessed: July 1, 2015.

Storm Events Database. National Climatic Data Center. http://www.ncdc.noaa.gov/stormevents/

Town Plans of Conservation and Development for 11 towns in Litchfield Hills Region (on file at LHCEO office, Goshen, CT).

Weston Observatory Earthquake Catalog, Earthquake Catalog for New England and Adjacent Regions (1638 - Jan 2014). Weston Observatory, Boston College. January 2014.

U.S. Census Bureau, Census 2000 Summary File 1. <http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>

U.S. Bureau of the Census, 2010 Census of Population and Housing, Profiles of General Demographic Characteristics. Updated every 10 years. http://factfinder2.census.gov.

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Front Cover “River” LHCEO (NHCOG) Photo

Page 1 “Morning view from the Wisdom House retreat center in Litchfield, CT.“ By Ian Beatty. https://www.flickr.com/photos/ibeatty/60510273/in/photolist-zARPe-6VsDfz-6VsDJn-6m8Az

Page 6 NewHartfordPlus.com “A flooded home on Litchfield Turnpike on Sunday, August 28, the day Hurricane Irene (downgraded to a Tropical Storm) passed through New Hartford.” By Maria Moore http://newhartfordplus.com/2011/09/08/fema-disaster-recovery-centers-open-in-every-county-in-state-gov-malloy-fema-reps-to-visit-new-hartford/

Page 19 Register Citizen. “CL&P crews are on site throughout Torrington with their first order of business to clear downed power lines and trees that have collapsed them, or are in danger of collapsing lines. This truck sat on Prospect Street this morning.” By Luther Turmelle POSTED: 10/30/11. http://www.middletownpress.com/general-news/20111030/clp-says-storm-damage-more-severe-than-irene

Page 22 Register Citizen. “Flooding on Main Street in Torrington” By Josh Cullen. POSTED 8/9/2013. http://www.registercitizen.com/general-news/20130809/more-than-5-inches-of-rain-soaks-torrington-several-streets-yards-flooded-photos

Page 38 Register Citizen. “Storm Damage repairs Continue in Torrington Area After Heavy Rain, Winds, Power Outages” By Rick Campbell. POSTED 6/26/2012. http://www.countytimes.com/articles/2012/06/26/news/doc4fe70cc645779187114984.txt

Page 42 NewhartfordPlus.com “Snowy Roadway in New Hartford” POSTED: 10/29/2011. http://newhartfordplus.com/2011/10/29/its-a-winter-wonderland-out-there/

Page 45 Norfolk Volunteer Fire Department. “9-09 Bruey Rd Burn 045” http://www.norfolkfire.org/?q=node/992

Page 53 Norfolk Volunteer Fire Department. “9-09 Bruey Rd Burn 027” http://www.norfolkfire.org/?q=node/981

Page 59 Register Citizen. “Firefighters work to pump water from a flooded section of grass behind Torrington’s Coe Memorial Park Civic Center on Aug. 28, 2013. By Tom Caprood POSTED: 8/28/2013. http://www.registercitizen.com/20130828/flash-flooding-in-torrington-damages-roads-floods-basements

Page 123 “2013 Winter Ploughing the streets“ [stet] https://www.flickr.com/photos/tattoodjay/11428371543

Page 195 “Impressive rainbow, sighted in Glastonbury, CT.” By Patrick https://www.flickr.com/photos/adwriter/14519112505/in/photolist-o81fiX-4Sz5tU