Killingworth, Connecticut
Natural Hazards
Mitigation Plan

Prepared for:
Killingworth Board of Selectmen

Adopted by:
Town of Killingworth, Connecticut
_____, 2013

Prepared by:
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On the Cover

Photo 1: **Road Washout on Route 80 after 1982 Flooding**
Source: Middletown Press

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i. ***Executive Summary***

The primary purpose of a Natural Hazard Mitigation Plan is to identify natural hazards and risks, existing capabilities, and activities that can be undertaken by a community to prevent loss of life and reduce property damages associated with identified hazards. The Disaster Mitigation Act of 2000 requires local communities to have a Federal Emergency Management Agency (FEMA)- approved mitigation plan in order to be eligible to receive Pre-Disaster Mitigation Program grants and Post-Disaster Hazard Mitigation Grant Program funds under the Hazard Mitigation Assistance program. This Plan was prepared by the Lower Connecticut River Valley Council of Governments (RiverCOG) in conjunction with the Town of Killingworth. It is an update of an NHMP first developed by the Connecticut River Estuary Regional Planning Agency (CRERPA) in 2006.

The town considers critical facilities to be those that serve the town on a day-to-day basis as well as during an emergency situation. The facilities include but are not limited to the Haddam- Killingworth Middle School (emergency shelter) , Town Hall, Resident State Trooper Office (location of EOC), Public Works Garage, Fire Department, Killingworth Elementary School, the two gas station in town and Killingworth Library. These critical facilities are necessary to support emergency response before, during, and after natural hazard events.

Transportation is essential in any major event. The town of Killingworth has a variety of transportation options. The town is served by three major arterials, Route 80, 81, and 148. Both Interstate 95 and Route 9 are within close proximity to Killingworth, although not located in the town itself. Smaller town roads act as collectors to bring people to larger roads. The town is also served by the Dial-A-Ride service of the 9 Town Transit District.

Situated in southern Connecticut the town of Killingworth is particularly susceptible to certain natural hazards. Residents are particularly susceptible to any natural hazard which may cause the loss of power. Without centralized water and sewer systems throughout town, resident are wholly reliant on private wells and septic system. In the winter months a lack of power can mean a loss of heat. Hurricanes, high wind events, and in some cases, winter storms can pose a significant threat.

This plan details natural hazards present in the town and steps that the town can take to mitigate long lasting effects from each hazard type. The Comprehensive Mitigation Action Item list is provided in Section III: Mitigation. This table includes the item, project status, the party responsible for carrying out the action item, and other pertinent information. The most prominent hazard in any of the towns within the region is flooding, and significant discussion is devoted to how best to mitigate flooding events. Other hazards discussed include dam failure, high winds and tornadoes, hurricanes and tropical storms, extreme heat, and drought and wildfire. Each hazard type has a list of mitigation action items that the town could implement, some being a higher priority than others. For each of the hazard types presented in the plan, historic events are presented along with the probability of that event occurring again. The town's specific impacts from each event are also noted.

The overall goal of this Natural Hazard Mitigation Plan is: *Reduction of elimination of injury to or loss of life and property and natural environments and the associated economic impacts form natural hazards.*

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I. PLANNING PROCESS

A. **Authority** (ELEMENT C)

Federal: The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288), as amended by the Disaster Mitigation Act of 2000, provides the legal basis for State, local, and Indian Tribal governments to undertake a risk-based approach to reducing risks from natural hazards through mitigation planning. *The Federal Emergency Management Agency (FEMA) coordinates mitigation planning nationwide and provides funding for State-level natural hazard mitigation planning.*

State: FEMA requires State, Indian Tribal, and local governments to develop hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance, including funding for mitigation projects. The requirements and procedures for State, Tribal and Local Mitigation Plans are found in the Code of Federal Regulations (CFR) at Title 44, Chapter 1, Part 201 (44 CFR Part 201). *The State of Connecticut Department of Energy & Environmental Protection (DEEP) administers the federal funds by providing grants and technical assistance to the regional planning organizations (RPOs) to write the hazard mitigation plans for each regional planning area and the municipalities within each.*

Region: The Connecticut General Statutes (§8-35a.(d)) require the regional planning organization to assist the municipalities within its region in developing and carrying out any plans of regional importance. *The Lower Connecticut River Valley Council of Governments (RiverCOG) intends that this town-specific plan standalone so that the Town may adopt it, or supplement to its local Plan of Conservation & Development (POCD).*

Municipal: The Connecticut General Assembly delegates certain powers of the state to its municipal subdivisions (city, town, borough, or special district), specifically that a municipality has the authorities in finance, public safety, and health that are necessary to effectuate the goals of this Plan (CGS §7-148).

B. **Purpose & Benefits**

Killingworth is one of seventeen towns served by the Lower Connecticut River Valley Council of Governments (RiverCOG). RiverCOG is the regional planning agency for an area covering all of Middlesex County and the towns of Lyme and Old Lyme in New London County. The Natural Hazard Mitigation Plan (NHMP) for the town of Killingworth is one of nine individual plan updates being developed by RiverCOG for the nine southern towns within the region (former CRERPA region). A multijurisdictional plan is also being prepared for the eight towns in the northern part of the region (former Midstate Planning Region). The Natural Hazard Mitigation Plan provides the region and its towns with information about natural hazards, including hazards specific to each town, past

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occurrences, chance for reoccurrence, and potential impacts. RiverCOG works with each town to update its natural hazard mitigation plan every five years and to continually implement the recommended actions.

RiverCOG and its communities prepare and periodically update the NHMP for two reasons: first, to keep abreast of changes to the physical environment, social fabric, or demographic composition of its people, as well as changes due to ongoing efforts undertaken to mitigate the effects of natural hazards; second, to remain eligible for Federal funds for ongoing and future mitigation actions.

The purpose of the NHMP is to:

- identify natural hazards that could occur and the geographic areas most likely to be affected by the occurrence of those natural hazards;
- assess threats from the occurrence of those natural hazards to natural resources, public infrastructure, private property and people;
- review existing actions and capabilities of and among the region(s) and its towns to mitigate threats from occurrence of those natural hazards;
- recommend additional actions to further prevent loss of life and reduce property damages associated with the occurrence of natural hazards; and
- update plans to remain eligible at the time a community applies for <u>and</u> when the Federal/State agencies award funds for hazard mitigation actions.

The benefits of an up-to-date hazard mitigation plan include:

- Home and business owners can make better decisions about protecting their properties.
- Planners and local officials better understand the risks of natural hazards and may improve local planning.
- Builders and developers have access to more accurate information for making decisions on where and how to build.
- Emergency management can use this information to better prepare for response made by police, fire, public health, and town officials, as well as organize efforts as a part of the cycle of recovery from occurrences of natural hazards.

C. **Plan Development** (ELEMENT A & D)

1. **Funding & Technical Assistance**

FEMA Region 1 provided guidance to the Lower Connecticut River Valley Council of Governments (RiverCOG) in following federal guidelines for natural hazard planning, particularly subsequent to Hurricane Irene and Snowstorm Alfred in September and October of 2011 and Hurricane Sandy in October 2012, respectively.

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The Connecticut Department of Energy & Environmental Protection (DEEP) awarded a Hazard Mitigation Assistance (HMA) grant to the Lower Connecticut River Valley Council of Governments (RiverCOG) to update the individual town NHMP's, which were first created in 2006. Under this grant overseen by Torrance Downes, Jeremy DeCarli, Regional Planner, prepared this update to the original 2005 Plan and Dan Bourret, GIS Specialist, prepared the HAZUS-MH Report for the town of Killingworth. Cathy Iino, First Selectwoman of Killingworth was also instrumental in the creation of this plan.

2. **Preparation** (A.1 & D.2)

The process began when RiverCOG staff met with the First Selectman of Killingworth to discuss how best to begin the plan update. The 2005 plan was assessed, and mitigation measures taken since that time were noted. The 2010 US Census and Connecticut Economic Resource Center (CERC) data in order to understand the changes that have occurred in the town since the last iteration of the plan.

RiverCOG staff solicited input from local officials about ongoing implementation and maintenance of the plan, information about recent experiences, adequacy of recommended infrastructure improvements, and the need for additional and ongoing in-house expertise. A Technical Advisory Committee mad of local officials was assembled including Catherine Iino, First Selectman; Walter Adametz, Public Works Official; Richard Bauer, Fire Company Chief, Richard Leighton, Building Official, Catherine Jefferson, Zoning Enforcement Officer; and Terence Dinnean, Assessor, and Donald McDougal, Emergency Management Director.

Officials from surrounding towns were also encouraged to contribute input about what effects mitigation efforts in Killingworth may have in other towns. As RiverCOG develops the nine individual plans, each town is aware of the plans being developed in its neighboring towns and the effects that may be had between neighboring communities. RiverCOG, as the entity developing the plan, encourages a regional approach.

3. **Agency Comment** (A.2)

The Lower Connecticut River Valley Council of Governments has prepared this Natural Hazard Mitigation Plan in synch with federal and state guidelines. It is one of nine stand-alone town plans being updated for towns in the former Connecticut River Estuary Planning Region. The Connecticut River Estuary Regional Planning Agency (CRERPA) created the first Natural Hazard Mitigation Plans for the towns in the region in 2005, the first such plans in the State. The agency recently merged with the Midstate Regional Planning Agency (MRPA) to form the Lower Connecticut River Valley Council of Governments (RiverCOG), a

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seventeen- town region covering all of Middlesex County as well as Lyme and Old Lyme in the southwestern part of New London County. This update process is currently being carried out for the nine towns of the former estuary region. A review will be made at the next update of how to best serve all seventeen towns of RiverCOG.

The purpose of a hazard mitigation plan is for communities to identify the natural hazards that affect them, to identify actions and activities to reduce any losses from those hazards, and to establish a coordinated process to implement the plan, taking advantage of a wide range of resources (44 CFR 201.1(a)). In keeping with this broader intent, local governments are required to prepare and adopt a hazard mitigation plan as a condition of receiving project grant funds under FEMA's hazard mitigation assistance programs such as the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) program (44 CFR §201.6(a)(1)).

FEMA's approval of a mitigation plan does not mean FEMA has approved funding for projects identified in the plan or approved an application for Federal assistance. An application for Federal assistance must be submitted to FEMA to be considered for funding and must meet the application requirements for the assistance program as described in the Catalog of Federal Domestic Assistance (www.cfda.gov).

Once a mitigation plan is approved, it is the community's decision to implement specific mitigation strategies or projects. As plans are updated every five years, the local government is required to document progress in local mitigation efforts; however, lack of resources, changes in priorities, community capacity to implement actions, or other concerns may limit a community's ability to implement actions. As described at 44 CFR 201.6, "The local mitigation plan is the representation of the jurisdiction's commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. Local plans will also serve as the basis for the State to provide technical assistance and to prioritize project funding."

Maps contained in this Plan are for planning purposes only.

4. **Public Involvement** (A.1, A.2 & A.3)

Following completion of the first Draft Plan, the Plan was made available on the Killingworth Town Website and RiverCOG website for public access. Paper copies of the Plan were available at Town Hall and Killingworth Library as well as upon request from either the Town of Killingworth or RiverCOG. The public was asked for input. A survey was created using Survey Monkey to engage the public, gauge their reactions, and garner input from town residents.

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A notice about the draft Plan and the survey was sent via email to various groups throughout town, including the members of all Boards and Commissions, and the neighborhood association at the Jensen's Beechwood Community as well as to officials in neighboring towns. The Plan and a link to the survey was provided on the Killingworth Town Website (www.townofkillingworth.com) and on the RiverCOG website (www.rivercog.org). A press release was posted in several news sources (Killingworth Today, The Haddams-Killingworth Patch, Killingworth Krier) to encourage residents to read the Plan and comment using the survey. See **Appendix VII** for screen shots and photos of the announcements.

As stated a Public Opinion Survey was created and announced to all Town Residents. The survey was open and available from 9/1/2013 to 10/22/2013 to residents, business owners, and officials from neighboring towns. The survey included questions about the specific mitigation actions, recent storms, and future concern over various natural hazards. The survey also allowed respondents to leave comments, which could include anything from new Only 24 residents responded. Responses were used throughout the Plan such as the addition of action items and the inclusion of flood prone areas. Comments will be used in the future as the Town pursues the mitigation projects in this Plan. See **Appendix VIII** for the survey questions and responses received.

In addition, First Selectman Cathy Iino attended a community meeting at the Jensen's Beechwood Community to explain the Plan, provide a paper copy for residents to read and provide paper copies of the survey for those that may not have computer/internet access.

Finally, a discussion of the Plan was included in a Town Meeting held on Wednesday, December 18 at the Killingworth Elementary School. See **Appendix VI** for the Agenda and Minutes.

5. **Incorporation of Existing Resource Materials** (A.4 & D.)

The plan update process began with a review the 2006 Plan. The current data was surveyed and analyzed regarding the environment and ecological resources, geography and land uses, demographics and critical facilities, as well as economic and cultural resources. From this information, elements of the original 2006 plan were incorporated. Information from the 2008 Plan of Conservation and Development, Killingworth Zoning Regulations, and Killingworth Subdivision Regulations were also incorporated into this plan update.

D. **Plan Adoption** (ELEMENT E)

The Town Meeting, as the "governing" body of the town [CFR § 201.6(c)(5)], officially adopted the Plan at a regular meeting on DATE.

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E. **Plan Implementation** (ELEMENT D)

The Plan prioritizes specific actions that could reduce the long-term likelihood of damage from natural disasters. Municipal improvements include rights-of-way, land, housing, or utilities for public purposes; programs include outreach, stewardship, and services; standards include road specifications, zoning regulations, fire/building code, and the local flood ordinance. Recommendations that require regional or inter-town cooperation are included in Figure 16, Natural Hazards Mitigation Action Items. See Section III **MITIGATION** (ELEMENT C).

1. **Priorities**

This Plan suggests assignments of priority for implementation. Those agencies and officials to whom the Plan assigns responsibility will fine-tune these priorities based on availability of resources.

2. **Responsibilities**

The Plan specifies those agencies and officials responsible for implementing the prescribed actions. The Town will track progress to ensure consistent and on-going implementation, as well as to update the Plan more readily.

3. **Resources** (C.6)

The town will use the plan as a guideline in allocating available resources, and it will maintain the Plan through regular updates (every 5 years). Officials/agencies identified as having responsibility for specified actions need to establish and maintain operating or capital budget plans that implementation (and continual maintenance).

These budgets are necessary to leverage opportunities for Federal and State grants, which typically require a “match” in funding commitment (funds and in-kind services). All of the grants described below require an approved Natural Hazards Mitigation Plan at the time of application and must have an approved plan at time of award.

The following sources of external funding are available to the region and its towns on a limited and often competitive basis:

a. **Hazard Mitigation Grant Program (HMGP)**

The HMGP provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate

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recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. This grant is administered by the Connecticut Department of Emergency Services and Public Protection (DESPP), Division of Emergency Management and Homeland Security (DEMHS).

b. **Flood Mitigation Assistance (FMA)**

The National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) created the FMA program with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP).

FEMA provides FMA funds to help states and communities implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured under the National Flood Insurance Program. This grant is administered by the Connecticut Department of Energy and Environmental Protection (DEEP).
Three types of FMA grants are available to states, regions and towns:

- **Planning Grants** to prepare Flood Mitigation Plans. Only NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project grant

- **Project Grants** to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures. States are encouraged to prioritize FMA funds for applications that include repetitive loss properties; these include structures with 2 or more losses each with a claim of at least $1,000 within any ten-year period since 1978.

- **Management Cost Grants** for the State to help administer the FMA program and actions. Up to ten percent (10%) of Project grants may be awarded to states for Management Cost Grants.

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c. **Pre-Disaster Mitigation Grant (PDM)**

The PDM program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds. This grant is administered by both the Connecticut Department of Energy and Environmental Protection (DEEP) and the Connecticut Department of Emergency Services and Public Protection (DESPP).

F. **Plan Maintenance** (ELEMENT A)

1. **Maintenance Method** (A.5)

The Board of Selectmen will monitor and evaluate progress in addressing action items in this Plan and include those accomplishments in its annual report to the Town. The Town posts its Annual Report on the Town website to inform and update the citizenry as a part of required ongoing citizen participation in implementation.

In order to evaluate progress made each year, responsible parties (First Selectman, Planning & Zoning Commission, and Public Works Department) will:

Conduct Reviews for Specific Mitigation Actions

Reviews will occur annually during the first quarter of each fiscal year (July-September). These reviews will ensure that action items in the NHMP remain a priority for the town. Reviews will also determine what projects are in progress, remain on schedule, have been completed, or have yet to be completed. The review will be carried out by Town officials responsible for their progress.

Annual Report

Each year, the Killingworth Board of Finance prepares an annual report, and the Town of Killingworth votes on acceptance of the report at a Town Meeting. The Annual Report is then published electronically and on paper. The report will include a description of progress made on mitigation action items within the preceding year, based on information gathered from the reviews and reports completed by designated town officials. The Annual

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Report is available on the town website, in the Town Clerk's Office, and at the town library.

Continued Public Involvement

Continued public involvement will be sought in the monitoring, evaluating, and updating of the NHMP. Public input will be solicited through appropriate measures such as meeting notices, information on the town website, and other methods deemed appropriate at the time. Direct input from the small number of homeowners in flood zones is expected to continue each year.

2. **Maintenance and Update Schedule** (A.6)

At a minimum, the Town will update the Plan every five years; it will do so sooner if conditions warrant. The following table shows a timeline for continuing action of the current plan and the beginning of the next update. Public input will be solicited upon commencing the Plan update process and will continue throughout the update process. Meetings will be open to the public allowing for public comment, and informational meetings and public opinion surveys will be used. This schedule may be updated as necessary.

The Town will be responsible for updating the Plan unless at which time it is decided that the RiverCOG will again administer the Plan update.

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Progress and Update Schedule	FY 2014				FY 2015				FY 2016				FY 2017				FY 2018			
	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q
Action Item Review					X				X				X				X			
Report on Action Items Status to Town					X				X				X				X			
Publish Annual Report	X				X				X				X				X			
Budget Action Items Based on Review						X				X				X				X		
Plan Update Committee Formation													X							
Begin Full Plan Review														X						
Begin 5 Year Update Process																X				
Completion of 5 Year Plan update (Submission to DEEP and FEMA and Adoption by Town)																		X	X	

Figure 1: **Plan Maintenance and Update Process** Schedule
Quarters are based on Fiscal Years which begin July 1 and end June 30.

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Lovers Lane
Flood Conditions

Photo 2: **Lovers Lane** Closed Due to Flooding
Source: Eastern Connecticut Environmental Review Team

II. **RISK ASSESSMENT** & **HAZARD IDENTIFICATION** (ELEMENTS B & D)

The 2005 Natural Hazard Mitigation Plan (NHMP) identified a number of natural hazards that could affect the town of Killingworth, including flooding, high winds and tornado, drought and wildfire, winter storm, earthquake, and hurricanes. This section acknowledges changes in local development since 2006 and their effects on natural hazard mitigation. Below are two tables that provide an overview of the hazards discussed in this section.

A. **The Town & the Vulnerability of its Resources** (ELEMENT B)

Given Killingworth's topography, location, and land use patterns, specific areas of the town are most vulnerable to flooding, hurricane, and high winds.

1. **Geography & Land Use Patterns**

Killingworth is located in the southwestern section of the region, bounded on the east by Chester and Deep River, to the south by Clinton, to the north by Durham and Haddam, and to the west by Madison (See Map 1). The total area in Killingworth is 36.0 square miles, of which 35.4 square miles is land area. It is one of only three towns in the region without a coastal area fronting either the Long Island Sound or the Connecticut River. Less than 2% of total town area is occupied by water bodies. Larger open water areas include the Killingworth Reservoir and a portion of the Hammonasett Reservoir. Killingworth historically has been a rural community without much industry or commerce. The town dates from 1663 and developed as a farming community with some industry in the form of water-powered mills. Today, Killingworth is primarily rural and, to a lesser degree, ex-urban in character.

According to the town's assessor, about 54% of the town's land area is currently occupied by residential uses. Approximately 2% of the land is occupied by commercial and industrial uses, while about 4% of land in Killingworth is vacant. The remaining 40% is designated open space including State forests and parks, Town owned lands, Land Trust land, and water company land. These numbers are approximate.

Killingworth has about 50 acres in commercial use and about 55 acres in industrial use. Institutional uses occupy about 6% of the land area, or 1,401 acres. Transportation uses occupy 2.2% of the land area, or 499 acres. The topography of Killingworth ranges from gently rolling terrain in the valleys to steep hilly terrain in several upland areas. The land area of Killingworth consists of mainly soil developed on well drained, glacial, stratified drift in the valleys and glacial till and bedrock in the uplands.

Killingworth is drained by three river basins running directly into Long Island Sound. Most of the town lies within the Hammonasset River Basin.

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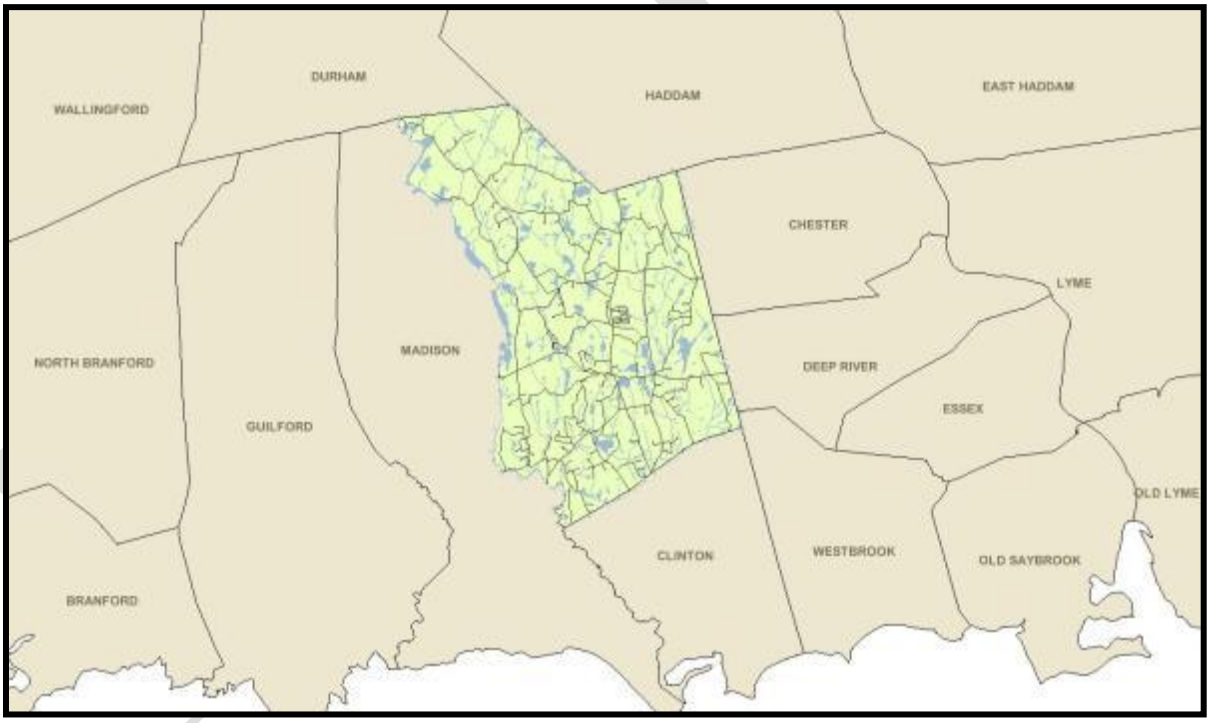
The eastern portion of town lies in the Menunketesuck River Basin. A smaller area between these two in the southern portion of town lies within the Indian River Basin. The largest surface-water bodies are reservoirs resulting from the construction of dams. The Hammonasset Reservoir (South Central Connecticut Regional Water Authority) lies in the Hammonasset River Basin and has a surface area of 377 acres and a total storage capacity of 1400 M gallons. This reservoir straddles the border of Madison and Killingworth. The Killingworth Reservoir (Connecticut Water Company) lies in the Menunketesuck River Basin and has a surface area of 107 acres and total storage capacity of 415 M gallons, increased from 254 M gallons as a result of raising the dam elevation. Deer Lake and Forster's Ponds are formed by dams along streams running into the Hammonasset River. Almost two-thirds of the Town's area lies within the watersheds of the two public water suppliers.

Killingworth and Surrounding Towns



Map 1: **Killingworth** with surrounding towns**.**
Source: Killingworth GIS

2. Demographics & Critical Facilities

The 2010 Census reported a town population of 6,525 people, which represents an 8.4% increase over the 2000 population of 6,018 people. This is in sharp contrast to the previous decade, 1990 – 2000, when the town population increased 25%. Stagnation of population growth allows the Town to focus on other factors in natural hazard mitigation's effects on population, such as its distribution and make-up.

Some 24% of the total population is under the age of 18 and 16% of the town population is over age 65. Beechwood by Jensen's is a manufactured home complex with 300 units, occupied only by people age 55 and up. At the 2010 census, there were a total of 521 households with residents over the age of 65, many of which are located at Beechwood by Jensen's. Also at the 2010 census there were a total of 877 households with children under the age of 18. Age-related dispositions and disabilities are a specific factor for the Town to take into account in mitigating the effects of natural hazards.

According to the 2000 census, **11.2% of the total population has a disability**. The distribution by age of these disabilities is:

disability	**age 5-15**	**age 16-64**	**age 65+**	
sensory	22	28	50	
physical	0	97	121	
mental	16	80	47	
self-care	0	11	9	
go outside house		31	65	
limited employment		152		
totals	38	399	292	**729 persons**

Figure 2: **Population of Persons with Disabilities**

This information is now tallied by the American Community Survey every five years. Specific town information is not yet available from the 2011 ACS.

The U.S. Census Bureau defines disabilities as the following:

- **Sensory Disability** Conditions that include blindness, deafness, or a severe vision or hearing impairment.
- **Physical Disability** Conditions that substantially limit one or more basic physical activities such as walking, climbing stairs, reaching, lifting, or carrying.
- **Mental Disability** Because of a physical, mental, or emotional condition lasting 6 months or more, the person has difficulty learning, remembering or concentrating.

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- **Self-care Disability** Because of a physical, mental, or emotional condition lasting 6 months or more, the person has difficulty dressing, bathing, or getting around inside the home.
- **Go-outside-home Disability** Because of a physical, mental, or emotional condition lasting 6 months or more, the person has difficulty going outside the home alone to shop or visit a doctor's office.
- **Employment Disability** Because of a physical, mental, or emotional condition lasting 6 months or more, the person has difficulty working at a job or business.

According to the 2010 census, 511 or 8.3% of Killingworth's 2010 population was characterized as non-English speaking. The largest percentage 3.6%, speak Indo-European languages, the languages of Europe to southwest Asia. Next most common was Spanish or Creole spoken by 3.2% of the population. Such a small population with a lack of concentration in one specific language makes it difficult to provide printed educational materials about the potential natural hazards in languages other than English or to be able to anticipate those languages for which the Town might provide translators at public meetings or at evacuation centers during natural disasters.

The 2010 U.S. Census tallied 2,598 residences, 124 of which were vacant at the time of the census. Of those 2,598 housing units, a total of 2,028 (84%) residences are "owner-occupied", leaving 446 structures that may or may not have tenants during all or portions of the year. Tenants may be omitted inadvertently from ongoing education about natural hazards or may be difficult to contact through typical Town resources to warn of pending natural events.

In Killingworth, structures or facilities that can produce, use, or store highly volatile, flammable, explosive, toxic or water-reactive materials are few and may only exist primarily in the commercial and industrial areas located along the southern portion of Route 81 and the eastern portion of Route 80. Currently only one of these types of facilities exists. AmeriGas has a propane distribution center just west of the Killingworth circle. In addition, just south of AmeriGas, the Killingworth True Value has a large propane tank for re-filling of household gas grill propane tanks. These locations are outside the flood hazard zone. In addition, on the eastern edge of town, APC Recycling has a facility for the recycling of plastics. This property is not in a flood zone; however, there is a small pond on the eastern edge of the property, which could become inundated in an extreme weather event.

There are no hospitals or nursing homes in Killingworth. However, there is a sizable retirement community with 300 units. Beechwood by Jensen's is designated for people 55 years of age and over. It is centrally located in town along Route 81 and is made up of manufactured homes. The area does not lie within the 100 year flood zone; however, there is a small

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stream and pond on the eastern edge of the property with a flood zone surrounding it. These homes are likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a natural disaster.

The fire station, public works vehicle and equipment storage facilities, and Killingworth Ambulance Association are centrally located along Route 81 just north of the Killingworth Circle and are not within a flood zone. The Emergency Operations Center is located at the southwest corner of the Killingworth Circle (intersection of Route 80 and 81) at the office of the Resident State Trooper, near, but not in a flood hazard zone. In October of 2012, the town received a grant in order to fund the construction of a new EOC as part of the town campus which also includes the town hall, Ambulance House and Fire Station, north of the circle along Route 81. This new location will not only move the EOC away from a flood zone, but will provide it with better vehicular access. As Killingworth is one of the towns in the region least likely to receive significant damage from natural hazards, towns to the south which would be significantly affected by a major hurricane or significant event affecting Long Island Sound, may need to rely on the Killingworth EOC.

Killingworth uses many of its public buildings for minor natural hazard events such heat waves. The Town's principal shelter is the Haddam - Killingworth Middle School (HKMS), 451 Route 81; it is outside special flood hazard areas. This building also functions as a Red Cross regional shelter. It is equipped with backup generators in case of extended power outages. The Killingworth Elementary School (KES), 340 Route 81, can also be used as a shelter if needed. This facility also sits outside of flood zones and is equipped with a backup generator in case of a long-term power outage. The KES gymnasium is to be used as the first shelter in a high wind event owing to its lack of windows. However, space is limited. If the KES gymnasium becomes full during such an event, the central hallway at the HKMS can be used as well.

Public and private utility facilities, which are vital to maintaining or restoring normal services to areas of town before, during, and after a natural disaster, were not inventoried extensively. Killingworth has two gas stations, both located along Route 81; they are accessible to most of the townspeople and businesses that may lose power and may seek gasoline to power emergency generators. One station is located at the southeast corner of the circle, directly opposite the EOC, while the other is located just north of the town hall on Route 81, north of the circle. However, during the 2011 Halloween Nor'easter and Tropical Storm Irene, residents of Killingworth were forced to leave town in order to find gasoline as neither of the gas stations had emergency generators in order to pump gas.

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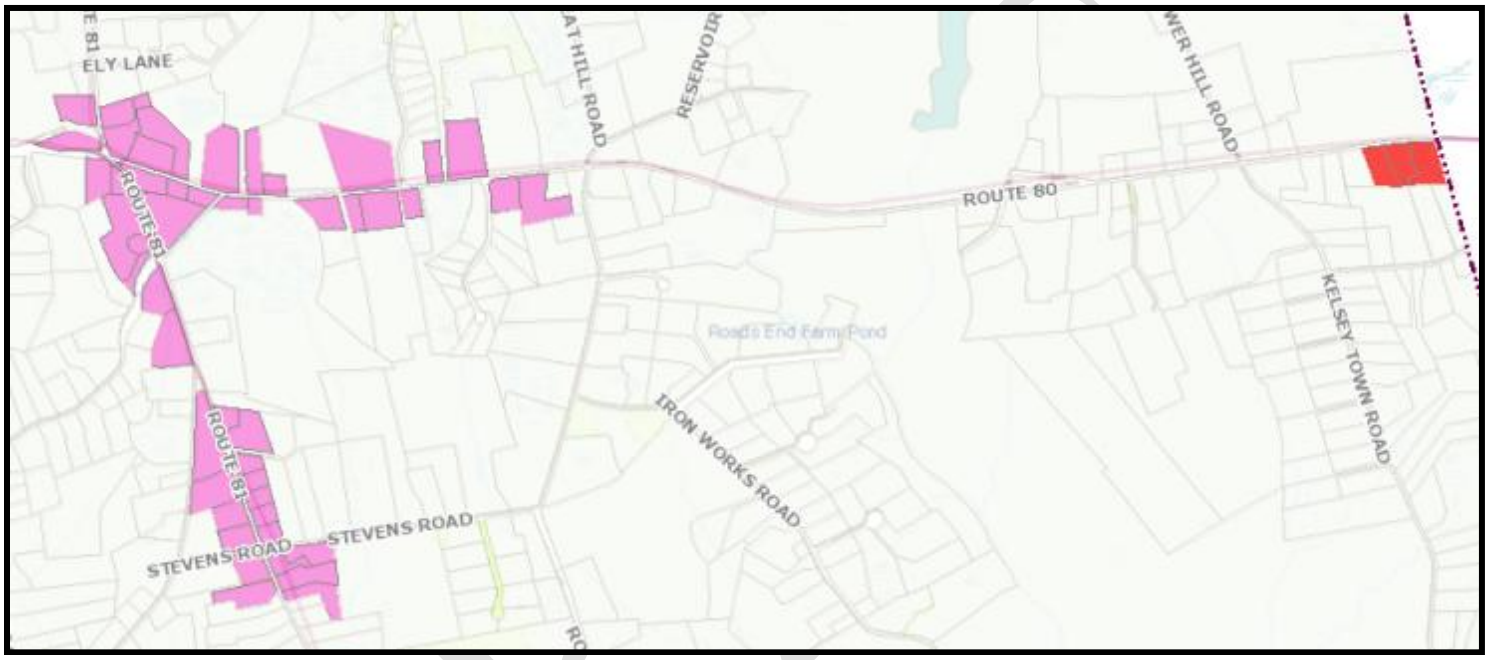
The True Value hardware store, located at the center of town, provides many supplies before and after emergencies, and provides propane for generators. This store does have back-up power generation.

Public and private utility facilities are subject to the same loss of power, potable water, communications, and accessibility as is the community they serve.

Business District Zoning

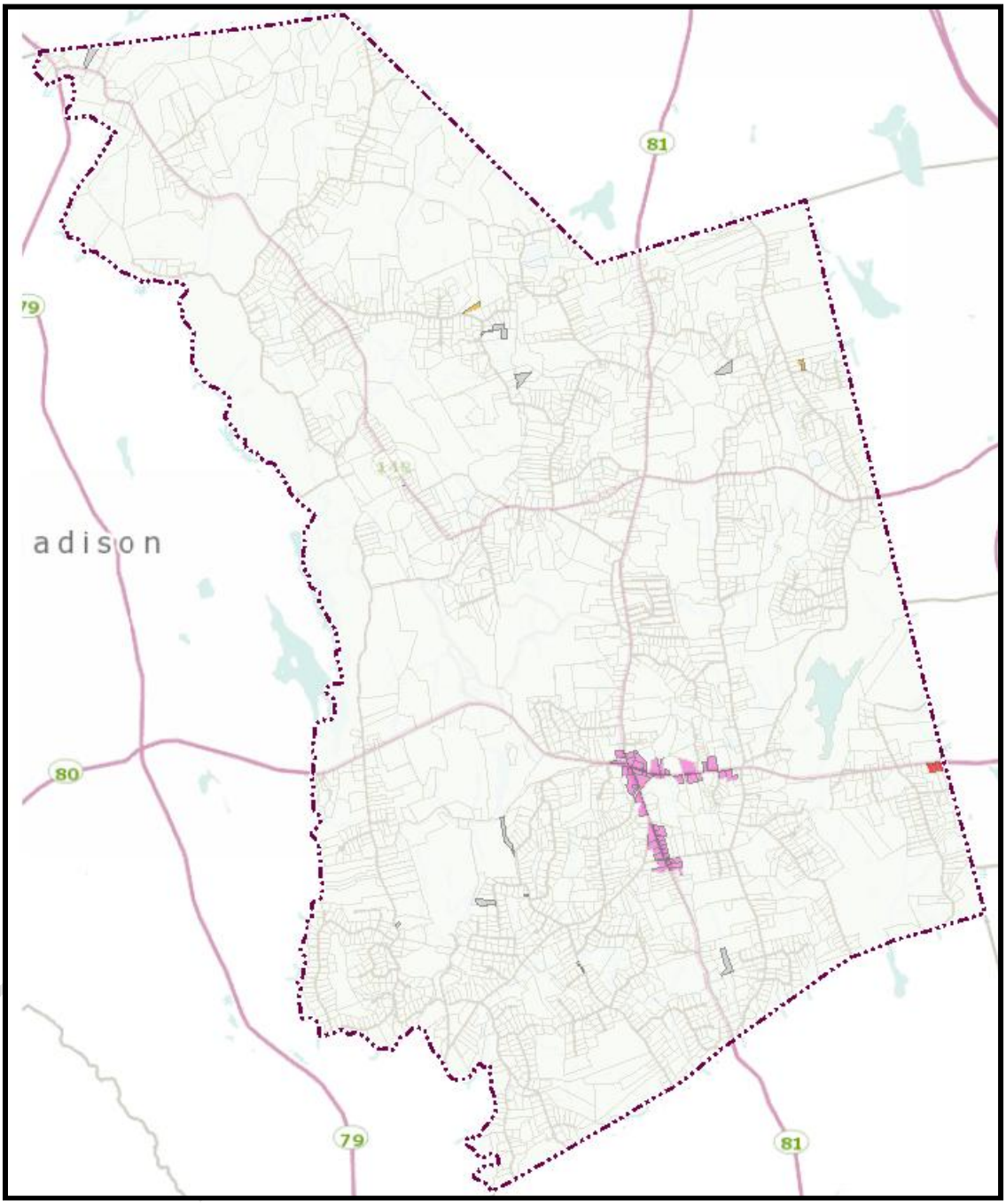


Map 2: **Commercial and Industrial Zones**
This map shows the commercial and industrial zones in Killingworth. The Circle at the intersection of Routes 80 and 81 is at the top left corner of the map.

- Industrial Zone
- Commercial, Large Business Zone
- R-2

Source: Killingworth GIS

Killingworth Zoning Districts

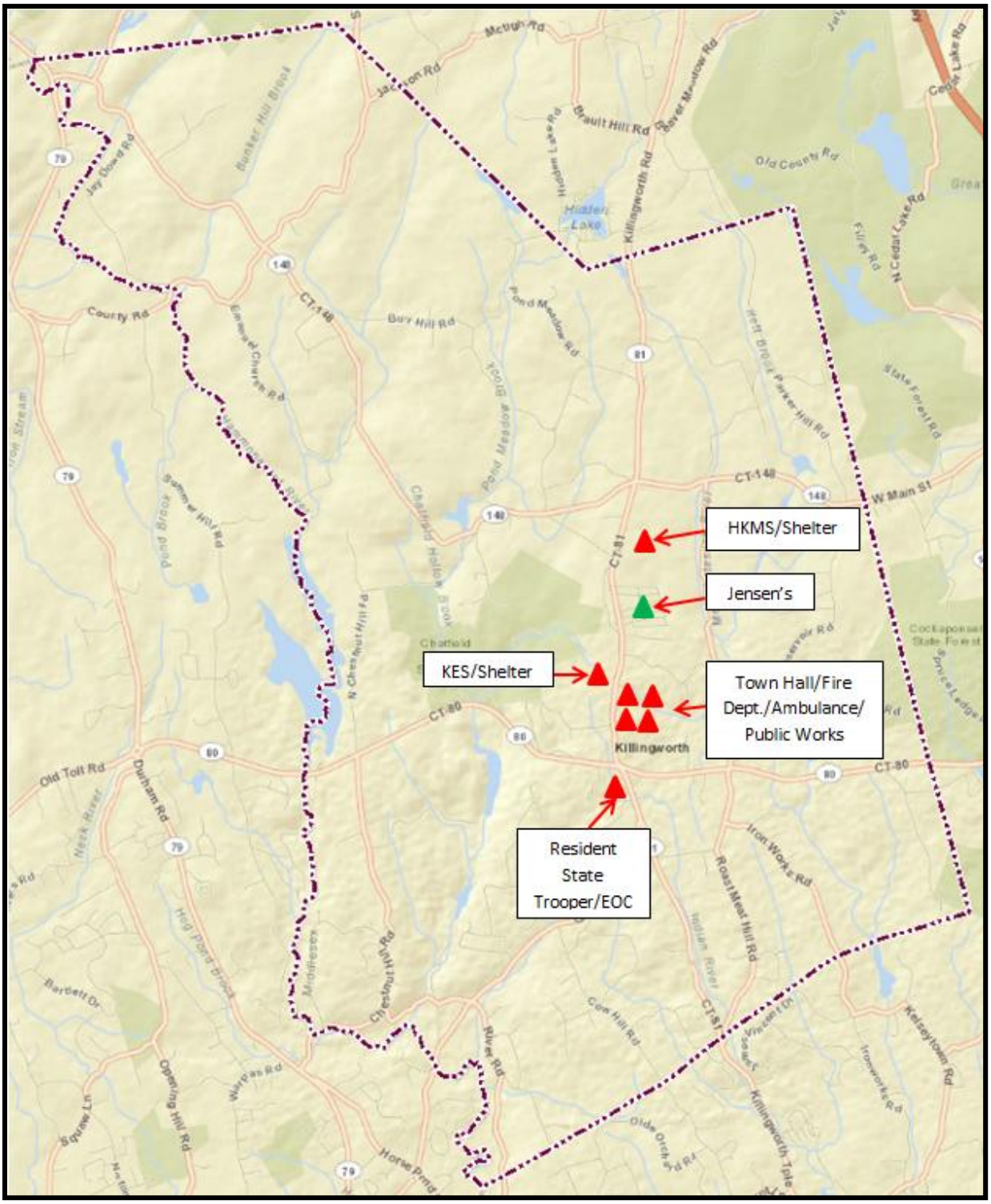


Map 3: **Zoning Districts**

- Industrial Zone
- Commercial, Large Business Zone
- R-2
- R-1

Source: Killingworth GIS

Critical Facilities



Map 4: **Critical Facilities**
This Map depicts critical facilities throughout Killingworth including shelters, town facilities and the Jensen's over-55 mobile home park.
Source: Killingworth GIS

3. **Economics & Cultural Resources**

The primary business and industry sectors in Killingworth are as follows:

2005 sector	% of total establishments	% of total employment
services	39.4%	45.1%
Const. and mining	19.9%	14.5%
trade	18.1%	21.7%
agriculture	10.5%	7.3%
finance, ins. & real estate	2.5%	2.6%
government	5.4%	3.0%
manufacturing	2.9%	4.8%
transportation & utilities	1.4%	1.0%
	100%	**100%**

Figure 3: **Economic Sectors** in Killingworth
Source: CERC Killingworth Town Profile, 2012

As might be true in any winter storm (and was demonstrated during Snowstorm Alfred in October 2011), the economic core of Killingworth is at threat due to downed utility lines that could result in loss of electrical and communications services. Killingworth was heavily affected by both Tropical Storm Irene and the unexpectedly severe Snowstorm Alfred in October 2011, which resulted in many closed businesses and week-long school closings (and subsequent extension of school year). Many of these same effects were again experienced by Killingworth following Hurricane Sandy in October 2012. Much of the town was without power for five days; however, power to the Route 81 corridor was restored within one day after the storm. The potential for services, the largest business sector, to be shut down for an extended period will affect the economic viability of the town, and a lag time due to damage assessment and insurance adjustments before the trade sector is employed to rebuild.

Residential uses collectively provide the majority of tax receipts in Killingworth. Fortunately, most of this use does not lie within a flood zone. Thus major flood damage would not likely produce major building loss. While there are numerous waterways and potential flooding, this is not the main damage threat in town. The largest threat comes from Killingworth's vast forest and the possibility of damage to homes and utility lines from downed trees and large limbs.

Designated open space is not a significant generator of tax revenue, but may serve as a buffer to absorb storm effects, thus protecting the value of nearby developed land. Killingworth has focused on preserving wetlands. Preserving open space in flood hazard areas protects against future development in these areas and thus the threat of damage. Therefore,

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vacant land may have potential to similarly provide protection of developed properties if set aside as open space.

4. The Environment and Ecological Resources

Killingworth is endowed with many ecological and environmental assets. Inland wetlands, ponds, lakes, cranberry bogs, and large tracts of uninterrupted forest are just a few of the blessings of nature bestowed upon the town.

Natural Diversity Area locations include State and Federally listed species and significant natural communities. Information on listed species is collected and compiled by the Natural Diversity Data Base (NDDB) from a number of data sources. Exact locations of species have been buffered to produce the general locations. Exact locations of species and communities occur somewhere in the shaded areas, not necessarily in the center (Source: CT DEEP).

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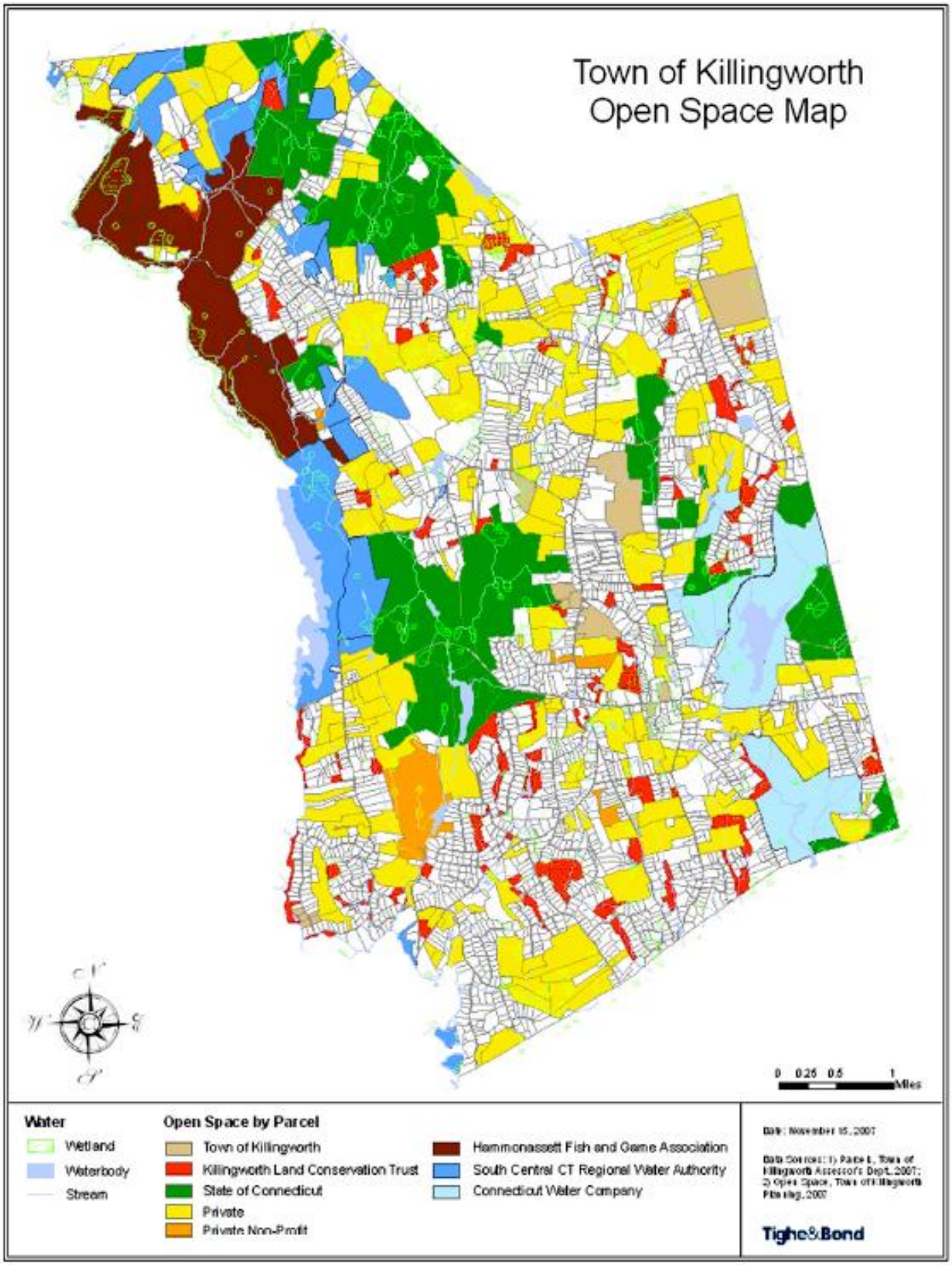
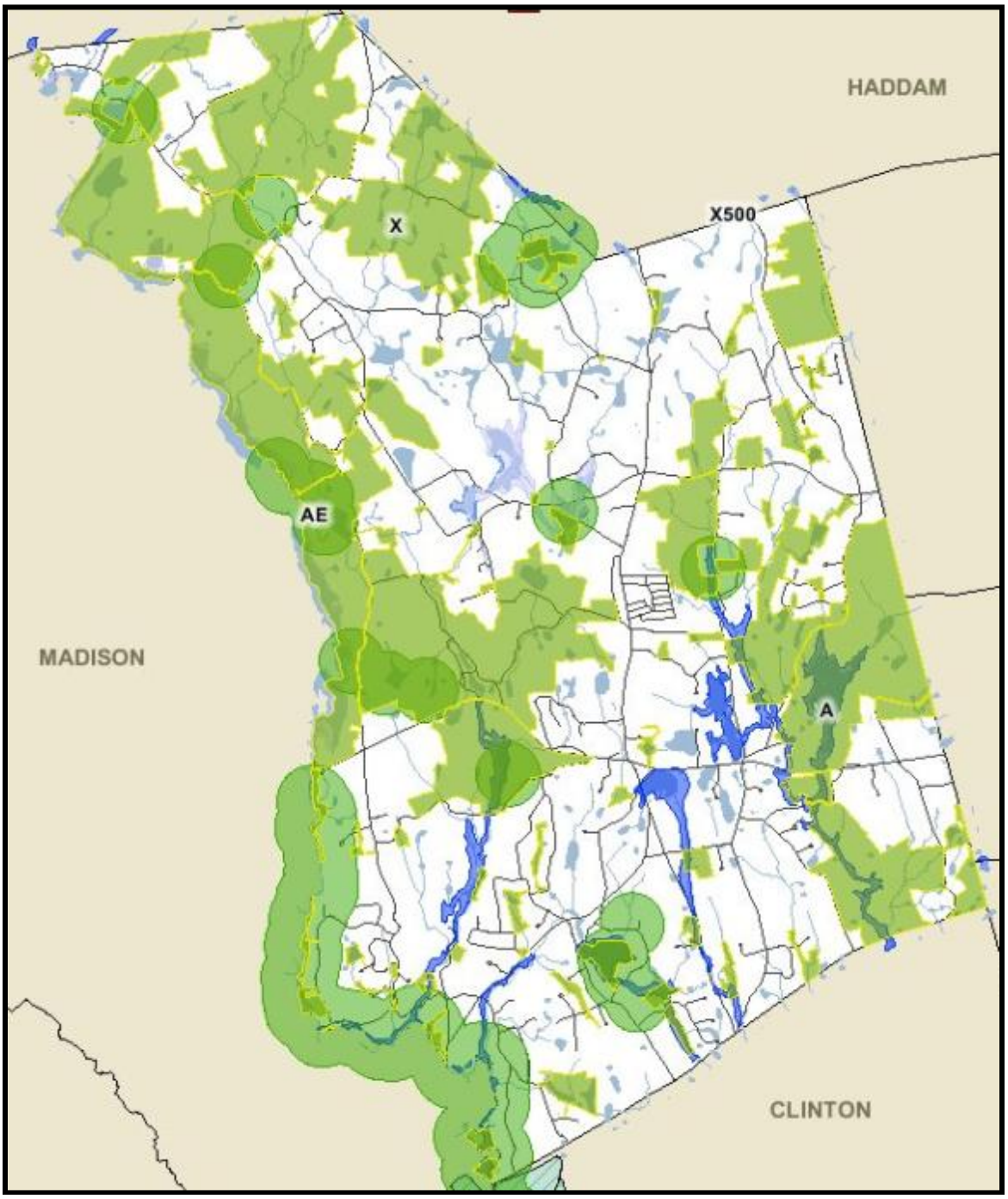


Map 5: **Open Space** Preserved and Private
Source: Killingworth POCD, 2008

Conservation and Open Space



Map 6: **Conservation and Open Space Areas** with Flood Zones

Open Space

Natural Diversity Area (Designated by CT DEEP)

Source: Killingworth GIS, DEEP

B. **Natural Hazards** (ELEMENT B)

This section describes natural hazards that could have an adverse effect on Killingworth and reasonable ways to mitigate those effects. Owing to its location and geography, Killingworth is susceptible to different events, and threatened in different ways, than many of its surrounding towns. Killingworth lacks a shoreline, making it safe from many major ocean and Long Island Sound events, but with its small streams and rivers it is susceptible to localized flooding after a heavy rain event. Other events, such as hurricanes, high wind events, large winter storms, and drought are potential threats to Killingworth residents and can have large impacts on the town and its infrastructure.

	Natural Hazard Type						
Natural Hazard Effects & Impacts	*Hurricane and Tropical Storm*	*Summer Storm*	*Winter Storm*	*High Wind and Tornado*	*Earthquake*	*Wildfire*	*Drought*
Building Damage (BD)	X	X	X	X	X	X	
Downed trees & branches (DT)	X	X	X	X			
Flooding – Dam Failure (DF)	X	X	X		X		
Flooding – Inland (FI)	X	X	X				
Fire (F)		X			X	X	X
High Wind (HW)	X	X	X	X			
Hail (H)		X					
Ice (I)			X				
Lightening (L)	X	X				X	
Power Failure (PF)	X	X	X	X	X	X	
Infrastructure Damage (ID)	X	X	X	X	X	X	
Snow (S)			X				

Figure 4: **Natural Hazard Effects & Impacts**
The categories of impacts that may be caused by different types of natural hazards.

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Natural Hazard Type	**Geographic Scope** 1 – localized 2 – large area 3 – town wide	**Frequency** 0 – extremely rare 1 – infrequent (< ten years) 2 – occasional (< annual) 3 – often (> annual)	**Predicted Damage Magnitude** 1 – Low 2 – Medium 3 – High
Hurricane and Tropical Storm	3	2	3
Summer Storm	1-3	3	2
Winter Storm	3	3	3
High Wind and Tornado	2	1	3
Earthquake	3	0	2
Wildfire	1	0-1	1
Drought	3	0-1	1
Flood	2	2	1

Figure 5: **Natural Hazard Scope, Frequency & Magnitude**

Natural hazard events can affect different parts of Killingworth, can range in occurrence from rare to often, and can cause varying degrees of damage. Figure 4 summarizes these differences among the types of natural hazards.

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Natural Hazards affecting the Lower Connecticut River Valley Region including Killingworth		
DATE	**NAME / TYPE**	**IMPACTS** (codes from Fig. 4)
March 1936	**Flood of 1936**	FI
September 1938	**Great New England Hurricane** (Cat. 1)	CE, BD, DT, FC, FI, FS,HW, PF, ID
September 1944	**Great Atlantic Hurricane** (Cat. 1)	CE, BD, DT, FC, FI, FS,HW, PF, ID
August 30, 1954	**Hurricane Carol** (Cat. 2)	CE, BD, DT, FC, FI, FS,HW, PF, ID
September 1960	**Hurricane Donna** (Cat. 1)	CE, BD, DT, FC, FI, FS,HW, PF, ID
March 2-5, 1960	snowstorm	S
February 2-5, 1961	snowstorm	S
January 1978	winter rainstorm	FI
February 1978	**Blizzard of '78**	BD, DT, HW, PF, ID
June 1982	rainstorm	FI
September 1985	**Hurricane Gloria** (Cat. 1)	CE, BD, DT, FC, FI, FS,HW, PF, ID
August 1991	**Hurricane Bob** (Cat. 1)	CE, BD, DT, FC, FI, FS,HW, PF, ID
October 1991	**Hurricane Grace** "The Perfect Storm"	CE, BD, DT, FC, FI, FS,HW, PF, ID
December 1992	nor'easter	S, HW, FC, FSS
March 12-14, 1993	snowstorm	S
January 6-8, 1996	snowstorm	S
July 1996	remnants of **Hurricane Bertha** (tropical storm)	CE, BD, DT, FC, FI, FS,HW, PF, ID
February 15-18, 2003	snowstorm	S
October 2005	remnants of **Hurricane Tammy**	CE, BD, DT, FC, FI, FS,HW, PF, ID
April 2007	nor'easter	HW, FC, FI
February 2011	**Winter Storm Ella** "Groundhog Day Blizzard"	S, HW
February 7, 2011	winter rainstorm	HW, FC, FI
August 2011	**Tropical Storm Irene**	CE, BD, DT, FC, FI, FS,HW, PF, ID
October 2011	**Snowstorm Alfred**	DT, PF, ID, S
October 2012	**Hurricane Sandy** (Cat.1)	CE, BD, DT, FC, FI, FS,HW, PF, ID
February 2013	**Blizzard**	S, HW, PF

Figure 6: **Natural Hazards Affecting the Lower Connecticut River Valley Region**

A chronological summary of various types of natural hazards that have caused significant damages in Killingworth and the surrounding region. The IMPACTS column summarizes the categories of damages (see Figure 4) from each storm.

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1. Flooding

A flood is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from overflow of inland or tidal waters; unusual and rapid accumulation or runoff of surface waters from any source; or mudflow. A flood can also be a collapse or subsidence of land along the shore of a lake or similar body of water because of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

a. **Geographic Extent** (B.1)

Killingworth is located on the primary transportation corridor of Route 80, which links the RiverCOG region with the City of New Haven. Flooding in Killingworth occurs in every season of the year. Spring floods are common and are caused by rainfall in combination with snowmelt. Floods in late summer and fall are usually the result of hurricanes or other storms moving northeast along the Atlantic coast. Winter floods result from occasional thaws, particularly in years of heavy snowfall. In some areas of town, roads are periodically closed, owing to flooding or winter storms and access becomes an important issue for residents. The severity of the floods depends on the type of rain event, duration, and ground conditions.

Killingworth has numerous small and large streams, ponds, and reservoirs. As evidenced from the damage in a 1982 flood event, flooding is an important hazard for mitigation planning within Killingworth. The Federal Emergency Management Agency (FEMA) has provided baseline information to identify areas within Killingworth that are vulnerable to flooding. In 2008, the Federal Emergency Management Agency (FEMA) updated the Flood Insurance Study for the Town. Pond Meadow Brook from Kroopa Dam to Schnoor Road, Lane District Brook from the confluence with Pond Meadow Brook to a point approximately 7,400 feet upstream, and the Hammonasset River between State Route 80 and Chestnut Hill Road were studied by detailed methods. Areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through 1985. Pond Meadow Stream and Lane District Brook are the major streams in the developed portion of Killingworth. Continuing economic development in the basins of those streams is expected and pressures leading to intensified flood plain use will undoubtedly accompany such development.

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b. **Occurrences** (B.2)

Major floods of the past 75 years occurred in Killingworth in March 1936, September 1938, August 1955, and March 2010. Of these, the flood of September 1938, which was caused by a hurricane, was by far the most severe. In 1982, damages to public property were all to roads, bridges, and culverts. In 1982, the State-owned bridge on Route 80 over the Menunketesuck River was completely washed out, as were two town bridges, on Birch Mill and Paper Mill Roads. The Bunnell Bridge over the Hammonasset River was also damaged.

Month	Year	Event
March	1936	Heavy Rain and melting snow caused major flooding throughout the Northeast and Middle Atlantic states
September	1938	Widespread 10 inch rainfall caused by a hurricane resulted in major flooding throughout the Connecticut River valley
August	1955	Hurricanes Connie and Diane came a week apart to batter most of New England with the most significant flooding recorded at many locations
March	1968	Heavy rain combined with snowmelt caused small river flooding in southeast New England
June	1972	Up to 16 inches of rainfall resulted in major flooding throughout Connecticut
June	1982	Heavy rains combined with snowmelt resulted in major flooding throughout New England
March	1987	Heavy rains combined with snowmelt resulted in major flooding throughout New England
March	2010	Heavy rainfall caused heavy localized flooding along smaller streams.

Figure 7: **Record Breaking Floods in CT since 1936**.
Source: NOAA

c. **Probability of Occurring Again** (B.2)

Floods are *a highly likely* hazard in Killingworth. In particular, snowy winters and rainy springs bring a high chance of a flood threat. The topography of Killingworth causes water to drain from hills to the low-lying areas where it collects and flows through streams. Streams and rivers in Killingworth can experience flash flooding from short, heavy rainstorms. The flood in 1982 was caused by a storm that dumped approximately 12 inches of rain over the region within just twenty-four hours. Flood plains along many of the inland streams and rivers throughout Killingworth are small, and thus the water level can rise quickly. With the large number of small streams and ponds, localized flooding is likely in Killingworth.

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d. **Potential Impacts** (B.3)

Within Killingworth, there are 154 properties within flood zones, only 14 or which are completely undeveloped. This includes 3 commercial properties and 1 industrial property. Many of these properties lie along the Indian and Hammonasset Rivers.

Several local roads are susceptible to closure if flooding becomes severe. Lovers Lane is closed annually due to flooding as it runs through a large, low-lying swamp. Water from the surrounding area drains to this swamp and Lovers Lane acts as a dam, raising the water level on the northern side of the swamp until the road is inundated. Development of housing units and paved surfaces upstream of this area will continue to make the flooding conditions worse as more water is directed into the swamp in the form of runoff. When Lovers Lane is closed to traffic, approximately 600 additional vehicles each day must travel through the Route 81/148 intersection and pass the entrance to the Haddam – Killingworth Middle School. Several portions of Route 80 east of the Killingworth Circle would also be affected by a 100-year flood. These locations have no easy bypass and major flooding would make access to the eastern portion of town more difficult. Other roads which experience flooding at times throughout the town include two different areas of Green Hill Road, Emanuel Church Road, Paper Mill Road, Roast Meat Hill Road between Route 148 and Route 80, Parker Hill Road, and Parker Hill Extension.

A HAZUS-MH: Flood Event Report was created using a 100-year probabilistic flood scenario. This report generates estimates on buildings and infrastructure throughout Killingworth. The report estimates that at least four (4) buildings in Killingworth will be at least moderately damaged during a large flooding event.

Occupancy	1-10	11-20	21-30	31-40	41-50	Substantially
Agriculture	0	0	0	0	0	0
Commercial	0	0	0	0	0	0
Education	0	0	0	0	0	0
Government	0	0	0	0	0	0
Industrial	0	0	0	0	0	0
Religion	0	0	0	0	0	0
Residential	0	0	0	3	1	0
Total	**0**	**0**	**0**	**3**	**1**	0

Figure 8: **Expected Building Damage by Occupancy**
Source: HAZUS-MH

For the full report, see Appendix V, Hazus – MH: Flood Event Report. The following chart details the estimates by the use of the buildings. Note that this is a prediction; real-life situations may produce different results.

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HAZUS estimates that flooding from a 100 year event will displace 185 Killingworth households, requiring 211 residents to seek temporary shelter. HAZUS also estimates an economic loss of $6.92 million to the town of Killingworth.

As stated previously, tt is important to note that HAZUS estimates are based on 2000 Census data, as HAZUS including 2010 census data is not yet available at the time of this writing.

Photo 3: **Lovers Lane** Flood Conditions
Source: Eastern Connecticut Environmental Review Team

e. **Authorities, Policies, Programs and Resources** (B.4, C.1 & C.2)

The Town of Killingworth participates in the National Flood Insurance Program (NFIP) and is committed to continuing participation. FEMA develops NFIP FIRMs through an engineering report called the Flood Insurance Study (FIS). FIRMs depict the limits of the floodwaters as special flood hazard areas within which “zones” establish the base flood elevation and, therefore, risk for flooding and flood-related damages.

Killingworth is committed to continuing NFIP compliance and standards, as has been demonstrated through zoning regulations.

Killingworth subdivision regulations require all new subdivisions to establish encroachment lines around all watercourses present on the property [§ 485-53]. These regulations also currently require all new subdivisions to submit a soil erosion and sediment control plan along with the application for any subdivision where the soil disturbance will be more than ½ acre. This plan is important in keeping disturbance to nearby watercourses and wetlands from occurring as the result of new housing developments. Silt and erosion can fill in the bottom of streams and ponds, creating a higher water level at all times, and especially during flooding events.

As of August 2011, Killingworth Subdivision Regulations require a Stormwater Management Plan with any subdivision, re-subdivision, or special permit application [§ 485-56.2].

Article XV of the Killingworth Zoning Regulations defines the Flood Plain District. Within Article XV there are standards and criteria designed to meet NFIP requirements that govern the location and elevation of structures, construction methods, and the placement or removal of fill. For construction within the special flood hazard areas, the Zoning Enforcement Officer, Building Official, and Town Engineer review and issue a flood permit and conduct follow-up inspections to confirm compliance with the permit. Article XV applies to substantial improvements to existing structures located in SFHAs. Substantial improvements are defined as “any combination of repairs, reconstruction, alteration, or improvements to a structure taking place within a ten-year period, in which the cumulative cost equals or exceeds 50% of the market value of the structure.” Within A and AE Zones in the SFHAs, all new construction and substantial improvements require that structures be elevated above the base flood elevation.

Article XV of the Killingworth Zoning Regulations defines the Flood Plain District. This section lists requirements for anyone building or doing any construction activities within the management area. Failure to adhere to these requirements can result in a cease-and-desist order on the property. Some of the requirements for the area include:

- maintaining records of pre- and post-construction flood elevation and flood proofing certificates;
- standards for manufactured homes;
- increased elevation standards for all new construction of critical facilities in SFHAs; and
- standards for use restrictions.

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New FIRMS have been in use since August 28, 2008 and will be updated along with any FEMA updates in the future.

The NFIP collects data on repetitive losses in special flood hazard areas. Repetitive loss properties (RLP) are those with insurance claims for multiple events. Since the beginning of the NFIP in 1979, one (1) property in Killingworth has been listed as an RLP. This property lies along the Menunketesuck River.

The Town annually cleans catch basins and other storm water infrastructure, and will clean them before large storms and as needed throughout the year.

f. **Mitigation Specific to this Hazard** (C.3, C.4 & C.5)

See Section III Mitigation (Figure 16) for Comprehensive Mitigation Action Items (Element C). The following are representative mitigation activities specific to this hazard:

i. Flood-Proofing Existing Structures

Very few structures are located within flood-prone areas. However, structures that lie within a flood zone should be considered for flood proofing measures in the future. For private residences, the town should provide information for residents interested in these measures.

Only one property in Killingworth is classified as a repetitive loss property.

ii. Residential Property Owners

Residential property owners within the flood districts have various options available for flood-proofing. Given the limited number of homes within the flood zones and the low probability for flooding for these homes, the primary recommendation is to provide information materials on sources of funding to homeowners for structures that may need retrofitting to sustain floodwaters.

iii. Business Properties

Killingworth does not have a significant business district area or industrial area. Small areas are located throughout the town. The primary business district is near the intersection of Route 80 and Route 81. Within that area, there are several properties within the flood zone that could be affected by stream flooding. Business properties along Route 80 could be affected by potential flooding of that route east of its intersection with Route 81.

During a flooding event, businesses should keep track of all expenses,

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including work performed related to the flood along with the hours worked, as their insurance company will likely reimburse them. Businesses should inform clients that the business will be closed for a time due to storm damage. Businesses should contact construction vendors, get estimates and record all expenses incurred as a result of damage.

iv. Storm Water

Storm water from municipal and private outflows has the potential for significantly exacerbating flooding within the town. Therefore, the town should continue to enforce as close to zero runoff as possible for storm water for subdivisions.

As several drainage basins within Killingworth cross town boundaries, it is recommended that the town cooperate with the other towns in the region by reviewing and adopting a regional plan for municipal storm water management. As part of this effort, mitigation should include:

- GIS mapping and monitoring of storm water outlets and infrastructure;
- Yearly maintenance programs for storm water infrastructure such as catch basins, retention ponds, drainage swales, and culverts.

v. Open Space Guidelines

Currently, almost one third of the land area within Killingworth is dedicated to some category of open space; about one fifth is committed open space. Uncommitted open space areas are owned by various entities. The largest percentage of committed open space is owned by the State of Connecticut. Many small privately owned open spaces also exist throughout town. Other uncommitted open space areas border the public reservoirs, Hammonasett Lake and Killingworth Reservoir (See Map 5).

Subdivision Regulations require that 15 percent of total land area within a subdivision over 20 acres be dedicated as open space. These regulations are an excellent way to promote open space and storm water infiltration. Open Space within a project can be used for storm water management, and the lots, roads, and structures can be designed to minimize disturbance to soils and to retain water on site. Storm water absorption techniques such as rain gardens, creative use of wetlands, and gallery systems can retain water on site and recharge aquifers in the area.

Within Killingworth, the largest flood-prone areas are adjacent to the Hammonasset, Menunketesuck, and Indian Rivers. All three run in a southerly direction through town with the Hammonasset along the western side of town, the Indian River in the center of town parallel to Route 81 and the Menunketesuck River in the eastern portion of town. (See Map 7)

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These areas are susceptible to flooding mainly after large rain events and spring snow melting. Other flood zones include that surrounding Kroopa Pond and Ryan's Pond.

Map 7: **Commercial Zones** with Flood Hazard
Source: Killingworth GIS

- Industrial Zone
- Commercial, Large Business Zone
- R-2
- Flood Hazard A

vi. Existing Infrastructure

A bridge on Reservoir Road that had been closed for nearly three years to through traffic was replaced in 2010. The prior structure was found to be hydraulically inadequate. The new structure was built to handle a higher volume of water and better protects the road from flooding in the future. As the town replaces failing bridges or constructs new ones, hydraulic adequacy will be a key consideration. Also, the following efforts should continue to be part of the mitigation process in Killingworth:

- The Flood Plain Regulations should continue to be enforced, preventing any road or house construction within the floodplain.
- Town should be aware and work with State when dams are being reviewed. (See Section B.2.)
- Strategic enforcement actions including engineering reports for structural alterations or structural expansion of infrastructure within the 100 flood zone. This includes updating the regional Geographic Information System (GIS) mapping for accuracy with FEMA layers and location of buildings across town boundaries.
- The town should continue to pursue options for solving flood conditions along Lovers Lane.

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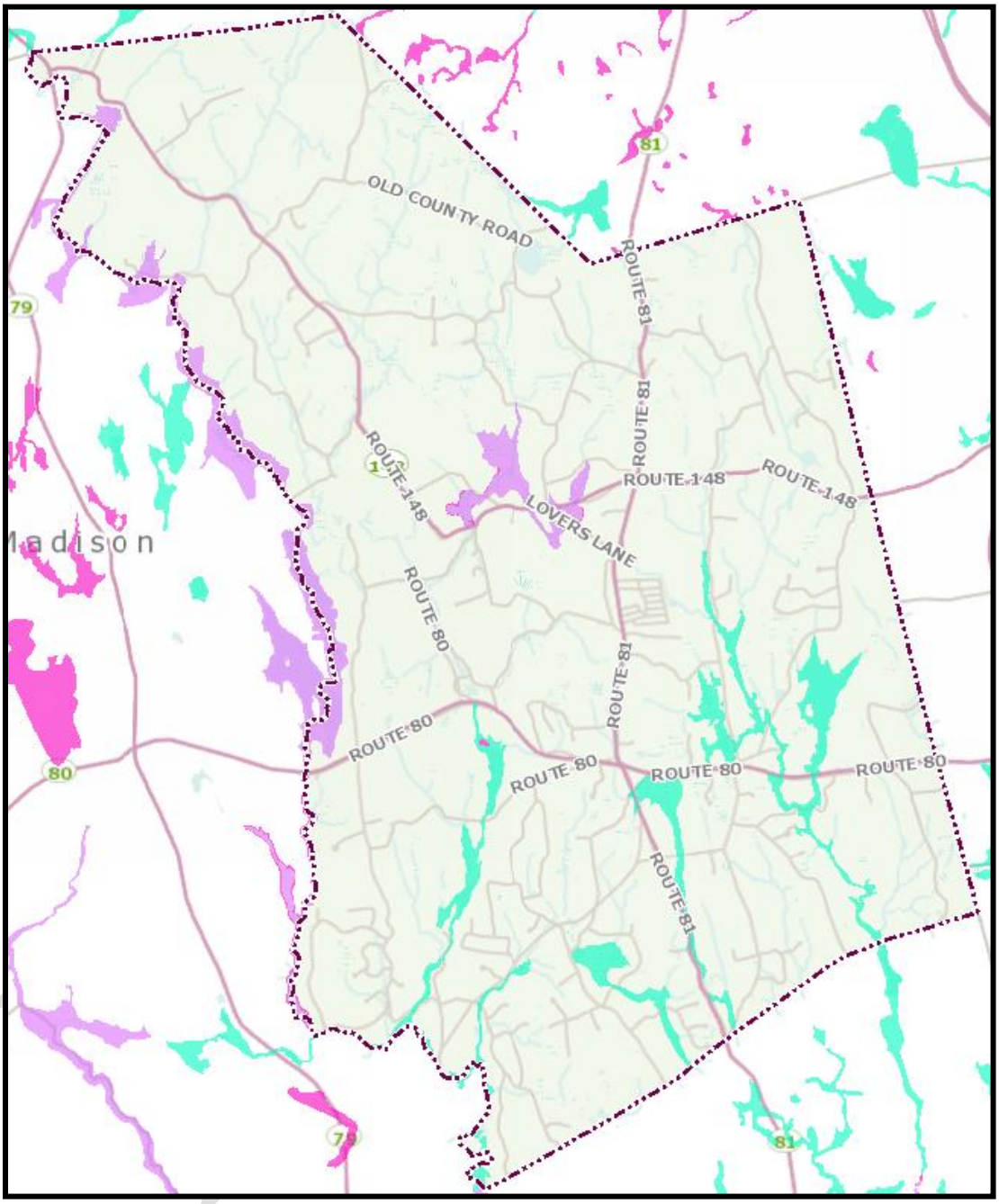
Killingworth Flood Hazard Zones



Map 8: **Flood Hazards**
Source: Killingworth GIS

This map depicts Special Flood Hazard Areas throughout the town of Killingworth.

Flood Zone A
Flood Zone AE

2. Dam Failure

A dam is a barrier that impounds water or underground streams. Dams generally serve the primary purpose of retaining water. Many dams built within Killingworth were built to power mills during the early years of industrial revolution. There are several different types of dams including earthen, cement, and stone.

a. **Geographic Extent** (B.1)

Although dams are man-made structures and thus not a true natural hazard, the consequences of dam failure resemble those of natural disasters. With over 4,000 dams state-wide, nearly every town in Connecticut is subject to the hazard of dam failure. There are twenty-nine dams in Killingworth. Four are owned by the two public water supply companies (South Central Connecticut Regional Water Authority and Connecticut Water); three are owned by DEEP; eighteen are privately owned, and two are owned by associations (See Map 9). Four dams are not depicted on Map 9. Data for those dams is incomplete.

Of the dams within Killingworth, two are rated as Hazard Type C. One dam is at the south end of Killingworth Reservoir, which holds 415 M gallons of water and has a surface area of 109 acres. Failure of that dam would seriously exacerbate flooding on the Menunketesuck River. The dam was significantly improved in August 2005. The other is at the southern end of Lake Hammonasset along the Hammonasset River, on the town line with Madison. This dam impounds 8,330 acre feet of water. A dam break here would cause significant flooding along the river downstream. This dam is owned and maintained by the South Central Regional Water Authority.

b. **Occurrences** (B.2)

In 1982, the Paper Mill Dam on the south end of Deer Lake failed, sending water downstream which washed out a portion of Paper Mill Road.

c. **Probability of Occurring Again** (B.2)

Although no dams have collapsed in Killingworth, the risk is still present. Old dams, some dating to the 1700s, can become over- burdened during flooding events and heavy rain storms. The dams, if not maintained properly could collapse under the stress of more water than normal.

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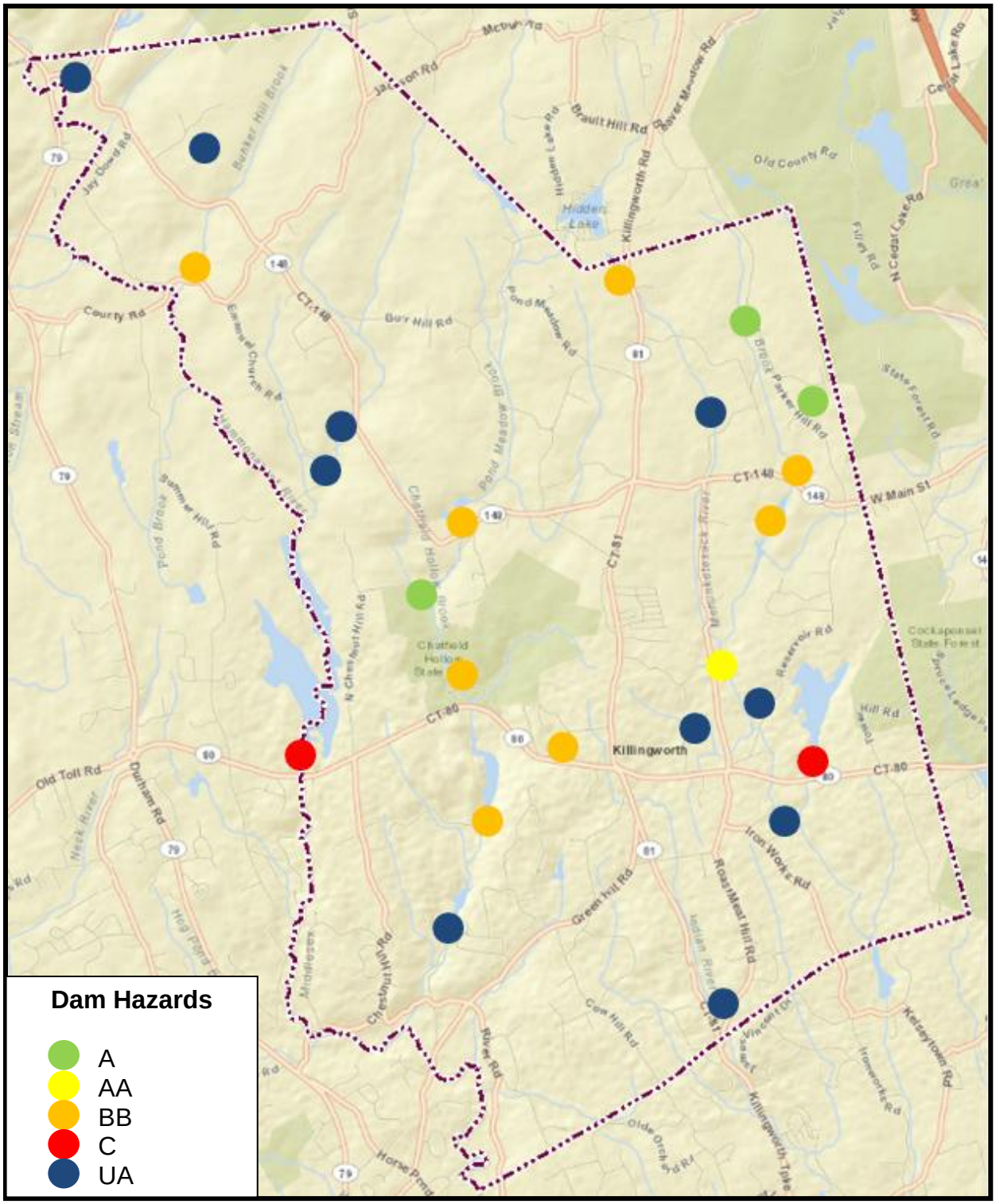
Killingworth Dam Hazards



Map 9: **Dam Hazards** throughout Killingworth**.**
Source: Killingworth GIS

d. **Potential Impacts** (B.3)

A dam break could cause significant downstream flooding and potentially cause other dams to break in succession. A dam break would release a significant amount of water at high velocity with significant pressure. This wall of water could cause other dams to break.

A dam break could cause flooding outside of normal flood hazard areas, meaning residents and businesses might be especially unprepared for dam breaks.

e. **Authorities, Policies, Programs, and Resources** (C.1)

The State Department of Environmental Protection requires the registration of all dams over the height of six feet. The Dam Safety Section of the Inland Water Resources Division of the Connecticut Department of Energy and Environmental Protection (DEEP) is responsible for administering and enforcing Connecticut's dam safety laws. The existing statutes require that permits be obtained to construct, repair, or alter dams, dikes, and similar structures and that existing dams, dikes, and similar structures be registered and periodically inspected to assure that their continued operation and use does not constitute a hazard to life, health, or property.

DEEP assigns dams to one of five classes according to their hazard potential:

Class AA: negligible hazard potential dam which, if it were to fail, would result in no measurable damage to roadways, land, or structures and negligible economic loss.

Class A: low hazard potential dam which, if it were to fail, would result in damage to agricultural land, damage to unimproved roadways, or minimal economic loss.

Class BB: moderate hazard potential dam which, if it were to fail, would result in damage to normally unoccupied storage structures, damage to low-volume roadways, or moderate economic loss.
Class B: significant hazard potential dam which, if it were to fail, would result in possible loss of life; minor damage to habitable structures, residences, hospitals, convalescent homes, schools, etc.; damage to or interruption of the use or service of utilities; damage to primary roadways and railroads; or significant economic loss.

Class C: high hazard potential dam which, if it were to fail, would result in the probable loss of life; major damage to habitable structures, residences, hospitals, convalescent homes, schools,

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etc.; damage to main highways; or great economic loss.

The classification of a dam can change due to changes in downstream development. Of dams in Connecticut, 83% fall within the negligible to moderate hazardous categories while only 17% fall within the significant and high hazard categories. Map 9 depicts which Hazard Class each dam in Killingworth is.

The DEEP keeps track of which dams have emergency plans, but not all of them would be up to date and not all dam owners will want those plans shared publically. Only the larger significant- and high-hazard dams would typically have an emergency plan with inundation areas specified, but not all do as it is not yet mandated by state statute or regulation.

f. **Mitigation** (C.3, C.4 & C.5)

See Section III Mitigation (Figure 16) for Comprehensive Mitigation Action Items (Element C). The following are representative mitigation activities specific to this hazard:

Mitigation includes prioritizing dams using the DEEP classification systems and inspection. The high hazard dams should be repaired by utilizing grant funding, low interest loans to the property owners, or other types of incentives. Lower priority dams should be evaluated for repair as funding is available. The Town should work together with DEEP to ensure that dam owners are properly maintaining their dams and understand the risks of dam failure.

Mitigation for dams within Killingworth includes monitoring, inspection, and structural repairs or modifications where necessary. Of the 29 dams in Killingworth, the ones that possess the highest hazard rating are owned by the Connecticut Water Company and by the State of Connecticut. These dams are routinely inspected and repaired as necessary by both the Connecticut Water Company and the State of Connecticut.

3. High Wind & Tornado

A tornado is a violently rotating column of air, pendant from a cumuliform cloud or underneath a cumuliform cloud, and often visible as a funnel cloud. High winds are typically 1-minute average surface winds 40 mph or greater lasting for 1 hour or longer, or winds gusting to 58 mph or greater regardless of duration that are either expected or observed over land. Straight-line winds, responsible for most thunderstorm wind damage, can exceed 100 mph. One type of straight-line wind, the downburst, is a small area of rapidly descending air beneath a thunderstorm. A downburst can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation. A “dry microburst” is a downburst that occurs with little or no rain.

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a. **Geographic Extent** (B.1)

Killingworth's rolling terrain make a sustained tornado event unlikely. However, high wind can cause considerable damage throughout town. While historically tornado damage is minimal in Middlesex County, tornadoes do occur in Connecticut.

b. **Occurrences**

Enhanced Fujita Scale	Date	Injuries	Fatalities	Town
EF 2	July 12, 1950	0	0	Portland
EF 3	August 21, 1951	8	0	East Hampton
EF 1	July 19, 1963	0	0	Middletown
EF 1	July 21, 1972	0	0	Middletown
EF 1	June 27 1974	0	0	Essex
EF 0	June 30, 1998	0	0	Killingworth
EF 1	June 30,1998	0	0	Chester
EF 1	June 30, 1998	0	0	Old Lyme

Figure 9: **Recorded Tornadoes** in RiverCOG Region, 1950-2013.
Source: Tornado History Project

As recently as Monday July 1, 2013 a tornado was reported in the towns of Windsor and East Windsor. "A tornado lashed its way across Windsor, Windsor Locks and East Windsor Monday afternoon, toppling trees, taking down power lines, tearing apart an inflatable sports dome and ripping tobacco netting from fields and draping it across houses and I-91." (Hartford Courant, *National Weather Service Confirms Two Tornadoes Monday*, July 2, 2013)

Deadly and destructive tornados do occur in New England, including Connecticut. There have been 8 recorded tornadoes in the RiverCOG region since 1950, the most recent having been in 1998. Although no tornadoes have been recorded since that time, evidence lead locals to believe tornadoes may have occurred in Chester and Old Lyme on July 31, 2009 when tornadoes were recorded in other parts of the state.

c. **Probability of Occurring Again** (B.2)

As a Southern Connecticut community, Killingworth is *highly likely* to experience hurricanes and tropical storms.

d. **Potential Impacts** (B.2)

When tornados do visit upon Connecticut they can have a significant impact. For example, on October 3, 1979 the Windsor Locks,

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Connecticut, Tornado, an extremely destructive F4 tornado and one of the worst in Connecticut history, killed three and injured 500 in northern Hartford County. The tornado struck without warning, tearing through Bradley International Airport, destroying more than a dozen airplanes, and narrowly missing a Boeing 727 which was attempting to land. About 100 homes were completely leveled. Most of the $200+ million in damage was done in Windsor Locks and Suffield.

High wind events in Killingworth can cause trees and tree limbs to collapse on power lines, taking out power, phone service, and other forms of communication. Tropical Storm Irene caused a significant number of trees to topple and limbs to break, knocking out power to almost all of Killingworth and the surrounding region. Both cell phone service and land line service were out of commission, owing to loss of power, and cable lines were down as well; thus normal communication was cut off for almost 24 hours. Without electricity, residents of Killingworth are without potable water and septic. Those that rely on electricity for health reasons are put at risk. High wind events can also cause trees to topple on homes causing significant damage.

Residents of the 300-unit Jensen's Beechwood Community are particularly susceptible to tornadoes. These are manufactured homes, and while many have been replaced with newer, stronger buildings, the older units are not permanently fastened to the ground and could be destroyed by tornadoes.

e. **Authorities, Policies, Programs, and Resources** (C.1)

The 2005 Connecticut State Building Code was amended in 2009 and adopted with an effective date of August 1, 2009. The code specifies the design wind speed for construction in all the Connecticut municipalities, with the addition of split zones for some towns. For example, for inland towns, wind speed criteria are different in relation to the distance from the shoreline. Killingworth uses the state Building Code as its own. Any updates to the State building Code automatically take effect in Killingworth. The design wind speed for Killingworth is 110 miles per hour. Section 235-2 of the Killingworth Code of Laws states "the Building Official shall review the plans of buildings or structures to be constructed or altered to determine their compliance with the requirements of the State Building Code."

f. **Mitigation** (C.3, C.4 & C.5)

See Section III Mitigation (Figure 16) for Comprehensive Mitigation Action Items (Element C). The following are representative mitigation activities specific to this hazard:

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Owners of older manufactured homes should be particularly aware of mitigation measures to protect their homes from damage. Business owners should follow the same mitigation plan as they would for those listed under mitigation measures for flood damage.

Specific mitigation measures for wind damage include enforcement of building code standards for light frame construction, especially wind resistant roofs. FEMA articles on bracing for gable trussed roofs and bracing for door and windows are available for review. There are also articles on placement of HVAC systems and electrical utilities to resist both wind damage and flood damage.

These techniques are applicable throughout town:

- Continuing to require underground/buried utilities in new developments
- Continuing to require installation of new, impact resistant windows, especially in new construction.
- Monitoring of tree health by tree warden, utility company, and home owners. Trimming of trees near roads, driveways, and power lines can safeguard against loss of electricity and access.
- Building code enforcement and advice for anchoring outbuildings and other structures against winds from hurricanes, extreme storms, and possible tornadoes.
- Education of public to be prepared to take immediate action when a severe thunderstorm watch or warning is issued. It is important for people to understand that damaging winds can and often do strike before the rain and intense lightning of a severe thunderstorm arrive. In the event of a warning, individuals should seek shelter inside a well-constructed building.
- Providing pamphlets and web-based information for property owners on hazard mitigation, including structural alterations to protect against wind damage.
- Encouraging local gasoline stations to invest in backup generators to allow customers to obtain fuel for generators and motor vehicles during an extended power outage.

Manufactured homes require special precautions. Jensen's mobile home park is home to 300 mobile units with residents age 55 and up. Many of the units have been replaced in recent years with more durable buildings, but older, more susceptible structures remain in place. These units may contain residents requiring assistance either relocating to a safe place or preparing for the storm.

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4. Drought & Wildfire

Drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people.

A wildfire is any uncontrolled fire in combustible vegetation that occurs in the countryside or a wilderness area. Other names such as brushfire, forest fire, desert fire, grass fire, hill fire, peat fire, vegetation fire, and veldfire may be used to describe the same phenomenon, depending on the type of vegetation being burned. In this area, the most common term is brushfire.

A wildfire differs from other fires in its extensive size, the speed at which it can spread out from its original source, its potential to change direction unexpectedly, and its ability to jump gaps such as roads, rivers, and fire breaks. Wildfires are characterized in terms of the cause of ignition, their physical properties such as speed of propagation, the combustible material present, and the effect of weather on the fire.

a. **Geographic Extent** (B.1)

Compared to other parts of the U.S., Connecticut is safe from drought. Abundant forests, water bodies, and natural weather patterns make extreme drought rare. Summer tends to be the driest time, while fall spring and winter tend to be quite wet. The largest threat of drought conditions in Killingworth is the potential for fire.

Large expanses of forested land are present throughout town. Western Killingworth is particularly heavily forested with the presence of Chatfield Hollow State Park, a largely forested property owned by the Department of Energy and Environmental Protection (DEEP). The northwestern portion of town is also heavily forested and sparsely developed.

Roads, bodies of water, and streams provide breaks which would make it difficult for a brush fire to spread. Streams and water bodies are abundant in Killingworth and would offer some natural protection against the spread of fire. These water bodies would also provide the water necessary to fire crews battling the flames.

According to the Palmer Drought Index, parts of Connecticut were in D-0 and D-1 drought conditions from the spring into the summer of 2012. In July 2012, all of Killingworth was in a D-0 drought condition. As of October, the condition had improved and the area was no longer in a drought situation; indeed, it averaged more than an inch above average rainfall. [Rivers Alliance of Connecticut website, based on analysis of U.S. National Weather Service data, July 19, 2012]

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b. **Occurrences** (B.2 & B.4)

Coastal Climate Division --		
Drought Periods	**Duration**	**Lowest PDSI**
1/1901 - 2/1901	2 months	-3.79 in 2/1901
8/1910 - 7/1911	12 months	-4.30 in 7/1911
7/1913 - 9/1913	3 months	-3.68 in 8/1913
12/1924 - 6/1925	7 months	-3.64 in 6/1925
4/1930 - 3/1931	12 months	-4.26 in 9/1930
11/1949 - 1/1950	3 months	-3.13 in 12/1949
9/1964 - 1/1965	5 months	-4.16 in 11/1964
3/1965 - 2/1967	24 months	-5.19 in 12/1965
3/1985 - 4/1985	2 months	-3.84 in 4/1985
8/1995 - 9/1995	2 months	-3.61 in 8/1995
7/1999 - 8/1999	2 months	-3.50 in 7/1999
1/2002 - 4/2002	4 months	-3.67 in 2/2002

Figure 10: **Historic Periods of Drought** throughout Connecticut
Based on the monthly Palmer Drought Severity Index as computed by the National Climatic Data Center. Period of record: January 1895 through June 2012

Below is a table of historic data for drought that includes coastal Connecticut. [Northeast Regional Climate Center (**NRCC**) in the Department of Earth and Atmospheric Sciences at Cornell University]

Brushfires were reported in the neighboring town of Durham in early April 2013. “Firefighters responded Tuesday night to another large brush fire along the Blue Trail hiking range, the third such brush fire in as many days” (Durham-Middlefield Patch April 10, 2013)

In the spring of 2012, headlines on the local network television stations such as, “Mar 28, 2012 – **Brush fires** have been reported in East Haddam, East Windsor and Fairfield,” were common. The most recent brush fire in Killingworth was in April 2012. “Brush fire reported at Chatfield Hollow state park.” [WFSB Website, April 29, 2012] Several fire departments from surrounding towns worked together to put out the fire. “The largest of the fires consumed more than 50 acres in Devil's Hopyard State Park in East Haddam and fire officials made the decision to let the fire burn.” [NBC Connecticut website, March 28, 2012] “Brush fires are not uncommon[,] since 2009 there has been 130 brush fires in Connecticut, fortunately none have been terribly large other than that 60 + acre fire in remote Salisbury that fire fighters had a tough time getting to last year.”

c. **Probability of Occurring Again** (B.2)

In comparison to other parts of the country, Killingworth is unlikely to experience wildfire or drought. With the intricate network of wetlands and

watercourses over the geography and the rarity of drought, there are more natural breaks that would contain fire than in other parts of the country. That being said, a brushfire can still threaten houses and other structures. Droughts do occur in the area, but the impacts are mitigated a well-developed network of firefighting organizations as well as significant natural breaks such as streams and ponds.

d. **Potential Impacts** (B.3)

A wildfire or brushfire that grew out of control could cause damage to local homes. However, due to the natural breaks, damage would be limited and localized. Homes surrounded with forest land would be most susceptible, especially if they are far from a break such as a road or water body. The main potential impacts include loss of wildlife habitat and health effects of smoke for nearby residents.
Connecticut towns that rely on aquifers and local well systems have the potential for increased problems during drought conditions. These problems can increase with population growth and increased demands for water. A forest fire plan can be developed by the town in conjunction with the state Department of Energy and Environmental Protection (DEEP), and land-use planning techniques will continue to be applied to existing, new, and redeveloping areas alike.

e. **Authorities, Policies, Programs, and Resources** (C.1)

Killingworth currently requires all subdivisions to submit a storm water management plan as part of the application process. This is in part to ensure that as much water as possible remains on site to recharge the ground. In addition, Killingworth subdivision regulations require that underground tanks be installed in order to provide water in case of fire. Placement of said tanks is at the direction of the Planning and Zoning Commission.

Killingworth Fire Department conducts wildfire training any time a new member enters the department and has mutual aid agreements in place with the surrounding towns including Chester, Clinton, Deep River, Durham, Haddam, Madison, and North Madison.

The DEEP Forestry Division updates fire danger ratings each day and publishes them on their website. The State requires that any open burning of brush be done with a permit and prohibits burning land for the purpose of clearing; the position of open burning official is mandated by the town charter. No open burning permits are granted if the air quality index is above 75 or if the fire danger is rated as high, very high, or extreme.

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f. **Mitigation** (C.3, C.4 & C.5)

See Section III Mitigation (Figure 16) for Comprehensive Mitigation Action Items (Element C). The following are representative mitigation activities specific to this hazard:

Killingworth has large expanses of forest. To ensure that forest or brushfires can be handled effectively, Killingworth collaborates with surrounding towns to promote training for fire fighters and employs land use techniques that promote fire and drought management. Drought can exacerbate potential for small wildfires and hinder the ability of the town to control outbreaks. The primary issue for Killingworth is the relative inaccessibility of large tracts of forest and water company land.

Mitigation for wildfires in Killingworth includes:

- Land-use and natural resource planning that encourages groundwater retention within existing, new, and redeveloping areas.
- Work with region EMD group to develop a wildfire management plan and protocol in conjunction with neighboring towns to ensure that outside fire-fighting resources, such as the National Guard, are available.
- Zoning regulations that guarantee the recharge of existing aquifers, including site design to encourage water conservation through such techniques as: strict regulation of vegetative buffers for stream and river corridors, rain gardens for site drainage, and prohibition of wetlands alteration.
- Monitoring and inspection of dry hydrants and underground water tanks to insure usability and a sufficient supply of water.
- During vulnerable periods, posting in public locations a system of warnings about tossing lit cigarettes and lighting campfires and open fires.
- Continued training and education of firefighters on fighting brush and forest fires.

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5. Winter Storms

A winter storm is an event in which the varieties of precipitation are formed that only occur at low temperatures, such as snow or sleet, or a rainstorm where ground temperatures are low enough to allow ice to form (i.e. freezing rain). In temperate continental climates, these storms are not necessarily restricted to the winter season, but may occur in the late autumn and early spring as well. Very rarely, they may form in summer, although it would have to be an abnormally cold summer, such as the summer of 1816 in the Northeast United States of America. Snow during the winter months is an important part of the natural process. When it melts during the spring months it helps to recharge aquifers, fill ponds and reservoirs, and protect against drought, leaving the ground damp.

Photo 4: **Route 148** was closed in Killingworth after the October 2011 snowstorm toppled trees and brought down power lines making travel unsafe.
Source: The Haddams-Killingworth Patch

a. Geographic Extent (B.1)

Rising from a low of about 35 feet above sea level in some areas to over 600 feet above sea level in others, Killingworth has areas that are affected very differently by the same weather events. Winter storms are part of life in Killingworth and are normally taken as a matter of course. Winter storms are most likely between November 1 and April 1, but as in October 2011, storms can happen outside that time frame, and unseasonable storms can be especially damaging.

b. Occurrences (B.2)

See Figure 6 for a comprehensive summary of events within the RiverCOG region.

Winter storms are not always news in Connecticut. Unless they are particularly bad, they are taken as a matter of course. The most recent noteworthy event was in February 2013: a storm dropped as much as 40

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inches of snow in some parts Connecticut in the overnight hours of February 8. Another storm in October 2011 caused significant power outages and blocked roads, when tree limbs still in leaf broke under the snow load.

Below are historic headlines from news articles in the *Hartford Courant* about past winter storms:

Extreme Weather of 2011: Freak October Snowstorm
Trees broke under the immense weight of snow building up on leaves, knocking out power to over 880,000 residents of Connecticut. Blocked roads, downed power lines, and record amounts of snow were a typical site across the state.

Ice Storm of November 2002
Much of northwestern Connecticut was slowly recovering electric power today after enduring more than 24 hours huddled around portable heaters, battery-powered radios and candlelight.

Winter Storm of December 1996
About 121,000 households and businesses were still without power early today from the powerful weekend snowstorm that slammed Connecticut. Some areas of the state could remain dark until Wednesday.

Blizzard of March 1993
Businesses opened late, major shopping malls didn't open at all and the Whalers hockey game was postponed Sunday as Connecticut tried to dig out from a March blizzard that left two dead, dozens injured and 8 to 21 inches of snow.

Blizzard Of 1978
The first flakes fell just before noon. By nightfall, gale-force winds were sculpting massive snowdrifts.

Ice Storm Of 1973
``The Ice Storm'' uses an infamous Connecticut storm as a dramatic device to explore a time when social mores were shattering like burdened tree limbs.

The Great Blizzard of 1888
‘It wasn't the snow. It was the velocity. And the cold’. Middletown received 50 inches of snow from this powerful storm.
[Source: Hartford Courant, 08/02/2012

c. **Probability of Occurring Again** (B.2)

This is a natural hazard that is highly likely to occur regularly in Killingworth. Ice storms and Nor'easters have caused significant damage in the area. These events are second only to hurricanes in potential damage that they could cause in Killingworth.

d. **Potential Impacts** (B.3)

As seen in the October 2011 snow storm, snow out of the typical season can cause significant damage. Heavy, wet snow clung to leaves still on the trees, and many trees broke under the immense weight. This caused significant power outages statewide as many trees and limbs fell on power lines. Once again, residents were left without electricity and therefor potable water in some cases for more than a week.

Impacts from typical snow storms include snow pack on roads, limiting travel and accessibility; localized power outages; and damage to homes. The 2010 winter season included many heavy snow storms and left much of the area under a blanket of snow many feet thick. Buildings across the state collapsed under the pressure of the buildup of snow on the roof. Nearby towns such as Middletown, Haddam, and Portland experienced building collapses due to the weight of the snow. Overall, the 2010 winter season caused about $2.6 billion in damages in Connecticut.

e. **Authorities, Policies, Programs, and Resources** (C.1)

In anticipation of severe winter storms, the Town has the authority to order parking bans and can order evacuations in extreme situations if there is a significant threat of localized flooding. In addition, Lover's Lane is typically closed through the winter months, owing to flooding of the road.

The Department of Public Works maintains a fleet of trucks and other snow removal equipment and monitors weather forecasts during the winter months to mobilize in advance of storms. Only during extreme conditions, such as the February 2013 Blizzard, does the DPW have difficulty keeping roads open.

f. **Mitigation Specific to this Hazard** (C.3, C.4, C.5)

See Section III Mitigation (Figure 16) for Comprehensive Mitigation Action Items (Element C). The following are representative mitigation activities specific to this hazard:

The town of Killingworth takes several steps to mitigate winter storm hazards. The town purchases adequate salt and sand supplies to apply to roads and conducts routine maintenance and replacement of equipment

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used for snow removal. A maintenance schedule is in place for all snow removal equipment to guarantee that the equipment is in good working order when the need arises. The Board of Finance and the Board of Selectmen work together to ensure proper funding for these mitigation efforts.

As with many of the other hazards listed in this report, information for residents on reducing damage from winter storms could be promoted through town hall and regional agencies. Links to town, regional, state and federal websites for information on reducing damage from natural hazards are an effective way to provide information.

Such information includes:

- The danger of carbon monoxide poisoning in motor vehicles, poorly maintained furnaces, portable heaters, and power generators in homes;
- The danger of house fires;
- The dangers of hypothermia resulting from prolonged exposure to cold weather.
- Landscaping practices that encourage the planting of species that are less susceptible to damage from ice storms to reduce to probability of damage structures

6. **Earthquakes**

An earthquake is the sudden, rapid shaking of the earth, caused by the breaking and shifting of subterranean rock as it releases strain that has accumulated over a long time.

a. **Geographic Extent** (B.1)

One might think there was no threat from earthquakes in Killingworth. As recently as March 23, 2011, however, the village of Moodus in East Haddam, just northeast of Killingworth, experienced a tremor of magnitude 1.3 on the Richter scale. [“TheHaddams-Killingworth Patch, Moodus Noises Return to East Haddam: The sounds many in the region heard last night were the result of a small earthquake,” By Eileen McNamara, March 24, 2011] On August 23 of the same year, a magnitude 5.9 earthquake, centered in Charlottesville, Virginia, evoked the following response recorded in the “Above the Law.Com publication”: “**UPDATE (2:13 PM)**: All government buildings in New York City have been evacuated, including all the courthouses. Seriously, our buildings here are not built for this. It’s like watching a person from Los Angeles try to drive in a snowstorm.” In the publication of mitigation options for the public on the website or in pamphlets, this hazard should be not be overlooked.

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b. **Occurrences** (B.2)

Date	Distance (miles)	Magnitude	Depth (miles)
6/3/2011	26.24	1.7	5
6/17/1982	13.56	3	2
10/21/1981	15.96	3.8	5
10/25/1980	16.13	3	0
10/24/1980	15.50	3.1	0

Figure 11: **Earthquakes** within 50 Miles of Killingworth, 1980 – 2013
Source: USGS

The most severe earthquake in Connecticut's history occurred at East Haddam on May 16, 1791. Describing that earthquake an observer said: "It began at 8 o'clock p.m., with two very heavy shocks in quick succession. The first was the most powerful; the earth appeared to undergo very violent convulsions. The stone walls were thrown down, chimneys were un-topped, doors which were latched were thrown open, and a fissure in the ground of several rods in extent was afterwards discovered. Thirty lighter ones followed in a short time, and upwards of one hundred were counted in the course of the night.

"The shock was felt at a great distance. It was so severe at Clinton, about 12 miles south, that a Capt. Benedict, walking the deck of his vessel, then lying in the harbor at that place, observed the fish to leap out of the water in every direction as far as his eyes could reach."
Still another report states: "the day after the earthquake in 1791, it is said that apertures and fissures were observed in the earth and rocks near Moodus River Falls, and that stones of several tons in weight were thrown from their places."

The record shows the next moderate tremor occurred at Hartford in April 1837. It jarred loose articles, set lamps swinging, and rang bells. Alarmed residents rushed from their homes into the streets.

In August 1840, an earthquake of similar intensity centered a few miles southwest of the 1837 tremor. It shook Hartford quite strongly, and was felt at many points in Connecticut. No damage resulted, however. At Chester, not far from East Haddam, observers compared the tremor "to the rumble of thunder." Its origin was apparently 10 to 20 miles north of New Haven.

On June 30, 1858, New Haven was shaken by a moderate tremor at 10:45 in the evening. Residents reported rattling of glasses and a noise "like carriages crossing a bridge." Derby residents were also shaken strongly by this earthquake.

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Seventeen years later, on July 28, an early morning tremor shook 2,000 square miles of Connecticut and Massachusetts. Rumbling noises were heard during this intensity V [approximately magnitude 4.5] earthquake.

The strongest tremor since that in 1791 hit near Hartford on November 14, 1925, at about 8 a.m. Plaster was knocked from walls, and many residents were frightened. At Windham, dishes were shaken from shelves, and at East Haddam, the familiar "Moodus" rumblings were noted.

In March 1953, Stamford sustained a minor tremor that alarmed many. "Radiators beat a weird tattoo against the floor of the police station," notes one report. Houses were jarred, and earth noises were heard. The tremor caused no damage.

An intensity V [approximately magnitude 4.5] earthquake in southern Connecticut occurred on November 3, 1968, at about 3:30 in the morning. Plaster cracked at Madison, furniture shifted at Chester, and small items fell and broke. Loud earth noises accompanied the tremor. The Moodus noises were noted once again at East Haddam.

A few damaging shocks centering in neighboring States, and several Canadian tremors, have been noted by Connecticut citizens the past three hundred years:

A devastating earthquake near Tros-Rivieres (Three Rivers), Quebec, on February 5, 1663, caused moderate effects in some areas of Connecticut. Sketchy accounts of this quake relate fantastic tales of mountains being thrown down and great forests sliding into the St. Lawrence River near its Quebec Center.

Massachusetts shocks in November 1727 and November 1755 were felt strongly by some Connecticut citizenry. Both were intensity VIII [approximately magnitude 5.9] at their epicenters, leaving behind collapsed walls, flattened chimneys, and other broken reminders common to most strong earthquakes.

The Timiskaming, Ontario, earthquake in November 1935 was quite noticeable in Connecticut and other New England States. Several cracked windowpanes were noted at Cornwall, Connecticut. Because of the sparse population, damage at the epicenter of this tremor was insignificant. However, an indication of its severity was the large felt area - one million square miles of Canada and the United States.

An earthquake near Massena, New York, in September 1944 was felt over a wide region. Mild effects were noticed by residents of Hartford, Marion, New Haven and Meriden, Connecticut. At its epicenter, the shock

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destroyed nearly all chimneys, crippled several buildings, and caused $2 million property damage in that region. [Source: USGS website, 2012]

As recently as October 16, 2012 New England Coastal Maine experienced a 4.0 magnitude earthquake. The quake was felt as far south as Long Island and as far west as the Finger Lakes Region of New York. Although there was no report of damage or injuries, the occurrence reminds us once again that earthquakes are possible throughout New England.

c. **Probability of Occurring Again** (B.2)

The likelihood of an earthquake in Killingworth is small. The USGS database shows that there is a 1.186% chance of a major earthquake within 50 kilometers of Killingworth, Connecticut within the next 50 years. [Source: USGS website, 2012] Killingworth-area historical earthquake action is slightly below Connecticut state average. It is 91% smaller than the overall U.S. average. (Source: City Data)

d. **Potential Impacts** (B.3)

With numerous older buildings in Killingworth not built to resist earthquakes, a major event could cause many buildings to collapse. However, the impacts from the more common tremors that affect the area are limited. There are no known building failures in the area due to an earthquake.

A Hazus - MH: Earthquake Event Report was created. The report was based on a 100 Year Probabilistic scenario. The report details building losses and damage as well as debris generation from an earthquake event. The report also inventories the number residential, commercial, industrial and critical facilities, as well as a dollar value for the replacement cost of these. The same is done for infrastructure. This scenario shows that in a 100 year probabilistic earthquake of 5.0 on the Richter scale, there would be no building loss of any kind in Killingworth. The report also estimates that there would be no infrastructure damage within town and no loss of life. For the full report, see Appendix III, Hazus MH: Earthquake – Killingworth.

e. **Authorities, Policies, Programs, and Resources** (C.1)

Warning is the most viable and therefore the primary method of existing mitigation for tornadoes and thunderstorm-related hazards in Connecticut. The NOAA National Weather Service issues watches and warnings when severe weather is likely to develop or has developed, respectively.

In addition, the Town enforces the State building code that dictates construction standards.

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f. **Mitigation Specific to this Hazard** (C.3, C.4 & C.5)

See Section III Mitigation (Figure 16) for Comprehensive Mitigation Action Items (Element C). The following are representative mitigation activities specific to this hazard:

Mitigation for the possibility of low magnitude earthquakes include: obtaining a low cost earthquake rider for homeowners and businesses. This would protect property owners for damage to chimneys, windows or foundations.

7. Hurricane & Tropical Storm

A hurricane is an intense tropical weather system of strong thunderstorms with a well-defined surface circulation and maximum sustained winds of 74 MPH (64 knots) or higher. A tropical storm is an organized system of strong thunderstorms with a defined surface circulation and maximum sustained winds between 39 mph and 74 mph.

a. **Geographic Extent** (B.1)

The primary risk for Killingworth in the event of a hurricane is high wind and stream and river flooding from heavy rain. High winds damage power lines, trees, and mobile homes. Although there is a common perception that hurricanes affect only coastal properties, damage reports from the 1938 hurricane indicate otherwise. Mitigation efforts should duplicate those listed in the sections on tornadoes flooding.

b. **Occurrences** (B.2)

See Figure 12, below, for a summary of hurricanes that have affected Killingworth.

Most recently, Killingworth was hit by Hurricane Sandy on October 29, 2012, and Tropical Storm Irene, on September 2, 2011, both of which caused extensive damage to the electric grid, blocked roads, damaged property, and sustained power outages.

Photo 5: **Tropical Storm Irene** led to several damaged headstones in Union Cemetery in Killingworth after two large trees toppled.
Source: The Haddams-Killingworth Patch

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Date	Name	Category (in CT)	Landfall	Wind Speed (mph)
September 16, 1858	Storm # 3	1	Groton, CT	80
September 8, 1869	Storm # 6	1	Westerly, RI	115
August 24, 1893	Storm # 4	1	Queens, NY	85
October 10, 1894	Storm # 5	1	Clinton, CT	85
September 21, 1938	Great New England Hurricane	3	New Haven, CT	115
September 15, 1944	Great Atlantic Hurricane	1	Matunuck, RI	85
August 30, 1954	Carol	2	Groton, CT	115
September 12, 1960	Donna	1	Old Saybrook, CT	100
September 127, 1985	Gloria	1	Milford, CT	85
August 19, 1991	Bob	1	New Shoreham, RI	105
August 24, 1893	Irene	TS	Brooklyn, NY	65
October 29, 2012	Sandy	1	Brigantine, NJ	80

Figure 12: **Major Hurricanes** and Tropical Storms Affecting Connecticut since 1858.
Source: Ryan Hanrahan, WVIT NBC 30

c. **Probability of Occurring Again** (B.2)

As a southern Connecticut community, Killingworth is likely to experience this natural hazard. As discussed above in the "Previous occurrences" section, the region has experienced numerous hurricanes of varying severity over the course of recorded weather. For this reason, and the effects can be severe, hurricanes are the disaster with the probability of causing the greatest damage.

d. **Potential Impacts** (B.3)

The primary risk for Killingworth in the event of a hurricane is high wind and rainfall. High rainfall totals can cause flooding on small streams and rivers, while high wind may knock down trees and power lines, leaving the area without power and blocking roads. The combination of rain-soaked ground and high wind is especially likely to result in fallen trees.

If rainfall totals are high enough, dams, especially those on small ponds, could become overstressed and suffer a breach. One dam in town is classified as Class C: the dam on Killingworth Reservoir. Many smaller, less significant dams throughout Killingworth could collapse, causing extreme flooding in lower elevations.

In the largest Category 3 and 4 Storms, Storm surge from Long Island Sound could travel up the Hammonasett River, reaching the very Southwestern portion of Killingworth near the Clinton and Madison borders. No homes are in danger, but the surge could raise the water level enough to affect some properties along River Road (See Map 10).

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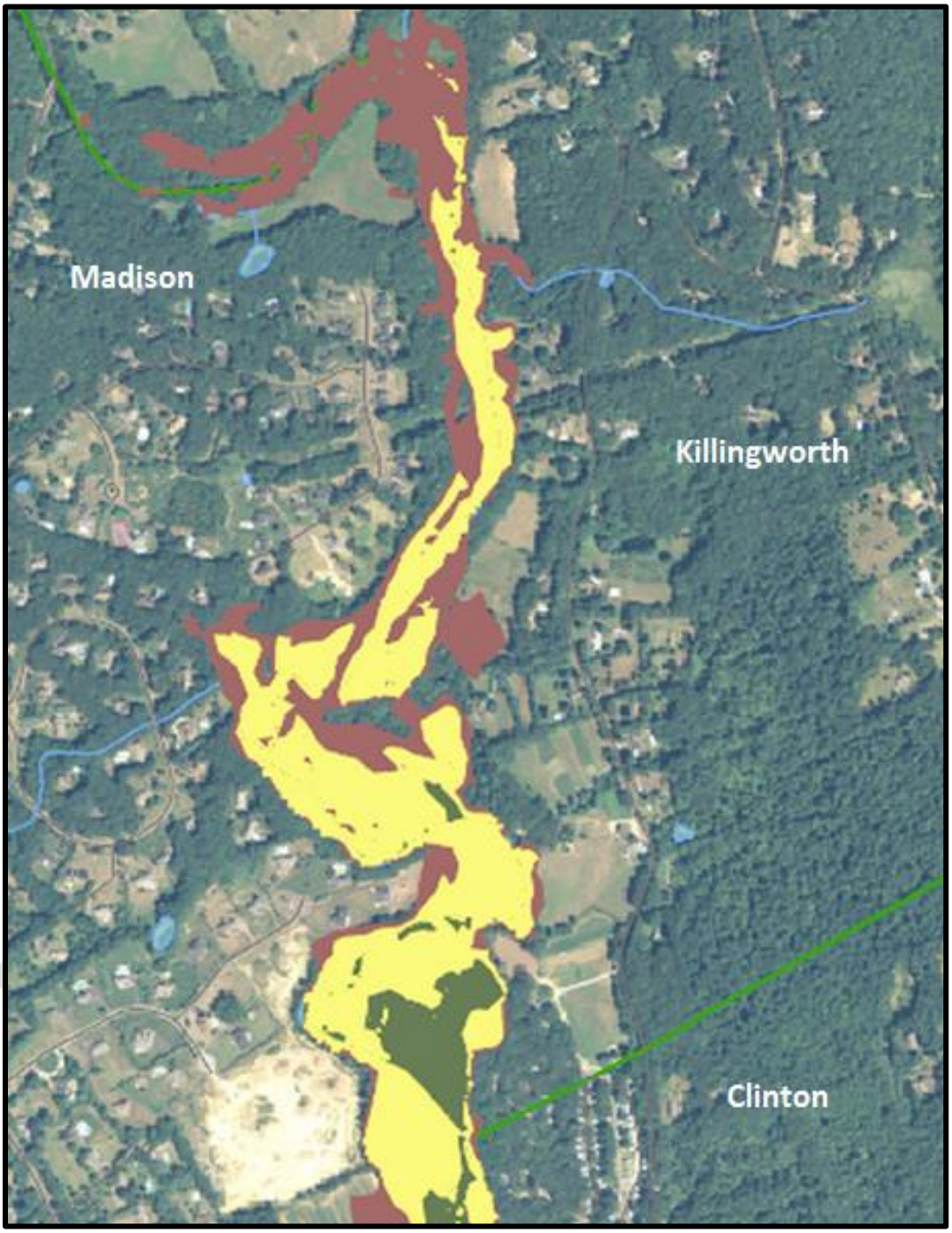
Hurricane Surge in Killingworth



Map 10: **Storm Surge in Southwest Killingworth**
A large hurricane could result in storm surge up the Hammonasset River in the southwestern portion of Killingworth.

- Category 2
- Category 3
- Category 4

Source: CT ECO

A Hazus-MH Hurricane Event Report was created based on a 100-Year Probabilistic scenario. In this scenario, buildings throughout town could suffer from some damage, albeit limited. The report breaks the building types down into categories based on occupancy and damage into Minor, Moderate, Severe, and Destruction.

Occupancy	No Damage	Minor Damage	Moderate Damage	Severe Damage	Destruction
Agriculture	20	2	0	0	0
Commercial	140	8	1	0	0
Education	5	0	0	0	0
Government	3	0	0	0	0
Industrial	58	3	0	0	0
Religion	8	0	0	0	0
Residential	2,132	184	14	0	0

Figure 13: **Building Damage** from 100-Year Hurricane
Source: HAZUS MH Hurricane Event Report

The report also estimates the amount of debris that would be generated throughout town during this scenario: 14,488 tons of debris would be generated by a 100-Year Hurricane, 88% of which would be in the form of tree debris. For the full report, see Appendix IV, Hazus MH Hurricane Report – Killingworth.

e. **Authorities, Policies, Programs, and Resources** (C.1)

Section 1, Flooding discusses policies regarding Flood Zone regulations. Section 2, High Wind & Tornado discusses policies regarding Wind Speed Compliance per the state building code.

The Town of Killingworth has an agreement to use local school buses stored within Regional School District 17 for mass evacuations. The Killingworth Lions Club will assist with evacuation of Jensen's using personal vehicles.

f. **Mitigation Specific to this Hazard** (C.3, C.4 & C.5)

See Section III Mitigation (Figure 16) for Comprehensive Mitigation Action Items (Element C). The following are representative mitigation activities specific to this hazard:
The biggest threat of a hurricane comes from high winds, as seen with both Hurricane Sandy in October 2012 and Tropical Storm Irene in August 2011. These gusts can take down weak trees and topple utility poles, knocking out power to thousands. Killingworth should continue to work with utility providers to restore power to as many residents as quickly as possible. Area utility companies should also consider measures to prevent mass power outages. These could include more resistant wires, burying

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utility lines, and aggressive tree trimming near wires. Homeowners can do their part by keeping tree limbs trimmed away from wires running through their property and near wires on the street.
Of immediate concern for hurricane mitigation in Killingworth is increased awareness for affected property owners of measures to protect property and structures.

This would include wind damage retrofitting, brochures on inspection of structures for mitigation, and flood proofing.

The town should continue to enforce the State Building Code. The code is used in Killingworth and will be updated automatically in Killingworth any time the State updates it.

8. Extreme Heat / Heat Waves

A heat wave is a prolonged period of excessively hot weather, which may be accompanied by high humidity. While definitions vary, a heat wave is measured relative to the usual weather in the area and relative to normal temperatures for the season. In Connecticut, a three-day period in which the daytime high reaches 90º or above is considered a heat wave. Severe heat waves have caused catastrophic crop failures, thousands of deaths from hyperthermia, and widespread power outages due to increased use of air conditioning.

a. **Geographic Extent** (B.1)

Killingworth falls in the humid continental climate zone, the same as much of interior Connecticut. Summer is hot and humid throughout the state, with average highs in New London of 81 °F (27 °C) and 87 °F (31 °C) in Windsor Locks. July and August tend to be the hottest months of the year with average temperatures in Hartford being 84ºF and 82ºF, respectively. The elevated summer temperatures bring the risk of extreme heat. With its dense forest coverage and abundant water features, Killingworth is slightly more protected from extreme heat than some of its neighbors, but heat waves do occur.

b. **Occurrences** (B.2)

Heat waves are a regular summer season event in Connecticut, including Killingworth. Summer 2012 was a particularly hot period, with many days in which temperatures in Hartford reached 100ºF and humidity levels were much higher than average. The entire northeast and much of the United States was under the intense heat for much of July. In June alone, 164 all-time high temperature records were broken across the country. In many areas, severe thunderstorms associated with the heat caused lengthy power outages, forcing people to cope with the heat as they lost the ability to have air conditioning.

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c. **Probability of Occurring Again** (B.2)

Extreme heat and heat waves are highly likely during the summer months in Killingworth. As global temperatures continue to climb, it heat waves will likely occur more frequently in the future.

d. **Potential Impacts** (B.3)

Elderly and very young populations, especially those living in homes with no air conditioning, are most likely to be adversely impacted by extreme heat. Dehydration, heat stroke, and other negative health effects are likely during heat waves.

Physical infrastructure can also be affected negatively by extreme heat. Heat always brings with it the potential for strong thunderstorms, which could knock out power by downing trees. Asphalt, especially in places where there is not a substantial base, can buckle or crack significantly under heat. Extended periods of very high temperatures can also exacerbate droughts.

e. **Authorities, Policies, Programs and Resources** (C.1)

The Killingworth Director of Emergency Management has the authority to designate cooling centers in public buildings during heat waves. The designated cooling center when needed is the Killingworth Library, located at 301 Route 81.

f. **Mitigation Specific to this Hazard** (C.3, C.4 & C.5)

See Section III Mitigation (Figure 16) for Comprehensive Mitigation Action Items (Element C).

The best mitigation when it comes to the public is information. Senior citizens should be made aware when an extreme heat wave is coming. Reminders about drinking water and staying indoors can help. In the past, the Killingworth Library has been used as a cooling center for those without air conditioning at home, and the Estuary Transit District has waived advance reservation requirements for its dial-a-ride service during heat waves. Maintaining a designated location for a cooling center is important for people living without air conditioning to take refuge during heat events. A cooling center can also provide water to those people, especially the elderly. The 300-unit Beechwood community, where many lower-income seniors live, has an air-conditioned clubhouse with a back-up generator.

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III. **Mitigation Strategy** (ELEMENTS C & D)

A. **Evaluation of Prior Plan** (ELEMENT D)

1. **Changes in Development**

Since the creation of the prior NHMP in 2005, Killingworth has undergone very few changes in development. Town population has risen a mere 4%. An important change to note is the construction of the Haddam-Killingworth Middle School at 451 Route 81. This facility has become a regional shelter facility equipped with emergency generators for use in the event of a loss of power.

Killingworth has seen only minimal housing development and minimal commercial construction in the last eight years. While a few new businesses were added to existing spaces, the one major addition to town was the new Killingworth True Value, just south of the Killingworth Circle. The business sits uphill of a flood zone, but is itself not in a flood zone and is not under threat of even a major floor.

As mentioned previously, in September 2012, Killingworth received a state grant to help fund the construction of a new Emergency Operations Center. This new center is expected to be located adjacent to town fire and ambulance facilities. In the event of a major coastal storm, this center could play an integral role in regional emergency response if shoreline towns' EOCs are compromised.

Any new subdivisions that have been built since the time of the last NHMP have been required to bury utility lines and set 15% of the total land area aside for open space.

Permits Issued	*2006-2007*	*2007-2008*	*2008-2009*	*2009-2010*	*2010-2011*	*2011-2012*
Residential	23	19	6	6	3	6
Commercial	1	4	5	6	3	6

Figure 14: **New Construction in Killingworth**, 2008-2013
Source: Killingworth Building Department

2. **Progress in Local Mitigation Efforts**

Since the time of the creation of the prior NHMP in 2005 the town has made some progress on mitigation efforts laid out in that plan.

- Killingworth regulations require all new subdivisions to put utility lines underground in order to prevent a loss of power from trees and tree limbs.

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- Public information of impending storms and dangers is posted to the town website and emailed to those signed up for notifications from the town. Reverse 9-1-1 dialing through the CT Alert Notification system is used for emergency notices. The town emails do not replace the reverse 911 dialing but allow residents to get updates on general town information, neighborhood watch announcements, public works announcements, and lost and found pet announcements.
- Jensen's Beechwood Community has worked to replace many older mobile homes in the park with newer, more substantial models that are less susceptible to damage in harsh conditions.
- Pamphlets have been disseminated to educate homeowners on hazard mitigation including structural alterations to protect against wind damage.
- The town enforces building codes requiring outbuildings and other structures to be properly anchored to the ground to protect against high wind events.
- Killingworth officials continue to monitor trees near roads and wires and to work with CL&P to trim when necessary.
- Flood plain regulations are enforced in order to prevent structures from being built within a hazard zone.
- Continuous updating of GIS maps allow for more in depth analysis of flood zones.
- Regulations now require underground tanks for the storage of water at all new subdivisions for use in case of a fire.

3. Changes in Priorities

Following an unprecedented year of impressive weather events, including Tropical Storm Irene and Snow Storm Alfred in 2011 and Hurricane Sandy in October 2012, it became clear in Killingworth, and across the state of Connecticut, that more aggressive tree trimming tactics need to be employed in order to prevent massive power outages. After Snow Storm Alfred, over 800,000 customers across Connecticut, including nearly all of those in Killingworth, were without power as a result of downed trees and limbs taking down utility lines. After Hurricane Sandy sent high winds to Connecticut in October 2012, about 630,000 CT residents were again without power, including 100% of customers in Killingworth, and many roads were blocked. Utility companies, the State of Connecticut, and individual towns have pledged to spend more on tree trimming to avoid this type of disaster from occurring in the future. Killingworth, with its extensive forest coverage is particularly susceptible. Downed trees near roads and utility lines can create a dangerous situation. Killingworth should diligently trim trees over town roads and work with utility providers to ensure that trees are trimmed far enough from power lines.

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B. **Goals to Reduce or Avoid Long-term Vulnerability** (C.3)

1. **Geography and Land Use Patterns**

Ensure that flood plains and wetlands are not built upon. Continue to protect wetlands and other low lying open space areas. These areas can absorb extra water so long as they are not built upon. Continue to require that subdivision applications include a storm water management plan in order to reduce the amount of runoff water from going downstream creating the potential for elevated flood risk.

2. **Demographics and Critical Facilities**

The town has a goal to: reduce the loss of life and property from natural hazards.

3. **Economics and Cultural Resources**

The Town has a goal to: Minimize associated economic impacts from natural hazards.

4. **The Environment and Ecological Resources**

The town has a goal to: minimize the damage and loss of ecological resources.

C. **Integration into Other Planning Mechanisms** (C.6)

The Town integrates the action items into several planning processes:

- **Plan of Conservation and Development.** The State of Connecticut requires an update of the POCD every ten years; when the town next updates the plan, it should consider adding mitigation items from this NHMP. For example, the POCD could prioritize road construction projects that lower the risk of flooding by raising roads and replacing inadequate bridges and culverts.
-
- **5-year Capital Improvement Plan,** This plan addresses *municipal improvements* including rights-of-way, roads, public facilities, and major equipment. Mitigation actions from this NHMP should be included in the CIP. Hazard mitigation should be a central consideration during each annual review of the CIP.

- **Administrative Planning.** New or updated *standards* including road specifications, zoning regulations, fire/building code, and the local flood ordinances should be regularly updated with a view to hazard mitigation.

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Regulation or Plan Status Relative to Hazard Mitigation	Changes to Potentially Be Made	Responsible Party
Zoning Regulations	Incorporate suggested changes from NHMP into ZR.	Planning & Zoning Commission
Subdivision Regulations	Incorporate suggested changes from NHMP into SR.	Planning & Zoning Commission
Inland Wetland Regulations	Incorporate suggested changes into IWR including prevention of runoff near waterways.	Inland Wetlands Commission
Plan of Conservation and Development	Consider adding NHMP as an appendix.	Planning & Zoning Commission
Capital Improvement Plan	Consider new projects listed in Figure 15 of this NHMP.	BOS, BOF

Figure 15: **Plans and Regulations to Be Potentially Updated**

D. **Priority** (C.5)

The individual town review was important for the development of goals and objectives within Killingworth. After the supporting tasks were compiled, town personnel evaluated each task using the STAPLEE criteria described in FEMA's "How-to Guide #3: Developing the Mitigation Plan" (FEMA 386-3. The evaluation yielded priority ratings based on the following: High (if the task met 6-7 of the STAPLEE criteria), Medium (if the task met 4-5 of the STAPLEE criteria, Low (if the task met 2-3 of the STAPLEE criteria), and Very Low (if the task met 1 of the STAPLEE criteria).

E. **Comprehensive Mitigation Action Items** (C.4)

Figure 16 below, describes and details the entire Mitigation Action Item List for the Town of Killingworth. A schedule is listed for each action item determining when the Town plans to carry out the project. Items that are shaded grey are items carried over from the 2006 Plan; other items are new to this 2013 Plan. Each Mitigation Action Item status is noted.

A column has been dedicated to a Benefit Cost Review, which considers the cost to the municipality and the Public. Costs are rated as Minimal, Up to $100,000, and Over $100,000.

In addition, each item has a Responsible Party listed. It should be noted that for each item which has more than one Party noted, the first party is the primary responsible party.

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Figure 16: **Comprehensive Mitigation Action Items**	Natural Hazards						Responsible Party * [1]	Schedule	Status	Cost[2]	Possible Funding Source** (where applicable)	Weighted STAPLEE Criteria							
								A. Daily B. Monthly C. Annually D. 2013-2017 E. 2018-2022 F. 2023 Onward		**$ = Minimal** **$$ = Up to $100,000** **$$$ = Over $100,000**		Costs (0)/ Benefits (1)							
	Flooding	High Wind and Tornado	Drought and Wildfire	Winter Storm	Earthquake	Hurricane						Social	Technical	Administrative	Political	Legal	Economic	Environmental	**STAPLEE Total**
Local Plans and Regulations																			
Benefit-Cost Analysis. Evaluate opportunities for public funding of mitigation projects on private property where public benefits exceed the cost for RL properties or for properties otherwise eligible for buy-out.	X	X	X	X	X	X	BOF, BOS	**C**	Completed for each project for which grants may be used.	**$**	CIP, OP	1	1	1	1	1	1	1	**7**
Best Management Practices. Continue to use best management practices (BMPs) as described in the Connecticut DEEP Storm water Management Guidelines on a site-by-site basis as advised by a professional engineer.	X	X	X	X	X	X	BOS, PW, LUO, BO	**A**	Currently used at each site.	**$**	OP	1	1	1	1	1	1	1	**7**
Business Recovery Plan. Develop business recovery plan cooperatively with other region towns and distribute to town businesses.	X	X	X	X	X	X	BOS	**D**	No Plan in place.	**$$**	CIP, OP	1	1	0	1	1	1	1	**6**
Capital Improvement Plan. Include infrastructure improvements to reduce loss of life and property during natural hazard (NH) events in Capital Improvement Plan. .	X	X	X	X	X	X	BOF, BOS, PW	**C**	CIP includes some hazard mitigation measures each year.	**$**	OP	1	1	1	1	1	1	1	**7**
Conservation Planning. Educate the public about how the Town uses planning, regulation, and ordinances to mitigate NHs via LID, aquifer recharge, riparian buffer, rain gardens, open burning ordinances, house numbering, etc.	X		X	X		X	CC	**D**	New	**$**	OP	1	1	1	1	1	1	1	**7**
Cooperative Agreements for Shelters. Develop supporting documentation and encourage the Board of Selectmen to establish agreements for shelters that can provide specialized services, throughout the region. Shelters with the capacity to provide for companion pets and medical equipment needs for individuals with disabilities are two examples of such specializations. Support changes in the laws that require every town to provide facilities capable of serving the most severely handicapped individuals, to allow towns to serve these individuals and their families through regional shelters equipped to handle their needs.	X	X	X	X	X	X	FS, BOS	**D**	Haddam Killingworth MS is regional Red Cross Shelter.	**$**	OP	1	1	1	1	1	1	1	**7**
Design Standards. Continue to implement State Building/Fire Code and local Flood Code for construction that minimizes loss of life and property damage due to NHs.	X	X	X	X	X	X	BO	**D**	State building Code is currently used.	**$**	CIP, OP	1	1	1	1	1	1	1	**7**
Immobile Evacuees. Review annually the program to evacuate persons without means of transport, including registration and house numbering.	X	X	X	X	X	X	EMD	**C**	New	**$**	OP	1	1	0	1	1	1	1	**6**

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Flood Zone Study. Update flood zone study for the town any time there is an update from FEMA to incorporate changed conditions upland and within the floodplain.	X						LUO, IWC	**D**	New Maps adopted 2008	**$$**	HMPG,PDM	1	1	1	1	1	1	1	**7**
Forest Management Plan. Consult with a forester to establish a forest management plan to enable ability of firefighters to access forest fires.			X				FS	**D**	New	**$**	OP	1	1	0	1	1	1	1	**6**
Grants. Identify and apply for grants to fund infrastructure improvements and other mitigation tasks identified in this plan.	X	X	X	X	X	X	BOF, BOS, LUO	**C**	Occurs annually.	**$**	OP	1	1	0	1	1	1	1	**6**
Land Use Regulation. Maintain, and strengthen as appropriate, subdivision, and zoning regulations to make safer new roads and lots within flood zones.	X	X	X	X	X	X	LUO, P&Z	**A**	Land use regulations are reviewed annually.	**$**	CIP, OP	1	1	1	1	1	1	1	**7**
Landlord Incentives. Research what kind of incentives would motivate land owners to make the additional investment that would reduce potential damages to their properties and loss of life of their tenants.	X	X	X	X	X	X	BOS, LUO	**D**	Regulations reviewed as needed.	**$**	OP	1	1	0	1	1	1	1	**6**
Local Social Resources. Identify local resources to assist with those populations (i.e. elderly, disabled, non-English speakers, who may frequent, reside, or work) in Killingworth. Seek grants to provide funding for developing more detailed data to assist in the social – demographic analysis of how Killingworth will be affected by natural hazards.	X	X	X	X	X	X	BOS, EMD	**D**	New	**$**	OP	1	1	0	1	1	1	1	**6**
Minimal runoff from development. Continue to require all new development to be built using techniques to eliminate run-off.	X		X	X		X	P&Z, IWC, LUO	**A**	Currently required in new development.	**$**	CIP, OP	1	1	1	1	1	1	1	**7**
Owner Participation. Promote owner participation in mitigation efforts to protect their own properties.	X	X	X	X	X	X	LUO, BOS	**C**	Owners are encouraged to mitigate property.	**$**	OP	1	1	0	0	1	0	1	**4**
Post Disaster School Arrangements. Establish reciprocal arrangements with other school districts for getting students back into classes during extended recovery periods.	X	X	X	X	X	X	DEM, BOE	**D**	New	**$**	BOE, OP	1	1	0	1	1	1	1	**6**
Potential Financial Impact of Probable Events. Estimate the municipal tax revenue that could potentially be lost in various events to provide the Board of Selectmen and Board of Finance with an idea of how large a "rainy day" fund might be necessary to cover that post disaster period when there would be minimal income and maximum output of public funds at all levels of government.	X	X	X	X	X	X	LUO, BOF	**D**	New	**$**	OP	0	0	0	0	1	1	1	**3**
Private Property Funds. Evaluate opportunities for public funding for projects on private property where the benefits exceed the costs.	X	X	X	X	X	X	BOS, BOF, LUO	**C**	Has not begun.	**$**	HMPG, FMA, RFC,SRL	0	0	0	0	1	1	1	**3**
Public Transit Funding. Support regional transportation system (RTD) to facilitate movement of people without means of transportation prior to NH events.	X	X	X	X	X	X	BOF, BOS	**C**	Contributes to 9TT Funding	**$$**	CIP, RTP, STIP	1	1	1	1	1	1	1	**7**
Recovery & Reconstruction Plan. Develop a post-disaster recovery and reconstruction plan to re-establish infrastructure and public services, etc. damaged or destroyed by any NH event, including establishment of a "rainy day" fund in case Federal assistance is insufficient or delayed.	X	X	X	X	X	X	FS,PW,BOF	**D**	New	**$$**	CIP, HMPG	1	0	0	1	1	1	1	**5**
Regulations. Strengthen existing subdivision regulations to either optimally prevent road or house construction within the floodplain, or alternatively raise structures above BFE.	X	X	X	X	X	X	IWC, P&Z, LUO	**D**	Updated to these requirements after 2006 NHMP.	**$**	OP	1	1	1	1	1	1	1	**7**

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Structure and Infrastructure Projects																			
Construction Standards. Ensure that flood proof construction standards for roads and structures within the flood plain are strictly enforced.	X			X		X	BO	**D**	Standards are enforced.	**$**	OP	1	1	0	1	1	1	1	**6**
Critical Facilities. Upgrade as necessary all facility mechanicals, such as generators, in municipal and other critical facilities.	X	X	X	X	X	X	PW, BOS, BOF	**C**	Upgraded case by case.	**$$**	PDM,HMPG, CIP	1	1	1	1	1	0	1	**6**
Data for Plans. Use GIS database to develop better mitigation plans.	X	X	X	X	X	X	BOF, LUO	**D**	GIS was used for the creation of this update.	**$**	CIP, OP	1	1	1	1	1	1	1	**7**
Drinking Water Cache. Continue to work with Water Companies to ensure adequate water will be available in times of emergencies.	X	X	X	X	X	X	PW, BOS	**C**	CT Water provides tanker truck when necessary for public use.	**$**	PDM,HMPG, CIP	1	1	1	1	1	1	1	**7**
Dry Hydrants. Continue to require dry hydrants, fire ponds, or water storage tanks in new developments where water supply is inadequate.			X				LUO, BO, P&Z	**A**	Currently required by regulations.	**$$**	CIP, OP	1	1	1	1	1	1	1	**7**
Electronic Records Preservation. Design databases for records keeping. Create a back-up of existing electronic records, including geographic information system (GIS) data.	X	X			X	X	BOS, BOF	**D**	Backups are currently used.	**$**	CIP, HMPG	1	1	1	1	1	1	1	**7**
Engineering Reports. Implement strategic enforcement actions to include engineering reports for structural expansion or alterations on properties within the 1% annual chance flood zone.	X			X		X	BO, LUO	**D**	Engineering reports are reviwed in the flood zone.	**$**	OP	1	1	1	1	1	0	1	**6**
Firefighting Infrastructure Analysis. Evaluate existing firefighting infrastructure to identify needs for improvement to cover gaps in availability.			X				Fire Dept.	**D**	Infrastructure is assessed yearly.	**$$$**	CIP, OP	1	1	1	1	1	1	1	**7**
Geographic Information System. Annually review and update as necessary existing town GIS data.	X	X	X	X	X	X	LUO	**D**	Updated regularly through contract.	**$$**	HMPG, CIP	1	1	1	1	1	1	1	**7**
GIS Database. Establish a comprehensive GIS database to better identify and assess areas, structures, and populations potentially affected by natural disasters. These data will provide the town with information necessary to assess natural hazard risks and develop plans to mitigate risks to people and property.	X	X	X	X	X	X	BOS, BOF, LUO	**D**	GIS Database exists. Maps available on Town website.	**$$**	CIP, OP	1	1	1	1	1	1	1	**7**
Municipal Buildings Capable of Being Shelters. Future investment in municipal structures should include funding for new construction or renovation that will assure the structure is compliant with the standards for use as a shelter, to the extent possible.	X	X	X	X	X	X	BOS, BOF, BO	**E**	New	**$$$**	HMPG,PDM, CIP	1	1	1	1	1	0	1	**6**
Oblique Imagery. Over the next five (5) years obtain oblique imagery in order to allow for assessment of such factors as extent of fire damage, and compliance with building standards.	X	X	X	X	X	X	LUO	**D**	Imagery is linked to Town GIS database.	**$**	OP	1	1	1	1	1	1	1	**7**
Paper Records Preservation. Convert all paper records maintained by the municipality to an electronic format, consistent with any State recommendations, to ensure their survival. Establish protocols for practices going forward.	X	X			X	X	BOS, BOF	**D**	Paper is converted as needed.	**$**	CIP	1	1	0	1	1	0	1	**5**
Promote Self Inspection. Develop a list of techniques for homeowner self-inspection.	X	X	X	X	X	X	BOS, LUO, BO	**A**	New	**$**	OP	1	1	0	1	1	1	1	**6**

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Public Works Garage & Transfer Station Generators. Install and upgrade generators for back-up power.		X		X		X	PW, BOF, BOS	**D**	Portables designated for PW garage.	**$$**	HMPG, CIP	1	1	1	1	1	1	1	**7**
RL Properties. Encourage property owners of repetitive loss properties to obtain assistance for hazard mitigation funding from DEEP/FEMA for elevation of structures and repairs where applicable.	X	X	X	X	X	X	LUO	**D**	Assistance is available through Town.	**$**	RFC, SRL	1	1	1	1	1	1	1	**7**
Road Evaluation. Evaluate to develop plans, and improve for emergency access and evacuation.	X			X	X	X	PW	**E**	New	**$$**	CIP, RTP, STIP, OP	1	1	1	1	1	1	1	**7**
Road Reconstruction. Develop a priority list for road reconstruction and elevation for roads which experience frequent flooding or are integral to evacuation. This includes bridges and culvert in need of upgrading or replacing.	X			X	X	X	PW	**F**	Trouble spots have been identified.	**$$$**	HMPG, FMA, CIP	1	1	1	0	0	0	0	**3**
Schools. Visit schools and educate children about the risks of floods, hurricanes, and other natural hazards and how to prepare for them.	X	X	X	X	X	X	BOS	**C**	New	**$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
Shelter Generator. Upgrade the generator at the HKMS shelter to include power for the kitchen and strengthen sheltering capabilities.	X	X	X	X	X	X	BOS, EMD, BOE	**C**	Current generator is not sufficient for sheltering operation.	**$$**	HMGP	1	1	1	1	1	1	1	**7**
Stormwater Infrastructure Inventory. Implement mapping and monitoring of catch basins, storm water outfalls, and related infrastructure.	X			X		X	PW	**D**	Inventory exists, but is not mapped.	**$**	HMPG, FMA, CIP	1	0	0	1	1	0	1	**4**
Stormwater Infrastructure Maintenance. Continue annual maintenance of storm water infrastructure, including detention basins.	X			X		X	PW	**C**	Cleaned annually, before storms and as needed.	**$**	CIP	1	1	1	1	1	1	1	**7**
Structural Reports. Continue to require structural engineering reports for expansion or alteration of buildings within the flood zones. Evaluate benefits of requiring structural engineering reports for expansion or alteration of buildings within other zones.	X	X		X		X	BO	**A**	Structural reports are required in Flood Zone.	**$**	OP	1	1	1	1	1	1	1	**7**
Telecommunication Tower Generators (Private). Evaluate whether generators are needed for back-up power at telecommunications facilities.		X		X		X	Private	**D**	New	**$$**	CIP, RTP, STIP	1	1	1	1	1	1	1	**7**
Underground Utilities. Require underground utilities for new development; require retrofitting during redevelopment of existing sites to bury utilities where appropriate to mitigate NHs.		X	X	X	X	X	BOS, BOF, LUO	**F**	New subdivisions are required to install utilities underground.	**$$**	HMPG,PDM, CIP	1	1	1	1	1	0	1	**6**
Wind Code Compliance. Consider establishing a policy that all building permit applicants be encouraged to construct their projects to meet 110 mile per hour wind resistance standard, whenever possible.		X					BO	**A**	State Building Code is strictly adhered to.	**$$**	CIP, OP	1	1	1	1	1	1	1	**7**
Natural Systems Protection																			
Assist Property Owners with Buyouts. Develop strategy and program for flood prone property owners who request a buyout.	X	X	X	X	X	X	BOS, BOF, LUO	**E**	New	**$**	HMGP, PDM, RFS, SRL	0	0	0	0	1	0	1	**2**
Below Base Flood Elevation Funding. Encourage property owners whose homes are below BFE to obtain assistance from DEEP and FEMA to acquire hazard mitigation funds to elevate structures where appropriate.	X			X		X	BOS, LUO	**D**	Assistance is available through Town.	**$**	HMPG, PDM, RFC, SRL	1	1	1	1	1	1	1	**7**
Drought Study. Conduct town-wide study of ground- and surface water capacity as it relates to planning for droughts.			X				LUO	**D**	New	**$$**	HMPG	1	0	0	0	1	0	1	**3**

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FIRMs. Work with Federal Emergency Management Agency (FEMA) to incorporate updated Flood Insurance Rate Maps (FIRMs) into town's planning, outreach, and mitigation actions.	X			X		X	LUO, P&Z	**D**	FIRM update adopted by the Town in 2008.	**$**	OP	1	1	1	1	1	1	1	**7**
Flood Enforcement. Enforce--through existing zoning, building, and flood permitting processes--construction standards to minimize flood risks.	X			X		X	IWC, P&Z, LUO	**A**	Construction Standards are enforced through zoning.	**$**	OP	1	1	1	1	1	1	1	**7**
Land Acquisition. Advance an assertive land acquisition plan to preserve vacant land subject to NHs.	X		X	X		X	BOS, BOF	**D**	New	**$$**	FMA, RFC, SRL	0	0	0	0	1	0	1	**2**
Park Maintainer. Assign stewardship duties to mitigate NHs at town-owned public open spaces, including parks, forests, drainage basins, conservation easements, and forests.	X	X	X	X	X	X	CC, BOF, BOS	**D**	New, Tree Warden monitors tree health on all Town lands.	**$$**	OP	1	1	0	1	1	0	1	**5**
Risk Assessment. Use GIS to conduct NH risk assessments that identify potentially affected areas and depict evacuation routes.	X	X	X	X	X	X	LUO	**D**	GIS was used for this Plan update.	**$**	OP	1	1	0	1	1	1	1	**6**
Stormwater Management. Continue to use best management practices (BMPs) as described in the Connecticut DEEP Storm water Management Guidelines on a site-by-site basis as advised by a professional engineer.	X			X		X	PW	**D**	BMPs are used at present.	**$$**	CIP	1	1	1	1	1	1	1	**7**
Tree Hazard Management Program. Implement a tree hazard management program, including appropriate planting practices to minimize future storm damage to buildings, utilities, and streets.		X		X		X	PW	**E**	Tree warden currently inspects trees along roads several times through the year. Town removes unhealthy trees as needed.	**$$**	CIP	0	1	0	1	1	0	1	**4**
Education and Awareness Programs																			
Circulate Existing Literature. Access existing literature prepared by regional groups and the chamber of commerce and FEMA and display for public distribution in the Town Hall and Library.	X	X	X	X	X	X	BOS	**C**	Literature is availble through Town and RiverCOG	**$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
Drought Education. Coordinate with Connecticut Water Company (Jensen's) on public education and public service announcements during droughts.			X				BOF, BOS	**C**	New	**$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
Educate About Risk Where People Live. Educate residents at high risk due to demographic or social attributes about the risk(s) relative to the areas that they populate.	X	X	X	X	X	X	LUO	**C**	New	**$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
Hotline. Publicize emergency "hotline" phone number or website for public information and volunteer support.	X	X	X	X	X	X	BOS	**D**	Website, email notifications sign-up	**$$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
Incident Notification System. Enlist public participation through public workshops to develop methods for notification of hazard events and emergencies.	X	X	X	X	X	X	BOS	**D**	CTAlert, email system available to sign up.	**$$**	OP	1	1	0	1	1	1	1	**6**
Natural Hazard Training. Continue to train and educate emergency responders about mitigating NHs.	X	X	X	X	X	X	LUO	**C**	Emergency Personnel are trainined throughout the year on various natural hazards.	**$$**	HMPG, PDM	1	1	1	1	1	1	1	**7**

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Outreach. Promote owner participation in mitigation efforts to protect their property.	X	X	X	X	X	X	LUO	**C**	Information is available on the Town website, survey was distributed, information posted on websites and mailings.	**$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
Pet Sheltering. Distribute hurricane preparedness information including pet sheltering plans.	X	X	X	X	X	X	EMD,FS	**C**	DEMHS Region 2 is currently in planning stages region-wide.	**$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
Preparedness Webpage. Keep up-to-date Town website with NH preparedness information, including hazard areas, evacuation routes deemed appropriate per NH event and locations of shelters.	X	X	X	X	X	X	EMD	**D**	Town website is continually updated.	**$$**	OP	1	1	1	1	1	1	1	**7**
Proactive Pamphlets. Provide pamphlets and refer to web-based information for property owners for hazards listed in this document to show options for obtaining additional insurance, structural alterations to protect against various hazard damage, and emergency procedures for families during a hazard. Include information for contractors and homeowners on the risks of building in hazard prone areas.	X	X	X	X	X	X	LUO	**C**	Pamphlets are available through Town Hall.	**$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
Recovery Webpage. Post on Town website information about recovery assistance following NH events.	X	X	X	X	X	X	BOS	**C**	Occurs after any large event.	**$$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
Webpage. Update town webpage with the section on Hazard Preparedness. Include options for mitigation for residential structures and business recovery and provide links to FEMA, NOAA, State OEM and RiverCOG websites for additional information.	X	X	X	X	X	X	BOS	**C**	Town website is continually updated.	**$$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
Information. Publish materials on additional hazards and encourage additional insurance.	X	X	X	X	X	X	BOS, LUO	**C**	New	**$**	OP	1	1	1	1	1	1	1	**7**
Private Roads. Engage street associations to ensure that they have plans in place for NH recovery, including snow removal.	X	X	X	X	X	X	BOS	**D**	Efforts are maed by Town staff to reach out to private road owners.	**$**	OP	1	1	1	1	1	1	1	**7**
Public Participation. Work with local civic organizations to develop methods for notification of emergencies.	X	X	X	X	X	X	FS	**C**	Work is done throughout the year.	**$**	OP	1	1	1	1	1	1	1	**7**
Wildfire Education. Educate the public about potential hazard of wildfire caused by campfires or open burning. Develop a warning system for when risks are high.			X				Fire Dept.	**C**	Burn permit required, DEEP has a warning system in place	**$**	HMPG, PDM	1	1	1	1	1	1	1	**7**

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Notes:
1. Many action items have more than one responsible party listed. The primary Responsible Party is the first listed, others follow. Definitions are on the following page.
2. A minimal cost includes staff time of existing staff personnel, copying, printing, and other small administrative costs.

*Responsible Party Code		**Funding Source Code	
BO	= Building Official	CIP	= Capital Improvement Plan
BOE	= Board of Education	FMA	= Flood Mitigation Assistance
BOF	= Board of Finance	HMGP	= Hazard Mitigation Program Grant
BOS	= Board of Selectman	OP	= Other Program
EMD	= Emergency Management Director	PDM	= Pre-Disaster Mitigation
LUO	= Land Use Office	RFC	= Repetitive Flood Claim
P&Z	= Planning & Zoning Commission	RTP	= Regional Transportation Program
PW	= Public Works	SRL	= Sever Repetitive Loss
ZEO	= Zoning Enforcement Officer	STIP	= State Transportation Improvement Program

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Appendix I - Sources of Information (A.4)

BOOKS AND ARTICLES:

Climate of Connecticut, *Joseph Brumbach, State Geological and Natural History Survey of Connecticut, 1965*

Flood Insurance Studies, Federal Emergency Management

Deep River, 1980	Old Lyme, 1983
Essex, 1986	Old Saybrook, 1984
Killingworth, 1981	Lyme, 1978
Westbrook, 1986	

Realizing the Risk, *L.R. Johnston Associates, Westport, CT, 1983, Natural Resources Center*

A New England Tropical Cyclone Climatology 1938-2000, *Abstract, Marc, Mailhot, EMA Storm Coordinator Center, Westbrook, ME*

Soil Survey of Middlesex County, *USDA, Connecticut Agricultural Experiment Station, 1979*

Suboceanic Landslides, *Steven N. Ward and Simon Day, 2002 Yearbook of Science and Technology, McGraw Hill*

The Face of Connecticut, People, Geology, and the Land, *Bulletin 110, State Geological and Natural History Survey of Connecticut, Michael Bell, 1985, reprint, 1997*

Movable Shore, *Peter C. Patton, and James M. Kent, Sponsored by the National Audubon Society and the Connecticut Department of Environmental Protection, 1992*

The Ocean's Reach, Digest of a Workshop on Identifying Coastal Flood Hazard Areas and Associate Risk Zones, *New England River Basins Commission, February 1976*

TOPO, Interactive Maps, Connecticut, *Wildflower Productions, 1999*

Primer on Natural Hazard Management in Integrated Regional Development Planning, *Department of Regional Development and Environment Executive Secretariat for Economic and Social Affairs, Organization of American States, With support from the Office of Foreign Disaster Assistance United States Agency for International Development, Washington, D.C., 1991*

Public Safety, What is Hazard Mitigation, *Commonwealth of Massachusetts, The Official Website of the Executive Office of Public Safety and Security (EOPSS), 2011*

Best Practices;:Disaster Mitigation Working in Massachusetts; High Marks for Buildings Higher: Hull's Freeboard Incentive Program; Get 'em Up: Scituate's Grant Committee

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Gets Homes in the Air; New Culvert Works: No Flooding at East Street; and New Drainage System Averts Flooding in Melrose; FEMA *Region 1 Mitigation Division as part of DR-1985-MA, June and July 2010*

Mitigation…In Massachusetts, *U.S. Department of Homeland Security, Federal Emergency Management Agency produced in cooperation with the Commonwealth of Massachusetts, circa 2011*

The Non Slippery Slope of Gravel Road Stabilization; Best Practices, *Federal Emergency Management Agency produced in cooperation with Massachusetts Emergency Management Agency, July 2007*

CT-Killingworth Town, 2010 Census Interactive Population Search, *http://2010.census.gov, November 2011*

Dams in Middlesex County East.jpg / Dams in Middlesex County West.jpg, *Connecticut Department of Energy and Environmental Protection, Inland Water Resources Division, Dam Safety Program, August 4, 2011*

PICTURES AND NEWS ARTICLES:

New Haven Register, Monday June 7, 1982, Tuesday June 8, 1982
Harford Courant, Monday, June 7, 1982 / Tuesday, June 8, 1982 / July 24, 1982 / July 26, 1982
Hartford Courant, "Retreat To High Ground: Hurricane Danger What if Irene had been a major hurricane?" Tuesday, August 30, 2011
Hartford Courant, "A Look Back at the Flood of '82" June 6, 2002
Middletown Press, Monday, June 7, 1982 / July 21, 1982
The Haddams – Killingworth Patch, November 1, 2011 / June 26, 2012 / October 29, 2012

MUNICIPAL DOCUMENTS:

Killingworth Plan of Conservation and Development, *March 15, 2008*
Killingworth Subdivision Regulations *Amended through 3-20-2001*
Killingworth Zoning Regulations *Amended through 4-16-2002*
CERC Killingworth Town Profile, 2012

WEB BASED SOURCES

City Data: http://www.city-data.com/city/Killingworth-Connecticut.html
Home Facts: http://www.homefacts.com/earthquakes/Connecticut/Middlesex-County/Killingworth.html
CT Environmental Conditions Online: www.cteco.uconn.edu
Killingworth GIS: http://107.20.209.214/killingworthct_public/default.html

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Appendix II - Acronyms

For the sake of brevity, this Plan identifies certain terms and entities with particularly long names by their commonly-known acronyms, as follows:

BFE:	Base Flood Elevation
BOS:	Board of Selectmen
CGS:	Connecticut General Statute
CLEAR:	Center for Land Use Education and Research, University of Connecticut, College of Agriculture and Natural Resources.
CL&P:	Connecticut Light and Power
CRERPA:	Connecticut River Estuary Regional Planning Agency
RiverCOG:	Lower Connecticut River Valley Council of Governments
DEEP:	Department of Energy & Environmental Protection, Connecticut
DOT:	Department of Transportation
EOC:	Emergency Operation Center
EOP:	Emergency Operations Plan
FEMA:	Federal Emergency Management Agency
FIRM:	Flood Insurance Rate Map
FIS:	Flood Insurance Study
FMA:	Flood Mitigation Assistance
GIS:	Geographical Information System
HKMS:	Haddam-Killingworth Middle School
HMA:	Hazard Mitigation Assistance
HMGP:	Hazard Mitigation Grant Program
KES:	Killingworth Elementary School
MPH:	Miles per Hour
MRPA:	Midstate Regional Planning Agency
NFIP:	National Flood Insurance Program
NOAA:	The National Oceanic and Atmospheric Administration
NRCC:	Northeast Regional Climate Center
PDM:	Pre-Disaster Mitigation
POCD:	Plan of Conservation and Development
P&Z:	Planning and Zoning Commission
RFC:	Repetitive Flood Claims
RLP:	Repetitive Loss Property
SFHA:	Special Flood Hazard Area
SRL:	Sever Repetitive Loss
STAPLEE:	Social, Technical, Administrative, Political, Legal, Economic, and Environmental (Method of Prioritizing)
TNC:	The Nature Conservancy
USGS:	United States Geological Survey

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Appendix III -

Hazus-MH: Earthquake Event Report

Region Killingworth

Scenario: Killingworth 100 Year Probabilistic

Print Date: January 10, 2013

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Totals only reflect data for those census tracts/blocks included in the user's study region.

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 35.75 square miles and contains 1 census tracts. There are over 2 thousand households in the region which has a total population of 6,018 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 2 thousand buildings in the region with a total building replacement value (excluding contents) of 484 (millions of dollars). Approximately 90.00 % of the buildings (and 85.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 195 and 0 (millions of dollars), respectively.

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Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 2 thousand buildings in the region which have an aggregate total replacement value of 484 (millions of dollars). Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 78% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 2 schools, 1 fire station, 0 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 7 dams identified within the region. Of these, 1 of the dams is classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 195.00 (millions of dollars). This inventory includes over 41 kilometers of highways, 3 bridges, and 371 kilometers of pipes.

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Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (Millions of dollars)
Highway	Bridges	3	5.90
	Segments	8	189.40
	Tunnels	0	0.00
		Subtotal	**195.30**
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	0	0.00
		Subtotal	**0.00**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	0	0.00
	Runways	0	0.00
		Subtotal	**0.00**
		Total	**195.30**

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Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (Millions of dollars)
Potable Water	Distribution Lines	NA	3.70
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**3.70**
Waste Water	Distribution Lines	NA	2.20
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**2.20**
Natural Gas	Distribution Lines	NA	1.50
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**1.50**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	0	0.00
		Subtotal	**0.00**
Communication	Facilities	0	0.00
		Subtotal	**0.00**
		Total	**7.40**

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Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Killingworth 100 Year Probabilistic
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	5.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

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Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	22	0.85	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	149	5.78	0	0.00	0	0.00	0	0.00	0	0.00
Education	5	0.19	0	0.00	0	0.00	0	0.00	0	0.00
Government	3	0.12	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	61	2.37	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	316	12.26	0	0.00	0	0.00	0	0.00	0	0.00
Religion	8	0.31	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	2,013	78.11	0	0.00	0	0.00	0	0.00	0	0.00
Total	**2,577**		**0**		**0**		**0**		**0**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	2,018	78.31	0	0.00	0	0.00	0	0.00	0	0.00
Steel	114	4.44	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	17	0.64	0	0.00	0	0.00	0	0.00	0	0.00
Precast	7	0.27	0	0.00	0	0.00	0	0.00	0	0.00
RM	23	0.89	0	0.00	0	0.00	0	0.00	0	0.00
URM	140	5.44	0	0.00	0	0.00	0	0.00	0	0.00
MH	258	10.01	0	0.00	0	0.00	0	0.00	0	0.00
Total	**2,577**		**0**		**0**		**0**		**0**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

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Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	0	0	0	0
Schools	2	0	0	2
EOCs	0	0	0	0
Police Stations	0	0	0	0
Fire Stations	1	0	0	1

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Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	8	0	0	8	8
	Bridges	3	0	0	3	3
	Tunnels	0	0	0	0	0
Railways	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

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Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7: Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8: Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	186	0	0
Waste Water	112	0	0
Natural Gas	74	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	2,196	0	0	0	0	0
Electric Power		0	0	0	0	0

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Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

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Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 6,018) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum; the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

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Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**0**	**0**	**0**	**0**
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**0**	**0**	**0**	**0**
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**0**	**0**	**0**	**0**

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Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	189.44	$0.00	0.00
	Bridges	5.87	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Subtotal	**195.30**	**0.00**	
Railways	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	0.00	$0.00	0.00
	Runways	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
	Total	**195.30**	**0.00**	

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Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution	3.70	$0.00	0.00
	Subtotal	**3.72**	**$0.00**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution	2.20	$0.00	0.00
	Subtotal	**2.23**	**$0.00**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution	1.50	$0.00	0.00
	Subtotal	**1.49**	**$0.00**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Communication	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
	Total	**7.43**	**$0.00**	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of $)

LOSS	Total	%

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Appendix A: County Listing for the Region

Middlesex, CT

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Appendix B: Regional Population and Building Value Data

Total

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	
Connecticut					
	Middlesex	6,018	411	73	484
Total State		**6,018**	**411**	**73**	**484**
Total Region		**6,018**	**411**	**73**	**484**

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Appendix IV -

Hazus-MH: Hurricane Event Report

Region Name: Killingworth

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Thursday, January 10, 2013

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Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 35.76 square miles and contains 1 census tracts. There are over 2 thousand households in the region and has a total population of 6,018 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 2 thousand buildings in the region with a total building replacement value (excluding contents) of 484 million dollars (2006 dollars). Approximately 90% of the buildings (and 85% of the building value) are associated with residential housing.

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Building Inventory

General Building Stock

Hazus estimates that there are 2,577 buildings in the region which have an aggregate total replacement value of 484 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	411,083	84.9%
Commercial	47,931	9.9%
Industrial	12,062	2.5%
Agricultural	3,266	0.7%
Religious	4,662	1.0%
Government	822	0.2%
Education	4,293	0.9%
Total	**484,119**	**100.0%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, no police stations and no emergency operation facilities.

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Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

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Building Damage

General Building Stock Damage

Hazus estimates that about 16 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	20	91.26	2	6.82	0	1.30	0	0.58	0	0.03
Commercial	140	93.82	8	5.33	1	0.76	0	0.09	0	0.00
Education	5	94.56	0	5.13	0	0.31	0	0.01	0	0.00
Government	3	94.60	0	5.08	0	0.32	0	0.00	0	0.00
Industrial	58	94.38	3	5.07	0	0.46	0	0.09	0	0.00
Religion	8	93.99	0	5.68	0	0.31	0	0.02	0	0.00
Residential	2,132	91.53	184	7.88	14	0.58	0	0.01	0	0.00
Total	**2,364**		**197**		**15**		**0**		**0**	

Table 3: Expected Building Damage by Building Type : 100 - year Event

	None		Minor		Moderate		Severe		Destruction	
Building Type	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	9	94.68	0	4.98	0	0.34	0	0.00	0	0.00
Masonry	92	91.71	7	7.10	1	1.02	0	0.16	0	0.01
MH	257	99.54	1	0.36	0	0.09	0	0.00	0	0.00
Steel	103	94.74	5	4.65	1	0.54	0	0.08	0	0.00
Wood	1,809	90.72	173	8.66	12	0.61	0	0.01	0	0.00

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Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
Fire Stations	1	0	0	1
Schools	2	0	0	2

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Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 14,488 tons of debris will be generated. Of the total amount, 12,721 tons (88%) is Other Tree Debris. Of the remaining 1,767 tons, Brick/Wood comprises 20% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 14 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 1,413 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 6,018) will seek temporary shelter in public shelters.

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Economic Loss

The total economic loss estimated for the hurricane is 3.9 million dollars, which represents 0.81 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 4 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 94% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	3,039.21	103.16	18.73	29.17	3,190.27
	Content	554.52	13.11	5.21	5.31	578.15
	Inventory	0.00	0.27	1.08	0.47	1.82
	Subtotal	**3,593.73**	**116.53**	**25.02**	**34.96**	**3,770.24**
Business Interruption Loss						
	Income	0.00	12.71	0.13	2.56	15.40
	Relocation	72.06	13.04	0.73	3.57	89.40
	Rental	21.23	8.10	0.13	0.23	29.70
	Wage	0.00	8.19	0.21	6.02	14.42
	Subtotal	**93.29**	**42.04**	**1.19**	**12.39**	**148.91**
	Total					
	Total	**3,687.02**	**158.58**	**26.21**	**47.34**	**3,919.15**

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Appendix A: County Listing for the Region

Connecticut
- Middlesex

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	**Residential**	**Non-Residential**	**Total**
Connecticut				
Middlesex	6,018	411,083	73,036	484,119
Total	**6,018**	**411,083**	**73,036**	**484,119**
Study Region Total	**6,018**	**411,083**	**73,036**	**484,119**

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Appendix V -

Hazus-MH: Flood Event Report

Region Name: Killingworth

Flood Scenario: Killingworth

Print Date: Tuesday, February 05, 2013

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Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 35 square miles and contains 147 census blocks. The region contains over 2 thousand households and has a total population of 6,018 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 2,577 buildings in the region with a total building replacement value (excluding contents) of 484 million dollars (2006 dollars). Approximately 90.38% of the buildings (and 84.91% of the building value) are associated with residential housing.

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Building Inventory

General Building Stock

Hazus estimates that there are 2,577 buildings in the region which have an aggregate total replacement value of 484 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	411,083	84.9%
Commercial	47,931	9.9%
Industrial	12,062	2.5%
Agricultural	3,266	0.7%
Religion	4,662	1.0%
Government	822	0.2%
Education	4,293	0.9%
Total	**484,119**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	365,511	85.6%
Commercial	38,882	9.1%
Industrial	10,548	2.5%
Agricultural	2,556	0.6%
Religion	4,453	1.0%
Government	822	0.2%
Education	4,224	1.0%
Total	**426,996**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire station, no police stations and no emergency operation centers.

DRAFT

Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Killingworth
Scenario Name:	Killingworth
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

DRAFT

Building Damage

General Building Stock Damage

Hazus estimates that about 4 buildings will be at least moderately damaged. This is over 4% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	3	75.00	1	25.00	0	0.00
Total	**0**		**0**		**0**		**3**		**1**		**0**	

Table 4: Expected Building Damage by Building Type

Building	**1-10**		**11-20**		**21-30**		**31-40**		**41-50**		**Substantially**	
Type	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	3	75.00	1	25.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

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Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	2	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

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Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

Analysis has not been performed for this Scenario.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 185 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 211 people (out of a total population of 6,018) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 6.92 million dollars, which represents 1.62 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

3.73 3.73 **3.73** 3.73

The total building-related losses were 6.92 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 53.95% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

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Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	2.47	0.50	0.35	0.05	3.36
	Content	1.27	1.35	0.49	0.36	3.47
	Inventory	0.00	0.01	0.08	0.00	0.09
	Subtotal	**3.73**	**1.86**	**0.92**	**0.41**	**6.92**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
	Total	**3.73**	**1.86**	**0.92**	**0.41**	**6.92**
	ALL					

Appendix A: County Listing for the Region

Connecticut

- Middlesex

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	**Residential**	**Non-Residential**	**Total**
Connecticut				
Middlesex	6,018	411,083	73,036	484,119
Total	**6,018**	**411,083**	**73,036**	**484,119**
Total Study Region	**6,018**	**411,083**	**73,036**	**484,119**

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Appendix VII – Screen Shots

Figure A: TownofKillingworth.com Home Page with link to NHMP and Survey on right.

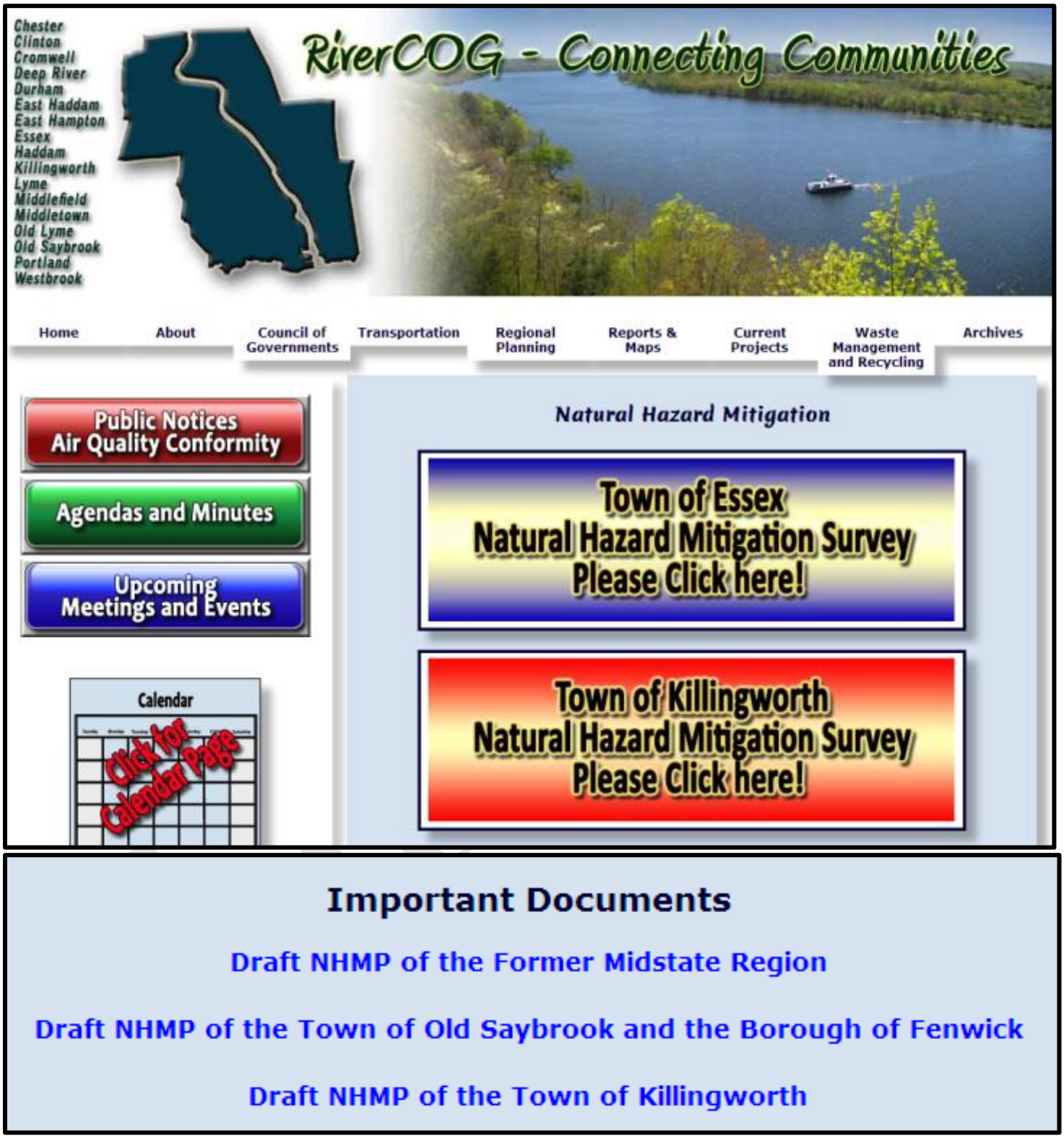
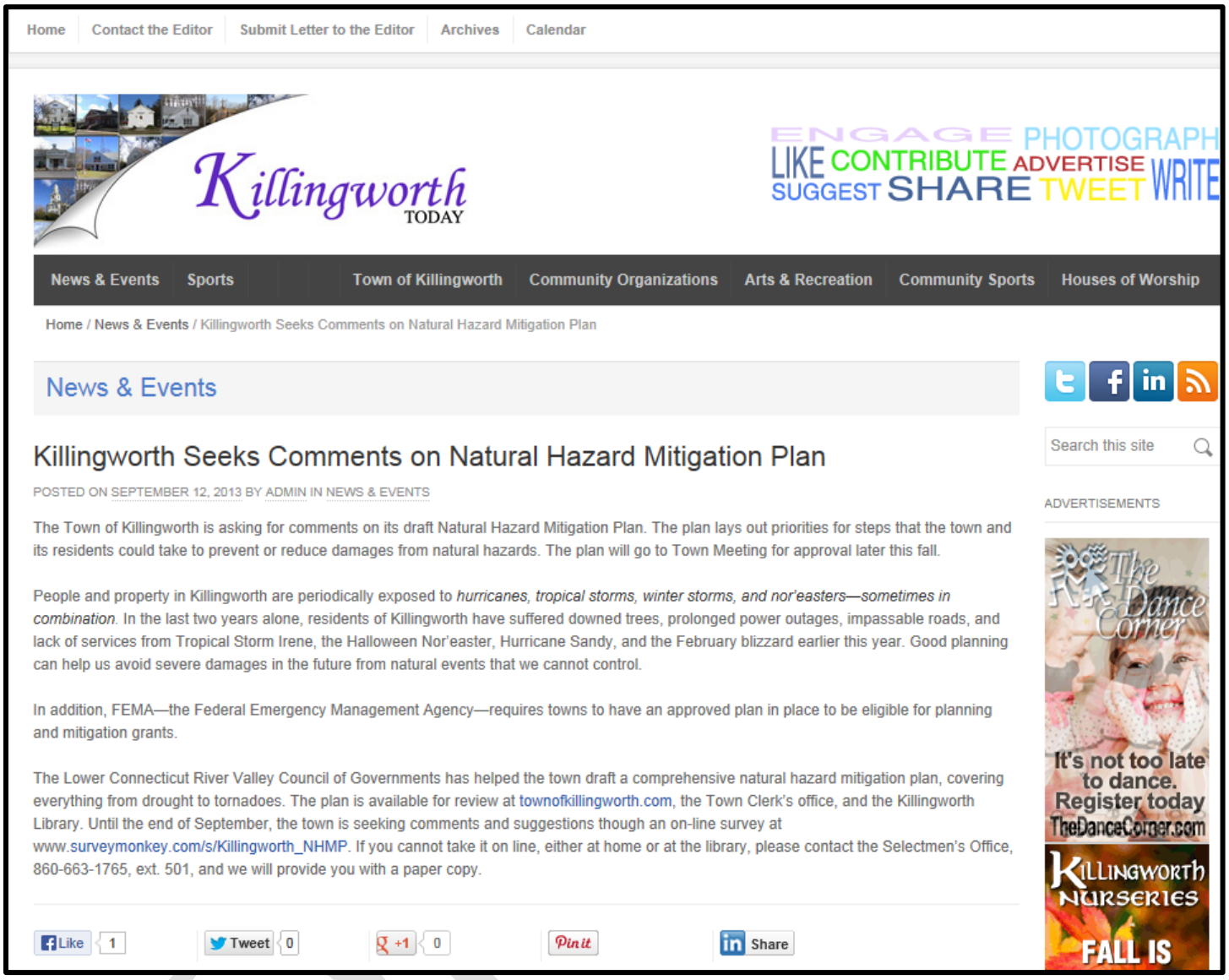


Figure B: RiverCOG.org Natural Hazard Mitigation Page with link to Killingworth Survey. The Killingworth NHMP is located at the bottom of the page (along with links to other Plans throughout the Region).



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Killingworth Seeks Comments on Natural Hazard Mitigation Plan

POSTED ON SEPTEMBER 12, 2013 BY ADMIN IN NEWS & EVENTS

The Town of Killingworth is asking for comments on its draft Natural Hazard Mitigation Plan. The plan lays out priorities for steps that the town and its residents could take to prevent or reduce damages from natural hazards. The plan will go to Town Meeting for approval later this fall.

People and property in Killingworth are periodically exposed to *hurricanes, tropical storms, winter storms, and nor'easters—sometimes in combination*. In the last two years alone, residents of Killingworth have suffered downed trees, prolonged power outages, impassable roads, and lack of services from Tropical Storm Irene, the Halloween Nor'easter, Hurricane Sandy, and the February blizzard earlier this year. Good planning can help us avoid severe damages in the future from natural events that we cannot control.

In addition, FEMA—the Federal Emergency Management Agency—requires towns to have an approved plan in place to be eligible for planning and mitigation grants.

The Lower Connecticut River Valley Council of Governments has helped the town draft a comprehensive natural hazard mitigation plan, covering everything from drought to tornadoes. The plan is available for review at townofkillingworth.com, the Town Clerk's office, and the Killingworth Library. Until the end of September, the town is seeking comments and suggestions though an on-line survey at www.surveymonkey.com/s/Killingworth_NHMP. If you cannot take it on line, either at home or at the library, please contact the Selectmen's Office, 860-663-1765, ext. 501, and we will provide you with a paper copy.

Like 1 | Tweet 0 | +1 0 | Pin it | Share

Figure C: KillingworthToday.com press release seeking public comments on the Killingworth Natural Hazard Mitigation Plan.

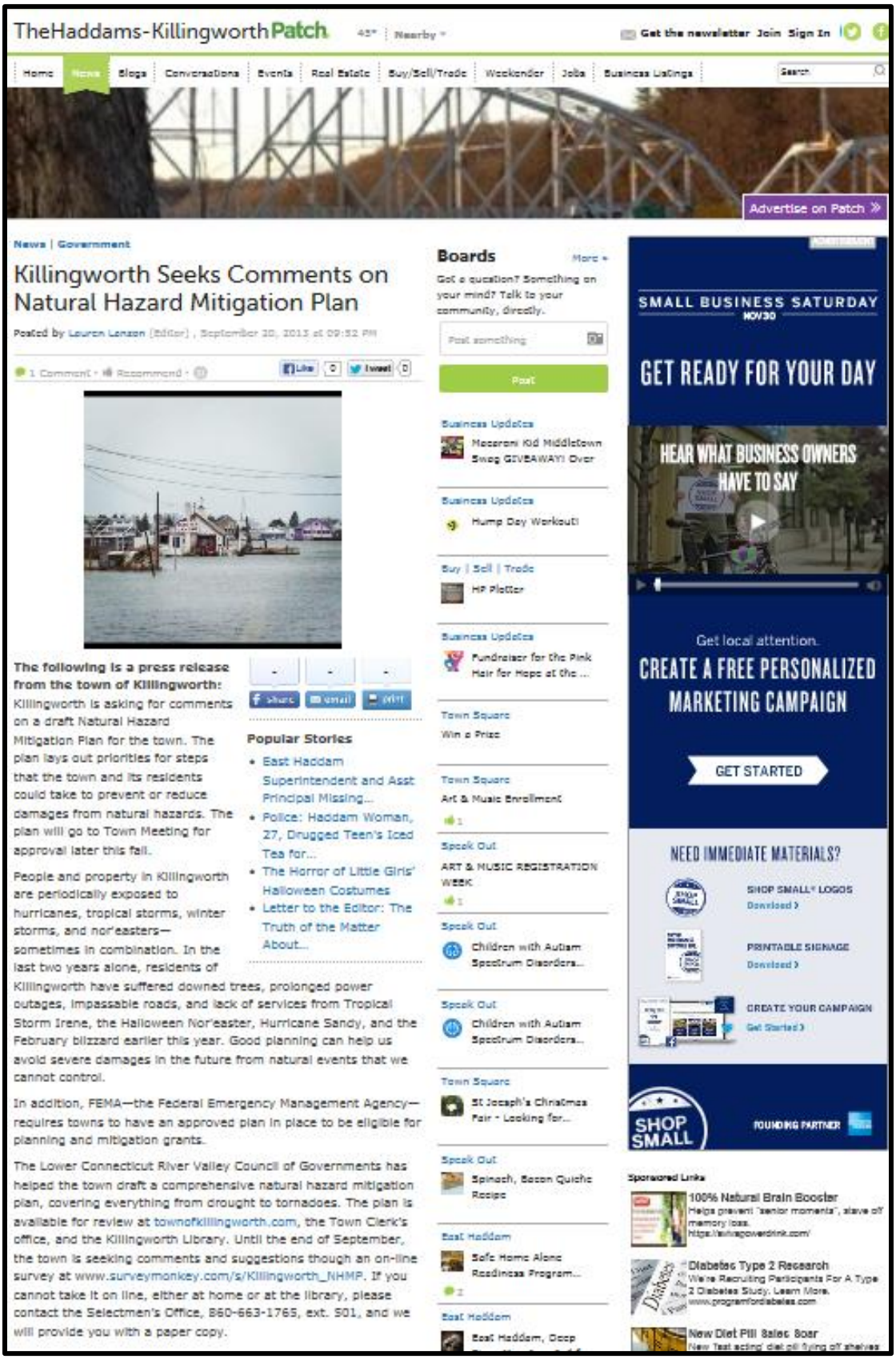

Figure D: The Haddams - Killingworth Patch press release seeking public comments on the Killingworth Natural Hazard Mitigation Plan.

Town Hall Notes

By Cathy Iino, First Selectwoman

Hazard Mitigation survey. In the last four years alone, Killingworth residents have suffered through six federally declared natural disasters, which brought flooding, downed trees, prolonged power outages, impassable roads, and lack of services. With the help of RiverCOG, our local council of governments, we are currently drafting a *Natural Hazards Mitigation Plan* identifying measures available to residents and the town to prepare for future natural hazards. FEMA, the Federal Emergency Management Agency, requires towns to have such plans in place to be eligible for planning and mitigation grants.

Now, we would like your input on the plan. *The Natural Hazards Mitigation Plan* and a short survey are on line at www.townofkillingworth.com. If you cannot complete the survey online, you can obtain a paper copy at the Town Hall or the Killingworth Library.

Recycling. We can now recycle plastic toys, beverage crates, laundry baskets, large buckets, storage containers. Remove metal parts such as axles and hinges—they can go in the metal bin—and glass mirrors. No black plastic or containers that held hazardous materials.

Mosquito alert. Two illnesses transmitted by mosquitoes in our area, Eastern Equine Encephalitis and West Nile Virus, have been found in mosquitoes trapped in Connecticut this year. Human infection with EEE is rare but deadly. West Nile is more common and is particularly threatening to the elderly.

We should all try to minimize the amount of standing water, where mosquitoes can breed in a very short time. Among the steps you can take are:

- Remove any containers that can collect rain.
- Empty standing water from old tires, including tire swings. Residents with Transfer Station stickers may discard tires for free.
- Clean clogged roof gutters.
- Turn over such items as wading pools, wheelbarrows, and recycling bins when not in use.
- Aerate ornamental pools or stock them with fish.

School's Open. Please drive like your kids live here—they do. And we want to keep it that way.

Sheltering in place. Here we are at the height of hurricane season, and once again the National Weather Service says there is a greater-than-average chance of major storms. Should a Category 3 hurricane hit us directly, we would have to evacuate our more vulnerable residences. In smaller storms, we are likely to suffer more from indirect damages such as blocked roads and power outages, and you may be most comfortable sheltering at home.

Photo by Amy Etra

For Your convenience, an Emergency Preparation Checklist can be found on the opposite page.

Clip off the checklist and keep in a handy spot as a reference. Additional state and town emergency information can be found on page 16.

Continued on next page

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14

Figure E: Press release in the Killingworth Krier, a monthly mailing to all Killingworth Residents.

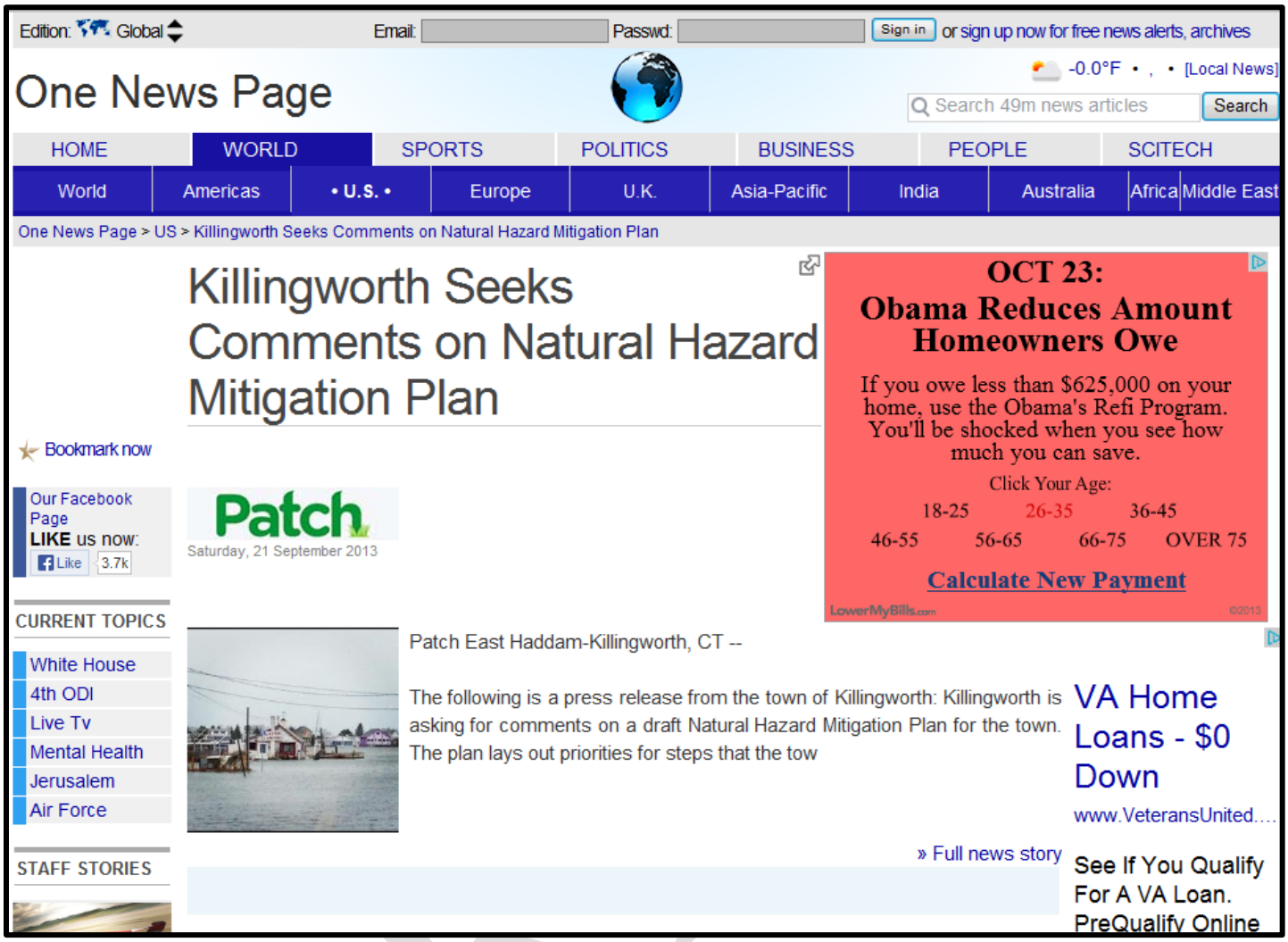
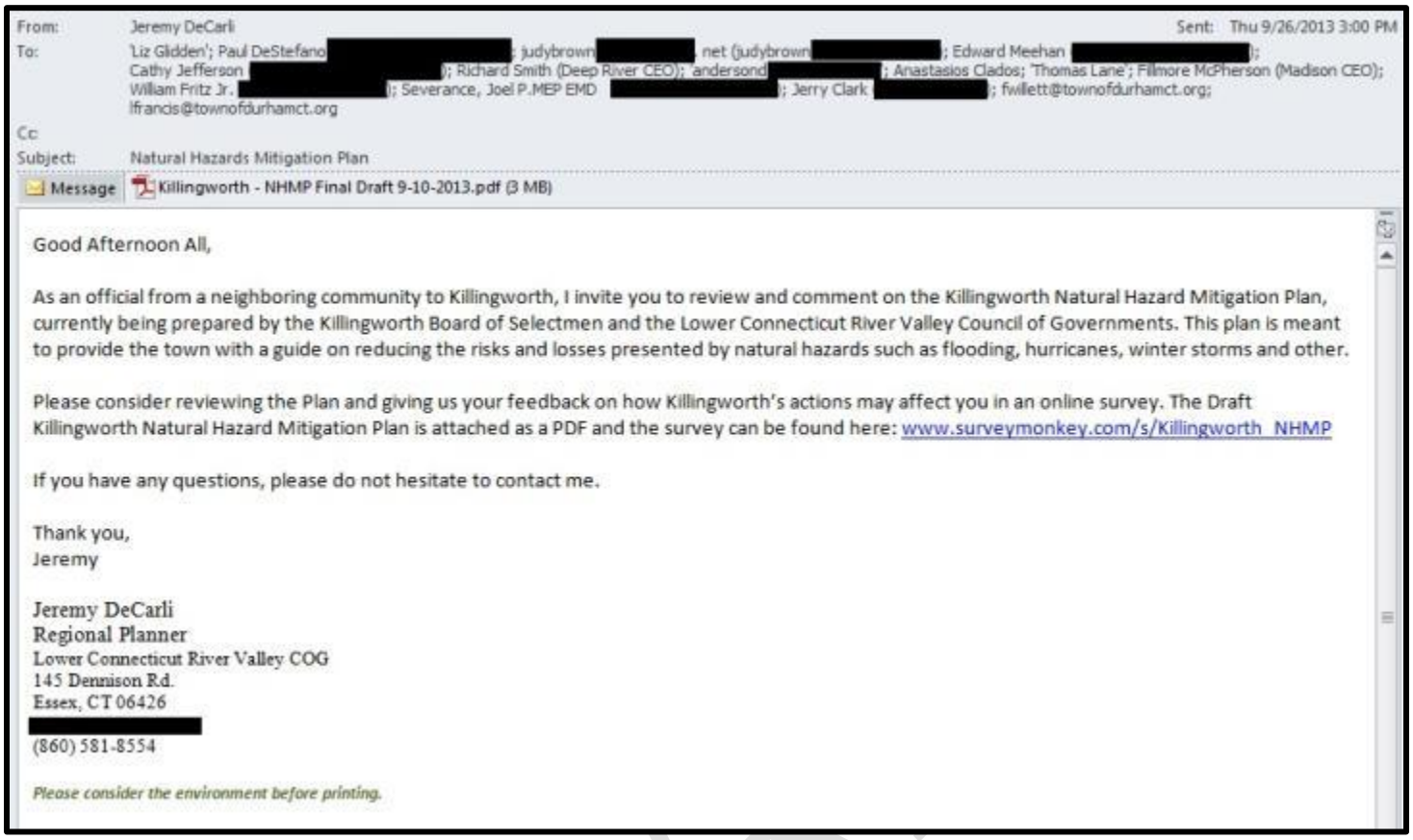


Figure F: One News press release seeking public comments on the Killingworth Natural Hazard Mitigation Plan.



From: Jeremy DeCarli Sent: Thu 9/26/2013 3:00 PM

To: 'Liz Glidden'; Paul DeStefano [redacted]; judybrown [redacted] net (judybrown [redacted]; Edward Meehan [redacted]; Cathy Jefferson [redacted]); Richard Smith (Deep River CEO); andersond [redacted]; Anastasios Clados; 'Thomas Lane'; Fillmore McPherson (Madison CEO); William Fritz Jr. [redacted]; Severance, Joel P.MEP EMD [redacted]; Jerry Clark [redacted]; fwillett@townofdurhamct.org; lfrancis@townofdurhamct.org

Cc:

Subject: Natural Hazards Mitigation Plan

Message | Killingworth - NHMP Final Draft 9-10-2013.pdf (3 MB)

Good Afternoon All,

As an official from a neighboring community to Killingworth, I invite you to review and comment on the Killingworth Natural Hazard Mitigation Plan, currently being prepared by the Killingworth Board of Selectmen and the Lower Connecticut River Valley Council of Governments. This plan is meant to provide the town with a guide on reducing the risks and losses presented by natural hazards such as flooding, hurricanes, winter storms and other.

Please consider reviewing the Plan and giving us your feedback on how Killingworth's actions may affect you in an online survey. The Draft Killingworth Natural Hazard Mitigation Plan is attached as a PDF and the survey can be found here: www.surveymonkey.com/s/Killingworth_NHMP

If you have any questions, please do not hesitate to contact me.

Thank you,
Jeremy

Jeremy DeCarli
Regional Planner
Lower Connecticut River Valley COG
145 Dennison Rd.
Essex, CT 06426
[redacted]
(860) 581-8554

Please consider the environment before printing.

Figure G: Email notification and request for comments sent from RiverCOG staff to neighboring community officials with Draft NHMP attached and a link to the online survey.

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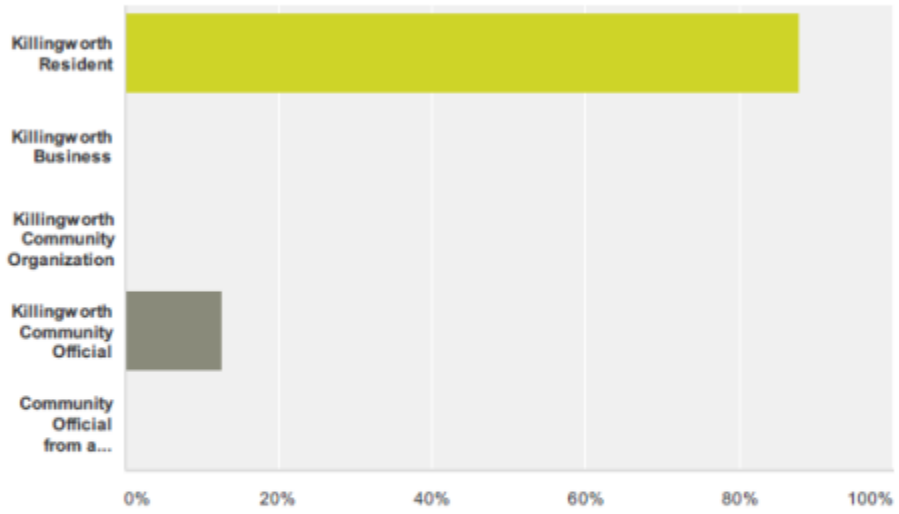
Appendix VIII – Public Survey Questions and Responses

Killingworth Natural Hazard Mitigation Plan

Q1 Are you responding as:

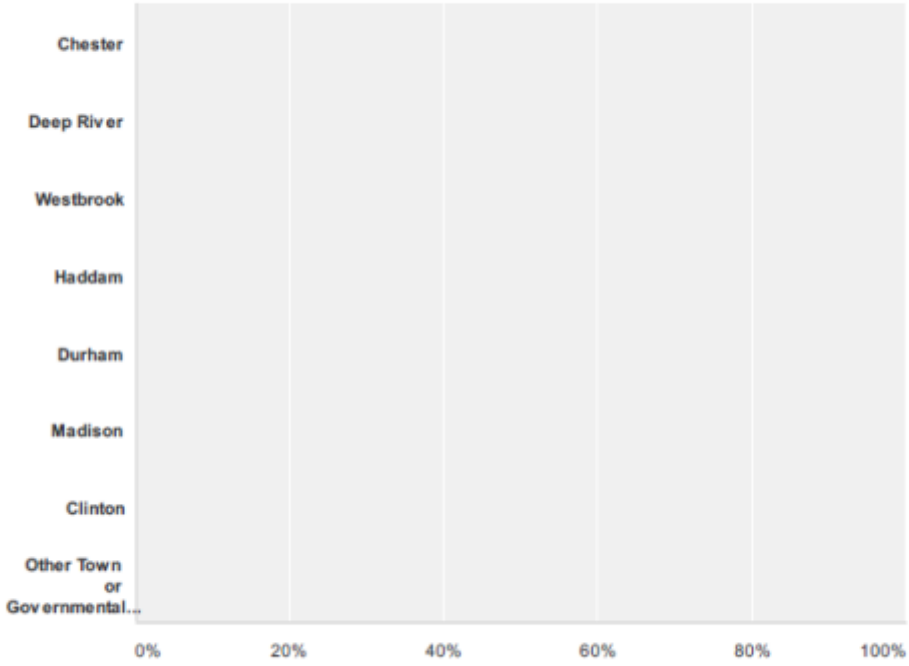
Answered: 24 Skipped: 0



Answer Choices	Responses	
Killingworth Resident	87.50%	21
Killingworth Business	0%	0
Killingworth Community Organization	0%	0
Killingworth Community Official	12.50%	3
Community Official from a Neighboring Town or Regional, State or Federal Agency	0%	0
Total		**24**

Q2 For what town or agency do you work?

Answered: 0 Skipped: 24



Answer Choices	Responses	
Chester	0%	0
Deep River	0%	0
Westbrook	0%	0
Haddam	0%	0
Durham	0%	0
Madison	0%	0
Clinton	0%	0
Other Town or Governmental Agency (please specify)	0%	0
Total		**0**

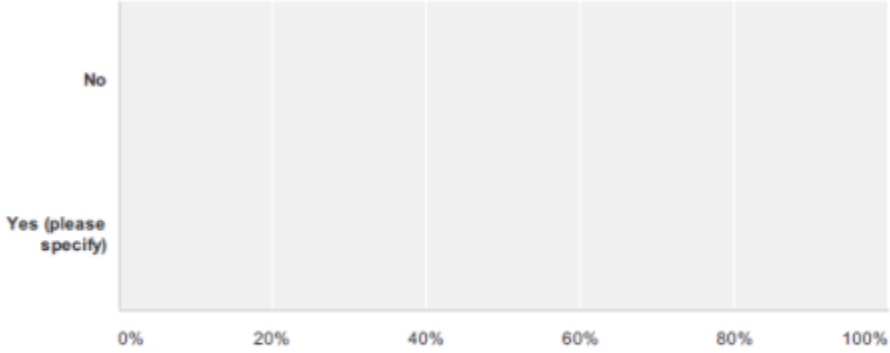
Q3 Are you actively involved in Natural Hazard Mitigation?

Answered: 0 Skipped: 24

Answer Choices	Responses	
No	0%	0
Yes	0%	0
Total		0

Q4 Have natural hazards in Killingworth impacted your town, region or agency?

Answered: 0 Skipped: 24



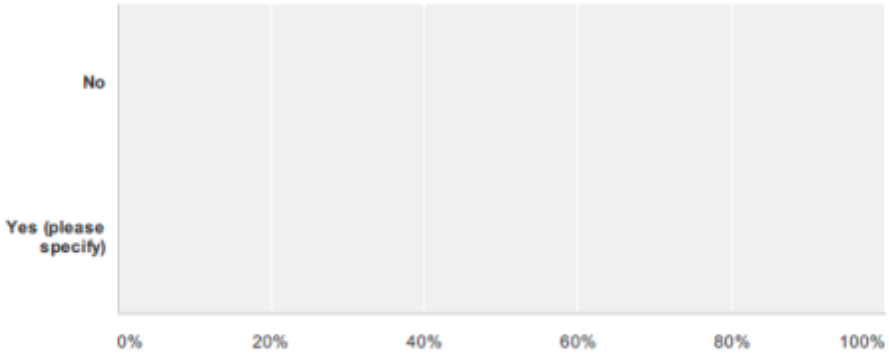
Answer Choices	Responses	
No	0%	0
Yes (please specify)	0%	0
Total		0

Q5 Please add any suggestions, ideas, concerns or comments that you would like the Town of Killingworth to consider.

Answered: 0 Skipped: 24

Q6 Are there inter-town or regional mitigation actions that need to be coordinated?

Answered: 0 Skipped: 24



Answer Choices	Responses	
No	0%	0
Yes (please specify)	0%	0
Total		0

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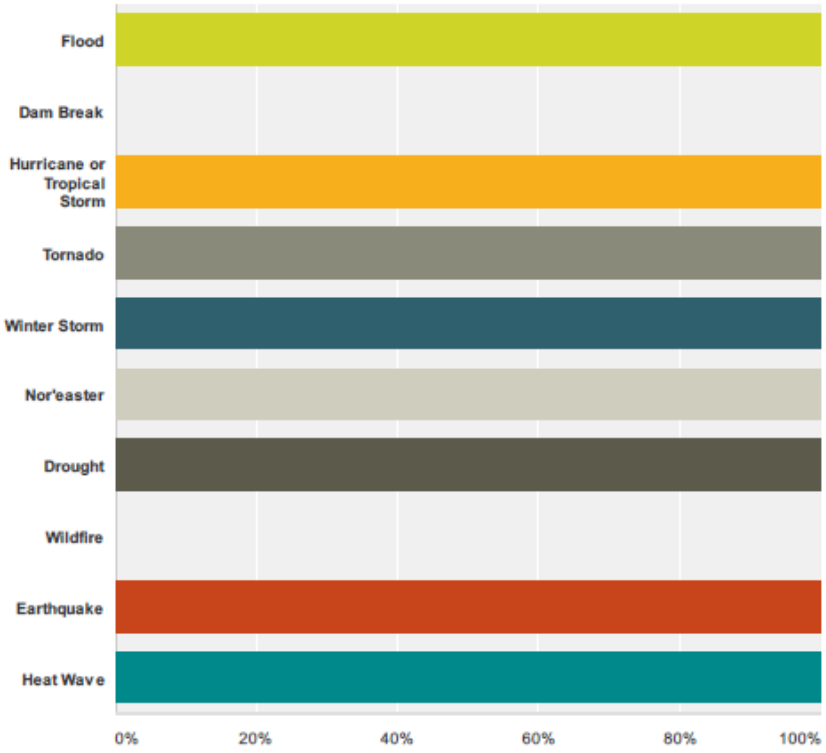
Q7 There are many types of natural hazards that have affected or could affect Killingworth. From the list below, please indicate each hazard that you have experienced in Killingworth.

Answered: 24 Skipped: 0

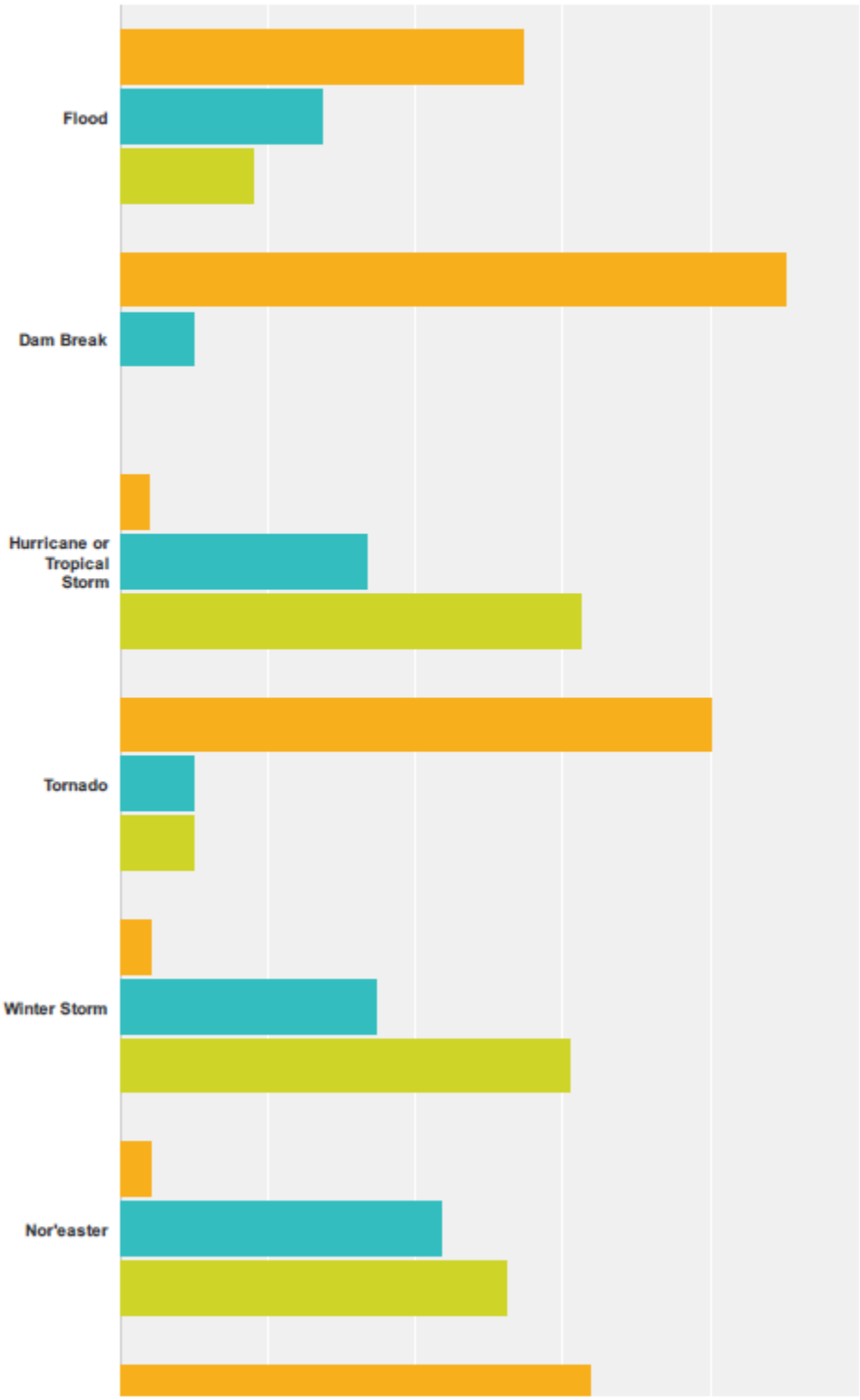


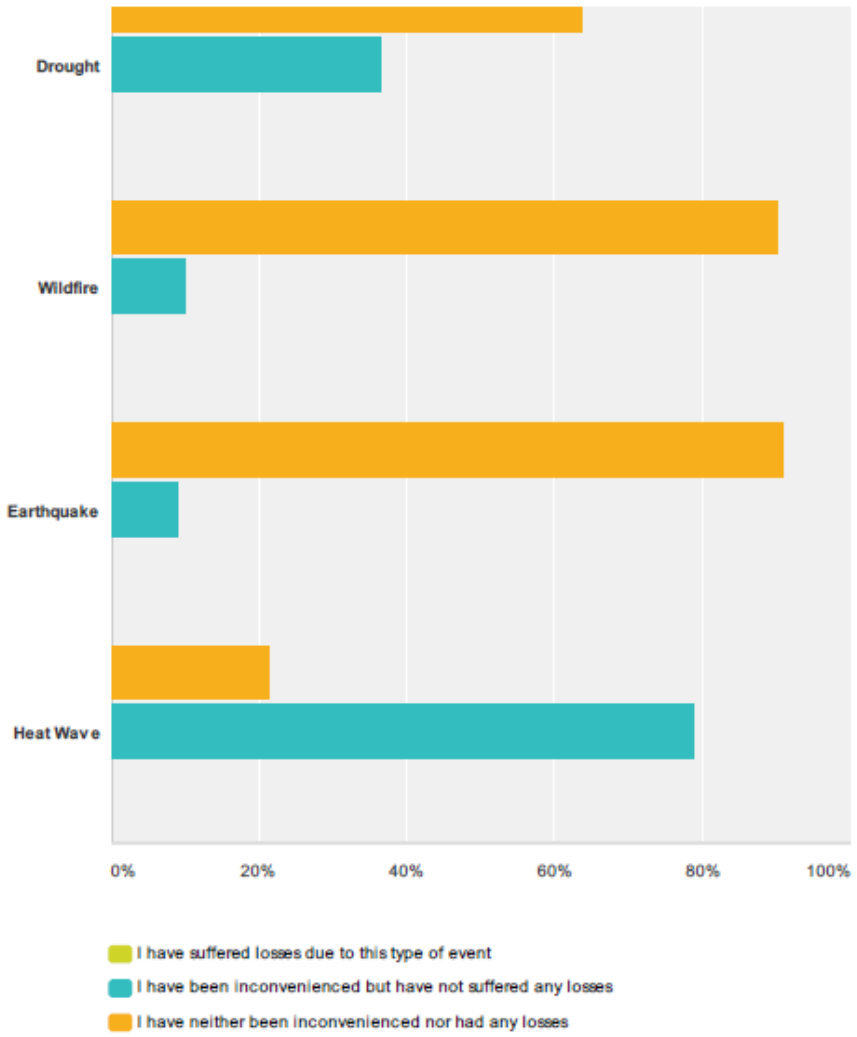
I have experienced this natural hazard in Killingworth

	I have experienced this natural hazard in Killingworth	Total Respondents
Flood	**100%** 4	4
Dam Break	**0%** 0	0
Hurricane or Tropical Storm	**100%** 21	21
Tornado	**100%** 1	1
Winter Storm	**100%** 22	22
Nor'easter	**100%** 22	22
Drought	**100%** 4	4
Wildfire	**0%** 0	0
Earthquake	**100%** 1	1
Heat Wave	**100%** 14	14

Q8 From the list of natural hazards, please indicate if you have had any losses from the hazard category.

Answered: 24 Skipped: 0

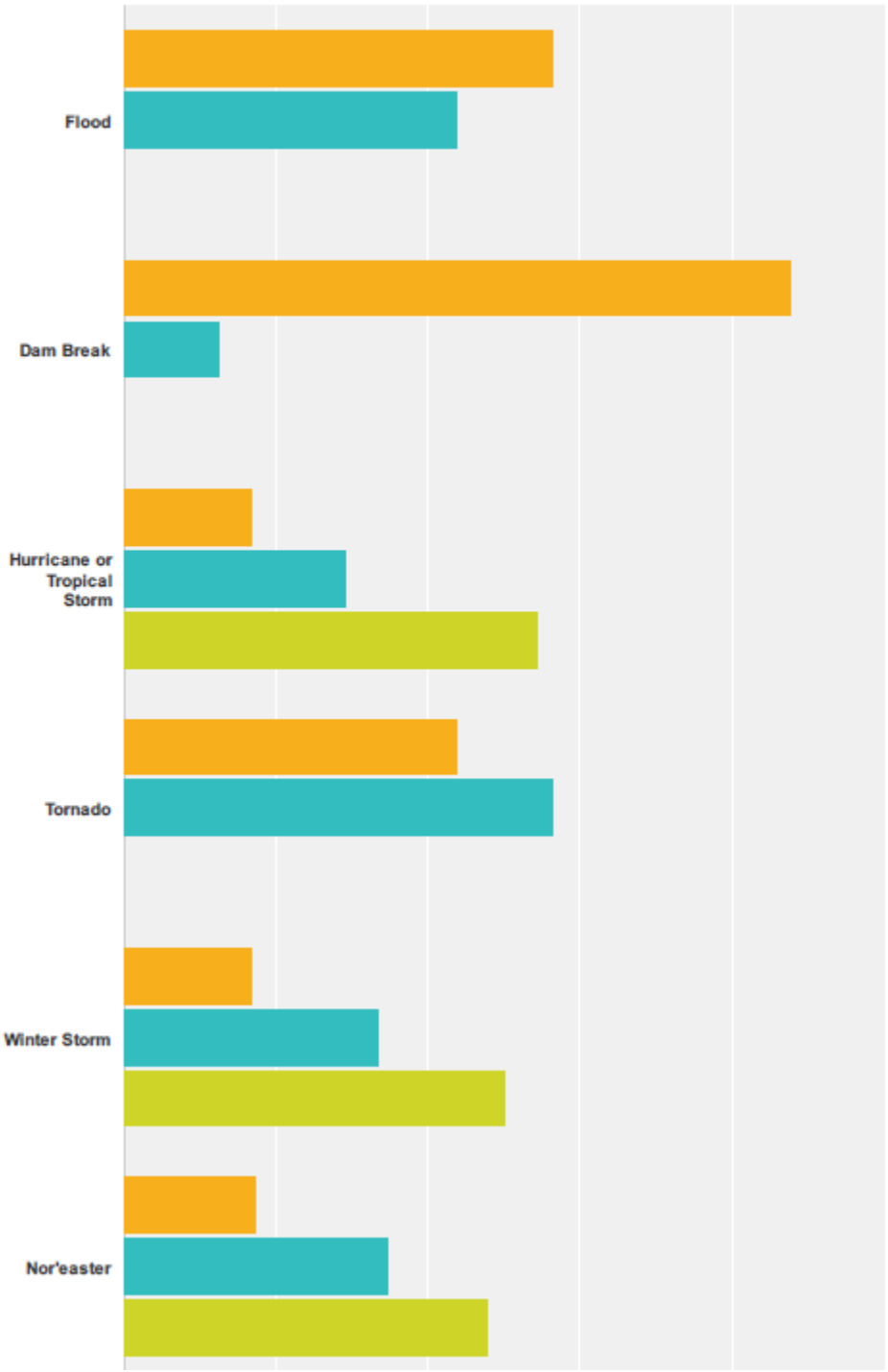


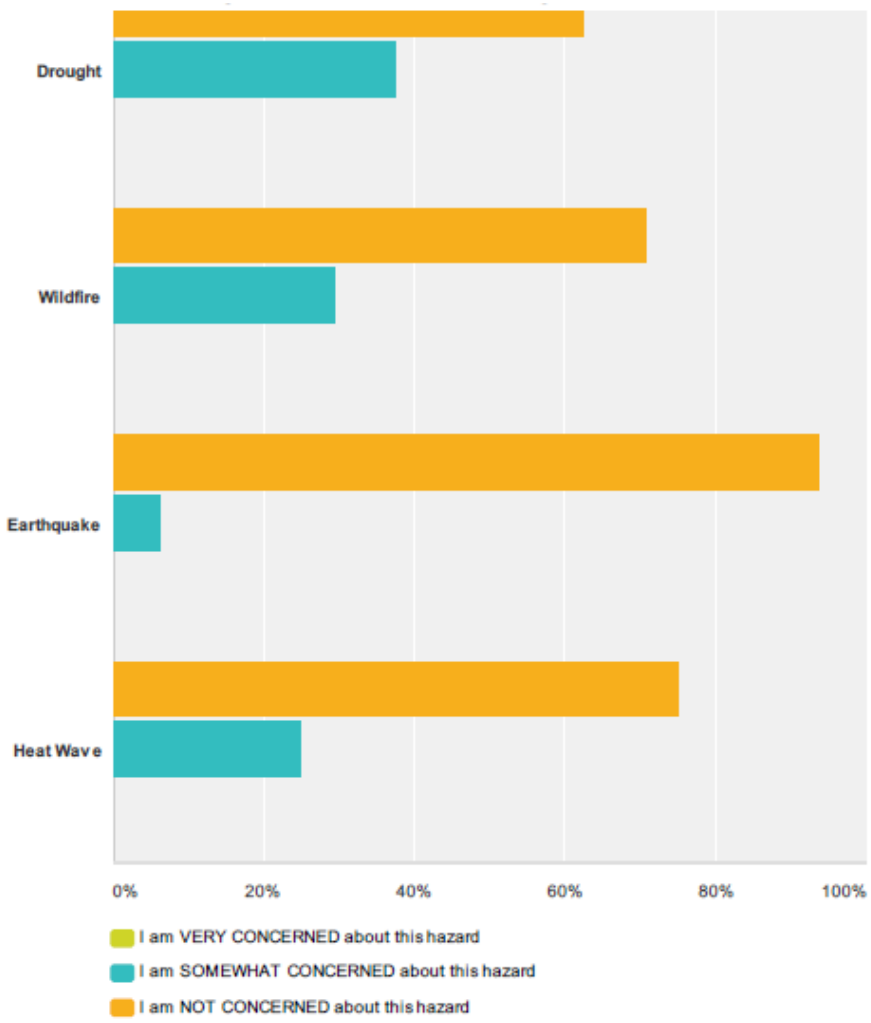


	I have suffered losses due to this type of event	I have been inconvenienced but have not suffered any losses	I have neither been inconvenienced nor had any losses	Total
Flood	**18.18%** 2	**27.27%** 3	**54.55%** 6	11
Dam Break	**0%** 0	**10%** 1	**90%** 9	10
Hurricane or Tropical Storm	**62.50%** 15	**33.33%** 8	**4.17%** 1	24
Tornado	**10%** 1	**10%** 1	**80%** 8	10
Winter Storm	**60.87%** 14	**34.78%** 8	**4.35%** 1	23
Nor'easter	**52.17%** 12	**43.48%** 10	**4.35%** 1	23
Drought	**0%** 0	**36.36%** 4	**63.64%** 7	11
Wildfire	**0%**	**10%**	**90%**	
Earthquake	**0%** 0	**9.09%** 1	**90.91%** 10	11
Heat Wave	**0%** 0	**78.57%** 11	**21.43%** 3	14

Q9 From the list of natural hazards on the left, please indicate your level of concern about the hazard recurring in the future.

Answered: 24 Skipped: 0

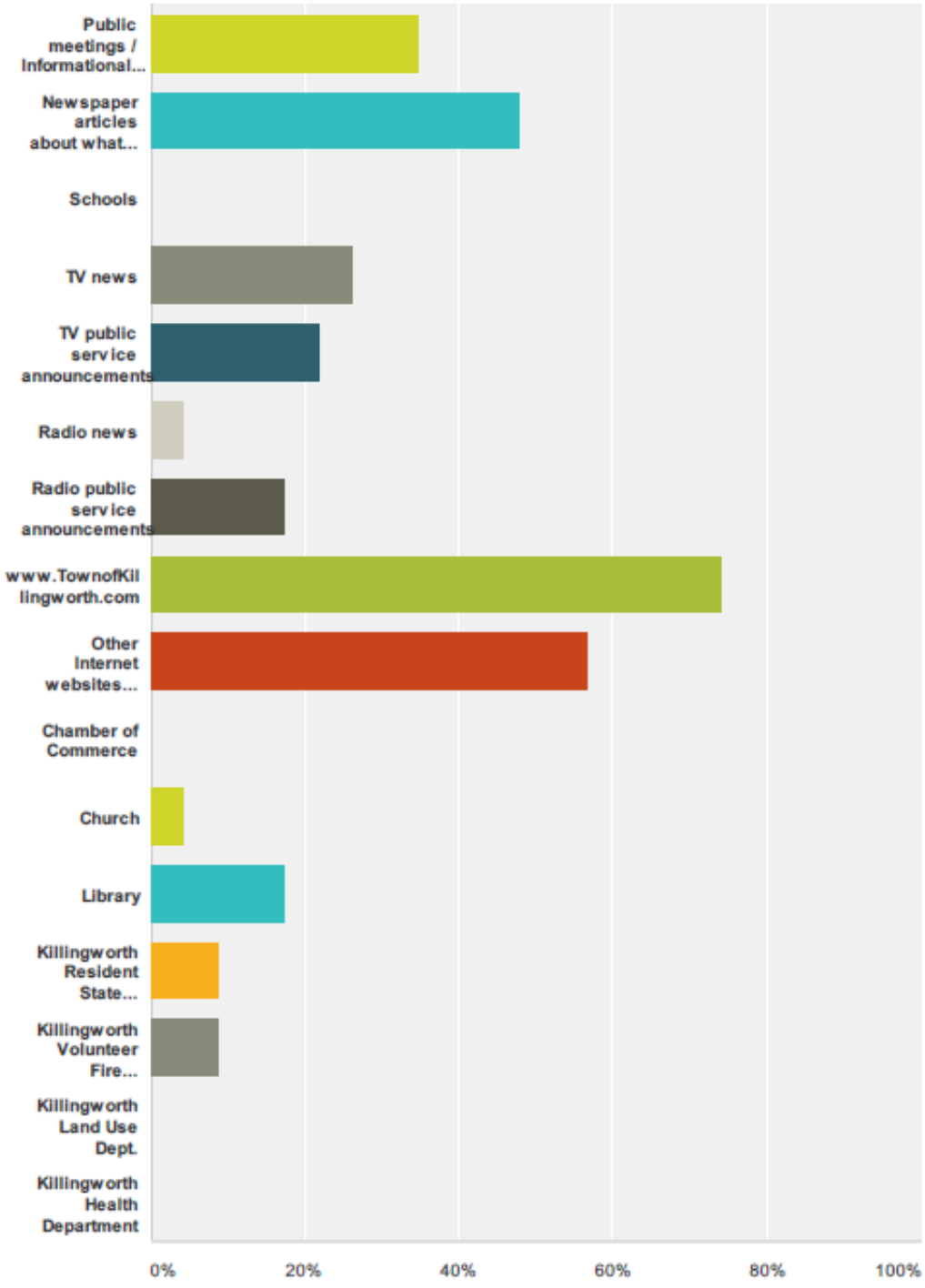




	I am VERY CONCERNED about this hazard	I am SOMEWHAT CONCERNED about this hazard	I am NOT CONCERNED about this hazard	Total
Flood	**0%** 0	**43.75%** 7	**56.25%** 9	16
Dam Break	**0%** 0	**12.50%** 2	**87.50%** 14	16
Hurricane or Tropical Storm	**54.17%** 13	**29.17%** 7	**16.67%** 4	24
Tornado	**0%** 0	**56.25%** 9	**43.75%** 7	16
Winter Storm	**50%** 12	**33.33%** 8	**16.67%** 4	24
Nor'easter	**47.83%** 11	**34.78%** 8	**17.39%** 4	23
Drought	**0%** 0	**37.50%** 6	**62.50%** 10	16
Wildfire	**0%** 0	**29.41%** 5	**70.59%** 12	17
Earthquake	**0%** 0	**6.25%** 1	**93.75%** 15	16
Heat Wave	**0%** 0	**25%** 4	**75%** 12	16

Q10 What is the best way for you personally to get information about what you can do to prevent future losses from natural hazards?

Answered: 23 Skipped: 1



Answer Choices	Responses	
Public meetings / Informational workshops	34.78%	8
Newspaper articles about what others have done	47.83%	11
Schools	0%	0
TV news	26.09%	6
TV public service announcements	21.74%	5
Radio news	4.35%	1
Radio public service announcements	17.39%	4
www.TownofKillingworth.com	73.91%	17
Other Internet websites (e.g. NOAA, NWS, weather radar, FEMA, State of CT)	56.52%	13
Chamber of Commerce	0%	0
Church	4.35%	1
Library	17.39%	4
Killingworth Resident State Trooper.	8.70%	2
Killingworth Volunteer Fire Company.	8.70%	2
Killingworth Land Use Dept.	0%	0
Killingworth Health Department	0%	0
Total Respondents: 23		

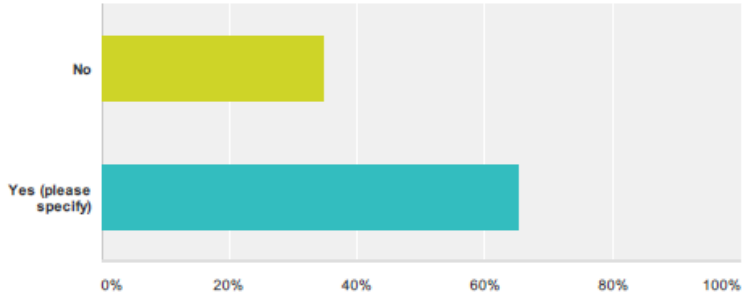
Showing 2 responses

System that doesn't require electricity or phone lines
9/22/2013 1:11 AM View respondent's answers

Killingworth Today
9/13/2013 9:29 AM View respondent's answers

Q11 Have you personally taken actions (e.g.replacing windows with wind resistent glass, removing large trees close to your house or business, etc.) to protect your home or business from natural hazards that might occur?

Answered: 23 Skipped: 1



Answer Choices	Responses	
No	34.78%	8
Yes (please specify)	65.22%	15
Total		23

Showing 15 responses

removed trees
10/11/2013 10:54 AM View respondent's answers

Tree removal in various town locations
10/7/2013 2:31 PM View respondent's answers

Removing trees.
10/7/2013 10:17 AM View respondent's answers

Removed large trees by house and wires. Grading by garage to prevent flooding into basement.
10/7/2013 8:14 AM View respondent's answers

I have cut down trees around my house
9/29/2013 6:27 PM View respondent's answers

Tree removal, generator purchase
9/22/2013 1:11 AM View respondent's answers

Remove lg. trees - generator
9/21/2013 10:00 PM View respondent's answers

installed a generator and transfer switch and begun to remove some trees and limbs.
9/21/2013 9:36 AM View respondent's answers

New home rated for higher wind speeds.
9/19/2013 4:18 PM View respondent's answers

Some tree removal. NOTE: Wind and/or impact resistent windows are very expensive and typically only required in direct or near-direct shoreline structures.
9/19/2013 10:59 AM View respondent's answers

removed tree
9/17/2013 7:15 PM View respondent's answers

remove trees
9/17/2013 7:16 AM View respondent's answers

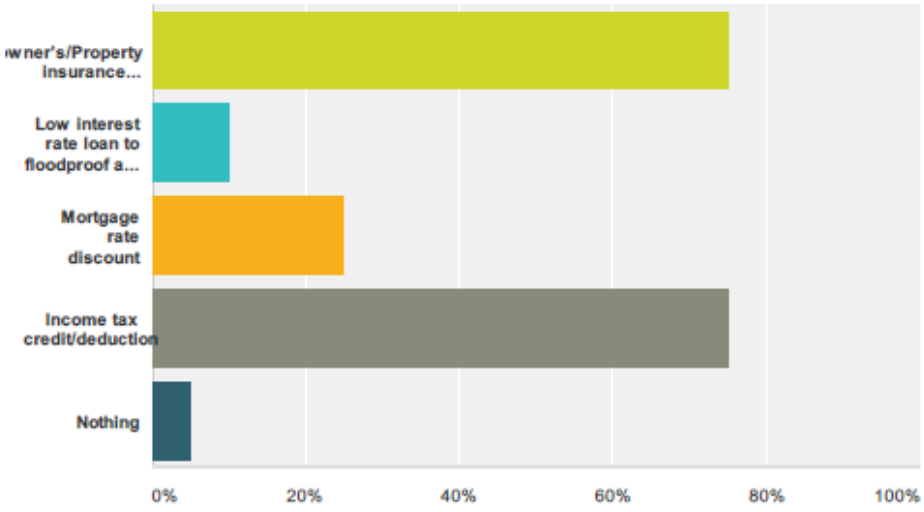
removal of mature oak and hickory trees electric pump for basement water seepage
9/14/2013 12:02 PM View respondent's answers

Removed large trees
9/13/2013 9:29 AM View respondent's answers

installed permanent house wired generator system; replaced all windows with wind resistant glass; removed large trees; built trench to handle run off of hill side water away from garage and house...
9/12/2013 2:24 PM View respondent's answers

Q12 What financial incentives would motivate you to mitigate against natural hazards to your home or business?

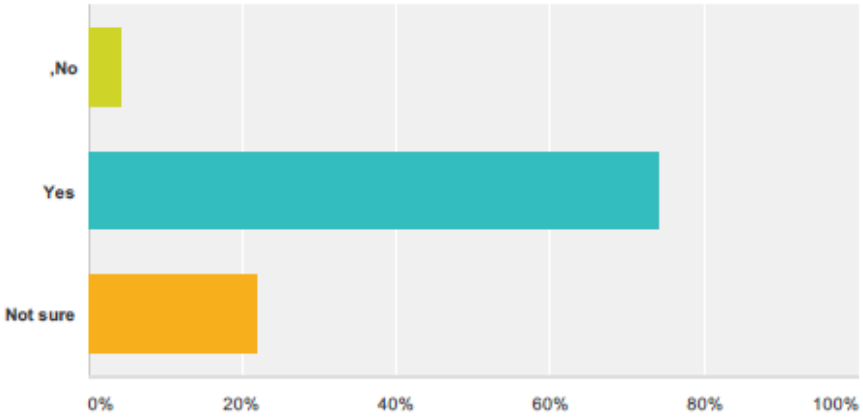
Answered: 20 Skipped: 4



Answer Choices	Responses	
Homeowner's/Property insurance discount	75%	15
Low interest rate loan to floodproof a structure	10%	2
Mortgage rate discount	25%	5
Income tax credit/deduction	75%	15
Nothing	5%	1
Total Respondents: 20		

Q13 Are you in favor of spending public funds on mitigation projects (e.g. elevating flood prone roads, improving capabilities at the Haddam-Killingworth Middle School emergency shelter, burying power lines, etc.) for the benefit of the entire community?

Answered: 23 Skipped: 1



Answer Choices	Responses	
,No	4.35%	1
Yes	73.91%	17
Not sure	21.74%	5
Total		23

I would have to evaluate spending public funds project by project. I don't trust public officials to know what they are doing.
10/13/2013 12:58 PM View respondent's answers

All of the above PLUS better emergency info signs for those who lose power and have very poor cell phone reception.
10/7/2013 8:14 AM View respondent's answers

activate the kitchen at HKMS
9/29/2013 6:27 PM View respondent's answers

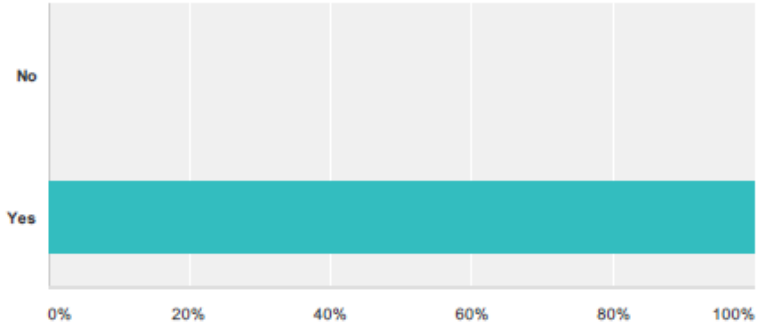
particularly burying power lines. Since we get very little help from the State of Connecticut in terms of what we pay in State taxes, we should receive this type of help.
9/21/2013 9:36 AM View respondent's answers

Guess it depends on the criticality of the project. Example: Not sure I'd be interested in spending EXTRA accessed funds to try to improve Lover's Lane. It's just not that critical if it's flooded and it will be a very expensive project since the ground is so boggy through there.
9/19/2013 10:59 AM View respondent's answers

Burying power lines good, but will never happen in Killingworth. Elevating Lover's Lane would be classic stupidity.
9/13/2013 9:29 AM View respondent's answers

Q14 During Tropical Storm Irene, The Halloweeen Nor'easter, or Hurricane Sandy, did you experience a prolonged power outage?

Answered: 23 Skipped: 1



Answer Choices	Responses	
No	0%	0
Yes	100%	23
Total Respondents: 23		

Showing 22 responses

7days
10/13/2013 12:58 PM View respondent's answers

5
10/11/2013 10:54 AM View respondent's answers

Longest was 8, after Irene
10/7/2013 2:31 PM View respondent's answers

6
10/7/2013 10:18 AM View respondent's answers

3-5 days Storm Gloria was 9 days
10/7/2013 8:15 AM View respondent's answers

5 or six days without power
9/29/2013 6:28 PM View respondent's answers

The longest was 8 days
9/26/2013 2:24 PM View respondent's answers

seven ?
9/23/2013 7:23 PM View respondent's answers

6,5,5 respectively. Something needs to be worked out with cl&p, so that we are not the first town shut down/ last to be pulled back up.
9/22/2013 1:13 AM View respondent's answers

10 days
9/21/2013 10:00 PM View respondent's answers

2 outages of more than 5 days
9/21/2013 9:37 AM View respondent's answers

9 days
9/19/2013 10:59 AM View respondent's answers

8
9/18/2013 7:43 AM View respondent's answers

8
9/17/2013 7:16 PM View respondent's answers

7
9/17/2013 7:17 AM View respondent's answers

Irene 6 days, Nor'easter 6 days, Sandy no loss
9/14/2013 3:22 PM View respondent's answers

eight days-Irene five days-Halloween
9/14/2013 12:07 PM View respondent's answers

8
9/13/2013 9:04 PM View respondent's answers

10
9/13/2013 9:29 AM View respondent's answers

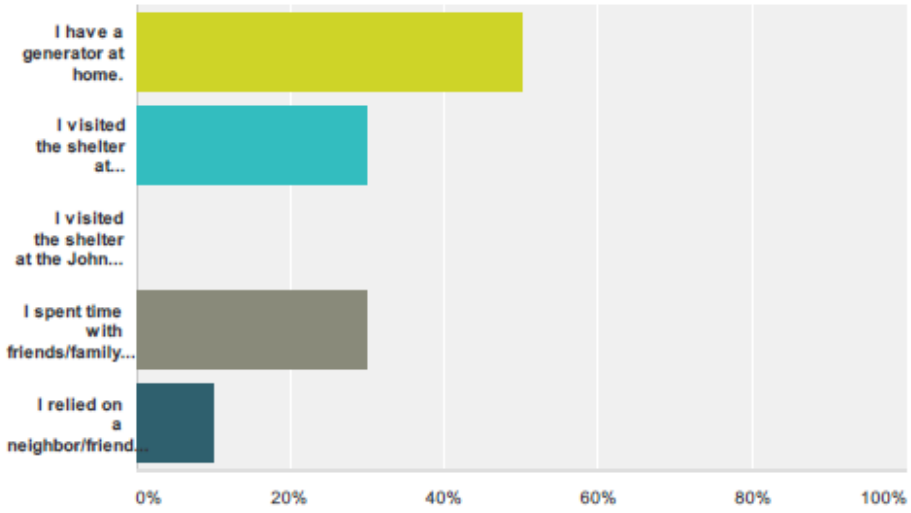
6 day x2, Sandy no
9/12/2013 7:52 PM View respondent's answers

up to 7 days
9/12/2013 2:24 PM View respondent's answers

5
9/11/2013 4:09 PM View respondent's answers

Q15 How were you able to cope during the extended power outage?

Answered: 20 Skipped: 4



Answer Choices	Responses	
I have a generator at home.	50%	10
I visited the shelter at Killingworth Elementary School or H-K Middle School.	30%	6
I visited the shelter at the John Winthrop Middle School in Deep River.	0%	0
I spent time with friends/family who had power.	30%	6
I relied on a neighbor/friend with a generator.	10%	2
Total Respondents: 20		

Showing 6 responses

I received no help;just did without; managed
10/13/2013 1:01 PM View respondent's answers

Radio,Coleman eqpt.Water at center
10/7/2013 8:21 AM View respondent's answers

I now have a generator but did not for the earlier storms.
9/26/2013 2:26 PM View respondent's answers

Generator purchased after oct 2011 extended outage.
9/22/2013 1:17 AM View respondent's answers

weathered it out
9/17/2013 7:17 PM View respondent's answers

went to vacation home out of state
9/14/2013 12:13 PM View respondent's answers

Q16 What recommendations do you have for the Town in coping with extended power outages in the future?

Answered: 15 Skipped: 9

Showing **15** responses

Since the town has no control over the power companies, I don't think the town can do anything about the outages.
10/13/2013 1:01 PM View respondent's answers

happy to see the trees cut back from powerlines. More work to push tree lines back from roads in general
10/11/2013 10:55 AM View respondent's answers

Keep cutting trees by wires-EXC.! Winter outage & frozen pipes my biggest concern. State & country needs to look at, redo grid system. Increase use of Middle School. Lions meals much appreciated.
10/7/2013 8:21 AM View respondent's answers

Educate the public on how to better prepare for future i.e. shelter in place for example
9/29/2013 6:31 PM View respondent's answers

Keep pressure on CL&P; keep residents informed; open shelter or warming/shower/recharging shelter as needed.
9/26/2013 2:26 PM View respondent's answers

I think the Town is doing a good job
9/23/2013 7:23 PM View respondent's answers

Move cl&p officials and their families here...or their parents. It is unacceptable that our power gets cut first and pulled back last. If our lines are down, it is understandable; but it is just frustrating when the issue is in another town and we lose power so they can be restored first (Durham and Higganum have both impacted my area in that way in the last 2 storms).
9/22/2013 1:17 AM View respondent's answers

Bury lines.
9/21/2013 9:37 AM View respondent's answers

Communications via web and maybe boards on RT 81 for quick answers.
9/19/2013 4:19 PM View respondent's answers

Early and ongoing communication w/ CL&P in advance of a super-storm. It was really their CL&P's issue though, not the town's. I think they both learned a lot, new best practices have been implemented and as we've seen since then, MUCH more aggressive tree trimming has occurred. That was responsible for a lot of the outages. As far as burying pwr lines go, nice thought but I don't see that happening any time soon - other than small sections in a sub-division or something but that gets done during construction. No one is going to bury feeder lines running down major roads for example. Trimming and removal of dead / diseased trees is the best course of action.
9/19/2013 11:04 AM View respondent's answers

doing what you are doing
9/17/2013 7:17 PM View respondent's answers

continue to improve shelter experience
9/17/2013 7:17 AM View respondent's answers

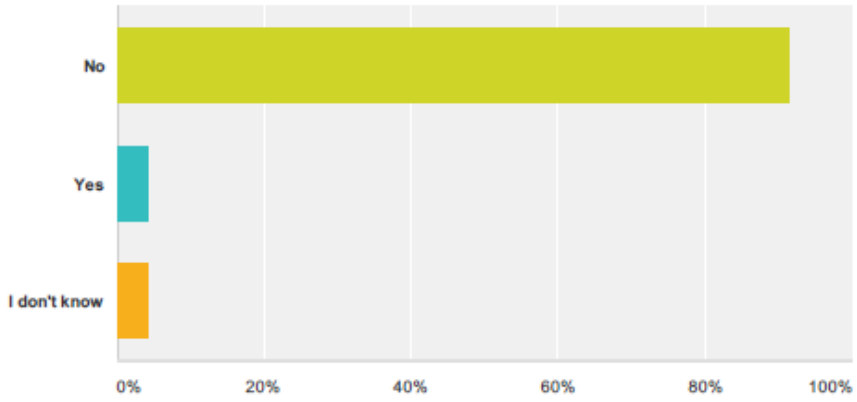
Prevention, extensive tree clearing around power lines.
9/14/2013 3:23 PM View respondent's answers

Extensive tree trimming to prevent them. Clear the roads sooner.
9/12/2013 7:54 PM View respondent's answers

Continue to apply pressure to CL&P to maintain the power system at it's fullest capacity, and to advocate for CL&P to look into how the system can be improved.
9/12/2013 2:26 PM View respondent's answers

Q17 Is your home or business located in a flood zone?

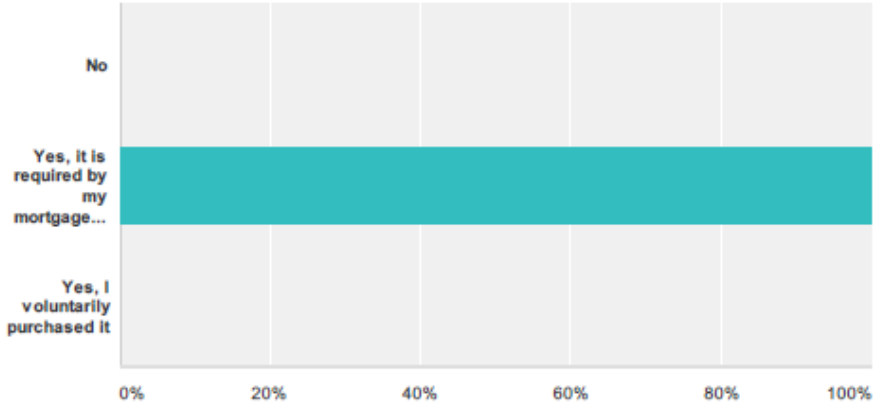
Answered: 23 Skipped: 1



Answer Choices	Responses	
No	91.30%	21
Yes	4.35%	1
I don't know	4.35%	1
Total		23

Q18 Do you currently have flood insurance?

Answered: 1 Skipped: 23



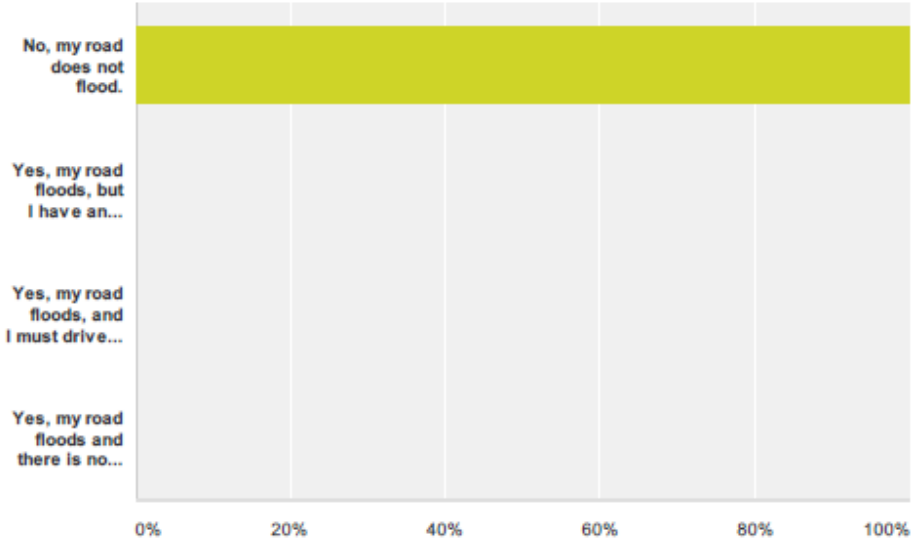
Answer Choices	Responses	
No	0%	0
Yes, it is required by my mortgage lender	100%	1
Yes, I voluntarily purchased it	0%	0
Total		1

Showing 1 response

I am 3/4 of an inch (surveyors) into flood zone.
10/7/2013 8:23 AM View respondent's answers

Q19 Does the road on which you live experience flooding and does it affect your ability to travel?

Answered: 1 Skipped: 23



Answer Choices	Responses	
No, my road does not flood.	100%	1
Yes, my road floods, but I have an alternate route available to use.	0%	0
Yes, my road floods, and I must drive a considerable distance to avoid it.	0%	0
Yes, my road floods and there is no way around it.	0%	0
Total		1

Showing 1 response

Generally the road is good.
10/7/2013 8:23 AM View respondent's answers

Q20 Please add any suggestions you may have about how individuals and the Town can reduce or eliminate damages from future natural hazard events. Please include your ideas for projects that the Town may choose to undertake.

Answered: 13 Skipped: 11

Any future homes or businesses that are built should be required to have a generator installed at the time they are built. Installing later on is very costly and disruptive. It is very shortsighted to not plan for disasters in advance. Building permits should be issued very cautiously in a flood zone; if mitagation is not possible, then the permit should not be issued.
10/13/2013 1:01 PM View respondent's answers

Create a fully operational EOC to handle future crises; improve communications between the Emergency Responders and the Road Crew; provide back-up power generation for Town Hall.
10/7/2013 2:42 PM View respondent's answers

The tree cutting done this summer was excellent! Some parts of the town have longer outages-up to 3-5 days. These people use emergency services at the Middle School. Signs such as the flickering one at the rotary advertising meals at the firehouse excellent! During storm outages/emergencies many people have no power and the cell phone service is very poor. The use of signs with information on Route 81 is crucial. Not all people can afford propane generators or wish to use gas generators. It is most important that gas stations be open. The use of computers at the library has been very, very important for me. Those who have Comcast full service do not have phone land lines. Comcast phone battery back-up is not that reliable. If I have warning I can get all my emergency equipment ready. However, periods beyond 1 day are a problem. Freezer loss can be considerable for families. I have extra wrap for garage or basement exposed pipes. Town Emergency services need to be aware of special health needs of residents-which I think they do know.
10/7/2013 8:36 AM View respondent's answers

Town should have a functional EOC capable of supporting emergency response for extended periods.
9/26/2013 2:28 PM View respondent's answers

Fix Lovers Lane
9/22/2013 1:18 AM View respondent's answers

This plan seems to be well prepared. Have you examined ways to get the non-English speaking residents in free English classes through Middletown Adult Education? If enough people attended, I'm pretty sure that they could offer services. They have a current working agreement with Reg. 17. With more that 500 residents, some community group could do outreach to get a class of 15 or 20 residents together.
9/21/2013 9:41 AM View respondent's answers

1.) I think HKMS is the logical choice for a "safe haven" shelter. Continue to plan as such by equipping with the ability to handle significant number of residents for an extended period of time. 2.) Ensure town bldg's and other "Critical infrastructure" is appropriately hardened and generators are in place - w/ plenty of fuel supply, drinking water, etc.. 3.) Equip key town officials, PW's employees and all other 1st responders with sat phones, should a really bad event be predicted so they can still communicate should cell towers fail. 4.) I think the Town has a Call Out system in town similar to what the school district has, but I'm not sure. If not, we should invest in one. These things could be invaluable in the event of real disasters - of any kind, not just weather-related, e.g., some kind of horrible shooting-related emergency (God forbid). It should be programmed with not only "home phone number land lines" but as many residents' cell phone numbers as possible 5.) Continue to ensure the utility companies (basically, CL&P) stay on top of regular tree trimming programs.
9/19/2013 11:16 AM View respondent's answers

The town can make sure that there are fewer trees and branches overhanging power lines to avoid too many power outages and the length of time of the outage.
9/18/2013 7:45 AM View respondent's answers

Making the town crew actually work a full time week of work.
9/14/2013 3:25 PM View respondent's answers

You would have to prove that there is any real hazard for me to come with any ideas. Or, maybe remove half of the trees to protect people and property from falling trees.
9/13/2013 9:05 PM View respondent's answers

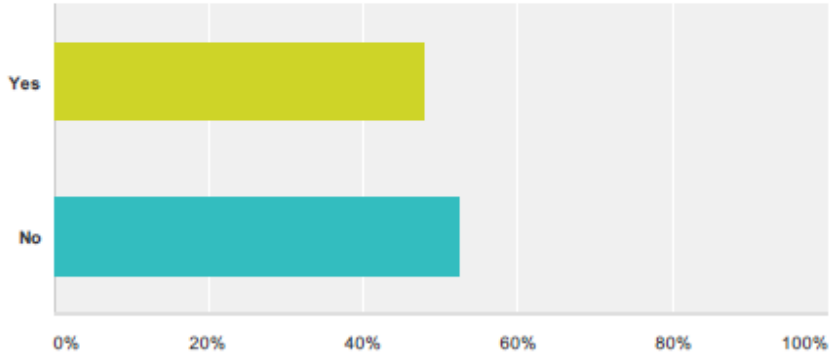
Cut down all the trees along all of the town roads.
9/13/2013 9:31 AM View respondent's answers

How about getting the town crew to actually do some work. How about having the Fire Company leadership become competent in Emergency Management.
9/12/2013 7:57 PM View respondent's answers

Notification is key. When we the residents have up to date information on road closures, power crews accurate schedules for restoration, and info on what businesses are open (ie: gas stations, grocery stores) then we can plan our own lives accordingly. Not knowing that the town is actively pursuing restoration processes is stressful and can also be scary.
9/12/2013 2:32 PM View respondent's answers

Q21 Would you like to review all of the Mitigation Action Items (Figure 16 from the Plan)?

Answered: 23 Skipped: 1



Answer Choices	Responses	
Yes	47.83%	11
No	52.17%	12
Total Respondents: 23		

Q22 Please indicate how you feel about each of the mitigation actions listed below.

Answered: 10 Skipped: 14

	Strongly Support	Support	Neither Support nor Oppose	Oppose	Strongly Oppose	Total
Benefit-Cost Analysis. Evaluate opportunities for public funding of mitigation projects on private property where public benefits exceed the cost for RL properties or for properties otherwise eligible for buy-out.	20% 2	20% 2	40% 4	10% 1	10% 1	10
Best Management Practices. Continue to use best management practices (BMPs) as described in the Connecticut DEEP Storm water Management Guidelines on a site-by-site basis as advised by a professional engineer.	30% 3	40% 4	30% 3	0% 0	0% 0	10
Business Recovery Plan. Develop business recovery plan cooperatively with other region towns and distribute to town businesses.	10% 1	30% 3	60% 6	0% 0	0% 0	10
Capital Improvement Plan. Include infrastructure improvements to reduce loss of life and property during natural hazard (NH) events in Capital Improvement Plan. .	30% 3	40% 4	20% 2	0% 0	10% 1	10
Conservation Planning. Educate the public about how the Town uses planning, regulation, and ordinances to mitigate NHs via LID, aquifer recharge, riparian buffer, rain gardens, open burning ordinances, house numbering, etc.	20% 2	50% 5	30% 3	0% 0	0% 0	10
Cooperative Agreements for Shelters. Develop supporting documentation and encourage the Board of Selectmen to establish agreements for shelters that can provide specialized services, throughout the region. Shelters with the capacity to provide for companion pets and medical equipment needs for individuals with disabilities are two examples of such specializations. Support changes in the laws that require every town to provide facilities capable of serving the most severely handicapped individuals, to allow towns to serve these individuals and their families through regional shelters equipped to handle their needs.	30% 3	20% 2	30% 3	20% 2	0% 0	10
Design Standards. Continue to implement State Building/Fire Code and local Flood Code for construction that minimizes loss of life and property damage due to NHs.	40% 4	20% 2	40% 4	0% 0	0% 0	10
Immobile Evacuees. Review annually the program to evacuate persons without means of transport, including registration and house numbering.	30% 3	60% 6	10% 1	0% 0	0% 0	10
Flood Zone Study. Update flood zone study for the town any time there is an update from FEMA to incorporate changed conditions upland and within the floodplain.	20% 2	40% 4	40% 4	0% 0	0% 0	10

	Strongly Support	Support	Neither Support nor Oppose	Oppose	Strong Oppose	Total
Forest Management Plan. Consult with a forester to establish a forest management plan to enable ability of firefighters to access forest fires.	30% 3	40% 4	30% 3	0% 0	0% 0	10
Grants. Identify and apply for grants to fund infrastructure improvements and other mitigation tasks identified in this plan.	40% 4	40% 4	10% 1	10% 1	0% 0	10
Land Use Regulation. Maintain, and strengthen as appropriate, subdivision, and zoning regulations to make safer new roads and lots within flood zones.	30% 3	30% 3	30% 3	10% 1	0% 0	10
Landlord Incentives. Research what kind of incentives would motivate land owners to make the additional investment that would reduce potential damages to their properties and loss of life of their tenants.	10% 1	30% 3	50% 5	10% 1	0% 0	10
Local Social Resources. Identify local resources to assist with those populations (i.e. elderly, disabled, non-English speakers, who may frequent, reside, or work) in Killingworth. Seek grants to provide funding for developing more detailed data to assist in the social – demographic analysis of how Killingworth will be affected by natural hazards.	20% 2	20% 2	40% 4	20% 2	0% 0	10
Minimal runoff from development. Continue to require all new development to be built using techniques to eliminate run-off.	60% 6	20% 2	20% 2	0% 0	0% 0	10
Owner Participation. Promote owner participation in mitigation efforts to protect their own properties.	40% 4	40% 4	20% 2	0% 0	0% 0	10
Post Disaster School Arrangements. Establish reciprocal arrangements with other school districts for getting students back into classes during extended recovery periods.	30% 3	10% 1	50% 5	10% 1	0% 0	10
Potential Financial Impact of Probable Events. Estimate the municipal tax revenue that could potentially be lost in various events to provide the Board of Selectmen and Board of Finance with an idea of how large a "rainy day" fund might be necessary to cover that post disaster period when there would be minimal income and maximum output of public funds at all levels of government.	10% 1	70% 7	20% 2	0% 0	0% 0	10
Private Property Funds. Evaluate opportunities for public funding for projects on private property where the benefits exceed the costs.	20% 2	30% 3	20% 2	10% 1	20% 2	10
Public Transit Funding. Support regional transportation system (RTD) to facilitate movement of people without means of transportation prior to NH events.	30% 3	10% 1	50% 5	0% 0	10% 1	10
Recovery & Reconstruction Plan. Develop a post-disaster recovery and reconstruction plan to re-establish infrastructure and public services, etc. damaged or destroyed by any NH event, including establishment of a "rainy day" fund in case Federal assistance is insufficient or delayed.	20% 2	60% 6	20% 2	0% 0	0% 0	10
Regulations. Strengthen existing subdivision regulations to either optimally prevent road or house construction within the floodplain, or alternatively raise structures above BFE.	40% 4	40% 4	10% 1	10% 1	0% 0	10

	Strongly Support	Support	Neither Support nor Oppose	Oppose	Strong Oppose	Total
Construction Standards. Ensure that flood proof construction standards for roads and structures within the flood plain are strictly enforced.	40% 4	40% 4	20% 2	0% 0	0% 0	10
Critical Facilities. Maintain and upgrade as necessary all facility mechanicals, such as generators, in municipal and other critical facilities.	70% 7	20% 2	10% 1	0% 0	0% 0	10
Data for Plans. Use GIS database to develop better mitigation plans.	40% 4	30% 3	30% 3	0% 0	0% 0	10
Drinking Water Cache. Continue to work with Water Companies to ensure adequate water will be available in times of emergencies.	40% 4	40% 4	20% 2	0% 0	0% 0	10
Dry Hydrants. Continue to require dry hydrants, fire ponds, or water storage tanks in new developments where water supply is inadequate.	50% 5	30% 3	20% 2	0% 0	0% 0	10
Electronic Records Preservation. Design databases for records keeping. Create a back-up of existing electronic records, including geographic information system (GIS) data.	20% 2	60% 6	20% 2	0% 0	0% 0	10
Engineering Reports. Implement strategic enforcement actions to include engineering reports for structural expansion or alterations on properties within the 1% annual chance flood zone.	20% 2	40% 4	40% 4	0% 0	0% 0	10
Firefighting Infrastructure Analysis. Evaluate existing firefighting infrastructure to identify needs for improvement to cover gaps in availability.	50% 5	30% 3	20% 2	0% 0	0% 0	10
Geographic Information System. Annually review and update as necessary existing town GIS data.	40% 4	30% 3	30% 3	0% 0	0% 0	10
GIS Database. Establish a comprehensive GIS database to better identify and assess areas, structures, and populations potentially affected by natural disasters. These data will provide the town with information necessary to assess natural hazard risks and develop plans to mitigate risks to people and property.	40% 4	40% 4	20% 2	0% 0	0% 0	10
Municipal Buildings Capable of Being Shelters. Future investment in municipal structures should include funding for new construction or renovation that will assure the structure is compliant with the standards for use as a shelter, to the extent possible.	20% 2	30% 3	40% 4	10% 1	0% 0	10
Oblique Imagery. Over the next five (5) years obtain oblique imagery in order to allow for assessment of such factors as extent of fire damage, and compliance with building standards.	10% 1	40% 4	40% 4	10% 1	0% 0	10
Paper Records Preservation. Convert all paper records maintained by the municipality to an electronic format, consistent with any State recommendations, to ensure their survival. Establish protocols for practices going forward.	10% 1	60% 6	20% 2	10% 1	0% 0	10
Promote Self Inspection. Develop a list of techniques for homeowner self-inspection.	40% 4	40% 4	20% 2	0% 0	0% 0	10
Public Works Garage & Transfer Station Generators. Maintain generators for back-up power.	40% 4	30% 3	30% 3	0% 0	0% 0	10
RL Properties. Encourage property owners of repetitive loss properties to obtain assistance for hazard mitigation funding from DEEP/FEMA for elevation of structures and repairs where applicable.	10% 1	50% 5	30% 3	10% 1	0% 0	10
Road Evaluation. Evaluate to develop plans, and improve for emergency access and evacuation.	40% 4	40% 4	20% 2	0% 0	0% 0	10
Road Reconstruction. Develop a priority list for road reconstruction and elevation for routes which experience frequent flooding or are integral to evacuation.	10% 1	60% 6	20% 2	0% 0	10% 1	10

	Strongly Support	Support	Neither Support nor Oppose	Oppose	Strong Oppose	Total
Schools. Visit schools and educate children about the risks of floods, hurricanes, and other natural hazards and how to prepare for them.	10% 1	60% 6	30% 3	0% 0	0% 0	10
Stormwater Infrastructure Inventory. Implement mapping and monitoring of catch basins, storm water outfalls, and related infrastructure.	20% 2	50% 5	30% 3	0% 0	0% 0	10
Stormwater Infrastructure Maintenance. Continue annual maintenance of storm water infrastructure, including detention basins.	22.22% 2	55.56% 5	22.22% 2	0% 0	0% 0	9
Structural Reports. Continue to require structural engineering reports for expansion or alteration of buildings within the floodzones. Evaluate benefits of requiring structural engineering reports for expansion or alteration of buildings within other zones.	20% 2	50% 5	30% 3	0% 0	0% 0	10
Telecommunication Tower Generators (Private). Evaluate whether generators are needed for back-up power at telecommunications facilities.	50% 5	20% 2	30% 3	0% 0	0% 0	10
Underground Utilities. Require underground utilities for new development; require retrofitting during redevelopment of existing sites to bury utilities where appropriate to mitigate NHs.	50% 5	10% 1	40% 4	0% 0	0% 0	10
Wind Code Compliance. Consider establishing a policy that all building permit applicants be encouraged to construct their projects to meet 110 mile per hour wind resistance standard, whenever possible.	30% 3	30% 3	30% 3	10% 1	0% 0	10
Assist Property Owners with Buyouts. Develop strategy and program for flood prone property owners who request a buyout.	10% 1	10% 1	50% 5	20% 2	10% 1	10
Below Base Flood Elevation Funding. Encourage property owners whose homes are below BFE to obtain assistance from DEEP and FEMA to acquire hazard mitigation funds to elevate structures where appropriate.	10% 1	30% 3	50% 5	10% 1	0% 0	10
Drought Study. Conduct town-wide study of ground- and surface water capacity as it relates to planning for droughts.	10% 1	30% 3	50% 5	10% 1	0% 0	10
FIRMs. Work with Federal Emergency Management Agency (FEMA) to incorporate updated Flood Insurance Rate Maps (FIRMs) into town's planning, outreach, and mitigation actions.	10% 1	40% 4	50% 5	0% 0	0% 0	10
Flood Enforcement. Enforce–through existing zoning, building, and flood permitting processes–construction standards to minimize flood risks.	30% 3	20% 2	50% 5	0% 0	0% 0	10
Land Acquisition. Advance an assertive land acquisition plan to preserve vacant land subject to NHs.	20% 2	30% 3	30% 3	0% 0	20% 2	10
Park Maintainer. Assign stewardship duties to mitigate NHs at town-owned public open spaces, including parks, forests, drainage basins, conservation easements, and forests.	10% 1	40% 4	50% 5	0% 0	0% 0	10
Risk Assessment. Use GIS to conduct NH risk assessments that identify potentially affected areas and depicts evacuation routes.	30% 3	30% 3	30% 3	10% 1	0% 0	10
Stormwater Management. Continue to use best management practices (BMPs) as described in the Connecticut DEEP Storm water Management Guidelines on a site-by-site basis as advised by a professional engineer.	30% 3	50% 5	20% 2	0% 0	0% 0	10
Tree Hazard Management Program. Implement a tree hazard management program, including appropriate planting practices to minimize future storm damage to buildings, utilities, and streets.	40% 4	40% 4	20% 2	0% 0	0% 0	10

	Strongly Support	Support	Neither Support nor Oppose	Oppose	Strongly Oppose	Total
Circulate Existing Literature. Access existing literature prepared by regional groups and the chamber of commerce and FEMA and display for public distribution in the Town Hall and Library.	33.33% 3	22.22% 2	44.44% 4	0% 0	0% 0	9
Drought Education. Coordinate with Connecticut Water Company (Jensens) on public education and public service announcements during droughts.	33.33% 3	22.22% 2	44.44% 4	0% 0	0% 0	9
Educate About Risk Where People Live. Educate residents at high risk due to demographic or social attributes about the risk(s) relative to the areas that they populate.	22.22% 2	22.22% 2	44.44% 4	11.11% 1	0% 0	9
Hotline. Publicize emergency "hotline" phone number or website for public information and volunteer support.	44.44% 4	11.11% 1	44.44% 4	0% 0	0% 0	9
Incident Notification System. Enlist public participation through public workshops to develop methods for notification of hazard events and emergencies.	44.44% 4	11.11% 1	44.44% 4	0% 0	0% 0	9
Natural Hazard Training. Continue to train and educate emergency responders about mitigating NHs.	33.33% 3	22.22% 2	44.44% 4	0% 0	0% 0	9
Outreach. Promote owner participation in mitigation efforts to protect their property.	22.22% 2	33.33% 3	44.44% 4	0% 0	0% 0	9
Pet Sheltering. Distribute hurricane preparedness information including pet sheltering plans.	44.44% 4	0% 0	44.44% 4	11.11% 1	0% 0	9
Preparedness Webpage. Keep up-to-date Town website with NH preparedness information, including hazard areas, evacuation routes deemed appropriate per NH event and locations of shelters.	44.44% 4	22.22% 2	33.33% 3	0% 0	0% 0	9
Proactive Pamphlets. Provide pamphlets and refer to web-based information for property owners for hazards listed in this document to show options for obtaining additional insurance, structural alterations to protect against various hazard damage, and emergency procedures for families during a hazard. Include information for contractors and homeowners on the risks of building in hazard prone areas.	33.33% 3	11.11% 1	44.44% 4	11.11% 1	0% 0	9
Recovery Webpage. Post on Town website information about recovery assistance following NH events.	22.22% 2	44.44% 4	33.33% 3	0% 0	0% 0	9
Webpage. Update town webpage with the section on Hazard Preparedness. Include options for mitigation for residential structures and business recovery and provide links to FEMA, NOAA, State OEM and RiverCOG websites for additional information.	33.33% 3	33.33% 3	33.33% 3	0% 0	0% 0	9
Information. Publish materials on additional hazards and encourage additional insurance.	11.11% 1	44.44% 4	44.44% 4	0% 0	0% 0	9
Private Roads. Engage street associations to ensure that they have plans in place for NH recovery, including snow removal.	22.22% 2	33.33% 3	44.44% 4	0% 0	0% 0	9
Public Participation. Work with local civic organizations to develop methods for notification of emergencies.	44.44% 4	22.22% 2	33.33% 3	0% 0	0% 0	9
Wildfire Education. Educate the public about potential hazard of wildfire caused by campfires or open burning. Develop a warning system for when risks are high.	33.33% 3	11.11% 1	55.56% 5	0% 0	0% 0	9

Appendix IX – Resolution to Adopt

RESOLUTION

TOWN OF KILLINGWORTH HAZARD MITIGATION PLAN

WHEREAS, the Disaster Mitigation Act of 2000 encourages communities to prepare a Natural Hazard
Mitigation Plan to outline natural hazard vulnerabilities and potential mitigation measures; and

WHEREAS, the primary goal of the Natural Hazard Mitigation Plan is to reduce the loss of or damage to
life, property, infrastructure, and natural, cultural, and economic resources from natural disasters; and

WHEREAS, in light of continuing natural disasters that severely impacted public infrastructure and private properties in the Town of Killingworth, the Town developed a Natural Hazard Mitigation Plan update to understand local conditions and plan accordingly; and

WHERAS, public information meetings were held to solicit public input and recommendations and to review the plan as required by law;

WHEREAS, the Natural Hazard Mitigation Plan recommends many hazard mitigation actions that will
protect the people and property affected by the natural hazards that potentially face the town; and

WHEREAS, some of the recommended mitigation actions may qualify for Federal funding but only if the Town of Killingworth officially adopts the Natural Hazard Mitigation Plan; and

WHEREAS, the Town of Killingworth shall implement, maintain, and update the Hazard Mitigation Plan through the appropriate municipal departments and commissions;

BE IT RESOLVED by the Board of Selectmen of the Town of Killingworth that the Natural Hazard Mitigation Plan is hereby adopted as an official plan of the Town of Killingworth, and that the appropriate municipal departments will report annually on their activities, accomplishments, and progress relative to the Natural Hazard Mitigation Plan for the Town of Killingworth.

BE IT FURTHER RESOLVED that the Town of Killingworth is authorized to apply for and accept any future Federal or State grant assistance to accomplish the goals of the Natural Hazard Mitigation Plan.

Adopted this ___ day of ____ 20__ by the Board of Selectmen of Killingworth, Connecticut

_____

(Signatures)

DRAFT