

**TOWN OF BETHLEHEM  
NATURAL HAZARD PRE-DISASTER MITIGATION PLAN**

**CENTRAL NAUGATUCK VALLEY  
REGIONAL PLANNING AREA**

**NOVEMBER 2008  
REVISED DECEMBER 2008**

**MMI #2937-02**

*Prepared For:*



**Council of Governments  
Central Naugatuck Valley**

Under a grant from the Federal Emergency Management Agency (FEMA) through the Connecticut Department of Environmental Protection (DEP)

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## EXECUTIVE SUMMARY

### *Town of Bethlehem Natural Hazard Pre-Disaster Mitigation Plan*

1. The primary purpose of a Natural Hazard Pre-Disaster 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 FEMA-approved mitigation plan in order to be eligible to receive Pre-Disaster Mitigation program grants and post-disaster Hazard Mitigation Grant Program funds.
2. The hilly, elevated terrain of Bethlehem makes it particularly vulnerable to an array of natural hazards, including small areas of inland flooding; hurricanes and high winds; tornadoes; earthquakes; summer storms including hail and lightning; wildfires; dam failures; and winter storms with ice, extreme cold, and blizzard conditions.
3. One inactive Jurassic-era fault is mapped traversing south to north through the eastern part of Town. While Bethlehem is unlikely to experience a damaging earthquake in any given year, areas underlain with sand and gravel are at increased risk due to amplification of energy and collapse if one should occur.
4. The Town of Bethlehem drains to seven major watersheds: Bantam River, Branch Brook, East Spring Brook, Nonnewaug River, Shepaug River, Sprain Brook, and the Weekeepeemee River. Over 80% of the town drains to the Weekeepeemee River and East Spring Brook, and then to the Pomperaug and Housatonic Rivers. There are also a number of water bodies in Town including Long Meadow Pond, the Bronson E. Lockwood Reservoir, and the Watertown Reservoir.
5. The Town considers its police, fire, governmental, communication utilities, and major transportation arteries to be its most important facilities as well as its elderly housing,

group homes, and educational institutions. None of these critical facilities are regularly impacted by flooding. Route 132 is a major east-west thoroughfare which has occasional flooding issues near Long Horizon Road and Sky Meadow Road.

6. The Town has a number of measures in place to prevent flood damage including regulations, codes, and ordinances preventing encroachments and development near floodways. 483 acres of land are located within the 100-year flood boundary and additional indirect and nuisance flooding occurs near streams and rivers throughout town due to inadequate drainage and other factors. Some of these areas include: Arrowhead Lane, Crane Hollow Road, Double Hill Road, Falls Road, Hickory Lane, Hard Hill Road North, and Route 132.
7. The Town may wish to identify floodprone areas for potential acquisition as stated in the Plan of Conservation and Development. Site plan and subdivision regulations might consider the requirement that a lot have a buildable area above the flood level.
8. The Fire Department is currently the primary shelter for small, short term events with police and fire departments serving as staff. Memorial Hall can use used as a shelter during larger hazard events but has limited bathrooms. Both facilities meet specific American Red Cross (ARC) guidelines for shelters. Amenities and operating costs are the responsibility of the community, not the ARC. Wisdom House in Litchfield has also been used as a shelter by families in Bethlehem. Bethlehem Elementary School serves as an emergency supply distribution center.
9. The Town's emergency communications systems are outdated and mostly incompatible with those in surrounding towns. A communications study is underway that will likely recommended an upgrade to these systems. The Town plans to apply to various grants to help fund the new equipment.



10. For a variety of purposes, literature on appropriate design standards would be useful at the Building Department during the permitting process. Literature on how the public can prepare and protect themselves and their property for natural disasters would be useful on the web or at various locations such as the Town Hall and library.
11. The likelihood of a nor'easter is considered high and considered very high for other winter storms. Icing due to poor drainage occurs in the hillier sections including several areas along Route 132.
12. The Town of Bethlehem is the first responder to the Horace Mann Nature Center in Washington. The access road is unpaved, narrow, and steep which could result in the facility becoming isolated in a winter emergency.
13. Evacuation routes, plow routes, and shelter information should be made available on the Town's web page and at municipal buildings.
14. Based on potential hazard, Bethlehem has six Class BB dams (Addie Road Pond Dam, Benjamin Pond Dam, Watertown Reservoir Dam, Long Meadow Pond Dam, Zieglers Pond Dam, and Kasser Road Pond Dam), one Class B (Bird Pond Dam), one Class C (Bronson Lockwood Dam) and one undefined (Newman Pond Dam). Some dam names registered with the Department of Environmental Protection do not reflect current road names. Failure of Classes BB, B, or C dams can cause moderate to great economic loss.
15. The Town of Bethlehem may wish to consider adopting a Flood and Erosion Control Board to oversee local flooding and erosion problems and repairs of municipal dams. Such a Board can be established by updating the Town charter and would consist of the Board of Selectmen.
16. The Town has been requested by DEP to retain an engineer to perform a hydraulic and hydrologic analysis of Long Meadow Pond Dam, and implement improvements needed

to pass the 100-year storm event. The Town should review and update the Emergency Operation Plan for the dam when these modifications are complete.

17. Bethlehem is at a low risk for wildfires. Those areas at the highest risk are limited access conservation properties and adjacent residential properties. Narrow and one-way roads hinder emergency access for firefighting.

## **1.0 INTRODUCTION**

### **1.1 Background and Purpose**

The term hazard refers to an extreme natural event that poses a risk to people, infrastructure, or resources. In the context of natural disasters, pre-disaster hazard mitigation is commonly defined as any sustained action that permanently reduces or eliminates long-term risk to people, property, and resources from natural hazards and their effects.

The primary purpose of a pre-disaster hazard mitigation plan (HMP) is to identify natural hazards and risks, existing capabilities, and activities that can be undertaken by a community or group of communities to prevent loss of life and reduce property damages associated with the identified hazards. This HMP is prepared specifically to identify hazards in the Town of Bethlehem, Connecticut ("Bethlehem" or "Town"). The HMP is relevant not only in emergency management situations, but also should be used within the Town of Bethlehem's land use, environmental, and capital improvement frameworks.

The Disaster Mitigation Act of 2000 (DMA), commonly known as the 2000 Stafford Act amendments, was approved by Congress and signed into law in October 2000, creating Public Law 106-390. The purposes of the DMA are to establish a national program for pre-disaster mitigation and streamline administration of disaster relief.

The DMA requires local communities to have a Federal Emergency Management Agency (FEMA)-approved mitigation plan in order to be eligible to receive post-disaster Hazard Mitigation Grant Program (HMGP) grants and Pre-Disaster Mitigation (PDM) program project grant funds. Once a community has a FEMA-approved hazard mitigation plan, the community is then eligible to apply for PDM project funds for mitigation activities.

The subject pre-disaster hazard mitigation plan was developed to be consistent with the requirements of the HMGP, PDM, and Flood Management Assistance (FMA) programs. These programs are briefly described below.

### **Pre-Disaster Mitigation (PDM) Program**

The Pre-Disaster Mitigation program was authorized by Part 203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 U.S.C. 5133. The PDM program provides funds to states, territories, tribal governments, communities, and universities for hazard mitigation planning and implementation of mitigation projects prior to disasters, providing an opportunity to reduce the nation's disaster losses through pre-disaster mitigation planning and the implementation of feasible, effective, and cost-efficient mitigation measures. Funding of pre-disaster plans and projects is meant to

#### ***Mitigation Funding***

Note that starting in 2008, applications for hazard mitigation grant funding are administered under the Unified Hazard Mitigation Assistance program. More information on this and the following programs can be found at FEMA's website, <http://www.fema.gov/>

reduce overall risks to populations and facilities. PDM funds should be used primarily to support mitigation activities that address natural hazards. In addition to providing a vehicle for funding, the PDM program provides an opportunity to raise risk awareness within communities.

### **Hazard Mitigation Grant Program (HMGP)**

The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. 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 recovery from a disaster. A key purpose of the HMGP is to ensure that any opportunities

to take critical mitigation measures to protect life and property from future disasters are not "lost" during the recovery and reconstruction process following a disaster.

### **Flood Mitigation Assistance (FMA) Program**

The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FEMA provides FMA funds to assist States and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, homes, and other structures insurable under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities. Three types of grants are available under FMA. These are Planning, Project, and Technical Assistance grants.

## **1.2 Hazard Mitigation Goals**

The primary goal of this hazard mitigation plan is to ***reduce the loss of or damage to life, property, infrastructure, and natural, cultural and economic resources from natural disasters***. This includes the reduction of public and private damage costs. Limiting losses of and damage to life and property will also reduce the social, emotional, and economic disruption associated with a natural disaster.

Developing, adopting, and implementing this hazard mitigation plan is expected to:

- ❑ ***Increase access to and awareness of funding sources for hazard mitigation projects.*** Certain funding sources, such as the Pre-Disaster Mitigation Competitive Grant Program and the Hazard Mitigation Grant Program, will be available if the hazard mitigation plan is in place and approved.

- ❑ ***Identify mitigation initiatives to be implemented if and when funding becomes available.*** This HMP will identify a number of mitigation recommendations, which can then be prioritized and acted upon as funding allows.
- ❑ ***Connect hazard mitigation planning to other community planning efforts.*** This HMP can be used to guide Bethlehem's development through inter-departmental and inter-municipal coordination.
- ❑ ***Improve the mechanisms for pre- and post-disaster decision making efforts.*** This plan emphasizes actions that can be taken now to reduce or prevent future disaster damages. If the actions identified in this plan are implemented, damage from future hazard events can be minimized, thereby easing recovery and reducing the cost of repairs and reconstruction.
- ❑ ***Improve the ability to implement post-disaster recovery projects*** through development of a list of mitigation alternatives ready to be implemented.
- ❑ ***Enhance and preserve natural resource systems.*** Natural resources, such as wetlands and floodplains, provide protection against disasters such as floods and hurricanes. Proper planning and protection of natural resources can provide hazard mitigation at substantially reduced costs.
- ❑ ***Educate residents and policy makers about natural hazard risk and vulnerability.*** Education is an important tool to ensure that people make informed decisions that complement the Town's ability to implement and maintain mitigation strategies.
- ❑ ***Complement future Community Rating System efforts.*** Implementation of certain mitigation measures may increase a community's rating, and thus the benefits that it derives from FEMA. The Town of Bethlehem has never participated in the Community Rating System.

### ***1.3 Identification of Hazards and Document Overview***

As stated in Section 1.1, the term *hazard* refers to an extreme natural event that poses a risk to people, infrastructure, or resources. Based on a review of the Connecticut Natural Hazard Mitigation Plan and correspondence with local officials, the following have been identified as natural hazards that can potentially affect the Town of Bethlehem:

- ☐ Inland Flooding
- ☐ Hurricanes and Tropical Storms
- ☐ Summer Storms (including lightning, hail, and heavy winds) and Tornadoes
- ☐ Winter Storms
- ☐ Earthquakes
- ☐ Dam Failure
- ☐ Wildfires

This document has been prepared with the understanding that a single *hazard effect* may be caused by multiple *hazard events*. For example, flooding may occur as a result of frequent heavy rains, a hurricane, or a winter storm. Thus, Appended Tables 1 and 2 provide summaries of the hazard events and hazard effects that impact the Town of Bethlehem, and include criteria for characterizing the locations impacted by the hazard, the frequency of occurrence of the hazards, and the magnitude or severity of the hazards.

Despite the causes, the effects of several hazards are persistent and demand high expenditures from the Town. In order to better identify current vulnerabilities and potential mitigation strategies associated with other hazards, each hazard has been individually discussed in a separate chapter.

This document begins with a general discussion of Bethlehem's community profile, including the physical setting, demographics, development trends, governmental structure, and sheltering capacity. Next, each chapter of this Plan is broken down into six

or seven different parts. These are *Setting*; *Hazard Assessment*; *Historic Record*; *Existing Programs, Policies, and Mitigation Measures*; *Vulnerabilities and Risk Assessment*; and *Potential Mitigation Measures, Strategies, and Alternatives*, and for chapters with several recommendations, a *Summary of Recommendations*. These are described below.

- ❑ ***Setting*** addresses the general areas that are at risk from the hazard. General land uses are identified.
- ❑ ***Hazard Assessment*** describes the specifics of a given hazard, including general characteristics, and associated effects. Also defined are associated return intervals, probability and risk, and relative magnitude.
- ❑ ***Historic Record*** is a discussion of past occurrences of the hazard, and associated damages when available.
- ❑ ***Existing Programs, Policies, and Mitigation Measures*** gives an overview of the measures that the Town of Bethlehem is currently undertaking to mitigate the given hazard. These may take the form of ordinances and codes, structural measures such as dams, or public outreach initiatives.
- ❑ ***Vulnerabilities and Risk Assessment*** focuses on the specific areas at risk to the hazard. Specific land uses in the given areas are identified. Critical buildings and infrastructure that would be affected by the hazard are identified.
- ❑ ***Potential Mitigation Measures, Strategies, and Alternatives*** identifies mitigation alternatives, including those that may be the least cost effective or inappropriate for Bethlehem.



- ❑ ***Summary of Recommended Mitigation Measures, Strategies, and Alternatives***  
provides a summary of the recommended courses of action for Bethlehem that is included in the STAPLEE analysis described below.

This document concludes with a strategy for implementation of the Hazard Mitigation Plan, including a schedule, a program for monitoring and updating the plan, and a discussion of technical and financial resources.

#### ***1.4 Discussion of STAPLEE Ranking Method***

To prioritize recommended mitigation measures, it is necessary to determine how effective each measure will be in reducing or preventing damage. A set of criteria commonly used by public administration officials and planners was applied to each proposed strategy. The method, called STAPLEE, stands for the "Social, Technical, Administrative, Political, Legal, Economic and Environmental" criteria for making planning decisions. The following questions were asked about the proposed mitigation strategies:

- ❑ **Social:** Is the proposed strategy socially acceptable to Bethlehem? Is there any equity issues involved that would mean that one segment of Bethlehem could be treated unfairly?
- ❑ **Technical:** Will the proposed strategy work? Will it create more problems than it will solve?
- ❑ **Administrative:** Can Bethlehem implement the strategy? Is there someone to coordinate and lead the effort?
- ❑ **Political:** Is the strategy politically acceptable? Is there public support both to implement and maintain the project?
- ❑ **Legal:** Is Bethlehem authorized to implement the proposed strategy? Is there a clear legal basis or precedent for this activity?

- ❑ **Economic:** What are the costs and benefits of this strategy? Does the cost seem reasonable for the size of the problem and the likely benefits?
- ❑ **Environmental:** How will the strategy impact the environment? Will the strategy need environmental regulatory approvals?

Each proposed mitigation strategy presented in this plan was evaluated and assigned a score (Good = 3, Average = 2, Poor = 1) based on the above criteria. An evaluation matrix with the total scores from each strategy can be found in Appendix A. After each strategy is evaluated using the STAPLEE method, it is possible to prioritize the strategies according to the final score. The highest scoring is determined to be of more importance, economically, socially, environmentally and politically and, hence, prioritized over those with lower scoring.

### ***1.5     Documentation of the Planning Process***

The Town of Bethlehem is a member of the Council of Governments of the Central Naugatuck Valley (COGCNV), the regional planning body responsible for Bethlehem and twelve other member municipalities: Beacon Falls, Cheshire, Middlebury, Naugatuck, Oxford, Prospect, Southbury, Thomaston, Waterbury, Watertown, Wolcott, and Woodbury. The municipalities of Cheshire, Prospect, Oxford, Waterbury, Watertown, Wolcott, and Woodbury have existing mitigation plans, and hazard mitigation plans are being concurrently developed for remaining municipalities.

Ms. Virginia Mason of the COGCNV coordinated the development of this Hazard Mitigation Plan. The COGCNV applied for the grant from FEMA through the Connecticut Department of Environmental Protection (DEP). The adoption of this Plan in the Town of Bethlehem will also be coordinated by the COGCNV. In addition, the COGCNV provided Geographic Information System (GIS) base mapping and created the figures presented in this document.

The following individuals from the Town of Bethlehem provided information, data, studies, reports, and observations; and were involved in the development of the Plan:

- ❑ Mr. Michael Devine, Emergency Service Director
- ❑ Mr. Jim Kacerguis, Director, Public Works Department
- ❑ Mr. John Rudzavice, Fire Marshal
- ❑ Mr. Roger Natusch, Building Official
- ❑ Ms. Jean Donegan, Land Use Coordinator

An extensive data collection, evaluation, and outreach program was undertaken to compile information about existing hazards and mitigation in the Town, as well as to identify areas that should be prioritized for hazard mitigation. The following is a list of meetings that were held to develop this Hazard Mitigation Plan:

- ❑ ***Field inspections were performed on February 13, 2008.*** Observations were made of flooding and problem areas within the Town after a period of heavy rain falling on frozen ground.
- ❑ ***A project meeting with Town officials was held March 4, 2008.*** Necessary documentation was collected, and problem areas within the Town were discussed.
- ❑ ***A public information meeting was held April 21, 2008 at 7:30 P.M.*** Preliminary findings were presented and public comments solicited.

Residents were invited to the public information meeting via newspaper, with three residents attending that were not Town personnel or a commission member. Similarly, eight municipal agencies and civic organizations were invited via a mailed copy of the press release that announced the public information meeting. These included the following:

- ❑ Long Meadow Lake Management Committee;
- ❑ Torrington Area Health District;
- ❑ United Way of Greater Waterbury;
- ❑ American Red Cross – Waterbury Area;
- ❑ Bethlehem Inland Wetlands Commission;
- ❑ Bethlehem Land Trust;
- ❑ Bethlehem Conservation Commission; and
- ❑ Bethlehem Planning Commission.

Of these organizations, the Long Meadow Lake Management Committee and the Bethlehem Conservation Commission were represented at the meeting. Residents were also encouraged to contact the COG with comments via newspaper articles. As another direct gauge of public interest, a review of Public Works Department complaint files was undertaken to document problems of public concern.

It is important to note that COGCVN manages the Central Naugatuck Valley Emergency Planning Committee. This committee has begun coordinating emergency services in the region. Fire, Police, EMS, Red Cross, emergency management directors, and other departments participate in these efforts. In June 2004, over 120 responders participated in the region's first tabletop exercise on biological terrorism. Area health directors, hospitals, and other health care professionals also meet monthly with the Health and Medical Subcommittee to share information, protocols, and training. Thus, local knowledge and experience gained through the Emergency Planning Committee activities has been transferred by the COGCVN to the pre-disaster mitigation planning process.

Additional opportunities for the public to review the Plan will be implemented in advance of the public hearing to adopt this plan, tentatively scheduled for January 2009, contingent on receiving conditional approval from FEMA. The draft that is sent for FEMA review will be posted on the Town website (<http://www.ci.bethlehem.ct.us/>) and the COGCVN website (<http://www.cogcnv.org>) to provide opportunities for public

review and comment. Such comments will be incorporated into the final draft where applicable. Upon receiving conditional approval from FEMA, the public hearing will be scheduled, at which time any remaining comments can be addressed. Notification of the opportunity to review the Plan on the above websites and the announcement of the public information meeting will be posted on the websites and placed in local newspapers.

If any final plan modifications result from the comment period leading up to and including the public hearing to adopt the plan, these will be submitted to FEMA as page revisions with a cover letter explaining the changes. It is not anticipated that any major modifications will occur at this phase of the project.

Appendix B contains copies of meeting minutes, field notes and observations, the public information meeting presentation, and other records that document the development of this Natural Hazard Pre-Disaster Mitigation Plan.

## **2.0 COMMUNITY PROFILE**

### **2.1 Physical Setting**

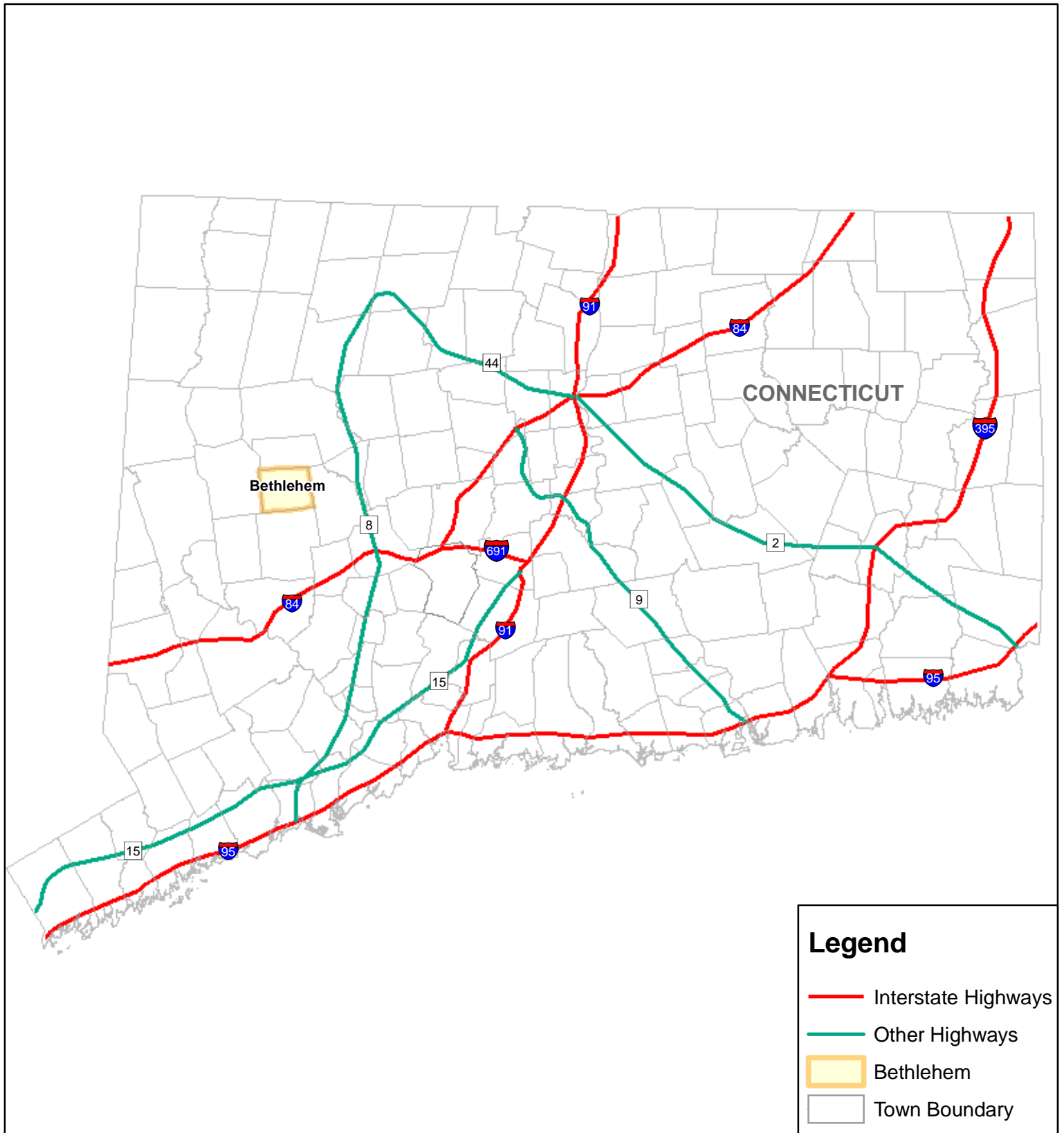
The Town of Bethlehem is located in Litchfield County. It is bordered by Woodbury to the south, Washington to the west, Morris to the north, and Watertown to the east. Refer to Figure 2-1 for a location schematic and Figure 2-2 for a location map.

Bethlehem is located within the western part of the crystalline uplands, or Western Highlands, of western Connecticut. This geologic feature consists of three belts of metamorphic rocks bounded to the west by the sediments and metamorphic rocks of the Hudson River valley and on the east by the Triassic sediments of the Connecticut River valley. The topography of the Town ranges from gently rolling terrain in the valleys to steep, hilly terrain in the upland areas. Elevations range from 450 feet above sea level along the Weekepeemee River in the southwestern part of Town to over 1,130 feet above sea level on Todd Hill in the northwestern part of Town, based on the National Geodetic Vertical Datum of 1929. The hilly, elevated terrain of Bethlehem makes it particularly vulnerable to an array of natural hazards.

### **2.2 Existing Land Use**

Bethlehem is characterized by its hills and soils that are typically unsuitable for large septic systems, both of which limit large development in much of the Town. A small commercial district is located in the center of the town at the intersection of East Street and Main Street (Route 61). Outside of the commercial area, agricultural areas are interspersed with low density residential neighborhoods. Much of the undeveloped areas of Bethlehem are private forested areas or land trust properties. Bethlehem is also the site of the Abbey of Regina Laudis, a Catholic monastic community, located on the southern end of Town.

# Figure 2-1: Bethlehem Location Map



Source: "Roads", c1984 - 2008 Tele Atlas, Rel. 04/08.

"Town Boundary", DEP

For general planning purposes only. Delineations may not be exact.  
June 2008

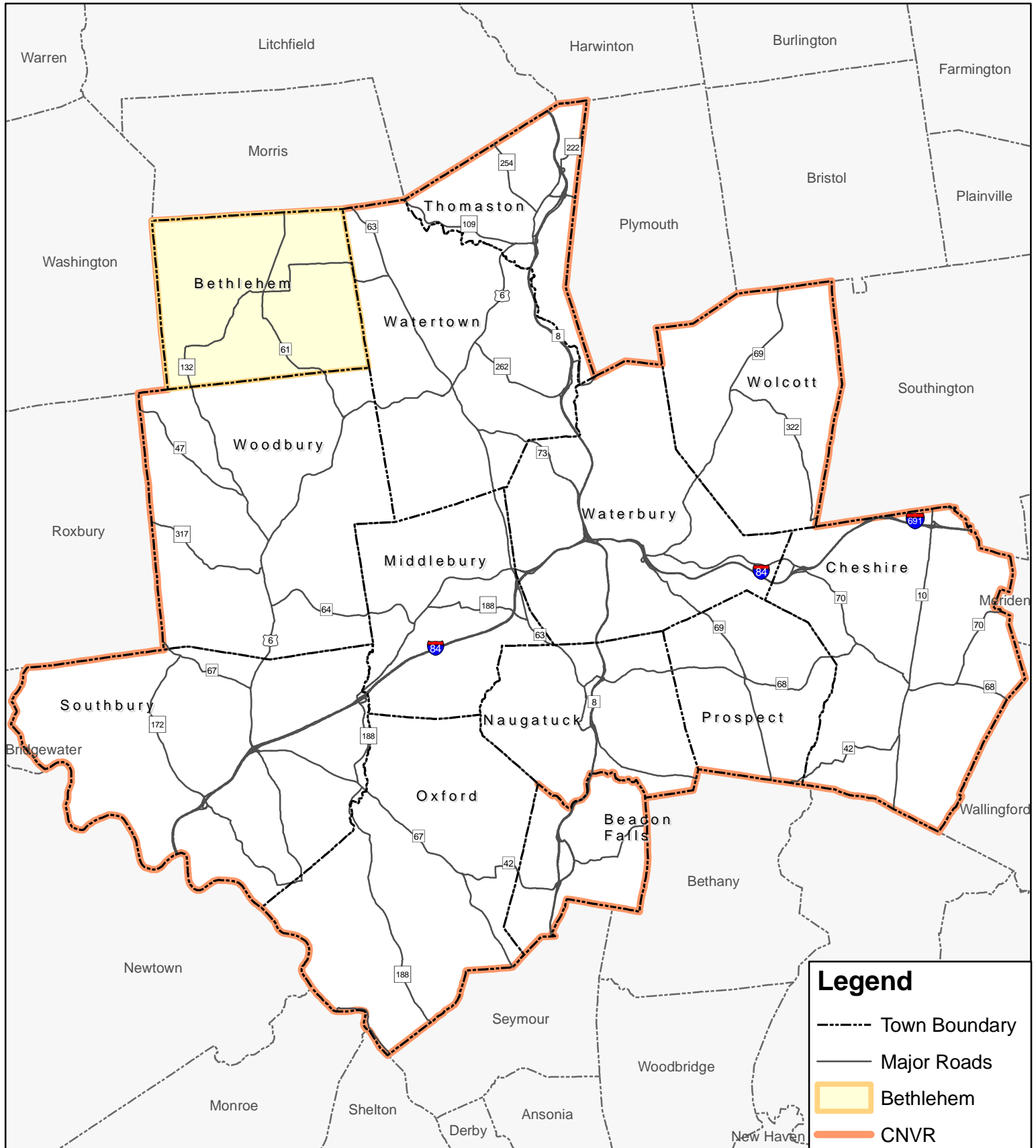


0 10 20 Miles



COUNCIL OF GOVERNMENTS  
CENTRAL NAUGATUCK VALLEY

# Figure 2-2: Bethlehem in the CNVR



Source: "Roads", c1984 - 2008 Tele Atlas, Rel. 04/08.

"Town Boundary", DEP

For general planning purposes only. Delineations may not be exact.  
June 2008



0 2 4 Miles



COUNCIL OF GOVERNMENTS  
CENTRAL NAUGATUCK VALLEY



The Town of Bethlehem encompasses 19.6 square miles. Table 2-1 provides a summary of land use in Bethlehem by area. In addition, refer to Figure 2-3 for a map of generalized land use provided by the COGCNV.

**Table 2-1**  
**Land Use by Area**

<b>Land Use</b>	<b>Area (acres)</b>	<b>Pct.</b>
Vacant	5,707	45.4%
Residential - Low Density	2,977	23.7%
Agricultural	2,956	23.5%
Institutional	460	3.7%
Water	210	1.7%
Recreational	198	1.6%
Mining	25	0.2%
Commercial	25	0.2%
Residential - High Density	8	0.1%

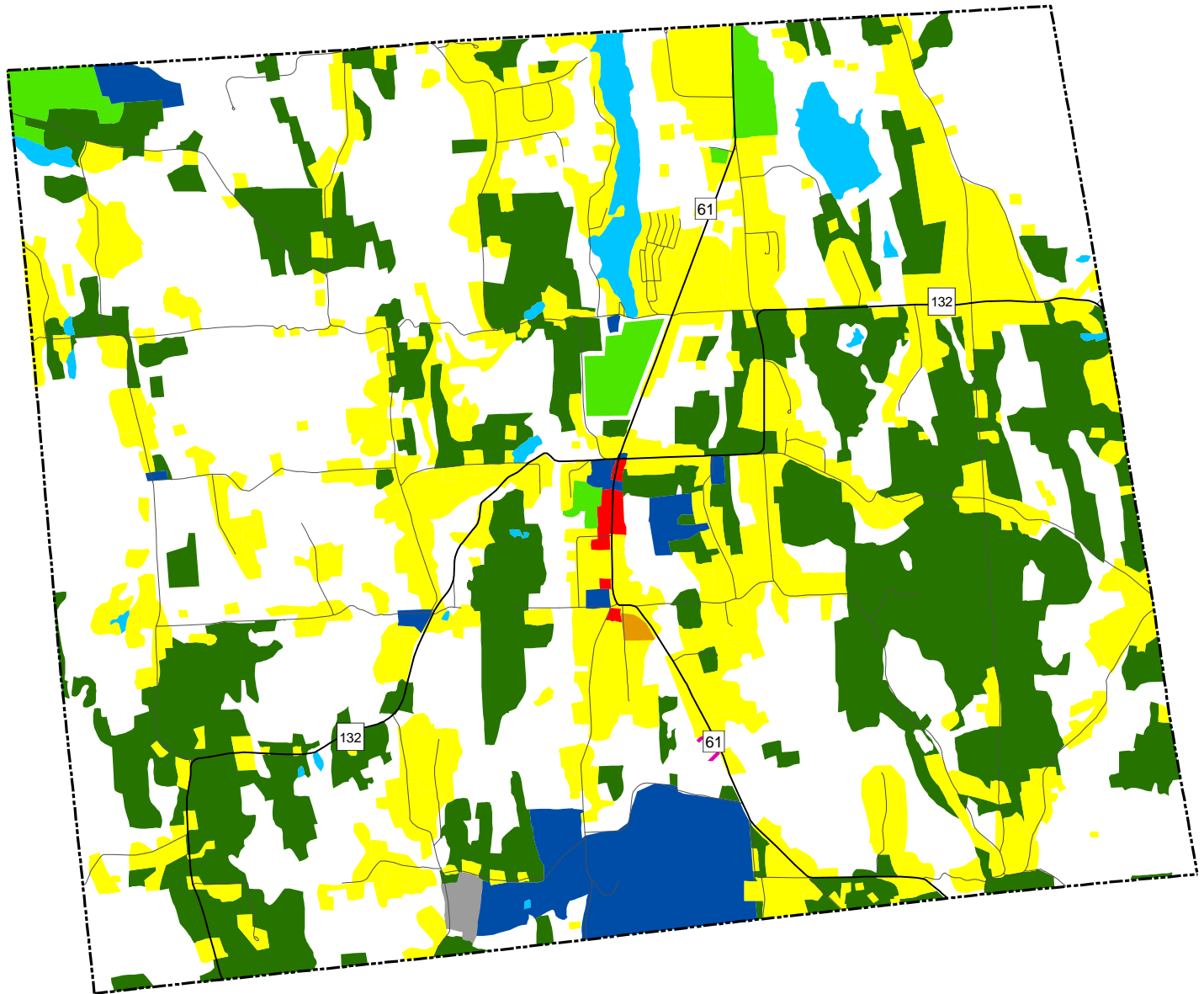
*Source: Council of Governments Central Naugatuck Valley, 2000*

## **2.3 Geology**

Geology is important to the occurrence and relative effects of natural hazards such as earthquakes. Thus, it is important to understand the geologic setting and variation of bedrock and surficial formations in Bethlehem. The following discussion highlights Bethlehem's geology at several regional scales. Geologic information discussed in the following section was acquired in GIS from the Connecticut DEP.

In terms of North American bedrock geology, the Town of Bethlehem is located in the northeastern part of the Appalachian Orogenic Belt, also known as the Appalachian Highlands. The Appalachian Highlands extend from Maine south into Mississippi and Alabama and were formed during the orogeny that occurred when the super-continent Pangea assembled during the late Paleozoic era. The region is generally characterized by deformed sedimentary rocks cut through by numerous thrust faults.

# Figure 2-3: Bethlehem Generalized Land Use



## Legend

- |                     |                                                                  |
|---------------------|------------------------------------------------------------------|
| ----- Town Boundary | RL Residential - Low Density less than 2 dwelling units per acre |
| — Major Roads       | RM Residential - Medium Density 2-8 dwelling units per acre      |
| — Local Roads       | RH Residential - High Density 8 or more dwelling units per acre  |
| AG Agriculture      | RX Resource Extraction                                           |
| CF Institutional    | TU Transportation & Utilities                                    |
| CM Commercial       | UL Undeveloped Land                                              |
| IN Industrial       | W Water                                                          |
| RC Recreational     |                                                                  |



Regionally, in terms of New England bedrock geology the Town of Bethlehem lies within the Eugeosyncline Sequence. Bedrock belonging to the Eugeosyncline Sequence are typically deformed, metamorphosed, and intruded by small to large igneous plutons.

The Town of Bethlehem's bedrock consists primarily of metasedimentary and metaigneous schists and granofels and secondarily of igneous granite and pegmatite. The bedrock alignment trends generally southwest to northeast through the Town. Refer to Figure 2-4 for a depiction of the bedrock geology in the Town of Bethlehem.

### ***Bedrock Geology***

Connecticut bedrock geology is comprised of several "terranes." Terranes are geologic regions that reflect the role of plate tectonics in Connecticut's natural history.

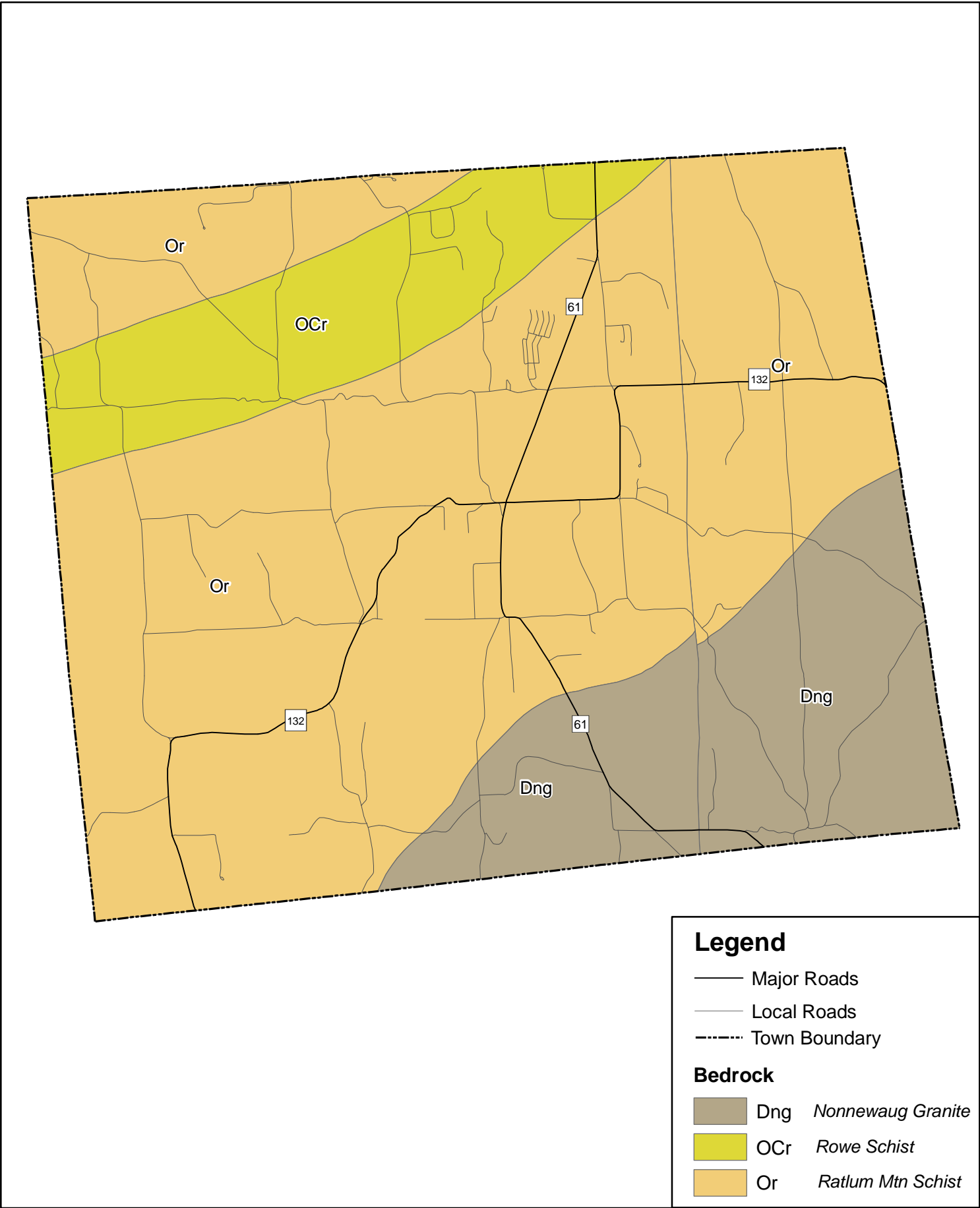
The bedrock beneath the Town of Bethlehem is part of the Iapetos Terrane, comprised of remnants of the Iapetos Ocean that existed before Pangaea was formed. This terrane formed when Pangaea was consolidated, and its boundaries are coincident with the Eugeosyncline Sequence geologic province described above.

The three primary bedrock formations in the Town (from north to south) are Ratlum Mountain Schist, Rowe Schist, and Nonewaug Granite:

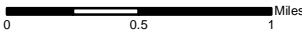
- ❑ The Ratlum Mountain Schist consists of gray, medium-grained schist and granofels.
- ❑ The Rowe Schist is a light-gray to silvery, fine to medium-grained schist.
- ❑ The Nonewaug Granite is a white to pink, fine to very coarse-grained granite with some parts pegmatitic.

One fault is mapped in the Town of Bethlehem. It is a high-angle, mostly Jurassic fault traversing south to north through the eastern part of Town. The fault extends from Newtown and runs into Massachusetts and is believed inactive. Bedrock outcrops can be difficult to find in Bethlehem due to the forested nature of the Town, although outcrops can be found at higher elevations and on hilltops.

Figure 2-4: Bethlehem Bedrock Geology



Source: "Roads", c1984 - 2008 Tele Atlas, Rel. 04/08.  
"Town Boundary", "Bedrock", DEP  
For general planning purposes only. Delineations may not be exact.  
June 2008



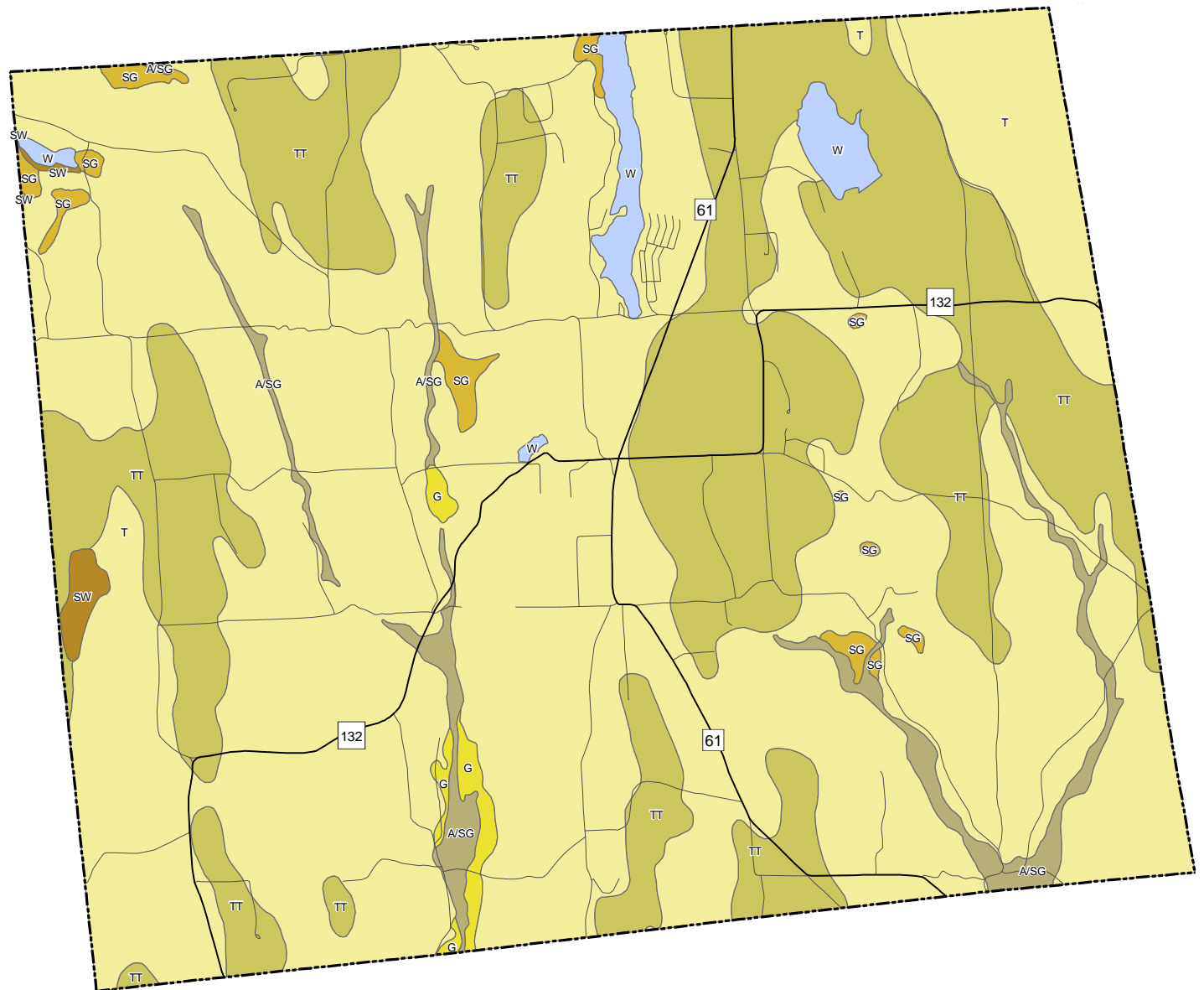
COUNCIL OF GOVERNMENTS  
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At least twice in the late Pleistocene, continental ice sheets moved across Connecticut. As a result, surficial geology of the Town is characteristic of the depositional environments that occurred during glacial and postglacial periods. Refer to Figure 2-5 for a depiction of surficial geology.

Bethlehem is covered primarily by glacial till. Tills contain an unsorted mixture of clay, silt, sand, gravel, and boulders deposited by glaciers as a ground moraine. This area includes nearly all of Bethlehem with the exception of the river valleys associated with the Weekepeemee River, Wood Creek, the Nonnewaug River and East Spring Brook. Stratified sand and gravel ("stratified drift") areas are associated with these watercourses. These deposits accumulated by glacial meltwater streams during the outwash period following the latest glacial recession. The remainder of Town is covered by small areas of swamp near the western and northwestern boundary, and by the ponds and reservoirs scattered throughout Bethlehem.

The amount of stratified drift present in the Town is important for several reasons. First, the stratified drift is currently used by water utilities in downstream Watertown to provide drinking water via pumping wells. Secondly, in regard to inland flooding, areas of stratified materials are generally coincident with inland floodplains. This is because these materials were deposited at lower elevations by glacial streams, and these valleys later were inherited by the larger of our present-day streams and rivers. However, smaller glacial till watercourses can also cause flooding, such as those in northern, eastern, and southeastern Bethlehem. The amount of stratified drift also has bearing on the relative intensity of earthquakes and the likelihood of soil subsidence in areas of fill. These topics will be discussed in later sections.

# Figure 2-5: Bethlehem Surfacial Materials

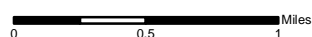


## Legend

- Town Boundary
- Major Roads
- Local Roads

## Surfacial Materials

	A/SG	Alluvium Overlying Sand and Gravel
	G	Gravel
	SG	Sand and Gravel
	SW	Swamp
	T	Till
	TT	Thick Till
	W	Water



In terms of soil types, approximately 80% of the Town contains Paxton and Montauk fine sandy loams, Canton and Charlton soils, Charlton-Chatfield complex, extremely stony Ridgebury, Leicester, and Whitman soils, and Woodbridge fine sandy loam (Table 2-2). The remainder of the Town has soil types of consisting primarily of various fine to medium sandy loams, wetland soils, and urban land. The following soil descriptions are taken in part from the official series descriptions from the United States Department of Agriculture (USDA) website.

**Table 2-2**  
**Soils by Taxonomic Class**

<b>Soil Type</b>	<b>Area (acres)</b>	<b>Pct.</b>
Paxton and Montauk fine sandy loams	3726	29.6%
Canton and Charlton soils	3169	25.2%
Charlton-Chatfield complex	1230	9.8%
Ridgebury, Leicester, and Whitman soils	1167	9.3%
Woodbridge fine sandy loam	1162	9.2%
Hollis-Chatfield-Rock outcrop complex	435	3.5%
Gloucester gravelly sandy loam	321	2.6%
Sutton fine sandy loam	275	2.2%
Water	228	1.85
Merrimac sandy loam	178	1.4%
Other (20 types)	684	5.4%
<b>Total</b>	<b>12575</b>	<b>100.0</b>

*Source: 2005 Soil Survey Geographic (SSURGO) database for the State of Connecticut*

- ❑ The Paxton and Montauk series consists of very deep, well-drained loamy soils formed in lodgment till derived primarily from granitic materials. The soils are very deep to bedrock and moderately deep to a densic contact. They are nearly level to steep soils on upland till plains, hills, moraines, and drumlins. Slope ranges from zero to forty-five percent. Saturated hydraulic conductivity is moderately high or high in the solum and low to moderately high in the substratum.
- ❑ The Canton and Charlton soils consist of very deep, well- drained soils formed in a loamy mantle underlain by sandy till with stones and boulders often present. The

soils are found on nearly level to steep glaciated plains, hills, and ridges. Slope ranges from zero to thirty-five percent. Saturated hydraulic conductivity is high in the solum and high or very high in the substratum.

- ❑ The Charlton-Chatfield complex consists of moderately deep to deep, well-drained, and somewhat excessively drained soils formed in glacial till. They are very nearly level to very steep soils on glaciated plains, hills, and ridges. The soil is often stony or very stony. Slope ranges from three to forty-five percent. Crystalline bedrock is at depths of 20 to 40 inches. Saturated hydraulic conductivity is moderately high to high in the mineral soil.
- ❑ Extremely stony Ridgebury, Leicester, and Whitman Soils consist of very deep, somewhat poorly drained to very poorly drained formed in glacial till derived mainly from granite, gneiss, and schist. These soils are shallow to a densic contact. They are nearly level to gently sloping soils in low areas, such as depressions or drainageways, in uplands. Slope ranges from zero to fifteen percent. Saturated hydraulic conductivity ranges from moderately low to high in the solum and very low to moderately low in the substratum.
- ❑ The Woodbridge series consists of moderately well drained loamy soils formed in subglacial till. They are very deep to bedrock and moderately deep to a densic contact. They are nearly level to moderately steep soils on till plains, hills, and drumlins. Slope ranges from zero to twenty-five percent. Saturated hydraulic conductivity ranges from moderately low or moderately high in the surface layer and subsoil and low or moderately low in the dense substratum.

## 2.4 Climate

Bethlehem has an agreeable climate, characterized by moderate but distinct seasons. The average mean temperature is approximately 48 degrees, with summer temperatures in the



mid-80s and winter temperatures in the upper 20's to mid-30s, Fahrenheit. Extreme conditions raise summer temperatures to near 100 degrees and winter temperatures to below zero. Median snowfall is just less than 46 inches per year as measured at Wigwam Reservoir weather station in Thomaston (NCDC, 2007). Median annual precipitation is 44 inches, spread evenly over the course of a year.

By comparison, average annual state-wide precipitation based on more than 100 years of record is nearly the same, at 45 inches. However, average annual precipitation in

***The continued increase in precipitation only heightens the need for hazard mitigation planning, as the occurrence of floods may change in accordance with the greater precipitation.***

Connecticut has been increasing by 0.95 inches per decade since the end of the 19<sup>th</sup> century (Miller et. al., 2002; NCDC, 2005). Likewise, total annual precipitation in the Town has increased over time.

## **2.5 Drainage Basins and Hydrology**

The Town of Bethlehem drains to seven major watersheds corresponding with the Bantam River, Branch Brook, East Spring Brook, Nonnewaug River, Shepaug River, Sprain Brook, and the Weekeepemee River. These drainage basins are described below and summarized in Table 2-3. Over eighty percent of the town drains to the Weekeepemee River and East Spring Brook, both of which ultimately drain through the Pomperaug River to the Housatonic River. The remainder of the Town also drains to the Housatonic River, but does so via the Shepaug or Naugatuck Rivers. Bethlehem is also home to a number of lakes and ponds, including Long Meadow Pond, the Bronson E. Lockwood Reservoir, and the Watertown Reservoir.

**Table 2-3**  
**Drainage Basins**

<b>Drainage Basin</b>	<b>Area (sq. mi)</b>	<b>Percent of Town</b>
Bantam River	0.20	1.0%
Branch Brook	0.72	3.6%
East Spring Brook	5.06	25.8%
Nonnewaug River	2.47	12.6%
Shepaug River	0.01	0.1%
Sprain Brook	0.27	1.4%
Weekeepeemee River	10.91	55.5%
<b>Total</b>	<b>19.64</b>	<b>100.0%</b>

*Source: Drainage Basins, 2008 CT DEP GIS Data for Connecticut*

#### *Bantam River*

A small section of Bethlehem's northwestern corner (approximately 1.0% of the Town) drains to the Bantam River in eastern Washington near Mt. Tom. The headwaters of the Bantam River are located in the area of the Litchfield Reservoir in Goshen. The Bantam River eventually drains into the Shepaug River in Washington. The subregional basin corresponding to the Bantam River drains 40.21 square miles of land across Washington, Morris, Bethlehem, Litchfield, Torrington, and Goshen, but only 0.20 square miles of this basin lie in the Town of Bethlehem.

#### *Branch Brook*

The Branch Brook drainage basin covers 0.72 square miles or 3.66% of the Town's land area in the northeastern corner of Bethlehem. It is the only basin in Bethlehem that drains to the Housatonic via the Naugatuck River, generally flowing to the east and southeast before entering the Naugatuck River in Mattatuck State Forest in Watertown. The upper reaches of this drainage basin are located in northeastern Morris and Litchfield, where Pitch Brook, Wigwam Brook, and their tributaries flow southward into Pitch Reservoir. In addition to the abovementioned tributaries, the Pitch Reservoir also

receives water from a seven mile long aqueduct built in the 1920s from the Shepaug Reservoir on the border between the Towns of Litchfield and Warren.

The Branch Brook drainage basin is heavily utilized for water supply. Pitch Reservoir is the first of three major impoundments in the watershed. Downstream are the Morris Reservoir on the Morris-Litchfield town line and the Wigwam Reservoir on the Watertown-Thomaston boundary. All of these reservoirs as well as the aqueduct were constructed by the City of Waterbury in the first half of the twentieth century for water supply purposes.

The part of Bethlehem within this basin drains through two unnamed watercourses to Morris Brook, and eventually into the Wigwam Reservoir just below the Morris Reservoir Dam. Branch Brook begins downstream of the Wigwam Reservoir Dam, where it makes up the boundary between Watertown and Thomaston before flowing into the Naugatuck River. In all, the Branch Brook basin drains 22.65 square miles of land in Thomaston, Watertown, Bethlehem, Morris, and Litchfield.

### *East Spring Brook*

The East Spring Brook drainage basin covers 5.06 square miles or 25.77% of the land area of Bethlehem. The basin extends from the eastern part of Bethlehem into southern Morris, from where several small watercourses converge into the Bronson E. Lockwood Reservoir in northeastern Bethlehem. This reservoir covers 73.5 acres and is operated by the Watertown Fire District Water Department, though it is not currently used for water supply.

East Spring Brook begins as the outlet from this reservoir and flows generally south across eastern Bethlehem. The brook first flows south into the Watertown Reservoir, and is later joined by two unnamed tributaries just downstream of its crossing of Magnolia Hill Road. Several more unnamed tributaries meet East Spring Brook before its

confluence with the Nonnewaug River in Woodbury, just to the south of the Bethlehem border. In total, East Spring Brook drains 5.85 square miles of land in the Towns of Woodbury, Bethlehem, and Morris.

#### Nonnewaug River

The southeastern corner of Bethlehem that does not drain to East Spring Brook drains directly to the Nonnewaug River. This area covers 2.47 square miles or 12.57% of Bethlehem's total land area. The Nonnewaug River has its headwaters along the border between Bethlehem and Watertown. Several unnamed streams flow into Big Meadow Pond in western Watertown. The Nonnewaug River begins as the outlet from this pond and flows to the southwest into Bethlehem where it is joined by three unnamed tributaries before crossing the border into Woodbury where it is joined by East Spring Brook.

Downstream of the East Spring Brook, the Nonnewaug River flows southward into Woodbury where it passes by Hart's Wellfield, a major source of water supply for the Watertown Fire District. The river is joined by several tributaries in Woodbury before it joins with the Weekepeemee River to form the Pomperaug River. In all, the Nonnewaug River drains 21.26 square miles of land in the Towns of Bethlehem, Watertown, Woodbury, and Middlebury.

#### Shepaug River

The smallest drainage basin in Bethlehem corresponds to the Shepaug River. It covers only 0.01 square miles in western Bethlehem, corresponding to 0.07% of the Town's total land area. This area drains west into Washington and into Mallory Brook, which meets up with the Shepaug River near the junction of Blackville Road and Route 47. The Shepaug River watershed is very large, draining 70.94 square miles of land from its confluence with the Housatonic River north to the Towns of Cornwall and Goshen.

### *Sprain Brook*

Approximately 0.27 square miles or 1.38% of Bethlehem's land area on Bethlehem's western and southwestern boundaries drains to Sprain Brook. Sprain Brook has its headwaters in eastern Washington, in a pond adjacent to the intersection of Nettleton Hollow Road and Carmel Hill Road. As it flows south out of this pond, Sprain Brook is fed by a number of unnamed tributaries on its way into Woodbury where it converges with the Weekeepemee River near the junction of Routes 47 and 132. In all, the subregional basin corresponding to Sprain Brook drains 10.96 square miles of the Towns of Woodbury, Roxbury, Washington, and Bethlehem.

### *Weekeepemee River*

The drainage basin corresponding to the Weekeepemee River covers 10.91 square miles, or 55.52% of Bethlehem's total land area. The basin covers almost the entire western half of the Town. The headwaters of the river form in a small swamp near the Bethlehem-Morris boundary. As the river flows southward, it is joined by the outlet stream from Long Meadow Pond, the largest body of water in Bethlehem at 110 acres in size.

Continuing downstream, the River passes under Route 132 and is joined by Wood Creek, a tributary that drains Zeiglers Pond in the northwest corner of Bethlehem. Several unnamed tributaries join the Weekeepemee River before it crosses into Woodbury, where the river eventually joins with the Nonnewaug River to form the Pomperaug River. In total, the Weekeepemee River basin drains 16.11 square miles of land across Woodbury, Washington, Bethlehem, and Morris.

## **2.6 *Population and Demographic Setting***

The total CNV Region estimated 2005 population is 281,895 persons. The total land area is 309 square miles, for a regional population density of 912 persons per square mile.

Waterbury has the highest population density in the region with 3,757 individuals per square mile, while Bethlehem has the lowest population density in the region with 185 individuals per square mile (Table 2-4).

**Table 2-4**  
**Population Density by Municipality, Region and State, 2005**

<b>Municipality</b>	<b>Total Population</b>	<b>Land Area (square miles)</b>	<b>Population Density</b>
Beacon Falls	5,700	9.77	583
Bethlehem	3,577	19.36	185
Cheshire	28,833	32.90	876
Middlebury	7,132	17.75	402
Naugatuck	31,872	16.39	1,945
Oxford	12,309	32.88	374
Prospect	9,264	14.32	647
Southbury	19,686	39.05	504
Thomaston	7,916	12.01	659
Waterbury	107,251	28.55	3,757
Watertown	22,329	29.15	766
Wolcott	16,269	20.43	796
Woodbury	9,757	36.46	268
CNV Region	281,895	309.02	912
Connecticut	3,495,753	4844.80	722

*Source: United States Census Bureau, 2005 Population Estimates*

Bethlehem is 145<sup>th</sup> out of 169 municipalities in Connecticut in terms of population, with an estimated population of 3,577 in 2006. The Town is the 129<sup>th</sup> most densely populated municipality in the state. According the Connecticut Economic Resource Center, the median sales price of owner-occupied housing in the Town of Bethlehem in 2006 was \$342,500, higher than the statewide median sales price of \$275,000.

The population of Bethlehem increased by 29% between 1960 and 1970, and increased again by 34% between 1970 and 1980, representing the last true surge in development in recent history. Population growth then slowed to 19% between 1980 and 1990 and slowed again to 11% between 1990 and 2000. Population growth in Town from 2000-2006 was only 5%. Based on analysis by the COGCNV, population growth in the region outside of Waterbury is estimated to be about 10% from 2005 to 2025, while the State of

Connecticut is expected to grow about 5% during this same timeframe. According to Bethlehem's Plan of Conservation and Development, population growth in Town is forecast to be only about 1% per year from 2005 to 2020.

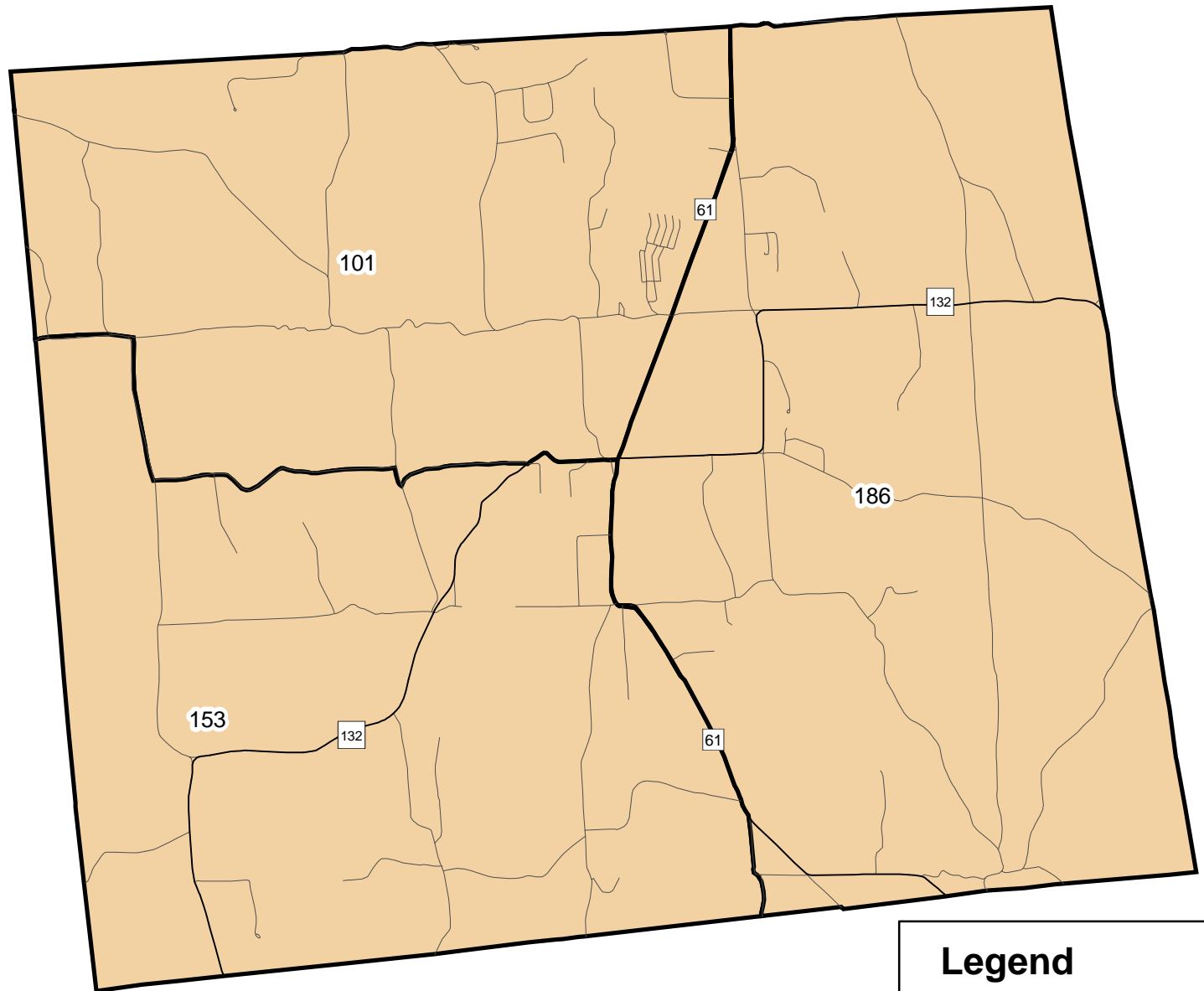
Bethlehem has populations of people who are elderly, linguistically isolated, and/or disabled. These are depicted by the three census blocks in Bethlehem on Figures 2-6, 2-7, and 2-8. The populations with these characteristics have numerous implications for hazard mitigation, as they may require special assistance or different means of notification before disasters occur. These will be addressed as needed in subsequent sections.

## **2.7 Governmental Structure**

The Town of Bethlehem is governed by a Selectman-Town Meeting form of government in which legislative responsibilities are shared by the Board of Selectmen and the Town Meeting. The First Selectman serves as the chief executive.

In addition to Board of Selectmen and the Town Meeting, there are boards, commissions and committees providing input and direction to Town administrators, while Town departments provide municipal services and day-to-day administration. Many of these commissions and departments play a role in hazard mitigation, including the Planning Commission, the Conservation Commission, the Inland Wetland Commission, the Long Meadow Lake Management Commission, the Highway Department / Department of Public Works, the Building Official, the Fire Department, and the Resident State Trooper.

# Figure 2-6: Bethlehem Elderly Population



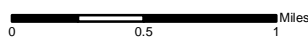
## Legend

Percentage of Persons Aged 65 or older

- 0.0 - 10.0 %
- 10.1 - 20.0 %
- 20.1 - 30.0 %
- 30.1 - 100 %

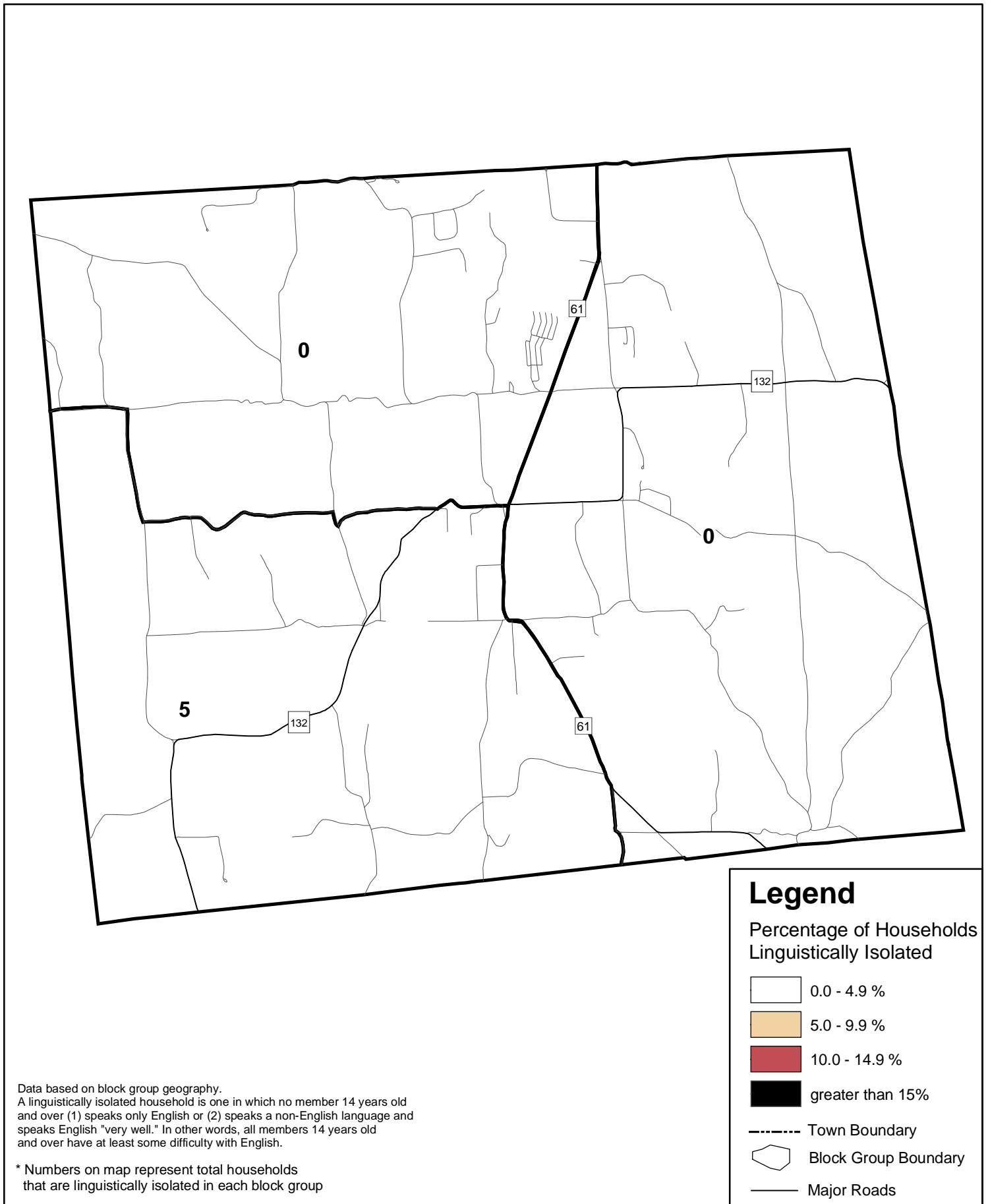
- Town Boundary
- Block Group Boundary
- Major Roads

\* Numbers on map represent total population aged 65 or older in each block group





# Figure 2-7: Bethlehem Linguistically Isolated Households

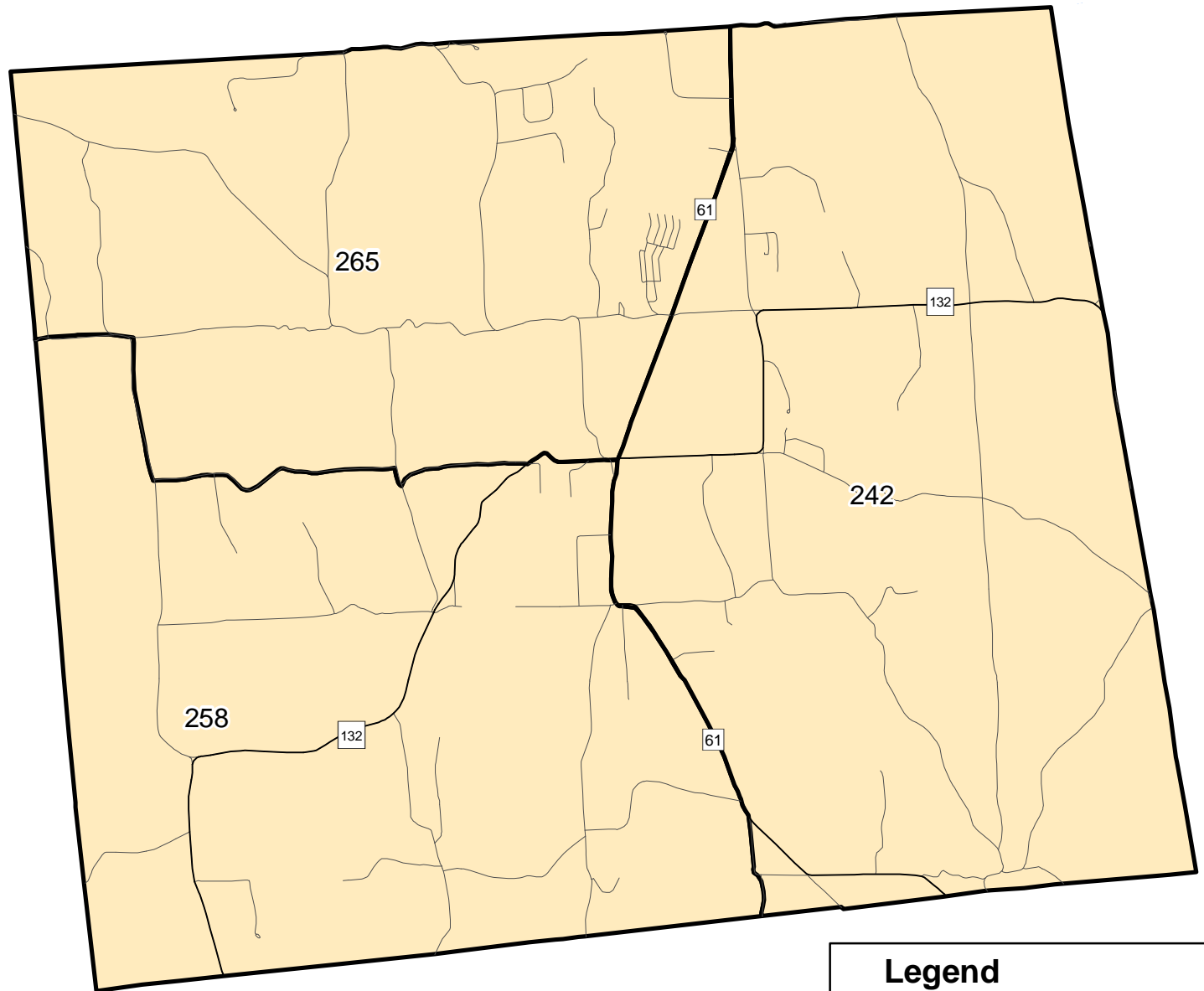


Data based on block group geography.  
A linguistically isolated household is one in which no member 14 years old and over (1) speaks only English or (2) speaks a non-English language and speaks English "very well." In other words, all members 14 years old and over have at least some difficulty with English.

\* Numbers on map represent total households that are linguistically isolated in each block group



# Figure 2-8: Bethlehem Disabilities Map



## Legend

Total Disabilities Tallied  
of People Aged 5 and Older

0 - 200

201 - 400

401 - 600

> 600

----- Town Boundary

Block Group Boundary

Major Roads

Disabilities are categorized as sensory, physical, mental,  
self-care, go-outside-home, and employment

\* Numbers on map represent total disabilities tallied  
for people aged 5 or older in each block group



The Highway Department / Department of Public Works is the principal municipal department that responds to problems caused by natural hazards. Complaints related to Town maintenance issues are routed to the Department of Public Works. These complaints are usually received via phone, fax, mail, or email and are recorded in a book. The complaints are investigated as necessary until remediation surrounding the individual complaint is concluded.

As the Town has an almost entirely residential tax base, funding of capital projects is difficult. Bethlehem relies heavily on outside grants for many projects and upgrades, which can be difficult to obtain due to the small size of the Town.

## **2.8 Development Trends**

Bethlehem was settled in the early 1700's as a section of Woodbury known as North Purchase. The name Bethlehem was adopted in 1739, although it was originally spelled phonetically as Bethlem. The Town was granted an additional portion of Woodbury in 1741 and was officially incorporated in 1787. The Town remained largely agrarian until the early 20<sup>th</sup> century, with farms sited on hilltops and apples being one of the primary crops. Some light industry did operate in Town in the 1800's, using water to provide power to mills, hat factories, and leather manufacturing companies. These industries relocated to industrial centers by the 20<sup>th</sup> century.

The Town of Bethlehem has no zoning regulations which would specifically prohibit more intense forms of development within the Town limits. However, Bethlehem has almost no development currently ongoing due to the lack of public water & sewer. In addition, most of the soils in Bethlehem provide inadequate processing capacity for large on-site septic systems, making such systems prohibitively expensive. Residential development has been limited since the late 1980's, and most development applications are typically for very small (one to two lot) subdivisions. As of 1998, the total number of housing units in Bethlehem was increasing by approximately 12 per year.

The Town has several development regulations pertinent to hazard mitigation. Subdivisions featuring cul-de-sacs offer a single access point for emergency services, lengthening emergency response times and rendering those residential areas vulnerable if access is cut off by flooding or downed tree limbs. Thus, cul-de-sacs in new developments are discouraged and connectivity of roads is encouraged. The Town of Bethlehem requires a 50-foot right of way for local residential streets with a hammerhead located at the end of dead end streets, and dead end streets can have only 20 homes or fewer. In addition, utilities serving new developments must be installed underground wherever possible. Exceptions due to shallow bedrock are granted on a case-by-case basis.

Based on the Town's 1999 Plan of Conservation and Development, efforts are being made to preserve Bethlehem's small farming town charm and limit the impact of future development. Specifically, a farmland preservation program has been pursued as a measure to retain open space and agriculture. This, in turn, will limit development in areas vulnerable to natural hazards.

## **2.9 Critical Facilities and Sheltering Capacity**

The Town considers its police, fire, governmental, and major transportation arteries to be its most important critical facilities, for these are needed to ensure that emergencies are addressed while day-to-day management of Bethlehem continues. Elderly housing facilities and group homes are included with critical facilities, as these house populations of individuals that would require special assistance during an emergency. Educational institutions are included in critical facilities as well, as these can be used as shelters. In addition, Town personnel consider its communication utilities to be a critical facility.

A list of critical facilities is provided in Table 2-5, and a map of these facilities is shown as Figure 2-9. Shelters, transportation, and communications are described in more detail

below, along with a summary of the potential for these facilities to be impacted by natural hazards.

**Table 2-5  
Critical Facilities in Bethlehem**

Type	Name	Address	Located in Floodplain?
Retirement Community	North Purchase Elderly Home	11 Jackson Lane	No
Group Home	Wellspring Foundation	84 Judge Lane	No
Group Home	Wellspring Foundation / Arch Bridge School	21 Arch Bridge Road	No
Group Home	Angelus House	158 Flanders Road	No
Town Hall	Municipal Complex	36 Main Street South	No
Public Works	Municipal Complex	36 Main Street South	No
Fire Department	Municipal Complex	26 Main Street South	No
Police	Municipal Complex	36 Main Street South	No
School	Bethlehem Elementary	92 East Street	No
School (Private)	The Woodhall School	58 Harrison Lane	No

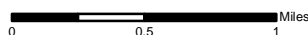
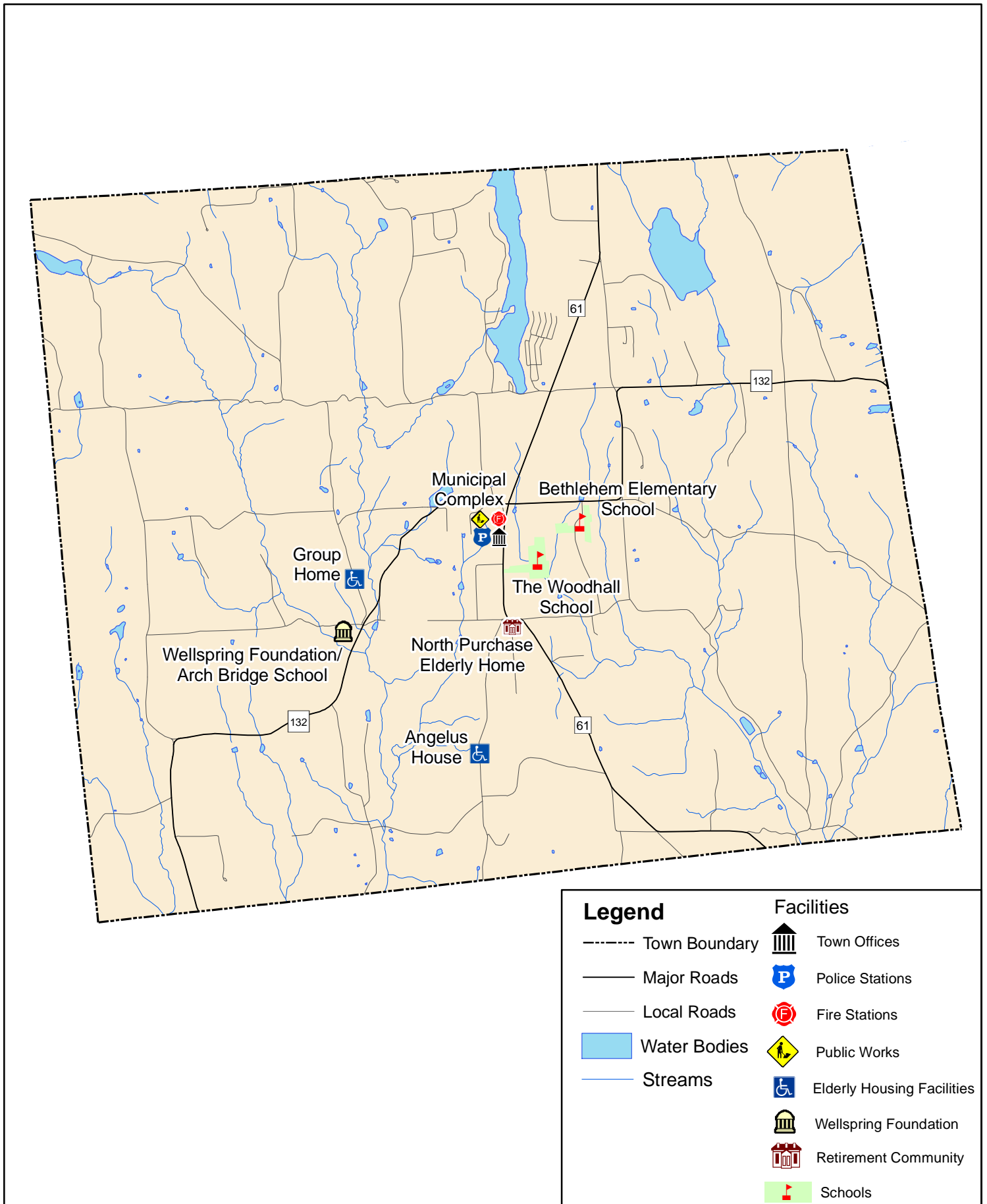
*Source: Council of Governments Central Naugatuck Valley; Town of Bethlehem*

### **Shelters**

Emergency shelters are considered to be an important subset of critical facilities, as they are needed in most emergency situations. The Town of Bethlehem has designated two emergency shelters, and additional facilities may be used if necessary. The Fire Department is currently the primary shelter for small, short term events. Memorial Hall can be used as a shelter during larger hazard events, but has limited bathrooms. Both buildings have generators. The police and fire departments staff the shelters. A potential problem with these shelters is that Memorial Hall and the Fire Department share the same long driveway, which can create a conflict during emergencies.

These buildings have been designated as public shelter facilities by meeting specific American Red Cross guidelines. Amenities and operating costs of the designated shelters including expenses for food, cooking equipment, emergency power services, bedding, etc., are the responsibilities of the community and generally are not paid for by the American Red Cross.

# Figure 2-9: Bethlehem Critical Facilities



The Town's other school buildings – Bethlehem Elementary and The Woodhall School – are not considered to be shelters but could be converted to additional shelter space in case of an emergency. Bethlehem Elementary School serves as an emergency supply distribution center. The Woodhall School is private and may only be available during a summer emergency. The Abby of Regina Laudis Priory is another potential shelter, but the Town only plans to ask to use it as a last resort out of respect for the cloistered nature of the facility. Other municipal buildings in the municipal complex, such as the Highway Department garage, have generators but are not considered to be shelter space.

In case of a power outage, it is anticipated that 10-20% of the population would relocate, although not all of those relocating would necessarily utilize the shelter facilities.

Bethlehem utilizes its facilities on a temporary basis for providing shelter until hazards such as hurricanes diminish. Regionally-located mass care facilities operated and paid for by the American Red Cross may also be available during recovery operations when additional sheltering services are necessary. During extended power outages, families in Bethlehem have also made use of the Wisdom House in Litchfield as a shelter as opposed to Town facilities.

### **Transportation**

The Town of Bethlehem does not have any hospitals or medical centers. Instead, residents use the nearby facilities in Waterbury, New Milford, Southbury, or Torrington. As a means of accessing these facilities, Bethlehem residents travel along Route 61 or Route 132, the two major transportation arteries out of Town. Flanders Road is also a good evacuation route south into Woodbury.

Evacuation routes (Route 61 and Route 132) are regionally defined by the Regional Evacuation Plan. No local evacuation plan exists. Bethlehem residents must use state roads in surrounding Towns to access Route 8, a major north-south thoroughfare to Waterbury and Torrington, and Interstate 84.

## **Communications**

The Town uses 9-1-1 for emergency notification and response. The overall communications system is outdated. All adjacent towns have upgraded to a high band radio system that is incompatible with Bethlehem's low band radio, so communications with neighboring emergency personnel is only accomplished via phone or by talking to them directly at a scene. The Town does have the capability to communicate to DEMS-5, and the State Trooper operates at 800 megahertz, so The Town does have minor out-of-town communication capability by radio. The Town Communications Plan mentions the use of the Morris Fire House as a Command Center during emergencies, but radio communications are not currently possible with that facility.

The Town of Bethlehem is in Region 5 of the Connecticut Emergency Medical Service regions. Thus, it is important to ensure that any upgrades to the existing emergency notification system are compatible with those of Region 5, which contains most of the COGCNV municipalities.

A communications study is underway which will likely recommend an upgrade to the emergency notification system compatible with those in surrounding towns, but the cost will likely be prohibitive for Bethlehem. The Town plans to apply for a communications grant to facilitate this project. In addition, the COGCNV is facilitating the possibility of instituting an enhanced emergency notification system in the area to further enhance emergency response. This program may be supported by the Region 5 – Northwest Connecticut Emergency Medical Services Council.



### Potential Impacts from Natural Hazards

Critical facilities are rarely impacted by flooding in the Town of Bethlehem, as none of the facilities are located within floodplains. Route 132 a major east–west thoroughfare, has occasional flooding issues near Long Horizon Road and Sky Meadow Road. Such flooding slows emergency response times to nearby neighborhoods due to detours around this area.

None of the critical facilities in Bethlehem are any more susceptible to wind, summer storms, winter storms, or earthquakes than the rest of the Town. In addition, no critical facilities are located within a mapped dam failure inundation area. The only critical facility at potential risk is the Angelus House group home, which is located near the boundary of a wildfire risk area. The following sections will discuss each natural hazard in detail and include a description of populations at risk.

## **3.0 INLAND FLOODING**

### **3.1 Setting**

According to FEMA, most municipalities in the United States have at least one clearly recognizable flood-prone area around a river, stream, or large body of water. These areas are outlined as Special Flood Hazard Areas (SFHA) and delineated as part of the National Flood Insurance Program (NFIP). Flood-prone areas are addressed through a combination of floodplain management criteria, ordinances, and community assistance programs sponsored by the NFIP and individual municipalities.

Many communities also have localized flooding areas outside the SFHA. These floods tend to be shallower and chronically reoccur in the same area due to a combination of factors. Such factors can include ponding, poor drainage, inadequate storm sewers, clogged culverts or catch basins, sheet flow, obstructed drainageways, sewer backup, or overbank flooding from small streams.

In general, inland flooding affects a small area of Bethlehem with moderate to frequent regularity. The areas impacted by overflow of river systems are generally limited to river corridors and floodplains. Indirect flooding that occurs outside floodplains and localized nuisance flooding along tributaries is a more common problem in the Town. This type of flooding occurs particularly along roadways as a result of inadequate drainage and other factors. The frequency of flooding in Bethlehem is considered highly likely for any given year, but flooding damage only has a limited effect (refer to Appended Table 2).

### **3.2 Hazard Assessment**

Flooding represents the most common and costly natural hazard in Connecticut. The state typically experiences floods in the early spring due to snowmelt and in the late summer/early autumn due to frontal systems and tropical storms, although localized

flooding caused by thunderstorm activity can be significant. Flooding can occur as a result of other natural hazards, including hurricanes, summer storms, and winter storms. Flooding can also occur as a result of dam failure, which is discussed in Section 8.0, and may also cause landslides and slumps in affected areas.

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of floodplain management and to determine the need for insurance. This flood has a one percent chance of being equaled or exceeded each year. The risk of having a flood of this magnitude or greater increases when periods longer than one year are considered. For example, FEMA notes that a structure located within a 100-year flood zone has a 26% change of suffering flood damage during the term of a 30-year mortgage. Similarly, a 500-year flood has a 0.2 percent chance of occurring in a given year. The 500-year floodplain indicates areas of moderate flood hazard.

***Floodplains*** are lands along watercourses that are subject to periodic flooding; ***floodways*** are those areas within the floodplains that convey floodwaters. Floodways are subject to water being carried at relatively high velocities and forces. The ***floodway fringe*** contains those areas of the 100-year floodplain that are outside the floodway and are subject to inundation but do not convey the floodwaters.

Flooding presents several safety hazards to people and property. Floodwaters cause massive damage to the lower levels of buildings, destroying business records, furniture, and other sentimental papers and artifacts. In addition, floodwaters can prevent emergency and commercial egress by blocking streets, deteriorate municipal drainage systems, and divert municipal staff and resources.

Furthermore, damp conditions trigger the growth of mold and mildew in flooded buildings, contributing to allergies, asthma, and respiratory infections. Snakes and rodents are forced out of their natural habitat and into closer contact with people, and ponded water following a flood presents a breeding ground for mosquitoes. Gasoline,

pesticides, and other aqueous pollutants can be carried into areas and buildings by flood waters and soak into soil, building components, and furniture.

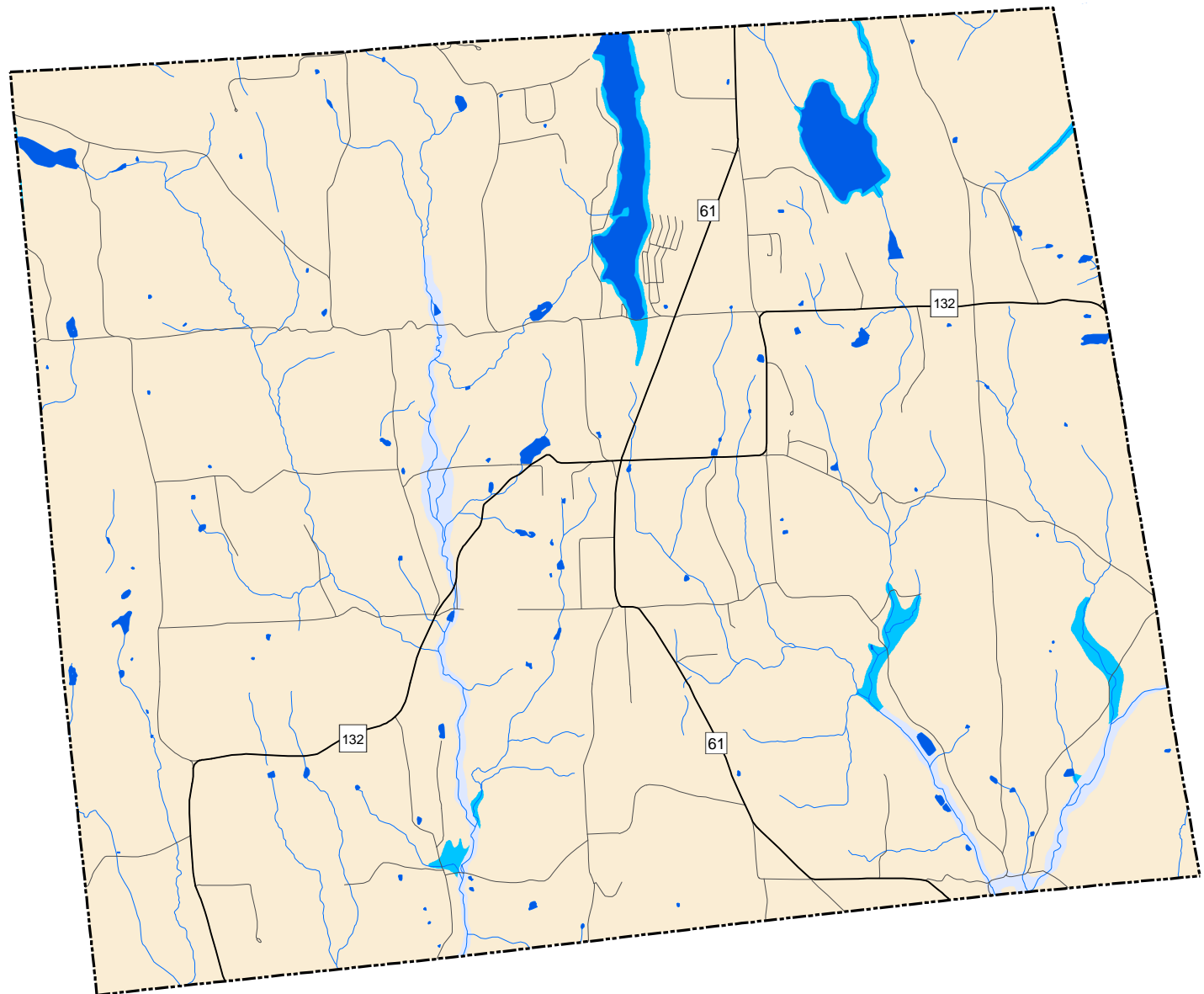
SFHAs in Bethlehem are delineated on a Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS). An initial Flood Hazard Boundary Map was identified on February 21, 1975. The FIRM delineates areas within Bethlehem that are vulnerable to flooding and was originally published on June 4, 1990. The Town's FIRM has not been updated and is the current effective map. The FIS was originally published on June 4, 1990 and also has not been updated. Refer to Figure 3-1 for the areas of Bethlehem susceptible to flooding based on FEMA flood zones. Table 3-1 describes the various zones depicted on the FIRM panel for Bethlehem.

**Table 3-1**  
**FIRM Zone Descriptions**

<b>Zone</b>	<b>Description</b>
A	An area inundated by 100-year flooding, for which no base flood elevations (BFEs) have been determined.
AE	An area inundated by 100-year flooding, for which BFEs have been determined.
Area Not Included	An area that is located within a community or county that is not mapped on any published FIRM.
X	An area that is determined to be outside the 100- and 500-year floodplains.

In some areas of Bethlehem, flooding occurs with a much higher frequency than those mapped by FEMA. This nuisance flooding occurs from heavy rains with a much higher frequency than those used to calculate the 100-year flood event, and often in different areas than those depicted on the FIRM panels. These frequent flooding events occur in areas with insufficient drainage; where conditions may cause flashy, localized flooding; and where poor maintenance may exacerbate drainage problems. These areas are discussed in Sections 3.3 and 3.5.

# Figure 3-1: FEMA Flood Zones in Bethlehem



## Legend

- Town Boundary
- Major Roads
- Local Roads
- Water
- Waterbodies

## Flood Zone

- A
- AE



During large storms, the recurrence interval level of a flood discharge on a tributary tends to be greater than the recurrence interval level of the flood discharge on the main channel downstream. In other words, a 100-year flood event on a tributary may only contribute to a 50-year flood event downstream. This is due to the distribution of rainfall and the greater hydraulic capacity of the downstream channel to convey floodwaters. Dams and other flood control structures can also reduce the magnitude of peak flood flows.

The recurrence interval level of a precipitation event also generally differs from the recurrence interval level of the associated flood. Another example would be of tropical storm Floyd in 1999, which caused rainfall on the order of a 250-year event while flood frequencies were slightly greater than a 10-year event on the Naugatuck River in Beacon Falls. Flood events can also be mitigated or exacerbated by in-channel and soil conditions, such as low or high flows, the presence of frozen ground, or a deep or shallow water table, as can be seen in the following historic record.

### **3.3 Historic Record**

In every season of the year throughout its recorded history, the Town of Bethlehem has experienced various degrees of flooding. Melting snow combined with early spring rains have caused frequent spring flooding. Numerous flood events have occurred in late summer to early autumn resulting from storms of tropical origin moving northeast along the Atlantic coast. Winter floods result from the occasional thaw, particularly during years of heavy snow, or periods of rainfall on frozen ground. Other flood events have been caused by excessive rainfalls upon saturated soils, yielding greater than normal runoff.

According to the FEMA FIS, major historic floods have occurred in Bethlehem in March 1913, November 1927, March 1936, September 1938, and August 1955. In terms of damage to the Town of Bethlehem, the most severe of these was damage associated with the August 1955 hurricane and flood which had a recurrence interval of 200 years as

measured at the USGS gauging station on Shepaug River in Roxbury. This flood was the result of high intensity rainfall falling on saturated ground.

According to the NCDC Storm Events Database, there have been 58 flooding events and 17 flash flood events in Litchfield County since 1993. The following are descriptions of more recent examples of floods in and around the Town of Bethlehem as described in the NCDC Storm Events Database, and based on correspondence with municipal officials.

- ❑ July 28, 1994: A heavy rain storm began in the early morning hours and continued into the afternoon, producing three to five inches of rain along the Interstate 84 corridor. The storm caused localized street flooding in Thomaston and Washington.
- ❑ August 21, 1994: A flash flood caused approximately \$5 million in property damage in Litchfield County. Two bridges washed out and approximately 40 miles of Town roads were damaged in Bethlehem, with six miles being severely damaged. Many residents reported basement flooding, but there was no significant damage to buildings or utilities.
- ❑ January 19, 1996: An intense area of low pressure over the Mid-Atlantic region produced unseasonably warm temperatures, resulting in the rapid melting of one to three feet of snow. This melting combined with one to three inches of rainfall to produce flooding across Litchfield County, particularly along small streams. This flooding caused approximately \$300,000 in property damage.
- ❑ July 13, 1996: The remnants of Hurricane Bertha tracked northeast over Connecticut, producing three to five inches of rain across Litchfield County. The storm resulted in minimal property damage, but caused flooding in several roads and streams, and the strong winds accompanying the storm caused scattered power outages when water-laden tree branches were downed on wires.

- ❑ September 16, 1999: Torrential record rainfall preceding the remnants of Tropical Storm Floyd caused widespread urban, small stream, and river flooding. Fairfield County was declared a disaster area, along with Litchfield and Hartford Counties. Initial cost estimates for damages to the public sector was \$1.5 million for those three counties. These estimates do not account for damages to the private sector and are based on information provided by the Connecticut Office of Emergency Management. Serious wide-spread flooding of low-lying and poor drainage areas resulted in the closure of many roads and basement flooding across Fairfield, New Haven, and Middlesex Counties.
- ❑ December 17, 2000: Unseasonably warm and moist air tracked northward from the Gulf of Mexico, bringing a record-breaking rainstorm to Litchfield County. The storm produced two to four inches of rain, strong winds, and combined with melting snow to produce flooding conditions. The bulk of the rainfall occurred in a short interval of time, with some localities receiving an inch per hour. In Torrington, the Naugatuck River washed construction equipment downstream, and widespread street flooding was reported in Litchfield. Trees were reported down in Bethlehem.
- ❑ June 17, 2001: The remnants of Tropical Storm Allison combined with a slow-moving cold front to produce torrential rainfall over much of Litchfield County. Two to six inches of rain fell in a short time in the central and southeastern portions of the county, causing a total of \$55,000 in property damage. Roads were washed out in the Town of Bethlehem, and numerous small streams overflowed and roads flooded in Woodbury.
- ❑ October 2005: Although the consistent rainfall of October 7-15, 2005 caused flooding and dam failures in most of Connecticut (most severely in northern Connecticut), the precipitation intensity and duration was such that only minor flooding occurred in Bethlehem.



- ❑ June 2, 2006: Up to eight inches of heavy rainfall caused widespread damage in Waterbury, Wolcott, and Prospect. The storm caused slumps and drainage failures throughout Waterbury and several streets were flooded in all three municipalities.
- ❑ April 15-16, 2007: A spring nor'easter dropped over six inches of rain in the Greater Waterbury area, causing widespread flooding.

### 3.4 **Existing Programs, Policies, and Mitigation Measures**

The Town of Bethlehem has in place a number of measures to prevent flood damage. These include regulations, codes, and ordinances preventing encroachment and development near floodways. Regulations, codes, and ordinances that apply to flood hazard mitigation in conjunction with and in addition to NFIP regulations include:

- ❑ ***Earth Materials Ordinance***. This ordinance regulates excavation and/or deposition of any materials in wetlands or floodplains and notes that activities in these areas must be regulated by the Inland Wetlands Commission of Bethlehem.
- ❑ ***Land Use Policy 1*** (Section VII of the Bethlehem Plan of Conservation and Development). One of the objectives of this policy is to "preserve environmentally sensitive natural resources by regulating encroachment by development on these resources to the extent permitted by statutes."
- ❑ ***Additional Evidence*** (Section 2.4.2 C of the Bethlehem Subdivision Regulations). This section authorizes the Planning Commission to request additional information if needed such that "proper provision will be made for protective flood control measures in areas contiguous to brooks, rivers, or other bodies of water subject to flooding".
- ❑ ***Decision*** (Section 2.4.5 of the Bethlehem Subdivision Regulations). This section notes that approval of a subdivision application is contingent upon "presentation of a

copy of a permit or copy of declaratory ruling or permit from the inland wetlands regulating agency of the Town of Bethlehem, authorizing construction of any roads, drainage, or other improvements or any grading that constitute a regulated activity affecting wetlands and/or watercourses".

- ❑ ***Natural Features*** (Section 3.6 of the Bethlehem Subdivision Regulations). This section authorizes the Commission to ask for alternative designs that demonstrate that all reasonable care has been taken to preserve the natural features of the tract, such as by avoiding cuts and fills which may cause erosion or damage to water resources, avoiding construction near or that alters watercourses, by avoiding excavation or filling of wetlands, floodplains, and other land subject to flooding, and by providing for preservation of wetlands and watercourses through easement.
- ❑ ***Terrain*** (Section 3.7.2 of Bethlehem Subdivision Regulations). Section 3.7.2 notes that "construction of homes, driveways, and sub-surface sewage disposal systems should not be proposed in areas with severe limitation for development," such as wetlands, floodplains, and watercourses.
- ❑ ***Inland Wetlands and Watercourses Regulations***. This document defines in detail the Town of Bethlehem's regulations regarding development near wetlands, watercourses, and water bodies that are sometimes coincident with floodplains. Section 2 defines "Regulated Activities" covered by the Regulations. Section 6 states that no person may conduct or maintain a regulated activity without obtaining a permit. Section 7 outlines the application requirements.
- ❑ ***Aquifer Protection Area (APA) Regulations***. After formal aquifer protection area mapping has been developed for the wells located in northeast Woodbury, it is likely that the APA will extend into the southeastern corner of Bethlehem, requiring the Town of Bethlehem to develop APA regulations. The Bethlehem Inland Wetlands

Commission has been designated the official Aquifer Protection Agency and will be developing APA Regulations. Refer to Section 3.6 for more information.

The intent of these regulations is to promote the public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas of the Town of Bethlehem by the establishment of standards designed to:

- ❑ Protect human life and public health;
- ❑ Minimize expenditure of money for costly flood control projects;
- ❑ Minimize the need for rescue and relief efforts associated with flooding;
- ❑ Ensure that purchasers of property are notified of special flood hazards;
- ❑ Ensure that all land approved for subdivision shall have proper provisions for water, drainage, and septic systems; and in areas contiguous to brooks, rivers, or other bodies of water subject to flooding, that proper provisions be made for protective flood control measures;
- ❑ Ensure that property owners are responsible for their actions;
- ❑ Ensure the continued eligibility of owners of property in Bethlehem for participation in the National Flood Insurance Program.

The Town of Bethlehem Emergency Service Director serves as the NFIP administrator and oversees the enforcement of NFIP regulations. The Town has not completed an update of its flood hazard regulations, and currently has no plans to enroll in the Community Rating System program. The Town of Bethlehem Planning Commission uses the 100-year flood lines from the FIRM and FIS delineated by FEMA to determine floodplain areas. Site plan standards require that all proposals be consistent with the need to minimize flood damage, that public facilities and utilities be located and constructed to minimize flood damage, and that adequate drainage is provided. The Bethlehem Inland Wetlands Agency also reviews new developments and existing land uses on and near wetlands and watercourses.

The Bethlehem Highway Department / Department of Public Works (DPW) is in charge of the maintenance of the Town's drainage systems, and performs clearing of bridges and culverts and other maintenance as needed. Drainage complaints are routed to the DPW and recorded. The Town uses these documents to identify potential problems and plan for maintenance and upgrades. The Town can also access the Automated Flood Warning System to monitor precipitation totals. The Connecticut DEP installed the Automated Flood Warning System in 1982 to monitor rainfall totals as a mitigation effort for flooding throughout the state.

The National Weather Service issues a flood watch or a flash flood watch for an area when conditions in or near the area are favorable for a flood or flash flood, respectively. A flash flood watch or flood watch does not necessarily mean that flooding will occur. The National Weather Service issues a flood warning or a flash flood warning for an area when parts of the area are either currently flooding, highly likely to flood, or when flooding is imminent.

The Town of Bethlehem can access the ***National Weather Service*** website at <http://weather.noaa.gov/> to obtain the latest flood watches and warnings before and during precipitation events.

In summary, the Town of Bethlehem primarily attempts to mitigate flood damage and flood hazards by restricting building activities inside flood-prone areas. This process is carried out through both the Planning Commission and the Inland Wetlands Agency. All watercourses are to be encroached minimally or not at all to maintain the existing flood carrying capacity. These regulations rely primarily on the FEMA-defined 100-year flood elevations to determine flood areas.

FEMA has commenced its "Map Mod" program to revise the FIRMs for each County in Connecticut, but it will be several years before this program begins for Litchfield County. This program will create a single FIRM for Litchfield County. Many municipalities with revised FIRMs from the Map Mod program are finding that more properties are in floodplains than originally believed.

### 3.5 *Vulnerabilities and Risk Assessment*

This section discusses specific areas at risk to flooding within the Town. Major land use classes and critical facilities within these areas are identified. According to the FEMA FIRMs, 483 acres of land in Bethlehem are located within the 100-year flood boundary. In addition, indirect and nuisance flooding occurs near streams and rivers throughout Bethlehem due to inadequate drainage and other factors. Based on correspondence with the State of Connecticut NFIP Coordinator, zero repetitive loss properties are located in the Town of Bethlehem (Appendix B).

The primary waterway in the Town is the Weekepeemee River, a non-navigable watercourse running north to south through the western part of Town. The secondary waterway in Bethlehem is East Spring Brook which runs north to south in the eastern part of Town. The remaining waterways in Bethlehem are mostly small streams and brooks significant for water supply and conservation purposes, but are not recreational resources. Recall from Figure 3-1 that floodplains with elevations are delineated for the Weekepeemee River, the Nonnewaug River, and portions of East Spring Brook, while several smaller brooks and streams, including the major water bodies, have floodplains delineated by approximate methods. All of these delineated floodplains are generally limited to the areas adjacent to the streams.

Due to the steep topography surrounding the major watercourses, there is little wide-scale flooding in Bethlehem. Specific areas susceptible to flooding were identified by Town personnel and observed by Milone & MacBroom, Inc. staff during field inspections as described in Section 1.5. Most flooding occurs due to large amounts of rainfall falling in conjunction with snowmelt and occurs due to undersized road culverts, as noted below.

- ❑ Arrowhead Lane – Homes here are near the Weekepeemee River and have experienced flooding damage in the past. The two homes at the end of the street reportedly have flooding problems due to a nearby small pond.

- ❑ Crane Hollow Road – Water from the Weekepeemee River overtops the road at least once every two years. As the FIS shows the 100-year flood elevation as not overtopping the road, this study may be outdated.
- ❑ Double Hill Road – A resident has beavers on property that includes the Weekepeemee River, and the beavers build the dam high enough such that water overtops the road crossing for the river. The owner does not want the beavers to be bothered, so the Town does not try to remove the dams.
- ❑ Falls Road – This area is the only access from Bethlehem into the Land Trust property on the Woodbury/Watertown border. Bethlehem is often the first responder for emergencies in this forest, but access is limited because of poor road conditions and a poor crossing over the Nonnewaug River. The tract is designed to be used for passive recreation but is primarily used by all-terrain vehicles (ATVs) and horses. Emergency personnel noted that this forest often has problems related to alcohol use, namely ATV and snowmobile accidents, parties, and underage drinking. While the Town of Bethlehem has pursued a multi-town resolution regarding emergency access to this parcel, including rebuilding the bridge on Falls Road, at least one of the other municipalities does not support such a resolution.
- ❑ Hickory Lane – The culvert on the south end of this road is undersized, causing the road to flood at least once every two years. The Town cannot fix the problem without elevating the road, but the fact that the area is in the 100-year floodplain of the Nonnewaug River produces an additional financial burden in the form of permitting for the Town.
- ❑ Hard Hill Road North – There are drainage issues along this road that occur primarily on private property. Each farm directs its drainage south to the next downstream farm, causing flooding problems on the downstream farms.

- ❑ Route 132 (Kasson Road) – Water overtops the road near the fire pond. This area is between Lakes Road and Sky Meadow Road. This flooding impedes emergency response to the Sky Meadow Lane, Woodland Road, Cabbage Lane, and Hard Hill Road neighborhoods.
- ❑ Route 132 (Lakes Road) – Town personnel have reported general flooding problems occur near Long Horizon Road.

### **Critical Facilities and Emergency Services**

Critical facilities are not regularly impacted by flooding in the Town of Bethlehem. Route 132, a major east-west thoroughfare, has occasional flooding issues in two areas as described above. This flooding slows emergency response times due to detours around these areas.

## **3.6 Potential Mitigation Measures, Strategies, and Alternatives**

A number of measures can be taken to reduce the impact of a local or nuisance flood event. These include measures that prevent increases in flood losses by managing new development, measures that reduce the exposure of existing development to flood risk, and measures to preserve and restore natural resources. These are listed below under the categories of *prevention, property protection, structural projects, public education and awareness, natural resource protection, and emergency services*. All of the recommendations discussed in the subsections below are reprinted in a bulleted list in Section 3.7.

### **3.6.1 Prevention**

Prevention of damage from flood losses often takes the form of floodplain regulations and redevelopment policies. These are usually administered by building, zoning, planning, and/or code enforcement offices through capital improvement programs and through zoning, subdivision, and wetland ordinances.

It is important to promote coordination among the various departments that are responsible for different aspects of flood mitigation. Coordination and cooperation among departments should be reviewed every few years as specific responsibilities and staff changes.

Municipal departments should identify areas for acquisition to maintain flood protection. Acquisition of heavily damaged structures after a flood may be an economical and practical means to accomplish this. The Town of Bethlehem should look at working with the land trusts in Bethlehem to identify properties worth acquiring, as much of the open space in Town is owned by land trusts. Policies can also include the design and location of utilities to areas outside of flood hazard areas, and the placement of utilities underground.

Planning and Zoning: Subdivision ordinances should regulate development in flood hazard areas. Flood hazard areas should reflect a balance of development and natural areas, although ideally they will be free from development.

Floodplain Development Regulations: Development regulations encompass subdivision regulations, building codes, and floodplain ordinances. Site plan and new subdivision regulations should include the following:

- ☐ Requirements that every lot have a buildable area above the flood level;



- ❑ Construction and location standards for the infrastructure built by the developer, including roads, sidewalks, utility lines, storm sewers, and drainage ways; and
- ❑ A requirement that developers dedicate open space and flood flow, drainage, and maintenance easements.

Building codes should ensure that the foundation of structures will withstand flood forces and that all portions of the building subject to damage are above or otherwise protected from flooding. Floodplain ordinances should at minimum follow the requirements of the National Flood Insurance Program for subdivision and building codes. These could be included in the ordinances for subdivisions and building codes, or could be addressed in a separate ordinance.

The Town should consider joining FEMA's Community Rating System to reduce the cost of flood insurance for its residents, and should consider using Town topographic maps to develop a more accurate regulatory flood-hazard map using the published FEMA flood elevations. According to the FEMA, communities are encouraged to use different, more accurate base maps to expand upon the FIRMs published by FEMA. This is because many FIRMs were originally created using United States Geological Survey quadrangle maps with 10-foot contour intervals, but most municipalities today have contour maps of one or two-foot intervals that show more recently constructed roads, bridges, and other anthropologic features. Another approach is to record high-water marks and establish those areas inundated by a recent severe flood to be the new regulatory floodplain.

Adoption of a different floodplain map is allowed under NFIP regulations as long as the new map covers a larger floodplain than the FIRM. It should be noted that the community's map will not affect the current FIRM or alter the SFHA used for setting insurance rates or making map determinations; it can only be used by the community to regulate floodplain areas. The FEMA Region I office has more information on this topic; contact information can be found in Section 11.

Reductions in floodplain area or revisions of a mapped floodplain can only be accomplished through revised FEMA-sponsored engineering studies or Letters of Map Change (LOMC). To date, no Letters of Map Amendment (LOMA) have been submitted under the LOMC program for the Town of Bethlehem, so such updates are considered rare for the Town.

Aquifer Protection Areas: Aquifer Protection Areas (APA) are often located near floodplains and can indirectly provide a level of protection against the development of certain commercial and industrial properties. The Town of Watertown operates a public water supply wellfield in the northeast corner of the Town of Woodbury. The wellfield has a preliminary APA that extends into the southeastern corner of Bethlehem in the vicinity of the Nonnewaug River and East Spring Brook floodplains. After formal APA mapping has been developed, it is likely that the APA will still extend into the corner of Bethlehem, requiring the Town of Bethlehem to develop APA regulations. The Bethlehem Inland Wetlands Commission has been designated the official Aquifer Protection Agency and will be developing APA Regulations.

Stormwater Management Policies: Development and redevelopment policies to address the prevention of flood losses must include effective stormwater management policies. Developers should be required to build detention and retention facilities where appropriate. Infiltration can be enhanced to reduce runoff volume, including the use of swales, infiltration trenches, vegetative filter strips, and permeable paving blocks. Generally, post-development stormwater should not leave a site at a rate higher than under pre-development conditions.

Standard engineering practice is to avoid the use of detention measures if the project site is located in the lower one-third of the overall watershed. The effects of detention are least effective and even detrimental if used at such locations because of the delaying effect of the peak discharge from the site that typically results when detention measures are used. By detaining stormwater in close proximity of the stream in the lower reaches

of the overall watershed, the peak discharge from the site will occur later in the storm event, which will more closely coincide with the peak discharge of the stream, thus adding more flow during the peak discharge during any given storm event. Due to its topography, Bethlehem is situated in the upper and middle parts of several watersheds. Developers should be required to demonstrate whether detention or retention will be the best management practice for stormwater at specific sites in regards to the position of each project site in the surrounding watershed.

Drainage System Maintenance: An effective drainage system must be continually maintained to ensure efficiency and functionality. Maintenance should include programs to clean out blockages caused by overgrowth and debris. Culverts should be monitored, and repaired and improved when necessary. The use of Geographic Information System (GIS) technology can greatly aid the identification and location of problem areas. The Town has a regular schedule of drainage system maintenance.

Education and Awareness: Other prevention techniques include the promotion of awareness of natural hazards among citizens, property owners, developers, and local officials. Technical assistance for local officials, including workshops, can be helpful in preparation for dealing with the massive upheaval that can accompany a severe flooding event. Research efforts to improve knowledge, develop standards, and identify and map hazard areas will better prepare a community to identify relevant hazard mitigation efforts.

The Town of Bethlehem Inland Wetlands Agency administers the wetland regulations and the Bethlehem Planning Commission administers the Subdivision regulations. The regulations simultaneously restrict development in floodplains, wetlands, and other flood prone areas. The Land Use Coordinator and Building Official are charged with ensuring that development follows the subdivision regulations and inland wetlands regulations. The Town of Bethlehem has a checklist that cross-references the bylaws, regulations, and

codes related to flood damage prevention that may be applicable to a proposed project, and the Town makes this list available to potential applicants.

### 3.6.2 **Property Protection**

Steps should be taken to protect existing public and private properties. Non-structural measures for public property protection include acquisition and relocation of properties at risk for flooding, purchase of flood insurance, and relocating valuable belongings above flood levels to reduce the amount of damage caused during a flood event.

Structural flood protection techniques applicable to property protection include the construction of barriers, dry floodproofing, and wet floodproofing techniques. Barriers include levees, floodwalls, and berms, and are useful in areas subject to shallow flooding. These structural projects are discussed in Section 3.6.6 below. For dry floodproofing, walls may be coated with compound or plastic sheathing. Openings such as windows and vents should be either permanently closed or covered with removable shields. Flood protection should only be two to three feet above the top of the foundation because building walls and floors cannot withstand the pressure of deeper water.

Wet floodproofing should only be used as a last resort. If considered, furniture and electrical appliances should be moved away from advancing floodwaters.

***Dry floodproofing*** refers to the act of making areas below the flood level water-tight.

***Wet floodproofing*** refers to intentionally letting floodwater into a building to equalize interior and exterior water pressures.

All of the above *property protection* mitigation measures may be useful for Town of Bethlehem residents to prevent damage from inland and nuisance flooding. The Building Official should consider outreach and education in these areas.

### 3.6.3 Emergency Services

A natural hazard pre-disaster mitigation plan addresses actions that can be taken before a disaster event. In this context, emergency services that would be appropriate mitigation measures for inland flooding include:

- ❑ Forecasting systems to provide information on the time of occurrence and magnitude of flooding;
- ❑ A system to issue flood warnings to the community and responsible officials; and
- ❑ Emergency protective measures, such as an Emergency Operations Plan outlining procedures for the mobilization and position of staff, equipment, and resources to facilitate evacuations and emergency floodwater control.
- ❑ Implementing an emergency notification system that combines database and GIS mapping technologies to deliver outbound emergency notifications to geographic areas; or specific groups of people, such as emergency responder teams.

Many of these mitigation measures are already in practice in the Town of Bethlehem. Based on the above guidelines, a number of specific proposals for improved *emergency services* are recommended to prevent damage from inland and nuisance flooding. These are common to all hazards in this plan, and are listed in Section 10.1.

### 3.6.4 Public Education and Awareness

The objective of public education is to provide an understanding of the nature of flood risk, and the means by which that risk can be mitigated on an individual basis. Public information materials should encourage individuals to be aware of flood mitigation techniques, including discouraging the public from changing channel and detention basins in their yards, and dumping in or otherwise altering watercourses and storage basins. Individuals should be made aware of drainage system maintenance programs and

other methods of mitigation. The public should also understand what to expect when a hazard event occurs, and the procedures and time frames necessary for evacuation.

Based on the above guidelines, a number of specific proposals for improved *public education* are recommended to prevent damage from inland and nuisance flooding. These are common to all hazards in this plan, and are listed in Section 10.1.

### 3.6.5 **Natural Resource Protection**

Floodplains can provide a number of natural resources and benefits, including storage of floodwaters, open space and recreation, water quality protection, erosion control, and preservation of natural habitats. Retaining the natural resources and functions of floodplains can not only reduce the frequency and consequences of flooding, but also minimize stormwater management and non-point pollution problems. Through natural resource planning, these objectives can be achieved at substantially reduced overall costs.

***Measures for preserving floodplain functions and resources typically include:***

- ☐ Adoption of floodplain regulations to control or prohibit development that will alter natural resources;
- ☐ Development and redevelopment policies focused on resource protection;
- ☐ Information and education for both community and individual decision-makers; and
- ☐ Review of community programs to identify opportunities for floodplain preservation.

Projects that improve the natural condition of areas or to restore diminished or destroyed resources can re-establish an environment in which the functions and values of these resources are again optimized. Administrative measures which assist such projects include the development of land reuse policies focused on resource restoration and review of community programs to identify opportunities for floodplain restoration.

Based on the above guidelines, the following specific *natural resource protection* mitigation measures are recommended to help prevent damage from inland and nuisance flooding:

- ❑ Pursue the acquisition of additional municipal open space properties, as stated on Page 31 in the Plan of Conservation and Development.
- ❑ Selectively pursue conservation objectives listed in the Plan of Conservation and Development and/or more recent planning studies and documents.
- ❑ Continue to regulate development in protected and sensitive areas, including steep slopes, wetlands, and floodplains.

### **3.6.6 Structural Projects**

Structural projects include the construction of new structures or modification of existing structures (e.g. floodproofing) to lessen the impact of a flood event. Stormwater controls such as drainage systems, detention dams and reservoirs, and culverts should be employed to lessen floodwater runoff. On-site detention can provide temporary storage of stormwater runoff. Barriers such as levees, floodwalls, and dikes physically control the hazard to protect certain areas from floodwaters. Channel alterations can be made to confine more water to the channel and accelerate flood flows. Care should be taken when using these techniques to ensure that problems are not exacerbated in other areas of the impacted watersheds. Individuals can protect private property by raising structures, and constructing walls and levees around structures.

Based on the above guidelines, the following specific *structural* mitigation measures are recommended to prevent damage from inland and nuisance flooding:

- ❑ Pursue funding to elevate Crane Hollow road to prevent future instances of overtopping.

- ❑ Pursue funding to elevate the road near Hickory Lane, or to widen the stream and install a box culvert.
- ❑ Encourage the State Department of Transportation to elevate the level of Route 132 between Lakes Road and Sky Meadow Lane, or to widen the stream and install a box culvert.

### 3.7 **Summary of Recommended Mitigation Measures, Strategies, and Alternatives**

While many potential mitigation activities were addressed in Section 3.6, the recommended mitigation strategies for addressing inland flooding problems in the Town of Bethlehem are listed below.

#### **Prevention**

- ❑ Consider joining FEMA's Community Rating System to reduce the cost of flood insurance for affected Town residents.
- ❑ Continue to regulate activities within SFHAs.
- ❑ Consider requiring buildings constructed in floodprone areas to be protected to the highest recorded flood level, regardless of being within a defined SFHA.
- ❑ Ensure new buildings be designed and graded to shunt drainage away from the building.
- ❑ Assist with the Map Mod program to ensure an appropriate update to the Flood Insurance Study, Flood Insurance Rate Maps, and Flood Boundary and Floodway Maps.
- ❑ After Map Mod has been completed, consider restudying local flood prone areas and produce new local-level regulatory floodplain maps using more exacting study techniques, including using more accurate contour information to map flood elevations provided with the FIRM.
- ❑ Adopt an aquifer protection area overlay zone to regulate development after Watertown Fire District has completed its final mapping of the Aquifer Protection



Area for their wellfield in northeastern Woodbury. Ensure that the aquifer protection area regulations are consistent with principles for regulating floodplains where the area intersects floodplains.

#### Property & Natural Resource Protection

- ❑ In conjunction with the land trusts in Town, pursue the acquisition of additional municipal open space inside SFHAs and set it aside as greenways, parks, or other non-residential, non-commercial, or non-industrial use.
- ❑ Selectively pursue conservation recommendations listed in the Plan of Conservation and Development and other studies and documents.
- ❑ Continue to regulate development in protected and sensitive areas, including steep slopes, wetlands, and floodplains.

#### Structural Projects

- ❑ Pursue funding to elevate Crane Hollow Road to prevent future instances of overtopping.
- ❑ Pursue funding to elevate the road near the south end of Hickory Lane, or to widen the stream and install a box culvert.
- ❑ Encourage the State Department of Transportation to elevate the level of Route 132 between Lakes Road and Sky Meadow Lane, or to widen the stream and install a box culvert.

In addition, mitigation strategies important to all hazards are included in Section 10.1

## **4.0 HURRICANES**

### **4.1 Setting**

Hazards associated with tropical storms and hurricanes include winds, heavy rains, and inland flooding. While only some of the areas of Bethlehem are susceptible to flooding damage caused by hurricanes, wind damage can occur anywhere in the Town.

Hurricanes therefore have the potential to affect any area within the Town of Bethlehem. A hurricane striking Bethlehem is considered a possible event each year that could cause critical damage to the Town and its infrastructure (refer to Appended Table 1).

### **4.2 Hazard Assessment**

Hurricanes are a class of tropical cyclones that are defined by the National Weather Service as non-frontal, low-pressure large scale systems that develop over tropical or subtropical water and have definite organized circulations. Tropical cyclones are categorized based on the speed of the sustained (1-minute average) surface wind near the center of the storm. These categories are: Tropical Depression (winds less than 39 mph), Tropical Storm (winds 39-74 mph, inclusive) and Hurricanes (winds at least 74 mph).

The geographic areas affected by tropical cyclones are called tropical cyclone basins. The Atlantic tropical cyclone basin is one of six in the world and includes much of the North Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico. The official Atlantic hurricane season begins on June 1 and extends through November 30 of each year, although occasionally hurricanes occur outside this period.

Inland Connecticut is vulnerable to hurricanes despite moderate hurricane occurrences when compared with other areas within the Atlantic Tropical Cyclone basin. Since hurricanes tend to weaken within 12 hours of landfall, inland areas are less susceptible to

hurricane wind damages than coastal areas in Connecticut; however, the heaviest rainfall often occurs inland. Therefore, inland areas are vulnerable to inland flooding during a hurricane.

### **The Saffir / Simpson Scale**

The Saffir / Simpson Hurricane Scale, which has been adopted by the National Hurricane Center, categorizes hurricanes based upon their intensity, and relates this

intensity to damage potential. The Scale uses the sustained surface winds (1-minute average) near the center of the system to classify hurricanes into one of five categories. The Saffir / Simpson scale is provided below.

A ***Hurricane Watch*** is an advisory for a specific area stating that a hurricane poses a threat to coastal and inland areas.

Individuals should keep tuned to local television and radio for updates.

A ***Hurricane Warning*** is then issued when the dangerous effects of a hurricane are expected in the area within 24 hours.

❑ **Category 1:** Winds 74-95 mph (64-82 kt or 119-153 km/hr). Storm surge generally 4-5 ft above normal. No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Some damage to poorly constructed signs, coastal road flooding, and minor pier damage.

⇒ Hurricane Diane was a Category 1 hurricane when it made landfall in North Carolina in 1955, and weakened to a tropical storm before reaching the Connecticut shoreline.

⇒ Hurricane Agnes of 1971 was a Category 1 hurricane when it hit Connecticut.

⇒ Hurricanes Allison of 1995 and Danny of 1997 were Category 1 hurricanes at peak intensity.

❑ **Category 2:** Winds 96-110 mph (83-95 kt or 154-177 km/hr). Storm surge generally 6-8 feet above normal. Some roofing material, door, and window damage of buildings. Considerable damage to shrubbery and trees with some trees blown down. Considerable damage to mobile homes, poorly constructed signs, and piers. Coastal

and low-lying escape routes flood two to four hours before arrival of the hurricane center. Small craft in unprotected anchorages break moorings.

- ⇒ Hurricane Bonnie of 1998 was a Category 2 hurricane when it hit the North Carolina coast.
- ⇒ Hurricane Georges of 1998 was a Category 2 hurricane when it hit the Florida Keys and the Mississippi Gulf Coast.
- ⇒ Hurricane Bob was a Category 2 hurricane when it made landfall in southern New England and New York in August of 1991.
- ⇒ Hurricane Ike was a strong Category 2 hurricane when it struck Galveston and Houston in September 2008.

❑ **Category 3:** Winds 111-130 mph (96-113 kt or 178-209 km/hr). Storm surge generally 9-12 ft above normal. Some structural damage to small residences and utility buildings with a minor amount of curtainwall failures. Damage to shrubbery and trees with foliage blown off trees and large trees blown down. Mobile homes and poorly constructed signs are destroyed. Low-lying escape routes are cut by rising water three to five hours before arrival of the center of the hurricane. Flooding near the coast destroys smaller structures with larger structures damaged by battering from floating debris. Terrain continuously lower than five feet above mean sea level may be flooded inland eight miles (13 km) or more. Evacuation of low-lying residences within several blocks of the shoreline may be required.

- ⇒ The Great New England Hurricane of 1938 was a Category 3 hurricane when it hit New York and southern New England.
- ⇒ The Great Atlantic Hurricane of 1944 was a Category 3 hurricane when it made landfall in North Carolina, Virginia, New York, and southern New England.
- ⇒ Hurricane Carol of 1954 was a Category 3 hurricane when it struck Connecticut, New York, and Rhode Island.

- ⇒ Hurricane Connie of 1955 was a Category 3 hurricane when it made landfall in North Carolina.
  - ⇒ Hurricane Gloria of 1985 was a Category 3 hurricane when it made landfall in North Carolina and New York, and weakened to a Category 2 hurricane before reaching Connecticut.
  - ⇒ Hurricanes Roxanne of 1995 and Fran of 1996 were Category 3 hurricanes at landfall on the Yucatan Peninsula of Mexico and in North Carolina, respectively.
  - ⇒ Hurricane Katrina of August 2005 was a Category 3 hurricane when it struck Louisiana and Mississippi.
  - ⇒ Hurricane Rita of September 2005 reached Category 3 as it struck Louisiana.
  - ⇒ Hurricane Wilma of October 2005 was a Category 3 hurricane when it made landfall in southwestern Florida.
- ❑ **Category 4:** Winds 131-155 mph (114-135 kt or 210-249 km/hr). Storm surge generally 13-18 ft above normal. More extensive curtainwall failures with some complete roof structure failures on small residences. Shrubs, trees, and all signs are blown down. Complete destruction of mobile homes. Extensive damage to doors and windows. Low-lying escape routes may be cut by rising water three to five hours before arrival of the center of the hurricane. Major damage to lower floors of structures near the shore. Terrain lower than 10 ft above sea level may be flooded requiring massive evacuation of residential areas as far inland as six miles (10 km).
- ⇒ Hurricane Donna of 1960 was a Category 4 hurricane when it made landfall in southwestern Florida, and weakened to a Category 2 hurricane when it reached Connecticut.
  - ⇒ Hurricane Luis of 1995 was a Category 4 hurricane while moving over the Leeward Islands.
  - ⇒ Hurricanes Felix and Opal of 1995 also reached Category 4 status at peak intensity.

- ❑ **Category 5:** Winds greater than 155 mph (135 kt or 249 km/hr). Storm surge generally greater than 18 ft above normal. Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. All shrubs, trees, and signs blown down. Complete destruction of mobile homes. Severe and extensive window and door damage. Low-lying escape routes are cut by rising water three to five hours before arrival of the center of the hurricane. Major damage to lower floors of all structures located less than 15 ft above sea level and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5-10 miles (8-16 km) of the shoreline may be required.
- ⇒ Hurricane Andrew was a Category 5 hurricane when it made landfall in southeastern Florida in 1992.
- ⇒ Hurricane Mitch of 1998 was a Category 5 hurricane at peak intensity over the western Caribbean.
- ⇒ Hurricane Gilbert of 1988 was a Category 5 hurricane at peak intensity and is one of the strongest Atlantic tropical cyclones of record.

Table 4-1 lists the hurricane characteristics mentioned above as a function of category, as well as the expected central pressure.

**Table 4-1**  
**Hurricane Characteristics**

Category	CENTRAL PRESSURE		WIND SPEED		SURGE Feet	Damage Potential
	Millibars	Inches	MPH	Knots		
1	>980	>28.9	74-95	64-83	4-5	Minimal
2	965-979	28.5-28.9	96-110	84-96	6-8	Moderate
3	945-964	27.9-28.5	111-130	97-113	9-12	Extensive
4	920-944	27.2-27.9	131-155	114-135	13-18	Extreme
5	<920	<27.2	>155	>135	>18	Catastrophic

The Saffir / Simpson Hurricane Scale assumes an average, uniform coastline for the continental United States and was intended as a general guide for use by public safety officials during hurricane emergencies. It does not reflect the effects of varying localized bathymetry, coastline configuration, astronomical tides, barriers or other factors that may modify storm surge heights at the local level during a single hurricane event. For inland communities such as the Town of Bethlehem, the coastline assumption is not applicable.

According to Connecticut's 2007 Natural Hazard Mitigation Plan Update, a moderate Category 2 hurricane is expected to strike Connecticut once every ten years, whereas a Category 3 or Category 4 hurricane is expected before the year 2040. These frequencies are based partly on the historic record described in the next section.

#### **4.3 Historic Record**

Through research efforts by NOAA's National Climate Center in cooperation with the National Hurricane Center, records of tropical cyclone occurrences within the Atlantic Cyclone Basin have been compiled from 1851 to present. These records are compiled in NOAA's Hurricane database (HURDAT), which contains historical data in the process of being reanalyzed to current scientific standards, as well as the most current hurricane data. During HURDAT's period of record, 29 hurricanes and 67 tropical storms have passed within a 150-mile radius of Newport, Rhode Island.

Since 1900, eight direct hits and two hurricanes that did not make landfall (but passed close to the shoreline) were recorded along the Connecticut coast, of which there were four Category 3, two Category 2, and two Category 1 hurricanes (two of the ten struck Connecticut before the Saffir / Simpson scale was developed). Of the four Category 3 hurricanes, two occurred in September and two occurred in August.

The most devastating hurricane to strike Connecticut, and believed to be the strongest hurricane to hit New England in recorded history, was believed to be a Category 3

hurricane. Dubbed the "Long Island Express of September 21, 1938", this name was derived from the unusually high forward speed of the hurricane, estimated to be 70 mph. The hurricane made landfall at Long Island, New York and moved quickly northward over Connecticut into northern New England.

The majority of damage was caused from storm surge and wind damage. Surges of 10 to 12 feet were recorded along portions of the Long Island and Connecticut Coast, and 130 mile per hour winds flattened forests, destroyed nearly 5,000 cottages, farms, and homes, and damaged an estimated 15,000 more throughout New York and southern New England. Overall, the storm left an estimated 700 dead and caused physical damages in excess of 300 million 1938 United States dollars (USD).

The "Great Atlantic Hurricane" hit the Connecticut coast in September 1944. This Category 3 hurricane brought rainfall in excess of six inches to most of the state and rainfall in excess of eight to ten inches in Fairfield County. Most of the wind damage from this storm occurred in southeastern Connecticut. Injuries and storm damage were lower in this hurricane than in 1938 because of increased warning time and the fewer structures located in vulnerable areas due to the lack of rebuilding after the 1938 storm.

Another Category 3 hurricane, Hurricane Carol, struck in August of 1954 shortly after high tide and produced storm surges of 10 to 15 feet in southeastern Connecticut. Rainfall amounts of six inches were recorded in New London, and wind gusts peaked at over 100 mph. Near the coast, the combination of strong winds and storm surge damaged or destroyed thousands of buildings, and the winds toppled trees that left most of the eastern part of the state without power. Overall damages were estimated at \$461 million (1954 USD), and 60 people died as a direct result of the hurricane. Western Connecticut was largely unaffected by Hurricane Carol due to the compact nature of the storm.

The following year, back-to-back hurricanes Connie and Diane caused torrential rains and record-breaking floods in Connecticut. Hurricane Connie was a declining tropical



storm when it hit Connecticut in August of 1955, producing heavy rainfall of four to six inches across the state. The saturated soil conditions exacerbated the flooding caused by Diane five days later, a Category 1 hurricane and the wettest tropical cyclone on record for the Northeast. Diane produced 14 inches of rain in a 30-hour period, causing destructive flooding conditions along nearly every major river system in the state. The Mad and Still Rivers in Winsted, the Naugatuck, the Farmington, and the Quinebaug River in northeastern Connecticut caused the most damage. The floodwaters resulted in over 100 deaths, left 86,000 unemployed, and caused an estimated \$200 million in damages (1955 USD). For comparison, the total property taxes levied by all Connecticut municipalities in 1954 amounted to \$194.1 million.

More recently, flooding and winds associated with hurricanes have caused extensive shoreline erosion and related damage. In September of 1985, hurricane Gloria passed over the coastline as a Category 2 hurricane. The hurricane struck at low tide, resulting in low to moderate storm surges along the coast. The storm produced up to six inches of rain in some areas and heavy winds which damaged structures and uprooted trees. Over 500,000 people suffered significant power outages.

Hurricane Bob, a Category 2 hurricane that made landfall in 1991, caused storm surge damage along the Connecticut coast, but was more extensively felt in Rhode Island and Massachusetts. Heavy winds were felt across eastern Connecticut with gusts up to 100 mph recorded, and the storm was responsible for six deaths in the state. Total damage in southern New England was approximately \$1.5 billion (1991 USD).

The most recent tropical cyclone to impact Connecticut was tropical storm Floyd in 1999. Floyd is the storm of record in the Connecticut Natural Hazard Mitigation Plan and is discussed in more detail in Section 3.3. Tropical Storm Floyd caused power outages throughout New England and at least one death in Connecticut.

#### **4.4 Existing Programs, Policies, and Mitigation Measures**

Existing mitigation measures appropriate for inland flooding have been discussed in Section 3. These include ordinances, codes, and regulations that have been enacted to minimize flood damage. In addition, various structures exist to protect certain areas, including dams and riprap.

Wind loading requirements are addressed through the state building code. The Connecticut Building Code was amended in 2005 and adopted with an effective date of December 31, 2005. The new 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 towns along the Merritt Parkway such as Fairfield and Trumbull, wind speed criteria are different north and south of the Parkway in relation to the distance from the shoreline. Effective December 31, 2005, the design wind speed for Bethlehem is 95 miles per hour. Bethlehem has adopted the Connecticut Building Code as its building code.

Parts or all of tall and older trees may fall during heavy wind events, potentially damaging structures, utility lines, and vehicles. Connecticut Light & Power, the local electric utility, provides tree maintenance near their power lines. The Town has a tree warden who encourages residents to cut trees that can be dangerous to power lines. Thus, landowners are primarily responsible for conducting tree maintenance on private property. In addition, all utilities in new subdivisions must be located underground whenever possible in order to mitigate storm-related damages.

During emergencies, the Town of Bethlehem currently has two designated emergency shelters available (Section 2.9). Bethlehem Fire Department is currently the primary shelter with a generator, while the secondary shelter (Memorial Hall) also has a generator. In addition, the Town has additional facilities available that could be converted to additional shelter space if the need arose. As hurricanes generally pass an

area within a day's time, additional shelters can be set up after the storm as needed for long-term evacuees.

The Town relies on radio and television to spread information on the location and availability of shelters. Prior to severe storm events, the Town ensures that warning/notification systems and communication equipment is working properly, and prepares for the possible evacuation of impacted areas.

#### **4.5 Vulnerabilities and Risk Assessment**

It is generally believed that New England is long overdue for another major hurricane strike. Recall that according to the 2007 Connecticut Natural Hazard Mitigation Plan Update, a moderate Category 2 storm is expected to strike the state once per decade. The Town of Bethlehem is less vulnerable to hurricane damage than coastal towns in Connecticut because it does not need to deal with the effects of storm surge.

The Town of Bethlehem is vulnerable to hurricane damage from wind and flooding, and from any tornadoes accompanying the storm. Areas of known and potential flooding problems are discussed in Section 3, and tornadoes will be discussed in Section 5. Hurricane-force winds can easily destroy poorly constructed buildings and mobile homes. There are currently no mobile home parks in the Town. Debris such as signs, roofing material, and small items left outside become flying missiles in hurricanes. Extensive damage to trees, towers, aboveground and underground utility lines (from uprooted trees), and fallen poles cause considerable disruption for residents. Streets may be flooded or blocked by fallen branches, poles, or trees, preventing egress. Downed power lines from heavy winds can also start fires, so adequate fire protection is important.

As the residents and businesses of the State of Connecticut become more dependent on the internet and mobile communications, the impact of hurricanes on commerce will continue to increase. A major hurricane has the potential of causing complete disruption

of power and communications for up several weeks, rendering electronic devices and those that rely on utility towers and lines inoperative. According to the Connecticut DEP, this is a significant risk that cannot be quantitatively estimated.

As the Town of Bethlehem is not affected by storm surge, hurricane sheltering needs have not been calculated by the Army Corps of Engineers for the Town. The Town of Bethlehem determines sheltering need based upon areas damaged within the Town. Under limited emergency conditions, a high percentage of evacuees will seek shelter with friends or relatives rather than go to established shelters. During extended power outages, it is believed that only 10% to 20% of the affected population of Bethlehem will relocate.

#### **4.6 Potential Mitigation Measures, Strategies, and Alternatives**

Many potential mitigation measures for hurricanes include those appropriate for inland flooding. These were presented in Section 3.6. However, hurricane mitigation measures must also address the effects of heavy winds that are inherently caused by hurricanes. Mitigation for wind damage is therefore emphasized in the subsections below.

##### **4.6.1 Prevention**

Although hurricanes and tropical storms cannot be prevented, a number of methods are available to continue preventing damage from the storms, and perhaps to mitigate damage. The following actions have been identified as potential preventive measures:

- ❑ Continue Town-wide tree limb inspection and maintenance programs to ensure that the potential for downed power lines is diminished.
- ❑ Continue location of utilities underground in new developments or as related to redevelopment.

- ❑ Continue to review the currently enacted Emergency Operations Plan for the Town and update when necessary.

#### **4.6.2 Property Protection**

Potential mitigation measures include designs for hazard-resistant construction and retrofitting techniques. These may take the form of increased wind and flood resistance, as well as the use of storm shutters over exposed glass and the inclusion of hurricane straps to hold roofs to buildings. Compliance with the amended Connecticut Building Code for wind speeds is necessary. Literature should be made available by the Building Department to developers during the permitting process regarding these design standards.

#### **4.6.3 Public Education and Awareness**

The public should be made aware of evacuation routes and available shelters. A number of specific proposals for improved public education are recommended to prevent damage and loss of life during hurricanes. These are common to all hazards in this plan, and are listed in Section 10.1.

#### **4.6.4 Emergency Services**

The Emergency Operation Plan of the Town of Bethlehem includes guidelines and specifications for communication of hurricane warnings and watches, as well as for a call for evacuation. The public needs to be made aware in advance of a hurricane event of evacuation routes and the locations of public shelters, which could be accomplished by placing this information on the Town website and by creating informational displays in local municipal buildings. In addition, Bethlehem should identify and prepare additional facilities for evacuation and sheltering needs. The Town should also review its mutual aid agreements and update as necessary to ensure help is available as needed.

#### **4.6.5 Structural Projects**

Structural projects for wind damage mitigation are not possible.

#### **4.7 Summary of Recommended Mitigation Measures, Strategies, and Alternatives**

While many potential mitigation activities were addressed in Section 4.6, the recommended mitigation strategies for mitigating hurricane and tropical storm winds in the Town of Bethlehem are listed below.

- ☐ Increase tree limb maintenance and inspections, especially along Route 61, Route 132, and other evacuation routes. Increase inspections of trees on private property near power lines and Town right-of-ways.
- ☐ Continue to require that utilities be placed underground in new developments and pursue funding to place them underground in existing developed areas, and
- ☐ Review potential evacuation plans to ensure timely migration of people seeking shelter in all areas of Bethlehem, and post evacuation and shelter information on the Town website and in municipal buildings.
- ☐ Provide for the Building Department to have literature available regarding appropriate design standards for wind.

In addition, important recommendations that apply to all hazards are listed in Section 10.1.

## **5.0 SUMMER STORMS & TORNADOES**

### **5.1 Setting**

Like hurricanes and winter storms, summer storms and tornadoes have the potential to affect any area within the Town of Bethlehem. Furthermore, because these types of storms and the hazards that result (flash flooding, wind, hail, and lightning) might have limited geographic extent, it is possible for a summer storm to harm one area within the Town without harming another. The entire Town of Bethlehem is therefore susceptible to summer storms (including heavy rain, flash flooding, wind, hail, and lightning) and tornadoes.

Based on the historic record, it is considered highly likely that a summer storm that includes lightning will impact the Town of Bethlehem each year, although lightning strikes have a limited effect. Strong winds and hail are considered likely to occur during such storms but also generally have limited effects. A tornado is considered a possible event in Litchfield County each year that could cause significant damage to a small area (refer to Appended Table 2).

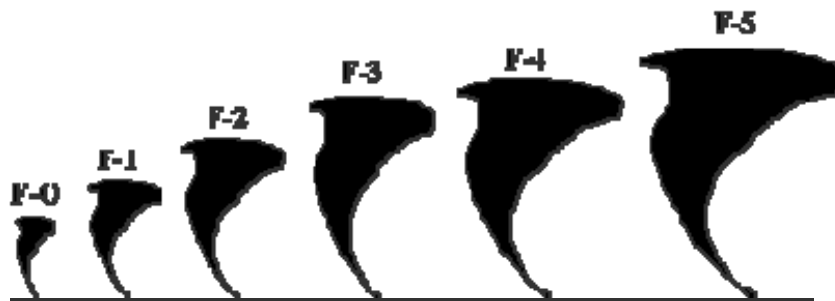
### **5.2 Hazard Assessment**

Heavy wind (including tornadoes and downbursts), lightning, heavy rain, hail, and flash floods are the primary hazards associated with summer storms. Inland flooding and flash flooding caused by heavy rainfall was covered in Section 3.0 of this plan and will not be discussed in detail here.

## Tornadoes

Tornadoes are spawned by certain thunderstorms. NOAA defines a tornado as "a violently rotating column of air extending from a thunderstorm to the ground." The Fujita scale was accepted as the official classification system for tornado damage for many years following its publication in 1971. The Fujita scale rated the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure. The scale ranked tornadoes using the now-familiar notation of F0 through F5, increasing with wind speed and intensity. The following graphic of the Fujita scale is provided by FEMA. A description of the scale follows in Table 5-1.

### **Fujita Tornado Scale**



**Table 5-1  
Fujita Scale**

<b>F-Scale Number</b>	<b>Intensity</b>	<b>Wind Speed</b>	<b>Type of Damage Done</b>
F0	Gale tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	Moderate tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.



**Table 5-1 (Continued)**  
**Fujita Scale**

<b>F-Scale Number</b>	<b>Intensity</b>	<b>Wind Speed</b>	<b>Type of Damage Done</b>
F3	Severe tornado	158-206 mph	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.
F6	Inconceivable tornado	319-379 mph	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 winds that would surround the F6 winds. Missiles, such as cars and refrigerators, would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies.

According to NOAA, weak tornadoes (F0 and F1) account for approximately 69% of all tornadoes. Strong tornadoes (F2 and F3) account for approximately 29% of all tornadoes. Violent tornadoes (F4 and above) are rare but extremely destructive, and account for only 2% of all tornadoes.

The Enhanced Fujita Scale was released by NOAA for implementation on February 1, 2007. According to the NOAA web site, the Enhanced Fujita Scale was developed in response to a number of weaknesses to the Fujita Scale that were apparent over the years, including the subjectivity of the original scale based on damage, the use of the worst damage to classify the tornado, the fact that structures have different construction depending on location within the United States, and an overestimation of wind speeds for F3 and greater. The Enhanced F-scale is still a set of wind estimates based on damage.

Its uses three-second gusts estimated at the point of damage based on a judgment of eight levels of damage to 28 specific indicators. Table 5-2 relates the Fujita and enhanced Fujita scales.

**Table 5-2  
Enhanced Fujita Scale**

<b>Fujita Scale</b>			<b>Derived EF Scale</b>		<b>Operational EF Scale</b>	
<i>F Number</i>	<i>Fastest 1/4-mile (mph)</i>	<i>3 Second Gust (mph)</i>	<i>EF Number</i>	<i>3 Second Gust (mph)</i>	<i>EF Number</i>	<i>3 Second Gust (mph)</i>
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

The historic record of tornadoes is discussed in Section 5.3. The pattern of occurrence in Connecticut is expected to remain unchanged according to the Connecticut Natural Hazards Mitigation Plan (2007). The highest relative risk for tornadoes in the state is Litchfield and Hartford Counties, followed by New Haven, Fairfield, Tolland, Middlesex, Windham, and finally New London County. By virtue of its location in Litchfield County, the Town of Bethlehem is therefore at a relatively higher risk of tornadoes compared to the rest of the state.

### **Lightning**

Lightning is a circuit of electricity that occurs between the positive and negative charges within the atmosphere or between the atmosphere and the ground. In the initial stages of development, air acts as an insulator between the positive and negative charges.

However, when the potential between the positive and negative charges becomes too great, a discharge of electricity (lightning) occurs.

In-cloud lightning occurs between the positive charges near the top of the cloud and the negative charges near the bottom. Cloud to cloud lightning occurs between the positive charges near the top of the cloud and the negative charges near the bottom of a second cloud. Cloud to ground lightning is the most dangerous. In summertime, most cloud to ground lightning occurs between the negative charges near the bottom of the cloud and positive charges on the ground.

According to NOAA's National Weather Service, lightning reportedly kills an average of 80 people per year in the United States, in addition to an average of 300 lightning injuries per year. Most lightning deaths and injuries occur outdoors, with 45% of lightning casualties occurring in open fields and ballparks, 23% under trees, and 14% involving water activities. Only 15 lightning-related fatalities occurred in Connecticut between 1959 and 2005, and only one occurred between 1998 and 2007. Most recently, on June 8, 2008, lightning struck a pavilion at Hamonassett Beach in Madison, Connecticut, injuring five and killing one.

Thunderstorms occur 18 to 35 days each year in Connecticut. According to a report by meteorologist Joe Furey on Fox 61 News, 2008 was an abnormal year for thunderstorms, with 20 days of thunderstorm activity occurring by the end of July.

In general, thunderstorms in Connecticut are more frequent in the western and northern parts of the state, and less frequent in the southern and eastern parts. Although lightning is usually associated with thunderstorms, it can occur on almost any day. The likelihood of lightning strikes in the Bethlehem area is very high during any given thunderstorm, although no one area of the Town is at higher risk of lightning strikes.

### **Downbursts**

A downburst is a severe localized wind blasting down from a thunderstorm. They are more common than tornadoes in Connecticut. These "straight line" winds are

distinguishable from tornadic activity by the pattern of destruction and debris. Depending on the size and location of these events, the destruction to property may be significant.

It is difficult to find statistical data regarding frequency of downburst activity. However, downburst activity is, on occasion, mistaken for tornado activity in Connecticut, indicating that it is a relatively uncommon yet persistent hazard. The risk to the Town of Bethlehem is believed to be low to moderate for any given year.

Downbursts may be categorized as ***microbursts*** (affecting an area less than 2.5 miles in diameter) or ***macrobursts*** (affecting an area at least 2.5 miles in diameter).

### **Hail**

Hailstones are chunks of ice that grow as updrafts in thunderstorms keep them in the atmosphere. Most hailstones are smaller in diameter than a dime, but stones weighing more than a pound have been recorded. While crops are the major victims of hail, it is also a hazard to vehicles and property.

Hailstorms typically occur in at least one part of Connecticut each year during a severe thunderstorm. As with thunderstorms, hailstorms are more frequent in the northwest and western portions of the state, and less frequent in the southern and eastern portions. Overall, the risk of at least one hailstorm occurring in Bethlehem is moderate in any given year.

## **5.3 Historic Record**

The National Climatic Data Center (NCDC) lists 22 tornado events in Litchfield County since 1950. This includes nine F2 rated tornadoes, 11 F1 rated tornadoes, and two F0

rated tornadoes. Property damages from tornados in the County totaled approximately 51 million dollars. Table 5-3 lists the tornado events for Litchfield County.

**Table 5-3  
Tornado Events in Litchfield County Since 1950**

<b>Date</b>	<b>Fujita Tornado Scale</b>	<b>Property Damage</b>	<b>Wind Speed</b>
August 21, 1951	F2	\$250,000	113 – 157 mph
August 21, 1958	F1	\$0	73 – 112 mph
May 12, 1959	F2	\$2,500	113 – 157 mph
June 18, 1962	F2	\$25,000	113 – 157 mph
August 11, 1966	F2	\$25,000	113 – 157 mph
August 20, 1968	F1	\$2,500	73 – 112 mph
August 7, 1972	F1	\$250,000	73 – 112 mph
August 9, 1972	F1	\$25,000	73 – 112 mph
June 12, 1973	F2	\$0	113 – 157 mph
June 29, 1973	F1	\$2,500	73 – 112 mph
July 3, 1974	F1	\$2,500	73 – 112 mph
June 19, 1975	F1	\$0	73 – 112 mph
July 20, 1975	F1	\$2,500	73 – 112 mph
June 30, 1976	F2	\$25,000	113 – 157 mph
July 10, 1989 2:45 P.M.	F2	\$25,000,000	113 – 157 mph
July 10, 1989 3:15 P.M.	F2	\$25,000,000	113 – 157 mph
May 31, 1998	F1	\$4,000	73 – 112 mph
June 23, 2001 1:00 P.M.	F1	\$150,000	73 – 112 mph
June 23, 2001 1:50 P.M.	F2	\$250,000	113 – 157 mph
July 1, 2001	F0	\$75,000	40 – 74 mph
June 5, 2002	F1	\$40,000	73 – 112 mph
June 16, 2002	F0	\$10,000	40 – 74 mph

A limited selection of summer storm damage in and around Bethlehem, taken from the NCDC Storm Events database, is listed below:

- ❑ July 10, 1989 – A particularly powerful thunderstorm produced 80 mile per hour winds and spawned two tornadoes that cut a path from Salisbury to New Haven. Two people were killed and 67 homes were destroyed. One of the fatalities occurred in Black Rock State Park in nearby Watertown. Damages from the storm totaled \$125 million (1989 dollars), and a Presidential Disaster Declaration was issued. One of the tornadoes passed above Bethlehem before landing again in Watertown and the Town received residual damage from flying debris.

- ❑ June 27, 1994 – Thunderstorm winds brought down trees and power lines in Litchfield, with a few hundred customers losing electric service.
- ❑ May 21, 1996 – Severe thunderstorms produced damage across parts of Litchfield County and caused approximately \$5,000 in property damage.
- ❑ July 9, 1997 – Severe thunderstorms produced flooding and damaging winds that downed trees throughout Litchfield County, causing approximately \$5,000 in damage. The wind downed trees and a power pole in Thomaston.
- ❑ October 1, 1998 – Gusty winds knocked down large limbs, trees, and power lines during the middle of the day throughout Litchfield County, resulting in as many as 7,800 electric customers being without power and bringing commerce to a halt. Approximately \$100,000 in property damage was reported.
- ❑ July 6, 1999 – Powerful thunderstorms brought down trees in New Milford, Litchfield and Bethlehem, causing \$2,000 in damage.
- ❑ September 16, 1999 – In addition to the flooding damages described in Section 3.3, the remnants of Tropical Storm Floyd also produced wind gusts up to 60 miles per hour in Litchfield County, causing widespread downing of trees and power lines. Up to 5,000 were left without power, and approximately \$100,000 in wind damage was reported.
- ❑ November 2, 1999 – A storm produced high wind across the higher elevations of Litchfield County, bringing down some trees and a few power lines. Scattered power outages and approximately \$11,000 in damages were reported.
- ❑ May 31, 2002 – Severe weather in Litchfield County produced hail up to two inches in diameter in Thomaston, blew down trees, and caused 37,000 power outages and \$10,000 in damages across the county.
- ❑ July 15, 2007 – Strong thunderstorm winds blew a large tree onto a house in Thomaston, causing structural damage.
- ❑ July 19, 2007 – Trees were reported down in Thomaston due to strong thunderstorm winds that gusted up to 50 miles per hour.

#### 5.4 Existing Programs, Policies, and Mitigation Measures

Warning is the primary method of existing mitigation for tornadoes and thunderstorm-related hazards. The NOAA National Weather Service issues watches and warnings when severe weather is likely to develop or has developed, respectively. Tables 5-4 and 5-5 list the NOAA Watches and Warnings, respectively, as pertaining to actions to be taken by emergency management personnel in connection with summer storms and tornadoes.

A ***severe thunderstorm watch*** is issued by the National Weather Service when the weather conditions are such that a severe thunderstorm (winds greater than 58 miles per hour, or hail three-fourths of an inch or greater) is likely to develop.

A ***severe thunderstorm warning*** is issued when a severe thunderstorm has been sighted or indicated by weather radar.

**Table 5-4**  
**NOAA Weather Watches**

Weather Condition	Meaning	Actions
Severe Thunderstorm	Severe thunderstorms are possible in your area.	Notify personnel, and watch for severe weather.
Tornado	Tornadoes are possible in your area.	Notify personnel, and be prepared to move quickly if a warning is issued.
Flash Flood	It is possible that rains will cause flash flooding in your area.	Notify personnel to watch for street or river flooding.

Aside from warnings, several other methods of mitigation for wind damage are employed in Bethlehem. Continued location of utilities underground is an important method of reducing wind damage to utilities and the resulting loss of services. The Connecticut Building Codes include guidelines for Wind Load Criteria that are specific to each municipality, as explained in Section 4.0. In addition, specific mitigation measures address debris removal and tree trimming.

**Table 5-5  
NOAA Weather Warnings**

<b>Weather Condition</b>	<b>Meaning</b>	<b>Actions</b>
Severe Thunderstorm	Severe thunderstorms are occurring or are imminent in your area.	Notify personnel and watch for severe conditions or damage (i.e. downed power lines and trees. Take appropriate actions listed in town emergency plans.
Tornado	Tornadoes are occurring or are imminent in your area.	Notify personnel, watch for severe weather and ensure personnel are protected. Take appropriate actions listed in emergency plans.
Flash Flood	Flash flooding is occurring or imminent in your area.	Watch local rivers and streams. Be prepared to evacuate low-lying areas. Take appropriate actions listed in emergency plans.

In the Town of Bethlehem, the local utilities are responsible for tree branch removal and maintenance above and near their lines. In addition, all new developments in Bethlehem must place utilities underground wherever possible. The Tree Warden also approaches residents on a case-by-case basis when trees and branches on their property look hazardous, though ultimately tree removal on private property is up to the property owner.

Municipal responsibilities relative to tornado mitigation and preparedness include:

- ☐ Developing and disseminating emergency public information and instructions concerning tornado safety, especially guidance regarding in-home protection and evacuation procedures, and locations of public shelters.
- ☐ Designate appropriate shelter space in the community that could potentially withstand tornado impact.
- ☐ Periodically test and exercise tornado response plans.
- ☐ Put emergency personnel on standby at tornado 'watch' stage.



## 5.5 **Vulnerabilities and Risk Assessment**

The central and southern portions of the United States are at higher risk for lightning and thunderstorms than is the northeast. However, more deaths from lightning occur on the East Coast than elsewhere, according to FEMA. Lightning-related fatalities have declined in recent years due to increased education and awareness.

Most thunderstorm damage is caused by straight-line winds exceeding 100 mph. Straight-line winds occur as the first gust of a thunderstorm or from the downburst from a thunderstorm, and have no associated rotation. Bethlehem is particularly susceptible to damage from high winds due to its high elevation and heavily treed landscape.

Heavy winds can take down trees near power lines, leading to the start and spread of fires. Such fires can be extremely dangerous during the summer months during dry and drought conditions. Most downed power lines in Bethlehem are detected quickly and any associated fires are quickly extinguished. However, it is important to have adequate water supply for fire protection to ensure this level of safety is maintained.

According to Town personnel, no single area of Town is more susceptible to wind damage than any other. Damage from falling branches and trees is more common than from actual wind damage.

## 5.6 **Potential Mitigation Measures, Strategies, and Alternatives**

Both the FEMA and the NOAA websites contain valuable information regarding preparing for and protecting

***More information is available at:***

FEMA – <http://www.fema.gov/library/>  
NOAA – <http://www.nssl.noaa.gov/NWSTornado/>

oneself during a tornado, as well as information on a number of other natural hazards.

Available information from FEMA includes:

- ☐ Design and construction guidance for creating and identifying community shelters;
- ☐ Recommendations to better protect your business, community, and home from tornado damage, including construction and design guidelines for structures;
- ☐ Ways to better protect property from wind damage;
- ☐ Ways to protect property from flooding damage; and
- ☐ Construction of safe rooms within homes.

NOAA information includes a discussion of family preparedness procedures and the best physical locations during a storm event. Although tornadoes pose a legitimate threat to public safety, their occurrence is considered too infrequent to justify the construction of tornado shelters. Residents should be encouraged to purchase a NOAA weather radio containing an alarm feature.

The implementation of an emergency notification system would be beneficial in warning residents of an impending tornado. A community warning system that relies on radios and television is less effective at warning residents during the night when the majority of the community is asleep. This fact was evidenced most recently by the severe storm that struck Lake County, Florida on February 2, 2007. This powerful storm that included several tornadoes struck at about 3:15 AM. According to National Public Radio, local broadcast stations had difficulty warning residents due to the lack of listeners and viewers and encouraged those awake to telephone warnings into the affected area.

Specific mitigation steps that can be taken to prevent property damage and protect property are given below.

### **Prevention**

- ☐ Continue or increase tree limb inspection programs to ensure that the potential for downed power lines is minimized.

- ☐ Continue to place utilities underground.

### **Property protection**

- ☐ Require compliance with the amended Connecticut Building Code for wind speeds.
- ☐ Provide for the Building Official to make literature available during the permitting process regarding appropriate design standards.

## **5.7 Summary of Recommended Mitigation Measures, Strategies, and Alternatives**

While many potential mitigation activities were addressed in Section 5.6, the recommended mitigation strategies for mitigating wind, hail, tornadoes, and downbursts in the Town of Bethlehem are listed below.

- ☐ Increase tree limb maintenance and inspections, especially in the downtown areas
- ☐ Continue outreach regarding dangerous trees on private property.
- ☐ Continue to require that utilities be placed underground in new developments and pursue funding to place them underground in existing developed areas
- ☐ Continue to require compliance with the amended Connecticut Building Code for wind speeds.
- ☐ Have the Building Department make literature available during the permitting process regarding appropriate design standards.

In addition, important recommendations that apply to all hazards are listed in Section 10.1.

## 6.0 WINTER STORMS

### 6.1 Setting

Similar to summer storms and tornadoes, winter storms have the potential to affect any area of the Town of Bethlehem. However, unlike summer storms, winter events and the hazards that result (wind, snow, and ice) have more widespread geographic extent. The entire Town of Bethlehem is susceptible to winter storms. In general, winter storms are considered highly likely to occur each year (major storms are less frequent), and the hazards that result (nor'easter winds, snow, and blizzard conditions) can potentially have a significant effect over a large area of the Town (refer to Appended Tables 1 and 2).

### 6.2 Hazard Assessment

This section focuses on those effects commonly associated with winter storms, including those from blizzards, ice storms, heavy snow, freezing rain and extreme cold. Most deaths from winter storms are indirectly related to the storm, such as from traffic accidents on icy roads and hypothermia from prolonged exposure to cold.

Damage to trees and tree limbs and the resultant downing of utility cables are a common effect of these types of events. Secondary effects include loss of power and heat.

According to the *National Weather Service*, approximately 70% of winter deaths related to snow and ice occur in automobiles, and approximately 25% of deaths occur from people being caught in the cold. In relation to deaths from exposure to cold, 50% are people over 60 years old, 75% are male, and 20% occur in the home.

The classic winter storm in New England is the nor'easter, which is caused by a warm moist, low pressure system moving up from the south colliding with a cold, dry high pressure system moving down from the north. The nor'easter derives its name from the northeast winds typically accompanying such storms, and such storms tend to produce a large amount of precipitation. Severe winter storms can produce an array of hazardous

weather conditions, including heavy snow, blizzards, freezing rain and ice pellets, flooding, heavy winds, and extreme cold. The National Weather Service defines a blizzard as having winds over 35 mph with snow with blowing snow that reduces visibility to less than one-quarter mile for at least three hours.

Connecticut experiences at least one severe winter storm every five years, although a variety of small and medium snow and ice storms occur nearly every winter. The likelihood of a nor'easter occurring in any given winter is therefore considered high, and the likelihood of other winter storms occurring in any given winter is very high.

The Northeast Snowfall Impact Scale (NESIS) was developed by Paul Kocin and Louis Uccellini (Kocin and Uccellini, 2004) and is used by NOAA to characterize and rank high-impact Northeast snowstorms. These storms have wide areas of snowfall with accumulations of ten inches and above. NESIS has five categories: Extreme, Crippling, Major, Significant, and Notable. The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements, thus giving an indication of a storm's societal impacts.

NESIS values are calculated within a geographical information system (GIS). The aerial distribution of snowfall and population information are combined in an equation that calculates a NESIS score, which varies from around one for smaller storms to over ten for extreme storms. The raw score is then converted into one of the five NESIS categories. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers. Table 6-1 presents the NESIS categories, their corresponding NESIS values, and a descriptive adjective.

**Table 6-1**  
**NESIS Categories**

Category	NESIS Value	Description
1	1—2.499	Notable
2	2.5—3.99	Significant
3	4—5.99	Major
4	6—9.99	Crippling
5	10.0+	Extreme

### **6.3     Historic Record**

Seven major winter nor'easters have occurred in Connecticut during the past 30 years (in 1979, 1983, 1988, 1992, 1996, 2003, and 2006). The 1992 nor'easter, in particular, caused the third-highest tides ever recorded in Long Island Sound and damaged 6,000 coastal homes. Inland areas received up to four feet of snow. Winter Storm Ginger in 1996 caused up to 27 inches of snow 24 hours and shut down the State of Connecticut for an entire day. The nor'easter which occurred on February 12 and 13, 2006 resulted in 18 to 24 inches of snow across Connecticut and was rated on NESIS as a Category 3 "Major" storm across the northeast. This storm ranked 20<sup>th</sup> out of 33 major winter storms ranked by NESIS for the northeastern United States since 1956.

The most damaging winter storms are not always nor'easters. According to the NCDC, there have been 135 snow and ice events in the State of Connecticut between 1993 and March 2008, causing over \$18 million in damages. Notably, heavy snow in December 1996 caused \$6 million in property damage. Snow removal and power restoration for a winter storm event spanning March 31 and April 1, 1997 cost \$1 million. On March 5, 2001, heavy snow caused \$5 million in damages, followed by another heavy snow event four days later that caused an additional \$2 million in damages. The last documented winter storm event that qualified as a blizzard was Winter Storm Ginger in January of 1996. These events were recorded for various counties throughout the state.

Catastrophic ice storms are less frequent in Connecticut than the rest of New England due to the close proximity of the warmer waters of the Atlantic Ocean and Long Island Sound. The most severe ice storm in Connecticut on record was Ice Storm Felix on December 18, 1973. This storm resulted in two deaths and widespread power outages throughout the state. An ice storm in November of 2002 that hit Litchfield and western Hartford Counties resulted in \$2.5 million in public sector damages.

Additional examples of recent winter storms to affect Litchfield County, taken from the NCDC database, include:

- ❑ January 13, 1993 – Six inches of snowfall beginning during the morning rush hour that created slippery roads and resulted in numerous accidents.
- ❑ February 12, 1993 – Five to seven inches of snow was reported in Litchfield County, followed by freezing rain and drizzle. This storm caused up to 10,000 power outages throughout the state.
- ❑ March 13 to 14, 1993 – A powerful storm caused blizzard conditions and up to 21 inches of snow in Litchfield County, with 40,000 power outages and \$550,000 in property damage reported throughout Connecticut.
- ❑ December 26, 1993 – Heavy arctic winds brought 40 to 60 mph gusts to the State.
- ❑ February 11, 1994 – A major storm produced eight to 13 inches of snow across Connecticut.
- ❑ December 23, 1994 – An unusual snow-less late December storm caused gale force winds across the state. The high winds caused widespread power outages affecting up to 130,000 customers statewide. Numerous trees and limbs were blown down, damaging property, vehicles, and power lines to a total of five million dollars in damages. Peak wind gusts of up to 64 miles per hour were reported.
- ❑ December 19, 1995 – A winter storm produced six to eight inches of snow in Litchfield County.

- ❑ January 2, 1996 – A winter storm originating near the Gulf of Mexico produced ten to 12 inches of snow across Litchfield County.
- ❑ January 7, 1996 – An intense winter storm caused heavy snow throughout Litchfield County, causing many power outages, several roofs to collapse, and approximately \$80,000 in damages. Reported snowfall totals included 24 inches in New Hartford and 22 inches in Harwinton.
- ❑ January 19, 1996 – An intense area of low pressure created damaging winds throughout Litchfield County, causing \$10,000 in property damage. Many downed trees, limbs, and power lines were reported.
- ❑ March 7, 1996 – A large winter storm caused heavy snow throughout Litchfield County, including eight inches in Thomaston.
- ❑ February 22, 1997 – High winds downed trees and wires across Litchfield County, resulting in approximately \$6,000 in property damage.
- ❑ March 14, 1997 – A storm brought heavy snow, sleet, and freezing rain to Litchfield County, producing two to four inches of snow, treacherous driving conditions, and downed trees and power lines.
- ❑ March 31, 1997 – A late season storm produced rain and wet snow across Litchfield County, with 12 inches of snow reported in Litchfield. This storm caused over one million dollars in property damage and over 30,000 homes lost power across the County.
- ❑ January 25, 2000 – A winter storm produced snow, sleet, and freezing rain in Litchfield County with accumulations of six to ten inches. \$25,000 in property damage was reported.
- ❑ April 9, 2000 – A late-season snowstorm produced snowfall rates of more than an inch per hour, with blizzard conditions reported at times. Four to eight inches accumulated throughout Litchfield County, with \$35,000 in property damage reported.
- ❑ December 25, 2002 – Six to 12 inches of snow fell throughout Litchfield County, with six inches reported at the Thomaston Dam.



- ❑ March 6, 2003 – A winter storm produced nine inches of snow as measured at the Thomaston Dam.
- ❑ March 16, 2007 – A winter storm beginning during the Friday afternoon rush hour produced eight to 12 inches of snow throughout Litchfield County, including 7.5 inches in Thomaston. The storm caused treacherous travel conditions that resulted in many accidents.

#### **6.4 Existing Programs, Policies, and Mitigation Measures**

Existing programs applicable to inland flooding and wind are the same as those discussed in Sections 3.0 and 4.0. Programs that are specific to winter storms are generally those related to preparing plows, sand and salt trucks; tree-trimming to protect power lines; and other associated snow removal and response preparations.

As it is almost guaranteed that winter storms will occur annually in Connecticut, it is important for municipalities to budget fiscal resources towards snow management. The Town ensures that all warning/notification and communications systems are ready before a storm, and ensures that appropriate equipment and supplies, especially snow removal equipment, are in place and in good working order. The Town also prepares for the possible evacuation and sheltering of some populations which could be impacted by the upcoming storm (especially the elderly and special needs persons).

The Town of Bethlehem primarily uses Town staff for plowing operations. The Highway Department utilizes plow trucks to clear and treat all Town-owned roadways, properties, and sidewalks. The Connecticut Department of Transportation plows Routes 61 and 132. Town roads are not prioritized for plowing because school buses traverse every road in Town. During emergencies, a plow vehicle can be dispatched ahead of an emergency vehicle.

## 6.5 *Vulnerabilities and Risk Assessment*

As mentioned for summer storms, the heavily treed landscape in close proximity to densely populated residential areas in the Town of Bethlehem poses problems in relation to blizzard condition damage. Tree limbs and some building structures may not be suited to withstand high wind and snow loads. Ice can damage or collapse power lines, render steep gradients impassable for motorists, undermine foundations, and cause "flood" damage from freezing water pipes in basements.

In addition, winter storms present additional problems for motorists all over the state. As the population of Connecticut and its dependence on transportation continues to increase, the vulnerability of the state to winter storms also increases. There is a high propensity for traffic accidents and traffic jams during heavy snow and even light icing events. Roads may become impassable, inhibiting the ability of emergency equipment to reach trouble spots and the accessibility to medical and shelter facilities. Stranded motorists, especially senior and/or handicapped citizens, are at particularly high risk of injury or death from exposure during a blizzard. After a storm, snow piled on the sides of roadways can inhibit line of sight and reflect a blinding amount of sunlight, making driving difficult. When coupled with slippery road conditions, poor sightlines and heavy glare create dangerous driving conditions.

A few areas in the Town of Bethlehem have been identified by Town personnel and residents as having problems with ice during the winter months. Icing causes difficult driving conditions throughout the hillier sections of Bethlehem, especially at the intersection of Cabbage Lane and Route 132, and at the intersection of Wood Creek Road and Route 132. Both of these instances of icing are due to poor drainage. The intersection of Cabbage Lane and Route 132 is especially dangerous because cars traveling towards Route 132 on Cabbage Lane are coming downhill, the ice collects near the intersection, and drivers tend to speed through this section of Route 132.

Icing is particularly a concern along the access road to the Horace Mann Nature Center in Washington off the end of Arch Bridge Road. There is no public access to this property in Washington due to private roads and limited egress over Sprain Brook. Approximately 30-40 children attend the facility each week 40 weeks per year. The Town of Washington has asked the Town of Bethlehem to be the first responder to this facility in case of emergency, as it is a 22 minute response time from Washington. However, the road leading in from Bethlehem is unpaved, narrow, and steep. Emergency personnel are worried that the facility could become isolated during a winter emergency.

Drifting snow is not as large a problem in Bethlehem as other areas, but it still occurs. This problem is mitigated through municipal plowing efforts. Ice jams are not a problem along the rivers in Bethlehem.

Recall from Figure 2-7, Figure 2-8, and Figure 2-9 that elderly, linguistically isolated, and disabled populations reside in the Town of Bethlehem. It is possible that several hundred of the population impacted by a severe winter storm could consist of the elderly, a small number could consist of linguistically isolated households, and several hundred could be disabled. Thus, it is important for Bethlehem's emergency personnel to be prepared to assist these special populations during emergencies such as winter storms.

## **6.6 Potential Mitigation Measures, Strategies, and Alternatives**

Potential mitigation measures for flooding caused by nor'easters include those appropriate for flooding. These were presented in Section 3.6. Winter storm mitigation measures must also address blizzard, snow, and ice hazards. These are emphasized below. Note that structural projects are generally not applicable to hazard mitigation for wind, blizzard, snow, and ice hazards.

### **6.6.1 Prevention**

Cold air, wind, snow, and ice can not be prevented from impacting any particular area. Thus, mitigation should be focused on property protection and emergency services (discussed below) and prevention of damage as caused by breakage of tree limbs.

Previous recommendations for tree limb inspections and maintenance in Sections 4.0 and 5.0 are thus applicable to winter storm hazards, as well. As mentioned previously, utilities in Bethlehem should continue to be placed underground where possible. This can occur in connection with new development and also in connection with redevelopment work. Underground utilities cannot be damaged by heavy snow, ice, and winter winds.

### **6.6.2 Property Protection**

Property can be protected during winter storms through the use of shutters, storm doors, and storm windows. Where flat roofs are used on structures, snow removal is important as the heavy load from collecting snow may exceed the bearing capacity of the structure. Heating coils may be used to remove snow from flat roofs. Pipes should be adequately insulated to protect against freezing and bursting. All of these recommendations should apply to new construction, although they may also be applied to existing buildings during renovations. Finally, as recommended in previous sections, compliance with the amended Connecticut Building Code for wind speeds is necessary.

### **6.6.3 Public Education and Awareness**

The public is typically more aware of the hazardous effects of snow, ice, and cold weather than they are with regard to other hazards discussed in this plan. Nevertheless, people are still stranded in automobiles, get caught outside their homes in adverse weather conditions, and suffer heart failure while shoveling during each winter in

Connecticut. Public education should therefore focus on safety tips and reminders to individuals about how to prepare for cold and icy weather, including stocking homes, preparing vehicles, and taking care of themselves during winter storms.

#### **6.6.4 Emergency Services**

Emergency services personnel and departments such as Police and Fire should identify areas which may be difficult to access during winter storm events and devise contingency plans to continue servicing those areas during moderate storms. The creation of through streets with new developments increases the amount of egress for residents and emergency personnel into neighborhoods. However, the creation of through streets is not consistent with the Town's Plan of Conservation and Development.

The Town of Bethlehem by default has plowing routes that prioritize access to and from most critical facilities, as these facilities are almost all located in the municipal complex. However, the Town should make the effort to design standard plowing routes that prioritize the remaining critical facilities. Residents should be made aware of the plow routes in order to plan how to best access critical facilities, perhaps via posting of the general routes on the Town website. Such routes should also be posted in other municipal buildings, such as the library and the post office. It is recognized that plowing critical facilities may not be a priority to all residents, as people typically expect their own roads to be cleared as soon as possible.

Available shelters should also be advertised and their locations known to the public prior to a storm event. Finally, existing mutual aid agreements with surrounding municipalities should be reviewed and updated as necessary to ensure help will be available when needed.

### **6.6.5 Structural Projects**

Structural projects for many aspects of Winter Storms are not possible. However, projects can be designed to mitigate icing due to poor drainage and other factors. In regards to the intersection of Cabbage Lane and Route 132, the Town wants to install 200 feet of catch basins down the end of Cabbage Lane and along Route 132 to facilitate street drainage. The Town plans to try to acquire grant funding at some point for this project. In addition, the Town should investigate complaints of icing at the intersection of Wood Creek Road and Route 132 and perform corrective actions if applicable.

### **6.7 Summary of Recommended Mitigation Measures, Strategies, and Alternatives**

Most of the recommendations in Sections 3.6 for mitigating flooding are suitable for mitigation of flooding caused by winter storms. These are not repeated in this subsection. While many potential mitigation activities for the remaining winter storm hazards were addressed in Section 6.6, the recommended mitigation strategies for mitigating wind, snow, and ice in the Town of Bethlehem are listed below.

- ☐ Increase tree limb maintenance and inspections, especially in the downtown areas
- ☐ Continue to require that utilities be placed underground in new developments and pursue funding to place them underground in existing developed areas
- ☐ Review and post evacuation plans to ensure timely migration of people seeking shelter in all areas of Bethlehem.
- ☐ Post a list of Town sheltering facilities in the Town Hall and on the Town's website so residents can best plan how to access to critical facilities during a winter storm event.
- ☐ Prioritize plowing routes and post the snow plowing prioritization in Town buildings each winter to increase public awareness.

- ❑ Consider modifying the Town Plan of Conservation and Development to encourage two modes of egress into every neighborhood by the creation of through streets.
- ❑ Pursue grant funding to install drainage along Cabbage Lane and Route 132 to eliminate icing at this dangerous intersection. Consider removing some trees to improve sight lines if possible.
- ❑ Investigate complaints of icing at the intersection of Wood Creek Road and Route 132, and perform corrective actions if applicable.
- ❑ Encourage the Horace Mann Nature Center to widen and improve the access road from Bethlehem to facilitate emergency and standard vehicular access.

In addition, important recommendations that apply to all hazards are listed in Section 10.1.

## **7.0 EARTHQUAKES**

### **7.1 Setting**

The entire Town of Bethlehem is susceptible to earthquakes. However, even though earthquakes have the potential to occur anywhere both in the Town and in the northeastern United States, the effects may be felt differently in some areas based on the type of geology. In general, earthquakes are considered a hazard that is possible to occur, but that may cause significant effects to a large area of the Town (Appended Table 1).

### **7.2 Hazard Assessment**

An earthquake is a sudden rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and telephone lines, and often cause landslides, flash floods, fires, avalanches, and tsunamis. Earthquakes can occur at any time without warning.

The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. The magnitude and intensity of an earthquake is determined by the use of the Richter scale and the Mercalli scale, respectively.

The Richter scale defines the magnitude of an earthquake. Magnitude is related to the amount of seismic energy released at the hypocenter of the earthquake. It is based on the amplitude of earthquake waves recorded on instruments which have a common calibration. The magnitude of an earthquake is thus represented by a single, instrumentally determined value recorded by a seismograph, which record the varying amplitude of ground oscillations.



The magnitude of an earthquake is determined from the logarithm of the amplitude of recorded waves. Being logarithmic, each whole number increase in magnitude represents a tenfold increase in measured strength. Earthquakes with a magnitude of about 2.0 or less are usually called micro-earthquakes, and are generally only recorded locally. Earthquakes with magnitudes of 4.5 or greater are strong enough to be recorded by seismographs all over the world.

The effect of an earthquake on the Earth's surface is called the intensity. The Modified Mercalli Intensity Scale consists of a series of key responses such as people awakening, movement of furniture, damage to chimneys, and total destruction. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It is an arbitrary ranking based on observed effects.

*The following is a description of the 12 levels of Modified Mercalli intensity from the USGS.*

- I. Not felt except by a very few under especially favorable conditions.
- II. Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
- III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration similar to the passing of a truck. Duration estimated.
- IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
- V. Felt by nearly everyone; many awakened. Some dishes and windows broken. Unstable objects overturned. Pendulum clocks may stop.
- VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
- VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
- VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
- IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
- X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
- XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
- XII. Damage total. Lines of sight and level are destroyed. Object thrown in the air.

Unlike seismic activity in California, earthquakes in Connecticut are not associated with specific known faults. Instead, earthquakes with epicenters in Connecticut are referred to

as intra-plate activity. Bedrock in Connecticut and New England in general is highly capable of transmitting seismic energy; thus, the area impacted by an earthquake in Connecticut can be four to 40 times greater than that of California. In addition, population density is up to 3.5 times greater in Connecticut than in California, potentially putting a greater number of people at risk.

The built environment in Connecticut includes old, non-reinforced masonry that is not seismically designed. Those who live or work in non-reinforced masonry buildings, especially those built on filled land or unstable soils, are at the highest risk for injury due to the occurrence of an earthquake.

### 7.3 **Historic Record**

According to the USGS Earthquake Hazards Program, Connecticut is a region of very minor seismic activity. This assessment is based on lack of historical and instrumental reports of strong earthquakes. However, earthquakes do occur in this region. The New England states regularly register seismic events.

According to the Northeast Region Emergency Consortium, there were 137 recorded earthquakes in Connecticut between 1568 and 1989. The most severe earthquake in Connecticut's history occurred at East Haddam on May 16, 1791. Stone walls and chimneys were toppled during this quake. Additional instances of seismic activity occurring in and around Connecticut includes is provided below, based on information provided in USGS documents, the Connecticut Natural Hazards Mitigation Plan (2007), other municipal hazard mitigation plans, and newspaper articles.

- ❑ A devastating earthquake near Three Rivers, Quebec on February 5, 1663 caused moderate damage in parts of Connecticut.
- ❑ Strong earthquakes in Massachusetts in November 1727 and November 1755 were felt strongly in Connecticut.

- ❑ In April 1837, a moderate tremor occurred at Hartford, causing alarm but little damage.
- ❑ In August 1840, another moderate tremor with its epicenter 10 to 20 miles north of New Haven shook Hartford buildings but caused little damage.
- ❑ In October 1845, an Intensity V earthquake occurred in Bridgeport. An Intensity V earthquake would be approximately 4.3 on the Richter scale.
- ❑ On June 30, 1858, New Haven and Derby were shaken by a moderate tremor.
- ❑ On July 28, 1875, an early morning tremor caused Intensity V damage throughout Connecticut and Massachusetts.
- ❑ The second strongest earthquake to impact Connecticut occurred near Hartford on November 14, 1925. No significant damage was reported.
- ❑ The Timiskaming, Ontario earthquake of November 1935 caused minor damage as far south as Cornwall, Connecticut. This earthquake affected one million square miles of Canada and the United States.
- ❑ An earthquake near Massena, New York in September 1944 produced mild effects in Hartford, Marion, New Haven, and Meriden, Connecticut.
- ❑ An Intensity V earthquake was reported in Stamford in March of 1953, causing shaking but no damage.
- ❑ On November 3, 1968, another Intensity V earthquake in southern Connecticut caused minor damage in Madison and Chester.
- ❑ Recent earthquake activity has been recorded near New Haven in 1988, 1989, and 1990 (2.0, 2.8, and 2.8 in magnitude, respectively), in Greenwich in 1991 (3.0 magnitude), and on Long Island in East Hampton, New York in 1992.
- ❑ The most recent earthquake to occur in Connecticut occurred on March 11, 2008. It was a 2.0 magnitude with its epicenter three miles northwest of the center of Chester.

#### **7.4 Existing Programs, Policies, and Mitigation Measures**

The Connecticut Building Codes include design criteria for buildings specific to municipality, as adopted by the Building Officials and Code Administrators (BOCA).

These include the seismic coefficients for building design in the Town of Bethlehem. The Town has adopted these codes for new construction and they are enforced by the Town Building Official. Due to the infrequent nature of damaging earthquakes, land use policies in the Town of Bethlehem do not address earthquake hazards.

The Subdivision Regulations of the Town of Bethlehem (Section 3.7.2) prohibits development on slopes greater than 25%. The Town reserves the right to impose more stringent regulations on a site to maintain the stability of the bank under the proposed conditions.

## **7.5 Vulnerabilities and Risk Assessment**

According to the USGS, Connecticut is at a low risk for experiencing a damaging earthquake. The USGS has determined that the State of Connecticut has a 10% chance that at some point in a 50-year period an earthquake would cause peak acceleration (ground shaking) values of 4% to 8% of the force of gravity. To appreciate why these values of ground shaking are expressed as a percentage of the force of gravity, note that it requires more than 100% of the force of gravity to throw objects up in the air.

In terms of felt effects and damage, ground motion at the level of several percent of gravity corresponds to the threshold of damage to buildings and houses (an earthquake intensity of approximately V). For comparison, reports of "dishes, windows and doors disturbed" corresponds to an intensity of about IV, or about 2% of gravity. Reports of "some chimneys broken" correspond to an intensity of about VII, or about 10% to 20% of gravity. According to the USGS National Seismic Hazard Mapping Project (2008), an earthquake impacting the Town of Bethlehem has a 2% chance of exceeding a peak acceleration of 10-12% of the force of gravity in a 50-year period.

According to the FEMA HAZUS-HM Estimated Annualized Earthquake Losses for the United States (2008) document, FEMA used probabilistic curves developed by the USGS

for the National Earthquakes Hazards Reduction Program to calculate Annualized Earthquake Losses (AEL) for the United States. Based on the results of this study, FEMA calculated the AEL for Connecticut to be \$11,622,000. This value placed Connecticut 30<sup>th</sup> out of the 50 states in terms of AEL. The magnitude of this value stems from the fact that Connecticut has a large building inventory that would be damaged in a severe earthquake, and takes into account the lack of damaging earthquakes in the historical record.

The ***AEL*** is the expected losses due to earthquakes each year. Note that this number represents a long term average; thus actual earthquake losses may be much greater or non-existent for a particular year.

The current Connecticut Natural Hazard Mitigation Plan (2007) states that "there is a 66% chance that an earthquake of a 2.7 magnitude or greater" will occur in the area of Bethlehem. According to the previous Connecticut Natural Hazard Mitigation Plan (2004), the State of Connecticut Department of Emergency Management notes the chance that a damaging earthquake of magnitude 5.0 or greater will occur within the state in any one year is 5%, and that the odds of an earthquake of magnitude 6.0 are about one in 300 each year. Therefore, the Town of Bethlehem is unlikely to experience a damaging earthquake in any given year. This belief is reinforced by the timeline and damages recorded in the historical record presented in Section 7.3.

Surficial earth materials behave differently in response to seismic activity. Unconsolidated materials such as sand and artificial fill can amplify the shaking associated with an earthquake. In addition, artificial fill material has the potential for liquefaction. When

***Liquefaction*** is a phenomenon in which the strength and stiffness of a soil are reduced by earthquake shaking or other rapid loading. It occurs in soils at or near saturation, especially the finer textured soils.

liquefaction occurs, the strength of the soil decreases and the ability of soil to support building foundations and bridges is reduced. Increased shaking and liquefaction can cause greater damage to buildings and structures, and a greater loss of life.

As explained in Section 2.3, several areas in the Town of Bethlehem are underlain by sand and gravel. Figure 2-5 depicts surficial materials in the Town. Structures in these areas are at increased risk from earthquakes due to amplification of seismic energy and/or collapse. The best mitigation for future development in areas of sandy material may be application of the most stringent building codes, or possibly the prohibition of new construction. However, many of these areas occur in floodplains associated with the Weekepeemee River, East Spring Brook, and the Nonnewaug River, so they are already regulated. The areas that are not at increased risk during an earthquake due to unstable soils are the areas in Figure 2-5 underlain by glacial till.

Areas of steep slopes can collapse during an earthquake, creating landslides. Seismic activity can also break utility lines, such as water mains, electric and telephone lines, and stormwater management systems. Damage to utility lines can lead to fires, especially in electric and gas mains. Dam failure can also pose a significant threat to developed areas during an earthquake. For this Plan, dam failure has been addressed separately in Section 9.0.

## **7.6 Potential Mitigation Measures, Strategies, and Alternatives**

As earthquakes are difficult to predict and can affect the entire Town of Bethlehem, potential mitigation can only include adherence to building codes, education of residents, and adequate planning. The following potential mitigation measures have been identified:

- ☐ Consider preventing new residential development in areas prone to collapse.
- ☐ Continue to require adherence to the state building codes.
- ☐ Ensure that municipal departments have adequate backup facilities in case earthquake damage occurs.

In addition, important recommendations that apply to all hazards are listed in Section 10.1.

## 8.0 ***DAM FAILURE***

### 8.1 ***Setting***

Dam failures can be triggered suddenly, with little or no warning, from other natural disasters such as floods and earthquakes. Dam failures often occur during flooding when the dam breaks under the additional force of floodwaters. In addition, a dam failure can cause a chain reaction where the sudden release of floodwaters causes the next dam downstream to fail. With 19 registered dams and potentially several other minor dams in the Town, dam failure can occur almost anywhere in Bethlehem. While flooding from a dam failure generally has a medium geographic extent, the effects are potentially catastrophic. Fortunately, a major dam failure is considered only a possible natural hazard event in any given year (Appended Table 2).

### 8.2 ***Hazard Assessment***

The Connecticut DEP administers the statewide Dam Safety Program, and designates a classification to each state-registered dam based on its potential hazard.

- ❑ *Class AA* dams are negligible hazard potential dams that upon failure would result in no measurable damage to roadways and structures, and negligible economic loss.
- ❑ *Class A* dams are low hazard potential dams that upon failure would result in damage to agricultural land and unimproved roadways, with minimal economic loss.
- ❑ *Class BB* dams are moderate hazard potential dams that upon failure would result in damage to normally unoccupied storage structures, damage to low volume roadways, and moderate economic loss.
- ❑ *Class B* dams are significant hazard potential dams that upon failure would result in possible loss of life, minor damage to habitable structures, residences, hospitals,



convalescent homes, schools, and the like, damage or interruption of service of utilities, damage to primary roadways, and significant economic loss.

- ❑ *Class C* dams are high potential hazard dams that upon failure would result in loss of life and major damage to habitable structures, residences, hospitals, convalescent homes, schools, and main highways with great economic loss.

As of 1996, there were 19 DEP-registered dams within the Town of Bethlehem, of which one is Class AA, nine are Class A, six are Class BB, one is Class B, one is Class C, and one is undefined. The list of Class B and C dams was updated by the DEP in 2007, with five dams being reduced from Class B status. Dams in Bethlehem are listed in Table 8-1. Note that the registered names of some dams do not match the current road names.

**Table 8-1**  
**Dams Registered with the DEP in the Town of Bethlehem**

Number	Name	Location	Class
1001	Bronson Lockwood Dam	Off Kasson Road	C
1002	Addie Road Pond Dam	Molzon Lane	BB*
1003	Benjamin Pond Dam	Munger Lane	BB
1004	Watertown Reservoir Dam	Off Kasson Road	BB*
1005	Bird Pond Dam	Wood Creek Road	B
1006	Long Meadow Pond Dam	Lake Drive	BB*
1007	Zieglers Pond Dam	Carmel Hill Road North	BB*
1008	Kassar Road Pond Dam	Kasson Road	BB*
1009	Asmus Dam	Guilds Hollow Road	A
1010	Leever Dam	Guilds Hollow Road	A
1011	Spring Brook Pond Dam	Off Woodland Road	A
1012	Messenger Lane Pond Dam	Off Munger Lane	A
1013	Unnamed Dam	Off Hickory Lane	A
1014	Park Pond Dam	Woods Edge Road	A
1015	Barnes Pond Dam	Wood Creek Road	A
1016	Assard Pond Dam	Off Woodcreek Road	A
1017	Newman Pond Dam	Arch Bridge Road	-
1020	Thurber Pond Dam	Off Harrison Lane	A
1022	Angelus Pond Dam	Off Flanders Road	AA

\*Rated a Class B dam in 1996, but was no longer rated Class B in 2007.

This section primarily discusses the possible effects of failure of significant and high hazard (Class B & C) dams. In addition, this section discusses the failure of Long

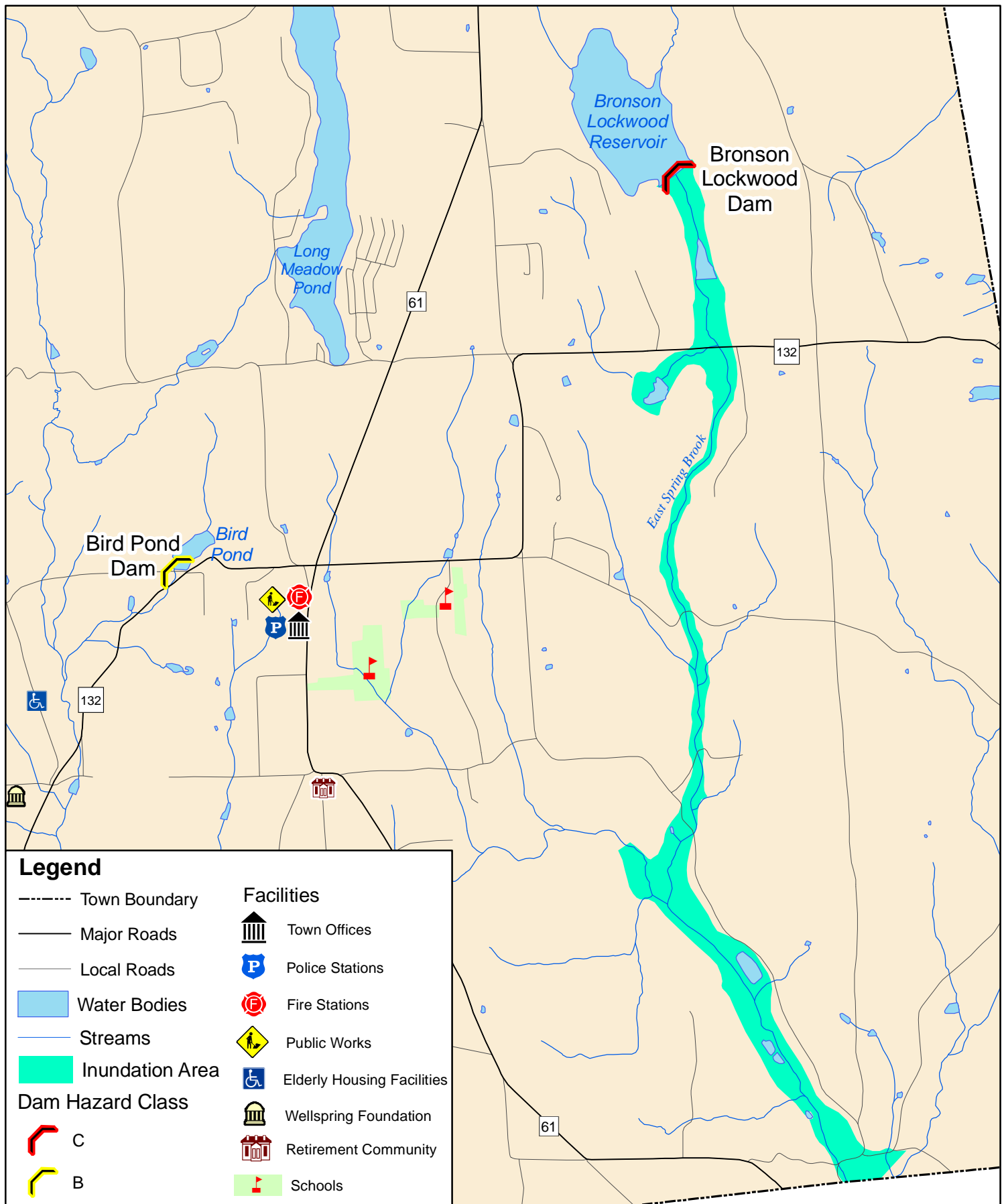
Meadow Pond Dam as it is owned by the Town of Bethlehem. Failure of a Class C dam has the potential for loss of life and property damage totaling millions of dollars. Failure of a Class B dam has the potential for loss of life and minor damage to property and critical facilities. Bronson Lockwood Dam is the only Class C dam in Bethlehem, and Bird Pond Dam is currently the only Class B dam in Bethlehem. The Class B and C dams, along with the dam failure inundation area for Bronson Lockwood Dam, are shown in Figure 8-1. A close-up of the area downstream of Long Meadow Pond is shown on Figure 8-2.

### 8.3 **Historic Record**

Approximately 200 notable dam and reservoir failures occurred worldwide in the twentieth century. More than 8,000 people died in these disasters. The following is a listing of some of the more catastrophic dam failures in Connecticut's recent history:

- ❑ 1938 and 1955: Exact numbers of dam failures caused by these floods are unavailable, but Connecticut DEP believes that more dams were damaged in these events than in the 1982 or 2005 flooding events.
- ❑ 1961: Crystal Lake dam in Middletown failed, injuring three and severely damaging 11 homes.
- ❑ 1963: Failure of the Spaulding Pond Dam in Norwich caused six deaths and six million dollars in damage (1963 dollars).
- ❑ June 5-6, 1982: Connecticut experienced a severe flood that caused 17 dams to fail and seriously damaged 31 others. Failure of the Bushy Hill Pond Dam in Deep River caused \$50 million in damages, and the remaining dam failures caused nearly \$20 million in damages.

# Figure 8-1: High Hazard Dams in Bethlehem



Source: "Roads", c1984 - 2008 Tele Atlas, Rel. 04/08.  
 "Town Boundary", "Hydrography", "Flood Zones", DEP  
 "Inundation Area", Emergency Operations Plan, Bronson E. Lockwood Reservoir Dam &  
 Watertown Reservoir Dam, Bethlehem, Connecticut by Roald Haestad, Inc. April 1997  
 "Facilities", COGCNV  
 For general planning purposes only. Delineations may not be exact.  
 August 2008




0 0.25 0.5 Miles



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<div><div>Engineering, Landscape Architecture and Environmental Science</div><div>MILONE &amp; MACBROOM®</div><div>99 Realty Drive Cheshire, Connecticut 06410 (203) 271-1773 Fax: (203) 272-9733 www.miloneandmacbroom.com</div></div>	<div>Long Meadow Pond Subset Area</div>	<div>LOCATION: Bethlehem, CT</div>
<div>MMI#: 2937-02 MXD: H:\Figure8-2.mxd SOURCE: 2004 CLEAR, CT DEP</div>	<div><div>N</div><div>Town of Bethlehem Natural Hazard Pre-Disaster Mitigation Plan</div></div>	<div>Map By: SJB Date: Dec.2008 Scale: 1"=500'</div>
		<div>SHEET: Figure 8-2</div>



More recently, the NCDC reports that flash flooding on April 16, 1996 caused three small dams in Middletown and one in Wallingford to breach, and the Connecticut DEP reported that the sustained heavy rainfall from October 7 to 15, 2005 caused 14 complete or partial dam failures, and damage to 30 other dams throughout the State. A sample of damaged dams is summarized in Table 8-2.

**Table 8-2**  
**Dams Damaged Due to Flooding from October 2005 Storms**

Number	Name	Location	Class	Damage Type	Ownership
-----	Somerville Pond Dam	Somers	--	Partial Breach	DEP
4701	Windsorville Dam	East Windsor	BB	Minor Damage	Private
10503	Mile Creek Dam	Old Lyme	B	Full Breach	Private
-----	Staffordville Reservoir #3	Union	--	Partial Breach	CT Water Co.
8003	Hanover Pond Dam	Meriden	C	Partial Breach	Meriden
-----	ABB Pond Dam	Bloomfield	--	Minor Damage	Private
4905	Springborn Dam	Enfield	BB	Minor Damage	DEP
13904	Cains Pond Dam	Suffield	A	Full Breach	Private
13906	Schwartz Pond Dam	Suffield	BB	Partial Breach	Private
14519	Sessions Meadow Dam	Union	BB	Minor Damage	DEP

No major dam failures have occurred in the Town of Bethlehem. According to Town personnel, the dams throughout Town are in varying stages of condition, with the higher hazard dams being in good to excellent condition. The following paragraphs provide a description and highlight the general condition these dams based on information available at the Connecticut DEP:

- Bronson E. Lockwood Dam – This reservoir dam is owned by the Watertown Fire District and located in the headwaters of East Spring Brook in northeastern Bethlehem. It consists of an earth and rockfill dam approximately 600 feet long. The dam is 142 feet high and 2,000 feet long. Outlet works are controlled by a gate house in the center of the structure. The dam is maintained by the Watertown Fire District and is believed to be in good to excellent condition. An Emergency Operations Plan (EOP) for this dam from 1997 is on file with the DEP.

- ❑ Bird Pond Dam – This private dam is located at 10 Woodcreek Road in central Bethlehem. The dam impounds an unnamed tributary on the way to its confluence with the Weekepeemee River. Outlet works are believed to include an earthen and concrete overflow into the outlet stream channel. The dam is maintained by the owner and is believed to be in good condition.
- ❑ Long Meadow Pond Dam – This dam is owned by the Town of Bethlehem and is currently rated below a Class B dam. This dam overtopped during the April 2007 storms, and though the dam sustained some damage, it did not fail. The Connecticut DEP sent the Town of Bethlehem an engineering request letter in October 2007 requiring the Town to retain an engineer to perform a hydraulic and hydrologic analysis of the dam, and to design improvements to allow the dam to safely pass the 100-year storm event.

#### 8.4 **Existing Programs, Policies, and Mitigation Measures**

The dam safety statutes are codified in Section 22a-401 through 22a-411 inclusive of the Connecticut General Statutes. Sections 22a-409-1 and 22a-409-2 of the Regulations of Connecticut State Agencies, have been enacted which govern the registration, classification, and inspection of dams. Dams must be registered by the owner with the DEP, according to Connecticut Public Act 83-38.

Dam Inspection Regulations require that over 600 dams in Connecticut be inspected annually. The DEP currently prioritizes inspections of those dams which pose the greatest potential threat to downstream persons and properties. Dams found to be unsafe under the inspection program must be repaired by the owner. Depending on the severity of the identified

***Dams regulated by the DEP*** must be designed to pass the 100-year rainfall event with one foot of freeboard, a factor of safety against overtopping.

***Critical and high hazard dams*** are required to meet a design standard greater than the 100-year rainfall event.

deficiency, an owner is allowed reasonable time to make the required repairs or remove the dam. If a dam owner fails to make necessary repairs to the subject structure, the DEP may issue an administrative order requiring the owner to restore the structure to a safe condition and may refer noncompliance with such an order to the Attorney General's Office for enforcement. As a means of last resort, the DEP Commissioner is empowered by statute to remove or correct, at the expense of the owner, any unsafe structures which present a clear and present danger to public safety.

Owners of Class C dams are required to maintain Emergency Operation Plans. The Watertown Fire District is responsible for maintaining the EOP for the Bronson E. Lockwood Dam. It is believed that no EOP exists for Bird Pond Dam.

## **8.5 Vulnerabilities and Risk Assessment**

By definition, failure of Class C dams may cause catastrophic loss of life and property. Therefore, the failure of Bronson E. Lockwood Dam would likely have the highest impact on the residents and infrastructure of the Town of Bethlehem. However, the failure of any of the 18 other dams in Town could also have impacts within the Town of Bethlehem. The impacts related to the larger and higher-hazard dams in Town, namely the Bronson E. Lockwood Dam, Bird Pond Dam, and Long Meadow Pond Dam, are described in general detail below.

### **Bronson E. Lockwood Dam**

The dam failure inundation area shown in Figure 8-1 and described below for the Bronson E. Lockwood dam was scanned in and redrawn from its EOP. Thus, the dam failure inundation area shown in Figures 8-1 is for planning purposes only and does not replace the official EOP map.

Bronson E. Lockwood Dam is owned by the Watertown Fire District and is used for public water supply. Based on dam failure inundation maps from the EOP, a dam failure at full pool height (worst-case scenario) would cause flooding along the East Spring Brook corridor all the way to the Nonnewaug River at the Watertown town boundary. The Watertown Reservoir Dam immediately downstream would likely fail, and water would likely wash out Route 132. Floodwaters would backwater up an unnamed stream to flood the area around Kassar Road Pond Dam, and Spring Brook Pond Dam would likely fail. Magnolia Hill Road and Maddox Road would likely be overtopped, and several houses along Nonnewaug Road / Paradise Valley Road would likely be inundated. Flood waters would spread in the area of Nonnewaug Road, Hickory Lane, and Porter Hill Road, ending the inundation area at the confluence of East Spring Brook with the Nonnewaug River.

#### *Bird Pond Dam*

Bird Pond Dam is privately owned and impounds an unnamed tributary to the Weekepeemee River. A failure of this dam would likely overtop Wood Creek Road, potentially flooding several homes nearby. Flood waters could also over top Route 132 twice downstream, and would likely washout the Asmus Dam as well. Downstream of the Asmus Dam, floodwaters would enter the Weekepeemee River and would likely not cause further flooding damage, although damage could be exacerbated if the failure Bird Pond Dam was caused in part by the failure of Long Meadow Pond Dam (see below).

#### *Long Meadow Pond Dam*

Long Meadow Pond Dam is owned by the Town of Bethlehem. The dam was formerly rated Class B but has recently been downgraded to at highest a Class BB. Long Meadow Pond is shallow (ten to 12 feet maximum depth) but is very long so it contains a lot of volume. The Town has been consistently performing all the necessary and required maintenance for this dam. Roald Haestad, Inc. performed an inspection following the



dam overtopping in April 2007 and made recommendations regarding the design of this dam. The overtopping of the dam occurred because the dam was not properly designed to pass the 100-year storm event. The Town is discussing its options with the DEP regarding correcting the design flaw, but wants to acquire grant funding to complete the project.

Should this dam fail, it is likely that floodwaters would travel down the outlet stream and cause damage to Lake Drive and Benjamin Pond Dam. Some flood waters could potentially overtop Munger Lane and drain south through the wetlands to Bird Pond, while the majority would likely continue southwest through forest into the Weekepeemee River. If the dam failure occurs during heavy rain, the Weekepeemee could already be flooded, and the additional waters would exacerbate flooding conditions downstream, particularly at Wood Creek Road, Crane Hollow Road, and in the Town of Woodbury. Increased flooding conditions could also potentially occur along the Pomperaug River in Woodbury and Southbury.

## **8.6 Potential Mitigation Measures, Strategies, and Alternatives**

The Dam Safety Section of the DEP Inland Water Resources Division is charged with the responsibility for administration and enforcement of Connecticut's dam safety laws. The existing statutes require that permits be obtained to construct, repair, or alter dams, and that existing dams be registered and periodically inspected to assure that their continued operation does not constitute a hazard to life, health, or property.

The Connecticut DEP also administers the Flood and Erosion Control Board program, which can provide non-competitive state funding for repair of municipality-owned dams. Funding is limited by the state bond commission. State statute Section 25-84 allows municipalities to form Flood and Erosion Control Boards, but municipalities must take action to create the board within the context of the local government, such as by revising the municipal charter. The Town of Bethlehem may wish to establish such a Flood and

Erosion Control Board to oversee local flooding and erosion problems and municipal dams. More information regarding the Flood and Erosion Control Board program can be found at [http://www.ct.gov/dep/lib/dep/water\\_inland/flood\\_mgmt/fecb\\_program.pdf](http://www.ct.gov/dep/lib/dep/water_inland/flood_mgmt/fecb_program.pdf).

The Town of Bethlehem should work with the Watertown Fire District, private property owners, and the Connecticut DEP to stay up to date on the evolution of Emergency Operations Plans and Dam Failure Analyses for the significant and high hazard dams in Bethlehem. When possible, copies of these documents should be made available at the Town Hall for reference and public viewing.

With regard to Long Meadow Pond Dam, the Town of Bethlehem is pursuing modifications of the dam to pass the 100-year flood event, and should review and update the Emergency Operations Plan when modifications are completed. The Town should also maximize Town emergency preparedness for a potential dam failure. The Town should continue its ongoing program of inspection and maintenance. In addition, all Class C & B dams in the Town should continue to be regularly inspected by their respective owners and DEP, with maintenance performed as required to keep the dams in safe and functional order. The Town should also consider implementing occasional Town inspections of Class A, AA, BB, and unranked dams.

The Town of Bethlehem should consider including dam failure areas into a CodeRED-style emergency notification system. This system combines database and GIS mapping technologies to deliver outbound emergency notifications to geographic areas or specific groups of people such as emergency responder teams at a rate of up to 60,000 calls per hour. This technology should be used to warn downstream residents of an impending dam failure and facilitate evacuation. The COGCNV is currently investigating the installation of such technology in all of its member municipalities.

In addition, there are several suggested potential mitigation strategies which are applicable to all hazards in this plan. These are outlined in the Section 10.1.

## **9.0 WILDFIRES**

### **9.1 Setting**

The ensuing discussion about wildfires is focused on the undeveloped wooded and shrubby areas of Bethlehem, along with low-density suburban type development found at the margins of these areas known as the wildland interface. Structural fires in higher density areas of the Town are not considered.

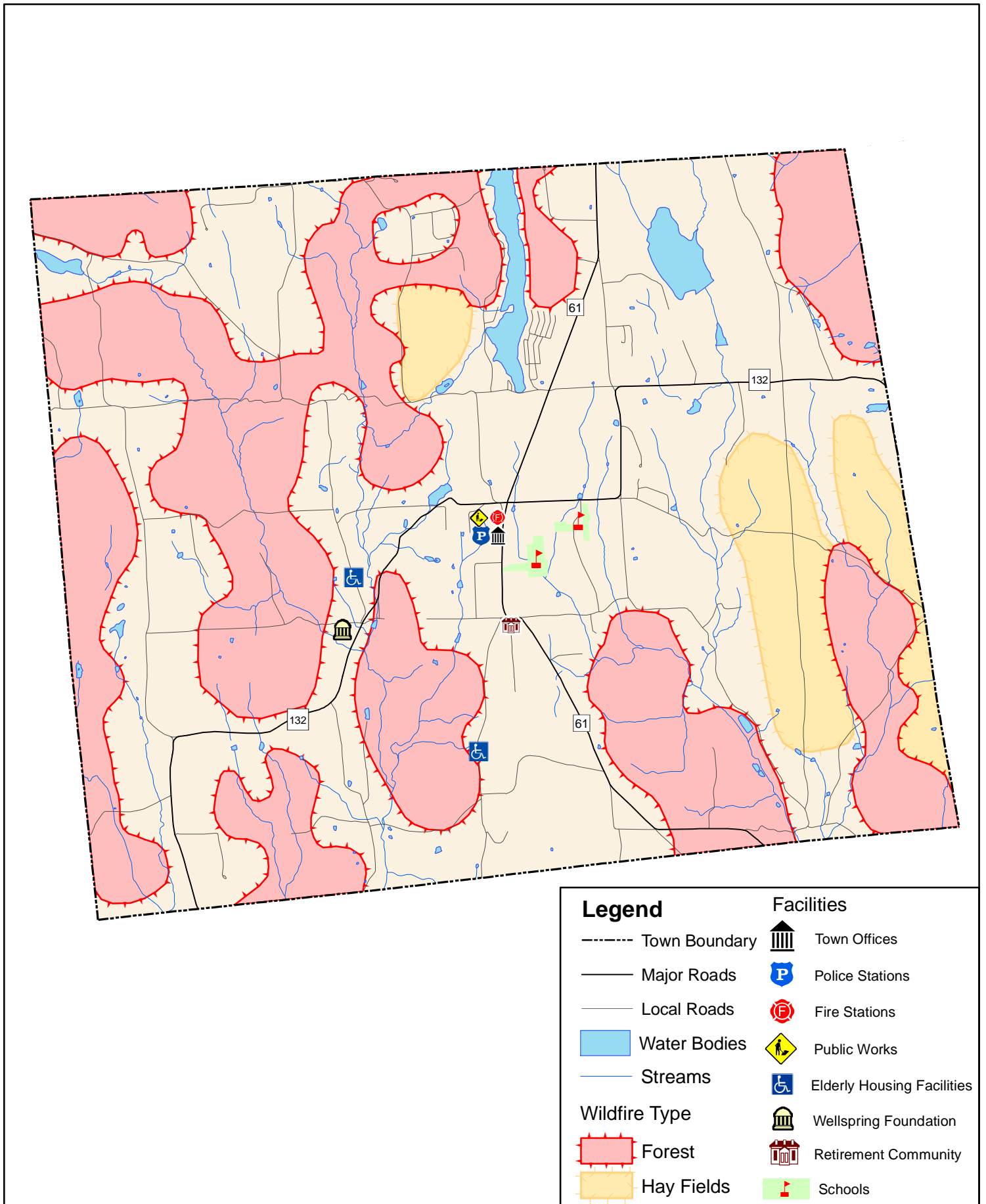
The Town of Bethlehem is considered a low-risk area for wildfires. Wildfires are of particular concern in the many wooded areas and other areas with poor access for fire-fighting equipment. Figure 9-1 presents the wildfire risk areas for the Town of Bethlehem. Hazards associated with wildfires include property damage and loss of habitat. Wildfires are considered a likely event each year, but when one occurs it is generally contained to a small range with limited damage to non-forested areas.

### **9.2 Hazard Assessment**

The current Connecticut Hazard Mitigation Plan does not specifically define wildfires separate from forest fires, but wildfires are well-defined by the Massachusetts Hazard Mitigation Plan as being "highly destructive, uncontrollable fires." Although the term brings to mind images of tall trees engulfed in flames, wildfires can occur as brush and shrub fires, especially under dry conditions. Wildfires are also known as "wildland fires."

Nationwide, humans have caused approximately 90% of all wildfires in the last decade. Accidental and negligent acts include unattended campfires, sparks, burning debris, and irresponsibly discarded cigarettes. The remaining 10% of fires are caused mostly by lightning.

# Figure 9-1: Bethlehem Wildfire Risk Area



Nevertheless, wildfires are also a natural process, and their suppression is now recognized to have created a larger fire hazard, as live and dead vegetation accumulates in areas where fire has been prevented. In addition, the absence of fire has altered or disrupted the cycle of natural plant succession and wildlife habitat in many areas. Consequently, federal, state and local agencies are committed to finding ways, such as prescribed burning to reintroduce fire into natural ecosystems, while recognizing that fire fighting and suppression are still important.

Connecticut has a particular vulnerability to fire hazards where urban development and wildland areas are in close proximity. The "wildland/urban interface" is where many such fires are fought. Wildland areas are subject to fires because of weather conditions and fuel supply. An isolated wildland fire may not be a threat, but the combined effect of having residences, businesses, and lifelines near a wildland area causes increased risk to life and property. Thus, a fire that might have been allowed to burn itself out with a minimum of fire fighting or containment in the past is now fought to prevent fire damage to surrounding homes and commercial areas, as well as smoke threats to health and safety in these areas.

### **9.3 Historic Record**

According to the Connecticut Natural Hazards Mitigation Plan (2007), Connecticut enacted its first state-wide forest fire control system in 1905, when the state was largely rural with very little secondary growth forest. By 1927, the state had most of the statutory foundations for today's forest fire control programs and policies in place, such as the State Forest Fire Warden system, a network of fire lookout towers and patrols, and regulations regarding open burning. The severe fire weather in the 1940's prompted the state legislature to join the Northeastern Interstate Forest Fire Protection Compact with its neighbors in 1949. Today, most of Connecticut's forested areas are secondary growth forests. According to the Connecticut DEP, forest has reclaimed over 500,000 acres of land that was used for agriculture in 1914. However, that new forest has been

fragmented in the past few decades by residential development. The urban/wildland interface is increasing each year as sprawl extends further out from Connecticut's cities.

The technology used to combat wildfires has significantly improved since the early 20<sup>th</sup> century. An improved transportation network, coupled with advances in firefighting equipment, communication technology, and training, has improved the ability of firefighters to minimize damage due to wildfires in the state. For example, radio and cellular technologies have greatly improved fire fighting command capabilities.

According to the USDA Forest Service Annual Wildfire Summary Report for 1994 through 2003, an average of 600 acres per year in Connecticut was burned by wildfires. In general, the fires are small and detected quickly, with most wildfires being contained to less than 10 acres in size. The number one cause of wildfires is arson, with about half of all wildfires being intentionally set.

Traditionally, the highest forest fire danger in Connecticut occurs in the spring from mid-March to mid-May. The worst wildfire year for Connecticut in the past decade occurred during the extremely hot and dry summer of 1999. Over 1733 acres of Connecticut burned in 345 separate wildfires, an average of about five acres per fire. Only one wildfire occurred between 1994 and 2003 that burned over 300 acres, and a wildfire in 1986 in the Mattatuck State Forest in the nearby Town of Watertown, CT burned 300 acres. More recently, a 30-acre wildfire occurred in Oxford at the south end of the Central Naugatuck Valley region on April 19, 2008. Much of Bethlehem is privately owned forest, and fires have occurred throughout the Town.

#### **9.4 Existing Programs, Policies, and Mitigation Measures**

Existing mitigation for wildland fire control is typically focused on Fire Department training and maintaining an adequate supply of equipment. The Town of

Bethlehem Subdivision Regulations require the creation of fire ponds for new subdivisions or re-subdivisions. In addition, new roads, subdivisions, and fire ponds are required to allow for fire truck access.

Unlike wildfires on the west coast of the United States where the fires are allowed to burn toward development and then stopped, the Bethlehem Fire Department goes to the fires. This proactive approach is believed to be effective for controlling wildfires. The Fire Department has some water storage capability, but primarily relies on the use of 32 fire ponds with dry hydrants to fight fires throughout Town.

The Bethlehem Fire Department is often the first responder for fires that happen in the Land Trust on the Watertown/Woodbury/Bethlehem boundary, and coordinates with the Watertown and Woodbury Fire Departments to control these forest fires. The Fire Department is also the first responder to part of Camp Columbia's property off Munger Lane and the nearby state forest in Morris. The DEP has recently increased public access to this area, so the Town feels it is at a higher risk for fires. The Bethlehem Fire Department has a four-wheel drive brush truck capable of accessing remote locations. The Town also has mutual aid agreements with all of its neighbors.

Finally, the DEP Forestry Division uses the rainfall data recorded by the Automated Flood Warning system (see Section 3.4) to compile forest fire probability forecasts. This allows the Division and the Town of Bethlehem to monitor the drier areas of the state in an effort to reduce forest fire risk.

## **9.5 Vulnerabilities and Risk Assessment**

The most common causes of wildfires are arson, lightning strikes, and fires started from downed trees hitting electrical lines. Thus, wildfires have the potential to occur anywhere and at any time in both undeveloped and lightly developed areas. The extensive forests and fields covering the state are prime locations for a wildfire. In many

areas, structures and subdivisions are built abutting forest borders, creating areas of particular vulnerability. Wildfires are more common in rural areas than in developed areas, as most fires in populated areas are quickly noticed and contained. The likelihood of a severe wildfire developing is lessened by the vast network of water features in the state, which create natural breaks likely to stop the spread of a fire. During long periods of drought, these natural features may dry up, increasing the vulnerability of the state to wildfires.

According to the Connecticut DEP, the actual forest fire risk in Connecticut is low due to several factors. First, the overall incidence of forest fires is very low. Secondly, as the wildfire/forest fire prone areas become fragmented due to development, the local fire departments have increased access to those neighborhoods for fire fighting equipment. Third, the problematic interface areas are site specific, such as driveways too narrow to permit emergency vehicles. Finally, trained fire fighters at the local and state level are readily available to fight fires in the state, and inter-municipal cooperation on such instances is common.

Based on the historic record presented in Section 9.3, most wildfires in Connecticut are relatively small. In the drought year of 1999, the average wildfire burned five acres in comparison to the two most extreme wildfires recorded since 1986 that burned 300 acres each. Given the availability of fire-fighting water in the Town, including the use of nearby water bodies, and long-standing mutual aid assurances the Town Fire Department has with neighboring communities, it is believed that these average and severe values are applicable to the Town as well. Indeed, Town personnel reported that the largest fires only burn a couple of acres before being contained despite the rural nature of the Town.

The wildfire risk areas presented in Figure 9-1 were defined as being contiguous wooded areas greater than 30 acres in size with limited access. These areas are generally associated with wooded water company lands, privately owned land trust property and forests, and Town-owned open space. The limited access conservation properties are



considered to be at the highest risk for fires. As each area borders residential sections of the Town, residents on the outskirts of these risk areas are the most vulnerable to fire, heat, and smoke effects of wildfires.

As described in Section 2, Bethlehem has many rural areas with hayfields. Town personnel feel that these areas are also at risk for wildfires, as such fires could quickly encompass the entire field during a drought. These areas are delineated separately on Figure 9-1, and often occur near residential areas and roadways, presenting an increased risk of smoke, heat, and fire damage to residents.

Despite having a large amount of forest/urban interface, the overall risk of wildfires occurring in the Town of Bethlehem is considered to be low. Such fires fail to spread far due speed of detection and strong fire response. The Town has no state parks, so there are few fires caused by out of control campfires. Town personnel report that the larger private tracts of forest do not tend to attract kids. As most of the Town has fire-fighting water available nearby in the forms of fire ponds, a large amount of water can be made readily available for fire fighting equipment. The Town also has the support of the Watertown Fire District to provide access to their extensive watershed lands in case of a wildfire.

Recall from Figure 2-7, Figure 2-8, and Figure 2-9 that elderly, linguistically isolated, and disabled populations reside in the Town of Bethlehem. In comparing these figures with the wildfire risk areas presented in Figure 9-1, it is possible that several hundred of the population impacted by a wildfire could consist of the elderly, a small number could consist of linguistically isolated households, and several with disabilities could reside near wildfire impact areas. Thus, it is important for the Bethlehem Fire Department to be prepared to assist these special populations during emergencies, including wildfire.

There are many areas of Town where roads are narrow and one-way. This hinders emergency access to fight fires. This is a particular problem around Long Meadow Pond,

such as on West Shore Drive and in the private Kasson community. Fire trucks often need to drive into such areas in line with the last one in being the first one to back out as there is no place to turn around. In other places, fire trucks simply can't get to the houses that are up narrow dirt roads. The Fire Department should consider public education in these areas and encourage homeowners and private communities to widen the access for emergency vehicles if possible.

In summary, areas adjacent to hayfields are considered most at risk from wildfires. In addition, there is concern about fires in the wooded southeastern, northern, and western sections of Town. While fires are infrequent in these areas, they can often be difficult to access. The Town has the support of the owners of the tracts of open space to provide access to their lands in case of a wildfire.

Should a wildfire occur, it seems reasonable to estimate that the average area to burn would be five acres, consistent with the state average during long period of drought. In the case of an extreme wildfire during a long drought on forested lands, it is estimated that up to 300 acres could burn before containment due to the limited access of those lands. Residential areas bordering such lands would also be vulnerable to wildfire, but would likely be more impacted by heat and smoke than by structure fires due to the strong fire response in the Town.

#### **9.6 Potential Mitigation Measures, Strategies, and Alternatives**

Potential mitigation measures for wildfires include a mixture of prevention, education, and emergency planning. Although educational materials are available through the Fire Department, they should be made available at other municipal offices as well. Education of homeowners on methods of protecting their homes is far more effective than trying to steer growth away from potential wildfire areas, especially given that the available land that is environmentally appropriate for development may be forested.

Water system improvements are an important class of potential mitigation for wildfires. The following recommendation could be implemented to mitigate forest fire risk:

- ❑ The Town of Bethlehem should continue to require the installation of fire ponds and dry hydrants in new subdivisions, and should look to install additional ponds where adequate water supplies do not currently exist.
- ❑ Encourage property owners to widen access roads such that fire trucks and other emergency vehicles can access remote locations.

Other potential mitigation strategies for preventing wildfires include:

- ❑ Continue to promote inter-municipal cooperation in fire fighting efforts;
- ❑ Continue to support public outreach programs to increase awareness of forest fire danger and how to use common fire fighting equipment;
- ❑ Continue reviewing subdivision applications to ensure new neighborhoods and driveways are properly sized to allow access of emergency vehicles;
- ❑ Provide outreach programs on how to properly manage burning and campfires on private property;
- ❑ Distribute copies of a booklet such as "Is Your Home Protected from Wildfire Disaster? – A Homeowner's Guide to Wildfire Retrofit" when developers and homeowners pick up or drop off applications;
- ❑ Patrol Town-owned open space and parks to prevent unauthorized campfires;
- ❑ Enforce regulations and permits for open burning; and
- ❑ Continue to place utilities underground.

In addition, specific recommendations that apply to all hazards are listed in Section 10.1.

## 10.0 RECOMMENDATIONS

### 10.1 Additional Recommendations

Recommendations that are applicable to two, three, or four hazards were discussed in the applicable subsections of Sections 3.0 through 9.0. For example, placing utilities underground is a recommendation for hurricane, summer storm, winter storm, and wildfire mitigation. A remaining class of recommendations is applicable to all hazards, because it includes recommendations for improving public safety and planning for emergency response. Instead of repeating these recommendations in section after section of this Plan, these are described herein.

Informing and educating the public about how to protect themselves and their property from natural hazards is essential to any successful hazard mitigation strategy. The Local Emergency Planning Commission or Fire Department should be charged with creating and disseminating informational pamphlets and guides to public locations such as the library, post office, senior center, and town hall. In particular, additional guides are recommended regarding fire protection, fire safety, and the importance of prevention. Such pamphlets include *"Are you ready? A Guide to Citizen Preparedness"* co-published by the American Red Cross, FEMA, and the National Oceanic & Atmospheric Administration and includes recommendations for dealing with heat waves, hurricanes, tornadoes, thunderstorms, flooding, fire, and winter storms. Other pamphlets include:

- ❑ *"Food & Water in an Emergency"*
- ❑ *"Disaster Supply Kit"*
- ❑ *"Family Disaster Plan"*
- ❑ *"Preparing for Disaster for People with Disabilities and Other Special Needs",* and
- ❑ *"Helping Children Cope with Disaster"*

- ❑ *"Is Your Home Protected from Wildfire Disaster? – A Homeowner's Guide to Wildfire Retrofit"*

In addition, the Town should consider adding pages to its website dedicated to citizen education and preparation for natural hazard events.

A community warning system that relies on radios and television is less effective at warning residents during the night when the majority of the community is asleep. Thus, Bethlehem should attempt to acquire an emergency notification system such as CodeRED. Databases could be set up as best possible for hazards with a specific geographic extent, particularly dam failure. Residents should also be encouraged to purchase a NOAA weather radio containing an alarm feature. In addition, the Town Emergency Operations Plan should continue to be reviewed and updated at least once annually.

## **10.2 Summary of Specific Recommendations**

Recommendations have been presented throughout this document in individual sections as related to each natural hazard. This section lists specific recommendations of the Plan without any priority ranking. Recommendations that span multiple hazards are only reprinted once in this section under the most appropriate hazard event. Refer to the matrix in Appendix A for recommendations with scores based on the STAPLEE methodology described in Section 1.0.

### **All Hazards**

- ❑ Disseminate informational pamphlets regarding natural hazards to public locations.
- ❑ Add pages to the Town website (<http://ci.bethlehem.ct.us/>) dedicated to citizen education and preparation for natural hazard events.
- ❑ Consider implementation of an emergency notification system.

- ❑ Upgrade emergency communications to a high band system to better facilitate emergency response, particularly in coordination with neighboring municipalities.
- ❑ Encourage residents to purchase and use NOAA weather radios with alarm features.
- ❑ Continue to review and update the Town Emergency Operations Plan at least once annually.
- ❑ Consider modifying the Plan of Conservation and development to encourage two modes of egress into every neighborhood by the creation of through streets.
- ❑ Continue reviewing subdivision applications to ensure new neighborhoods and driveways are properly sized to allow access of emergency vehicles;

### **Inland Flooding**

#### **Prevention**

- ❑ Consider joining FEMA's Community Rating System.
- ❑ Continue to regulate activities within SFHAs.
- ❑ Consider requiring buildings constructed in floodprone areas to be protected to the highest recorded flood level, regardless of being within a defined SFHA.
- ❑ Ensure new buildings be designed and graded to shunt drainage away from the building.
- ❑ Assist with the Map Mod program to ensure an appropriate update to the Flood Insurance Study, Flood Insurance Rate Maps, and Flood Boundary and Floodway Maps.
- ❑ After Map Mod has been completed, consider restudying local flood prone areas and produce new local-level regulatory floodplain maps using more exacting study techniques, including using more accurate contour information to map flood elevations provided with the FIRM.
- ❑ Adopt an aquifer protection area overlay zone to regulate development after Watertown Fire District has completed their final mapping of the Aquifer Protection Area for their wellfield in northeastern Woodbury.

### *Property & Natural Resource Protection*

- ☐ Pursue the acquisition of additional municipal open space properties inside SFHAs and set it aside as greenways, parks, or other non-residential, non-commercial, or non-industrial use.
- ☐ Selectively pursue conservation recommendations listed in the Plan of Conservation and Development and other studies and documents.
- ☐ Continue to regulate development in protected and sensitive areas, including steep slopes, wetlands, and floodplains.

### *Structural Projects*

- ☐ Pursue funding to elevate Crane Hollow Road to prevent future instances of overtopping.
- ☐ Pursue funding to elevate the road near the south end of Hickory Lane, or to widen the stream and install a box culvert.
- ☐ Encourage the State Department of Transportation to elevate the level of Route 132 between Lakes Road and Sky Meadow Lane, or to widen the stream and install a box culvert.

### *Wind Damage Related to Hurricanes, Summer Storms, and Winter Storms*

- ☐ Continue outreach regarding dangerous trees on private property.
- ☐ Continue to require that utilities be placed underground in new developments and pursue funding to place them underground in existing developed areas.
- ☐ Continue to require compliance with the amended Connecticut Building Code for wind speeds.
- ☐ Provide for the Building Department to make literature available during the permitting process regarding appropriate design standards.

- ❑ Increase tree limb maintenance and inspections, especially along Route 61, Route 132, and other evacuation routes. Increase inspections of trees on private property near power lines and Town right-of-ways.

### **Winter Storms**

- ❑ Review and disseminate potential evacuation plans to ensure timely migration of people seeking shelter in all areas of Bethlehem.
- ❑ Post a list of Town sheltering facilities in the Town Hall and on the Town's website so residents can best plan how to access to critical facilities during a winter storm event.
- ❑ Prioritize plowing routes and post the snow plowing prioritization in Town buildings each winter to increase public awareness.
- ❑ Pursue grant funding to install drainage along Cabbage Lane and Route 132 to eliminate icing at this dangerous intersection. Consider removing some trees to improve sight lines if possible.
- ❑ Investigate complaints of icing at the intersection of Wood Creek Road and Route 132, and perform corrective actions if applicable.
- ❑ Encourage the Horace Mann Nature Center to widen and improve the access road from Bethlehem to facilitate emergency and standard vehicular access.

### **Earthquakes**

- ❑ Consider preventing new residential development in areas prone to collapse.
- ❑ Continue to require adherence to the state building codes.
- ❑ Ensure that municipal departments have adequate backup facilities in case earthquake damage occurs.



### **Dam Failure**

- ❑ Stay current on the evolution of EOPs and Dam Failure Analyses for Class C and Class B dams whose failure could impact areas of Bethlehem.
- ❑ Consider implementing Town inspections of Class AA, A, and unranked dams.
- ❑ If the Town acquires an emergency notification system, include dam failure areas in the contact database.
- ❑ When possible, have copies of the Class C dam EOPs and Dam Failure Analyses on file in the Town hall for public viewing.
- ❑ Continue pursuing modifications to Long Meadow Pond Dam to pass the 100-year flood event, review and update the Emergency Operations Plan when modifications are completed, and maximize Town emergency preparedness for a potential dam failure.
- ❑ Continue the ongoing program of inspection and maintenance of Long Meadow Pond Dam.
- ❑ Consider forming a Flood and Erosion Control Board in Bethlehem to oversee municipal dam maintenance and problems with flooding and erosion.

### **Wildfires**

- ❑ The Town of Bethlehem should continue to require the installation of fire ponds and dry hydrants in new subdivisions, and should look to install additional ponds where adequate water supplies do not currently exist.
- ❑ Encourage property owners to widen access roads such that fire trucks and other emergency vehicles can access remote locations.
- ❑ Continue to promote inter-municipal cooperation in fire fighting efforts.
- ❑ Continue to support public outreach programs to increase awareness of forest fire danger and how to use common fire fighting equipment.
- ❑ Provide outreach programs on how to properly manage burning and campfires on private property.

- ❑ Patrol Town-owned open space and parks to prevent unauthorized campfires.
- ❑ Enforce regulations and permits for open burning.

### ***10.3 Sources of Funding***

The following sources of funding and technical assistance may be available for the priority projects listed above. This information comes from the FEMA website (<http://www.fema.gov/government/grant/index.shtm>). Funding requirements and contact information is given in Section 11.4.

#### **FEMA (Federal Emergency Management Agency) Grants and Assistance Programs**

##### **Buffer Zone Protection Program (BZPP)**

<http://www.fema.gov/government/grant/bzpp/index.shtm>

This grant provides security and risk management capabilities at State and local level for Tier I and II critical infrastructure sites that are considered high-risk/high-consequence facilities. Each State with a BZPP site is eligible to submit applications for its local communities to participate in and receive funding under the program. The funding for this grant is based on the number, type, and character of the site.

##### **Citizen Corps Program National Emergency Technology Guard (NET Guard) Pilot Program**

<http://www.fema.gov/government/grant/netguard/index.shtm>

The purpose of this grant, under the Homeland Security Act of 2002, is to re-establish a communication network in the event that the current information systems is attacked and rendered inoperable. A total of \$80,000 may be available to each applicant provided they are a locality that meets the required criteria.

##### **Community Disaster Loan Program**

[http://www.fema.gov/government/grant/fs\\_cdl.shtm](http://www.fema.gov/government/grant/fs_cdl.shtm)

This program provides funds to any eligible jurisdiction in a designated disaster area that has suffered a substantial loss of tax and other revenue. The assistance is in the form of loans not to exceed twenty-five percent of the local government's annual operating budget for the fiscal year in which the major disaster occurs, up to a maximum of five million dollars.

### **Competitive Training Grants Program (CTGP)**

<http://www.fema.gov/emergency/ctgp/index.shtm>

Funds allocated from this program will be used to bolster training and education for Homeland Security. Applicants, if funded, must deliver innovative training/education programs to its trainees.

### **Emergency Food and Shelter Program**

<http://www.fema.gov/government/grant/efs.shtm>

This program was created in 1983 to supplement the work of local social service organizations, both private and governmental, to help people in need of emergency assistance.

### **Emergency Management Performance Grants**

<http://www.fema.gov/emergency/empg/empg.shtm>

The Emergency Management Performance Grant (EMPG) is designed to assist local and state governments in maintaining and strengthening the existing all-hazards, natural and man-made, emergency management capabilities. Allocations of this fund is authorized by the 9/11 Commission Act of 2007, and grant amount is determined demographically at the state and local level.

### **Emergency Operations Center (EOC) Grant Program**

<http://www.fema.gov/government/grant/eoc/index.shtm>

The Emergency Operations Center Grant is designated to support the needed construction, renovation or improvement of emergency operation centers at the State, Local, or Tribal governments. The State Administrative Agency (SAA) is the only eligible entity able to apply for the available funding on behalf of qualified State, local, and tribal EOCs.

### **Flood Mitigation Assistance (FMA) Program**

<http://www.fema.gov/government/grant/fma/index.shtm>

The FMA was created as part of the National Flood Insurance Reform Act of 1994 with the goal of reducing or eliminating claims under the NFIP. FEMA provides funds in the form of planning grants for Flood Mitigation Plans and project grants to implement measures to reduce flood losses, including elevation, acquisition, or relocation of NFIP-insured structures. Repetitive loss properties are prioritized under this program. This grant program is administered through the DEP.

**Hazard Mitigation Grant Program (HMGP)**

<http://www.fema.gov/government/grant/hmgp/index.shtm>

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 recovery from a disaster. This grant program is administered through the DEP.

**Homeland Security Grant Program (HSGP)**

<http://www.fema.gov/government/grant/hsgp/index.shtm>

The objective of the FY 2008 HSGP is to enhance the response, preparedness, and recovery of local, State, and tribal governments in the event of a disaster or terrorist attack. Eligible applicants include all 50 states, the District of Columbia, Puerto Rico, American Samoa, Guam, Northern Mariana Islands, and the Virgin Islands. Risk and effectiveness, along with a peer review, determine the amount allocated to each applicant.

**Interoperable Emergency Communications Grant Program**

<http://www.fema.gov/government/grant/iecgp/index.shtm>

Funding through the Interoperable Emergency Communications Grant Program will enable States, Territories, local units of government, and tribal communities to implement their Statewide Communication Interoperability Plans (SCIP) in conjunction with the National Emergency Communications Plan (NECP) to further enhance interoperability. The only applicants eligible for funding through this grant are State Administration Agencies.

**Intercity Bus Security Grant Program (IBSGP)**

<http://www.fema.gov/government/grant/ibsgp/index.shtm>

The mission of the IBSGP is to maintain the protection of intercity bus systems and public transportation from terrorism. The only eligible grantees for this program are private operators servicing at least 50 trips annually along fixed established routes.

**National Flood Insurance Program (NFIP)**

<http://www.fema.gov/library/viewRecord.do?id=3005>

This program enables property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Municipalities that join the associated Community Rating System can gain discounts of flood insurance for their residents.

**Pre-Disaster Mitigation Grant Program**

<http://www.fema.gov/government/grant/pdm/index.shtm>

The purpose of the PDM program is to fund communities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. PDM grants are provided to states, territories, Indian tribal governments, communities, and universities, which, in turn, provide sub-grants to local governments. PDM grants are awarded on a competitive basis. This grant program is administered through the DEP.

**Port Security Grant Program (PSGP)**

<http://www.fema.gov/government/grant/psgp/index.shtm>

The goal of the PSGP is to provide protection of critical port infrastructure from terrorism, involving explosive and non-conventional weapons. Protection includes enhancing training, recovery, prevention, management, response and awareness. Those who may apply include owners of federally regulated terminals, facilities, U.S. inspected passenger vessels, state and local agencies, and local stakeholders.

**Public Assistance Grant Program**

<http://www.fema.gov/government/grant/pa/index.shtm>

The Public Assistance Grant Program (PA) is designed to assist State, Tribal and local governments, and certain types of private non-profit organizations in recovering from major disasters or emergencies. Along with helping to recover, this grant also encourages prevention against potential future disasters by strengthening hazard mitigation during the recovery process. The first grantee to apply and receive the PA would usually be the State, and the State could then allocate the granted funds to the sub-grantees in need of assistance.

**Regional Catastrophic Preparedness Grant Program (RCPGP)**

<http://www.fema.gov/government/grant/rcp/index.shtm>

The main focus of RCPGP is to strengthen the national preparedness against any catastrophic event within the designated Tier I and Tier II Urban Areas. RCPGP will fund the designated Tier I and II Urban areas only.

**Repetitive Flood Claims Program**

<http://www.fema.gov/government/grant/rfc/index.shtm>

The Repetitive Flood Claims (RFC) grant program was set into place to assist States or communities with insured properties that have had prior claims to the National Flood Insurance Program (NFIP) but do not meet the requirements for FMA. This grant is provided to eligible States/Tribes/Territories that, in turn, will allocate sub-grants to local governments.

**Severe Repetitive Loss (SRL) Program**

<http://www.fema.gov/government/grant/srl/index.shtm>

The SRL provides funding to reduce or eliminate the long-term risk of flood damage to SRL structures insured under the NFIP. This program is for residential properties only, and eligible project activities include acquisition and demolition or relocation of the structure with conversion of the property to open space, elevation, minor localized flood reduction projects, and dry flood proofing (historic properties only).

**Transit Security Grant Program (TSGP)**

<http://www.fema.gov/government/grant/tsgp/index.shtm>

The purpose of TSGP is to bolster security and safety for public transit infrastructure within Urban Areas throughout the United States. Applicable grantees include only the state Governor and the designated State Administrative Agency (SAA) appointed to obligate program funds to the appropriate transit agencies.

**Trucking Security Program (TSP)**

<http://www.fema.gov/government/grant/tsp/index.shtm>

The TSP provides funding for an anti-terrorism and security awareness program for highway professionals in support of the National Preparedness Guidelines. All applicants are accepted so long as they support all four funding priority areas: participant identification and recruitment; training; communications; and information analysis and distribution for an anti-terrorism and security awareness program.

**Urban Areas Security Initiative Nonprofit Security Grant Program (UASI-NSGP)**

<http://www.fema.gov/government/grant/uasi/index.shtm>

The UASI-NSGP specifically targets major areas of concern, those being areas designated as having the highest level of terrorist threat or vulnerability, and aims to improve the protection and preparedness of potentially targeted organizations. Applicants only include non-profit organizations deemed as having a high risk to terrorism and who reside within the areas of concern.

## **U.S. Fire Administration**

### **Assistance to Firefighters Grant Program (AFGP)**

<http://www.firegrantsupport.com/afg/>

<http://www.usfa.dhs.gov/fireservice/grants/>

The primary goal of the Assistance to Firefighters Grants (AFG) is to meet the firefighting and emergency response needs of fire departments and nonaffiliated emergency medical services organizations. Since 2001, AFG has helped firefighters and other first responders to obtain critically needed equipment, protective gear, emergency vehicles, training, and other resources needed to protect the public and emergency personnel from fire and related hazards. The Grant Programs Directorate of the Federal Emergency Management Agency administers the grants in cooperation with the U.S. Fire Administration.

### **Fire Prevention & Safety Grants (FP&S)**

<http://www.firegrantsupport.com/fps/>

The Fire Prevention and Safety Grants (FP&S) are part of the Assistance to Firefighters Grants (AFG) and are under the purview of the Grant Programs Directorate in the Federal Emergency Management Agency. FP&S grants support projects that enhance the safety of the public and firefighters from fire and related hazards. The primary goal is to target high-risk populations and mitigate high incidences of death and injury. Examples of the types of projects supported by FP&S include fire prevention and public safety education campaigns, juvenile firesetter interventions, media campaigns, and arson prevention and awareness programs.

### **Reimbursement for Firefighting on Federal Property**

<http://www.usfa.dhs.gov/fireservice/grants/rfff/>

Reimbursement may be made to fire departments for fighting fires on property owned by the federal government for firefighting costs over and above normal operating costs. Claims are submitted directed to the U.S. Fire Administration. For more information, please contact Tim Ganley at (301) 447-1358.

### **Staffing for Adequate Fire & Emergency Response (SAFER)**

<http://www.firegrantsupport.com/safer/>

The goal of SAFER is to enhance the local fire departments' abilities to comply with staffing, response and operational standards established by NFPA and OSHA (NFPA 1710 and/or NFPA 1720 and OSHA 1910.134 - see <http://www.nfpa.org/SAFERActGrant> for more details). Specifically, SAFER funds should assist local fire departments to increase their staffing and deployment capabilities in order to respond to emergencies whenever they may occur. As a result of the enhanced staffing, response times should be sufficiently reduced with an

appropriate number of personnel assembled at the incident scene. Also, the enhanced staffing should provide that all front-line/first-due apparatus of SAFER grantees have a minimum of four trained personnel to meet the OSHA standards referenced above. Ultimately, a faster, safer and more efficient incident scene will be established and communities will have more adequate protection from fire and fire-related hazards.

## **Other Grant Programs**

### **Flood Mitigation**

- ❑ U.S. Army Corps of Engineers – *50/50 match funding for flood proofing and flood preparedness projects.*
- ❑ U.S. Department of Agriculture – *financial assistance to reduce flood damage in small watersheds and to improve water quality.*
- ❑ CT Department of Environmental Protection – *assistance to municipalities to solve flooding and dam repair problems through the Flood and Erosion Control Board Program.*

### **Hurricane Mitigation**

- ❑ FEMA State Hurricane Program - *financial and technical assistance to local governments to support mitigation of hurricanes and coastal storms.*
- ❑ FEMA Hurricane Program Property Protection – *grants to hurricane prone states to implement hurricane mitigation projects.*

### **General Hazard Mitigation**

- ❑ Americorps – *teams may be available to assist with landscaping projects such as surveying, tree planting, restoration, construction, and environmental education, and provide volunteers to help communities respond to natural hazard-related disasters.*



Erosion Control and Wetland Protection

- ❑ U.S. Department of Agriculture – *technical assistance for erosion control.*
- ❑ CT Department of Environmental Protection – *assistance to municipalities to solve beach erosion problems through the Flood and Erosion Control Board Program.*
- ❑ North American Wetlands Conservation Act Grants Program – *funding for projects that support long term wetlands acquisition, restoration, and/or enhancement. Requires a 1-to-1 funds match.*

## ***11.0 PLAN IMPLEMENTATION***

### ***11.1 Implementation Strategy and Schedule***

The Council of Governments of the Central Naugatuck Valley is authorized to update this hazard mitigation plan as needed, coordinate its adoption with the Town of Bethlehem, and guide it through the FEMA approval process.

The individual recommendations of the hazard mitigation plan must be implemented by the municipal departments that oversee these activities. The Office of the First Selectman and the Highway Department / Public Works in the Town of Bethlehem will primarily be responsible for developing and implementing selected projects. Appendix A incorporates an implementation strategy and schedule, detailing the responsible department and anticipated time frame for the specific recommendations listed throughout this document.

Upon adoption, the Plan will be made available to all Town departments and agencies as a planning tool to be used in conjunction with existing documents. It is expected that revisions to other Town plans and regulations, such as the Plan of Conservation and Development, department annual budgets, and the Subdivision Regulations, will reference this plan and its updates. The Office of the First Selectman will be responsible for ensuring that the actions identified in this plan are incorporated into ongoing Town planning activities, and that the information and requirements of this plan are incorporated into existing planning documents within five years from the date of adoption or when other plans are updated, whichever is sooner.

The Office of the First Selectman will be responsible for assigning appropriate Town officials to update the Plan of Conservation and Development, Subdivision Regulations, Wetlands Regulations, and Emergency Operations Plan to include the provisions in this plan. Should a general revision be too cumbersome or cost prohibitive, simple

addendums to these documents will be added that include the provisions of this plan. The Plan of Conservation and Development and the Emergency Operations Plan are the two documents most likely to benefit from the inclusion of the Plan in the Town's library of planning documents.

Finally, information and projects in this planning document will be included in the annual budget and capital improvement plans as part of implementing the projects recommended in this plan. This will primarily include the annual budget and capital improvement projects lists maintained and updated by the Town Highway Department.

### ***11.2 Progress Monitoring and Public Participation***

The Office of the First Selectman will be the party responsible for monitoring the successful implementation of the Plan as part of its oversight of all municipal departments. Such monitoring may include periodic reports to the COGCNV regarding certain projects, meetings, site visits, and telephone calls as befits the project being implemented. The COGCNV will coordinate an annual review and evaluation of the plan. Participants in this review may include, but need not be limited to, representatives of the departments listed in Section 11.1.

Matters to be reviewed will include the goals and objectives of the original plan, hazards or disasters that occurred during the preceding period, mitigation activities that have been accomplished to date, a discussion of reasons that implementation may be behind schedule, and recommendations for new projects and revised activities. The meeting will be conducted in August or September, at least two months before the annual application cycle for pre-disaster grants (applications are typically due to DEP in November of any given year). This will enable a list of possible projects to be circulated for Town Departments to review, with sufficient time for developing an application.

Continued public involvement will be sought regarding the monitoring, evaluating, and updating of the Plan. Public input may be solicited through community meetings and input to web-based information gathering tools. Public comment on changes to the Plan may be sought through posting of public notices, and notifications posted to the website of the Council of Governments of the Central Naugatuck Valley, as well as of the Town of Bethlehem.

### ***11.3 Updating the Plan***

The Council of Governments of the Central Naugatuck Valley will update the hazard mitigation plan if a consensus to do so is reached by the Board of Selectmen of Bethlehem and a request is presented to the Council of Governments of the Central Naugatuck Valley, or at least once every five years. A committee will be formed consisting of representatives of many of the same departments solicited for input to this plan. In addition, local business leaders, community and neighborhood group leaders, relevant private and non-profit interest groups, and the six neighboring municipalities will be solicited for representation, including the following:

- ❑ The Central Naugatuck Valley Emergency Planning Committee, managed by the COGCNV;
- ❑ Pomperaug River Watershed Association;
- ❑ Key organizations from the list presented on Page 1-10;
- ❑ Town of Washington Public Works Department and Planning Department;
- ❑ Town of Morris Public Works Department and Planning Department;
- ❑ Town of Watertown Public Works Department and Planning Department; and
- ❑ Town of Woodbury Public Works Department and Planning Department;

Updates may include deleting recommendations as projects are completed, adding recommendations as new hazard effects arise, or modifying hazard vulnerabilities as land

use changes. In addition, the list of shelters and critical facilities should be updated as necessary, or at least every five years.

#### **11.4 Technical and Financial Resources**

This Section is comprised of a list of resources to be considered for technical assistance and potentially financial assistance for completion of the actions outlined in this plan. This list is not all-inclusive and is intended to be updated as necessary.

##### **Federal Resources**

##### **Federal Emergency Management Agency**

Region I  
99 High Street, 6<sup>th</sup> floor  
Boston, MA 02110  
(617) 956-7506  
<http://www.fema.gov/>

##### **Mitigation Division**

The Mitigation Division is comprised of three branches that administer all of FEMA's hazard mitigation programs. The **Risk Analysis Branch** applies planning and engineering principles to identify hazards, assess vulnerabilities, and develop strategies to manage the risks associated with natural hazards. The **Risk Reduction Branch** promotes the use of land use controls and building practices to manage and assess risk in both the existing built developments and future development areas in both pre- and post-disaster environments. The **Risk Insurance Branch** mitigates flood losses by providing affordable flood insurance for property owners and by encouraging communities to adopt and enforce floodplain management regulations.

FEMA Programs administered by the Risk Analysis Branch include:

- ❑ *Flood Hazard Mapping Program*, which maintains and updates National Flood Insurance Program maps;
- ❑ *National Dam Safety Program*, which provides state assistance funds, research, and training in dam safety procedures;
- ❑ *National Hurricane Program*, which conducts and supports projects and activities that help protect communities from hurricane hazards; and

- ❑ *Mitigation Planning*, a process for states and communities to identify policies, activities, and tools that can reduce or eliminate long-term risk to life and property from a hazard event.

FEMA Programs administered by the Risk Reduction Branch include:

- ❑ *Hazard Mitigation Grant Program (HMGP)*, which provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration;
- ❑ *Flood Mitigation Assistance Program (FMA)*, which provides funds to assist states and communities to implement measures that reduce or eliminate long-term risk of flood damage to structures insurable under the National Flood Insurance Program;
- ❑ *Pre-Disaster Mitigation Grant Program (PDM)*, which provides program funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event;
- ❑ *Severe Repetitive Loss Program (SRL)*, which provides funding to reduce or eliminate the long-term risk of flood damage to "severe repetitive loss" structures insured under the National Flood Insurance Program;
- ❑ *Community Rating System (CRS)*, a voluntary incentive program under the National Flood Insurance Program that recognizes and encourages community floodplain management activities; and
- ❑ *National Earthquake Hazards Reduction Program (NEHRP)*, which in conjunction with state and regional organizations supports state and local programs designed to protect citizens from earthquake hazard.

The Risk Insurance Branch oversees the *National Flood Insurance Program (NFIP)*, which enables property owners in participating communities to purchase flood insurance. The NFIP assists communities in complying with the requirements of the program and publishes flood hazard maps and flood insurance studies to determine areas of risk.

FEMA also can provide information on past and current acquisition, relocation, and retrofitting programs, and has expertise in many natural and technological hazards. FEMA also provides funding for training state and local officials at Emergency Management Institute in Emmitsburg, Maryland.

The Mitigation Directorate also has in place several *Technical Assistance Contracts (TAC)* that support FEMA, States, territories, and local governments with activities to enhance the effectiveness of natural hazard reduction program efforts. The TACs support FEMA's responsibilities and legislative authorities for implementing the earthquake, hurricane, dam safety, and floodplain management programs. The range of technical assistance services provided through the TACs varies based on the needs of the eligible contract users and the natural hazard programs. Contracts and services include:

- ❑ *The Hazard Mitigation Technical Assistance Program (HMTAP) Contract*-supporting post-disaster program needs in cases of large, unusual, or complex projects; situations where resources are not available; or where outside technical assistance is determined to be needed. Services include environmental and biological assessments, benefit/cost analyses, historic preservation assessments, hazard identification, community planning, training, and more.
- ❑ *The Wind and Water Technical Assistance Contract (WAWTAC)*-supporting wind and flood hazards reduction program needs. Projects include recommending mitigation measures to reduce potential losses to post-FIRM structures, providing mitigation policy and practices expertise to States, incorporating mitigation into local hurricane program outreach materials, developing a Hurricane Mitigation and Recovery exercise, and assessing the hazard vulnerability of a hospital.
- ❑ *The National Earthquake Technical Assistance Contract (NETAC)* – supporting earthquake program needs. Projects include economic impact analyses of various earthquakes, vulnerability analyses of hospitals and schools, identification of and training on non-structural mitigation measures, and evaluating the performance of seismically rehabilitated structures, post-earthquake.

#### *Response & Recovery Division*

As part of the National Response Plan, this division provides information on dollar amounts of past disaster assistance including Public Assistance, Individual Assistance, and Temporary Housing, as well as information on retrofitting and acquisition/relocation initiatives. The Response & Recovery Division also provides mobile emergency response support to disaster areas, supports the National Disaster Medical System, and provides urban search and rescue teams for disaster victims in confined spaces.

The division also coordinates federal disaster assistance programs. The Public Assistance Grant Program (PA) that provides 75% grants for mitigation projects to protect eligible damaged public and private non-profit facilities from future damage. "Minimization" grants at 100% are available through the Individuals and Family Grant Program. The Hazard Mitigation Grant Program and the Fire Management Assistance Grant Program are also administered by this division.

### **Computer Sciences Corporation**

New England Regional Insurance Manager  
Bureau and Statistical Office  
(781) 848-1908

Corporate Headquarters  
3170 Fairview Park Drive  
Falls Church, VA 22042  
(703) 876-1000  
<http://www.csc.com/>

A private company contracted by the Federal Insurance Administration as the National Flood Insurance Program Bureau and Statistical Agent, CSC provides information and assistance on flood insurance, including handling policy and claims questions, and providing workshops to leaders, insurance agents, and communities.

### **Small Business Administration**

Region I  
10 Causeway Street, Suite 812  
Boston, MA 02222-1093  
(617) 565-8416  
<http://www.sba.gov/>

SBA has the authority to "declare" disaster areas following disasters that affect a significant number of homes and businesses, but that would not need additional assistance through FEMA. (SBA is triggered by a FEMA declaration, however.) SBA can provide additional low-interest funds (up to 20% above what an eligible applicant would "normally" qualify for) to install mitigation measures. They can also loan the cost of bringing a damaged property up to state or local code requirements. These loans can be used in combination with the new "mitigation insurance" under the NFIP, or in lieu of that coverage.

### **Environmental Protection Agency**

Region I  
1 Congress Street, Suite 1100  
Boston, MA 02114-2023  
(888) 372-7341

Provides grants for restoration and repair, and educational activities, including:

- ☐ *Capitalization Grants for State Revolving Funds:* Low interest loans to governments to repair, replace, or relocate wastewater treatment plans damaged in floods. Does not apply to drinking water or other utilities.



- ❑ *Clean Water Act Section 319 Grants*: Cost-share grants to state agencies that can be used for funding watershed resource restoration activities, including wetlands and other aquatic habitat (riparian zones). Only those activities that control non-point pollution are eligible. Grants are administered through the CT DEP, Bureau of Water Management, Planning and Standards Division.

### **U.S. Department of Housing and Urban Development**

20 Church Street, 19<sup>th</sup> Floor  
Hartford, CT 06103-3220  
(860) 240-4800  
<http://www.hud.gov/>

The U.S. Department of Housing and Urban Development offers *Community Development Block Grants (CDBG)* to communities with populations greater than 50,000, who may contact HUD directly regarding CDGB. One program objective is to improve housing conditions for low and moderate income families. Projects can include acquiring flood prone homes or protecting them from flood damage. Funding is a 100% grant; can be used as a source of local matching funds for other funding programs, such as FEMA's "404" Hazard Mitigation Grant Program. Funds can also be applied toward "blighted" conditions, which is often the post-flood condition. A separate set of funds exists for conditions that create an "imminent threat." The funds have been used in the past to replace (and redesign) bridges where flood damage eliminates police and fire access to the other side of the waterway. Funds are also available for smaller municipalities through the State Administered CDBG program participated in by the State of Connecticut.

### **U.S. Army Corps of Engineers**

Institute for Water Resources  
7701 Telegraph Road  
Alexandria, VA 22315  
(703) 428-8015  
<http://www.iwr.usace.army.mil/>

The Corps provides 100% funding for floodplain management planning and technical assistance to states and local governments under the Floodplain Management Services Program (FPMS). Various flood protection measures such as beach re-nourishment, stream clearance and snagging projects, flood proofing, and flood preparedness are funded on a 50/50 matching basis by Section 22 planning Assistance to States program. They are authorized to relocate homes out of the floodplain if it proves to be more cost effective than a structural flood control measure.

**U.S. Department of Commerce***National Weather Service*

Northeast River Forecast Center  
445 Myles Standish Blvd.  
Taunton, MA 02780  
(508) 824-5116  
<http://www.nws.noaa.gov/>

The National Weather Service prepares and issues flood, severe weather, and coastal storm warnings. Staff hydrologists can work with communities on flood warning issues and can give technical assistance in preparing flood warning plans.

**U.S. Department of the Interior***National Park Service*

Steve Golden, Program Leader  
Rivers, Trails, & Conservation Assistance  
15 State Street  
Boston, MA 02109  
(617) 223-5123  
<http://www.nps.gov/rtca/>

The National Park Service provides technical assistance to community groups and local, state, and federal government agencies to conserve rivers, preserve open space, and develop trails and greenways, as well as identify non-structural options for floodplain development.

**U.S. Fish and Wildlife Service**

New England Field Office  
70 Commercial Street, Suite 300  
Concord, NH 03301-5087  
(603) 223-2541  
<http://www.fws.gov/>

The U.S. Fish and Wildlife Service provide technical and financial assistance to restore wetlands and riparian habitats through the North American Wetland Conservation Fund and Partners for Wildlife programs. It also administers the *North American Wetlands Conservation Act Grants Program*, which provides matching grants to organizations and individuals who have developed partnerships to carry out wetlands projects in the United States, Canada, and Mexico. Funds are available for projects focusing on protecting, restoring, and/or enhancing critical habitat.

**U.S. Department of Agriculture**

*Natural Resources Conservation Service* (formerly SCS)

Connecticut Office

344 Merrow Road, Suite A

Tolland, CT 06084-3917

(860) 871-4011

The Natural Resources Conservation Service provides technical assistance to individual land owners, groups of landowners, communities, and soil and water conservation districts on land-use and conservation planning, resource development, stormwater management, flood prevention, erosion control and sediment reduction, detailed soil surveys, watershed/river basin planning and recreation, and fish and wildlife management. Financial assistance is available to reduce flood damage in small watersheds and to improve water quality. Financial assistance is available under the Emergency Watershed Protection Program; the Cooperative River Basin Program; and the Small Watershed Protection Program.

**Regional Resources****Northeast States Emergency Consortium**

1 West Water Street, Suite 205

Wakefield, MA 01880

(781) 224-9876

<http://www.serve.com/NESEC/>

The Northeast States Emergency Consortium (NESEC) develops, promotes, and coordinates "all-hazards" emergency management activities throughout the Northeast. NESEC works in partnership with public and private organizations to reduce losses of life and property. They provide support in areas including interstate coordination and public awareness and education, along with reinforcing interactions between all levels of government, academia, non-profit organizations, and the private sector.

## **State Resources**

### **Connecticut Department of Economic and Community Development**

505 Hudson Street  
Hartford, CT 06106-7106  
(860) 270-8000  
<http://www.ct.gov/ecd/>

The Connecticut Department of Economic and Community Development administers HUD's State CDBG Program, awarding smaller communities and rural areas grants for use in revitalizing neighborhoods, expanding affordable housing and economic opportunities, and improving community facilities and services.

### **Connecticut Department of Environmental Protection**

79 Elm Street  
Hartford, CT 06106-5127  
(860) 424-3000  
<http://www.dep.state.ct.us/>

The Connecticut DEP includes several divisions with various functions related to hazard mitigation:

*Bureau of Water Management, Inland Water Resources Division* - This division is generally responsible for flood hazard mitigation in Connecticut, including administration of the National Flood Insurance Program. Other programs within the division include:

- ❑ *National Flood Insurance Program State Coordinator*: Provides flood insurance and floodplain management technical assistance, floodplain management ordinance review, substantial damage/improvement requirements, community assistance visits, and other general flood hazard mitigation planning including the delineation of floodways.
- ❑ *State Hazard Mitigation Officer (shared role with the Department of Emergency Management and Homeland Security)*: Hazard mitigation planning and policy; oversight of administration of the Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, and Pre-Disaster Mitigation Program. Has the responsibility of making certain that the Natural Hazard Mitigation Plan is updated every 3 years.
- ❑ *Flood Warning and Forecasting Service*: Prepares and issues flood, severe weather, and coastal storm warnings. Staff engineers and forecaster can work with communities on flood warning issues and can give technical assistance in

preparing flood warning plans. This service has helped the public respond much faster in flooding condition.

- ❑ *Flood & Erosion Control Board Program:* Provides assistance to municipalities to solve flooding, beach erosion and dam repair problems. Have the power to construct and repair flood and erosion management systems. Certain non-structural measures that mitigate flood damages are also eligible. Funding is provided to communities that apply for assistance through a Flood & Erosion Control Board on a non-competitive basis.
- ❑ *Stream Channel Encroachment Line Program:* Similar to the NFIP, this state regulatory program places restrictions on the development of floodplains along certain major rivers. This program draws in environmental concerns in addition to public safety issues when permitting projects.
- ❑ *Inland Wetlands and Watercourses Management Program:* Provides training, technical and planning assistance to local Inland Wetlands Commissions, reviews and approves municipal regulations for localities. Also controls flood management and natural disaster mitigations.
- ❑ *Dam Safety Program:* Charged with the responsibility for administration and enforcement of Connecticut's dam safety laws. Regulates the operation and maintenance of dams in the state. Permits the construction, repair or alteration of dams, dikes or similar structures and maintains a registration database of all known dams statewide. This program also operates a statewide inspection program.
- ❑ *Rivers Restoration Grant Program:* Administers funding and grants under the Clean Water Act involving river restoration, and reviews and provides assistance with such projects.

*Bureau of Water Management - Planning and Standards Division* - Administers the Clean Water Fund and many other programs directly and indirectly related to hazard mitigation including the Section 319 non-point source pollution reduction grants and municipal facilities program which deals with mitigating pollution from wastewater treatment plants.

*Office of Long Island Sound Programs (OLISP)* - Administers the Coastal Area Management Act (CAM) program and Long Island Sound License Plate Program.

**Connecticut Department of Emergency Management and Homeland Security**

25 Sigourney Street, 6<sup>th</sup> Floor

Hartford, CT 06106-5042

(860) 256-0800

<http://www.ct.gov/demhs/>

DEMHS is the lead agency responsible for emergency management. Specifically, responsibilities include emergency preparedness, response & recovery, mitigation, and an extensive training program. DEMHS is the state point of contact for most FEMA grant and assistance programs. DEMHS administers the Earthquake and Hurricane programs described above under the FEMA resource section. Additionally, DEMHS operates a mitigation program to coordinate mitigation throughout the state with other government agencies.

**Connecticut Department of Public Safety**

1111 Country Club Road

Middletown, CT 06457

(860) 685-8190

<http://www.ct.gov/dps/>

*Office of the State Building Inspector* - The Office of the State Building Inspector is responsible for administering and enforcing the Connecticut State Building Code, and is also responsible for the municipal Building Inspector Training Program.

**Connecticut Department of Transportation**

2800 Berlin Turnpike

Newington, CT 06131-7546

(860) 594-2000

<http://www.ct.gov/dot/>

The Department of Transportation administers the federal Intermodal Surface Transportation Efficiency Act (ISTEA) that includes grants for projects which promote alternative or improved methods of transportation. Funding through grants can often be used for projects with mitigation benefits such as preservation of open space in the form of bicycling and walking trails. CT DOT is also involved in traffic improvements and bridge repairs which could be mitigation related.

### **Private and Other Resources**

#### **The Association of State Floodplain Managers (ASFPM)**

2809 Fish Hatchery Road, Suite 204  
Madison, WI 53713  
(608) 274-0123  
<http://www.floods.org/>

ASFPM is a professional association of state employees that assist communities with the NFIP with a membership of over 1,000. ASFMP has developed a series of technical and topical research papers, and a series of Proceedings from their annual conferences. Many "mitigation success stories" have been documented through these resources, and provide a good starting point for planning.

#### **Institute for Business & Home Safety**

4775 East Fowler Avenue  
Tampa, FL 33617  
(813) 286-3400  
<http://www.ibhs.org/>

A non-profit organization put together by the insurance industry to research ways of reducing the social and economic impacts of natural hazards. The Institute advocates the development and implementation of building codes and standards nationwide and may be a good source of model code language.

#### **Multidisciplinary Center for Earthquake Engineering and Research (MCEER)**

University at Buffalo  
State University of New York  
Red Jacket Quadrangle  
Buffalo, New York 14261  
(716) 645-3391  
<http://mceer.buffalo.edu/>

A source for earthquake statistics, research, and for engineering and planning advice.

**The National Association of Flood & Stormwater Management Agencies (NAFSMA)**

1301 K Street, NW, Suite 800 East  
Washington, DC 20005  
(202) 218-4122  
<http://www.nafsma.org>

NAFSMA is an organization of public agencies who strive to protect lives, property, and economic activity from the adverse impacts of stormwater by advocating public policy, encouraging technology, and conducting educational programs. NAFSMA is a voice in national politics on water resources management issues concerning stormwater management, disaster assistance, flood insurance, and federal flood management policy.

**National Emergency Management Association (NEMA)**

P.O. Box 11910  
Lexington, KY 40578  
(859)-244-8000  
<http://www.nemaweb.org/>

A national association of state emergency management directors and other emergency management officials, the NEMA Mitigation Committee is a strong voice to FEMA in shaping all-hazard mitigation policy in the nation. NEMA is also an excellent source of technical assistance.

**Natural Hazards Center**

University of Colorado at Boulder  
482 UCB  
Boulder, CO 80309-0482  
(303) 492-6818  
<http://www.colorado.edu/hazards/>

The Natural Hazards Center includes the Floodplain Management Resource Center, a free library and referral service of the ASFPM for floodplain management publications. The Natural Hazards Center is located at the University of Colorado in Boulder. Staff can use keywords to identify useful publications from the more than 900 documents in the library.



**New England Flood and Stormwater Managers Association, Inc. (NEFSMA)**

c/o MA DEM  
100 Cambridge Street  
Boston, MA 02202

NEFSMA is a non-profit organization made up of state agency staff, local officials, private consultants and citizens from across New England. NEFSMA sponsors seminars and workshops and publishes the NEFSMA News three times per year to bring the latest flood and stormwater management information from around the region to its members.

***Volunteer Organizations*** - Volunteer organizations including the American Red Cross, the Salvation Army, Habitat for Humanity, and the Mennonite Disaster Service are often available to help after disasters. Service Organizations such as the Lions Club, Elks Club, and the Veterans of Foreign Wars are also available. Habitat for Humanity and the Mennonite Disaster Service provide skilled labor to help rebuild damaged buildings while incorporating mitigation or flood proofing concepts. The office of individual organizations can be contacted directly, or the FEMA Regional Office may be able to assist.

***Flood Relief Funds*** - After a disaster, local businesses, residents and out-of-town groups often donate money to local relief funds. They may be managed by the local government, one or more local churches, or an ad hoc committee. No government disaster declaration is needed. Local officials should recommend that the funds be held until an applicant exhausts all sources of public disaster assistance, allowing the funds to be used for mitigation and other projects than cannot be funded elsewhere.

***Americorps*** - Americorps is the recently installed National Community Service Organization. It is a network of local, state, and national service programs that connects volunteers with nonprofits, public agencies, and faith-based and community organizations to help meet our country's critical needs in education, public safety, health, and the environment. Through their service and the volunteers they mobilize, AmeriCorps members address critical needs in communities throughout America, including helping communities respond to disasters. Some states have trained Americorps members to help during flood-fight situations, such as by filling and placing sandbags.

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## **APPENDED TABLES**

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## Appended Table 1 Hazard Event Ranking

*Each hazard may have multiple effects; for example, a hurricane causes high winds and inland flooding. Some hazards may have similar effects; for example, hurricanes and earthquakes may cause dam failure.*

Natural Hazards	Location	Frequency of Occurrence	Magnitude / Severity	Rank
	1 = small 2 = medium 3 = large	0 = unlikely 1 = possible 2 = likely 3 = highly likely	1 = limited 2 = significant 3 = critical 4 = catastrophic	
Winter Storms	3	3	2	8
Hurricanes	3	1	3	7
Summer Storms and Tornadoes	2	3	2	7
Earthquakes	3	1	2	6
Wildfires	1	2	1	4

### Location

1 = small	isolated to specific area during one event
2 = medium	multiple areas during one event
3 = large	significant portion of the town during one event

### Frequency of Occurrence

0 = unlikely	less than 1% probability in the next 100 years
1 = possible	between 1 and 10% probability in the next year; or at least one chance in next 100 years
2 = likely	between 10 and 100% probability in the next year; or at least one chance in next 10 years
3 = highly likely	near 100% probability in the next year

### Magnitude / Severity

1 = limited	injuries and/or illnesses are treatable with first aid; minor "quality of life" loss; shutdown of critical facilities and services for 24 hours or less; property severely damaged < 10%
2 = significant	injuries and / or illnesses do not result in permanent disability; shutdown of several critical facilities for more than one week; property severely damaged <25% and >10%
3 = critical	injuries and / or illnesses result in permanent disability; complete shutdown of critical facilities for at least two weeks; property severely damaged <50% and >25%
4 = catastrophic	multiple deaths; complete shutdown of facilities for 30 days or more; property severely damaged >50%

*Frequency of Occurrence, Magnitude / Severity, and Potential Damages based on historical data from NOAA National Climatic Data Center*

## Appended Table 2 Hazard Effect Ranking

*Some effects may have a common cause; for example, a hurricane causes high winds and inland flooding.  
Some effects may have similar causes; for example, hurricanes and nor'easters both cause heavy winds.*

Natural Hazard Effects	Location	Frequency of Occurrence	Magnitude / Severity	Rank
	1 = small 2 = medium 3 = large	0 = unlikely 1 = possible 2 = likely 3 = highly likely	1 = limited 2 = significant 3 = critical 4 = catastrophic	
Nor'Easter Winds	3	3	2	8
Snow	3	3	2	8
Blizzard	3	3	2	8
Hurricane Winds	3	1	3	7
Ice	3	2	2	7
Flooding from Dam Failure	2	1	4	7
Thunderstorm Winds	2	2	2	6
Tornado Winds	2	1	3	6
Shaking	3	1	2	6
Inland Flooding	1	3	1	5
Flooding from Poor Drainage	1	3	1	5
Lightning	1	3	1	5
Falling Trees/Branches	1	3	1	5
Hail	1	2	1	4
Fire/Heat	1	2	1	4
Smoke	1	2	1	4

### Location

1 = small	isolated to specific area during one event
2 = medium	multiple areas during one event
3 = large	significant portion of the town during one event

### Frequency of Occurrence

0 = unlikely	less than 1% probability in the next 100 years
1 = possible	between 1 and 10% probability in the next year; or at least one chance in next 100 years
2 = likely	between 10 and 100% probability in the next year; or at least one chance in next 10 years
3 = highly likely	near 100% probability in the next year

### Magnitude / Severity

1 = limited	injuries and/or illnesses are treatable with first aid; minor "quality of life" loss; shutdown of critical facilities and services for 24 hours or less; property severely damaged < 10%
2 = significant	injuries and / or illnesses do not result in permanent disability; shutdown of several critical facilities for more than one week; property severely damaged <25% and >10%
3 = critical	injuries and / or illnesses result in permanent disability; complete shutdown of critical facilities for at least two weeks; property severely damaged <50% and >25%
4 = catastrophic	multiple deaths; complete shutdown of facilities for 30 days or more; property severely damaged >50%

*Frequency of Occurrence, Magnitude / Severity, and Potential Damages based on historical data from NOAA National Climatic Data Center*

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**APPENDIX A**  
**STAPLEE MATRIX**

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Strategies Listed by Primary Report Section for Bethlehem	Responsible Department <sup>1</sup>	Schedule	Associated Report Sections							Category	STAPLEE Criteria							
			Inland Flooding	Hurricanes	Summer Storms and Tornadoes	Winter Storms	Earthquakes	Dam Failure	Wildfires		Good = 3, Average =2, and Poor = 1							
											Socially acceptable?	Technically feasible?	Administratively workable?	Politically acceptable?	Can it be legally implemented?	Economically beneficial?	Environmentally beneficial?	STAPLEE Sum of Scores
A. Ongoing										1. Prevention								
B. 2009-2014										2. Property Protection								
C. 2014-2019										3. Natural Resource Prot.								
D. 2019-2024										4. Structural Projects								
										5. Public Information								
ALL HAZARDS																		
Dissemination of informational pamphlets regarding natural hazards to public locations	First Selectman	B	x	x	x	x	x	x	x	1,2,5	3	3	3	3	3	3	3	21
Add pages to Town website dedicated to citizen education and preparation for natural hazard events	First Selectman	B	x	x	x	x	x	x	x	1,2,5	3	3	2	3	3	3	3	20
Consider implementation of an enhanced emergency notification system such as CodeRED	First Selectman	A	x	x	x	x	x	x	x	1,2,5	3	2	3	3	3	2	1	17
Upgrade emergency communications to high band radio system	First Selectman	B	x	x	x	x	x	x	x	2,3	3	2	3	3	3	3	2	19
Encourage residents to purchase and use NOAA weather radio with an alarm feature	First Selectman	B	x	x	x	x	x	x	x	2,5	2	3	2	3	3	2	1	16
Continue to review and update Emergency Operations Plan, at least once annually	First Selectman	A	x	x	x	x	x	x	x	1	3	3	3	3	3	3	1	19
Consider modifying the Plan of Conservation and Development to encourage two modes of egress into every neighborhood via through streets	PZC	B	x	x	x	x	x	x	x	1	3	2	3	3	3	2	1	17
Continue reviewing subdivision applications to ensure proper access for emergency vehicles	PZC	A	x	x	x	x	x	x	x	1	3	3	2	3	3	2	2	18
INLAND FLOODING																		
Prevention																		
Consider joining FEMA's Community Rating System	First Selectman	B	x	x	x	x				2	3	3	2	3	3	2	1	17
Continue to regulate activities within SFHAs	PZC	A	x	x	x	x				1	2	3	2	3	3	3	2	18
Require new buildings constructed in flood prone areas to be protected to the highest recorded flood level regardless of SFHA	PZC	B	x	x	x	x				1,2	2	2	2	2	2	3	1	14
Require that new buildings be designed and graded to shunt drainage away from the building	PZC	B	x	x	x	x				1,2	2	2	3	3	3	3	1	17
Assist with the MapMod Program to ensure an appropriate update to the FIS, FIRM, and Flood Boundary & Floodway Maps for the Town	First Selectman, DPW	B, C	x	x	x	x				1	3	3	2	3	3	2	1	17
After the MapMod Program, use the Town contour maps to develop more exact regulatory flood maps using FEMA flood elevations	DPW	C, D	x	x	x	x				1,2	2	2	2	2	2	3	1	14
Adopt an aquifer protection overlay zone once Watertown Fire District finalizes its aquifer protection area	PZC	B	x	x	x	x				1	2	3	3	3	3	2	3	19
Property and Natural Resource Protection																		
Acquire open space properties within SFHAs and set aside as greenways, parks, or other non-residential, non-commercial, or non-industrial use	First Selectman	A	x	x	x	x		x		2,3	3	2	2	3	3	3	3	19
Selectively pursue conservation objectives listed in the Plan of Conservation & Development	First Selectman	A	x	x	x	x				3	3	2	2	3	3	2	3	18
Continue to regulate development in protected and sensitive areas, including steep slopes, wetlands, and floodplains	PZC, IWC	A	x	x	x	x	x	x	x	3	2	3	3	2	3	2	3	18
Structural Projects																		
Pursue funding to elevate Crane Hollow Road	First Selectman	B	x	x	x	x		x		2,4	2	3	2	3	3	2	1	16
Pursude funding to elevate the road near the south end of Hickory Lane, or to widen the stream and install a box culvert	First Selectman	B	x	x	x	x		x		4	1	2	2	2	3	2	1	13
Encourage the State DOT to elevate Route 132 between Lakes Road and Sky Meadow Lane, or to widen the stream and install a box culvert	First Selectman	C	x	x	x	x		x		4	3	2	3	3	3	2	1	17
WIND DAMAGE RELATED TO HURRICANES, SUMMER STORMS, AND WINTER STORMS																		
Increase tree limb inspections and maintenance, especially along evacuation routes, and ensure minimum potential for downed power lines	DPW	B		x	x	x	x			1,2	3	2	1	3	3	2	1	15
Increase inspections of trees on private property near power lines and Town right-of-ways	DPW	B		x	x	x	x			1,2	3	2	1	3	3	2	1	15
Continue outreach regarding dangerous trees on private property	DPW	A		x	x	x	x			1	3	2	2	3	3	3	1	17
Continue to require that utilities be placed underground in new developments and pursue funding to move them underground in existing areas	PZC, First Selectman	A, C	x	x	x	x		x	x	1,2	3	2	2	3	3	3	1	17
Continue to require compliance with the Connecticut Building Code for Wind Speeds	PZC/LUC	A		x	x	x				1	3	3	3	3	3	3	1	19
Provide for the Building Department to make literature available during the permitting process regarding appropriate design standards	PZC/LUC	B		x	x	x				1	3	3	3	3	3	3	1	19

Strategies Listed by Primary Report Section for Bethlehem	Responsible Department <sup>1</sup>	Schedule	Associated Report Sections							Category	STAPLEE Criteria							
			Inland Flooding	Hurricanes	Summer Storms and Tornadoes	Winter Storms	Earthquakes	Dam Failure	Wildfires		Good = 3, Average =2, and Poor = 1							
											Socially acceptable?	Technically feasible?	Administratively workable?	Politically acceptable?	Can it be legally implemented?	Economically beneficial?	Environmentally beneficial?	STAPLEE Sum of Scores
		A. Ongoing								1. Prevention								
		B. 2009-2014								2. Property Protection								
		C. 2014-2019								3. Natural Resource Prot.								
		D. 2019-2024								4. Structural Projects								
										5. Public Information								
WINTER STORMS																		
Post a list of Town sheltering facilities in the Town Hall and on the Town's website	LEPC	B	x	x	x	x	x	x	x	5	3	3	3	3	3	3	1	19
Complete evacuation plan to ensure timely evacuation of shelterees from all areas of Town, and post publicly	First Selectman	B	x	x	x	x	x	x	x	5	3	3	3	3	3	3	1	19
Prioritize plowing routes and post the snow plowing prioritization in Town buildings each winter	DPW	B				x				5	2	3	3	3	3	3	1	18
Pursue grant funding to install drainage along Cabbage Lane near Route 132 to eliminate icing	First Selectman	B	x	x	x	x				1,4	2	3	2	3	3	2	1	16
Encourage the Horace Mann Nature Center to widen and improve the access road from Bethlehem to facilitate emergency access	First Selectman	B		x	x	x	x		x	1,4	2	2	3	3	3	2	2	17
EARTHQUAKES																		
Consider preventing residential development in areas prone to collapse, such as below steep slopes	PZC	B						x		1	2	3	3	2	3	2	2	17
Continue to require adherence to the state building codes	PZC	A		x	x	x	x			1	2	3	3	3	3	3	1	18
Ensure that municipal departments have adequate backup facilities (power generation, heat, water, etc.) in case earthquake damage occurs	First Selectman	B		x	x	x	x	x		1	2	2	2	2	3	2	1	14
DAM FAILURE																		
Stay current on the evolution of EOPs and Dam Failure Analyses for Class C and B dams that can impact Bethlehem	First Selectman	A	x				x	x		2	3	3	3	3	3	3	3	21
Continue pursuing modifications to Long Meadow Pond Dam to pass the 100-year flood event, update EOP, and maximize preparedness for dam failure	First Selectman, DPW	A	x				x	x		1,2,4	3	3	3	3	3	2	2	19
Consider implementing Town inspections of Class A, AA, and unranked dams	DPW	B	x				x	x		2	2	3	1	2	1	3	2	14
If an enhanced emergency notification system is acquired, include dam failure inundation areas in database	First Selectman	B	x				x	x		1	3	3	3	3	3	3	1	19
Have copies of the Class C dam EOPs and Dam Failure Analyses on file at the Town Hall for public viewing	First Selectman	B						x		5	3	2	3	3	2	1	1	15
Continue ongoing inspections and maintenance of Long Meadow Pond Dam	DPW	A						x		1,2	3	3	3	3	3	2	1	18
Consider forming a Flood and Erosion Control Board to oversee municipal dam maintenance and problems with flooding and erosion	First Selectman	B	x	x	x	x		x		1,2,3,4	3	3	3	3	3	3	2	20
WILDFIRES																		
Continue to require the installation of fire ponds and dry hydrants in new developments, and pursue additional ponds where supplies are inadequate	PZC, Fire Dept.	A			x				x	2,4	3	2	3	3	3	3	2	19
Continue to promote inter-municipal cooperation in fire-fighting efforts	Fire Dept.	A			x				x	1	3	3	3	3	3	3	3	21
Continue to support public outreach programs to increase awareness of forest fire danger and how to use common fire fighting equipment	Fire Dept.	A							x	5	3	3	3	3	3	3	3	21
Encourage property owners to widen access roads to facilitate emergency access to remote locations	First Selectman	B		x	x	x	x	x	x	1	2	2	3	2	2	2	1	14
Provide outreach programs that include tips on how to properly manage burning and campfires on private property	Fire Dept.	B							x	5	3	3	3	3	3	3	3	21
Patrol Town-owned open space and parks to prevent campfires	Police Dept.	B							x	3	2	2	2	3	3	2	3	17
Enforce regulations and permits for open burning	Police Dept.	A							x	1,3	2	2	2	3	3	3	3	18

<sup>1</sup>Notes  
PZC = Planning Commission  
LUC = Land Use Coordinator  
DPW = Department of Public Works / Highway Department  
IWC = Inland Wetlands & Watercourses Commission

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**APPENDIX B**  
**DOCUMENTATION OF PLAN DEVELOPMENT**

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***APPENDIX B***  
***PREFACE***

An extensive data collection, evaluation, and outreach program was undertaken to compile information about existing hazards and mitigation in the Town of Bethlehem as well as to identify areas that should be prioritized for hazard mitigation. Documentation of this process is provided within the following sets of meeting minutes and field reports.

COGCNV field notes

Field inspection on February 13, 2008.

Notes typed February 14, 2008

Scott Bighinatti

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Connecticut experienced a period of heavy rains on frozen ground on February 13, 2008. Precipitation measured 1.35 inches over approximately 9 hours in nearby Litchfield and 1.62 inches in Waterbury. On February 13, 2008 David Murphy and Vince McDermott outlined areas of potential flooding in the Towns of Thomaston and Bethlehem. These sites were visited on February 13, 2008 and problematic areas were photographed. These problematic areas primarily included areas of potential poor drainage due to the snow cover. The sequence of photography is listed below:

Camera #1:

1. North end of Reynolds Bridge Road, Thomaston
2. Northern part of Munger Lane, Bethlehem (facing north)
3. Northern part of Munger Lane, Bethlehem (facing south)
4. North end of Westshore drive, Bethlehem (facing south)
5. North end of West shore drive, Bethlehem (facing west)

Many areas of both Towns were subject to minor sheet flow. Other areas had deeper puddles due to snow inhibiting inflow to the storm sewers. No major tree falls were noted, although there were areas with small branches that had fallen into or next to the streets.

**Thomaston:**

- a) Waterbury Road (Route 262) (South) – Nibbling Brook appears to bend around a factory, but the channel appeared well developed. The stream was flowing hard, but the water did not contain much sediment. There is a low area on the south side of the road that is in the 100-year flood plain, but appeared to be used for storage. It was not flooded at the time of inspection.
- b) Waterbury Road (Route 262) (South) – At the bend in Rt. 262 where Jericho Brook enters the Naugatuck River from the west, and there was a large puddle over the northbound lane about five inches deep. This curve is south of the Stevens business. No problems were noted near the Stevens business.
- c) Waterbury Road (Route 262) (South) – A factory on the west side of the road had no problems with flooding, but the east side of the road was not draining. Two to three inches of water was present in the northbound lane.
- d) Naugatuck River – The Naugatuck River was high, but not close to being over bank, during field inspections in Thomaston. All the bridges over the Naugatuck River are very high and in no danger of being overtopped by normal floods.



- e) Reynolds Bridge Road – The north end of this road near the Route 8 northbound off-ramp had a deep puddle (approximately eight inches in the middle). This puddle is likely due to a clogged culvert in the low spot, but this was not verified. See Picture #1.
- f) Unnamed Tributary near Route 6 – An unnamed tributary to the Naugatuck River is channelized starting from Watertown Road (Route 6) and running under Sumpf Avenue, Warner Lane, and Route 262. No flooding was noted upstream of the culvert.
- g) Northfield Brook – No flooding was noted along Northfield Road (Route 254). Despite several crossings under Northfield Road, the culverts appear well sized to handle the discharge along Northfield Brook that outlets from Northfield Pond Dam, which is managed by the US Army Corps of Engineers.
- h) Unnamed Stream along High Street Extension – A stream drains from a small pond along the west side of the street. While it is unlikely that the stream will be high enough to overtop the road, several driveway crossings exist over the stream, indicating the potential for residents to be trapped if the crossings back up.
- i) Smith Road – No flooding problems were noted here on this unnamed stream that outlets from Southerly Pond Dam. The stream is a tributary to the Naugatuck River. The new development to the northeast has a large detention basin providing storage.
- j) Unnamed stream under Atwood Road – This stream takes a sharp bend and may have been redirected around a nearby field. It was flowing under Atwood road with no problems.
- k) Branch Brook – No problems were noted along Branch Brook, but access was limited due to the snow, the steep grade, and the closed recreation areas.
- l) Wigwam Reservoir – The area around Wigwam Reservoir is undeveloped. The reservoir was low compared to Route 109.

### **Bethlehem:**

- m) Kasson Road (Route 132) (East) – While the wetlands along East Spring Brook appeared to be near the road level, no flooding was present at the time of inspection. However, this road would certainly be overtopped should either of the upstream dams fail.
- n) Kasson Avenue (private road)– Long Meadow Pond is well downgradient of the houses along the lake, and the lake would overtop Route 132 at the south end of the pond before coming close to any of the houses. The wetlands nearby the south end of the lake on Bellamy Lane were high, but the road was not flooded.
- o) Munger Lane (South and Middle) – No flooding was observed along these section of Munger Lane despite the nearby agricultural fields. The unnamed tributary to the Weekepeemee River that drains from Long Meadow Pond and Benjamin Pond was not flooding Munger Lane, but some ponding was occurring at the crossing due to the snow pack.

- p) Munger Lane (North) – The large plot of agricultural fields halfway to Gros Road were producing a significant amount of runoff, leading to ponding in the roadway up to four inches in places. The storm drains on this street may be too far apart, but the snow is definitely a factor contributing to the depths of ponding. See Photos #2 and #3.
- q) Lake Road – The outlet channel was flowing regularly and the road was not flooded during the inspection.
- r) Westshore Drive – An unnamed tributary to Long Meadow Pond flows under the northern section of Westshore Drive. The crossing was backed up and the street was flooded. A storm drain was noted above the crossing, but was completely filled with water. See Photos #4 and #5.
- s) East Street – The unnamed tributaries along East Spring Brook appeared to be flowing normally. No flooding was present. Pondered water was present on Harrison Road near the Elementary School, but this appeared primarily due to snow pack.
- t) East Spring Brook at Nonnewaug Road – East Spring Brook was flowing rapidly here, and contained a lot of sediment. There are several agricultural operations upstream on Maddox Road that could have contributed to the sediment levels.
- u) Nonnewaug Road at Hickory Lane – East Spring Brook is still flowing hard, but is not overbank before its confluence with the Nonnewaug River.
- v) Unnamed Pond off Hickory Lane – A small pond on the west side of Hickory Lane was overflowing, but erosion was not present along the south end.
- w) Town Line Highway South – No erosion was noted along the dirt road sections of Hickory Lane and Town Line Highway South.



## ***Meeting Minutes***

### **NATURAL HAZARD PRE-DISASTER MITIGATION PLAN FOR BETHLEHEM Council of Governments Central Naugatuck Valley Initial Data Collection Meeting March 4, 2008 Minutes Revised August 6, 2008**

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#### ***I. Welcome & Introductions***

The following individuals attended the data collection meeting:

- ☐ David Murphy, P.E., Milone & MacBroom, Inc. (MMI)
- ☐ Samuel Eisenbeiser, Fitzgerald & Halliday, Inc. (FHI)
- ☐ Scott Bighinatti, Milone & MacBroom, Inc. (MMI)
- ☐ Virginia Mason, Council of Governments Central Naugatuck Valley (CGCNV)
- ☐ Jim Kacerguis, Bethlehem Public Works Director
- ☐ Mike Devine, Bethlehem Emergency Management
- ☐ John Rudzavice, Bethlehem Fire Marshall
- ☐ Roger Natusch, Bethlehem Building Official
- ☐ Jean Donegan, Bethlehem Land Use Coordinator

#### ***II. Description and Need for Hazard Mitigation Plans / Disaster Mitigation Act of 2000***

Virginia and David described the basis for the natural hazard planning process and possible outcomes. Bethlehem is responsible for a 1/8 cost share through in-kind services.

#### ***III. Project Scope and Schedule***

The project scope was described, including project initiation and data collection, the vulnerability assessment, public meetings, development of recommendations, and the FEMA Review and Plan adoption. A 14-month schedule was presented.

Jean Donegan was selected to be the main point of contact for billing. The Board of Selectman will be the governing body to eventually approve the Plan.

#### ***IV. Hazards to Address***

The Bethlehem plan will likely address flooding, hurricanes and tropical storms, winter storms and nor'easters, summer storms and tornadoes, earthquakes, dam failure, and wildfires.

***V. Discussion of Hazard Mitigation Procedures in Effect & Problem Areas***

- ❑ The Town has an almost entirely residential tax base, so funding of capital projects is difficult. The Town relies on outside grants, which can be difficult to obtain due to the small size of the Town.
- ❑ The FEMA FIS is in need of updating, but Litchfield is a low priority in the MapMod program.
- ❑ The Town has had no known history of earthquakes.
- ❑ The informational public meeting was scheduled for April 21<sup>st</sup> at 7:00 PM in the Town Hall.

***Emergency Response Capabilities & Evacuation Routes***

- ❑ The Fire House is the primary shelter used for small, short term events. Memorial Hall is used for larger events, but has limited bathrooms. Both have their own generators, as does each building in the municipal complex. The problem is that Memorial Hall and the Firehouse share the same long driveway, which could create a conflict during an emergency.
- ❑ Other sheltering spots that could be utilized include Bethlehem Elementary School and the private school (The Woodhall School) in Town during the summer. Neither have generators. In addition, the Wisdom House in Litchfield has been used as a shelter in the past for families that had extended power outages.
- ❑ The Abby of Regina Laudis Priory may also be used as a shelter in an emergency, but the Town is hesitant to do so because of the cloistered nature of the facility. The Town would only ask under the direst circumstances.
- ❑ Evacuation routes are regionally defined by the Regional Evacuation Plan. Evacuation Routes are Route 61 and Route 132. Flanders Road is also another good route south into Woodbury. Route 132 has some areas where flooding has been a problem where a watercourse crosses the road.
- ❑ There are three problem areas for the emergency personnel of Bethlehem related to surrounding Towns:
  1. A piece of Camp Columbia's property in Morris has public access off Munger Lane from Route 109 in Morris. Part of this property is state forest in Morris. They do some logging and the DEP has recently increased public access.

2. The Horace Mann Nature Center in Washington is located off the end of Arch Bridge Road. There is no public access to this property in Washington due to private roads and limited egress over Sprain Brook. Approximately 30-40 children are bussed in each week from New York, 40 weeks per year. This facility has dorms and outbuildings being built and renovated in a \$10 million upgrade, and has COPE-style facilities and ziplines. The Town of Washington has asked the Town of Bethlehem to be the first responders to this facility in the case of an emergency, as it takes 22 minutes to reach the center from their fire house. Bethlehem has accepted this responsibility, but is wary as the road from Bethlehem is unpaved, narrow and steep. It is extremely difficult to get up the road when it snows in winter, despite the sand that is put down. The Town of Bethlehem plows most of the road with a pickup truck because of how narrow it is. Bethlehem worries about the students being isolated during an emergency, though the facility is well-funded and safety conscious.
  3. Land Trust on the Woodbury / Watertown border. Physical access is via Bethlehem off the south end of Hickory Lane (Falls Road). The Town tries to keep the gate here locked, but people repeatedly cut the lock. Woodbury limits access but the tract is not well-managed. The tract is supposed to be used for “passive recreation” but is primarily used by ATVs and horses, especially along developed trails and the power lines. ATVs access the property via Watertown and other locations such as Route 6 and along the power lines. Bethlehem is the first responder here as well, but access is limited because of a bad crossing and poor road conditions. This forest often has problems related to alcohol – ATV and snowmobile accidents, parties, underage drinking, etc.
- ❑ The Town communications system is poor. All the adjoining Towns have upgraded to a high band radio system, so Bethlehem cannot communicate with any of its neighbors via its antiquated low band. The state trooper operates at 800 MHz. The Town does have the means to communicate to DEMS-5. Communications with their neighbors and police consists of walking up to them and talking while responding. A communications study is underway, which will likely recommend a new UHF/VHF communication system. The Town wants a system compatible with all personnel and surrounding Towns. However, the cost of the upgrade will be very high and difficult to fund through the Town budget. Instead, the Town plans to apply for grant funding in consecutive funding cycles in an effort to cobble together grant money from various sources.
  - ❑ The Town has no emergency notification system, and no method to alert residents of floods or other problems.
  - ❑ Homes around Long Meadow Pond are difficult to reach. This includes West Shore Drive and the private Kasson community. Some of the streets are essentially one-way. Fire trucks need to go in line with the last one in being the first one to back out

because there is no place to turn around. In some places, the fire trucks simply can't get to the houses that are up narrow dirt roads.

### ***Critical Facilities***

- ☐ 40-unit "North Purchase Elderly Home" at 11 Jackson Lane is considered a critical facility.
- ☐ There are several group homes for troubled children in Town, including 84 Judge Lane (4 children), Wellspring Foundation at 21 Arch Bridge Road (more than 20 children, also has a day school called Arch Bridge School), and Angelus House at 158 Flanders Road (approximately 10 children)
- ☐ The Town maintains a salt shed in the municipal complex, but plans are in place to replace it. It is too small, and DEP wants it to be a covered structure. The Town would like to move the entire Public Works facility. The DEP has a consent order on the Town regarding this, but the Town has limited funding. This project won't be eligible under PDM due to the consent order, but still is useful to be in the plan.
- ☐ The Town Hall, Department of Public Works & Highways, Fire House, elderly housing, group homes, and schools are considered to be critical facilities. Many of the Town buildings are in the municipal complex.

### ***Subdivision, Inland Wetlands and Other Regulations***

- ☐ Regulations were collected from Jean.

### ***Noted Flooding and/or Drainage Problem Areas***

- ☐ Crane Hollow Road – water floods out at least once every two years. The road over the Weekepeemee acts as a dike and eventually overtops.
- ☐ Arrowhead Lane – Homes here are near the Weekepeemee River and can flood out. The two homes at the end of the street have flooding problems associated with the nearby pond.
- ☐ South end of Hickory Lane – The culvert here is undersized and floods the road every two years, but the Town can't fix this problem without elevating the road. This culvert is near Land Trust property.
- ☐ Hard Hill Road North – There are drainage issues along the road, but they occur primarily on private property. Farmers pass along drainage to their downstream neighbor. For example, one farmer built a 500' berm, which caused flooding problems on a field downstream.

- ❑ Route 132 near Swenson's Farm – water overtops the road near the fire pond.
- ❑ Double Hill Road – A resident has beavers on her property, and the beavers create a lake that eventually overtops the road. This might be along the Weekepeemee River. The owner does not want the beavers to be bothered, so Town personnel don't try to remove the dams.

#### ***Problem Areas for Wind Damage***

- ❑ The electric utility (CL&P) performs tree maintenance, and the Town has a tree warden who encourages the removal of trees that pose a danger to power lines. Outages due to tree fall have been less frequent recently.
- ❑ There are no mobile home parks in Bethlehem.
- ❑ A Tornado struck Morris in 1989 and passed over Bethlehem before landing again in Watertown. Bethlehem received some residual damage from that event from flying debris.

#### ***Problems Due to Snow and Ice***

- ❑ There are many hills in Bethlehem which can sometimes make driving difficult during icy weather.
- ❑ The south end of Cabbage Lane has a drainage problem where it intersects Route 132. The end of the road is a low point and water collects and freezes in the winter, and cars slide out into Route 132 when trying to stop. There is also a poor sight line for cars on Route 132 to see cars coming out of Cabbage Lane, and people tend to speed on this relatively straight section of Route 132. This area is a serious problem, although reportedly there have been no fatalities. The Town wants to install 200 feet of catch basins down the side of Route 132 to help drain the area, but DOT won't pay for it because the problem is on the Town road.
- ❑ Plowing isn't prioritized because the school buses go down every road in Town, so DPW does all the side streets as fast as they can. CT DOT plows the state roads, which are the main routes in Town. Bethlehem uses "magic salt" which is supposed to cause less vehicle rust, while DOT uses regular salt.

#### ***Dams***

- ❑ The Town owns Long Meadow Dam. The dam is not considered to be a significant hazard dam as of 2007, but was formerly a Class B dam. The dam needs to be elevated and spillway enlarged, or the whole dam needs to become a spillway.



Haested Engineering inspected this dam and made the recommendations. The Town would like to be able to find a way to get funding through PDM or another grant program for the necessary dam work (which is due to a design flaw, not a failure of the Town in performing regular maintenance). The Town needs to talk to DEP to weigh its options.

- ❑ Long Meadow Pond is shallow (10-12 feet deep maximum) but very long so it has a lot of volume. It would have a significant dam failure inundation area to the Weekepeemee River.
- ❑ Bronson Lockwood Dam is Class C but is in good condition.

### ***Wildfires and Fire Protection***

- ❑ Fires only burn a couple of acres at their largest. The Town has no state parks, so there are no public camping related fires. The large private tracts of land don't tend to attract kids. The limited-access conservation properties are considered to be at the highest risk for fires.
- ❑ Bethlehem has a 4-wheel drive brush truck and utilizes a system of 32 fire ponds with dry hydrants to provide fire protection to the Town.
- ❑ In addition to the forest areas, the Town feels that its many hayfields are a significant fire risk, particularly just prior to harvest time.
- ❑ The Town has mutual aid agreements with all its neighbors.

### ***Development Trends***

- ❑ Bethlehem has almost no development ongoing because there is no public water, no public sewer, and poor soils for large on-site septic systems. Such systems would be expensive due to the poor soils. Applications are typically for very small (1-2 lot) subdivisions. Last real development push was in the late 80's.
- ❑ Underground utilities are required in new developments wherever possible.
- ❑ Bethlehem has a lot of undeveloped open space, but it is primarily private forest or land trust property.

## ***VI. Acquisitions***

- ❑ *Bethlehem Town Guide* – Voices, March 2007
- ❑ *2006 Annual Report* – Bethlehem, Connecticut
- ❑ *Bethlehem Inland Wetlands Regulations* – Undated, but most current copy

- ☐ *Earth Materials Ordinance – Bethlehem, Connecticut* effective May 5, 1977
- ☐ *Subdivision Regulations* effective October 10, 2003
- ☐ *Plan of Conservation & Development* effective November 1, 1999.


*D Murphy*

March 17, 2008

 Richard Stubbs  
 American Red Cross Waterbury Area  
 64 Holmes Avenue  
 Waterbury, CT 06710


**Re: Pre-Disaster Natural Hazard Mitigation Planning  
 Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston**

Dear Mr. *Rich* Stubbs,

The Council of Governments Central Naugatuck Valley (COGCNV) is coordinating the development of pre-disaster natural hazard mitigation plans for Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston. Plan development and adoption is required in order to be eligible for certain pre-disaster mitigation funds from FEMA, as well as a greater portion of post-disaster funding.

In order to successfully develop the local mitigation plans, a significant public outreach effort is required by FEMA. In addition, FEMA requests that stakeholders such as land trusts, neighborhood groups, chambers of commerce, health districts, watershed associations, and educational institutions be invited to provide input. Therefore, COGCNV invites your participation at one or more of the public informational meetings listed below:

<i>Meeting</i>	<i>Date</i>	<i>Time</i>	<i>Location</i>
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Please contact the COGCNV at 203-757-0535 or [vmason@cogcnv.org](mailto:vmason@cogcnv.org) if you have any questions about the planning process or the meetings.

We hope that you will assist in this very important project, and we look forward to seeing you soon.

Sincerely,

*Virginia Mason*  
 Virginia Mason

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March 17, 2008

James Rokos  
Director of Health  
Torrington Area Health District  
350 Main Street  
Torrington, CT 06790

**Re: Pre-Disaster Natural Hazard Mitigation Planning  
Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston**

Dear Mr. Rokos,

The Council of Governments Central Naugatuck Valley (COGCNV) is coordinating the development of pre-disaster natural hazard mitigation plans for Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston. Plan development and adoption is required in order to be eligible for certain pre-disaster mitigation funds from FEMA, as well as a greater portion of post-disaster funding.


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Virginia Mason

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March 17, 2008

Kristen Bulkovitch  
President  
United Way of Greater Waterbury  
P.O. Box 2688  
Waterbury, CT 06723-2688

**Re: Pre-Disaster Natural Hazard Mitigation Planning  
Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston**

Dear Ms. Bulkovitch,

The Council of Governments Central Naugatuck Valley (COGCV) is coordinating the development of pre-disaster natural hazard mitigation plans for Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston. Plan development and adoption is required in order to be eligible for certain pre-disaster mitigation funds from FEMA, as well as a greater portion of post-disaster funding.

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Virginia Mason

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March 17, 2008

Mr. Paul E. Reid  
Inland Wetlands Commission  
36 Main Street South  
Bethlehem, CT 06751

**Re: Pre-Disaster Natural Hazard Mitigation Planning  
Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston**

Dear Mr. Reid,

The Council of Governments Central Naugatuck Valley (COGCNV) is coordinating the development of pre-disaster natural hazard mitigation plans for Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston. Plan development and adoption is required in order to be eligible for certain pre-disaster mitigation funds from FEMA, as well as a greater portion of post-disaster funding.


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Sincerely,

  
Virginia Mason

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March 17, 2008

Mr. John Nelson  
Bethlehem Land Trust  
PO Box 322  
Bethlehem, CT 06751

**Re: Pre-Disaster Natural Hazard Mitigation Planning  
Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston**

Dear Mr. Nelson, *Jack*

The Council of Governments Central Naugatuck Valley (COGCNV) is coordinating the development of pre-disaster natural hazard mitigation plans for Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston. Plan development and adoption is required in order to be eligible for certain pre-disaster mitigation funds from FEMA, as well as a greater portion of post-disaster funding.

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Sincerely,

*Virginia Mason*  
Virginia Mason

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March 17, 2008

Nancy McMillan  
Bethlehem Conservation Commission  
237 Wood Creek Road  
Bethlehem, CT 06751

**Re: Pre-Disaster Natural Hazard Mitigation Planning  
Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston**

Dear Ms. McMillan, *Nancy*

The Council of Governments Central Naugatuck Valley (COGCNV) is coordinating the development of pre-disaster natural hazard mitigation plans for Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston. Plan development and adoption is required in order to be eligible for certain pre-disaster mitigation funds from FEMA, as well as a greater portion of post-disaster funding.

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Sincerely,

*Virginia*  
Virginia Mason

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March 17, 2008

Robert Gallo  
Planning Commission  
36 Main Street South  
Bethlehem, CT 06751

**Re: Pre-Disaster Natural Hazard Mitigation Planning  
Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston**

Dear Mr. Gallo,

The Council of Governments Central Naugatuck Valley (COGCNV) is coordinating the development of pre-disaster natural hazard mitigation plans for Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston. Plan development and adoption is required in order to be eligible for certain pre-disaster mitigation funds from FEMA, as well as a greater portion of post-disaster funding.

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Sincerely,

Virginia Mason

T:\Projects\Emergency Planning\Pre-Disaster Mitigation\Predisaster FY 06\Letter to Stakeholders.doc



March 17, 2008

Long Meadow Lake Management Committee  
36 Main Street South  
Bethlehem, CT 06751

**Re: Pre-Disaster Natural Hazard Mitigation Planning  
Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston**

Dear Director,

The Council of Governments Central Naugatuck Valley (COGCNV) is coordinating the development of pre-disaster natural hazard mitigation plans for Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury, and Thomaston. Plan development and adoption is required in order to be eligible for certain pre-disaster mitigation funds from FEMA, as well as a greater portion of post-disaster funding.

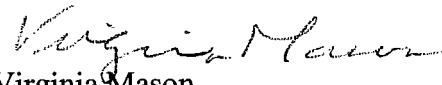
In order to successfully develop the local mitigation plans, a significant public outreach effort is required by FEMA. In addition, FEMA requests that stakeholders such as land trusts, neighborhood groups, chambers of commerce, health districts, watershed associations, and educational institutions be invited to provide input. Therefore, COGCNV invites your participation at one or more of the public informational meetings listed below:

<i>Meeting</i>	<i>Date</i>	<i>Time</i>	<i>Location</i>
Naugatuck	March 3, 2008	6:00 PM	Town Hall
Southbury	March 19, 2008	6:30 PM	Town Hall
Thomaston	March 24, 2008	7:00 PM	Town Hall
Beacon Falls	April 3, 2008	7:00 PM	Town Hall
Middlebury	April 7, 2008	6:30 PM	Town Hall
Bethlehem	April 21, 2008	7:30 PM	Library

Please contact the COGCNV at 203-757-0535 or [vmason@cogcnv.org](mailto:vmason@cogcnv.org) if you have any questions about the planning process or the meetings.

We hope that you will assist in this very important project, and we look forward to seeing you soon.

Sincerely,

  
Virginia Mason

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## **Natural disaster meeting planned**

BETHLEHEM — The Council of Governments of the Central Naugatuck Valley will host a meeting Monday at 7:30 p.m. at the Town Library to identify natural hazards in town and discuss ways to reduce their impact.

The public is invited to discuss the possible damage caused by hurricanes, nor'easters, floods, severe thunderstorms, icing, and earthquakes.

Consultants hired by COGC-NV will then develop a plan identifying projects that can be undertaken prior to a disaster to reduce loss and damages. The plan will be submitted to FEMA in accordance with the Disaster Mitigation Act of 2000, which requires communities to have approved mitigation plans in order to receive pre-disaster project grants.

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*Republican-American*

*4-18-08*

**Council of Governments of the Central Naugatuck Valley**  
**Bethlehem Pre-Disaster Mitigation Meeting**  
**April 21, 2008**

Name	Affiliation	Phone No.	FAX No.	e-mail
Jeann Donagan	P.O. Box 402	203-266-	203-266	JFDwk
	Berthelton Land Use	5000 (home)	5615	@AOL.COM
Tim Kacerguis	Bethlehem Public Works	203 266 7664	203 408 1074	
TED CRAWFORD		203-266-7869	—	—
Therese O'Neill	municipal Agent for Elderly	203 266 7089		
John L. Varley	Resident	203-266-5862		KSUSLV@AOL.com
Mike Devine	Emergency Mgmt	203-266-5817		michaeljdevine@sbglobal.net
Vince McDermott	—	203-266-7549		vcm@netcape.net
Miele Schuyler	Long Meadow Lake Management	203-263-2207	203-263-0112	LMLM@earthlink.net
Nancy McMillan	Conservation Commission	203-266-5229	266-6688	n1mcm@yahoo.com

# Natural Hazard Pre-Disaster Mitigation Plan Bethlehem, Connecticut



## Presented by:

**David Murphy, P.E. – Associate**



**Milone & MacBroom, Inc.**

**Sam Eisenbeiser, AICP**



**Fitzgerald & Halliday, Inc.**

# History of Hazard Mitigation Plans



- **Authority**

- Disaster Mitigation Act of 2000 (amendments to Stafford Act of 1988)

- **Goal of Disaster Mitigation Act**

- Encourage disaster preparedness
- Encourage hazard mitigation measures to reduce losses of life and property





# Municipalities Currently Involved in the Regional Mitigation Planning Process

- Beacon Falls
- Bethlehem
- Middlebury
- Naugatuck
- Southbury
- Thomaston



Local municipalities must have a FEMA approved Hazard Mitigation Plan in place to receive federal grant funds for hazard mitigation projects



## Selection of FEMA Pre-Disaster Mitigation Grants: 2003-2006

*List does not include seismic, wind retrofit, home acquisition, and planning projects*

<i>State</i>	<i>Description</i>	<i>Grant</i>
Colorado	Detention pond	\$3,000,000
Oregon	Water conduit replacement	\$3,000,000
Washington	Road elevation	\$3,000,000
Oregon	Floodplain restoration	\$2,984,236
Colorado	Watershed mitigation	\$2,497,216
Georgia	Drainage improvements	\$1,764,356
Massachusetts	Pond flood hazard project	\$1,745,700
Oregon	Ice storm retrofit	\$1,570,836
North Dakota	Power transmission replacement	\$1,511,250
Texas	Home elevations	\$1,507,005
Florida	Storm sewer pump station	\$1,500,000
Massachusetts	Flood hazard mitigation project	\$1,079,925
Kansas	Effluent pump station	\$765,000
South Dakota	Flood channel restoration	\$580,657
Massachusetts	Culvert project	\$525,000
Texas	Storm shelter	\$475,712
Massachusetts	Housing elevation and retrofit	\$473,640
Utah	Fire station retrofit	\$374,254
Washington	Downtown flood prevention project	\$255,000
New York	WWTP Floodwall construction	\$223,200
Massachusetts	Road mitigation project	\$186,348
Massachusetts	Flood mitigation project	\$145,503
Vermont	Road mitigation project	\$140,441
New Hampshire	Water planning for firefighting	\$134,810
Oregon	Bridge scour relocation project	\$116,709
New Hampshire	Box culvert project	\$102,000
Missouri	Bank stabilization	\$48,750
Tennessee	Utility protection	\$40,564
Wisconsin	Waterway stabilization	\$12,909





# What is a Natural Hazard ?

- An extreme natural event that poses a risk to people, infrastructure, and resources



# What is Hazard Mitigation?

- ***Pre-disaster*** actions that reduce or eliminate long-term risk to people, property, and resources from natural hazards and their effects



A Road Closure During / After a Large Scale Rainfall Event is a Type of Hazard Mitigation



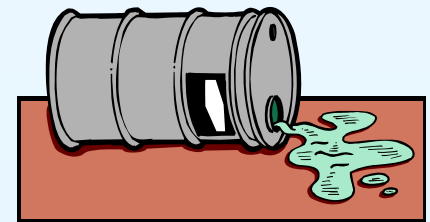
# Long-Term Goals of Hazard Mitigation

- Reduce loss / damage to life, property, and infrastructure
- Reduce the cost to residents and businesses
- Educate residents and policy-makers about natural hazard risk and vulnerability
- Connect hazard mitigation planning to other community planning efforts
- Enhance and preserve natural resource systems in the community



# What a Hazard Mitigation Plan Does Not Address

- Terrorism and Sabotage
- Disaster Response and Recovery
- Human Induced Emergencies (some fires, hazardous spills and contamination, disease, etc.)



# Components of Hazard Mitigation Planning Process

- Identify natural hazards that could occur in Bethlehem
- Evaluate the vulnerability of structures and populations and identify critical facilities and areas of concern
- Assess adequacy of mitigation measures currently in place
- Evaluate potential mitigation measures that could be undertaken to reduce the risk and vulnerability
- Develop recommendations for future mitigation actions



# Bethlehem's Critical Facilities

- Emergency Services – Police, Fire, Ambulance
- Municipal Facilities – Town Hall
- Public Works Center



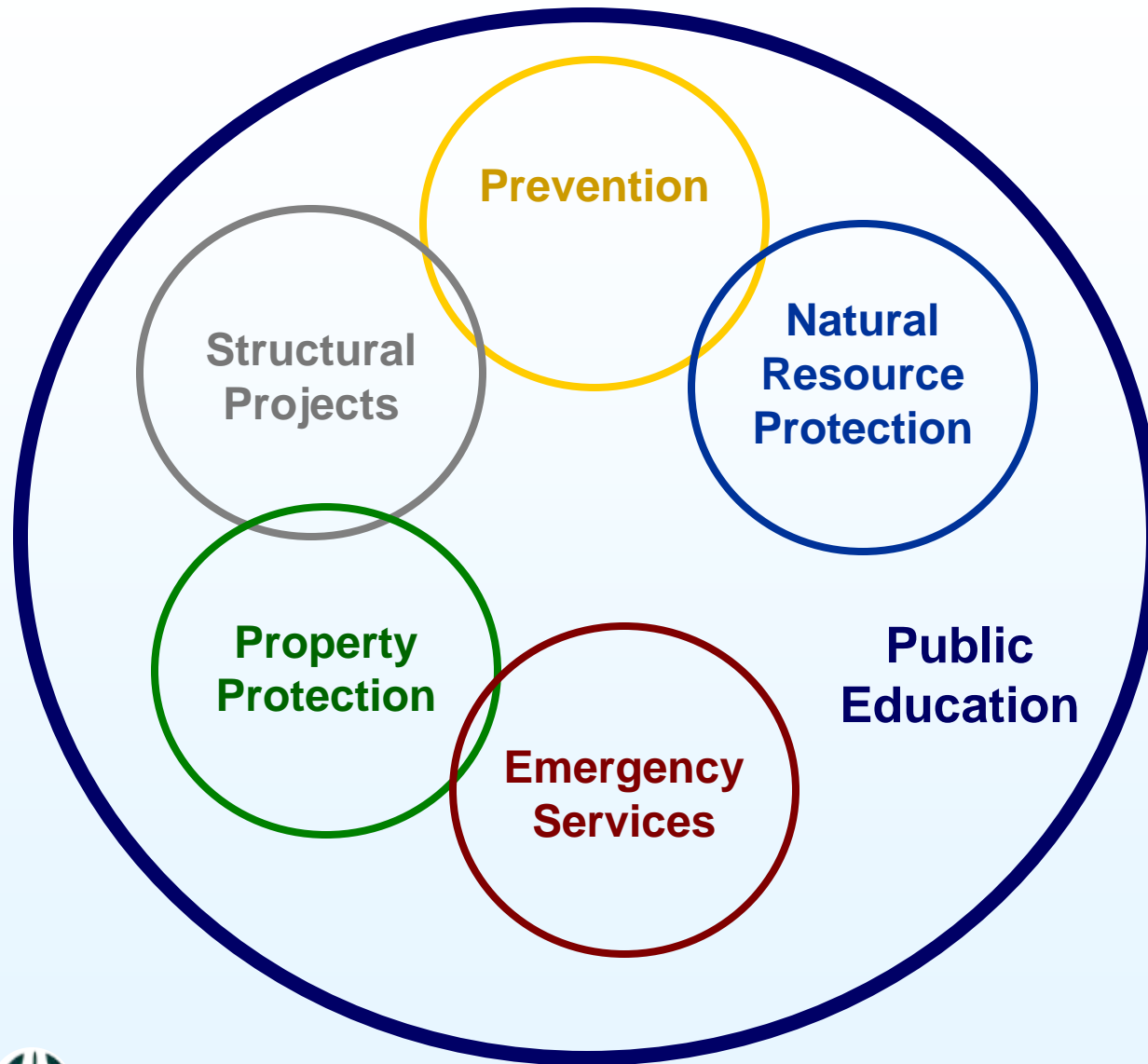


# Bethlehem's Critical Facilities

- Health Care and Assisted Living – North Bridget Home
- Group Homes
- Shelters – Fire House, Memorial Hall, Bethlehem Elementary School



# Potential Mitigation Categories





# Potential Mitigation Measures

- Updating Communications Systems
- Adopt local legislation that limits or regulates development in vulnerable areas
- Public education programs – dissemination of public safety information
- Construction of structural measures
- Allocate technical and financial resources for mitigation programs
- Preserve critical land areas and natural systems



# Primary Natural Hazards Facing Bethlehem

- Inland flooding
- Winter storms, nor'easters, heavy snow, blizzards, ice storms
- Hurricanes
- Summer storms, tornadoes, thunderstorms, lightning, hail
- Dam failure
- Wildfires
- Earthquakes



# Hurricanes

- Winds
- Heavy rain / flooding



# Summer Storms and Tornadoes



Lightning over Boston

- Heavy wind / tornadoes / downbursts
- Lightning
- Heavy rain
- Hail



Tornado in KS



Flooding in MN



# Winter Storms

- Blizzards and nor'easters
- Heavy snow and drifts
- Freezing rain / ice



CT River - April 2007



Southbury - April 2007





# Dam Failure

- Severe rains or earthquakes can cause failure
- Possibility of loss of life and millions of dollars in property damage



Long Meadow Pond Dam



Bronson Lockwood Pond Dam



# Wildfires

- Bethlehem has low to moderate risk of wildfires
- Land subject to wildfires is mostly private or land trust forests or farms during drought
- Fire
- Heat
- Smoke



Photo courtesy of FEMA



# Earthquakes

- Bethlehem is in an area of minor seismic activity
- Chester, CT experienced a small, 2.0 magnitude earthquake on March 11, 2008
- Can cause dam failure
  - ◆ Shaking
  - ◆ Liquefaction
  - ◆ Secondary (Slides/Slumps)



Photos courtesy of FEMA





# Area-Specific Problems

- Roadway and property flooding at rivers and streams
  - ◆ Crane Hollow Road
  - ◆ Arrowhead Lane
  - ◆ Route 132
  - ◆ Double Hill Road
- Localized problems
  - ◆ Hard Hill Road North
- Flooding caused by poor drainage
  - ◆ Hickory Lane
  - ◆ Cabbage Lane at Route 32 – ice

Other potential hazards

- Long Meadow Pond Dam
- Drought conditions – wildfires in hay fields



# Flooding at Rivers and Streams

- Dowd Brook and tributary at Crane Hollow Road
- Homes along the Weekepeemee on Arrowhead Lane
- Route 132 overtops at the pond near Swanson's farm.
- Beaver dams back water over Double Hill Road



# Localized Problems

- Hard Hill Road North – farmers pass drainage from one field to the next



# Flooding and Ice Caused by Poor Drainage

- Hickory Lane – culvert undersized, but can't fix without elevating road
- Cabbage Lane – poor drainage at Route 132 causes dangerous icing conditions

Route 132 at Cabbage Lane





# Other Potential Hazards

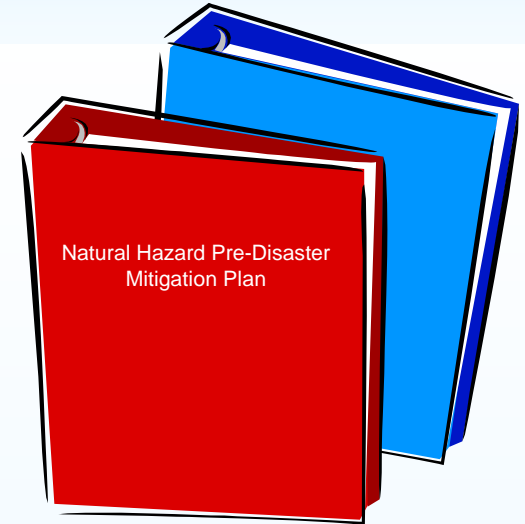
- Long Meadow Pond dam
- Hay fields could spread wildfires during drought

Fields off Munger Lane



# Next Steps

- Incorporate input from residents
- Rank hazard vulnerability
- Develop a response strategy
- Prepare the draft plan with recommendations for review by the Town and the public
- Adopt and implement the plan



## Questions and Additions

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There is no handwriting or other markings on the paper.

## ***Meeting Minutes***

### **NATURAL HAZARD PRE-DISASTER MITIGATION PLAN FOR BETHLEHEM Council of Governments Central Naugatuck Valley Public Information Meeting April 21, 2008**

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#### ***I. Welcome & Introductions***

The following individuals attended the public meeting:

- ☐ David Murphy, P.E., Milone & MacBroom, Inc. (MMI)
- ☐ Samuel Eisenbeiser, Fitzgerald & Halliday, Inc. (FHI)
- ☐ Virginia Mason, Council of Governments Central Naugatuck Valley (CGCNV)
- ☐ Jean Donegan, Bethlehem Land Use Coordinator
- ☐ Jim Kacerguis, Bethlehem Public Works Director
- ☐ Mike Devine, Bethlehem Emergency Management
- ☐ Nancy McMillan, Conservation Commission
- ☐ Meike Schuyler, Long Meadow Pond Management
- ☐ Theresa O'Neill, municipal agent for the elderly
- ☐ Ted Crawford, resident
- ☐ Vince McDermott, resident
- ☐ John Vail, Jr., resident

Ms. Mason introduced the project team and the project, explaining the COG's role in the project, the goals of the Disaster Mitigation Act, and the relationship to the FEMA pre-disaster and post-disaster funding processes.

#### ***II. Power Point: "Natural Hazard Pre-Disaster Mitigation Plan, Bethlehem, Connecticut"***

Mr. Murphy and Mr. Eisenbeiser presented the power point slideshow.

#### ***III. Questions, Comments, and Discussion***

*Corrections and Comments:*

- ☐ "Swanson's" farm is "Swenson's" farm
- ☐ North "Bridget" Home is North "Purchase" Home
- ☐ Dowd Brook may not be the problem at Crane Hill Road. It may be a different stream. This needs to be checked.

*Discussion:*

- ☐ Ms. McMillan reported that an icy spot occurs at Route 132 and Wood Creek Road near the Weekepeemee River due to poor drainage.



- ❑ A long discussion took place regarding the condition of Long Meadow Pond Dam and the potential impacts in Bethlehem, Woodbury, and Southbury if the dam should fail. Ms. Schuyler of the Long Meadow Pond Management Association would like to work with Milone & MacBroom, Inc. after the public meeting to ensure that proper documentation is available for the planning project. A potential teaming of communities such as Bethlehem and Southbury was discussed to apply for PDM grants for Long Meadow Pond Dam maintenance.
- ❑ Another discussion involved inadequate communication during emergencies. The town Communications Plan specifies the use of Morris Fire House as a Command Center but radio communications are not possible inside the facility. Mr. Murphy explained that PDM grants are generally not available for communications but that it was necessary to describe the problem and recommend improvements in the plan.
- ❑ Mr. Vail believes that more tree and branch trimming is necessary due to vulnerability of power lines.
- ❑ Flooding at Swenson's farm reportedly prevents emergency response to the Woodlands, Cabbage Lane, and Hard Hill Road neighborhoods.

From: Ifkovic, Diane [Diane.Ifkovic@ct.gov]  
Sent: Friday, December 12, 2008 8:54 AM  
To: Jfdwk@aol.com; mmartin@thomastonct.org; susanacable@aol.com  
Cc: Christian, Art; Virginia Mason; Shawn Goulet; Dave Murphy; Scott Bighinatti  
Subject: No RLPs for Bethlehem, Beacon Falls or Thomaston

Importance: Low

Hi all,

According to FEMA's Repetitive Loss Property (RLP) database, there are NO RLPs in Bethlehem, Beacon Falls or Thomaston.

If you need any data, such as list of properties in town with flood insurance, please give a call or email.

diane

Diane S. Ifkovic

State NFIP Coordinator/Environmental Analyst III  
Connecticut Department of Environmental Protection  
Bureau of Water Protection & Land Reuse  
Inland Water Resources Division  
Flood Management Program  
79 Elm Street, 3rd floor  
Hartford, CT 06106-5127  
Phone: (860) 424-3537  
Fax: (860) 424-4075  
Email: diane.ifkovic@ct.gov

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**APPENDIX C**  
**RECORD OF MUNICIPAL ADOPTION**

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**FEMA**

February 2, 2009

Jeffrey Hamel  
First Selectman  
Town of Bethlehem  
PO Box 160  
Bethlehem, CT 06751

Dear Mr. Hamel:

Thank you for the opportunity to review the Town of Bethlehem Natural Hazard Pre-Disaster Mitigation Plan. The Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) Region I has evaluated the plan for compliance with the Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR Parts 201 and 206). The plan satisfactorily meets all of the mandatory requirements of the regulations except §201.6(c)(5), adoption by the local governing body.

Federal regulations require that a plan must include documentation of its formal adoption by the local governing body (e.g., Board of Selectmen). Accordingly, this letter reflects a conditional approval of the plan until we receive a copy of its signed and stamped adoption resolution. Once this adoption resolution has been received and accepted, FEMA Region I will send a formal letter of approval to you confirming the Town of Bethlehem's eligibility to apply for Mitigation Grants administered by FEMA. If the plan is not adopted within one calendar year of FEMA's conditional approval, the jurisdiction must update the entire plan and resubmit it for FEMA review.

Along with a copy of the plan's adoption resolution, please also be sure to submit an electronic version of the plan. FEMA must upload complete, electronic versions of all approved plans into the National Emergency Management Information System (NEMIS) database. Acceptable electronic formats include a .doc or .pdf file and may be submitted to us on a CD.

Thank you for your continued dedication to public service demonstrated by preparing and adopting a strategy for reducing future disaster losses. Congratulations once again for achieving this milestone and ensuring a safer future for the residents of the Town of Bethlehem. Should you have any questions, please do not hesitate to contact Marilyn Hilliard at (617) 956-7536.

Sincerely,

  
Kevin M. Merli, Director *fm*  
Mitigation Division

Enclosure

Cc: Art Christian, CT State Hazard Mitigation Officer  
Scott Bighinatti, Environmental Scientist, Milone & MacBroom

## Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

### INSTRUCTIONS FOR USING THE PLAN REVIEW CROSSWALK FOR REVIEW OF LOCAL MITIGATION PLANS

Attached is a Plan Review Crosswalk based on the *Local Multi-Hazard Mitigation Planning Guidance*, published by FEMA in July, 2008. This Plan Review Crosswalk is consistent with the *Robert T. Stafford Disaster Relief and Emergency Assistance Act* (Stafford Act), as amended by Section 322 of the *Disaster Mitigation Act of 2000* (P.L. 106-390), the *National Flood Insurance Act of 1968*, as amended by the *National Flood Insurance Reform Act of 2004* (P.L. 108-264) and *44 Code of Federal Regulations (CFR) Part 201 – Mitigation Planning*, inclusive of all amendments through October 31, 2007.

#### SCORING SYSTEM

**N – Needs Improvement:** The plan does not meet the minimum for the requirement. Reviewer's comments must be provided.

**S – Satisfactory:** The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

Each requirement includes separate elements. All elements of a requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a summary score of "Satisfactory." A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing.

When reviewing single jurisdiction plans, reviewers may want to put an N/A in the boxes for multi-jurisdictional plan requirements. When reviewing multi-jurisdictional plans, however, all elements apply. States that have additional requirements can add them in the appropriate sections of the *Local Multi-Hazard Mitigation Planning Guidance* or create a new section and modify this Plan Review Crosswalk to record the score for those requirements. Optional matrices for assisting in the review of sections on profiling hazards, assessing vulnerability, and identifying and analyzing mitigation actions are found at the end of the Plan Review Crosswalk.

#### The example below illustrates how to fill in the Plan Review Crosswalk.:

Assessing Vulnerability: Overview				
Requirement §201.6(c)(2)(ii): (The risk assessment shall include a) description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.				
Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard?	Section II, pp. 4-10	The plan describes the types of assets that are located within geographically defined hazard areas as well as those that would be affected by winter storms.		
B. Does the new or updated plan address the impact of each hazard on the jurisdiction?	Section II, pp. 10-20	The plan does not address the impact of two of the five hazards addressed in the plan. <b>Required Revisions:</b> <ul style="list-style-type: none"><li>Include a description of the impact of floods and earthquakes on the assets.</li></ul> <b>Recommended Revisions:</b> This information can be presented in terms of dollar value or percentages of damage.		
SUMMARY SCORE				

# Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

## LOCAL MITIGATION PLAN REVIEW SUMMARY

The plan cannot be approved if the plan has not been formally adopted. Each requirement includes separate elements. All elements of the requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a score of "Satisfactory." Elements of each requirement are listed on the following pages of the Plan Review Crosswalk. A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing. Reviewer's comments must be provided for requirements receiving a "Needs Improvement" score.

### Prerequisite(s) (Check Applicable Box)

- Adoption by the Local Governing Body: §201.6(c)(5) OR
- Multi-Jurisdictional Plan Adoption: §201.6(c)(5) AND
- Multi-Jurisdictional Planning Participation: §201.6(a)(3)

NOT MET

MET

X
---

N/A
N/A

### Planning Process

- Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)

N
X

### Risk Assessment

- Identifying Hazards: §201.6(c)(2)(i)
- Profiling Hazards: §201.6(c)(2)(i)
- Assessing Vulnerability: Overview: §201.6(c)(2)(ii)
- Assessing Vulnerability: Addressing Repetitive Loss Properties: §201.6(c)(2)(ii)
- Assessing Vulnerability: Identifying Structures, Infrastructure, and Critical Facilities: §201.6(c)(2)(ii)(B)
- Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)
- Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)
- Multi-Jurisdictional Risk Assessment: §201.6(c)(2)(iii)

N	S
	X
	X
	X
	X
X	
X	
	X
	N/A

\*States that have additional requirements can add them in the appropriate sections of the Local Multi-Hazard Mitigation Planning Guidance or create a new section and modify this Plan Review Crosswalk to record the score for those requirements

\*\*Plan conditionally approved pending receipt of adoption documentation

## SCORING SYSTEM

Please check one of the following for each requirement.

**N – Needs Improvement:** The plan does not meet the minimum for the requirement. Reviewer's comments must be provided.

**S – Satisfactory:** The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

### Mitigation Strategy

	N	S
13. Local Hazard Mitigation Goals: §201.6(c)(3)(i)		X
14. Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)		X
15. Identification and Analysis of Mitigation Actions: NFIP Compliance. §201.6(c)(3)(ii)		X
16. Implementation of Mitigation Actions: §201.6(c)(3)(iii)		X
17. Multi-Jurisdictional Mitigation Actions: §201.6(c)(3)(iv)		N/A

### Plan Maintenance Process

	N	S
18. Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(ii)		X
19. Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)		X
20. Continued Public Involvement: §201.6(c)(4)(iii)		X

### Additional State Requirements\*

	N	S
Insert State Requirement		
Insert State Requirement		
Insert State Requirement		

## LOCAL MITIGATION PLAN APPROVAL STATUS

PLAN NOT APPROVED

See Reviewer's Comments

PLAN APPROVED X\*\*

# Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

## Local Mitigation Plan Review and Approval Status

<b>Jurisdiction:</b> Bethlehem, CT	<b>Title of Plan:</b> Town of Bethlehem, CT Natural Hazard Pre-Disaster Mitigation Plan	<b>Date of Plan:</b> November 2008
<b>Local Point of Contact:</b> Scott Bighinatti	<b>Address:</b> 99 Realty Drive Cheshire, Connecticut 06702	
<b>Title:</b> Environmental Scientist		
<b>Agency:</b> Milone & MacBroom		
<b>Phone Number:</b> (203) 271-1773	<b>E-Mail:</b> scottb@miloneandmacbroom.com	

<b>State Reviewer:</b>	<b>Title:</b>	<b>Date:</b>
------------------------	---------------	--------------

<b>FEMA Reviewer:</b> Reid Dominie	<b>Title:</b> Hazard Mitigation Specialist	<b>Date:</b> December 9, 2008
<b>Date Received in FEMA Region [Insert #]</b>		
Plan Not Approved		
Plan Conditionally Approved	February 2, 2009	
Date Approved		

<b>Jurisdiction:</b> Bethlehem, CT	<b>NFIP Status*</b>			
	Y	N	N/A	CRS Class
	X			

\* Notes: Y = Participating N = Not Participating N/A = Not Mapped

# Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

## PREREQUISITE(S)

### 1. Adoption by the Local Governing Body

**Requirement §201.6(c)(5):** [The local hazard mitigation plan **shall** include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Has the local governing body adopted <b>new or updated</b> plan?			X	
B. Is supporting documentation, such as a resolution, included?			X	
SUMMARY SCORE			X	

### 2. Multi-Jurisdictional Plan Adoption

**Requirement §201.6(c)(5):** For multi-jurisdictional plans, each jurisdiction requesting approval of the plan **must** document that it has been formally adopted.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Does the <b>new or updated</b> plan indicate the specific jurisdictions represented in the plan?				
B. For each jurisdiction, has the local governing body adopted the <b>new or updated</b> plan?				
C. Is supporting documentation, such as a resolution, included for each participating jurisdiction?				
SUMMARY SCORE				N/A

### 3. Multi-Jurisdictional Planning Participation

**Requirement §201.6(a)(3):** Multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process ... Statewide plans will not be accepted as multi-jurisdictional plans.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Does the <b>new or updated</b> plan describe how each jurisdiction participated in the plan's development?				
B. Does the updated plan identify all participating jurisdictions, including new, continuing, and the jurisdictions that no longer participate in the plan?				
SUMMARY SCORE				N/A



## Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

**PLANNING PROCESS: §201.6(b):** *An open public involvement process is essential to the development of an effective plan.*

### 4. Documentation of the Planning Process

**Requirement §201.6(b):** *In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process **shall** include:*

- (1) *An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;*
- (2) *An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and*
- (3) *Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*

**Requirement §201.6(c)(1):** *[The plan **shall** document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the plan provide a narrative description of the process followed to prepare the <b>new or updated</b> plan?	Pg 1-8 to 1-11	The Plan provides a detailed description of the planning process.		X
B. Does the <b>new or updated</b> plan indicate who was involved in the <b>current</b> planning process? (For example, who led the development at the staff level and were there any external contributors such as contractors? Who participated on the plan committee, provided information, reviewed drafts, etc.?)	Pg 1-8 to 1-11	Ms. Virginia Mason of COGCNV spearheaded the development of Bethlehem's Plan. The Town personnel involved in the planning process are listed on page 1-9.		X
C. Does the <b>new or updated</b> plan indicate how the public was involved? (Was the public provided an opportunity to comment on the plan during the drafting stage and prior to the plan approval?)	Pg 1-8 to 1-11	The Public was invited to participate in the planning process via newspaper and were also encouraged to "contact the COG with comments via newspaper articles" (1-10). Additional public comments will be heard at the tentatively scheduled Plan adoption meeting in January 2009.		X
D. Does the <b>new or updated</b> plan <b>discuss</b> the opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?	Pg 1-8 to 1-11	"Similarly, eight municipal agencies and civic organizations were invited via a mailed copy of the press release that announced the public information meeting" (1-9). These entities are listed on page 1-10 and included neighboring communities.		X
E. Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?	Pg 1-8 to 1-11	The Plan cites the CT State Hazard Mitigation Plan <b>AND</b> the MA State Hazard Mitigation Plan. Plans and Studies are referenced throughout the Plan and cited in Section 12.0. Under each hazard section, a subsection analyzes existing programs, policies and mitigation measures. This is a new Plan.		X
F. Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process?				N/A

## Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 4. Documentation of the Planning Process

**Requirement §201.6(b):** In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process **shall** include:

- (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
- (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
- (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

**Requirement §201.6(c)(1):** [The plan **shall** document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

SUMMARY SCORE	
SCORE	X

**RISK ASSESSMENT:** §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

### 5. Identifying Hazards

**Requirement §201.6(c)(2)(i):** [The risk assessment **shall** include a] description of the type ... of all natural hazards that can affect the jurisdiction.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?	Pg 1-5	The Plan lists the identified hazards on page 1-5, "based on a review of the Connecticut Natural Hazard Mitigation Plan and correspondence with local officials."		X
SUMMARY SCORE				X

### 6. Profiling Hazards

**Requirement §201.6(c)(2)(i):** [The risk assessment **shall** include a] description of the ... location and extent of all natural hazards that can affect the jurisdiction. The plan **shall** include information on previous occurrences of hazard events and on the probability of future hazard events.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?	Sections 3-9	Each hazard is granted its own section, under which fall the following subsections: setting; hazard assessment; historic record; existing programs, policies and mitigation measures; vulnerabilities and risk assessment; and potential mitigation measures, strategies and alternatives.		X
B. Does the risk assessment identify the extent (i.e.,	Sections 3-9	See above		X

# Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

magnitude or severity) of each hazard addressed in the new or updated plan?					
C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?	Sections 3-9	See Above			X
D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?	Sections 3-9	See Above			X
SUMMARY SCORE					X

## Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 7. Assessing Vulnerability: Overview

**Requirement §201.6(c)(2)(ii):** [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard?	Sections 3-9	Each hazard is granted its own section, under which fall the following subsections: setting; hazard assessment; historic record; existing programs, policies and mitigation measures; vulnerabilities and risk assessment; and potential mitigation measures, strategies and alternatives.		X
B. Does the new or updated plan address the impact of each hazard on the jurisdiction?	Sections 3-9	See above		X
SUMMARY SCORE				X

### 8. Assessing Vulnerability: Addressing Repetitive Loss Properties

**Requirement §201.6(c)(2)(ii):** [The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan describe vulnerability in terms of the types and numbers of repetitive loss properties located in the identified hazard areas?	Pg 3-12	Note: This requirement becomes effective for all local plans approved after October 1, 2008. "zero repetitive loss properties are located in the Town of Bethlehem" (3-12).		X
SUMMARY SCORE				X

### 9. Assessing Vulnerability: Identifying Structures

**Requirement §201.6(c)(2)(ii)(A):** The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area ....

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?	Pg 1-23 to 1-25	Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing. Critical Facilities in Bethlehem are listed and mapped.		X
B. Does the new or updated plan describe vulnerability in terms of the types and numbers of future buildings.		Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.	X	

# Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

infrastructure, and critical facilities located in the identified hazard areas?			
		SUMMARY SCORE	X

## Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 10. Assessing Vulnerability: Estimating Potential Losses

**Requirement §201.6(c)(2)(ii)(B):** [The plan *should* describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate ....

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan estimate potential dollar losses to vulnerable structures?	Not Found	Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.	X	
B. Does the new or updated plan describe the methodology used to prepare the estimate?	Not Found	Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.	X	
SUMMARY SCORE			X	

### 11. Assessing Vulnerability: Analyzing Development Trends

**Requirement §201.6(c)(2)(ii)(C):** [The plan *should* describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan describe land uses and development trends?	Pg 2-22 to 2-23	Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.		X
SUMMARY SCORE				X

### 12. Multi-Jurisdictional Risk Assessment

**Requirement §201.6(c)(2)(iii):** For multi-jurisdictional plans, the risk assessment *must* assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan include a risk assessment for each participating jurisdiction as needed to reflect unique or varied risks?				
SUMMARY SCORE				N/A

## Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

**MITIGATION STRATEGY:** §201.6(c)(3): *The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.*

### 13. Local Hazard Mitigation Goals

**Requirement §201.6(c)(3)(i):** *[The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A Does the <b>new or updated</b> plan include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards?	Pg 1-3 to 1-4	Hazard Mitigation Goals are listed. In future updates of the Plan, we recommend that a description of the process used to develop these goals be provided.		X
<b>SUMMARY SCORE</b>				X

### 14. Identification and Analysis of Mitigation Actions

**Requirement §201.6(c)(3)(ii):** *[The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan identify and analyze a <b>comprehensive range</b> of specific mitigation actions and projects for each hazard?	Sections 3-9 and Specifically Section 10	A summary of proposed mitigation actions can be found on pages 10-2 to 10-7		X
B Do the identified actions and projects address reducing the effects of hazards on <b>new</b> buildings and infrastructure?	Sections 3-9 and Specifically Section 10			X
C. Do the identified actions and projects address reducing the effects of hazards on <b>existing</b> buildings and infrastructure?	Sections 3-9 and Specifically Section 10			X
<b>SUMMARY SCORE</b>				X

## Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 15. Identification and Analysis of Mitigation Actions: National Flood Insurance Program (NFIP) Compliance

**Requirement: §201.6(c)(3)(ii):** [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan describe the jurisdiction (s) participation in the NFIP?	Pg 3-8 & 3-10	<b>Note: This requirement becomes effective for all local mitigation plans approved after October 1, 2008.</b> The Plan includes the adoption date of its FIRM of June 4, 1990. The Emergency Services Director is called out as being the NFIP administrator overseeing the flood regulations.		X
B. Does the mitigation strategy identify, analyze and prioritize actions related to continued compliance with the NFIP?	Pg 10-2 to 10-7	<b>Note: This requirement becomes effective for all local mitigation plans approved after October 1, 2008.</b> The Plan proposes such actions as "Consider joining FEMA's Community Rating System" and considering a restudy of local flood prone areas and "produce new local level regulatory maps..."		X
<b>SUMMARY SCORE</b>				X

### 16. Implementation of Mitigation Actions

**Requirement: §201.6(c)(3)(iii):** [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated mitigation strategy include how the actions are prioritized? (For example, is there a discussion of the process and criteria used?)	Pg 1-7 to 1-8	The Plan provides a discussion of STAPLEE ranking method used to prioritize the Town's mitigation actions.		X
B. Does the new or updated mitigation strategy address how the actions will be implemented and administered, including the responsible department, existing and potential resources and the timeframe to complete each action?	Pg 11-1 and Appendix A			X
C. Does the new or updated prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits?	Pg 1-8	STAPLEE		X
D. Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for		This is a new Plan.		N/A



# Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

progress, and if activities are unchanged ( <i>i.e.</i> , deferred), does the updated plan describe why no changes occurred?				
SUMMARY SCORE				X

## Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 17. Multi-Jurisdictional Mitigation Actions

*Requirement §201.6(c)(3)(iv): For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan include identifiable action items for each jurisdiction requesting FEMA approval of the plan?				
B. Does the <b>updated</b> plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?				
SUMMARY SCORE				N/A

### PLAN MAINTENANCE PROCESS

### 18. Monitoring, Evaluating, and Updating the Plan

*Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan describe the method and schedule for <b>monitoring</b> the plan, including the responsible department?	Pg 11-2	"The Office of the First Selectman will be the party responsible for monitoring the Plan" (11-2). The method and schedule for monitoring the Plan is discussed.		X
B. Does the <b>new or updated</b> plan describe the method and schedule for <b>evaluating</b> the plan, including how, when and by whom (i.e. the responsible department)?	Pg 11-2 to 11-3			X
C. Does the <b>new or updated</b> plan describe the method and schedule for <b>updating</b> the plan within the five-year cycle?	Pg 11-3	"The Council of Governments of the Central Naugatuck Valley will update the hazards mitigation plan if a consensus to do so is reached by the Board of Selectmen of Bethlehem and a request is presented to the Council of Governments of the Central Naugatuck Valley, or at least once every five years" (11-3).		X
SUMMARY SCORE				X

## Bethlehem, CT LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 19. Incorporation into Existing Planning Mechanisms

**Requirement §201.6(c)(4)(iii):** [The plan **shall** include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?	Pg 11-1 to 11-2	"It is expected that revisions of other Town plans and regulations, such as the Plan of Conservation and Development, department annual budgets, and the Subdivision Regulations, will reference this plan and its updates" (11-1).		X
B. Does the <b>new or updated</b> plan include a process by which the local government will incorporate the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?	Pg 11-1 to 11-2	"The Office of the First Selectmen will be responsible for ensuring that the actions identified in this plan are incorporated into ongoing Town planning activities..." (11-1).		X
C. Does the <b>updated</b> plan explain how the local government incorporated the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?		This is a new Plan.		N/A
<b>SUMMARY SCORE</b>				X

### Continued Public Involvement

**Requirement §201.6(c)(4)(iii):** [The plan maintenance process **shall** include a] discussion on how the community will continue public participation in the plan maintenance process.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan explain how <b>continued public participation</b> will be obtained? (For example, will there be public notices, an on-going mitigation plan committee, or annual review meetings with stakeholders?)	Pg 11-3	"Continued public involvement will be sought regarding the monitoring, evaluating, and updating of the Plan. Public input may be solicited through community meetings and input to web-based information gathering tools. Public comment on changes to the Plan may be sought through posting of public notices, and notifications posted to the website of the Council of Governments of the Central Naugatuck Valley, as well as the Town of Bethlehem" (11-3).		X
<b>SUMMARY SCORE</b>				X

TRUE AND ATTESTED  
BETHLEHEM BOARD OF SELECTMEN  
REGULAR MEETING MINUTES

*Kathleen Gallo*  
TOWN CLERK  
ASST TOWN CLERK  
BETHLEHEM, CT

February 17, 2009

*Acid*  
*Feb. 26, 2009*  
*12 Noon*  
*K. Gallo TC*

The 2/17/2009 regular meeting of the Bethlehem Board of Selectmen was called to order at 7:30 PM by Jeffrey Hamel, First Selectman.

Present: Jeffrey Hamel Leo Bulvanoski Thomas O'Neil

Others: Janet Turner, Ex. Secy

1) Approval of Minutes:

02/03/09 Regular Meeting – L.Bulvanoski – there is a typo on P.2 – should read ‘working on it’ not ‘working n it’. Thomas O’Neil moved to approve the 2/03/09 regular meeting minutes as amended. Leo Bulvanoski seconded the motion. T.O’Neil – ave. L.Bulvanoski – ave. Two aves. Motion carried.

2. Ad Hoc Committee – Review of Land Ordinances report

Bob Gallo, Len Assard, Jean Donegan, Vince McDermott, and Tom Brayton present for the Ad Hoc Committee. Would be in favor of zoning if a Town Meeting could vote on the regulations. That would need to be done by special legislation in Hartford.

L.Hamel spoke to Rob Kane on special legislation. Can look at the ordinance and committee could put forward recommendations.

V.McDermott – the Board of Selectmen could approach them. There are a number of “Special Act Towns” such as West Hartford and Stamford. Could look at this and approach Rob Kane and Craig Miner.

L.Assard – need to do more, should begin to lay the ground work.

V.McDermott – have to be practical, Bethlehem has turned down zoning more than once. Town meeting loses some control with zoning.

R.Gallo – not certain if legislation were to change that zoning would pass in Town. Would need to have about 28 volunteers to run for the zoning boards. Have trouble filling Town boards and agencies now without looking for 28 more people.

L.Bulvanoski – what do other small towns do?

T.O’Neil – the Ad Hoc Committee was put together because of concerns of a meeting and rumors of an amusement park.

V.McDermott – areas looked at are: 1. right to farm, 2. alternate energy source, 3. height (already addressed), 4. light control, 5. noise control (T.A.H.D. addresses this and they are making new rules) measured with volume and repetitiveness, and 6. traffic generation.

L.Assard – in 70’s we went to Hartford and were enabled to adopt an ordinance for health, safety, and welfare. Should go up there and talk to people. We could get somewhere if serious. Could find out what they would support.

V.McDermott – should go that way and then explore alternatives if needed.

R.Gallo – Town should not be held hostage – spend money as an investment. You could lose something you’ll never get back.

T.O’Neil – would like to commend the committee. Information is invaluable to us. Don’t want to see it collect dust on the shelf.

R.Gallo – I am available to the Town

V.McDermott – if the Town moves forward on this we would all be available

J.Hamel – can’t happen overnight. An ordinance could be put together fairly quickly.

V.McDermott – can we get a special act to allow the town of Bethlehem to consider adopting zoning that would allow the legislative body to adopt regulations  
 J.Donegan – adopt broad wording of what we are looking for  
 L.Assard – even if we get zoning it may not be what we want  
 R.Gallo – would rather not combine Planning and Zoning Commission  
 V.McDermott – if separate would create checks and balances  
 J.Hamel – I would like to thank you for the time you spent on this project, and the diligent job that was done.  
 L.Assard – V.McDermott was the chairman and did most of the legwork.  
 B.Mosch – want to thank the direct leadership in putting this committee together. This committee did a fine job in a civilized manor, and it was handled in a good way.  
 J.Hamel – we are pleased with the findings

3. **COGCNV's Town of Bethlehem Natural Hazard Pre-Disaster Mitigation Plan:**

The plan was presented at a Public Hearing prior to the last regular selectmen's meeting. The selectmen have reviewed the material. This is a book of recommendations. The map is posted on the bulletin board in Town Hall. Will put the book in the Town Clerk's office. It is also available on line. L.Bulvanoski feels it is well written and thorough. Leo Bulvanoski moved to accept the Town of Bethlehem Natural Hazard Pre-Disaster Mitigation Plan as prepared by COGCNV. Thomas O'Neil seconded the motion. L.Bulvanoski – aye, T. O'Neil – aye. Two ayes. Motion carried.

4. **Set Date and Time for a Special Town Meeting for Phase III of the Firehouse STEAP Grant:**

DPS is asking us to approve a resolution to go forward with the \$275,000 grant for Phase III of the Firehouse project. Leo Bulvanoski moved to hold a special town meeting at 7:00 PM on March 3, 2009, in the Leever Room of the Bethlehem Public Library to act on a resolution for the Phase III Firehouse STEAP Grant project. Thomas O'Neil seconded the motion. L.Bulvanoski – aye, T.O'Neil – aye. Two ayes. Motion carried.

5. **Tax Refund of excess taxes – Better Barns LLC \$32.84:**

Thomas O'Neil moved to refund \$32.84 of excess taxes to Better Barns LLC as recommended by the Tax Collector. Leo Bulvanoski seconded the motion. T.O'Neil – aye, L.Bulvanoski – aye. Two ayes. Motion carried.

Jeffrey Hamel moved to add to tonight's agenda as 5A approval of a grievance form. Thomas O'Neil seconded the motion. All ayes. Motion carried.

5A. **Approval of a Grievance form:**

The union contract states the grievance form must be approved. This is a formality but we need to approve the form. Leo Bulvanoski moved to accept the form as an approved grievance form. Thomas O'Neil seconded the motion. L.Bulvanoski – aye, T. O'Neil – aye. Two ayes. Motion carried.

6. **Correspondence:**

Walter from HRP has approved the roof structure for the salt shed. Dave Roberts is working with the cover company. Waiting on drawings.

Met in with DEP in Hartford on the fines. We may be able to do projects in lieu of payment. Discussed parking areas – #1- at beach. Could expand the parking area, and take out the fence and put boulders along the side. #2 – re-address the parking area for the ball field behind Town Hall. T.O'Neil suggested cutting into the bank and putting in a retaining wall. J.Hamel – mafia blocks could be put all the way down to keep kids off – plus a split rail fence. Also discussed a project on Wood Creek Road by Bird's Pond so cars won't go off the road and into the pond. State was not in favor of this as a project. Also discussed the dam at Long Meadow Pond. Would like to do Munger Lane as a shovel ready project. Bethlehem is rated #9. This must go through DEP.

Received a letter from the Agent for Elderly Persons requesting a Tai Chi class. She stated the money would come from the State Grant. Need to verify this is an approved project. The State funds health promotion for seniors. Have until April to do the project. Ten weeks is \$750.00.

**7. Audience to the Public:**

D.Detlefsen – concerned with the 'nice' article in the paper where T.O'Neil called into have Woodland Road sanded. Looked like the First Selectman wouldn't sand the road.

J.Hamel – explained the article was wrong as it wasn't a state agency that got stuck on the road. The Town did respond, but did not put down any sand. The policy is **not** to go on private property unless there is an emergency such as a fire or medical call. Public Works went there, looked, and didn't sand. To our knowledge the private contractor that services that private road was never called. Nor did the First Selectman, who was available, get a call. The Resident Trooper drove the stuck vehicles out.

T.O'Neil – stated he would do again if the situation arose.

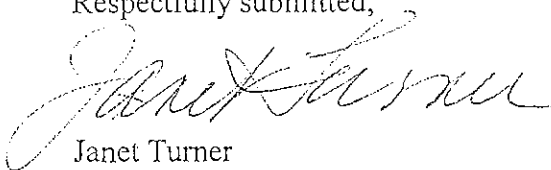
J.Hamel – reminded the selectmen it is not part of their directives. The First Selectman needs to be contacted for approval.

**8. Adjourn**

Thomas O'Neil moved to adjourn. Leo Bulvanoski seconded the motion. All ayes. Motion carried.

Meeting adjourned at 8:55 PM.

Respectfully submitted,



Janet Turner  
Executive Secretary