

**SOUTHEASTERN CONNECTICUT  
REGIONAL  
HAZARD MITIGATION PLAN**



**PREPARED FOR:**

**Southeastern Connecticut  
Council of Governments**

**DATE: June 2005**



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**Town of Bozrah**  
**Town of Colchester**  
**Town of East Lyme**  
**Town of Franklin**  
**Town of Griswold**  
**City of Groton**  
**Town of Groton**  
**Town of Ledyard**  
**Town of Lisbon**  
**Mashantucket Pequot Tribal Nation**  
**Mohegan Tribe**  
**Town of Montville**  
**City of New London**  
**Town of North Stonington**  
**City of Norwich**  
**Town of Preston**  
**Town of Salem**  
**Town of Sprague**  
**Borough of Stonington**  
**Town of Stonington**  
**Town of Voluntown**  
**Town of Waterford**

\* Individual community annexes are separate documents that provide community specific detailed hazard mitigation information. A community annex should be kept with the regional plan in each community.

## **I. INTRODUCTION**

### **A. Purpose of the Plan**

On October 10, 2000, Congress approved the Disaster Mitigation Act of 2000 (DMA 2000), also known as the 2000 Stafford Act amendments. The bill was authorized into law on October 30, 2000, creating Public Law 106-390. DMA 2000 establishes a national program for pre-disaster natural hazard mitigation while streamlining the federal administration of disaster relief. The purpose of the DMA 2000 tribal and local mitigation planning criteria is to standardize planning requirements over time and to help eliminate the separate planning requirements currently in place for all FEMA mitigation programs.

Specific rules on the implementation of DMA 2000 were published in February 2002 in the Federal Register as the Interim Final Rule, 44 CFR Parts 201 and 206. These rules provide information on the policies and procedures for mitigation planning as required by Section 322 of the Stafford Act 42 U.S.C. 5165. DMA 2000 requires that communities adopt a Hazard Mitigation Plan as a prerequisite for disaster mitigation grants under FEMA's Hazard Mitigation Grant Program implemented following a Presidential disaster declaration.

The primary purpose of this regional hazard mitigation plan is to identify hazards and risks, existing capabilities, and activities that can be undertaken by the southeastern Connecticut municipalities to prevent loss of life and reduce property damages associated with identified hazards.

Public safety and property loss reduction are the driving forces behind this plan. However, careful consideration also must be given to the preservation of history, culture and the natural environment of the region.

## **B. Setting**

The Southeastern Connecticut Council of Governments (SCCOG) is the regional planning organization consisting of 20 municipalities in the southeastern corner of Connecticut. The member communities include the towns and cities of: Bozrah, Colchester, East Lyme, Franklin, Griswold, City of Groton, Town of Groton, Ledyard, Lisbon, Montville, New London, North Stonington, Norwich, Preston, Salem, Sprague, Borough of Stonington, Town of Stonington, Voluntown, and Waterford. Two federally recognized Native American tribes, the Mashantucket Pequot Tribe and the Mohegan Tribe, are affiliate members of the SCCOG. The communities of Waterford, East Lyme, City and Town of Groton, New London, and Stonington, including the Borough of Stonington are bordered by Long Island Sound to the south.

According to the 2000 U.S. Census, the Southeastern Connecticut region's population is 242,759 persons. The land area of the region is 559.5 square miles, of which nearly 75% is largely undeveloped, consisting of forests, wetlands, lands in agricultural use, active and passive recreation, and dedicated open space. (Land Use-2000, Southeastern Connecticut Region). State forests are found throughout the region and include the Pachaug State Forest in Voluntown and Griswold, the Salmon River State Forest in Colchester, Rocky Neck State Park and Nehantic State Forest in East Lyme, and the Hopeville State Forest in Griswold. Of the developed land, over 61% is residential with 56% of it in the medium to high density range (defined as greater than 1 dwelling unit per acre). The remaining land in the region is a mix of commercial, industrial, and institutional.

Commercial and industrial development throughout the southeastern region includes businesses specializing in defense technology, healthcare, biotechnology, marine research, and tourism. Smaller businesses include restaurants, clothing stores, gift shops, antique shops, bookstores, and hardware stores. Two of the larger employers in the region include the U.S. Naval Submarine Base and the Electric Boat submarine manufacturing facility in Groton. Tourism has assumed a large role in the development in the region since the opening of Foxwoods Resort Casino in Ledyard and the Mohegan Sun Resort in Montville. Other major tourist attractions in the region include the Mystic Seaport, Mystic Marinelife Aquarium, and Olde Mistick Village in Stonington. Mill towns, seaports, and villages enhance the cultural New England feel of the region.

Numerous “critical facilities” including hospitals, medical centers, fire and police departments, and municipal buildings are located throughout the region. The “critical facilities” include William W. Backus Hospital in Norwich, Lawrence & Memorial Hospital in New London, and medical centers in many of the surrounding towns such as East Lyme, Ledyard, and Colchester. Every town and city has a fire department and most towns and cities have a police department, however, several of the smaller rural towns have resident Connecticut State Police troopers.

The network of transportation corridors and services throughout the region consists of highways, rail lines, bus service, air service, passenger ferry service, and shipping services. I-95 serves the east/west corridor in the region and is the most heavily traveled thoroughfare in the region. It is the main highway for travelers along the Atlantic coast from Florida to Maine. With future development potential along this corridor, increases in congestion are inevitable (Regional Transportation Plan, SCCOG- FY 2004-2005). I-395 serves a north-south corridor in the region, with highest traffic volumes concentrated in the Montville section due to recent developments and expansion of the Mohegan Sun Casino and Hotel complex. AMTRAK provides passenger rail service with stops at New London and Mystic. Freight service is offered by the New England Central Railroad and the Providence and Worcester Railroad. Southeast Area Transit (SEAT) operates the public bus system in several towns and cities in the region. The Groton-New London Airport provides service as the single public airport in the region. Significant marine transportation exists in Long Island Sound, comprising passenger ferries, commercial shipping, and pleasure boating. The Admiral Shear State Pier in New London, which is adjacent to the Central New England Railroad pier, functions as the region’s most important commercial marine facility.

Several watercourses flow from the interior parts of the region to Long Island Sound. Main watercourses include the Mystic and Pawcatuck Rivers in the eastern end of the region and the Shetucket River and the Yantic River, which act as tributaries to the Thames River to the west. The southeastern region has approximately 40 miles of shoreline along Long Island Sound, and numerous additional miles of shoreline along its many tidal estuaries. As a result of the presence of both coastal and riverine floodplains, the southeastern region is faced with significant flood hazards.

### C. Plan Development Process and Public Involvement

This Hazard Mitigation Plan was developed through a series of meetings and the completion of written questionnaires, personal interviews and workshops. To provide oversight of the plan development process and maximize local involvement, all member communities in the region and the two tribal affiliate members were invited to appoint a representative to serve on the Hazard Mitigation Steering Committee. Committee members and chief elected officials received notices of all the committee meetings and were encouraged to attend. Meeting notices and agendas were also sent to area media and to town and city clerks for posting in each community. Steering committee meetings were held in public at the Southeastern Connecticut Council of Governments office in Norwich. The schedule of meetings held to date is shown below. The committee meetings allowed each jurisdiction in the region to be involved in all aspects of the development of both the Regional Hazard Mitigation Plan and in the development of the annexes for all neighboring communities. Verbal reports on progress were given to monthly meetings of the Southeastern Connecticut Council of Governments, which are routinely attended and covered by area press in local newspapers. Articles describing the planning process have appeared in the three issues of the SCCOG Quarterly Newsletter since March, 2003. This newsletter is mailed to 285 officials, organizations and media within the region.

#### Steering Committee Meetings

<b>Date</b>	<b>Location</b>	<b>Number of Communities &amp; Tribes Attending</b>	<b>Public Involvement</b>
6/23/03	SCCOG-Norwich	13	Agendas sent in advance to region's newspapers and to all City/Town Clerks for posting.
9/29/03	SCCOG-Norwich	16	Agendas sent in advance to region's newspapers and to all City/Town Clerks for posting.
2/23/04	SCCOG-Norwich	13	Agendas sent in advance to region's newspapers and to all City/Town Clerks for posting.



After the first steering committee meeting was held, staff mailed a questionnaire to each steering committee member, containing the following questions:

1. In your opinion, what are the greatest hazards in your community?
2. What hazard prevention projects or studies have been completed, or are currently being proposed in your community?
3. What project would you like to see considered during the hazard mitigation planning process?

Sixteen communities replied. The study team offered to meet in each member community for an in-depth discussion of local issues and resources. The meetings held are listed below and were attended by the steering committee representative, in some cases the chief elected official, and other staff from relevant departments, e.g. public works, emergency management, fire and police. Attendance by other interested groups, agencies, and organizations was also encouraged at the individual community meetings. As revisions to the Regional Plan and the Annexes are completed the depth of continued involvement of other stakeholders such as the American Red Cross, colleges and universities, businesses and non profit organizations will be documented.

Communities outside of the region were included in the development of the annexes to the extent practicable. As an example, the Town of Colchester involved the Town of Lebanon in their planning process when considering a replacement project for a bridge that connects the two communities. All communities in the region reviewed the mitigation strategies formulated by all of their neighboring municipalities. The small number of communities not able to schedule an individual meeting were given ample opportunity to review and comment on the regional plan and community annexes during plan development.

**Individual Community Meetings - Attended by City/Town/Tribal Representatives, Consultants, and SCCOG Staff**

<b>Date</b>	<b>City/Town</b>	<b>Number of Community Representatives Attending</b>
8/7/03	City of Groton	2
8/7/03	Borough of Stonington	3
8/14/03	Sprague	1
8/14/03	Voluntown	1
8/26/03	Montville	4
8/26/03	Waterford	6
8/26/03	East Lyme	3
8/28/03	Ledyard	2
8/28/03	Mohegan Tribe	4
9/2/03	Franklin	2
9/2/03	Norwich	6
9/2/03	Griswold	1
9/2/03	Lisbon	2
9/9/03	New London	5
9/9/03	Town of Stonington	6
9/9/03	Town of Groton	6
9/16/03	Colchester	3
9/16/03	Preston	1
3/2/04	Mashantucket Pequot Tribe	1

The plan adoption process included two regional public meetings, one held inland at the SCCOG offices in Norwich on August 5, 2004 and one in Waterford on August 25, 2004. The meeting that was held at the SCCOG offices was video taped by public television station CT-N.

The station ran the tape frequently during the months of August and September, 2004. Following the regional meetings, each community employed its usual process to provide for adoption by its governing body, e.g. City Council, Board of Selectmen, Town Meeting, Tribal Council, etc. A copy of a recommended Adoption Resolution is enclosed in Appendix H. Copies of the regional plan and the annexes for each individual jurisdiction along with both the regional and local adoption documentation are on file at the SCCOG office and available for review upon request.

#### **D. Goals, Policies and Objectives**

The following section provides a brief outline of the goals, policies and objectives that have guided the SCCOG Hazard Mitigation Committee in the development of this plan.

##### **GOALS**

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

##### **POLICIES**

1. To encourage planning of community services and decision-making so that the risks of hazards are considered.
2. To guide the expenditure of public funds on a priority basis relative to natural hazard mitigation.
3. To give high priority to human safety in the programming of hazard mitigation projects.

##### **OBJECTIVES**

1. To develop an inventory of the existing hazards in the region.
2. To develop a list of potential hazard mitigation projects, based on priorities of the plan.

3. To provide data municipalities can use to apply for Federal and State funds as they become available to supplement regional funds for mitigation purposes.
4. To conduct meetings of the Hazard Mitigation Steering Committee on an as-needed basis to review progress on the plan and determine current priorities and projects.
5. To provide municipalities with information that will facilitate their review of local ordinances and regulations to determine methods for improving consistency with the goals of the plan.
6. To identify and provide information that municipalities can convey to property owners within the floodplain regarding risks, responsibilities, and responses.
7. To develop a plan for the implementation of the objectives of the Hazard Mitigation Plan.

## II. HAZARD RISK ASSESSMENT

Meetings of the Hazard Mitigation Committee were conducted on June 23, 2003 and September 29, 2003 to discuss the development of a risk assessment for each of the regional municipalities. Based on the results of those meetings and additional risk assessment research it was determined that the most significant hazard in the southeastern region is flooding. Other natural hazards, including earthquakes and winter storms, are a concern. The hurricane of 1938 caused the most damage ever experienced throughout the region with flood waters reaching record-breaking heights. Ice damming along rivers causes flooding in the winter months. Other hazards that were discussed but not deemed to be of significance region wide were wildfire, drought, landslides and coastal erosion. The abundance of rainfall and ample water supply have historically made serious droughts rare occurrences.

Wildfires have not been experienced in the region as a significant hazard as they have in other regions of the country. Based on information contained in the State of Connecticut Hazard Mitigation Plan approximately 600 acres of forest per year are burned by wildfire. The areas most prone to wildfire are those jurisdictions that have large tracts of forest land within their boundaries. Most wildfires are less than ten acres in area and are detected early. Almost half of all wildfires in the state are intentionally set. During the highest forest fire risk period the CT DEP sends daily advisories to municipalities, fire departments and the media. The vulnerability to wildfire is reduced by the DEP's fire fighting capability. The agency maintains a trained staff of 70 firefighters for assignment to fires on state property and throughout the region.

The land forms in the region are generally stable, making significant landslides unlikely. Coastal erosion is a concern in some locations, but it generally occurs during coastal flooding events. Therefore, erosion as a hazard is covered in the consideration given to coastal flooding.

Major rivers that are at risk of flooding and impacting structures include the Thames River, Shetucket River, Quinebaug River, Yantic River, Niantic River, Pachaug River, and Mystic River. Significant flooding can also take place within the floodplain of smaller tributaries throughout the region.

Buildings located in flood hazard areas include residential, commercial, industrial, and critical facility structures. Most of the structures that are threatened by flooding are located within the 100-year floodplain, but some are also in the coastal velocity zone. Location in the velocity zone poses an increased threat to structures due to high wind and potential wave damage, as well as inundation by flood waters.

Maps depicting the 100-year and the 500-year flood hazard areas in the southeastern Connecticut communities are included in Appendix C.

Municipalities have also expressed concern regarding the impact of potential hazards on the many dams located throughout the region. Dams are inspected and maintained in accordance with the State of Connecticut's Dam Safety Program.

Through this program State and privately owned structures have been evaluated in order to determine the degree of risk they pose in the case of failure during flooding. A presentation of the State's data regarding "High" and "Significant" hazard dams is included in the local and regional scale mapping assembled as part of this plan.

There is no formalized program currently in place on a local, regional, or state level to identify the location or the number of individual structures that are susceptible to flooding in the region. Such information would be valuable in directing hazard mitigation efforts to locations with the greatest risk. A potential region wide hazard mitigation project would involve the review of all existing available data regarding flood hazards and the preparation of a comprehensive inventory and assessment of structures at risk in the flood hazard areas.

Such an inventory program would be the first step in completing a regional Flood Audit, which would provide early flood warning, guidance and technical information regarding flood risks to property owners, as well as prioritize future property protection projects. The completion of a Flood Audit would be an important step in the National Flood Insurance Program Community Rating System by which towns can qualify for a reduction in flood insurance rates.

## **A. Residential**

Based on review of Flood Insurance Rate Maps and topographic maps for each of the individual municipalities, areas of communities that contain residential structures that are subject to coastal flooding during significant flood events were identified. These structures are primarily situated in the southern section of the region in the coastal communities of East Lyme, Waterford, New London, the City and Town of Groton, and the Town and Borough of Stonington.

Most of the southeastern region's velocity zones are located along the immediate Long Island Sound and Fishers Island Sound shoreline, though some areas are included along the mouths of the major rivers. Beachfront properties in the velocity zone are highly susceptible to damage such as those in the areas of Jupiter Point and Eastern Point in the City of Groton.

Over the years, the character of the shoreline has become more of a year-round community with the conversion of many seasonal cottages to year-round dwellings, thus intensifying risks to life and property for those residents. Beachfront properties are susceptible to damage, not only as a result of flooding, but also because the dynamic nature of the beach system results in shoreline erosion in some locations.

Repetitive flood insurance claims have been filed at thirty-two properties in the region over the past twenty-five years. These repeat claims demonstrate the persistent nature of the flood hazards throughout the region. Maps indicating the approximate location of the repetitive flood insurance losses are included in Appendix C to this report.

While the vast majority of the repeat flood insurance claims are in coastal areas, other areas in the region have experienced repeated flooding in the vicinity of the Yantic River in Franklin and Norwich and Latimer Brook in East Lyme. Individual community annex plans detail areas of residential structures in potential flood zones.

## **B. Commercial / Industrial**

The southeastern Connecticut region has a strong economic base for commercial and industrial development that includes businesses in defense technology, healthcare, biotechnology, marine research, and tourism.

Examples of some of the larger employers in the region include the U.S. Naval Submarine Base, Electric Boat, Pfizer, the Millstone Nuclear Power Plant, Lawrence & Memorial Hospital, Backus Hospital, the United States Coast Guard Academy, and Connecticut College.

A significant concentration of commercial and industrial facilities is located on both sides of the Thames River in New London and Groton and upriver in the Town of Montville and the City of Norwich. Concentrations of industrial development also occur along the Pawcatuck River in the Pawcatuck section of Stonington as well as at the sites of former mills along many of the major rivers in the region.

Tourism plays a large role in the region's economy. Major commercial developments that have a significant impact on the regional economy include Foxwoods Resort Casino in Ledyard, the Mohegan Sun Resort in Montville, and the Mystic Seaport, Mystic Marinelife Aquarium, and Olde Mistick Village in Stonington.

Other tourist attractions in the region include the Nautilus Memorial/Submarine Force Library and Museum in Groton, the Lyman Allyn Art Museum in New London, the Slater Memorial Museum in Norwich, the Eugene O'Neill Theater Center in Waterford, and the Mashantucket Pequot Museum in Ledyard.

Some of the commercial and industrial facilities in the region have been identified as being located within the floodplain and are considered to be susceptible to damage. These facilities include Electric Boat in Groton, an access road to the Millstone Nuclear Power Plant in Waterford, and several areas in Norwich along the Yantic River, the Borough of Stonington, and along the Mystic River. These developments are discussed further in the community annex reports.

### **C. Critical Facilities**

Numerous "critical facilities" have been identified throughout the region. These facilities include hospitals, medical centers, fire departments, police departments, and municipal buildings. Significant and high hazard dams (as classified by the State of Connecticut) have been identified and are depicted on the mapping included in Appendix C.



Critical medical facilities include the two hospitals in the region: William W. Backus Hospital in Norwich and Lawrence & Memorial Hospital in New London. Medical centers found throughout the region include the Charter Oak Walk-In and Flanders Health Medical Center in East Lyme, Backus Health Center in the Gales Ferry section of Ledyard, Pequot Medical Center and Women's Care Medical Center in the Town of Groton, Seaport Walk-In in Mystic, Conn Care of Colchester, Backus Health Center in Montville, North Stonington Walk-In, and West Side Walk-In in Norwich.

Municipalities in the region have either municipal fire departments or volunteer fire companies. Larger cities or towns generally have several fire houses in different areas of the city or town to assure rapid emergency response. Police departments are found in most of the suburban and urban municipalities but not in all rural towns. Some towns have resident troopers in lieu of a municipal police department. All municipalities have municipal offices where elected officials help maintain order during emergency situations. Critical public facilities also include military facilities in Groton and East Lyme. Major correctional facilities are located in East Lyme and Montville.

Some of the region's critical public facilities have been identified as being located in flood hazard areas. Facilities that may not be accessible during emergency situations include the Griswold Firehouse on Route 138 (Voluntown Road), the Town of Stonington's Sewer Plant, the Yantic Village Fire Station and Department of Public Works in Norwich, and the Mystic Fire Department, Quiambaug Fire Department, Mystic Post Office, and Mystic Train Station in Stonington.

#### **D. Transportation Corridors**

Southeastern Connecticut possesses a transportation network of highways, rail lines, bus service, air service, passenger ferry service, and shipping corridors. Major highways throughout the region include I-95, I-395, Route 2, and Route 32. Rail lines extend to several of the communities allowing people to travel via train. Rail service is offered through Amtrak and the Providence/Worcester railroad line and rail freight service is available on the New England Central Railway. The New England Central Railroad is located on the west side of the Thames River and offers north-south freight service. The Amtrak rail line travels east-west from Boston to New York.

The southeastern region has a public bus system, SEAT, which serves the municipalities of East Lyme, Griswold, Groton, Ledyard, Montville, New London, Norwich, Stonington, and Waterford. SEAT runs routes throughout the region including to the two area casinos. Many community members as well as casino employees rely on this public transportation.

Air service throughout the region is offered by the state owned Groton-New London Airport, private airports in Griswold and Stonington, a heliport in Colchester, and two military airports. Services at the Groton-New London Airport were recently updated including reconstruction of one of the runways as well as renovations to the passenger terminal building and airport restaurant. Groton-New London Airport is in a flood zone which may pose a potential impact on the arrival and departure of aircraft during a significant storm event.

Marine transportation is located along the Thames River at New London's State Pier. New London's State Pier is Connecticut's only major deepwater seaport within a multi-use Foreign Trade Zone. In an effort to reduce congestion on I-95, the State Pier may be utilized in the future to ship non-time sensitive goods along the Connecticut coast to the port of New Jersey.

Ferry service out of New London becomes increasingly busy during the summer months and is available to Long Island, Fishers Island, Martha's Vineyard, MA; and Block Island, RI. Long Island Sound and Fishers Island Sound have numerous harbors and inlets that are used extensively by pleasure craft during the summer months. A few of the harbors along the southeastern region's coastline that offer protection during storms include Stonington Harbor, Mystic Harbor, the Thames River, and the Niantic River.

Increased thru-traffic throughout the region raises municipal concern with the transportation of hazardous materials over the regions' roadways and their ability to respond to a major incident regarding a release of such materials.

Throughout the region many roadways are affected by flooding due to roads being within floodplains, having poor drainage, and/or inadequate culvert sizes. Individual community annex reports identify such problem areas.

A detailed evaluation of the flooding impact of hazards on the region's transportation systems is a regional goal. Such an evaluation would focus on critical transportation corridors in terms of providing safe evacuation of low lying areas and those emergency response routes that are critical for use by emergency response personnel.

#### **E. Hazard Impacts/Vulnerability**

The potential impacts of flooding in all jurisdictions in the region is high with potential dollar damages as a result of serious flooding being very significant. The potential damage from an earthquake in the region is also high as a result of the age and type of many buildings, making them vulnerable. Tornado hazards are considered to be moderate in severity throughout Connecticut. The Southeast Region has not experienced significant tornados. As a result it was given a lower vulnerability and impact priority in the Regional Plan.

Winter storm hazards are significant and regularly cause moderate to high levels of damage including power outages and transportation disruption.

Individual communities such as Voluntown consider that they are vulnerable and potentially seriously impacted by wildfires because of the presence of large state forest tracts. The Town of Sprague considered itself vulnerable and potentially highly impacted by dam failure because of the number of high hazard dams in the town.

As a result these hazards were given a high priority locally and specific hazard mitigation actions were identified. While wildfire was not considered to have a high damage potential region wide a hazard mitigation action to improve data regarding available fire water locations was included in the regional plan.

Landslides, and drought are considered to have low potential for causing widespread damage to the region.

### **III. HAZARD MITIGATION MEASURES**

The following sections provide a description of the types of hazard mitigation measures and programs that are currently in place in the southeastern region and those that are available to address the hazards that exist in the region.

#### **A. Prevention**

Hazard prevention includes identification of risks and the use of land-use regulatory and other available management tools to prevent future damage. The municipalities in the southeast region have planning and zoning tools in place that incorporate floodplain management. Planning and zoning regulations, inland wetlands and watercourses regulations, harbor management regulations and building departments' enforcement of the Connecticut Basic Building Code are all important existing regulatory mechanisms that address hazard prevention and incorporate floodplain management.

The following are examples of how hazard prevention can be accomplished through existing programs:

##### **1. Planning and Zoning**

Planning and Zoning Regulations can be tailored to be consistent with hazard mitigation planning. Establishment of Flood Prone Conservancy Districts, Coastal Resource Zones, and River Corridor Preservation Zones are all techniques that can potentially be employed to limit additional development in hazardous locations.

##### **2. Open Space Preservation**

Community Planning that includes open space acquisition and preservation can be established or revised in a manner that is consistent with hazard mitigation planning. For example, acquisition of floodplain and river corridor properties should be encouraged as a municipal priority.

3. Floodplain Development Regulations

The modification of floodplain management regulations to include more restrictive development standards is consistent with hazard mitigation planning. The National Flood Insurance Program Community Rating System gives credit to communities that exceed the minimum floodplain management requirements of the National Flood Insurance Program. Requirements include elevating structures higher than the 100-year base flood elevation, which is an example of a more stringent standard.

4. Stormwater Management

Stormwater management regulations that limit any potential increase in the discharge of stormwater and that preserve floodplain storage are examples of the use of stormwater management in a manner consistent with hazard mitigation planning.

Communities should conduct catch basin surveys in order to identify and prioritize potential replacements of catch basins and overall stormwater drainage improvements. The identification and improvement of drainage systems and culverts that have inadequate capacity, helps reduce flooding risks and also prevents further damage to roadways.

5. Wetlands Protection

Wetlands areas generally serve as critical flood storage areas. By limiting wetlands development not only are important natural resource areas protected but additional floodplain development is also limited.

6. Erosion and Sediment Control Regulations

Effective implementation of Sediment and Erosion controls include utilization of detention basins and use of other Best Management Practices to slow the velocity and limit increase in runoff. Strict adherence to the requirements are effective hazard mitigation tools.

## **B. Property Protection**

Property protection measures can address hazards at individual or multiple structures. Examples of property protection projects that have been successful in the region include actions within the City of Norwich and the Town of Franklin. The State of Connecticut acquired and demolished twelve residences within the Yantic River's floodplain. The acquired land is now open space in the City of Norwich. The Norwichtown Mall erected a 4-foot high concrete floodproofing reinforcement abutting the entire perimeter of its exterior walls. The Town of Franklin completed property acquisition and demolition projects along Old Route 32 and West Town Street.

The following list identifies common property protection measures:

1. Relocation

Moving a structure or locating a new structure out of a flood zone.

2. Acquisition

When feasible the community should acquire property that is repeatedly flooded or in a floodplain.

3. Building Elevation

Elevate the lowest floor of structures 1-foot above the base flood elevation.

4. Utility Protection

Relocate utilities such as electrical panels and heating and hot water systems in structures above the flood level.

5. Flood Proofing - Dry Floodproofing & Wet Floodproofing

Dry floodproofing: Installing water tight floor and wall systems.

Wet floodproofing: Constructing areas so as to permit the entry and passage of flood waters and relocating items of value to higher elevations.

## 6. Storm Shutters

Provide protection against wind damage, especially for properties exposed along the coastline.

Additional descriptions of property protection measures are provided in Appendix A of the Regional Hazard Mitigation Plan.

### **C. Emergency Services**

Aspects of emergency services typically addressed in hazard mitigation include the following:

1. Emergency Communication
2. Emergency Warning / Response
3. Emergency Shelter
4. Critical Facilities Protection

Emergency Services hazard mitigation measures can be combined with other types of measures to form successful projects, or remain as stand-alone projects. Emergency communication is a critical aspect of the hazard response programs currently in place in southeastern Connecticut. In the event of an emergency, the municipalities within the region establish an emergency command post within each town and mobilize their response agencies.

The interagency communications among the communities, State agencies and independent utilities requires continued coordination to establish and maintain the critical communication links. A need for improved and continued coordination has been identified during this study.

A local example of successful emergency communication in use is a fire alarm signal used in the Borough of Stonington. An audible alarm horn is signaled throughout the borough indicating the location of fire calls. The number of alarm horn signals indicates the area of emergency. The Borough also uses the emergency communication system for snow emergencies and to communicate “no school.”

Evacuation of the borough may be necessary during storms and the alarm sounding the signal "7" notifies residents of the need to evacuate.

Many municipalities within the region have expressed interest in a reverse 9-1-1 emergency communication system. A reverse 9-1-1 system would automatically call telephones throughout the municipality, efficiently replaying important information. This type of system is increasingly considered an effective tool in warning and instructing residents during the event of an emergency. The Mashantucket Pequot Tribal Nation, Department of Fire and Emergency services currently utilizes such a system.

Support of surrounding towns is an important aspect of emergency services within the region. Mutual aid agreements as well as regional dispatch centers allow for successful assistance between communities in the region in the event of emergencies. Several municipalities in the region have also expressed the need for improving redundancy within the emergency communications systems in order to provide alternate communication in the event of a loss of land line or cell phone service.

Upgrading emergency shelters is an important hazard mitigation measure that includes contacting the local Red Cross or other local emergency aid groups and updating supplies. Supplies include the number of emergency beds, food, and clothes. Communication equipment should be updated and working properly. Emergency shelters should not be sited within the floodplain. Community officials should take steps to relocate existing emergency shelters within the floodplain, or to properly protect the shelter with measures such as floodproofing or elevating the structure.

Police, fire fighters, and paramedics should maintain emergency response training. This should include maintaining and updating emergency equipment and emergency response protocols.

A fire hydrant survey should be conducted in each community. All communities, especially inland and rural communities should consider dry hydrants. A dry hydrant is a permanently installed hydrant into an existing lake, pond, stream, or waterbody and is available to be connected to a pump truck. It is a non-pressurized pipe system that allows firefighters access to water sources from roadways. It is relatively inexpensive with minimal maintenance and may be of use and more cost effective than other water resource alternatives.



The use of a fire boat can be considered in order to provide additional protection of critical facilities, structures, and other assets, (such as the commercial fishing fleet in Stonington) which are located in geographically isolated areas along the coastline.

#### **D. Structural Projects**

The history of coastal flooding in the southeastern region has prompted completion of a series of structural flood prevention and property protection projects along the coastline. Projects include the New London hurricane barrier in Shaw's Cove, construction of breakwaters at Stonington Harbor, and construction of seawalls, bulkheads, and groins in multiple locations along the shoreline. A series of major flood control dams were constructed in the headwaters of the Thames River basin to protect the cities and towns along the tributary rivers from flooding. Many potential structural projects have not been pursued to date, however, because it is questionable whether an acceptable cost-benefit ratio exists for the projects. The potential environmental impacts of structural projects is often also a concern.

Structural projects that can be included in hazard mitigation planning include the following:

1. Levees/Floodwalls
2. Bridge & Culvert Replacement
3. Channel Modifications
4. Storm Sewer Improvements
5. Structural Project Maintenance and Repair

Through the course of investigating potential structural projects in the region, it was determined that some hazards within the individual communities in the region often involve roads and corridors owned and operated by the State of Connecticut. The State Department of Transportation recommends that problems involving state roads/structures be reported every time they occur so that DOT can coordinate an evaluation of the problem. State of Connecticut agencies are also able to apply for hazard mitigation funding and should be encouraged to do so.

Additional information on structural hazard mitigation projects is provided in Appendix A of this Regional Hazard Mitigation Plan.

## **E. Public Information**

Public Information is another type of hazard mitigation measure which, like prevention and resource protection, can be most effectively implemented in conjunction with other hazard mitigation projects.

The Hazard Mitigation Committee has identified the need for a continued and expanded program of public information. Such a program could include providing educational information to the homeowners and business owners in the flood hazard areas. A public education and information component should be included in all hazard mitigation projects undertaken in the region.

The following includes some common types of public information measures:

### 1. Map Information

Development of hazard maps for public distribution or posting in public locations. This type of information is easily understood and assists in raising the public's awareness of the natural hazards that exist in their community.

### 2. Flood Audits

For additional information regarding flood audits refer to Appendix F of the Regional Hazard Mitigation Plan.

### 3. Real Estate Disclosure

This is a procedure where buyers and sellers of real estate are compelled to provide notice of known hazards affecting the property to be conveyed.

### 4. Public Library

Libraries can be an effective location of a hazard information center. Town Halls and other public facilities can also serve as information centers. A wide range of hazard mitigation documentation should be compiled for review.

5. Technical Assistance

Local governments can provide technical assistance to homeowners and contractors regarding hazard resistant construction. An appropriate time for such assistance can be at the time of a building permit application.

Two examples of publications that provide such assistance are:

Federal Emergency Management Agency. Homeowner's Guide to Retrofitting: Six Ways to Protect Your House From Flooding, June 1998.

Federal Emergency Management Agency. Protecting Building Utilities From Flood Damage: Principles and Practices for the Design and Construction of Flood Resistant Building Utility Systems, November 1999.

6. Environmental Education

Private and public schools and adult education programs can offer environmental education classes that include hazard identification and hazard mitigation components.

## **IV. OTHER MITIGATION MEASURES**

### **A. Earthquake Mitigation Measures**

Damage-causing earthquakes are infrequent events in southeastern Connecticut. As a result this section focuses on the history of earthquakes and vulnerability in a statewide framework. The portions of this section, which deal with existing capabilities, goals and objectives, and planned mitigation actions are specific to the southeastern Connecticut region.

Connecticut has the oldest record of earthquakes in the United States. The earliest settlers learned of seismic activity, dating back to 1568 in Moodus, from the Native Americans. Connecticut has experienced 137 recorded earthquakes for the period between 1568 and 1989. Of those closest to the southeastern region, 61 were in the Moodus/East Haddam area in south-central Connecticut.

Connecticut is considered to be in a Moderate seismic risk zone. "Moderate" relates specifically to the fact that earthquakes in the State have a relatively infrequent recurrence interval. This term does not demote a predictor of potential earthquake magnitudes or impact on the population. Earthquake magnitude is a measure of the strength of an earthquake, or the strain energy released by it.

Connecticut is located near the middle of the North American Tectonic Plate and is subject to intra-plate earthquakes. Connecticut is not near an active tectonic plate boundary, but there are many fault lines in the state that formed millions of years ago when the area was at a plate boundary. The activity observed today appears to be a result of stresses applied to the sides and base of moving plates which are transmitted to the plate interiors reactivating the old faults.

Connecticut has a population density that is 3.5 times greater than that of the State of California and has bedrock that transmits seismic energy 4 to 40 times more efficiently. These facts place more people at risk since the built environment in this region is predominately old, unreinforced masonry, and is not seismically designed.

The majority of structures are extremely strong for normal vertical load for which they were designed. Masonry structures do not fare well against the horizontal forces of an earthquake if they are not reinforced or braced.

Certain geological features are more susceptible to earthquake effects than others. Facilities located on filled or sandy soil can sustain heavy damage in a serious tremor. Consideration of the location of critical facilities (i.e. hospitals, schools, nursing homes, fire stations, etc) and critical infrastructure (roads, bridges, water lines, etc) is important in assessing their vulnerability.

Earthquake mitigation in Connecticut has been limited to enforcement of the Connecticut State Building Code. The code addresses earthquakes for construction of new commercial buildings only.

Due to the unpredictable and infrequent nature of earthquakes, mitigation of the hazard at the local level is difficult. Aside from emergency preparedness, and recovery functions, there are no local programs in place which can effectively address earthquake mitigation in the region.

The Connecticut Earthquake Program, located in the Department of Public Safety, Office of Emergency Management, is particularly concerned with the safety of the school population. The program includes: active participation in risk evaluation and assessment, public awareness and education programs, information transfer to public school faculty, and assisting the planning by emergency response personnel and agencies.

The FEMA publication entitled "The Home Builder's Guide for Earthquake Design" can be made available to all design professionals, builders and others who are issued permits for new construction. "Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide" (FEMA-74, 1994) can also be made available. All commercial, industrial and institutional property owners should have an opportunity to obtain a copy of the FEMA publication entitled "Emergency Management Guide for Business and Industry" (FEMA-141, 10/93).

In order to be able to effectively mitigate against earthquake damage at the regional level, it is crucial to have an understanding of what is at danger in the event of an earthquake. An earthquake survey should be completed in each community to effectively mitigate against earthquake damage. The earthquake survey should include all municipally owned buildings including hospitals, schools, nursing homes, fire stations, and critical infrastructures such as roads, bridges, water lines, etc. with details of location and the building's ability to withstand earthquake and wind loading.

## **B. Wind Storm Mitigation Measures**

This section of the plan focuses on mitigation of wind hazards associated with hurricanes, tornadoes, severe thunderstorms and winter storms. Southeastern Connecticut's location on Long Island Sound, increases its susceptibility to damaging winds. Experience indicates that winds in excess of 50 miles per hour cause significant tree damage.

Damage to trees, resulting power outages, and damage to buildings are the most problematic issues facing the southeastern region during storms with high winds. Wind damage is also the most frequently occurring natural hazard in the region. Burying power lines along routes where trees may snap and bring down power lines or in locations where there have been numerous power outages may result in fewer power outages

All communities in the region have tree trimming programs to mitigate against wind damage. Efforts are typically spent on response and clean-up following wind events. Connecticut Light & Power (CL&P) also has a tree trimming maintenance program in place. Contractors are hired to trim limbs and small trees along utility lines in portions of the region on a revolving basis. CL&P, along with City of Groton Utilities have self-maintenance programs that deal with potential threats to the companies' power lines.

The southeastern coast is home to private and municipal marinas which are vulnerable to the effects of both wind and flooding. Harbor management plans should include provisions for hazard mitigation. Information on Best Management Practices for marinas and yacht clubs is available from both State and Federal agencies.

Power outages throughout the region are of great concern to the emergency response community in the southeastern region. The loss of power to the region's many traffic signals potentially causes expenditures of a great deal of manpower to control and post the intersections for duration of the power outages. Improved emergency communication between the region's emergency response agencies and the emergency response coordinators at the utility company is critical to improved hazard mitigation efforts in the region.

After a series of deadly tornadoes struck Litchfield and New Haven counties in 1989, killing two persons and causing millions of dollars in damage, Connecticut installed a new type of warning system.

The National Oceanic and Atmospheric Administration (NOAA) Weather Radio Specific Area Message Encoder (WRSAME) system allows forecasters at three National Weather Service offices to send watches and warnings to specific areas of Connecticut. Warnings can be sent within a few minutes of a Doppler radar indication that a tornado may be forming within a severe thunderstorm. In addition to information on tornadoes, the weather radios receive information on any severe weather occurrences in the area, including hurricanes and severe thunderstorms.

Information on wind resistant construction techniques can be made available to all building permit applicants. Literature on this topic should be incorporated into the natural hazards reduction reference information available in the regions' libraries.

## **V. HAZARD MITIGATION PROJECT RANKING**

Based on the hazard risk assessment analysis, the Hazard Mitigation Committee has developed a matrix of several potential hazard mitigation projects recommended to reduce the region's vulnerability to natural hazards. The matrix and a prioritized ranking is included in Appendix B of the Regional Hazard Mitigation Plan.

Projects identified in the matrix have been prioritized based on the following criteria:

- Safety of the population
- Historical damage
- New development in high risk areas
- Value of property at risk
- Consistency with plan goals and objectives

The projects were also considered on how they relate to potential health risks, structural damage, access/egress for evacuation, protection of structures that house people with special needs and residential areas housing a large portion of the region's population. For a complete list of criteria used in the prioritization process, see Appendix B of the Regional Hazard Mitigation Plan.

The mitigation action priorities were based on the outline provided in appendix B. They were determined subjectively on both the regional and local level. The communities will be in a position to address action priorities in a more quantitative manner in future revisions of the plan.

The project listing and prioritization which is presented in the attached appendix represents the committee's list and ranking as of the date of this report. The goals of hazard mitigation planning allow for and encourage the periodic review and revision of these items over time.

Regional priorities for hazard mitigation strategies were arrived at by collecting input from individual communities on their priorities. The individual priorities were tallied in terms of the number of times that a particular strategy appeared as a local priority. As an example, addressing flood hazards and emergency communications were a top priority for essentially all jurisdictions. As a result, these became a top, regional priority. Other hazards were by cited by fewer communities, making their identified priority lower. The prioritization process focused on identifying the costs and benefits of the various projects.



A detailed benefit-cost ratio will be developed as part of the Hazard Mitigation Grant Application process for each project considered. The cost of projects will be developed as part of the project design. The benefits will be evaluated both in dollar value of damage prevented and in terms of intangible benefits such as lives saved and business disruption avoided.

## **VI. IMPLEMENTATION, MONITORING, AND EVALUATION**

This plan was prepared with the understanding that potential funding sources may not be available within the time frame necessary to implement the recommended actions on a specific schedule. It is therefore necessary to incorporate into the plan a system of monitoring its progress and making necessary adjustments. In addition, the goals and objectives may need to be modified over time in order to meet the demands of a changing community. Accomplished activities will be eliminated, and new ones added.

The Southeastern Regional Council of Governments will be responsible for implementation of the hazard mitigation actions contained in the regional plan, working with the local coordinators to pursue regional actions at the local level. The Council of Governments will offer its expertise as a resource to identify and pursue the potential funding sources identified in Appendix G to complete both regional and local actions.

The local jurisdictions will utilize their own budgetary resources to the extent that they are available to implement the actions detailed in their individual annexes. Local funds will be supplemented by regional, state and federal funding that may be available from the sources contained in Appendix G of the plan. The administration and coordination of the local implementation process will be the responsibility of the local coordinators. Within the first year of plan adoption they will meet with the local chief elected official or town manager to identify the local agency that will be responsible for carrying out the actions contained in their annex. Projects that involve structural actions will be the responsibility of the local engineering or engineering department. Projects that involve review and incorporation of plan actions in other town regulations and ordinances will be the responsibility of local planning departments. Actions involving emergency communications will be the responsibility of the local fire and police departments or the local emergency management director.

Actions such as bridge and culvert replacements will take five years to complete if funding is available. Other actions such as posting and distributing hazard mitigation information will take place within the first year after adoption.

Local administration will generally be the responsibility of the regional steering committee representative. Many of the low-cost strategies will be implemented both locally and regionally during the first year after plan adoption. The higher-cost projects will be implemented as funding becomes available.

The staff of the Southeastern Connecticut Council of Governments serves as coordinator of the Hazard Mitigation Committee that provided oversight of the plan preparations. In accordance with § 201.6 (c)(4)(I) of the Interim Final Rule, the Committee will meet on or before the fifth anniversary of the adoption of the plan to review the implementation progress as well as the goals, objectives, and actions outlined in the plan. With input from the Committee, SCCOG staff will prepare a report on the status of plan implementation each time the plan is updated. The report will include the following: a review of the goals and objectives of the original plan; a review of any disasters or hazards that occurred during the period; a review of each element or objective of the original plan, including what was accomplished the previous year; and recommendations for new projects or revised objectives. As a part of the first comprehensive review of the plan, time frames for implementation of all local and regional actions will be reviewed and adjusted as appropriate based on the first five years of experience

The local communities have identified by ordinance a person as a local coordinator for the implementation and monitoring of the progress of the plan. This person acts as a contact for the Southeastern Connecticut Council of Governments and the State of Connecticut National Flood Insurance Program Coordinators during the grant application and cost-benefit analysis process.

The regional plan and each of the community annexes will be revised and updated as appropriate based on the results of the review process. Progress on implementation will be judged based on the input of the communities and the public on their perception of the effectiveness of the mitigation projects that have been completed. The Southeast Regional Council of Governments will be responsible for making appropriate revisions to the regional plan after the first comprehensive plan review. Each local jurisdiction will be responsible for revising their annex.

Continued public involvement in the in the hazard mitigation plan revision and action implementation process will be encouraged by publishing public notices of all local and regional meetings related to hazard mitigation. Press releases will also be issued.

The Southeast Regional Council of Governments and Communities with internet sites will post appropriate hazard mitigation information and meeting schedules. SCCOG will continue to periodically include updates on plan implementation progress in its newsletter.

During the first year of adoption, each of the communities will evaluate aspects of the plan that can be incorporated into their zoning regulations, plans of development, and open-space plans. Appropriate hazard mitigation strategies will be incorporated at the times of updating each of the plans.

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**APPENDIX A**  
**HAZARD MITIGATION MEASURES**

## MITIGATION MEASURES

### Natural Hazards

#### Hurricane

- Provide information to contractors and homeowners on the risks of building in hazard-prone areas
- Develop a list of techniques for homeowner self-inspection and implementation of mitigation activities
- Implement dune restoration and other coastal protection projects consistent with the CT Coastal Area Management Program.
- Acquire shorefront land for open space
- Develop a comprehensive sheltering system.
- Implement a formal Tree Hazard Management Program to encourage responsible planting practices and minimize future storm damage to buildings, utilities, and streets
- Distribute hurricane preparedness information including pet sheltering plans
- Encourage the purchase of flood insurance
- Retrofit:
  - Wet flood proofing (allowing water to enter uninhabited areas of the house)
  - Dry flood proofing (sealing the structure to prevent floodwaters from entering)
  - Install backflow valves on sewer systems
  - Venting on roofs
  - Garage doors with stiffer horizontal members, glider tracks and track support

- Hurricane straps and hurricane clips
- Reinforcement of concrete block wall; concrete tie-columns at all corners
- Bracing with struts or columns in walls perpendicular to freestanding walls
- Elevation of structures on piers, posts, columns, and pilings
- Add shutters for glazed openings
- Renail sheathing
- Create a secondary water barrier
- Provide support for sliding glass doors and double doors opening to the outside
- Improve anchorage of windows to openings
- Add ridge ventilators to reduce uplift of wood sheathing
- Anchor adjacent structures, including privacy fences, pool enclosures, and patio roofs
- Improve connections of porch roofs and overhangs
- Reinforce entry doors

## **Flood**

- Elevate structures above the 100-year flood level
- Maintenance program to clear debris from stormwater drainage areas
- Provide information to contractors and homeowners on the risks of building in hazard-prone areas

- Develop a list of techniques for homeowner self-inspection and implementation of mitigation activities
- Install backflow valves in sewer systems
- Develop sediment control to prevent clogged drainage systems such as street sweeping, curb and gutter cleaning, paving dirt roads, and planting vegetation on bare ground
- Investigate the use of flood prone areas as open space
- Retrofit:
  - Elevate the lowest floor above the 100-year flood level
  - Wet flood proofing (allowing water to enter uninhabited areas of the structure)
  - Dry flood proofing (sealing the structure to prevent flood waters from entering)
  - Levees and floodwalls (constructing a barrier around the structure to keep out flood waters)
  - Demolition (tearing down the structure and rebuilding with appropriate flood proof techniques or relocating the structure)
  - Elevate the main breaker or fuse box

### **Severe Thunderstorms and Lightning**

- Clear dead or rotting trees and branches
- Public information on when to turn off gas, electricity, and water; how to develop an emergency communication plan; and actions to take during a severe thunderstorm such as avoiding bathtubs, water faucets, and sinks
- Secure outdoor objects that could become projectiles
- Install lightning rods



## **Tornadoes**

- Telephone warning system
- Community warning sirens
- NOAA weather radio tone alerts
- Retrofit structures to include reinforced “safe room”

## **Soil / Beach Erosion**

- Sand management
- Relocation of threatened facilities
- Threatened real estate set aside as open space
- Vegetation replenishment program

## **Seismic Hazards**

- Rodent control
- Mosquito control
- Regular maintenance of cooling and plumbing systems
- Water purification maintenance
- Adequate sanitation control measures

## **Technological Hazards**

## **Power Failure**

- Voluntary conservation public information (bill inserts)
- Electrical Emergency Contingency Plan

## **Transportation System Accident**

- Develop accident contingency plans

## **All Hazards**

- Map vulnerable areas and distribute information about the hazard mitigation strategy and projects
- Develop a list of techniques for homeowner self-inspection and implementation of mitigation activities
- Organize and conduct training opportunities regarding natural hazards and hazard mitigation
- Distribute NOAA weather radios (school superintendents, etc.)
- Sound land use planning based on known hazards
- Enforcing building codes and local ordinances
- Increasing public awareness of community hazards
- Consider conservation of open space by acquisition of repetitive loss structures
- Maintain a hazard mitigation committee

## **PROPERTY PROTECTION PROJECTS**

Specific measures which are considered property protection include:

- Installation of temporary or permanent closures for openings in structures
- Raising existing structures in-place
- Constructing structures on fill or columns
- Constructing small walls or levees around structures
- Relocating or protecting damageable property within an existing structure
- Relocating existing structures and/or contents out of a flood hazard area
- Use of water resistant materials in new or existing structures
- Acquisition of title or easement to floodplain land
- Flood Insurance
- Establishment of flood forecast and warning systems with an appropriate evacuation plan

Structures whose exterior is generally impermeable to water can be retrofitted to keep flood water out by installing watertight closures in openings such as doorways and windows. While some seepage will still potentially occur, it can be reduced by applying a sealant to walls and floors. Closures can be temporary or permanent. Temporary closures are installed only after a flood forecast and therefore need warning time for installation. Specific measures which may be taken are described below.

Doorway Closures: Exterior doors do not normally seal tight enough to prevent seepage around the door jamb. Installation of a rubber type gasket and the means to press the door against the gasket to create a tight seal can be adequate for low flooding depths (0-1 feet). A more effective means is the use of flood shields. Shields are normally of aluminum, steel, wood or plastic and are made to the height and width desired. In commercial/industrial structures they are permanently installed at the doorway on hinges or rollers for swinging or sliding into place. More often however, they may be stored nearby for installation on brackets or anchor bolts at the time of a flood. The shield seals against the door jamb with a rubber type gasket.

Window Closures: Normal window glass can resist very little hydrostatic pressure and is vulnerable to breakage by floating debris. Flood shields are commonly used to protect windows and prevent water from entering. As with doorway shields, window shields can be permanently installed on hinges or rollers or stored and installed temporarily during floods. Another alternative is to install heavy duty Plexiglas, as a substitute to window glass, which can resist hydrostatic pressures of several feet. Large display windows in commercial structures are sometimes protected by installing weep holes at the base of the window. This allows water on the inside to equalize the hydrostatic pressure on the window, but it is prevented from entering the remainder of the structure by parapet walls. Windows not needed can be permanently closed with bricks, blocks, or other impermeable material. The condition of the structure, and the number, location and size of openings influence the feasibility of utilizing closures. Structures with large and/or numerous openings lack advantages associated with structures with fewer openings. The most favorable situation is a structure constructed of relatively impermeable materials, in good condition, with few openings.

Seals: Waterproofing sealants can be applied to generally impermeable walls and floors to limit seepage. Sealants are particularly effective on brick veneer, cement block, reinforced concrete and similar masonry type surfaces, as well as rigid aluminum and vinyl siding. Cracks in masonry can be filled by caulking. Structures with exterior walls constructed of brick, brick veneer, concrete and cement block are relatively impermeable and can be made more so by sealing exterior surfaces.

Structural Adequacy: When water is prevented from entering a structure, the walls become subject to lateral hydrostatic forces which may cause failure by bending or shear, and the floors to uplift forces which may cause buckling or flotation. It is somewhat more difficult to analyze the capability of existing structures to resist these forces because of the general lack of knowledge about workmanship and materials used during construction and about the present condition of these materials.

Building Elevation: This alternative involves raising the building in place so that the first floor elevation is above the flood level. Raising buildings is generally used in areas of low to moderate water depth and velocity. After the building is jacked up, existing foundation walls are extended vertically. Although raising foundations walls is often viewed as the easiest flood proofing, there are several important considerations. The most important concern is that the original foundation and footing must be able to withstand the extra loading from the vertical dead load of the new wall.

Flood Proofing Utilities: Elevation is the most effective way to prevent flood damage to exterior utilities. All incoming electrical power lines, transformers, and panels should be located at least one foot above the 100 year flood elevation. Because sewer lines in most areas are highly susceptible to infiltration, they often become saturated during flooding events. In such cases floodwater may enter a building through the sewer system and create internal flooding that is near or equal to exterior flood levels. To prevent this, backflow prevention valves should be installed on the building's sewer lines.

Water distribution lines are not usually contaminated when flooding occurs unless the water source itself is inundated by floodwater.

Heating or air conditioning units, or similar facilities located outside the structure, must also be flood proofed. Elevating the equipment is preferred, but if this is not feasible, a watertight closure system should be provided.

To complete the utility system flood proofing process, all openings below the base flood elevation where pipes, conduits, vents or other fixtures pass through a floor or exterior wall must be sealed to prevent leakage. Penetrations can be pressure sealed in several ways: gel-like expansive sealants, electrometric seals, molded sleeves, and neoprene seals.

## **STRUCTURAL PROJECTS**

Flood Walls and Levees: Flood walls and levees are freestanding structures located away from the building that prevent inundation of the building. They may completely encompass the perimeter of the building or provide protection just to the low lying areas. Generally, levees are constructed of compacted soils. Levees have the advantage of being compatible with the surrounding landscape since they are easy to shape.

An important factor in considering the feasibility of a levee involves the availability of suitable fill material for the levee, and the adequacy of the underlying supporting soil. Most types of soils are suitable for levee construction, with the exception of extremely fine-grained or highly organic soils. In addition, levees require a substantial area to construct and may not be feasible on small lots.

Construction of flood walls is another option. Flood walls are similar to levees however they are not constructed of earthen materials. They are generally thinner and take up less area than levees. Flood walls can be constructed using a variety of designs and materials. The most common material for flood wall construction is concrete.

**APPENDIX B**  
**HAZARD MITIGATION PROJECT RANKING CRITERIA & MATRIX**

## **PROJECT RANKING CRITERIA**

The following ranking system was developed to rank the Hazard Mitigation projects in this plan. It is based on FEMA's guidance for Hazard Mitigation Planning.

1. Does the project address severe impacts? Projects should reduce loss of life, loss of essential services, damage to critical facilities, or severe economic hardship.
2. Is the project consistent with the overall plan of development, coastal plan and zoning regulations for the municipalities?
3. Does the project have the greatest potential to reduce future losses in the project area after examining the alternatives available?
4. Is the project cost-effective?
5. Is the project in an area with a history of repetitive damage?
6. Does the project provide measures designed to accomplish multiple objectives, including damage reduction, environmental enhancement, and economic recovery?
7. Does the project protect primary residences versus secondary homes and businesses?
8. Are the environmental impacts minimized?
9. Does the project have a distinct beginning and end?
10. What is the number of people that are directly benefited by the project?
11. What is the value of the property to be protected by the project?

<b>Regional Plan of Hazard Mitigation Projects</b>			
<b>Hazard</b>	<b>Vulnerable Location</b>	<b>Mitigation Project</b>	<b>Priority</b>
All Hazards	Region Wide	Evaluate the Hazard Resistant Nature of All Critical Facilities	High
All Hazards	Region Wide	Comprehensive Evaluation of Emergency Communication Capabilities of all Municipalities	High
Flooding	Region Wide	Develop a Flood Audit Program for all Municipalities in the Region	High
All Hazards	Region Wide	Review of Regional Transportation Facilities to Identify Critical Risks	Medium
Hazardous Materials Spills on Roadways	State Roads	Identify Appropriate Improvements to Traffic Infrastructure and Emergency Response Training and Equipment	Medium



<b>Regional Plan of Hazard Mitigation Projects</b>			
<b>Hazard</b>	<b>Vulnerable Location</b>	<b>Mitigation Project</b>	<b>Priority</b>
All Hazards	Region Wide	Implement a Reverse 9-1-1 System to automatically call telephones throughout each municipality, relaying important information during an emergency	Low
All Hazards	Region Wide	Distribute or post information public information regarding hazards in the community	Low
All Hazards	Region Wide	Evaluate emergency shelters, update supplies and check communication equipment	Low
All Hazards	Region Wide	Maintain emergency personnel training as well as maintaining and updating emergency equipment and response protocols	Low

<b>Regional Plan of Hazard Mitigation Projects</b>			
Wind Hazards	Region Wide	Evaluate and consider burying power lines underground and away from possible tree damage	Low
<b>Hazard</b>	<b>Vulnerable Location</b>	<b>Mitigation Project</b>	<b>Priority</b>
Earthquake Hazards	Region Wide	Complete an earthquake survey of all critical facilities and infrastructures	Low
Flooding	Region Wide	1) Complete catch basin surveys to identify catch basins in need of maintenance and/or replacement  2) Complete Culvert survey to determine priority for maintenance and/or replacement plan	Low

**Regional Plan of Hazard Mitigation Projects**

Fire Hazards	Region Wide	<p>Complete a survey of fire hydrants in each community to assess vulnerabilities and capabilities for fire protection</p> <p>Dry hydrants should be considered for all communities especially inland and rural communities</p>	Low
<b>Hazard</b>	<b>Vulnerable Location</b>	<b>Mitigation Project</b>	<b>Priority</b>
Coastal Hazards	Coastal Communities	<p>Improve property protection with storm shutters and when possible elevate property above the base flood elevation.</p> <p>Communities should consider acquisition of properties that are repeatedly flooded</p> <p>A fireboat should be considered as a means of emergency equipment</p>	Low



**APPENDIX C**  
**REGIONAL HAZARD ASSESSMENT MAPS**

## **COST EFFECTIVENESS OF HAZARD MITIGATION PROJECTS**

It is important to identify mitigation projects that are the most cost effective. A cost effective plan is one where the total cost of installation operation and maintenance is less than the amount of physical damage, lost earnings, and other economic impacts that are likely to occur if the project is not completed.

In order to qualify for federal assistance under the Hazard Mitigation Grant Program, a hazard mitigation project must have a positive benefit-to-cost ratio. Over the economic life of the project, the total benefits must exceed the cost of the project.

Damages are generally calculated on an average annual damage basis over the economic life of the structure. These average annual damages that would be incurred without mitigation are considered as the average annual benefits associated with the proposed project. Other benefits, such as reductions in insurance premiums, and reduction in lost production time are also included in the calculation of annual benefits.

The total cost of implementing a mitigation plan must also be calculated. All factors must be considered, including the cost of installation, operation, maintenance and financing. Once these variables have been identified, it is possible to amortize the total project over the economic life of the structure to identify an average annual cost. The average annual cost can then be directly compared with the average annual benefits (damages prevented) to determine the relative cost effectiveness of proposed projects.

### **Benefits**

Direct benefits include the prevention of:

- Building damages;
- Loss of, or damage to, personal property or building contents;
- Infrastructure damages;
- Displacement costs after a disaster event;
- Casualties;
- Loss of function: Critical public facilities;
- Transportation routes;
- Electrical power;
- Businesses; and emergency protective measures.

### **Indirect Benefits**

Some benefits may not be considered when determining the benefits of a mitigation project. Damages and losses are not included in the analysis when there is no clear cause and effect relationship between the event and the damages or loss. Some examples of indirect benefits include avoidance of:

- Lost wages;
- Looting;
- Gross or region-wide economic effects; and
- Recreation opportunities lost or gained.

**APPENDIX E**  
**CONNECTICUT STATE FLOOD WARNING SYSTEM**



**APPENDIX F**  
**FLOOD AUDIT PROGRAM**

## TECHNICAL & 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 Office  
J.W. McCormack POCH, Room 462  
Boston, MA 02109-4595  
(617)-223-9575

#### Mitigation Division

*Administers all of FEMA's hazard mitigation programs, including: National Flood Insurance Program and Community Rating System; prepares and revises flood insurance studies and maps; information on past and current acquisition, relocation, and retrofitting programs; expertise in other natural and technological hazards, including hurricanes, earthquakes and hazardous materials. Financial assistance includes Hazard Mitigation Grant Program (post-disaster); Flood Mitigation Assistance Program (pre-and post-flood); training for local officials at Emergency Management Institute in Emmitsburg, Maryland.*

*Earthquake Hazards Reduction Assistance Program: As part of the National Earthquake Hazards Reduction Program (NEHRP), the purpose of the FEMA's State Earthquake Hazards Reduction Program is to provide funds for the development of comprehensive risk reduction programs at the State level and risk reduction measures at the local level to reduce future earthquake damages and losses. The fundamental goal of the program is to reduce earthquake impacts and the subsequent loss of lives, property damages, and economic losses. To accomplish these goals, technical assistance from State programs to local governments in the areas of structural and non-structural mitigation, building codes, and land-use planning ordinances is necessary.*

*State Hurricane Program: This program is concerned with reducing the impacts of hurricanes and coastal storms on coastal areas of the United States and its territories as well as reducing the extent of subsequent losses.*

*FEMA provides financial and technical assistance to State and local governments to support*

*their efforts to mitigate the damaging effects of hurricane and coastal storms. State Hurricane Program funds are to be used for mitigation and preparedness activities related to hurricane hazards. Each participating State receives a Local Assistance allocation of \$5,000 in addition to the State Assistance Grant.*

*Hurricane Program Property Protection - Mitigation Grants: This element of the Hurricane Program provides grants to hurricane-prone States to implement mitigation projects. Each FEMA region with States participating in the Hurricane Program receives funds for this activity.*

*The regional offices solicit the States to undertake projects that reduce the risk of loss of life or injury from damaged structures and reduce the overall cost of hurricane disasters due to property damage. This program is administered by the CT OEM.*

*Multi-State Groups: There are three multi-state (regional) consortia that FEMA funds: the Western States Seismic Policy Council (WSSPC), the New England States Emergency Consortium (NESEC), and the Central United States Earthquake Consortium (CUSEC). The mission of all three consortia is to support the National Earthquake Hazard Reduction Program (NEHRP) funded State earthquake programs. They provide support in areas such as coordination between the States in a region and public awareness and education, and they also reinforce interactions between all levels of government, academia, non-profit associations, and the private sector.*

*Technical Assistance Contracts: The Mitigation Directorate 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): 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 mitigative 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.*

*Hazard Mitigation Grant Program (HMGP): HMGP is a post-disaster mitigation program that provides funding for hazard mitigation projects in affected counties following presidentially declared disasters. Available funds are based on a percentage of the total damages caused by the particular disaster. Grants from this program are limited to state and local governments and certain non-profit organizations.*

*There is a need to demonstrate a positive cost/benefit analysis and a cost-share requirement of 25% to match the federal funds provided. Grants are competitive within the affected area. This program is administered by the state of Connecticut, Department of Environmental Protection.*

*Flood Mitigation Assistance Program (FMA): FMA is a pre-disaster mitigation program created by the National Flood Insurance Reform Act of 1994. This program provides both project and planning grants annually for flood hazard mitigation planning and projects with direct demonstrable benefits to the NFIP insurance fund. Administratively, this program is very similar to the HMGP described above.*

### Response & Recovery Division

*Information on dollar amounts of past disaster assistance including Public Assistance, Individual Assistance, and Temporary Housing; information on retrofitting and acquisition/relocation initiatives.*

*Coordinates federal disaster assistance programs, including 75% grants for mitigation projects to protect eligible damaged public and private nonprofit facilities from future damage through the Public Assistance Program, and 100% "minimization" grants through the Individual and*

*Family Grant Program.*

Computer Sciences Corporation

New England Headquarters,  
140 Wood Road, Suite 200,  
Braintree, MA 02184  
(781) 848-1908

*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 lenders, insurance agents, and communities.*

Small Business Administration

360 Rainbow Boulevard South, 3rd Floor  
Niagara Falls, NY 14303  
Disaster Program Director: Win Allred  
(716) 282-4612 or 800-659-2955

*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. Can be used in combination with the new “mitigation insurance” under the NFIP, or in lieu of that coverage.*

Environmental Protection Agency

Region I - JFK Federal Building, Government Center,  
Boston, MA 02203  
(617) 565-3400

**Capitalization Grants for State Revolving Funds**

*Low interest loans to governments to repair, replace, or relocate wastewater treatment plants 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>U.S. Dept. of Housing</u>	and	<u>CT Dept. Of Economic and Comm. Development</u>
<u>Urban Development</u>		505 Hudson Street
330 Main Street		Hartford, CT 06106
Hartford, CT 06106		(860) 566-5310
(860) 240-4515		

*Community Development Block Grants (CDBG): Communities with populations greater than 50,000 contact HUD directly regarding CDBG. Communities smaller than 50,000 compete for funds allocated to the state Department of Economic Development. 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 which create an "imminent threat." The funds have been used in the past to replace (and redesign) bridges where flood damage eliminated police and fire access to the other side of the waterway.*

## U.S. Army Corps of Engineers

New England District  
696 Virginia Road  
Concord, MA 01742-2751  
(978) 318-8505

*Provide 100% funding for floodplain management planning and technical assistance 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 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  
445 Myles Standish Blvd.  
Taunton, MA 02780  
(508) 823-2266

*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  
Rivers and Trails Conservation Program  
Regional Office, 15 State Street  
Boston, MA 02109  
(617) 223-5203

*Technical Assistance with open space preservation planning; can help facilitate meetings and identify non-structural options for floodplain development.*

Fish and Wildlife Service

New England Field Office  
22 Bridge Street, Unit # 1  
Concord, NH 03301

*Can provide technical and financial assistance to restore wetlands and riparian habitats through the North American Wetland Conservation Fund and Partners for Wildlife programs.*

U.S. Department of Agriculture

Natural Resources Conservation Service (formerly SCS)  
344 Merrow Road, Suite A  
Tolland, CT 06084  
(860) 871-4016

*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.*

## **State Resources**

Connecticut Department of Environmental Protection  
79 Elm Street  
Hartford, CT 06106  
(860) 424-3706

*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.*

*National Flood Insurance Program State Coordinator - 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.*

*State Hazard Mitigation Officer - Hazard mitigation planning and policy; oversight of administration of the Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, and Project Impact initiative.*

*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.*

*Flood & Erosion Control Board Program - provides assistance to municipalities to solve flooding, beach erosion and dam repair problems. 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 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, and reviews and approves municipal regulations.*

*Dam Safety Program - Charged with the responsibility for administration and enforcement of Connecticut's dam safety laws. Permits the construction, repair or alteration of dams, dikes or similar structures and maintains a registration data base of all known dams statewide. This unit also operates a statewide inspection program.*

*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 Rivers Restoration Grant Program, 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 - Administers the Coastal Area Management Act program and Long Island Sound License Plate Program.*

#### State Military Department

Office of Emergency Management

360 Broad Street

Hartford, CT 06105

(860) 566-3376

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

#### Connecticut Department of Public Safety

Office of the State Building Inspector

1111 Country Club Road

Middletown, CT 06457  
(860)685-8310

*Responsible for administering and enforcing the Connecticut State Building Code. Also responsible for the municipal Building Inspector Training Program.*

Department of Transportation

Berlin Turnpike  
Newington, CT  
(860) 594-3236

*The Department of Transportation administers the federal Intermodal Surface Transportation Efficiency Act (ISTEA) which 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 also be mitigation related.*

**Regional Resources**

Southeastern Connecticut Council of Governments  
5 Connecticut Avenue  
Norwich, CT 06360

**Private And Other Resources**

The Association of State Floodplain Managers  
2809 Fish Hatchery Road, Suite 204  
Madison, WI 53711  
(608) 274-0123

*Professional association that assists communities with the NFIP with a membership of almost 2000. ASFPM has developed a series of technical and topical research papers, and a series of Proceeding from their annual conferences. Many mitigation “success stories” have been documented through these resources, which also provide a good starting point for planning.*

Natural Hazards Center (303) 492-6818 (M-F, 11:00AM-6:00PM Eastern)

*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.

J. W. McCormack

P.O. Box 676

Boston, MA 02102-0676

*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.*

National Center for Earthquake Engineering and Research (716) 645-3391

*A Source for earthquake statistics, research, engineering and planning advice.*

National Emergency Managers Association

c/o Council of State Governments

3650 Iron Works Pike, P.O. Box 11910

Lexington, Kentucky 40578-1910

606-244-8000

*A national association of state Emergency Management Directors and other emergency management officials. The NEMA Mitigation Committee is a voice in shaping all-hazard mitigation policy in the nation. NEMA is also a source of technical assistance.*

New England States Emergency Consortium (NESEC) (800) 445-6332

*Clearinghouse for mitigation and preparedness information and cooperation among all New England states. NESEC presents a unique, non-governmental approach to aid. This agency could secure access to private sources of monetary and logistics support.*

Institute for Business and Home Safety (IBHS)

1408 Westshore Boulevard, Suite 208

Tampa, FL 33604

(813) 286-3400

*A non-profit organization established by the insurance industry to research ways of lessening the impact of natural hazard. IBHS advocates the development and implementation of building codes and standards nationwide and may be a good source of model code language. IBHS is also involved in the promoting of strong land use planning practices which incorporate natural hazards into local development processes.*

*Volunteer Organizations - Volunteer organizations, such as the American Red Cross, the Salvation Army, and the Mennonite Disaster Service are often available to help after disasters. Service Organizations, such as the Lions, Elks, and VFW are also helpful. The Mennonite Disaster Service provides skilled labor to help rebuild damaged buildings 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. That would allow the funds to be used for mitigation and other projects that cannot be funded elsewhere.*

**APPENDIX H  
ADOPTING RESOLUTION**

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## **THE CONNECTICUT FLOOD WARNING SYSTEM**

The Automated Local/Statewide Evaluation in Real Time (ALERT) system is an automated early flood warning and response system. ALERT was installed in Connecticut by the Natural Resources Conservation Service (NRCS) in cooperation with the Department of Environmental Protection (DEP) in 1985 as a direct result of the June flooding of 1982. Rainfall, river, tidal, and weather data collected by the flood warning system is radioed into the DEP Alert Center and the three offices of the National Weather Service and used to issue faster severe weather watches, and warnings. The Alert System has aided communities in responding more rapidly to flash flooding and other weather related emergencies in Connecticut.

The automated rainfall, river, tidal and weather gauges that make up the ALERT flood warning system measure weather conditions statewide, and transmit their data via VHF radio signals to computer base stations located throughout Connecticut.

Two of the computer base stations are located at the State DEP/Inland Water Resources Division (IWRD) Flood Alert Center in Hartford and the Hartford Public Works Department.

Once received at each base station, the precipitation, river, tidal and weather data are stored in the database. Special software is used to analyze the data and alert IWRD staff of potential flooding conditions before they occur. The data is also uploaded to the Northeast River Forecast Center (NERFC) in Taunton, MA., and the Weather Service Offices at Albany, New York, and Brookhaven, Long Island. NERFC personnel analyze the rainfall and river data, and prepare river flood forecasts. The ALERT system also provides valuable rainfall data to the Department of Forestry's fire monitoring program, and roughly 30 other public and private agencies.

In addition to the Statewide Flood Warning System there are nine local Automated Flood Warning Systems encompassing 13 Towns and Cities. These nine communities suffer from repeated flooding and have installed ALERT Systems to increase their flood warning and response time. Each Town has its own computer base station that can monitor local conditions as well as communicate via phone modem with the central base stations in Hartford. With the aid of a modem line to the Hartford base stations, Towns can view heavy rainfall moving in their direction before it arrives.



## **FLOOD WARNING SYSTEM DESIGN**

The Committee on Automated Flood Warning was formed from a study group in 1985 to design and install an Automated Local/Statewide Evaluation in Real Time (ALERT) Flood Warning System for Connecticut.

Prior to the installation of the Statewide system in 1985, ALERT systems were already operational in the Cities of Stamford and Hartford. The first phase of installation of the statewide system involved the placing of 14 automated precipitation gauges evenly spaced across the state. The gauges were designed to collect and transmit rainfall data automatically. To receive and store the rainfall data, a pair of computer operated base stations were installed at the DEP in Hartford and the National Weather Service Northeast River Forecast Center (NERFC) in Bloomfield (now located in Taunton, MA). Five radio repeaters were installed to relay data transmissions from the gauges to the base stations.

The second phase of the installation called for two local ALERT systems to be installed in the communities of Southington and Norwich. Each of these ALERT systems consists of four precipitation gauges, one river gauge, a computer base station and a radio repeater. Rainfall and river data from the gauges are received at the local base stations, and relayed via radio repeater to the two state ALERT base stations in Hartford.

Since 1990, the statewide system has been further expanded to include the Hartford, Milford, and Wallingford Alert Systems. New systems are currently planned to be installed in, the Norwalk River basin, Danbury and East Haven.

These communities receive warnings of heavy rainfall and potential flooding several hours in advance of damage, and they use this additional time to implement special community Emergency Operations Plans (EOPs). Individual homeowners and businesses are notified so that they can implement their flood audit action plans to reduce flooding damages before flooding occurs.

In 1992, six fully automated weather stations were also installed to replace six aging weather stations that were installed as part of the second phase in 1986. Devices on these weather stations collect and transmit rainfall, temperature, soil moisture, wind speed/direction, and relative humidity data to the base stations via radio repeaters. The University of Connecticut and the Division of Forestry use the data for climatological research and to forecast forest fire burn potential.

The system was expanded again in 1997 to include ten additional river gauges on the state's seven largest rivers and two tide elevation gauges in Old Saybrook and Groton. Because these new gauges are located in areas that do not suffer flash flooding, but are prone to normal river flooding which takes 12-36 hours to occur, this expansion used gauges that operate via telephone and cellular links.

## **NOAA/EAS WEATHER WARNING RADIO NETWORK**

During 1993-1994, with assistance from the Federal Emergency Management Agency (FEMA), Connecticut installed the NOAA Weather Warning Radio WRSAME system. The acronym WRSAME stands for Weather Radio Specific Area Message Encoder. This new system allows the NWS to issue warnings to specific areas of Connecticut without alarming the entire state.

Specialized message encoder consoles were installed at the three NWS Forecast offices covering Connecticut, and 300 NOAA Weather Radios (with built-in decoders) were placed in schools, state parks, police and fire departments statewide. These newer radios can store messages and alert users when watches and warnings are issued. The radios also scan the frequency for static or weak signals, and alert users if problems are detected.

The NOAA/WRSAME system operates on the Federal Hydrologic frequencies. In Connecticut, four transmitters; Hamden (162.400 MHz), Soapstone (162.475 MHz) Montville (162.550 MHz), Central Park (162.550 MHz) and Mohawk Mountain (162.500 MHz); are used by the NWS to transmit forecasts, watches, and warnings. The NWS conducts weekly tests of the system.

During 1997-98 the NOAA/WRSAME system was upgraded to work with the newer Emergency Alerting System (EAS). The new EAS system includes civil preparedness messages along with the existing weather watches and warnings.

## **COASTAL FLOOD WARNING SYSTEM**

During 1997, Connecticut installed a Coastal Flood Warning system. The system consists of two automated tide gauges which transmit data via telephone links to the DEP and NWS. These gauges measure still water elevation, rainfall, and barometric pressure. As part of the Coastal Flood Warning System, about 300 hurricane evacuation signs have been installed in 13 Towns along the coast.

These signs serve two purposes: 1) they direct evacuating vehicles along routes away from the coast, 2) each sign has an 8 foot staff gauge beneath it that shows the ground surface elevation at that location. Using these signs, Towns can evacuate persons in phases based on their elevation above sea level.

## **FORECAST & WARNING PROCEDURES IN CONNECTICUT**

### **NATIONAL WEATHER SERVICE**

The National Weather Service (NWS) is responsible for preparing daily weather forecasts, severe weather watches and warnings, and flash flood watches and warnings that are broadcast over radio and television in Connecticut. Weather forecasting for Connecticut is divided between three different NWS offices. Each office covers part of the state.

The NWS office in Taunton, MA is responsible for the counties of Hartford, Tolland and Windham. Litchfield County is covered by the Albany NWS office, and the four southern counties of Fairfield, New Haven, Middlesex and New London are covered by the NWS office at Brookhaven, Long Island. These offices also provide the daily forecasts seen on the weather channel.

Also located in the same office as the NWS Forecast office in Taunton, MA, is the NWS Northeast River Forecast Center (NERFC). The NERFC is responsible for preparing river stage forecasts, headwater guidance, and flash flood guidance for a large portion of southern New England. The NERFC also issues flood warnings and river statements for all rivers in Connecticut. Among the rivers forecasted in Connecticut by the NERFC are the Connecticut, Farmington, Quinnipiac, and Park river basins

Coordination between the three NWS offices is handled by their AFOS (Automation of Field Operations and Services) computer network. The latest weather maps, ALERT rainfall data, and computer products from the National Meteorological Center in Washington D.C. are sent through the AFOS computer network to the NWS offices and River Forecast Centers all across the country.

Most precipitation and river readings as well as all weather watches, warnings, statements and forecasts are transmitted by AFOS from one NWS Office. ALERT rainfall and river data from Connecticut's flood warning system are automatically relayed to the NERFC via a micro-wave link.

Once received by the NERFC the AFOS computer relays the data to all NWS facilities in southern New England.

When printed forecasts, watches and warnings need to be broadcast in Connecticut, the forecast or warning message is read off the AFOS network by personnel at the State Office of Emergency Management (OEM) and typed onto the Connecticut On-Line Law Enforcement Teletype (COLLECT) system. Within 15 minutes, the COLLECT system relays the message to all 169 Towns within the state.

All forecasts, watches and warnings are also transmitted over the National Oceanic and Atmospheric Administration (NOAA) Weather Radio Network. This network uses the Weather Radio Specific Area Message Encoding System (WRSAME) and the Emergency Alerting System (EAS) to warn areas that are in the path of severe weather.

### **Routine Operations**

During routine operations, ALERT rainfall and river data are automatically transmitted to the NERFC and stored in their ALERT computer. Shortly after the top of each hour, these data are transmitted through AFOS to the rest of the NWS facilities in southern New England.

As mentioned earlier, each NWS office issues different messages to the general public. Each message, whether a flood statement or warning for specific gauges, issued by the NERFC, or a flash flood warning for generally ungauged streams issued by the WSOs is sent into AFOS. These forecasts, watches, and warnings are then relayed to the Office of Emergency Management in Hartford, and then they are sent to the towns via the COLLECT system.

This cycle takes from less than one hour to several hours depending on the type of watch, warning, or forecast that the National Weather Service is issuing and the time it takes to generate or update the forecast.

### **Emergency Operations**

In heavy rainfall situations, whether forecasted or not, the NERFC and WSFO will take the lead. Since flood watches are issued for the most part by the WSFO, coordination between offices must take place. In the most rapid of situations, NERFC will issue forecasts and warnings for ALERT river basins and coordinate with the DEP and OEM.

In many of these situations, the DEP will contact ALERT base stations and Emergency Operations Centers (EOCs) directly, and relay the latest warnings using it's high speed faxing service. This cuts the response time considerably. Personnel at the local EOCs have the ability to phone persons living in the floodplains and inform them of the latest river stage forecast. Individuals then begin moving their stock and contents listed in their Flood Audit Emergency Operations Plans out of basements and flood prone areas.

Towns with ALERT base station computers also have the capability to monitor rainfall and river levels in their own area. The computer base stations are equipped with antenna that receive the rainfall and river data at the same time it is transmitted to the NWS. This gives the local authorities the ability to respond quickly to the sudden rise of a local river, or locally heavy rains. The diagram included on the following pages shows how data start at the gaging stations and are sent to the NERFC ALERT base computer, and then sent from there to the other weather offices in southern New England. Each office will use the data for a different type of forecast.

NERFC will issue specific stage forecasts and warnings where necessary. These river forecasts will frequently contain forecasted rainfall for the next few hours. This provides users of the forecasts with a scenario. If for example, an additional inch of rain falls during the next hour, then the user can expect the river to rise to a certain stage. This If/Then scenario adds to the flood warning lead time.

All forecasts or warnings will be sent into AFOS and from AFOS to OEM. Once received by OEM, the warnings are sent into the COLLECT system. Within 15 minutes the towns receive their new forecasts.

### **High Speed Faxing Service**

In 1995 the DEP began using a new technology that allows detailed fax messages and maps to be sent to every town in Connecticut in as little as five minutes during emergencies. Faxes are computer generated and sent simultaneously to 340 locations statewide. Some of the locations re-transmit the faxes to more locations in their local areas. The total number of recipients is estimated at 1,000. Most of the fax locations are 911 centers, police and fire headquarters, civil preparedness offices, schools and state parks.

The faxes contain maps, and forecasts along with any watches or warnings issued by the NWS. If necessary, radar images and satellite pictures can also be faxed. This service is also used for routine operations to send out weekly tropical weather updates and storm reports.

## THE FLOOD AUDIT PROGRAM

The flood audit program was developed by the USDA Natural Resource Conservation Service (NRCS) and the Connecticut Department of Environmental Protection to help reduce flood damage to contents and nonstructural building components for buildings within the 100 year floodplain of selected rivers. This program is performed in conjunction with the installation of municipal ALERT flood warning and response systems.

The flood audit provides homeowners and small businesses with information on flood warning levels and the relationship of the flood levels to their structures. When a flood warning level is forecast for the area, the individual takes the actions listed in the flood audit for the corresponding level. The audit includes an individual action plan which will help owners react quickly and effectively to flood warning reports broadcast over the radio, television or both. Using this information, the individual can move furniture, appliances, etc., out of basements and other low areas. Flood audit data is also loaded into the local community's flood warning system computer database. The display includes an elevation graph for each structure in the flood-prone area. The structures are listed in order of height. Each bar on the graph represents a building. The bottom of the bar is the basement or lowest floor elevation, and the top of each bar is the elevation of the next floor, usually the first floor.

If the next floor is above 12 feet, the bar extends to the top of the graph, and has no top. The elevation at which water from the river will spill into the building through an opening, such as a door or window, is shown by an arrow pointing to a level on the bar. The names of owners and residents are listed in the same order (by structure height) as in the graph. Under the person's name is a phone number. With the computer display, municipal and state officials can quickly spot the lowest structures in flood-prone areas and notify audited homeowners and small businesses to begin taking actions to reduce flood damages.

Audits generally require one field day per structure and result in a package of information that property owners maintain and review annually. When a flooding event is imminent, home owners and businesses take the actions prescribed in the audits, including evacuation when flood heights are at a level that threatens lives and roads are flooded.

**APPENDIX D**  
**COST EFFECTIVENESS OF HAZARD MITIGATION PROJECTS**

**APPENDIX G**  
**TECHNICAL & FINANCIAL RESOURCES**



**APPENDIX I  
REFERENCES**

**I. Local Governing Body Adoption Resolution**

Whereas the \_\_\_\_\_ of \_\_\_\_\_ has participated as a member of the Southeastern Connecticut Council of Governments' Regional Hazard Mitigation Planning process;

Whereas the Regional Hazard Mitigation Steering Committee has overseen preparation of a recommended Southeastern Connecticut Regional Hazard Mitigation Plan and Community Annex for the \_\_\_\_\_ of \_\_\_\_\_.

Whereas the Regional Plan and Community Annex have been publicized and made available for review by the \_\_\_\_\_ 's residents, neighboring communities and the Connecticut Department of Environmental Protection;

Now, therefore be it resolved that:

The Southeastern Connecticut Regional Hazard Mitigation Plan and the Community Annex for the \_\_\_\_\_ of \_\_\_\_\_ is hereby adopted as an official plan of the \_\_\_\_\_ of \_\_\_\_\_.

The \_\_\_\_\_ is charged with supervising the implementation of the plan's recommendations within funding limitation as provided by the \_\_\_\_\_ or other sources.

The \_\_\_\_\_ shall annually monitor implementation of the plan and shall submit a written progress report to this governing body.

Passed this \_\_\_\_\_ day of \_\_\_\_\_, 2004.

Name: \_\_\_\_\_

