

## **HAZARD MITIGATION PLAN UPDATE ANNEX FOR THE TOWN OF LEDYARD**

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

**DECEMBER 2017**  
**ADOPTED**

**MMI #3570-09**



*Prepared for:*

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## TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
ACKNOWLEDGEMENTS.....	AK-1
1 INTRODUCTION.....	1
1.1 Purpose of Annex.....	1
1.2 Setting .....	1
1.3 Plan Development.....	1
1.4 Progress Monitoring .....	3
2 COMMUNITY PROFILE.....	1
2.1 Physical Setting .....	1
2.2 Land Use and Development Trends.....	1
2.3 Drainage Basins.....	3
2.4 Governmental Structure .....	4
2.5 Review of Existing Plans and Regulations.....	5
2.6 Critical Facilities, Sheltering Capacity, and Evacuation.....	8
3 INLAND FLOODING.....	1
3.1 Setting / Historic Record .....	1
3.2 Existing Capabilities.....	1
3.3 Vulnerabilities and Risk Assessment.....	3
3.4 Potential Mitigation Strategies and Actions .....	4
4 COASTAL FLOODING.....	1
4.1 Setting / Historic Record .....	1
4.2 Existing Capabilities.....	1
4.3 Vulnerabilities and Risk Assessment.....	2
4.4 Potential Mitigation Strategies and Actions .....	3
5 HURRICANES AND TROPICAL STORMS.....	1
5.1 Setting / Historic Record .....	1
5.2 Existing Capabilities.....	1
5.3 Vulnerabilities and Risk Assessment.....	2
5.4 Potential Mitigation Strategies and Actions .....	3

## TABLE OF CONTENTS (Continued)

<u>Section</u>		<u>Page</u>
6	SUMMER STORMS AND TORNADOES .....	1
6.1	Setting / Historic Record .....	1
6.2	Existing Capabilities.....	1
6.3	Vulnerabilities and Risk Assessment.....	1
6.4	Potential Mitigation Strategies and Actions .....	2
7	WINTER STORMS AND NOR'EASTERS.....	1
7.1	Setting / Historic Record .....	1
7.2	Existing Capabilities.....	1
7.3	Vulnerabilities and Risk Assessment.....	2
7.4	Potential Mitigation Strategies and Actions .....	2
8	EARTHQUAKES.....	1
8.1	Setting .....	1
8.2	Existing Capabilities.....	1
8.3	Vulnerabilities and Risk Assessment.....	1
8.4	Potential Mitigation Strategies and Actions .....	2
9	WILDFIRES .....	1
9.1	Setting / Historic Record .....	1
9.2	Existing Capabilities.....	1
9.3	Vulnerabilities and Risk Assessment.....	2
9.4	Potential Mitigation Strategies and Actions .....	2
10	DAM FAILURE .....	1
10.1	Setting / Historic Record .....	1
10.2	Existing Capabilities.....	1
10.3	Vulnerabilities and Risk Assessment.....	2
10.4	Potential Mitigation Strategies and Actions .....	3

## **TABLE OF CONTENTS (Continued)**

<u>Section</u>	<u>Page</u>
11 MITIGATION STRATEGIES AND ACTIONS.....	1
11.1 Status of Mitigation Strategies and Actions.....	1
11.2 Prioritization of Specific Actions .....	6

### **Tables**

Table 2-1: Critical Facilities.....	9
Table 10-1: Dams Registered with the DEEP in the Town of Ledyard.....	1
Table 11-1: Town of Ledyard STAPLEE Matrix for Prioritizing Actions.....	7

### **Figures**

Figure 3-1 FEMA Special Flood Hazard Areas .....	3-5
Figure 4-1 FEMA Hurricane Surge Zones .....	4-4
Figure 10-1 High and Significant Hazard Dams in the Town of Ledyard .....	10-4

### **Appendices**

Appendix A – Record of Local Adoption



## INTRODUCTION

### **1.1    Purpose of Annex**

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

The primary goal of this hazard mitigation plan annex is to identify risks to natural hazards and potential mitigation measures for such natural hazards in order to ***reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources.*** This includes the reduction of public and private damage costs. Limiting losses of and damage to life and property will also reduce the social, emotional, and economic disruption associated with a natural disaster. Ledyard, with an approved Mitigation Plan, may apply for assistance from FEMA directly as a subgrantee through the state of Connecticut under the various grant programs.

### **1.2    Setting**

Ledyard is a town of approximately 40 square miles that is situated in central New London County approximately seven miles southeast of the City of Norwich. The town is bordered by the Town of Preston to the north, the Town of North Stonington to the east, the United States Naval Submarine Base and the Town of Groton to the south, and the Thames River to the west. The most significant surface water bodies include the Thames River / Poquetanuck Cove which straddle the town's western boundary, Joe Clark Brook which discharges into Poquetanuck Cove, and Whitford Brook (including Whitford Pond) in the south and southeastern part of Ledyard. The three major transportation routes through town includes Route 12 which runs north-south along the Thames River on the western edge of town, Route 214 which transects the town across the center in an east-west orientation, and Route 117 which is oriented north-south and stretches from the Town of Preston to the north to the Town of Groton to the south.

### **1.3    Plan Development**

The 2012 HMP and its annexes were developed through a series of meetings and the completion of written questionnaires, personal interviews, and workshops as described in the Multi-Jurisdictional HMP update. The HMP was updated in 2017 through a similar suite of data collection meetings with municipal staff, information meetings with the public, and a public online survey. Since adoption of the 2012 HMP, the HMP has been available in local governmental offices and available to emergency personnel. Residents have been encouraged to contact the Planning Department or the Public Works Department with any concerns regarding emergency response or potential projects related to natural hazard damage.

Based on the existing plan, existing information, and hazards that have occurred since 2012, SCCOG determined that the following data collection program would be sufficient to collect data to update the Multi-Jurisdictional plan and each annex.

- ❑ The SCCOG issued a press release on November 4<sup>th</sup>, 2016 announcing two public information meetings on the multi-jurisdictional HMP update. This press release was published in the Norwich Bulletin and The Day, as well as in relevant local "Patch" news websites. This notice was also posted on the SCCOG Facebook page and website. The public information meetings were held on November 28 and December 1, 2016, at the Town of Groton Library and the SCCOG office, respectively.
- ❑ A survey soliciting public input was hosted at [www.surveymonkey.com/r/SCCOGHazard](http://www.surveymonkey.com/r/SCCOGHazard) from October 17, 2017 through March 17, 2017. Topics addressed by the survey included the types of natural hazards that concern participants, the assets, infrastructure, and government services they feel are most at risk, and the types of mitigation measures they support. The survey link was publicized along with the public meetings in The Day, The Norwich Bulletin, and local *Patch* websites, and at all public meetings.
- ❑ A data collection meeting was held with the Emergency Management director and the Mayor on December 12, 2016 to discuss the scope, process for updating the Plan, and to collect information. The meeting focused on reviewing each section of the existing hazard mitigation plan and annex, critical facilities, and various types of hazards that have affected Ledyard and that should be addressed in the update.
- ❑ The draft that is sent for State review will be posted on the Town of Ledyard's website (<http://www.ledyardct.org>) as well as the SCCOG website ([www.seccog.org](http://www.seccog.org)) for public review and comment. In addition, a hard copy will be made available in the SCCOG office in Norwich. A press release will announce the availability of the HMP for review. This will provide residents, business owners, and other stakeholders throughout the SCCOG region the opportunity to review and comment on a relatively complete draft with all annexes. Comments received from the public will be incorporated into the final draft where applicable following State and Federal comments.

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

## **1.4 Progress Monitoring**

Following adoption, the **Emergency Management Director** will administer this HMP with assistance from the **Planning Director** under the authority of the Town of Ledyard Town Council and Mayor. The Emergency Management Director will be the local coordinator of the HMP. The Planning Director will serve as the deputy local coordinator. The Emergency Management Director, with assistance from the Planning Director, will coordinate with responsible departments as listed in Table 11-1 and ensure that the recommendations of this HMP are considered or enacted. Refer to Section 1.8 of the Multi-Jurisdictional HMP for a description of how the local coordinator will perform progress monitoring. The majority of recommendations in this annex can be accomplished within or with only a slight increase in the operating budgets of the various departments. Projects that require capital improvements or additional funding will need to be approved by the Town Council.

The HMP will be on file in Town Hall at the Planning & Development Department, available to all departments, to assist in guiding growth decisions. See Section 2.5 for recommendations related to integrating the findings of this HMP into additional town planning documents. The HMP will also be posted to the Town Website. Ledyard will continue to encourage town residents to contact the Emergency Management Director and the Planning Director with concerns related to natural hazards or emergency response via the town's website.

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

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

## COMMUNITY PROFILE

### **1.5 Physical Setting**

Ledyard is located in the center of the SCCOG planning area. Elevations range from approximately 470 at the top of Ayer Hill in the northeast corner of town near the town line with North Stonington and Preston to sea level along the Thames River. The most densely populated areas of town include the Route 12 corridor in the southwest portion of town between the United States Naval Submarine base and the Allyn Point area, and along Route 117 between Route 214 and the Colonel Ledyard Highway. While a majority of outlying areas are rural, the town contains a number of suburban neighborhoods.

The short stretch of Route 2 in the northeastern corner of town near the Preston and North Stonington town lines is associated with the Mashantucket Pequot Tribal Nation and includes some land uses ancillary to the Foxwoods Resort and Casino development on the tribal lands.

Geology is important to the occurrence and relative effects of natural hazards such as earthquakes. Thus, it is important to understand the geologic setting and variation of bedrock and surficial formations in lands underlying Ledyard. Ledyard lies above ten bedrock formations which largely trend east-west. The formations are interrupted by several inactive faults. The formations branch to the south in the southeastern corner of town. The majority of the town (27%) is underlain by the Potter Hill Granite Formation. The Potter Hill Granite Formation consists of light to medium-grey or light pink to grey, tan weathering or spotted, fine-to medium grained well-foliated gneiss.

The town's surficial geologic formations include glacial till (approximately 74% of town) and stratified drift. Refer to the Multi-Jurisdictional HMP for a generalized view of surficial materials. Till contains an unsorted mixture of clay, silt, sand, gravel, and boulders deposited by glaciers as a ground moraine. Areas underlain by sand, sand and gravel, fines, alluvial sediment, or gravel include an extensive region mostly within the Mashantucket Pequot Tribal Nation (associated with Cedar Swamp); land surrounding tributaries to the Thames River such Joe Clark Brook, Billings Avery Brook, and Flat Brook; and other streams such as Williams Brook, Whitford Brook, Rose Hill Brook. The amount of stratified drift present is important as areas of stratified materials are generally coincident with floodplains. In Ledyard a substantial amount of the built landscape has been built on land defined as stratified drift. Furthermore, the amount of stratified drift also has bearing on the relative intensity of earthquakes and the likelihood of soil subsidence in areas of fill.

### **1.6 Land Use and Development Trends**

After being initially settled in 1653 as part of the New London colony, then part of the Town of Groton, Ledyard was incorporated in 1836. By the 1950s and 1960s, Ledyard was one of the fastest growing communities in Connecticut, attributable largely to the combination of national growth in population and the substantial increase in defense manufacturing jobs located in Groton and New London. Population and the number of homes grew in town as the cities of

Norwich, New London, and Groton grew in commercial and industrial scale. Although the town is characterized as a suburban community, Ledyard continues to retain a rural feel.

According to the 2006 land use data provided by UConn CLEAR, approximately 15% of town was developed (in contrast to the 23% figure provided in the POCD). That leaves approximately 80% of the town open for development. However, a portion of the hypothetically developable land includes land cover having steep slopes, water, wetlands, protected open space, and the like that prohibit this land from being developed for short or long-term.

SCCOG data on land use collected in 2011 indicates that approximately 32% of town land is developed, 16% has been dedicated to open space, and 43% remains hypothetically open to development. This reflects an increase in development in recent years. Some of this change may be due to differences in data collection and land use designation between the UConn CLEAR program and SCCOG.

The large presence of wetlands, ledge, and the lack of infrastructure limits density of development in different parts of town. According to the 2005 *Plan of Conservation and Development* (POCD), residents value the residential community feel of Ledyard and wish to remain unchanged. The POCD also discusses the town's Capital Improvement Program (CIP) which is prepared annually by the Mayor. The CIP for fiscal year 2014 called mostly for infrastructure maintenance and equipment upgrades, fitting the stated interest of residents in limited growth. Previous municipal developments, including combining emergency services into a single building in Ledyard Center, developing a Community Center, and expanding the Bill Library Building, have been completed.

The most significant areas of development in Ledyard include the Route 12 corridor from the town line with Groton to the Village of Gales Ferry, Ledyard Center, and the land near Foxwoods Resort and Casino (some of it located within the Mashantucket Pequot Tribal Nation) in the northeast corner of town. These areas include substantial commercial and industrial development with residential development mixed in.

The lack of sewer and/or water service in a few notable areas of town limits the intensity of the commercial and industrial development. Although the POCD states that maintaining the rural aspect of Ledyard is important to residents, it also states that the encouragement of economic growth and diversification and expansion of the nonresidential tax base is also desired. Thus, extension of sewer service to Ledyard Center is desired by the town to enable development of a more densely-developed town center with mixed-use projects. Even without sewers, the town expects the area to experience infill over time such as within the developable land behind (to the west of) Town Hall.

According to town officials, small-scale subdivisions of 10 to 12 acres with eight to ten housing units are commonly proposed or pending in town. These are largely scattered throughout town. The housing stock in Ledyard consists primarily of single family homes on larger building lots. According to the POCD, between 1996 and 2000, almost 96% of residential units authorized with building permits were single-family units. Nearly all new development in Ledyard over the

previous ten years since the last POCD included larger lot subdivisions or individual, large-lot single family homes.

Opportunities for commercial/industrial development outside the town center may be focused at the Baldwin Hill Industrial Park. Land preparation including blasting has begun at the park. Six lots have been approved for construction here.

It is likely that Ledyard will continue to be a largely suburban yet partially rural community in the future, with less intense industrial and commercial development than residential development and a large amount of undeveloped land remaining.

## **1.7 Drainage Basins**

As previously stated, the Thames River / Poquetanuck Cove, Joe Clark Brook, and Whitford Brook are the major water bodies in Ledyard. Their locations are described in Section 1.2. Aside from the Thames River, Joe Clark Brook, and Whitford Brook, there are approximately 16 named flowing watercourses and many unnamed small tributaries in Ledyard. Named streams include Billings Avery Brook, Great Brook, Haleys Brook, and Williams Brook. Significant impoundments include the Ledyard Reservoir, and Morgan Pond in south-central Ledyard on Great Brook and Long Pond and Lantern Hill Pond along the North Stonington town line just north of Lantern Hill Road in northeastern Ledyard.

There are a total of seven subregional watershed basins in Ledyard. The subregional basins are Great Brook, Haleys Brook, Poquetanuck Brook, Shewville Brook, Thames River, Whitford Brook, and Williams Brook. The Thames River subregional drainage basin dominates Ledyard covering approximately 25% of town, while Williams Brook, Great Brook, Shewville Brook, and Haleys Brook cover between 15.5% with Williams and Great Brook to approximately 11% coverage by Haleys Brook. Whitford Brook, the smallest subregional drainage basin in Ledyard covers almost 7% of town.

The extreme northwest corner of Ledyard drains to the Poquetanuck Brook subregional drainage basin and the extreme northeast corner drains to the Shewville Brook drainage basin, while the Thames River drainage basin extends from below the Poquetanuck Brook basin to the southwestern corner of town and the Whitford Brook basin stretches from below the Shewville Brook basin in the northeast corner along the eastern town line to the southeast corner. The Williams Book basin is situated in the east-central section of town while the Great Brook and Haleys Brook basins cover the south-central portion of town to the town line with Groton.

The two dams with the most significant classifications are the Long Pond Dam (Class C) and the Morgan Pond Dam (Class B). In addition to these two dams, according to the "Connecticut Dams" data file published in 1996, additional dams in town include ten unclassified, nine Class A dams, and four Class BB dams. Ten dams, the most in any drainage basin in town, are within the Thames River subregional basin in the western portion of Ledyard. The ten include four unclassified dams, four Class A dams, and two Class BB dams. Section 10.0 provides more information about dams.

## **1.8 Governmental Structure**

Ledyard is governed by a Mayor-Council form of government. The authority of town officials is granted by Connecticut General Statutes. The Mayor is the full-time Administrator and Chief Executive elected to a four year term. The nine-member Council and nine-member Board of Education are elected for two year terms in accordance with state statutes.

The Town of Ledyard has boards and commissions that can take an active role in hazard mitigation, including the Inland Wetlands and Watercourses Commission, the Planning and Zoning Commission (formerly two separate commissions combining in October 2012), the Zoning Board of Appeals, the Economic Development Commission, and the Conservation Commission. Departments and commissions common to all municipalities in SCCOG are described in Section 2.8 of the Multi-Jurisdictional HMP. More specific information for the departments and commissions of the Town of Ledyard is noted below:

- The Building Official reviews plans for new development and inspects the work to ensure it meets current building codes.
- The Ledyard Fire Company and the Gales Ferry Volunteer Fire Company provides fire suppression, fire prevention, rescue, and hazardous materials response services to the town. The Mashantucket Fire Department serves the Mashantucket Pequot Tribal Nation (MPTN) land in the northeast corner of Ledyard. More information on their services can be found in the MPTN update annex of the SCCOG HMP.
- The Emergency Management Department in Ledyard is charged with ensuring that Ledyard Emergency Services are ready to respond in times of emergency to assist and restore services to normal as soon as possible following emergency conditions. The Department is staffed by volunteers and key town department heads. Personnel are involved in the development of emergency plans and the operation of the EOC.
- The Inland Wetlands and Watercourses Commission is the Inland Wetlands Regulatory Agency for the Town of Ledyard and reviews plans for compliance with said regulations and maintains the town's inland wetlands map.
- The Town recently approved combining the Planning and Zoning Commissions. This took effect in October 2012. The Planning & Zoning Commission is now responsible for reviewing and approving subdivision plans and the capital improvement program, updating and overseeing the implementation of the *Plan of Conservation and Development*, and reviewing commercial, governmental, institutional, non-profit, and residential developments for compliance with local and state land-use regulations. These duties are performed with the assistance of the Department of Planning & Development along with the Zoning Department. The Planning & Zoning Commission encourages mutually beneficial development with the Mashantucket Pequot Tribal Nation.
- The Zoning Board of Appeals considers requests from property owners who wish to use their property in a manner prohibited by the Zoning regulations.

- The Economic Development Commission is responsible for expanding the tax base of Ledyard and for advocating, facilitating, promoting, and advising on economic development issues within the town.
- The Conservation Commission is an advisory body for the matters of development, conservation, supervision, and regulation of natural resources. Resources include water, within the territorial limits of Ledyard.
- Since the previous edition of the HMP in 2012, the Town has established a Public Safety Commission that regularly meets to discuss emergency management decisions. This Commission includes members of a number of different Town departments.

These town departments enable Ledyard to be technically, financially, and legally capable of implementing mitigation projects for natural hazards to the extent that funding is available.

## **1.9 Review of Existing Plans and Regulations**

Ledyard has different plans and regulations that suggest or create policies related to natural hazard mitigation. These policies and regulations are outlined in the *Emergency Operations Plan* (2006), *Plan of Conservation and Development* (Rev. 2005), Zoning Regulations, Subdivision Regulations, and Inland Wetlands and Watercourses Regulations. The Zoning Regulations incorporate the NFIP requirements.

### Emergency Operations Plan

The town has an Emergency Operations Plan (EOP) that provides general procedures to be instituted by the Mayor, or anyone legally administering as the Chief Executive Officer, to manage large-scale emergency situations, mobilize resources, and order large-scale evacuations.

The Emergency Management Director serves as staff assistant to the Chief Executive Officer and is responsible for:

- organization and management of the Emergency Operations Center (EOC)
- establishment of communications facilities in the EOC
- coordination between departments
- coordination of all emergency activities
- collection, analysis, and reporting of information

Emergencies can include but are not limited to natural hazard events such as hurricanes and nor'easters. The EOP is directly related to providing emergency services prior to, during, and following a natural hazard event.

The EOP is reviewed and submitted by the Emergency Management Director, and certified by the Mayor, annually. Updates are made as needed during the review process, with the previously most recent notable updates occurring in 2013. The EOP was more thoroughly revised for January 1<sup>st</sup>, 2017, in order to meet new State requirements for local EOP templates.

## Plan of Conservation and Development (Rev. 2005)

The *Plan of Conservation and Development* (POCD) was adopted in 2004 and had its last revision in 2005. The POCD was developed through contributions from local boards and commissions, citizens, and citizen groups. The POCD is a guiding framework for the future conservation and development of the community and is an important tool in the land use decision making process of the town.

The POCD includes the following statements relevant to hazard mitigation:

- Existing subdivision regulations target open space acquisition of areas possessing flood hazard areas
- Higher density development is proposed where water/sewer is available
- Community sewer and/or water systems should be promoted for existing larger residential developments
- IWWC regulations should be amended to include 25 foot minimum setback from wetlands for developments
- Ledyard should expand its water supply system, and tie in existing systems through interconnections
- Whenever resurfacing of local street or road is planned, plans should include Stormwater runoff controls capable of reducing serious pollution and erosion control problems
- Town goal is to preserve more open space
- Town should establish educational municipal property management program encouraging forest stewardship and long term conservation objectives for town owned land

With respect to flood hazard areas, the POCD recognizes that existing Subdivision Regulations specifically target open space set-asides for these areas. Section VI, entitled "Development and Land Use Management", and Part G "Land Use Regulations" briefly cover the town's Zoning Regulations, mentioning that, among other things, the Regulations address proposed development and changes to wetlands and 100-year flood zones. The POCD additionally states that the town should prepare to budget for renovation and upgrade of the existing municipal properties, rather than plan for new construction.

Ledyard has actively revised and updated its POCD since it was adopted, with a formal amendment in 2010. Information from the first iteration of the HMP has already been incorporated into recommended revisions and additions. The Ledyard POCD is considered somewhat consistent with the current goals and actions of the hazard mitigation plan. It does not directly address several of the hazards such as winter storm hazards, earthquake hazards, and wind hazards. The next update to the POCD (during the life of the current hazard mitigation plan) should incorporate more elements of the hazard mitigation plan. Future updates of the POCD will incorporate information from this and future updates of the HMP.

## Zoning Regulations (Revised to 2016)

The most recent edition of Ledyard's Zoning regulations were made effective October 18, 2012, and have been revised to August 8, 2016.

Updates include NFIP regulations associated with the release of the FIS and DFIRM for New London County in July, 2011, though the language notes that subsequent updates (such as that of August 2013, not explicitly mentioned) are adopted by reference.

Regulations regarding floodplain management are found in Section 12.3 of the Zoning Regulations. These regulations are applied during the permitting process for new construction and during substantial improvement of existing structures. Ledyard's Zoning Regulations define substantial improvement cumulatively over a one-year period. Ledyard does not require any freeboard.

## Subdivision Regulations (Amended 2013)

Hazard prevention includes identification of risks and the use of land-use regulatory and other available management tools to prevent future damage. Section 5.3 of the Subdivision Regulations addresses stormwater requirements maintaining that systems must be designed in accordance with the Drainage Ordinance.

The Subdivision Regulations specify that sixty-percent of new developments over two lots must be set aside as open space. A recent development at 800 Long Cove Road created a large amount of open space.

## Ordinance Amending an Ordinance Regulating the Addition of Any New Street or Highway to the Highway System of the Town of Ledyard (1988)

The Road Ordinance (a.k.a. Ordinance #45) was adopted on December 14, 1988. The ordinance has language throughout which references drainage design and its place in the town's regulatory process. For instance, Part II discusses the application process for acceptance of a proposed street as a public street and speaks to the town's involvement in the process, including in respect to drainage system design.

## Ordinance Regulating the Management of Stormwater Runoff (1995)

The Drainage Ordinance (a.k.a. Ordinance #44) regulates the management of stormwater runoff and was adopted on February 22, 1995. The ordinance requires adherence to the Connecticut Guidelines for Soil Erosion and Sediment Control. The ordinance requires a zero percent increase in discharge characteristics in certain cases where existing downstream land use or property is shown to be subject to flooding.

## Inland Wetland and Watercourses Regulations (2017)

The most recent Inland Wetlands and Watercourses Regulations in the Ledyard were made effective on April 5, 2017. The Regulations define "regulated activities" as being any operation within or use of a wetland or watercourse involving removal or deposition of material, or any obstruction, alteration or pollution of such wetlands or watercourses, not including activities in Section 22a-40 of the Connecticut General Statutes (CGS). Additionally, the town regulates additional activities within 100 feet from any wetland or watercourse boundary. These regulations build on the preventative flood mitigation provided in the CGS.

### **1.10 Critical Facilities, Sheltering Capacity, and Evacuation**

Ledyard considers several facilities to be critical to ensure that emergencies are addressed while day-to-day management of the town continues. Critical facilities are presented on figures throughout this annex and summarized in Table 2-1. No critical facilities are located within a Special Flood Hazard Area (SFHA). These facilities are described in more detail below.

#### Town of Ledyard Police Department

At the time the previous HMP was adopted, the Town of Ledyard Police Department (LPD) was administered by a Resident State Trooper. On January 1, 2016, the Town began operating its own independent police department. The LPD is located in a building next to the Town Hall. The building serves as a backup Emergency Operations Center (EOC) and has a new emergency power generator.

The Ledyard Police Department's mission is to provide service and protection to its citizens and visitors by maintaining a highly trained force consisting of Patrol and Detective divisions in addition to the assistance from its Emergency Telecommunications and Animal Control Divisions.

The Police Chief functions as the department head and is responsible for the Department's operations. The Department's Executive Officer provides direct supervision to the Patrol, Detective, Emergency Telecommunications, and Animal Control Divisions. The Police Department maintains a generator. The Police Department maintains use of both Facebook and Twitter social platforms to get information to residents as fast as possible.

#### Town Hall and Annex

The Town Hall and Annex, which are located on the same property and house many of the municipal departments, are considered a critical facility. A generator at this location can provide emergency power supply for the Town's backup dispatch equipment, but cannot provide power to either building. Minor upgrades have been made to these buildings since the previous HMP.

**Table 2-1: Critical Facilities**

Facility	Address or Location	Emergency Power?	Shelter?	In SFHA?
<b><i>Emergency Services</i></b>				
Police Department**	737 Colonel Ledyard Highway	✓		
Ledyard Fire Company	11 Fairway Drive	✓		
Gales Ferry Volunteer Fire Company	1772 Route 12	✓		
<b><i>Municipal</i></b>				
Town Hall and Annex	741 Colonel Ledyard Highway			
Public Works Garage	889 Colonel Ledyard Highway	✓		
High School*	24 Gallup Hill Road		✓	
Middle School	1860 Route 12		✓	
Highlands Wastewater Treatment Facility	80 Town Farm Road	✓		

\*Emergency Operations Center (EOC)

\*\* Backup EOC

### Public Works Garage

The Public Works Garage houses equipment to maintain the town's infrastructure and transfer municipal and bulky wastes for residents and property owners. The Department works to help ensure public and environmental health and safety. Since the previous edition of the HMP in 2012, the Public Works Garage fuel tanks have been replaced with new, above-ground tanks.

### Ledyard Fire Company

The Ledyard Fire Company was established in 1951. The Fire Company provides fire, rescue, emergency medical services, and hazardous material response to the residents of Ledyard and surrounding towns on a mutual aid basis. The company most recently moved from its old headquarters next to Town Hall to its new facility on Fairway Drive where the Ledyard Fire Marshall's Office is also located. The Company is comprised of 24 firefighters and nine members of the Fire Police. The Company has three fire engines in addition to three rescue and support vehicles, equaling six trucks in total.

### Gales Ferry Volunteer Fire Company

The Gales Ferry Volunteer Fire Company was organized in 1942 to safeguard the residents and property of the Village of Gales Ferry and the Town of Ledyard. The Company includes a ladder truck with a 65' ladder and a 500 gallon water tank, a rescue-pumper with a 750 gallon poly water tank, a tanker truck equipped with a 3,000 gallon poly water tank and a 3,000 gallon portable water supply tank, a rescue truck, a forestry truck, and a 20 foot "special operations" service trailer.

## Shelters and Emergency Operations Center

The High School is the town's primary shelter and the EOC. In case of an emergency, the High School Gymnasium is planned to be used as the town's central evacuation point for severe weather problems. The High School shelter is certified by the American Red Cross.

The Ledyard Middle School is the secondary shelter and, when needed, a regional shelter in Groton or Norwich may be used depending on the weather issues. The Middle School is currently undergoing major renovations that will include a large addition to increase the capacity of the school building. Upon completion, an emergency generator will be installed, and the Town will pursue American Red Cross certification of the building as a shelter.

## Highlands Wastewater Treatment Facility

The Wastewater Treatment Facility (WWTF) is undergoing a major upgrade to modernize the facility's equipment. A solar panel array is being installed.

## Communications

The town is registered to the CT Alert "Everbridge" Emergency Notification System for Reverse 9-1-1. The town has a link which is listed on the Gales Ferry Volunteer Fire Company web site and the town web site. Sign-ups have been advertised through the Police Department's social media tools.

Internal emergency communications are performed over radio. The Town has upgraded its radio towers to utilize microwave bandwidths. This has increased the reliability of their radio communications.

## Evacuation Routes

The three major transportation routes through town includes Route 12 which runs north-south along the Thames River on the western edge of town, Route 214 which transects the town across the center in an east-west orientation, and Route 117 which is oriented north-south and stretches from the Town of Preston to the north to the Town of Groton to the south.

Annex E of Ledyard's EOP describes the town's evacuation plans. Section V, Part A entitled "Administration" states that the Evacuation Coordinator is responsible for maintaining up-to-date evacuation route maps which depict designated primary and alternate evacuation routes. In addition, the Ledyard Emergency Management web site's "Contents" page includes explanations of the town's evacuation procedures for those buildings one mile from the Allyn's Point Complex. The Complex is currently occupied by the Dow Chemical Company and could be a large source of contamination of the area if equipment were to malfunction.

## INLAND FLOODING

### **1.11 Setting / Historic Record**

Flooding is the primary hazard that impacts the town each year as documented in the previous HMP. While riverine flooding is of primary concern, nuisance flooding and poor drainage are also issues at different locations in the town. Flooding is typically caused by heavy rainstorms, but can also be caused by relatively light rains falling on frozen ground. Flooding of roadways is more common than damage to structures.

The March 2010 storms continue to be considered the event that caused the most widespread flooding in Ledyard since the town began participating in the multi-jurisdiction hazard mitigation plan. These flood events caused roadway flooding and a significant amount of nuisance flooding as noted below. Structures in one area were directly affected by overbank flooding.

- At the Ledyard and North Stonington town line, Lantern Hill Road at the Lantern Hill Brook crossing was washed out during the March 2010 heavy rains and flooding. Both towns and the Mashantucket Pequot Tribal nation are collectively working to resolve the issue at this crossing.
- Other sections of Lantern Hill Road are also considered at high risk of flooding. This includes the area near Homestead Road, Bush Pond, and Whitford Brook.
- Where Flat Brook crosses under Baldwin Hill Road, the watercourse flows under a non-residential building which has had historical issues becoming inundated.
- Lambtown Road Extension crosses through a wetland and the road forms a "dam" of Lamb Brook near Haleys Brook. This situation, along with beaver activity in the area has brought about flooding and a scouring of a 300-foot stretch of the road.
- The Shewville Road Bridge at the Shewville Brook/Indiantown Brook crossing is in need of replacement as it has been historically associated with flooding. Replacement of this bridge is in the final stages of State approval and will be undertaken as soon as approvals are granted and funding is finalized.
- The Williams Brook Bridge at Town Farm Road has experienced inundation during significant storms. This bridge should be considered to be elevated and/or replaced.

### **1.12 Existing Capabilities**

The town attempts to mitigate inland flood damage and flood hazards by utilizing a wide range of measures including restricting activities in floodprone areas, replacing bridges and culverts, promoting flood insurance, maintaining drainage systems, through education and outreach, and by utilizing warning systems. Town staff are prepared to offer technical assistance regarding flood proofing measures to owners of non-residential structures that suffer flood damage, should they be interested. Many mitigation measures are common to all hazards and therefore

were listed in Section 2.6. No structural flood control projects are located within or upstream of Ledyard, although the existing dams provide a small amount of flood mitigation.

### Bridge Replacements, Drainage, and Maintenance

The Public Works Department cleans and inspects catch basins and culverts at least annually or more often if problems are noted. When flooding occurs, typically either the Mayor's Office, the Public Works Department, or either Fire Department handles complaints from residents. All are involved in some capacity in these cases. For example, the Mayor's Office may field calls regarding a flooded roadway while the Public Works Department inspects culverts, catch basins, problematic roadways and bridges and erects barricades to close roads, and the Fire Department responds to calls requesting help for pumping flooded basements. Drainage complaints are directed to the Public Works Department.

The Town has completed several minor projects since the last HMP to alleviate flooding problems caused by poor drainage. Improvements were made to the stream crossing of Shewville Road at Wiffle Brook, which is a tributary to Williams Brook. Local officials completed work with North Stonington and the Mashantucket Pequot Tribal Nation to resolve flooding issues on Lantern Hill Road at the Lantern Hill Brook crossing. The Town also worked with the Mashantucket Pequot Tribal Nation to replace, in 2016, the bridge at Shewville Road over Shewville Brook which was damaged during the March 2010 floods. The Town redirected the watercourse of Flat Brook at Baldwin Hill Road to reduce flooding.

The Town is working on an additional improvement to Lantern Hill Road, near Homestead Road, in the form of increasing the size of the culvert and improving the bridge structure over Whitford Brook. That project is expected to be completed by the end of 2017. The Town is also pursuing funding to replace and increase the capacity of the Town Farm Road Bridge over Williams Brook.

### Regulations, Codes, and Ordinances

Ledyard has planning and zoning tools in place that incorporate floodplain management. The town also has subdivision regulations and a drainage and road ordinance that require adequate drainage be provided to reduce exposure to flood hazards. Retention ponds are required at new developments. Regulations covering development in and/or near inland wetland areas and watercourses also exist within the town's Inland Wetlands and Watercourses Regulations.

### Acquisitions, Elevations, and Property Protection

Approximately 289 acres of old farmland along Haley Brook, on the Groton-Ledyard border, were acquired by the Groton Open Space Association in December of 2013. The site is called Avery Farm. Lambtown Road Extension, which required upgrades at the crossings with Lamb and Haleys Brooks, has been permanently closed to traffic as part of that acquisition. This removes any risk associated with the inundation or failure of this road.

## Flood Watches and Warnings

The Mayor and both Fire Companies access weather reports through the National Weather Service and local media. The town participates in the CT Alerts "Everbridge" Emergency Alerting and Notification Reverse 9-1-1 System and encourages residents to join through its web sites and social media. The town is encouraged to post the link for residents to join the system on the Emergency Management and Ledyard Fire Company web sites. Effective utilization of this service allows the town the ability to receive geographically specific weather warnings when storms are imminent. This service provides Ledyard with the ability to telephone warnings into specific areas, prior to or during natural hazard events.

The Town has interactive maps online that depict SFHAs and are accessible to the public.

### Summary

In general, municipal capabilities to mitigate flood damage have increased slightly since the 2012 edition of the hazard mitigation plan was adopted. This is because the Town has continued to make investments in staffing, public works projects, and open space acquisition.

## **1.13 Vulnerabilities and Risk Assessment**

This section discusses specific areas at risk to inland flooding within Ledyard. Inland flooding due to nuisance flooding or poor drainage is most common type of flooding experienced by the town, although roadway inundation also occurs during more severe events.

### **1.13.1 Vulnerability Analysis of Areas along Watercourses**

Stretches of Thames River, Flat Brook, Pine Swamp Brook, Clark Cove, Tom Allyn Brook, Billings Avery Brook, Joe Clark Brook, Shewville Brook, and Williams Brook are designated as SFHAs defined by FEMA. These areas are designated as AE flood zones, indicating that flood elevations are available. Additionally, a large stretch of Great Brook that includes Morgan Pond and the Ledyard Reservoir, Haleys Brook, Billings Avery Brook, Joe Clark Brook, Rose Hill Brook, Shewville Brook, Indiantown Brook, Whitford Brook, and a few others are mapped Zone A floodplains. These areas lack flood elevations. As previously discussed, there are a few areas of town where flooding is hazardous to travelers or roadways. Those areas are discussed in Section 3.1. Refer to Figure 3-1 for the location of SFHAs within Ledyard.

Additionally discussed previously, the three major transportation routes through town includes Route 12 which runs north-south along the Thames River on the western edge of town, Route 214 which transects the town across the center in an east-west orientation, and Route 117 which is oriented north-south and stretches from the Town of Preston to the north to the Town of Groton to the south. The DFIRM mapping suggests that all the routes can be affected by extreme flooding. Routes 12 and 214 are crossed at multiple locations by SFHAs, while Route 117 is crossed at only one location by a 0.2 percent annual chance flood hazard zone as defined by FEMA.

### **1.13.2 Vulnerability Analysis of Private Properties**

As noted in Table 3-4 of the Multi-Jurisdictional HMP, a total of 115 structures in Ledyard appear to be located in an SFHA floodplain. The majority of structures are located in the Gales Ferry section of Ledyard with the majority of structures being residential while less are classified as commercial or industrial. Seventy-one structures appear to be located within the Zone A floodplain (the SFHA floodplain without flood elevations defined), while the remaining 44 appear to be located either within Zone AE or the floodway in Zone AE. Town personnel indicate that structures typically do not get damaged by riverine or overbank flooding.

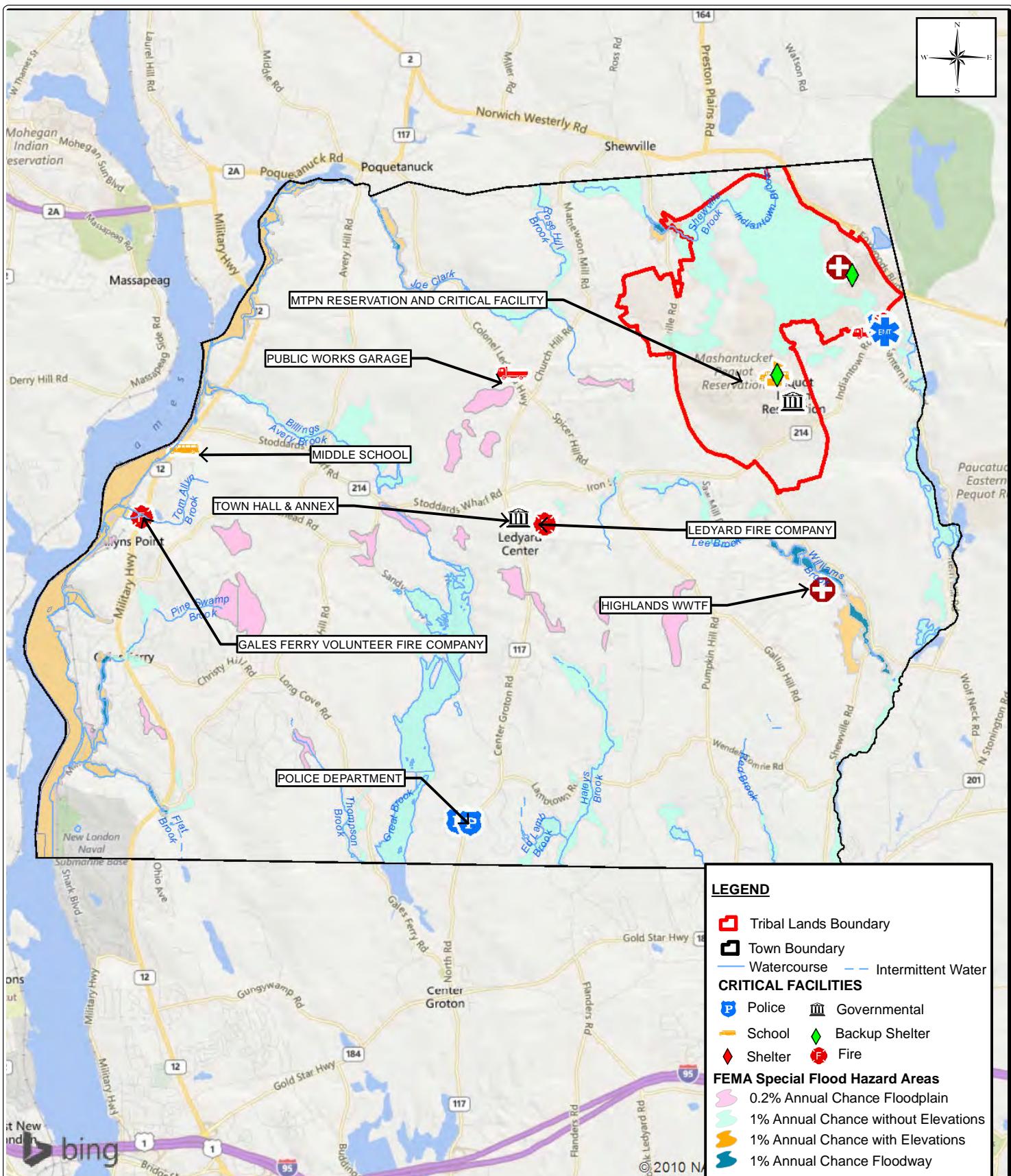
Three repetitive loss properties are listed in Table 3-5 of the Multi-Jurisdictional HMP. Such properties are those which have received two or more claim payments of more than \$1,000 from the NFIP with any rolling 10-year period for the home or business. Two of the repetitive loss properties are located across a roadway from a small impoundment but are not located below the base flood elevation, as they are situated on the high points of the lots. These homes may experience drainage-related or basement flooding. The third repetitive loss property is associated with the Whitford Brook watershed, but is not located near the brook. This home might also experience poor drainage or basement flooding.

### **1.13.3 Vulnerability Analysis of Critical Facilities**

As noted in Section 2.6, none of Ledyard's critical facilities are located within an SFHA flood zone. With respect to critical facilities, there are no serious concerns to the town facilities in conjunction with flooding.

## **1.14 Potential Mitigation Strategies and Actions**

Potential mitigation measures for reducing or eliminating the impact of inland flooding fall into the categories of prevention, property protection, emergency services, public education and awareness, natural resource protection, and structural projects. General potential mitigation measures that can be taken to reduce the effects of inland flooding were discussed in Section 3.7 and in Section 11.2.2 of the Multi-Jurisdictional HMP. General recommendations pertinent to all natural hazards that could affect the town are listed in Section 11 of this annex, as are specific measures pertinent to reducing inland flooding in the Ledyard.

**LEGEND**

- |  |                                     |
|--|-------------------------------------|
| <span style="color:red;">■</span>        | Tribal Lands Boundary               |
| <span style="color:black;">■</span>      | Town Boundary                       |
| <span style="color:blue;">—</span>       | Watercourse                         |
| <span style="color:blue;">—</span>       | Intermittent Water                  |
| <b>CRITICAL FACILITIES</b>               |                                     |
| <span style="color:blue;">P</span>       | Police                              |
| <span style="color:blue;">G</span>       | Governmental                        |
| <span style="color:orange;">S</span>     | School                              |
| <span style="color:green;">BS</span>     | Backup Shelter                      |
| <span style="color:red;">S</span>        | Shelter                             |
| <span style="color:red;">F</span>        | Fire                                |
| <b>FEMA Special Flood Hazard Areas</b>   |                                     |
| <span style="color:pink;">■</span>       | 0.2% Annual Chance Floodplain       |
| <span style="color:lightgreen;">■</span> | 1% Annual Chance without Elevations |
| <span style="color:orange;">■</span>     | 1% Annual Chance with Elevations    |
| <span style="color:blue;">■</span>       | 1% Annual Chance Floodway           |

**FEMA SPECIAL FLOOD HAZARD AREAS****SCCOG HAZARD MITIGATION UPDATE  
TOWN OF LEDYARD ANNEX**

LEDYARD, CONNECTICUT

SOURCE: NATIONAL FLOOD HAZARD LAYER, FEMA, 2017

DATE: JULY 26, 2017		
SCALE: 1"=6,000'		
PROJ. NO.: 3570-09		
DESIGNED SB	DRAWN PS	CHECKED DM
DRAWING NAME:		

**FIG. 3-1**

## COASTAL FLOODING

### **1.15 Setting / Historic Record**

Despite being located inland from the Connecticut shoreline, Ledyard has coastal resource areas that are tidally influenced along the Thames River. The shoreline of Ledyard contains a combination of undeveloped and developed storefront with estuarine embayments at Long Cove, Mill Cove, and elsewhere. The coastal resources found in Connecticut and described by DEEP are listed in the Multi-Jurisdictional HMP.

Homes, businesses, and industry are located in close proximity to the storefront along the coastal area. However, the Town's inland location places many properties at higher elevations than typical coastal low-lying areas adjacent to Long Island Sound. As such, the town does not typically experience coastal flooding. While coastal flooding is relatively infrequent, hurricanes and tropical storms have the potential to induce coastal flooding and storm surge that can impact structures.

The last major hurricane or tropical storm wind event to affect the Town was Hurricane Sandy in October 2012. Sandy brought high winds and coastal flooding to the entire Connecticut coastline; however no significant coastal flooding occurred within Ledyard along the tidal Thames River. The town may be concerned with the potential long-term effects of sea level rise and its potential to exacerbate coastal flooding conditions in the future.

### **1.16 Existing Capabilities**

The town primarily attempts to mitigate coastal flood damage and flood hazards by controlling and restricting activities in floodprone areas and the coastal management area, maintaining hard structures in good condition, and providing signage and warning systems. Many of the Existing Capabilities utilized in the town for inland flood mitigation (Section 3.2) are also applicable to coastal flood mitigation, and additional programs were listed in Section 2.5.

The shoreline of Ledyard contains many flood and erosion control structures. Private bulkheads can be found in many of the residentially, commercially and industrially developed coastal neighborhoods. The Riverside Place neighborhood is a good example of residential properties with shoreline protection structures. The shorelines of the Dow Chemical site and the Navy Base are developed with riprap and bulkheads. The railroad line parallel to Route 12 forms an embankment along parts of the Thames shoreline. In particular, the railroad embankment separates Mill Cove and Clark Cove from the Thames River.

As noted in Section 3.2 and Section 2.5, the town utilizes the 1% annual chance floodplains delineated by FEMA. These consist of the 1% annual chance floodplain with elevations (Zone AE) including floodway areas. As noted by the Zoning Regulations, building activities in the floodplain are restricted and new construction or substantial redevelopment must prove that the lowest horizontal member of the new construction will be above the base flood elevation. In addition, the town requires the submission of a coastal site plan for any project located within the coastal area management boundary.

Like many communities, the Town lacks existing policies and mitigation measures that are specifically designed to address sea level rise. The Town participated in a resiliency planning initiative with SCCOG and TNC in 2016-2017<sup>1</sup>. However, the Town has not yet embarked on detailed coastal hazard planning to the degree that nearby communities like Waterford and the Town of Groton have done. Although the Town of Ledyard does not currently have a specific plan to address sea level rise, important pieces are in place in the form of the codes and regulations cited in this HMP that have been enacted to minimize storm, erosion, and flood damage to structures.

### Summary

In general, municipal capabilities to mitigate coastal flood damage have remained flat since the 2012 edition of the hazard mitigation plan was adopted. This is likely because the coastal flood risks are minimal along the tidal portion of the Thames River. However, the Town must continue to monitor changes occurring along the Thames River and plan accordingly.

## **1.17 Vulnerabilities and Risk Assessment**

This section discusses specific areas at risk to coastal flooding within the town. This flooding can be the result of astronomical high tides, hurricanes, nor'easters, or storm surge. Historic record coastal flooding typically only occurs due to storm surge. Refer to Figure 4-1 for a depiction of areas susceptible to storm surge.

Note that *HAZUS-MH*, FEMA's hazard loss estimation software, was utilized to calculate the potential damages to the Town of Ledyard from a combined 1% annual chance riverine and coastal flood. Results were presented in Section 3.5.2 of the Multi-Jurisdictional HMP.

### **1.17.1 Vulnerability Analysis of Areas along Coastal Waters**

The area potentially flooded by storm surge is not as extensive as the 1% annual chance floodplain. In general, the coastal area affected by storm surge is limited to areas immediately adjacent to the Thames River. The area of Mill Cove off of the Thames has been pointed to by Town personnel as somewhat vulnerable to tidal flooding, but waters must rise eight to ten feet above normal high tide before it will affect the road there.

In general, it is assumed that as sea level rises, the frequency and magnitude of coastal flooding in the town will increase, with structures and roadways closest to existing sea level being affected more quickly.

Coastal erosion is generally not an issue in the Town of Ledyard since much of the shoreline is either fully developed (particularly along the Navy Base and Dow industrial area) or characterized by high bedrock. However, as sea level rises, the effectiveness of these structures

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<sup>1</sup> <https://tnc.app.box.com/s/8nne60yjk2g3m1mgzkfa86rndxyjiawf>

could be undermined such that erosion will be able to occur landward of riprap, bulkheads, and embankments, thus necessitating expansion of the structures.

#### **1.17.2 Vulnerability Analysis of Private Properties**

The coastal areas of the Town of Ledyard have properties that are inhabited year-round. This intensifies risk to life and property in coastal areas. Waterfront properties are very susceptible to damage from storm surge although FEMA has not established any coastal velocity zones in Ledyard.

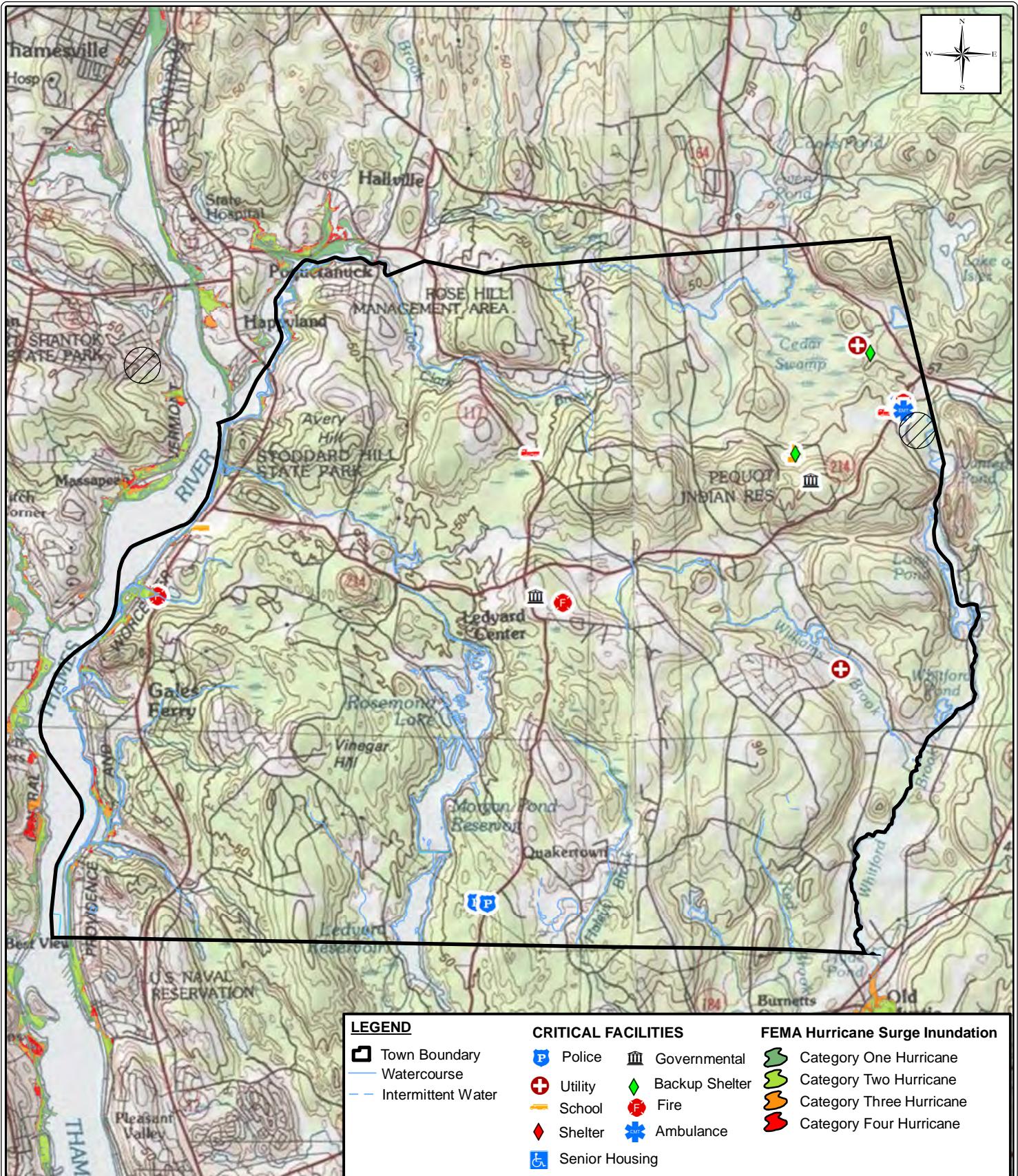
Buildings located in flood hazard areas are primarily commercial or industrial but also include some residential and critical facility structures as noted in Section 4.3.1. Most of the structures that are threatened by flooding are also located within the 1% annual chance floodplain.

#### **1.17.3 Vulnerability Analysis of Critical Facilities**

As shown on Figure 4-1, critical facilities are not located within potential storm surge areas.

### **1.18 Potential Mitigation Strategies and Actions**

General potential mitigation measures that can be taken to reduce the effects of coastal flooding were discussed in Section 4.7 and in Section 11.2.2 of the Multi-Jurisdictional HMP. General recommendations pertinent to all natural hazards that could affect the Town are listed in Section 2.8 of this annex. General and specific measures pertinent to reducing coastal flooding in the town are listed below under the categories of prevention and structural projects. No additional recommendations beyond those listed in Section 2.8 were applicable for property protection, emergency services, public education and awareness, or natural resource protection at this time.



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## POTENTIAL HURRICANE STORM SURGE

### SCCOG HAZARD MITIGATION UPDATE TOWN OF LEDYARD ANNEX

LEDYARD, CONNECTICUT

SOURCE: HURRICANE SURGE INUNDATION LAYER; CTDEEP, 2012

DATE: JULY 26, 2017
SCALE: 1"=6,000'
PROJ. NO.: 3570-09
DESIGNED <input type="checkbox"/> DRAWN <input type="checkbox"/> CHECKED <input type="checkbox"/>
SB PS DM
DRAWING NAME:

**FIG. 4-1**

## HURRICANES AND TROPICAL STORMS

### 1.19 Setting / Historic Record

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

Tropical Storm Irene impacted the region August 2011. Branches and entire trees fell throughout the town and the region causing power outages that lasted at least seven days and, in some cases, as many as nine days in Ledyard. Connecticut Light & Power (CL&P) is the electrical utility in Ledyard that worked to restore power following Irene.

On October 29<sup>th</sup> 2012, Hurricane Sandy impacted the region with rains and high winds. Ledyard suffered power outages due to the wind toppling trees onto power lines. The town received approximately \$70,000 of federal assistance to cover the damages.

### 1.20 Existing Capabilities

Wind loading requirements are addressed through the state building code. The Connecticut State Building Code was most recently adopted with an effective date of October 1, 2016. The code specifies the design wind speed for construction in all the Connecticut municipalities. The ultimate design wind speed for Ledyard ranges from 125 to 145 miles per hour depending on the building use (for example, hospitals must be designed to the higher wind speed). Note that changes in design wind speed figures since the previous HMP are largely the result of a shift from "nominal" to "ultimate" wind speeds, for compatibility purposes; see the Connecticut Building Code or the American Society of Civil Engineers website for more information. Ledyard has adopted the Connecticut Building Code as its building code.

#### Tree Maintenance

Parts of trees (limbs) or entire tall and older trees may fall during heavy wind events, potentially damaging structures, utility lines, and vehicles. In Ledyard, the Public Works Director is the Tree Warden who can post notification and schedule tree removal. The Town's utility provider is Eversource, which acquired the previous provider Connecticut Light and Power (CL&P). Following the major regional outages caused by Tropical Storm Irene, Hurricane Sandy, and Winter Storm Nemo, Eversource has instituted an aggressive tree-trimming regime and has built redundancies into the grid. Eversource is also expanding a local substation. The Town reports improved resilience of the electric grid. Communication between the electric utility and the Town has also improved since the previous HMP.

The Tree Warden is allotted an extremely limited budget to allocate towards proactive tree trimming; most trimming in Town is performed by Eversource. The Town sometimes contracts private companies to help with tree trimming.

### Debris Management

The Ledyard DPW collects debris following a storm and deposits it at the Town Transfer Station, where they convert it to mulch for reuse within the Town. Town staff are discussing additional debris collection and disposal sites in case they run out of room at the transfer station, which has about six acres of storage space. Private companies are contracted to assist with debris removal as necessary.

### Warnings and Communication

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

Residents are currently able to sign up to receive warnings from the CT Alert "Everbridge" Emergency Notification System to receive critical information specific to different areas within Ledyard. Although hurricanes that have impacted Ledyard have historically passed in a day's time, additional regional shelters could be outfitted following a storm with the assistance of the American Red Cross on an as-needed basis for long-term evacuees.

### Education and Preparation

The Fire Marshal performs regular building inspections, and encourages building owners to prepare emergency response plans during those inspections.

The DPW surveys Town owned buildings to detect weaknesses with regards to snow and wind loading as part of the department's standard activities. Engineering level studies are not performed.

### Summary

In general, municipal capabilities to mitigate hurricane damage have increased slightly since the 2012 edition of the hazard mitigation plan was adopted. This is likely because the Town increased its capabilities in response to the winds of Tropical Storm Irene in 2011 and Hurricane Sandy in 2012.

## **1.21 Vulnerabilities and Risk Assessment**

The entire town is vulnerable to hurricane and tropical storm wind damage and from any tornadoes (Section 6) accompanying the storm, as well as inland flooding (Section 3). Of particular concern are the blockage of roads and the damage to the electrical power supply from

falling trees and tree limbs. There was a town-wide seven to nine day power outage following Tropical Storm Irene in 2011, and additional power outages following Hurricane Sandy in 2012, due to tree damage to utility lines.

Many structures built in town do not meet current wind load building codes and are particularly susceptible to roof and window damage from high wind events. This risk to structures will be reduced with time as these buildings are remodeled or replaced with buildings that meet current codes. Those newer structures put in place since the 1990s are less vulnerable to damage from hurricanes and/or tropical storms.

The strength of a large hurricane could cause a moderate economic impact to the town. The potential economic effect of wind damage to SCCOG was evaluated in the Multi-Jurisdictional HMP. A separate analysis was not performed specifically for Ledyard.

## **1.22 Potential Mitigation Strategies and Actions**

Potential mitigation measures for reducing or eliminating the impact of wind damage fall into the categories of prevention, property protection, emergency services, public education and awareness, natural resource protection, and structural projects. General potential mitigation measures that can be taken to reduce the effects of wind damage from hurricanes and tropical storms were discussed in Section 5.7 and in Section 11.2.3 of the Multi-Jurisdictional HMP. General recommendations pertinent to all natural hazards that could affect the town are listed in Section 11 of this annex, as are specific measures pertinent to reducing wind damage to Ledyard.

## SUMMER STORMS AND TORNADOES

### **1.23 Setting / Historic Record**

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

### **1.24 Existing Capabilities**

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

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

#### Summary

In general, municipal capabilities to mitigate thunderstorm and tornado damage have not increased significantly since the 2012 edition of the hazard mitigation plan was adopted, with the exception of some of the changes described in Section 5.2.

### **1.25 Vulnerabilities and Risk Assessment**

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

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

dangerous during the summer months during dry and drought conditions. Fortunately, most fires are quickly extinguished due to the town's strong fire response.

Lightning and hail are generally associated with severe thunderstorms and can produce damaging effects. All areas of the town are equally susceptible to damage from lightning and hail, although lightning damage is typically mitigated by warnings and proper grounding of buildings and equipment. Hail is primarily mitigated by warning, although vehicles and watercraft can often not be secured prior to the relatively sudden onset of a hailstorm. Lightning and hail are considered likely events each year, but typically cause limited damage in the town. Older buildings are most susceptible to lightning and hail damage since many were constructed prior to current building codes, and many campgrounds offer little structural protection from the elements.

Although tornadoes pose a threat to all areas of Connecticut, their occurrence is least frequent in New London County as compared with the rest of the Connecticut. Thus, while the possibility of a tornado striking the town exists, it is considered to be an event with a very low probability of occurrence.

## **1.26 Potential Mitigation Strategies and Actions**

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

## WINTER STORMS AND NOR'EASTERS

### **1.27 Setting / Historic Record**

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

Winter storms and nor'easters have affected the town since the last HMP as reported to the NCDC and reported by town officials.

- ❑ The winter of 2010-2011 produced significant snowfall in Ledyard. Gales Ferry School was closed temporarily while the roof's snow load was evaluated and was ultimately deemed safe. One residential roof collapsed. Winter Storm Alfred in late October 2011 caused only minor tree damage and no loss of power in town.
- ❑ A low pressure zone rapidly intensified while moving northeast to a position east of Cape Cod by the morning of Saturday, February 9, 2013, producing blizzard conditions and very heavy snowfall across southern Connecticut on February 8th and 9th. Groton Airport ASOS (KGON) reported at least 3 consecutive hours of blizzard conditions. Snowfall began at 7:40 am on February 8. Spotters reported an average snowfall of 6 inches by 7:50 pm. Total snowfall ranged from 15 inches in Stonington to as much as 23.6 inches in Old Lyme. Winds also gusted as high as 60 mph at Groton Airport. Snowfall totals were 22 inches in Ledyard Center.
- ❑ Winter Storm Juno, or the Blizzard of 2015, dropped 19 inches of snow on Ledyard from January 26-27. Blizzard conditions were experienced, and schools canceled.

### **1.28 Existing Capabilities**

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

As it is almost guaranteed that winter storms will occur annually in Connecticut, it is important to locally budget fiscal resources toward snow management. Snow is the most common natural hazard requiring additional overtime effort from town staff, as parking lots and roadways need constant maintenance during storms.

The Public Works Department oversees snow removal in the town. The Connecticut Department of Transportation (DOT) plows the State roadways, while the town employs 11

plow trucks and three small plow trucks to clear town roads and facilities. The Department has prioritized routes for the 11 large plow trucks. Each route is approximately ten miles in length. The town uses treated salt for the de-icing of the roadways. The Town believes that its snow removal capabilities are sufficient.

The Connecticut Building Code specifies that a pressure of 30 pounds per square foot be used as the base "ground snow load" for computing snow loading for roofs. This specification is adhered to by the town. The DPW removes snow from the roofs of Town-owned buildings, while the Board of Education oversees removal of snow from the school buildings. The Building and Grounds Department of the Town Hall campus, which includes the Town Hall, the Town Hall Annex, the DPW, and the new Police Department, has a plan for snow removal from campus driveways and roofs.

Information related to protecting Town residents during cold weather, and for mitigating icing and of pipes at residences, is posted on the Town website.

#### Summary

In general, municipal capabilities to mitigate snowstorm damage have increased slightly since the 2012 edition of the hazard mitigation plan was adopted. This is because the Town continues to experience heavy snow each winter.

### **1.29 Vulnerabilities and Risk Assessment**

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

Warning and education can prevent most injuries from winter storms. Most deaths from winter storms are indirectly related to the storm, such as from traffic accidents on icy roads and hypothermia from prolonged exposure to cold. Damage to trees and tree limbs and the resultant downing of utility cables are a common effect of these types of events. Secondary effects can include loss of power and heat.

In general, there are few steep slopes such that extra sanding and salting of the roadways in necessary locations alleviates any trouble spots. Town officials did not indicate this to be a major issue, rather an issue that deserves priority when town staff begins their treatment of roads. These areas are usually treated first by town staff during and following winter storms. Also, there are no issues with ice jams on any of the streams in the town.

### **1.30 Potential Mitigation Strategies and Actions**

Potential mitigation measures for flooding caused by nor'easters include those appropriate for flooding that were discussed in Section 3.7 of the Multi-Jurisdictional HMP and Section 11 of this annex. However, winter storm mitigation measures must also address blizzards, snow, and ice

hazards. General potential mitigation measures that can be taken to reduce the effects of wind damage were discussed in Section 5.7 and in Section 11.2.3 of the Multi-Jurisdictional HMP and Section 11 of this annex.

## EARTHQUAKES

### 1.31 Setting

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

### 1.32 Existing Capabilities

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

Due to the infrequent nature of damaging earthquakes, town land use policies do not directly address earthquake hazards. However, the potential for an earthquake and emergency response procedures is addressed in the town's EOP. The Town maintains emergency supplies in case of isolation caused by a hurricane, winter storm, or earthquake.

#### Summary

In general, municipal capabilities to mitigate earthquake damage have not increased since the 2012 edition of the hazard mitigation plan was adopted. This is because the hazard continues to pose a low risk of damage to the Town.

### 1.33 Vulnerabilities and Risk Assessment

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

Nine inactive bedrock faults largely stretch north-south through town. Unlike seismic activity in California, earthquakes in Connecticut are not associated with specific known active faults.

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

The built environment in the town primarily includes some more recent construction that is seismically designed. However, most buildings were built before the 1990s and therefore are not built to current building codes. In addition, there are areas such as town parks with recreational buildings or shelters that may not be seismically designed. Thus, it is believed that most buildings would be at least moderately damaged by a significant earthquake. Those town residents who live or work in older, non-reinforced masonry buildings are at the highest risk for experiencing earthquake damage.

Areas of steep slopes can collapse during an earthquake, creating landslides. Ledyard has areas of steep slopes and bluffs although almost all of these features occur in undeveloped areas. Thus, landslides are not a concern in the town.

Seismic activity can also break utility lines such as water mains, gas mains, electric and telephone lines, and stormwater management systems. Damage to utility lines can lead to fires, especially in electric and gas mains. Dam failure can also pose a significant threat to developed areas during an earthquake. For this HMP, dam failure has been addressed separately in Section 10.0. As noted previously, most utility infrastructure in the town is located above ground. A quick and coordinated response with CL&P will be necessary to inspect damaged utilities following an earthquake, to isolate damaged areas, and to bring backup systems online. This is covered in the Ledyard and Eversource's EOPs.

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

### **1.34 Potential Mitigation Strategies and Actions**

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

## WILDFIRES

### **1.35 Setting / Historic Record**

Wildfires are considered to be highly destructive, uncontrollable fires. The most common causes of wildfires are arson, lightning strikes, and fires started from downed trees hitting electrical lines. Thus, wildfires have the potential to occur anywhere and at any time in both undeveloped and developed areas of Ledyard. Structural fires in higher density areas of the town are not directly addressed herein.

According to the town officials, no specific areas of wildfire risk or vulnerability are known. Small brush fires occur every summer, but do not typically cause significant damage. Some examples include the following:

- Summer 2016: A brushfire affected over an acre, and proved to be difficult to put out because it began to burn below the ground surface.
- July, 2016: a brushfire south of Whippoorwill Drive burned ten acres, and required 14 fire departments to put it out over six hours.
- May 2015: a fire on Avery Hill Road burned around eight acres; neighboring fire stations assisted.

### **1.36 Existing Capabilities**

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

Existing mitigation for wildland fire control is typically focused on building codes, public education, Fire Department training, and maintaining an adequate supply of equipment. The Gales Ferry Fire Company has a variety of equipment including a 280 gallon forestry truck. Since the previous edition of the HMP in 2012, the Fire Department has purchased two new brush trucks. Additionally, new all-terrain-vehicle firefighting equipment is available from neighboring Towns through mutual aid agreements. Robust mutual aid agreements are maintained between Ledyard's Fire Department and those of neighboring towns.

The Fire Companies attack fires as quickly as possible in the town. Fire protection water is obtained through the hydrants wherever possible and different water surfaces spread throughout town. In areas located far from the dry hydrant, water is drafted from the various streams, ponds, and rivers in the town, and pump trucks carry the water to the distant area. The amount of fire protection afforded by the dry hydrants and nearby streams is considered to be adequate for the development level of Ledyard. The Fire Companies will continue to evaluate the level of risk and the need for additional hydrants as development continues in the future. Dry hydrants and cisterns are not required for new developments, as tanker trucks are the preferred means of firefighting.

Several key changes to the public water system profile in Ledyard have occurred since the previous edition of the HMP in 2012. For example, interconnections between systems have been constructed and/or activated, and additional areas are served. This has helped improve the ability of the Fire Department to obtain water.

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

#### Summary

In general, municipal capabilities to mitigate wildfire damage have increased since the 2012 edition of the hazard mitigation plan was adopted, with the acquisition of new equipment and extension of public water systems; as well as the changes in the State's regulation of open burning.

#### **1.37 Vulnerabilities and Risk Assessment**

Forests and inaccessible tracks of land are at the highest risk for wildfires. However, according to town officials, there are no specific areas of wildfire risk or vulnerability in Ledyard. Refer to Figure 9-1 in the Multi-Jurisdictional HMP for a general depiction of wildfire risk areas region-wide.

#### **1.38 Potential Mitigation Strategies and Actions**

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

## DAM FAILURE

### 1.39 Setting / Historic Record

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

A dam failure affecting Ledyard is considered a possible event each year with potentially critical effects. Substantial scouring occurred on Lantern Hill Road downstream of Lantern Hill Pond Dam when the dam failed during the March 2010 flood. Lantern Hill Pond Dam is presently being reconstructed in accordance with a design that will mitigate future failure and relieve chronic downstream flooding. This is the only known dam failure to have affected the town since the time of the last HMP.

### 1.40 Existing Capabilities

The Connecticut DEEP administers the Dam Safety Section and designates a classification to each state-registered dam based on its potential hazard as detailed in the regional plan. As noted in the Multi-Jurisdictional HMP, Ledyard is home to two Class B (significant hazard) dams. These dams are listed in Table 10-1. No Class C (high hazard) dams are located within Ledyard. No Class B or Class C dams are located upstream of Ledyard whose failure could potentially lead to flooding within the town.

**Table 10-1: Dams Registered with the DEEP in the Town of Ledyard**

Number	Name	Owner	Class
7202	Long Pond Dam	Private Association	B
7207	Morgan Pond Dam	City of Groton	B

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

Owners of high and significant hazard dams are required to maintain EAPs for such dams. The Town of Ledyard does not own any dams. The town should work with the DEEP and dam owners to ensure that EAPs remain current and on file.

## Summary

In general, municipal capabilities to mitigate dam failure damage have not increased significantly since the 2012 edition of the hazard mitigation plan was adopted. However, changes in the State's regulation of dams have increased Statewide capabilities sharply.

### **1.41 Vulnerabilities and Risk Assessment**

The potential impacts related to the failure of Class B dams within Ledyard are described below. Where information was available, the descriptions below are based on information available at the Connecticut DEEP Dam Safety Section. Refer to Figure 10-1 for a location map showing the dams and potential dam failure inundation areas (where available).

- Long Pond – The Long Pond Dam is a Class B dam located at the southern end of Long Pond, located along the eastern town line of Ledyard with North Stonington. The dam is owned by the private Lantern Hill Valley Association. The dam impounds Long Pond on Whitford Brook and is a 109-acre recreational pond. Long Pond, along with Lantern Hill Pond, are the headwaters of the Mystic River, draining south into Whitford Brook, through Old Mystic, becoming the Mystic River. Long Pond and Lantern Hill Pond are both sites for Connecticut state boat launches. The pond is also used by different regional Fire Departments for equipment testing, cleaning and drills. The pond is surrounded by homes occupied year-round. A six-foot cross culvert under Lantern Hill Road connects Long Pond and Bush Pond.

An EOP was created and is maintained by the Lantern Hill Valley Association is dated May 1, 2006 and is on file with the CT DEEP. The association was formed by landowners surrounding Long and Bush Ponds to maintain the dam and spillway of Long Pond. In March 2010, significant damage occurred due to the overtopping of the dam during heavy rain flows. Town officials have noted scouring on Lantern Hill Road occurred below the dam. The dam was the discussion of a January 2012 meeting between representatives from the Lantern Hill Valley Association, the Mayor of Ledyard and the First Selectman of North Stonington. The meeting discussed options that Lantern Hill Valley Association had concerning the dam including making repairs, removing, or returning ownership to the original owners of the dam.

The town has been working with the CT DEEP and owners of the dam to address the state of the Long Pond / Bush Pond complex and its dams. The CT DEEP has performed a study of the potential effects of a 0.2% annual-chance storm on the dams here. The Town has not yet seen the results of those reports, and will decide on appropriate action moving forward once that report is received.

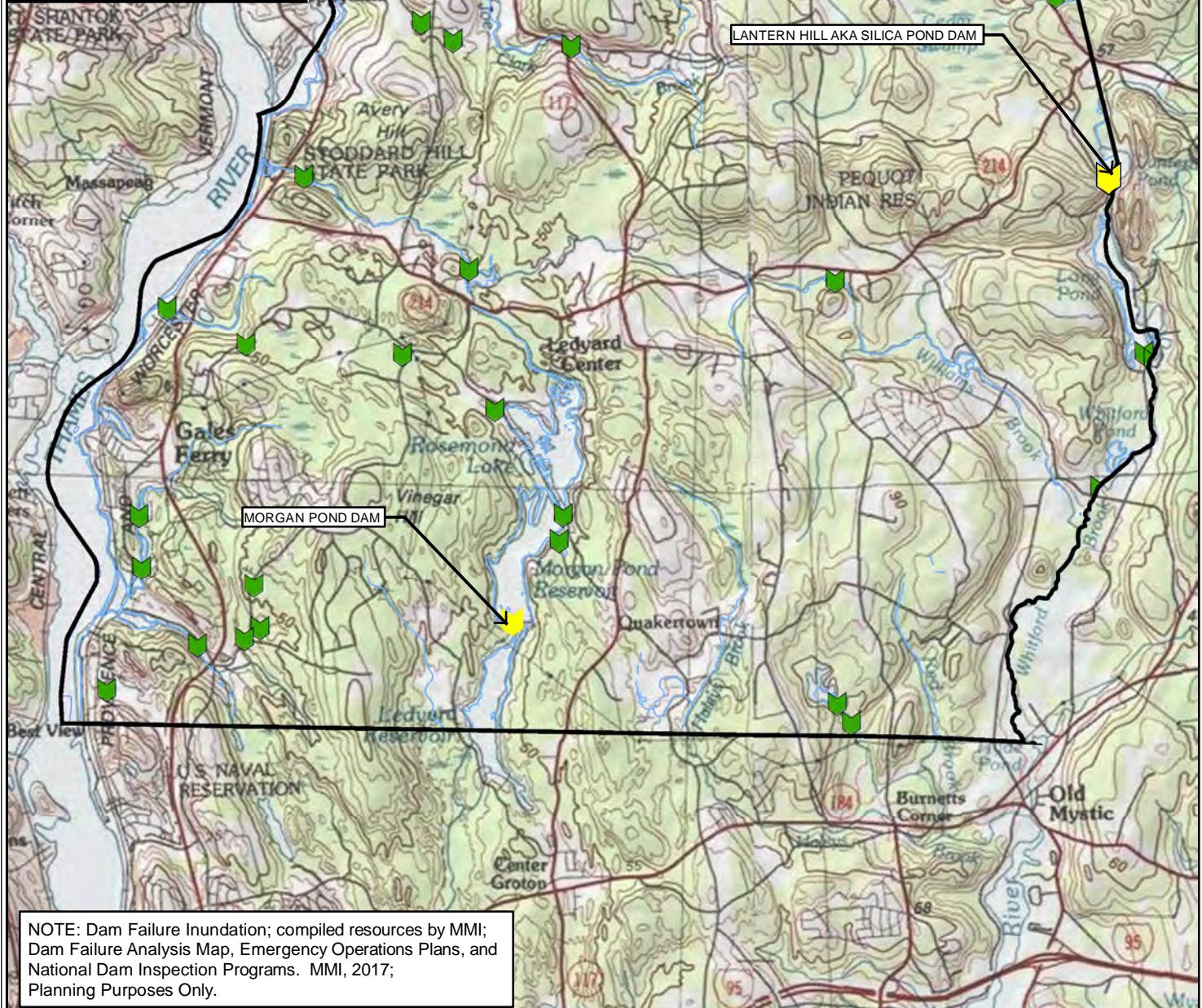
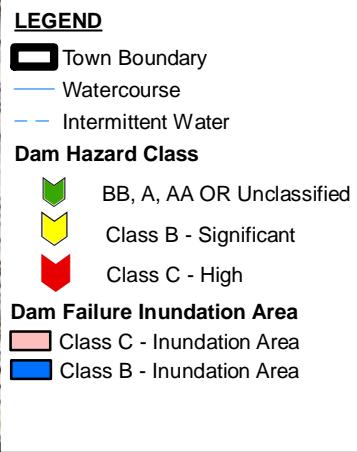
Since the previous HMP, the Lantern hill Pond Dam (one of the three dams impounding Long Pond) has been completely restructured, along with the road below it. This dam was overtopped during the floods of 2010, and the road below it damaged.

- Morgan Pond – The Morgan Pond Dam is a Class B dam located at the southern end of the Morgan Pond Reservoir. The water body is the most upstream of the Groton Utilities water

supply reservoirs. Water passing over the Morgan Pond Dam spillway flows into Ledyard Reservoir, eventually discharging to Great Brook into the terminal Poquonnock Reservoir. The pond also receives water from the Billings Avery Reservoir, a registered diversion. According to a 1987 inspection by Lenard Engineering, the dam is an earthen embankment with concrete spillway having a length of 1,500 feet and a maximum height of 45 feet. The spillway is located 600 feet from the right embankment contact area, and is 40 feet long with an ogee crest. Installation of crest gates was completed in March 1992, which effectively raised the pond elevation by three feet. A Dam Failure Analysis (DFA) was completed as part of the 1987 inspection, and utilized a  $\frac{1}{2}$  PMF of 1,726 cfs. The dam is owned by Groton Utilities.

#### **1.42 Potential Mitigation Strategies and Actions**

Ledyard is considered a low-risk area for dam failure since no dams are higher than Class B and there is evidence of active coordination between the town, the owner of the Long Pond Dam and CT DEEP. Potential mitigation measures for dam failure include a combination of prevention, education, and emergency planning, as well as dam removal projects as discussed in Section 11.



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## HIGH & SIGNIFICANT HAZARD DAMS

### SCCOG HAZARD MITIGATION UPDATE TOWN OF LEDYARD ANNEX

LEDYARD, CONNECTICUT

SOURCE: DAM HAZARD CLASS; DAMS, CTDEEP 1996 & LISTING OF DAMS; CTDEEP, 2016

DATE:	JULY 26, 2017	
SCALE:	1"=6,000'	
PROJ. NO.:	3570-09	
DESIGNED	DRAWN	CHECKED
SB	PS	DM
DRAWING NAME:		

FIG. 10-1

## MITIGATION STRATEGIES AND ACTIONS

### **1.43 Status of Mitigation Strategies and Actions**

The previous edition of the SCCOG Multi-Jurisdictional HMP and Town of Ledyard annex listed a suite of hazard mitigation actions applicable both locally and region-wide. These actions, along with commentary regarding the status of each, are listed in the tables in this section.

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

#### **1.43.1 Actions Applicable to All Hazards**

Action	Status	Notes
<b>Regional Coordination</b>		
Continue to promote inter-jurisdictional coordination efforts for emergency response	Capability	<i>Completed through mutual-aid agreements, agreements and SCCOG regional hazard management initiatives.</i>
Continue to promote local and regional planning exercises that increase readiness to respond to disasters	Capability	<i>Completed through participation in regional and statewide exercises, as well as locally run exercises.</i>
Continue to evaluate communication capabilities and pursue upgrades to communication and ensure redundant equipment is available	Capability	<i>Performed by Emergency Management Director. Recently upgraded to microwave radio.</i>
Continue to promote regional transportation planning through SCCOG	Capability	<i>This action is the responsibility of, and is being performed by, SCCOG. This action is redefined as a regional capability.</i>
Work with the SCCOG to perform a regional study of the vulnerability of critical facilities to natural hazard damage	Complete	<i>This action is the responsibility of, and was performed by, SCCOG. None of the facilities in the analysis were located in Ledyard.</i>
<b>Local Emergency Response &amp; Public Information</b>		
Continue to review and update the City EOP at least once annually	Capability	<i>Performed by Emergency Management Director.</i>
Continue to maintain emergency response training and equipment and upgrade equipment when possible	Capability	<i>Performed by Emergency Management Director, Fire Companies, Police.</i>
Encourage local officials to attend FEMA-sponsored training seminars at EMI	Capability	<i>Officials attend seminars online and locally when possible. Drop "at EMI," as travel is prohibitive and unnecessary.</i>
Continue to evaluate emergency shelters, update supplies, and check communication equipment	Capability	<i>Performed by Emergency Management Director.</i>
Continue to promote dissemination of public information regarding natural hazard effects into Government buildings, with additions	Capability	<i>Performed by Emergency Management Director.</i>
Pursue the American Red Cross-certification of Ledyard High School (primary shelter) and Ledyard Middle School (secondary Shelter)	Complete / Carry Forward	<i>Primary Shelter has been certified. This is complete. Secondary Shelter is undergoing renovations, including installation of emergency generator. Certification will be pursued upon completion. Carry forward until Middle School Shelter generator is installed and certification secured.</i>
Resolve and utilize the Reverse 9-1-1 system to telephone warnings into affected areas, and add DFIRM floodplain areas to the database	Capability	<i>Town utilizes Everbridge system</i>

Action	Status	Notes
Work closely with the town's Emergency Management Department with all emergency management and services decisions moving forward	Complete	<i>Created a Public Safety Commission that includes Emergency Management Department and other Departments. Regularly meets to discuss emergency management decisions.</i>
Update the town's EOP and POCD annually	Capability	<i>EOP is updated annually. POCD is updated on a ten-year cycle with amendments as necessary.</i>
<b>Prevention</b>		
Develop a checklist for land development applicants that cross-references the specific regulations and codes related to disaster resilience	Capability	<i>This is built into application requirements. Additionally, a "Zoning Guidelines for Builders" document serves the same purpose.</i>
Integrate additional elements of this HMP into the POCD during the 2013 update and beyond	Carry Forward	<i>The POCD has not yet been updated.</i>
Continue reviewing building plans to ensure proper access for emergency vehicles	Capability	<i>This is required by Zoning and Subdivision Regulations</i>
Continue to enforce the appropriate building code for new building projects	Capability	<i>Responsibility of the Building Official</i>
Encourage residents to install and maintain lightning rods on their buildings	Delisted	<i>The Town has not seen strong evidence that installation of lightning rods on private residential property will be helpful. Additionally, there is little access in this area to companies capable of performing such installations.</i>
Advertise the sign up page for the CT Alert "Everbridge" Emergency Notification System	Capability	<i>Advertised through website</i>
<b>Natural Resource Protection &amp; Open Space</b>		
Continue to regulate development in protected and sensitive areas including steep slopes, wetlands, and floodplains	Capability	<i>Required through Zoning, Subdivision, and Inland Wetlands and Watercourses Regulations</i>

#### 1.43.2 Actions Applicable to Inland Flooding

Action	Status	Notes
<b>Prevention</b>		
Continue to regulate new development activities within SFHAs to the greatest extent possible within City land use regulations	Capability	<i>Zoning Regulations regulate development according to FEMA requirements.</i>
Require developers to demonstrate whether detention or retention of stormwater is the best option for reducing peak flows downstream	Capability	<i>Included in Subdivision Regulations</i>
Conduct an annual inspection of floodprone areas that are publically accessible. Recommend drainage improvements as appropriate	Delisted	<i>There are not many publically accessible floodprone areas in Town. The Lantern Hill study (by the CT DEEP) involved a thorough inspection of areas that are, which the Town deems to be sufficient for the time being. The Public Works Director regularly inspects dams and areas of beaver activity. Further activity than what is currently performed is deemed unnecessary</i>
Revise and/or update the Ordinance Regulating Management of Stormwater Runoff (Ordinance #44) with more current practices	Carry Forward	<i>This ordinance has not yet been updated.</i>
<b>Property Protection</b>		
Incorporate information on the availability of flood insurance into all hazard-related public education workshops	Delisted	<i>This is not done at the local level. The Town believes that FEMA's public advertisements and outreach methods are sufficient.</i>

Action	Status	Notes
Make available FEMA-provided flood insurance brochures and encourage residents to purchase insurance if they are in a SFHA	Delisted	<i>Mortgage companies inform homeowners and buyers about Flood insurance. This is considered to be sufficient.</i>
Provide technical assistance to owners of non-residential structures that suffer flood damage regarding flood proofing measures	Capability	<i>There has not been any significant flooding in the last five years, so such assistance has not been necessary. If the scenario arises, the Town can provide assistance as noted in the Capabilities section of Chapter 3.</i>
Encourage residents to submit flood insurance claims following damage events	Capability	<i>There has not been any significant flooding in the last five years, so such assistance has not been necessary. If the scenario arises, the Town can provide assistance as noted in the Capabilities section of Chapter 3.</i>
<b>Emergency Services</b>		
Pursue mutual aid agreements with non-profits to provide volunteer labor for response activities	Carry Forward	<i>The Town is concerned about issues with civilian volunteers, including a lack of training. Nevertheless, they would like to carry this action forward and explore their options.</i>
<b>Public Education and Awareness</b>		
Conduct a "Natural Hazards Fair" so that interested parties can familiarize themselves with natural hazard mitigation options	Delisted	<i>Town does not feel this would be a productive activity</i>
Visit schools and educate children about the risks of flooding and how to prepare	Delisted	<i>Town does not feel this would be a productive activity</i>
Encourage builders, developers, and architects to become familiar with NFIP land use and building standards at annual workshops	Delisted	<i>Town has found that developers, etc., are all fully aware of NFIP standards, and does not feel more encouragement is necessary. Also, as noted above, Town staff are able to provide sufficient information as needed.</i>
<b>Natural Resource Protection</b>		
Pursue the acquisition of additional open space in SFHAs	Complete / Capability	<i>This is performed by a number of organizations as opportunities arise. For example, Avery Farm, 289 acres of old farmland along Haley Brook on the Groton border, was purchased by Groton Open Space Association in December of 2013, and will now be permanently open space.</i>
Continue to aggressively pursue wetlands protection and incorporate performance standards into subdivision reviews	Capability	<i>This is conducted. 60% of new developments must be set aside as open space.</i>
<b>Structural Projects</b>		
Encourage the use of floodplain storage and other flood control methods in new developments and at existing properties where appropriate	Capability	<i>60% of new developments must be set aside as open space. Retention ponds are required at new developments.</i>
Utilize the recently available extreme rainfall data to determine existing culvert sizing and encourage upgrades where undersized	Delisted	<i>It appears that extreme rainfall data is used for some projects, but the procedure is not be formalized. This action is dropped and replaced with that listed below this table.</i>
Continue to perform catch basin and culvert surveys to prioritize upgrades and perform maintenance and cleaning	Capability	<i>Performed by the DPW</i>
Complete construction of Lantern Hill Road infrastructure improvements with North Stonington and MPTN	Complete	<i>Complete</i>
Work with the non-residential owner on Baldwin Hill Road to reduce flooding at the Flat Brook crossing	Complete	<i>Redirected water course. Problem has been mitigated.</i>

Action	Status	Notes
Consider upgrade of culvert outlet on Lambtown Road Extension near Lamb and Haleys Brooks	Complete	<i>As part of the Avery Farm open space acquisition this road was permanently closed to traffic, removing the flood hazard.</i>
Continue pursuing State approval to complete replacement of the Shewville Road bridge at the Shewville Brook/Indiantown Brook	Complete	<i>Replaced in 2016</i>
Pursue funding to replace/increase the capacity of the Town Farm Road bridge over Williams Brook	Carry Forward	<i>Funding has not yet been secured.</i>

Other actions or strategies developed during the HMP update include:

- Develop formalized guidance for culvert and bridge construction and replacement that requires utilization of the most up-to-date extreme rainfall data from <http://precip.eas.cornell.edu>

#### 1.43.3 Actions Applicable to Wind Damage from Hurricanes, Tropical Storms, Summer Storms, Tornadoes, and Winter Storms

Action	Status	Notes
<b>Prevention</b>		
Encourage CL&P to also cut down trees as opposed to just trimming trees near power lines	Complete	<i>CL&amp;P has been acquired by Eversource. The Eversource liaison program has improved communication. Eversource has instituted an aggressive tree trimming program.</i>
Continue to perform appropriate tree maintenance to the greatest extent possible	Capability	<i>Town has limited budget for trimming. Contracts out trimming as needed.</i>
<b>Property Protection</b>		
Promote the use of functional shutters for older buildings in the town and investigate funding sources	Delisted	<i>Window blowout is not a significant issue in town.</i>
Make information on wind-resistant construction techniques available to all building permit applicants	Delisted	<i>Completed through building code requirements; providing additional information is unnecessary.</i>
Encourage commercial building owners to develop emergency response plans and identify mitigation opportunities	Capability	<i>Fire Marshall encourages building owners to develop all-hazard emergency response plans during building inspections.</i>
<b>Emergency Services</b>		
Identify a location for a brush-disposal operation for dealing with debris following wind storms and determine potential reuse	Complete/ Carry Forward	<i>City Transfer station is a designated disposal site. There have been conversations at the Town level to designate additional or alternative debris collection areas, but there has been no resolution so far.</i>
Consider surveying all town-owned buildings, particularly historic buildings, to determine their ability to withstand wind loading	Capability	<i>This is covered by the Department of Public Works routine activities.</i>
Develop agreements with landowners and companies to chop/chip to ensure backup plans are in place for debris removal	Capability	<i>The town has tree trimming companies on contract to help trim trees and collect debris. There is at least one landowner with whom an agreement is in place. DPW will make additional agreements as needed.</i>
<b>Public Education and Awareness</b>		
Visit schools and educate children about the	Delisted	<i>Town does not run educational activities for children.</i>

Action	Status	Notes
risks of wind events and how to prepare		

#### 1.43.4 Actions Exclusively Applicable to Winter Storms

Action	Status	Notes
Consider posting snow plowing routes in Town Hall and on the town's website	<i>Delisted</i>	<i>Plow routes change too frequently for this action to be feasible.</i>
Consider drafting a written plan for inspecting and prioritizing the removal of snow from town-owned structures	<i>Complete/Capability</i>	<i>Building and Grounds department of Town Hall campus has plans for snow removal. The recently redone campus (especially the creation of a large parking lot and installation of the new police department into one of the buildings) has led to these new plans.</i>
Continue making funding available to the Public Works Department each year for clearing snow from roads and parking lots	<i>Capability</i>	<i>Capability</i>
Provide information for protecting Town residents during cold weather and for mitigating icing and insulating pipes at residences	<i>Capability</i>	<i>This information is available through the Town website.</i>
Continue to identify areas that are difficult to access during winter storm events and develop contingency plans to access such areas	<i>Complete/Capability</i>	<i>The Town does not have any public areas that are difficult to access during storms. Fire Departments have four-wheel-drive pickup trucks for long driveways.</i>

#### 1.43.5 Actions Applicable to Earthquakes

Action	Status	Notes
Ensure that town departments have adequate backup supplies and facilities for continued functionality following an earthquake	<i>Capability</i>	<i>Town maintains supplies as part of hurricane/snowstorm preparations.</i>
Consider preventing residential development in areas prone to collapse such as below steep slopes or areas prone to liquefaction	<i>Delisted</i>	<i>No dangerous areas have been identified in the Town.</i>

#### 1.43.6 Actions Applicable to Wildfires

Action	Status	Notes
Continue to evaluate dry hydrants, fire ponds, and areas at risk of wildfire in the town if and when they develop	<i>Capability</i>	<i>Performed by the Fire Companies</i>
Continue to support public outreach programs to increase awareness of forest fire danger, equipment usage, and protecting homes	<i>Capability</i>	<i>Performed by the Fire Companies</i>
Ensure that provisions of town regulations regarding fire protection facilities and infrastructure are being enforced	<i>Capability</i>	<i>Performed by the Fire Marshal</i>

### **1.43.7 Actions Applicable to Dam Failure**

Action	Status	Notes
Work with CT DEEP and Lantern Hill Valley Association (Long Pond Dam) to insure issues are resolved and EOP is updated	Carry Forward	<i>CT DEEP conducted a study that was performed recently. Town is waiting for the report from this study so they can determine next steps.</i>
Continue to work with North Stonington and MPTN to complete repairs and improvements to the Lantern Hill Pond Dam	Completed	<i>This has been repaired</i>
Provide assistance to the owners of lesser ranked dams regarding resources available for inspections and maintenance	Capability	<i>Assistance is given on a case by case basis by the Town Engineer, who helps determine whether city needs to hire outside help.</i>

### **1.44 Prioritization of Specific Actions**

As explained in Section 11.3 of the Multi-Jurisdictional HMP, the STAPLEE method was utilized in this annex to prioritize actions. Table 11-1 presents the STAPLEE matrix for the Town of Ledyard. Each action includes the department or commission responsible for implementing the action, a proposed schedule, and whether or not the action is new or originally from the previous HMP. Refer also to Section 2.7 for the list of previous plan actions and whether or not each action was carried forward into this HMP.

Action or Strategy #	Table 11-1: Mitigation Actions and Strategies for Ledyard 2016 - 2021	Status	Responsible Department <sup>1</sup>	Fiscal Year					Cost	Potential Funding Sources <sup>2</sup>	Weighted STAPLEE Criteria <sup>3</sup>								Total STAPLEE Score	Priority for Community							
											Benefits				Costs												
				7/2018-6/2019	7/2019-6/2020	7/2020-6/2021	7/2021-6/2022	7/2022-6/2023			Social	Technical (x2)	Administrative	Political	Legal	Economic (x2)	Environmental	Social	Technical (x2)	Administrative	Political	Legal	Economic (x2)	Environmental			
1	Pursue the American Red Cross-certification of Ledyard Middle School (secondary Shelter)	Carried Forward	EM		x				Minimal <\$1,000	OB	1	1	1	1	1	0	0	6.0	0	0	0	0	0	0.0	6.0	Medium	
2	Integrate additional elements of this HMP into the POCD update	Carried Forward	LU	x	x	x	x	x	Low < \$10,000	OB	1	1	1	1	1	0	0	6.0	0	0	0	0	0	0.0	6.0	Medium	
3	Revise and/or update the Ordinance Regulating Management of Stormwater Runoff (Ordinance #44) with more current practices	Carried Forward	LU	x					Mod. < \$100,000	OB	1	1	1	1	1	0	0.5	6.5	0	0	0	0	0	0.0	6.5	High	
4	Pursue mutual aid agreements with non-profits to provide volunteer labor for response activities	Carried Forward	EM			x			High > \$100,000	OB	1	1	1	0.5	0.5	0	0	5.0	0	0	0	0	0	0.0	5.0	Low	
5	Pursue funding to replace/increase the capacity of the Town Farm Road bridge over Williams Brook	Carried Forward	DPW				x			CIB	0.5	1	1	1	1	0.5	0	6.5	0	0	0	0	-1	0	-2.0	4.5	Low
6	Develop formalized guidance for culvert and bridge construction and replacement that requires utilization of the most up-to-date extreme rainfall data from <a href="http://precip.eas.cornell.edu">http://precip.eas.cornell.edu</a>	New	DPW	x						OB	1	1	1	1	1	0	0	6.0	0	0	0	0	0	0.0	6.0	Medium	
7	Identify a location for a brush-disposal operation for dealing with debris following wind storms and determine potential reuse	Carried Forward	DPW		x					OB	1	1	1	1	1	0	0	6.0	0	0	0	0	0	-0.5	-0.5	5.5	Medium
8	Work with CT DEEP and Lantern Hill Valley Association (Long Pond Dam) to insure issues are resolved and EOP is updated	Carried Forward	EM	x	x	x	x	x		OB	0.5	1	1	1	1	0.5	0	6.5	0	0	0	0	0	0.0	6.5	High	

<sup>1</sup>Notes

DPW = Department of Public Works &amp; Engineering

EM = Emergency Management

LU = Land Use Department

<sup>2</sup>Notes

CIB = Capital Improvement Budget

EOC = EOC Grants

HMA = FEMA Grant Programs

OB = Operating Budget

<sup>3</sup>Notes

Beneficial or favorable ranking = 1

Neutral or Not Applicable ranking = 0

Unfavorable ranking = -1

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



**APPENDIX A**

**ADOPTION RESOLUTION**



CERTIFICATE OF ADOPTION  
TOWN OF LEDYARD TOWN COUNCIL

**A RESOLUTION ADOPTING THE HAZARD MITIGATION PLAN UPDATE, 2017**

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

WHEREAS, the Ledyard Town Council approved the previous version of the Plan in 2012; and

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

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

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

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

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

RESOLVED by the Town Council:

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

Adopted this \_\_\_\_\_ day of \_\_\_\_\_, 201\_\_\_\_\_ by the Town Council of Ledyard, Connecticut

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Mayor

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

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Town Clerk

