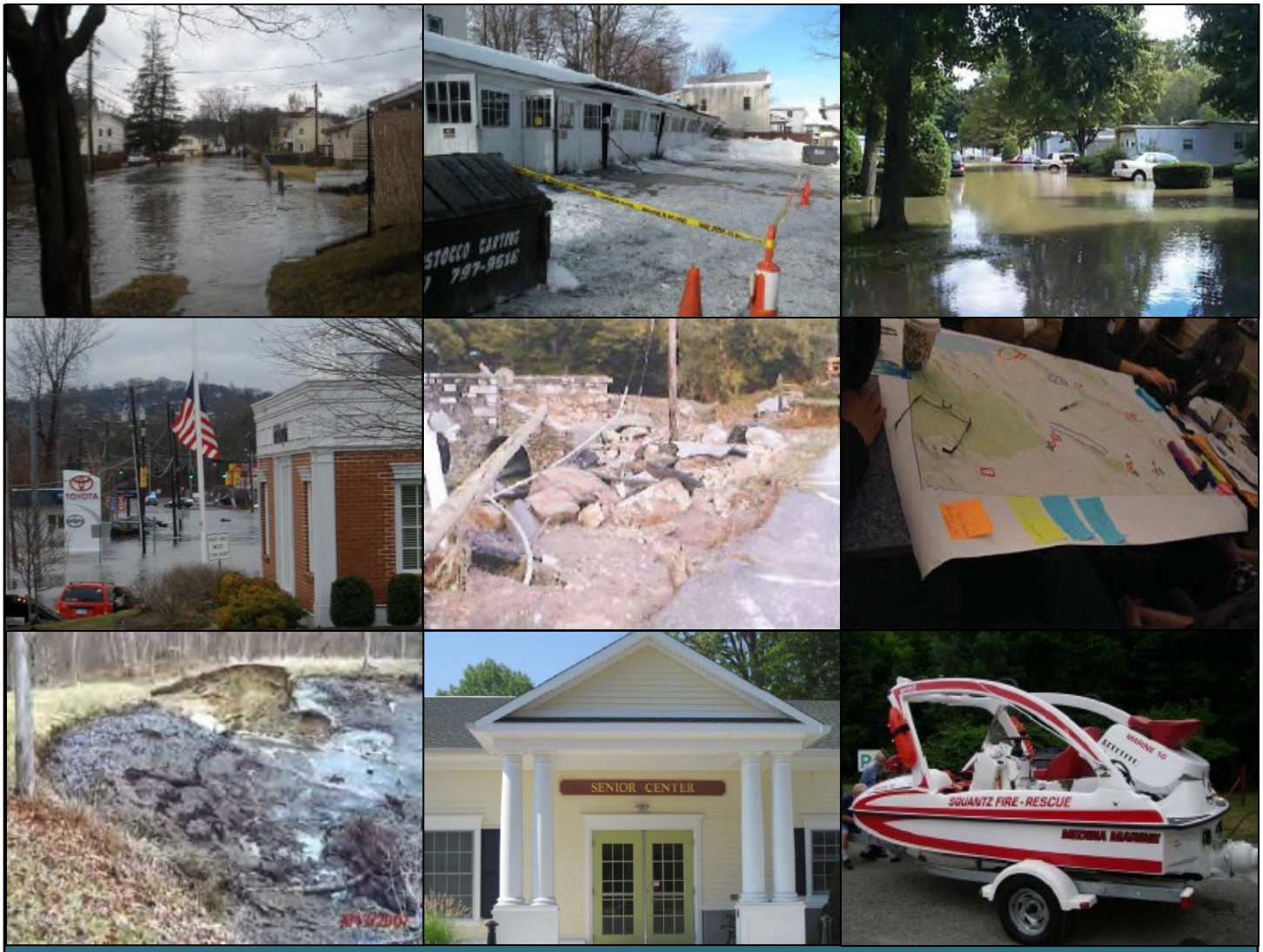

Western Connecticut Council of Governments

Multi-Jurisdiction Hazard Mitigation Plan Update

2021 – 2026

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Notice to Readers

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Changes to Planning Process and Plan Document

This document represents the first multi-jurisdiction hazard mitigation plan to concurrently cover all 18 municipalities in the Western Connecticut region served by WestCOG. Previously, the 10 municipalities that were formerly part of the Housatonic Valley Council of Elected Officials each had standalone single-jurisdiction hazard mitigation plans, while the 8 municipalities that were formerly part of the Southwestern Connecticut Regional Planning Area were covered under a multi-jurisdictional plan. In order to streamline the HMP, WestCOG adopted a "Regional Plan-Municipal Annex" format similar to that used by other multi-jurisdictional hazard mitigation plans in Connecticut. In this manner, information pertinent to the entire region may be provided once in the regional plan, while the municipal annexes provide detailed information regarding each WestCOG municipality. Thus, while information in this hazard mitigation plan presents much of the information in the previous plans for the region, it has been reformatted.

As part of this planning process, each municipality updated its list of critical facilities, provided updates regarding its capabilities, provided updates regarding areas of hazard risk, and noted mitigation successes. The mitigation strategies developed for each municipality under previous planning efforts were reviewed and updated. Finally, new Statewide and regional mitigation strategies have been developed and incorporated.

For the first time, the hazard mitigation planning process considered the potential impact to historic resources within an exposure analysis. This inclusion is based on recent efforts by the State Historic Preservation Office to identify and digitize historic resources in the four coastal counties of Connecticut.

Updated loss estimates are presented by municipality herein. The current version of HAZUS-MH (version 4.2) was utilized to generate loss estimates for floods, hurricane wind, and earthquake hazards. The datasets and methodology used within HAZUS differs slightly in the current version than in previous versions such that the loss estimates herein may differ from those presented in previous hazard mitigation plans for the region. Other loss estimates herein are derived from county-wide damages tabulated and presented in the 2019 *Connecticut Natural Hazards Mitigation Plan Update*, while previous estimates were drawn from earlier versions of the state hazard mitigation plan.

This hazard mitigation plan adds "Fact Sheets" to make the document livelier and give community planners the flexibility to pull standalone pages out of the plan document when pursuing specific projects, grants, goals, etc. These are interspersed throughout the document and include new initiatives, impacts of climate change, regional challenges, mitigation success stories, and other considerations.

With the planning process taking place entirely in 2020, the precautions necessary to minimize spread of the coronavirus responsible for COVID-19 caused considerable challenges. All public engagement was virtual, from an online survey to virtual public meetings that focused on individual municipalities and small groups of municipalities. A scripted version of a more generic public information presentation was recorded and posted to YouTube with subtitles in various languages. Because all of the WestCOG municipalities have developed prior hazard mitigation plans, WestCOG believes that this level of public engagement was appropriate given the limitations.

Executive Summary

Introduction

This document represents the first multi-jurisdiction hazard mitigation plan to concurrently cover all 18 municipalities in the Western Connecticut region served by WestCOG. Previously, the 10 municipalities that were formerly part of the Housatonic Valley Council of Elected Officials each had standalone single-jurisdiction hazard mitigation plans, while the 8 municipalities that were formerly part of the Southwestern Connecticut Regional Planning Area were covered under a multi-jurisdictional plan. This hazard mitigation plan uses the "Regional Plan-Municipal Annex" format to provide information pertinent to the entire region in one document, with an annex for each member municipality that provides information specific to that community.

As part of this planning process, each municipality identified a Local Coordinator to lead the local planning process, updated its list of critical facilities, provided updates regarding its capabilities, provided updates regarding areas of hazard risk, and noted mitigation successes. The mitigation strategies developed for each municipality under previous planning efforts were reviewed and updated. Finally, new Statewide and regional mitigation strategies have been developed and incorporated.

This hazard mitigation plan adds "Fact Sheets" to make the document livelier and give community planners the flexibility to pull standalone pages out of the plan document when pursuing specific projects, grants, goals, etc. These are interspersed throughout the document and include new initiatives, impacts of climate change, regional challenges, mitigation success stories, and other considerations.

Hazards Impacting the Western Connecticut Region

The Region experiences a variety of weather and other incidents each year. Certain events rise to the level of being considered hazards due to their risk to people, property, and other resources. Natural hazards that affect the Region include high intensity storms such as hurricanes, severe thunderstorms, and severe winter storms. The effect of such severe storms can include related hazards such as flooding, severe winds, and tornadoes. Other natural hazards that may affect the Region include the potential flooding impacts from dam failure, droughts, earthquakes, and wildfires. Finally, WestCOG has chosen to include the potential risk from terrorist actions in this Plan based on the historical record.

Annualized loss estimates from natural hazards have been prepared for each jurisdiction based on analysis using FEMA's HAZUS-MH software, local loss data, or information presented in the 2019 *Connecticut Natural Hazards Mitigation Plan Update*. These estimates are summarized for each community in Table ES-1 below and range from approximately $100,000 per year in Bridgewater to nearly $4.6 million in Stamford. Details regarding these loss estimates are provided in Section 3.3 of this Plan.

Table ES-1: Annualized Loss Estimates by Natural Hazard for WestCOG Municipalities (Thousands of Dollars)

Town	DF	DRO	EQ	FL	HU/TS	Ter.	Thun.	Tor.	WF	WS	Total
Bethel	$2	$10	$76	$17	$204	$171	$14	$3	$7	$39	$543
Bridgewater	<$1	$1	$6	$3	$22	$15	$1	$15	$42	$9	$114
Brookfield	$1	$9	$74	$6	$200	$147	$12	$2	$10	$70	$531
Danbury	$5	$42	$344	$181	$827	$732	$59	$12	$4	$247	$2,453
Darien	$1	$11	$97	$460	$765	$188	$15	$3	$5	$24	$1,569
Greenwich	$4	$32	$436	$951	$1,776	$543	$44	$9	$6	$67	$3,868
New Canaan	$1	$10	$100	$38	$426	$175	$14	$3	$9	$57	$833

Town	DF	DRO	EQ	FL	HU/TS	Ter.	Thun.	Tor.	WF	WS	Total
New Fairfield	$1	$7	$38	$11	$123	$120	$10	$2	$12	$28	$352
New Milford	$1	$20	$95	$85	$253	$232	$24	$230	$10	$80	$1,030
Newtown	$2	$14	$95	$12	$367	$241	$19	$4	$17	$104	$875
Norwalk	$6	$45	$422	$1,266	$2,370	$767	$62	$12	$2	$65	$5,017
Redding	$1	$5	$34	$19	$127	$79	$6	$1	$29	$37	$338
Ridgefield	$2	$13	$117	$22	$353	$216	$17	$3	$12	$57	$812
Sherman	<$1	$2	$11	$13	$32	$31	$3	$1	$50	$8	$212
Stamford	$8	$65	$744	$813	$2,781	$1,120	$90	$18	$2	$107	$5,748
Weston	$1	$5	$39	$90	$168	$89	$7	$1	$16	$23	$439
Westport	$2	$14	$160	$1,122	$1,323	$246	$20	$4	$6	$53	$2,950
Wilton	$1	$9	$115	$49	$298	$158	$13	$3	$12	$55	$713
WestCOG	**$38**	**$314**	**$3,004**	**$5,155**	**$12,417**	**$5,268**	**$429**	**$324**	**$253**	**$1,129**	**$28,331**

Note: DF = Dam Failure, DRO = Drought, EQ = Earthquake, FL = Flooding, HU/TS = Hurricanes / Tropical Storms, Thun. = Thunderstorms, Tor. = Tornadoes, WF = Wildfires, WS = Winter Storms.

Mitigation Goals, Strategies, and Actions

WestCOG and its member municipalities identified a variety of strategies and actions aimed at reducing the risk and/or vulnerability of the Region to hazards over the next five years. While the intended strategies and actions for each municipality are included with the municipal annex, the Regional Plan (Section 5) includes summary tables of these municipal actions to help WestCOG potentially assist multiple communities in implementing common strategies and actions. Furthermore, a table of potential strategies and actions for WestCOG to perform over the next five years is provided.

Planning Process, Plan Implementation, and Plan Maintenance

The Local Coordinators and WestCOG intend to work together over the next five years to annually review the plan, enact strategies and actions, and incorporate the lessons learned during this planning process into other community and regional planning efforts. The availability of a current, FEMA-approved hazard mitigation plan enables WestCOG municipalities to apply for certain types of FEMA grant funding opportunities. WestCOG intends to regionally coordinate the next plan update prior to the expiration of this plan (anticipated to be in 2026) to ensure that the hazard mitigation plan remains up to date and that its member communities remain eligible for these grant opportunities.

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List of Acronyms

ARC	American Red Cross
BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Ratio
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CDC	Center for Disease Control and Prevention
CEDS	Comprehensive Economic Development Strategy
CEQ	Council on Environmental Quality
CIRCA	Connecticut Institute for Resilience and Climate Adaptation
CLEAR	Center for Land Use Education and Research
cm	Centimeter
CT NHMP	Connecticut Natural Hazards Mitigation Plan
CRS	Community Rating System
CTSDC	Connecticut State Data Center
CTDOT	Connecticut Department of Transportation
DEEP	Connecticut Department of Energy and Environmental Protection
DEMHS	Division of Emergency Management & Homeland Security
DESPP	Department of Emergency Services and Public Protection
DMA	Disaster Mitigation Act
DVE	Domestic Violent Extremist
EF	Enhanced Fujita
EAP	Emergency Action Plan
EOP	Emergency Operations Plan
EWP	Emergency Watershed Protection
F	Fujita
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
GIS	Geographic Information System
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HVA	Housatonic Valley Association
LID	Low Impact Development
m/s	Meters per second
MetroCOG	Metropolitan Council of Governments
mph	Miles per hour
NCDC	National Climatic Data Center
NCEI	National Centers for Environmental Information
NFIP	National Flood Insurance Program
NHCOG	Northwest Hills Council of Governments
NIFC	National Interagency Fire Center
NOAA	National Oceanic & Atmospheric Administration
NPDP	National Performance of Dams Program
NRCC	Northeast Regional Climate Center
NRCS	National Resource Conservation Service
NVCOG	Naugatuck Valley Council of Governments
NWS	National Weather Service
POCD	Plan of Conservation and Development
psf	Pounds per square foot
PURA	Public Utility Regulatory Authority
RLP	Repetitive Loss Property
RSI	Regional Snowfall Index
RWIS	Roadway Weather Information System
SFHA	Special Flood Hazard Area
SHPO	State Historic Preservation Office
SRLP	Severe Repetitive Loss Property
STEAP	Small Town Economic Assistance Program
SWRPA	Southwestern Connecticut Regional Planning Area
SVI	Social Vulnerability Index
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WestCOG	Western Connecticut Council of Governments
WUI	Wildland Urban Interface

1.0 Introduction

The Western Connecticut Council of Governments (WestCOG) provides regional services to 18 municipalities in western Connecticut (the Region). Each municipality has a previously adopted Hazard Mitigation Plan (HMP or "Plan"). The purpose of the hazard mitigation planning process is to encourage assessment of natural hazard risks at the regional and local levels as well as the completion of mitigation actions that will reduce that risk.

Natural hazard events and disasters can and do inflict damage on the same locations year after year, requiring repeated reconstruction efforts that become more expensive as the years go by. Hazard mitigation breaks this expensive cycle of recurrent damage and escalating reconstruction costs by preventing damage up front and taking a long-term view of rebuilding and recovery following natural disasters. This requires long-term strategies including planning, policymaking, programs, projects, and other activities.

According to the Federal Emergency Management Agency (FEMA) March 2013 Local Mitigation Planning Handbook, "a mitigation action is a specific action, project, activity, or process taken to reduce or eliminate long-term risk to people and property from hazards and their impacts. Implementing mitigation actions helps to achieve the Plan's missions and goals. The actions to reduce vulnerability to threats and hazards form the core of the Plan and are a key outcome of the planning process. Types of mitigation actions to reduce long-term vulnerability include local plans and regulations, structure and infrastructure projects, natural systems protection, and education and awareness programs."

1.1 Background, Authority, and Purpose

The Federal Disaster Mitigation Act of 2000 (DMA 2000) amended Section 322, "Mitigation Planning" and other sections of the Robert T. Stafford Disaster Relief and Emergency Assistance Act to promote natural hazard mitigation planning. The DMA 2000 requires that local governments have an approved HMP to be eligible to receive Hazard Mitigation Assistance (HMA) project funding. Once approved by FEMA and adopted locally, this multi-jurisdictional plan will fulfill that requirement.

Hazard mitigation planning in the region began in the early 2000s. For some communities, this HMP update ("Plan update") will be their first HMP update; for others, this will be their third HMP update. Table 1-1 presents the years each previous HMP was developed. FEMA requires that local HMPs be updated every five years in order to ensure that the HMP remains current.

Table 1-1:
Hazard Mitigation Plan Approval Dates

Municipality	Initial Plan	1st Update	2nd Update
Bethel	2015		
Bridgewater	2015		
Brookfield	2014		
Danbury	2011	2016	
Darien	2005	2011	2016
Greenwich	2005	2011	2016
New Canaan	2005	2011	2016
New Fairfield	2011	2016	
New Milford	2015		
Newtown	2015		
Norwalk	2005	2011	2016
Redding	2015		
Ridgefield	2015		
Sherman	2011	2017	
Stamford	2005	2011	2016
Weston	2005	2011	2016
Westport	2005	2011	2016
Wilton	2005	2011	2016

Funding for this Plan Update was provided by FEMA (as administered by the Connecticut Division of Emergency Management & Homeland Security (DEMHS)) under DEMHS Grant Number PDMC-PL-01-CT-2018-004, with the required grant match from WestCOG via its 18 municipalities.

The purpose of this HMP is to identify natural hazards likely to affect the Region, assess the region's vulnerabilities to these hazards, review existing mitigation strategies and capabilities, and set forth new mitigation strategies that will reduce the loss of life and property, economic disruptions, and the cost of post-disaster recovery for the region's communities. Unlike emergency management plans already adopted in the region, this HMP focuses on reducing or eliminating the impacts of natural hazards.

This HMP evaluates the risk of the region for damage due to flooding, winter storms, tropical cyclones, tornadoes, thunderstorms, wildfires, drought, earthquakes, dam failure, and terrorism / mass casualty events. This does not preclude the possibility that other natural hazards will affect the region. However, in general any other potential natural hazards are of overall low or negligible risk that they need not be considered in detail for the Region. For example, certain WestCOG communities have concerns regarding tsunamis and mudslides, both of which are discussed herein as potential hazard effects under flooding.

The WestCOG communities recognize their responsibility to protect the health, safety, and welfare of their citizens and will strive to implement the mitigation strategies they propose. However, while this Plan provides a blueprint for local and regional efforts to reduce or eliminate risk to life and property from natural hazards, it does not constitute a mandate, specification, or regulation. Mitigation strategies will be enacted as staff time, budgets, property availability, property owner permission, and the availability of grant funding allow.

1.2 Hazard Mitigation Vision, Goals, Objectives, and Strategies

Each of the 18 WestCOG municipalities had similar goals in their previous HMPs. In general, each municipal goal was to reduce the loss of life and property, and the economic and cultural consequences as a result of natural disasters. Several communities had additional goals which were generally consistent with the above but directed towards one or more specific hazard such as flooding or drought.

When WestCOG was formed in 2014, its member municipalities were either part of a multi-jurisdictional HMP or had single-jurisdiction plans prepared or in progress. In preparing this HMP Update, one of WestCOG's objectives is to standardize the hazard mitigation planning process and plan maintenance schedule for each of its 18 member municipalities.

WestCOG's goal for this planning process is presented below. Consistent with this goal, each municipality developed objectives that could be met through the implementation of various strategies and actions. These objectives, strategies, and actions are presented in each municipal annex.

> WestCOG's goal for this HMP is to reduce loss of life, damage to property and infrastructure, costs to residents and businesses, and municipal service costs due to the effects of natural hazards and disasters. Education of residents and policymakers and the connection of hazard mitigation planning to other community planning efforts are key to achieving this goal, as is the enhancement and preservation of natural resource systems in each member community.

1.3 Document Overview

This plan update builds on the existing *Natural Hazard Mitigation Plan 2016-2021 Update for the South Western Region* as well as single jurisdiction plans prepared for the remaining ten WestCOG municipalities.

This introductory section contains a brief overview of the plan's purpose and discusses the planning process used to develop the HMP. Section 2 introduces the region and its current conditions and emergency response capabilities. Section 3 profiles and evaluates the natural hazards that affect the Region. Section 4 discusses federal, state, regional, and municipal capabilities related to hazard mitigation. Section 5 presents the types of potential mitigation strategies, challenges for implementation, and presents the ranking methodology used to prioritize strategies and actions for implementation. Regional mitigation strategies that are for WestCOG's consideration over the next five years are also presented in Section 5. Section 6 presents the plan implementation process necessary to keep the HMP current. Section 7 presents a variety of technical and financial resources to assist with implementation as well as documenting the references used in preparation of this HMP. Finally, the appendices provide further details on our planning process, critical facilities, historic and cultural resources, and loss estimates.

Annexes were developed for each of the 18 WestCOG municipalities. The annexes present detailed information for each member municipality including capabilities,

vulnerabilities, progress on previous mitigation actions, and new objectives, strategies, and actions to be undertaken over the next five years. Local adoption information is appended to each annex.

1.4 Updates from Previous Plans

As noted above, the previous HMPs developed for the WestCOG municipalities were comprised of ten single jurisdictional HMPs as well as a multi-jurisdictional HMP for the eight southwestern communities. In order to develop one HMP for the entire Region, the information in the previous HMPs were necessarily consolidated into one document. Although the previous multi-jurisdictional HMP in the region did not include separate municipal annexes, including text for all 18 communities within the main body of this HMP document would make the document difficult to use. Therefore, specific details pertinent to each individual municipality are included within a dedicated annex at the end of this document.

While much of the background data for the region is relatively unchanged since development of the previous HMPs for each municipality, this Plan update provides more recent information with regard to the extent of hazards, the impacts of hazards, and an updated historical record. These hazards are all addressed in the 2019 *Connecticut Natural Hazards Mitigation Plan Update* (CT NHMP). Each of these hazards is evaluated for location, extent, and impact including likelihood of occurrence and potential for loss of life and property.

Municipalities in the region continue to possess and maintain a variety of formal and informal hazard mitigation capacities and programs, often known as capabilities. The Plan update identifies and assesses these existing capabilities and proposes new strategies that address identified gaps in current mitigation efforts. Each community also updated its list of mitigation strategies and actions that each community will attempt to achieve over the next five years. The Plan update prioritizes these mitigation strategies and proposes an overall implementation strategy. At a minimum, each community must participate in an annual plan maintenance process to review the stated goal, community objectives, and strategies and actions.

1.5 Planning Process for Plan Update

WestCOG determined that the planning area for this multi-jurisdictional HMP would be the 18 municipalities that comprise the Region. After securing grant funding via application to Connecticut DEMHS, WestCOG identified Local Coordinators for each municipality to assist in coordinating the planning process for each municipality. Table 1-2 presents the local coordinators.

Table 1-2: Municipal Local Coordinators

Municipality	Local Coordinator(s)	Title
Bethel	Thomas Galliford	Fire Marshal
Bridgewater	Curtis Read	First Selectman
Brookfield	Ralph Tedesco	Public Works Director
Danbury	Tim Nolan	Public Services Supt.
Darien	Jayme Stevenson	First Selectman
Greenwich	Dan Warhoza	Emer. Mgmt. Dir.
New Canaan	Tiger Mann	Public Works Director
New Fairfield	Patricia Del Monaco	First Selectman
New Milford	Jack Healy	Public Works Director
Newtown	Rob Sibley	Dep. Dir. of Planning
Norwalk	Michele Deluca Vanessa Valadares Chris Torres Mike Yeosock	Dep. Emer. Mgmt. Dir. Principal Engineer Supt. Of Operations Asst. Dir. of Trans.
Redding	Julia Pemberton	First Selectman
Ridgefield	Rudy Marconi	First Selectman
Sherman	Jim Reilly	OEM Director
Stamford	Erin McKenna	Associate Planner
Weston	Tracy Kulikowski	Land Use Director
Westport	Michele Onofrio Michelle Perillie	Building Assistant Town Planner
Wilton	John Lynch Thomas Conlan	Chief of Police / EMD Captain / EO, Police

The local coordinators serve as municipal liaisons to ensure municipal needs and objectives continue to be identified throughout the 5-year timeframe of the HMP. Local coordinators provided key input for plan development via local planning discussions, two workshops, the local public meetings, and throughout the process in general. In addition to the local coordinators, other municipal staff played a vital role in the development of this HMP. Such individuals were invited to participate in meetings and workshops throughout the

planning process to provide input on municipal capabilities and vulnerabilities.

1.5.1 Local Planning Coordination

To begin the plan update process for each municipality, a local planning discussion was held to discuss several topics with both the local coordinator and other municipal staff. Due to the COVID-19 pandemic, meetings were held remotely using a virtual platform.

Milone & MacBroom gave a brief presentation on the importance and need for hazard mitigation planning, changes to the HMA grant programs, types of hazard mitigation strategies and actions, and recent mitigation successes in the region. Next, MMI lead a discussion geared toward collecting pertinent information regarding past natural hazards and their impacts, changes in emergency response capabilities and critical facilities, progress on previous hazard mitigation plan actions, and potential strategies the municipality would like to pursue by way of mitigation.

Table 1-3 identifies the dates for each of the local planning discussions conducted. In total, 15 of the 18 municipalities participated in the virtual local planning discussions led by MMI, while 3 municipalities chose to hold internal discussions with their staff without MMI involvement due to the ongoing pandemic. These 3 municipalities (Bethel, Bridgewater, and New Fairfield) provided comments and feedback to MMI similar to the information requested at the 15 virtual discussions.

Table 1-3: Local Planning Meeting Dates

Municipality	Date or Information
Bethel	Provided comments and feedback via email
Bridgewater	Provided comments and feedback via email
Brookfield	April 7, 2020
Danbury	April 20, 2020
Darien	April 3, 2020
Greenwich	April 13, 2020
New Canaan	June 11, 2020
New Fairfield	Provided comments and feedback via email
New Milford	April 2, 2020
Newtown	April 2, 2020
Norwalk	April 7, 2020
Redding	March 31, 2020
Ridgefield	June 3, 2020
Sherman	April 27, 2020
Stamford	May 28, 2020
Weston	April 27, 2020
Westport	April 9, 2020
Wilton	June 11, 2020

The presentation and minutes of these discussions can be found in Appendix A.

1.5.2 First Regional Workshop

A regional workshop was held virtually on June 29, 2020 to present preliminary findings to municipalities. Local coordinators and municipal staff were invited to attend and participate in the workshop.

A brief overview of background information was presented to participants, similar to the of the information presented during the local coordination meetings. In addition, MMI presented on various topics including changes in risk and capabilities throughout the region, effects of climate change on natural hazards, and loss estimates based on FEMA Public Assistance, National Centers for Environmental Information (NCEI), and National Flood Insurance Program (NFIP) data.

Three breakout sessions were offered during this workshop to discuss coastal flood risks, riverine flood risks, and wind and snow events resulting in power outages. Appendix B includes documentation from this workshop including the presentation, list of attendees, and breakout session notes.

1.5.3 Public Information Meetings

Eight virtual public information meetings were held in July and August 2020 to encourage public involvement in the hazard mitigation planning process. MMI worked with WestCOG to develop an informational flyer to promote the meetings. A press release was also used to inform residents, and social media posts were made by local communities when possible. Two rounds of announcements were posted in the local editions of the Patch newspaper (www.patch.com). Each meeting was targeted to provide specific information for certain municipalities; while residents of those municipalities were encouraged to participate during their respective meeting, ultimately residents were able to attend any

meeting they chose. The following were the dates of each meeting and the targeted municipalities:

- Thursday July 9, 2020 – Bridgewater, New Fairfield, New Milford, Sherman
- Tuesday July 14, 2020 -Bethel, Brookfield, Newtown
- Thursday July 23, 2020 – Danbury
- Tuesday July 28, 2020 – Redding, Ridgefield, Weston, Wilton
- Thursday August 6, 2020 – Greenwich
- Tuesday August 11, 2020 – Stamford
- Thursday August 20, 2020 – Darien, New Canaan, Westport
- Tuesday August 25, 2020 – Norwalk

Administrators of community Facebook groups and pages were contacted and asked to share information about the potential public engagement opportunities (public information meetings and public survey discussed in Section 3.2. The goal of was to expand the public outreach efforts to residents and businesses that do not regularly review traditional media outlets and therefore were unlikely to see the press release. Table 1-4 presents the Facebook groups who were asked to share information regarding public engagement opportunities.

Table 1-4: Outreach to Facebook Group Administrators

Municipality Served	Group or Page Name	Approximate Members
Bethel	The Bethel, CT Forum – A Social, Economic, and Political Discussion	7,100
Bridgewater	No group available	N/A
Brookfield	Brookfield, CT Business & Happenings	5,600
Danbury	The REAL Danbury, CT Group	1,800
Darien	You know you are from DARIEN CT	3,900
Greenwich	IN Greenwich Greenwich CT Community and Events	4,100 1,700
New Canaan	If you're from New Canaan (CT)…	4,700
New Fairfield & Sherman	New Fairfield / Sherman – Our Town	6,300
New Milford	New Milford, CT – A Wonderful Place to Live, Work, and Visit! New Milford, CT New Milford Ct *Residents Only*	4,000 15,000 1,800
Newtown	Newtown Neighbors Unite	6,800
Norwalk	I Love Norwalk CT!	4,500
Redding	Redding 411	2,800
Ridgefield	Ridgefield, CT	13,300
Stamford	If you're really from Stamford (CT) you'd know…	15,200
Weston	WESTON – a small town with a big heart Weston Connecticut Bulletin Board	3,200 2,300
Westport	Westport Front Porch	7,700
Wilton	Wilton CT 412 Wilton CT 411	6,700 5,600

As part of the virtual public meetings, a poll was utilized to gauge natural hazard awareness and concerns among attendees. The final poll results of the eight public meetings can be found in Section 3.2 based on the 10 attendees who participated in the public information meetings. Appendix C contains public meeting materials including meeting notes, presentation, promotional flyer, and the press release.

Attendees of the public information meetings were primarily concerned with high wind events and somewhat concerned about the effect of climate change on natural hazards, particularly in regard to the potential for more frequent and intense wind events in the future. Attendees were primarily aware of increased emergency alerts and notifications, electric grid resilience, and emergency services projects taking place in their communities. Most attendees desired further projects to increase electric grid resilience as well as natural resource protection projects.

In addition to the live public meetings, a special scripted version of the presentation was developed as a recording and was posted on YouTube and the WestCOG website. The use of this platform allowed for subtitles in English, Spanish, and several other languages. The YouTube video was viewed 86 times through September 30, 2020. Fact Sheets discussing the Virtual Public Meetings and the online video with multilingual subtitles are included on the following pages.

OUTREACH EFFORTS

VIRTUAL PUBLIC MEETINGS

Flyer advertising public meetings

WHAT WAS ACCOMPLISHED?

WestCOG held eight meetings for local residents to learn about the Hazard Mitigation Plan update process, ask questions, and provide input for the update.

Meetings were held virtually using the Zoom Workshop platform, and each meeting focused on a different portion of the region (although members of the public were invited to attend any meeting that worked for their schedule).

Attendees were encouraged to participate by asking questions or making comments through the Zoom chat functions, responding to polls presented through the Zoom platform, or speaking during a final open-discussion period.

Questions and comments brought by the public during these meetings informed plan development by highlighting hazards of concern, existing community capabilities and gaps in those capabilities, and specific actions recommended for future pursuit.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Some key input from the meetings is summarized below:

Concerns:

- High Wind Events
- Snow Events
- Extreme Temperatures
- Riverine & Flash Flooding
- Wildfire

Mitigation Needs:

- Electric Grid Resilience
- Structural Projects & Property Protection
- Emergency Services, Alerts, and Notifications
- Public Education & Awareness

Tornadoes in 2018 and Tropical Storm Isaias in 2020 have brought high wind hazards to the forefront in people's minds, which in turn affected meeting discussions.

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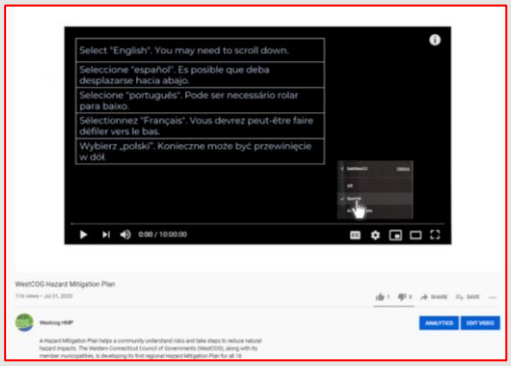
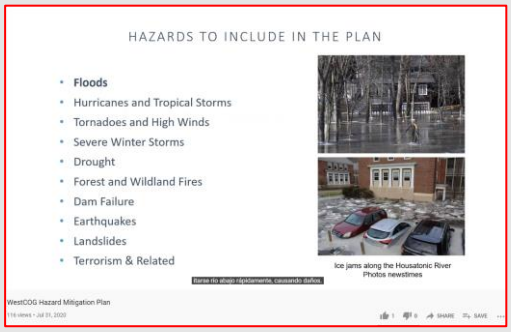
OUTREACH EFFORTS

ONLINE VIDEO WITH MULTILINGUAL SUBTITLES





Screenshots of presentation video
Photo: Youtube

WHAT WAS ACCOMPLISHED?

Maximizing public participation in the Hazard Mitigation Planning process was a top focus of WestCOG. As part of this effort, WestCOG recorded a video-friendly version of its public meeting presentation to post on a YouTube page created for the project.

The video summarizes the hazard mitigation planning process, describes hazards of concern in the region, and discusses mitigation approaches.

Links to an online survey are presented to encourage feedback from watchers, and links to a project website are provided to encourage further participation.

As an additional effort to make the planning process accessible to as many regional residents as possible, subtitles for the presentation were generated in English, Spanish, Portuguese, French, and Polish. Instructions for activating subtitles are provided in each language at the beginning of the video.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Creating a video for public engagement enables a broader cross-section of the population to participate in the planning process by allowing viewers to engage whenever is convenient to them.

The video will be available indefinitely and can be used by the region and its communities whenever needed over the course of the planning process.

By providing multilingual subtitles, the region increases the reach of its engagement still further by including residents and workers who prefer to participate in a language other than English, or who otherwise require subtitles to follow a presentation.

Public participation is essential to successful implementation of any planning project, including hazard mitigation. Municipalities should continue to engage using multiple approaches and platforms in the future.

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1.5.4 Second Regional Workshop

The second regional workshop was held virtually on October 1, 2020 to present preliminary hazard mitigation strategies and actions to the local planning teams. Local coordinators and municipal staff were invited to attend and participate in the workshop.

Topics discussed at the meeting included a brief risk assessment update, the public comments received, and hazard mitigation goals, objectives, and strategies. Guest presentations were provided regarding the Sustainable CT program and the Resilient Connecticut project; and statewide mitigation initiatives were discussed. Fact sheets describing the Sustainable CT program and the Resilient Connecticut project can be found after this page. These are two of the primary new hazard mitigation initiatives incorporated by WestCOG for its communities.

Three breakout sessions were offered during this workshop to again discuss coastal flood risks, riverine flood risks, and wind and snow events resulting in power outages. Appendix B includes documentation from this workshop including the presentation, list of attendees, and breakout session notes.

1.5.5 Outreach to Neighboring Communities

In addition to the opportunity provided to the general public to participate in the online survey for this planning process, communities adjacent to the Region were invited to provide comment on this process by letter dated November 30, 2020. This letter was addressed to adjacent county governments in New York State and regional councils of government in Connecticut. A copy of this letter is provided in Appendix C.

1.5.6 Review of Draft Plan

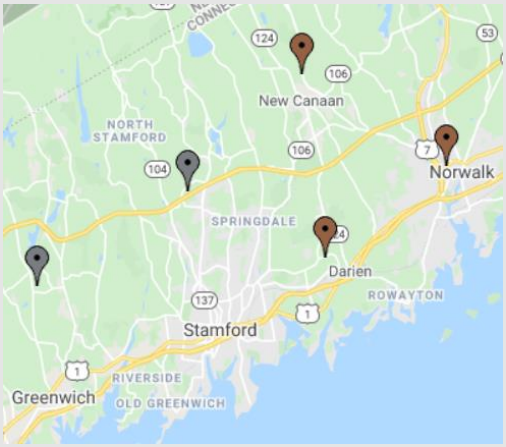
The initial draft HMP and municipal annexes were made available to local coordinators for review and comment in November 2020. Comments were provided from December 2020 through February 2021 and addressed for the final draft HMP.

The final draft HMP including all municipal annexes was made available for public review and comment on March 3, 2021 with comments due on March 31, 2021. The HMP was publicly posted on the WestCOG website. Member municipalities were requested to provide a link to the WestCOG site from their home page to encourage public review. Reviewers were requested to submit comments through a dedicated link on the WestCOG site. One public comment was received during this period which led to an additional strategy for the Town of Brookfield.

Following incorporation of public comments, the HMP was submitted to Connecticut DEMHS for review and comment on April 2, 2021. Following review by Connecticut DEMHS, that agency submitted the HMP to FEMA for review and comment. Once the document is approved by FEMA pending adoption, WestCOG coordinates adoption by local governing bodies (Section 6.1). Copies of local adoption resolutions are appended to each municipal annex. As required by FEMA, Plan submission and approval dates are included on the cover of this HMP.

NEW INITIATIVES

SUSTAINABLE CT



Images courtesy of Sustainable CT

FOR MORE INFORMATION

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Willimantic, CT 06226
(860) 465-2813

Sustainable CT Mailing Address:
83 Windham St
Willimantic, CT 06226

https://sustainablect.org/about/contact-us/

WHAT IS THE INITIATIVE?

Sustainable CT is a voluntary certification program to recognize thriving and resilient Connecticut municipalities. An independently funded, grassroots, municipal effort, Sustainable CT provides a wide-ranging menu of best practices. Municipalities choose Sustainable CT actions, implement them, and earn points toward certification.

Sustainable CT also provides opportunities for grant funding to help communities promote economic well-being and enhance equity, all while respecting the finite capacity of the natural environment. The program is designed to support all Connecticut municipalities, regardless of size, geography or resources. Sustainable CT empowers municipalities to create high collective impact for current and future residents.

The Sustainable CT mission statement is:

To provide municipalities with a menu of coordinated, voluntary actions to continually become more sustainable; to provide resources and tools to assist municipalities in implementing sustainability actions and advancing their programs for the benefit of all residents; and to certify and recognize municipalities for their ongoing sustainability achievements.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Sustainable CT provides a “Master Action List” to serve as a resource as communities track progress towards certification. Many actions are consistent with the goals of hazard mitigation and, if accomplished, may demonstrate progress with hazard mitigation. Examples include:

- Identify, or create and disseminate, a toolkit for pre-disaster business preparedness and for post-disaster conditions.
- Review and revise regulations to encourage and promote LID.
- Review the POCD and adopt a revised POCD that includes the Hazard Mitigation Plan goals and at least three other sustainability concepts.
- Conduct a Climate Vulnerability Assessment, identify how the impacts of climate change will likely affect the community, and demonstrate consideration has been given to low-income residents and their vulnerability to extreme weather events.

All towns in the region have a Climate Vulnerability Assessment in their respective annex of the Hazard Mitigation Plan. In addition, the annexes of communities not registered with Sustainable CT have an action to register; those of communities already registered have an action to pursue one of the other actions listed above.

The towns of Brookfield, Darien, New Milford, Ridgefield, Weston, Westport, and Wilton are Bronze Certified Communities. The Town of Greenwich and the City of Stamford are Silver Certified Communities.

NEW INITIATIVES

RESILIENT CONNECTICUT

Resilient Connecticut

Resilient Connecticut

FOR MORE INFORMATION

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WHAT IS THE INITIATIVE?

The Connecticut Institute for Resilience and Climate Adaptation (CIRCA) began the Resilient Connecticut initiative in 2018. Resilient Connecticut aims to establish resilient coastal communities through the Resilience Framework, which includes:

- Supporting healthy buffering ecosystems
- Fostering critical infrastructure that is adapted to withstand occasional flooding
- Establishing resilient and strong connections between critical services, infrastructure, and transport hubs
- Increasing investment in identified "Resilience Zones" that will increase economic resilience by strongly tying-back to regional transportation networks and economic opportunities.

The initiative is currently in Phase II, which consists of regional and municipal resilience planning and engagement efforts built around the Resilience Framework.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Resilient Connecticut is working to make the planning components of Phase II well-aligned with municipal hazard mitigation strategies.

Resilient Connecticut specifically focuses on communities with major highways and passenger rail lines, and communities with transit-oriented development (TOD) potential. In the region, these communities are Danbury, Bethel, Ridgefield, Redding, Wilton, Westport, New Canaan, Norwalk, Darien, Stamford, and Greenwich. Each of these municipal annexes in this HMP includes an action to "Collaborate with CIRCA on the 'Resilient Connecticut' project."

WestCOG communities can accomplish this by:

- Participating in Resilient Connecticut engagement efforts.
- Recognizing "zones of shared risk" that may not follow political boundaries.
- Look for options to link "zones of shared risk" with more resilient areas by establishing resilient corridors.
- Visiting https://resilientconnecticut.uconn.edu/ to learn more.

2.0 Regional Profile

The Region is comprised of 18 municipalities which extend from the southwest "panhandle" of Fairfield County north along the western Connecticut border to include towns in southern Litchfield county as shown on Figure 2-1. This region is a compilation of the former South Western Regional Planning Agency (SWRPA) and the Housatonic Valley Council of Elected Officials regions. The WestCOG member municipalities include:

Town of Bethel	Town of Newtown
Town of Bridgewater	City of Norwalk
Town of Brookfield	Town of Redding
City of Danbury	Town of Ridgefield
Town of Darien	Town of Sherman
Town of Greenwich	City of Stamford
Town of New Canaan	Town of Weston
Town of New Fairfield	Town of Westport
Town of New Milford	Town of Wilton

These 18 municipalities are diverse in many ways, varying between urban, suburban, and rural; hilly and flat; and densely and sparsely populated. They have differing levels of economic activity, educational attainment, and ethnic diversity. They enjoy varying levels of accessibility via highways, rail lines, and bus routes. However, they share many common goals, including a strong commitment to protecting their economic interests and businesses from the ravages of natural hazards.

Five of these municipalities have direct coastal frontage on Long Island Sound. Several other municipalities are located less than 10 miles from the coast, while others are located farther inland. The geographic setting has an influence on the frequency and types of natural hazards that can affect the region as discussed in the next section.

2.1 Geographic Setting

2.1.1 Physical Setting

The region is located in the northeastern portion of the Greater New York City metropolitan area and is a gateway region into Connecticut. It is bounded to the west by Westchester County, Putnam County, and Dutchess County, New York; to the north by the Northwest Hills Council of Governments (NHCOG), and to the east by the Naugatuck Valley Council of Governments (NVCOG) and the Connecticut Metropolitan Council of Governments (MetroCOG) communities.

Many municipalities in the region have hilly topography and forested slopes. Other towns are relatively flat, with higher concentrations of prime and statewide-important farmland soils. Topography in the region ranges from sea level along the coastline to over more than 1,000 feet in some parts of Sherman and New Milford. The change in topography means that inland communities can experience significantly different weather and hazard event impacts.

Major transportation routes in the region include Interstate 95 and the Merritt Parkway which traverse southern Connecticut and connects to Interstate 91 in New Haven and Wallingford, respectively, Route 7 running north from Interstate 95 into New Milford, and Interstate 84 connecting Interstate 684 in New York to Hartford (Interstate 91) and Worcester, Massachusetts. All municipalities in the region access these major routes through local and state highways.

2.1.2 Geology

Geology is important to the occurrence and relative effects of natural hazards such as floods and earthquakes. Thus, it is important to understand the geologic setting and variation of bedrock and surficial formations in the Region. Geologic information discussed in the following section was acquired in Geographic Information System (GIS) format from the United States Geological Survey and the Connecticut Department of Energy and Environmental Protection (DEEP).

Bedrock Geology

The Region is located in the northeastern part of the Appalachian Orogenic Belt or the "Appalachian Highlands". Bedrock is generally characterized by deformed sedimentary rocks cut through by numerous thrust faults. The most significant thrust fault is Cameron's Line which runs from New Jersey into Greenwich and along the western portion of the region into Ridgefield. In general, these faults are no longer active and are believed to pose little earthquake hazard. Figure 2-2 presents bedrock geology in the region.

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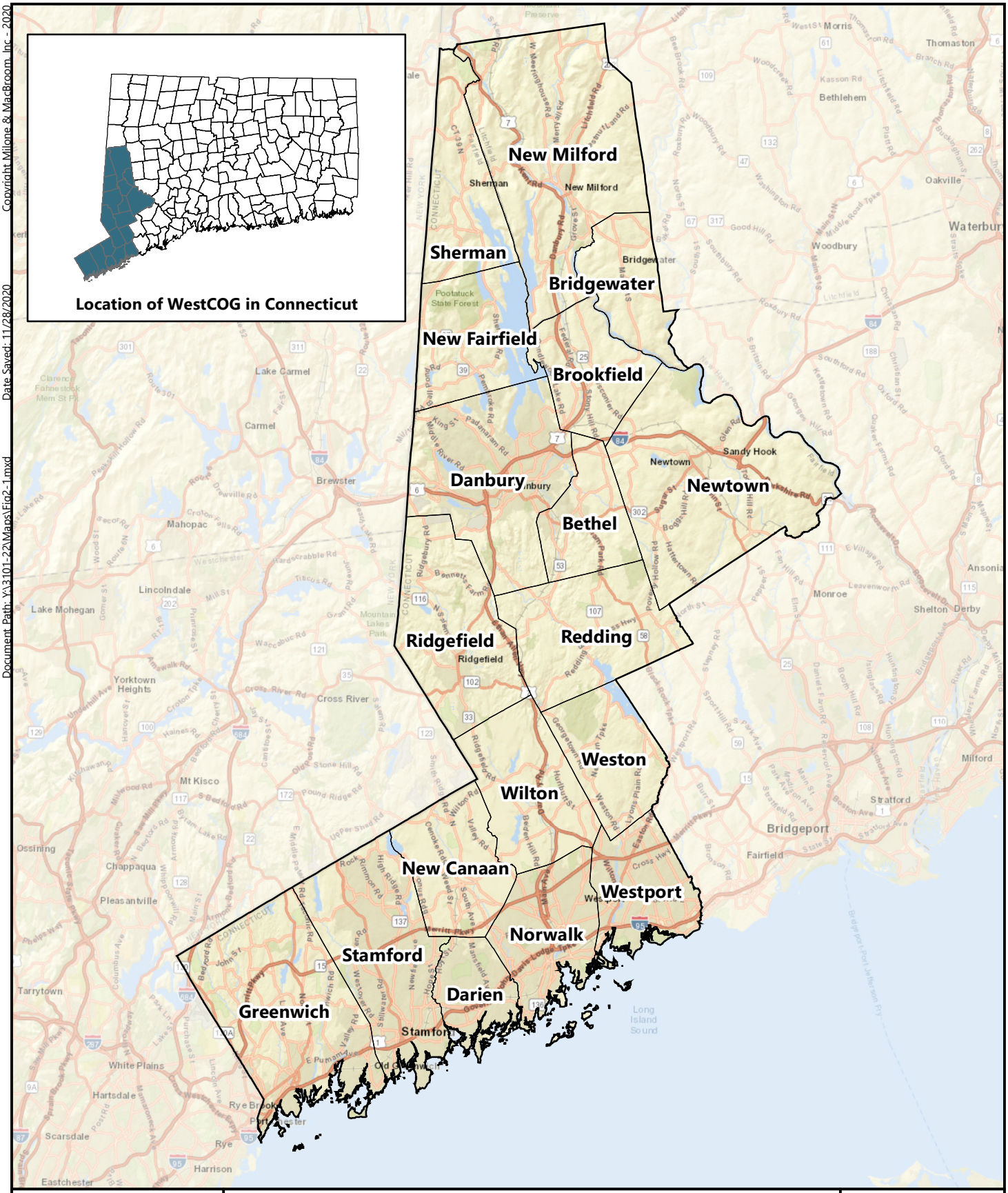

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LOCATION MAP

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1 RIVERSIDE ROAD
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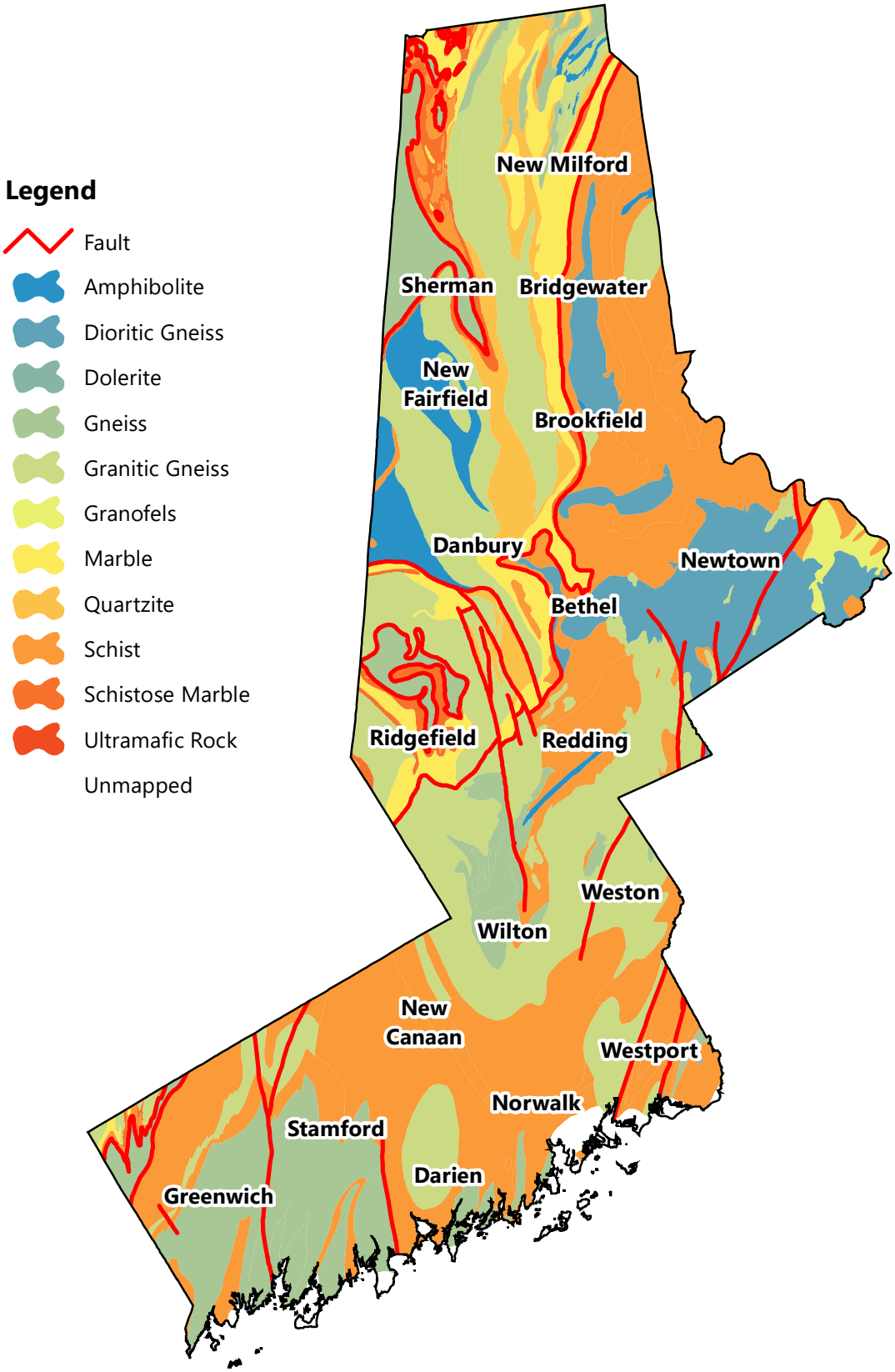
FIG. 2-1



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BEDROCK GEOLOGY

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FIG. 2-2

Surficial Geology

Continental ice sheets moved across Connecticut at least twice in the late Pleistocene era. As a result, the regional surficial geology is characteristic of the depositional environments that occurred during glacial and postglacial periods.

The Region is covered primarily by glacial till (Figure 2-3). Glacial till contains an unsorted mixture of clay, silt, sand, gravel, and boulders deposited by glaciers as a ground moraine. The deposits are generally less than 50 feet thick, although deeper deposits of till are scattered across the region such as in New Milford. Stratified glaciofluvial deposits are generally coincident with stream corridors in each community.

Stratified Glacial Meltwater Deposits

Stratified glacial meltwater deposits are generally coincident with riverine floodplains. These materials were deposited in valleys by glacial streams, and these valleys were later inherited by the larger of our present-day streams and rivers. Large deposits are often associated with public water supply aquifers or wetland areas that provide significant floodplain storage. The smaller glacial till watercourses throughout the region can also cause flooding.

The amount of stratified drift also has bearing on the relative intensity of earthquakes.

Soil Types

The type of soil present affects the ability of precipitation to infiltrate the ground, which in turn affects the timing and magnitude of flooding. According to the United States Department of Agriculture (USDA), soils in the region primarily range from being well-drained to excessively drained, with. poorly drained and very poorly drained wetland soils occupying low lying areas. The ability of soils to encourage infiltration is reduced due to the presence of impervious surfaces that restrict or prevent infiltration.

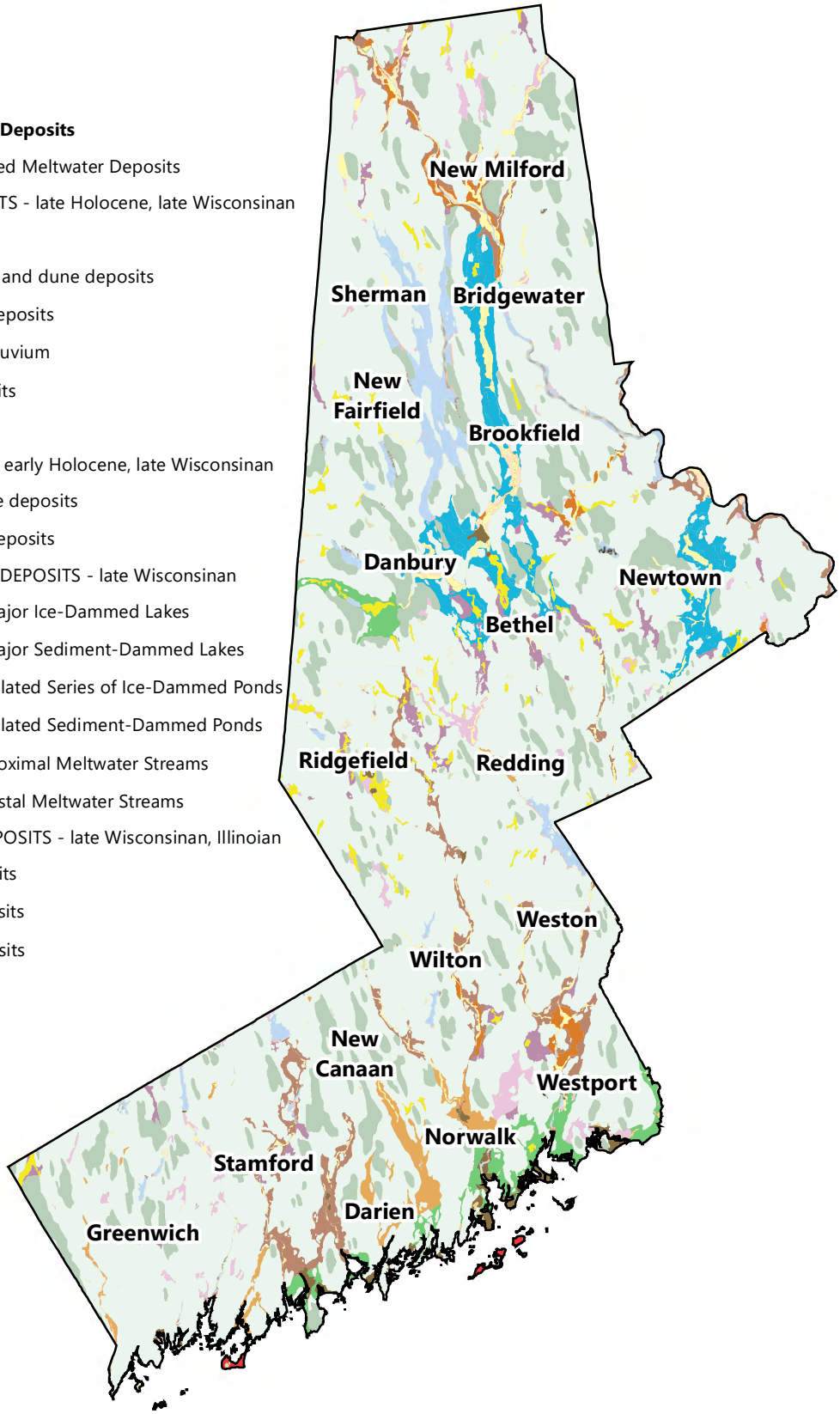
2.1.3 Climate and Climate Change

The region's climate, like the state's, is dominated by a relatively even distribution of precipitation across four seasons, a significant range in temperatures both seasonally and daily, and significant variability in weather over brief time spans as well as across years. Generally, the region has a moderate climate with maximum temperatures ranging from 35^0 to 40^0 in winter to 80^0 to 85^0 in summer. Average annual precipitation is about 46 inches although this can vary widely, and the amount of precipitation may be changing as the climate changes. About 40 inches of snow can be expected per year, with wide variation across the hills and valleys of the region, and again, with wide variation from year to year.

Climate change is expected to impact temperature, precipitation, and wind patterns and could cause a change in the frequency or intensity of natural hazards such as floods, droughts, winter storms, and damaging rain storms. Climate change is projected to result in an acceleration of observed rates of relative sea level rise. The 2019 Connecticut Natural Hazard Mitigation Plan Update identifies sea level rise as a natural hazard affecting the state. The state plan evaluated the impact of rises in sea level ranging from 0.5 to 5.0 feet relative to mean sea level. The state analysis determined that a number of state-owned facilities and other critical facilities such as fire stations, EMS and law enforcement structures, and storage tank farms in Fairfield, New Haven, and New London counties could be exposed to the risks associated with sea level rise.

Connecticut's lawmakers adopted Public Act No. 18-82, "An Act Concerning Climate Change Planning and Resiliency" in 2018. This Act mandates that sea level rise be considered during planning projects and requires municipalities to consider sea level rise scenarios when preparing hazard mitigation plans. Refer to the following fact sheet for more information about sea level rise.

Many researchers have shown that average annual precipitation in Connecticut has been increasing by 0.95 inches per decade since the end of the 19th century (Miller et al., 1997; NCDC, 2005). In recent years, much of this increase is attributed to extreme storms. Winter has also produced extreme storms in recent years such as the winter of 2010-2011, which saw upwards of 80 inches of snowfall in parts of Connecticut. The increase in precipitation, along with sea level rise and the potential for increased heavy snowfall during the winter months, must be accounted for in regional planning.



Legend

Quaternary Geology Deposits

- Undifferentiated Meltwater Deposits

POSTGLACIAL DEPOSITS - late Holocene, late Wisconsinan

- Artificial fill
- Coastal beach and dune deposits
- Tidal-marsh deposits
- Flood-plain alluvium
- Swamp deposits
- Talus

EARLY POSTGLACIAL - early Holocene, late Wisconsinan

- Stream-terrace deposits
- Inland dune deposits

GLACIAL MELTWATER DEPOSITS - late Wisconsinan

- Deposits of Major Ice-Dammed Lakes
- Deposits of Major Sediment-Dammed Lakes
- Deposits of Related Series of Ice-Dammed Ponds
- Deposits of Related Sediment-Dammed Ponds
- Deposits of Proximal Meltwater Streams
- Deposits of Distal Meltwater Streams

GLACIAL ICE-LAID DEPOSITS - late Wisconsinan, Illinoian

- Thin till deposits
- Thick till deposits
- Moraine deposits

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SURFICIAL GEOLOGY

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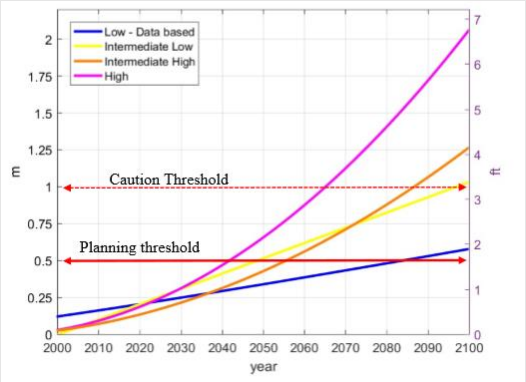
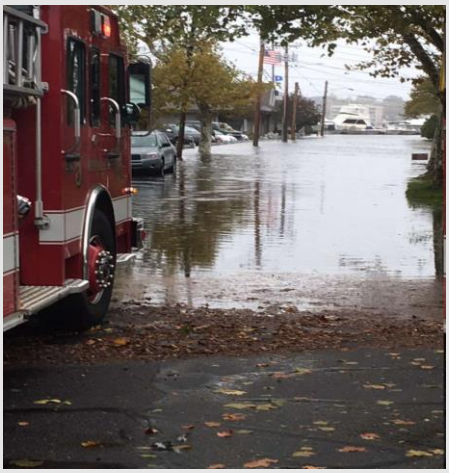
FIG. 2-3

REGIONAL CHALLENGES

SEA LEVEL RISE



Connecticut sea level rise projections showing observation and model based predictions, with the planning and caution thresholds.



Flooding in Norwalk
Photo CT Post

FOR MORE INFORMATION

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WHAT IS THE CHALLENGE?

Global sea level rise (SLR) is accelerating as land ice melts and ocean water expands due to heat absorption associated with climate change.

SLR impacts both human development and the environment. Rising seas cause more flood events along the coast, and along water-bodies connected to the coast. This flooding affects homes, business, utilities, and infrastructure. Higher sea levels can also harm coastal ecosystems like saltmarshes, impact groundwater resources, and alter currents and sediment dynamics.

SLR also increases the severity of flooding associated with storm events. If the water is higher to begin with, the flooding from storm surge and precipitation will be deeper and more widespread.

Communities impacted by SLR and coastal flooding must continually implement and review mitigation actions to make sure they are appropriate for the most recent SLR figures and projections. Regional variations in SLR rates can be significant and must be considered for local planning. Observations show that the sea level in Long Island Sound is rising at a more rapid rate than the global SLR projections.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

WestCOG includes five coastal towns that are directly impacted by sea level rise. Areas of Greenwich, Stamford, Darien, Norwalk, and Westport already experience nuisance flooding during some high tide events, and flooding will worsen as sea levels continue to rise.

The Connecticut Institute for Resilience and Climate Adaptation (CIRCA) has developed regional projections for Connecticut, and has recommended that planning anticipate a **0.5 meter (1 foot, 8 inch) rise in sea level by 2050.** Beyond the year 2050, SLR projections diverge significantly; for 2050, the difference between the lowest and highest CIRCA projection is approximately 0.3 meters, and for 2100 the difference is almost 1.5 meters.

Connecticut's lawmakers adopted Public Act No. 18-82 "An Act Concerning Climate Change Planning and Resiliency" in 2018. This Act mandates that sea level rise be taken into account during planning projects, and requires municipalities to consider sea level rise scenarios when preparing hazard mitigation plans.

The State Water Plan (2018) notes that there is general consensus in the climate models for a hotter and wetter future. Mean annual temperature changes for the 2080 planning horizon, compared to historical baseline, range from approximately +0.5 ˚C to + 6.5 ˚C. Mean annual precipitation changes range from approximately -5% to +30%, with most of the projections predicting an increase in mean annual precipitation.

According to the Connecticut *State Water Plan* (2018) climate change analysis, climate models project a year-round increase in temperature. Projected temperature changes appear relatively consistent across calendar months and percentile levels for each of the scenarios. In other words, both summer and winter temperatures are projected to increase by similar amounts, and a similar shift is observed for both extreme cold and extreme hot months. Precipitation projections are more variable although consistently projecting a generally wetter future for all four scenarios. The largest precipitation increases are projected for the wetter months, including extreme wet months. It follows, then, that the seasonality plots show that winter and spring precipitation changes are projected to be larger than summer and autumn changes. Drier months are generally projected to remain about the same in terms of both frequency and rainfall level. Small decreases in extreme dry month precipitation are projected for the "hot/dry" scenario.

As climate continues to change, the Region must consider not just the past and present but also potential future conditions. As the expectation is that the precipitation magnitude associated with smaller, more frequent storms is expected to increase, design standards will likely need to continue to increase to compensate. Furthermore, with the expectation that the precipitation magnitude associated with larger, less frequent storms is also expected to increase, more efficient and effective stormwater management controls will be necessary to mitigate flash and poor drainage flooding.

The Connecticut Institute for Resilience & Climate Adaptation (CIRCA) has conducted a number of key studies over the last few years related to climate change. Beyond addressing phenomena such as sea level rise that predominantly impact coastal areas, CIRCA's efforts encompass climatic changes relevant to inland communities, including changes to precipitation, drought, temperature, and inland flooding. CIRCA also funds climate adaptation planning in Connecticut's inland communities; for example, by contributing funding to local hazard mitigation planning. Some of CIRCA's research relevant to the Region is highlighted on Fact Sheets in the appropriate risk sections for flooding and droughts. These pages are designed to be removed as needed by the Region's community leaders and used to support initiatives related to climate change.

2.1.4 Hydrology

One concern raised by continued development in the region is its impact on natural systems, particularly hydrologic systems. Due to its geographic location and topographic variability, actions taken in the region have the potential to impact areas that are quite distant, and actions in upstream communities have the potential to impact downstream communities.

Several rivers run through the region, including the Housatonic, Still, Saugatuck, Norwalk, Fivemile, Mianus, and Byram. These rivers along with myriad streams and brooks feed into and flow from several lakes, ponds, and reservoirs. Candlewood Lake in Sherman, New Milford, New Fairfield, Brookfield, and Danbury is by far the largest lake in the Region. Stream corridors are presented in Figure 2-4.

Water from the region drains into three of the state's major watershed basins: the Housatonic, Hudson, and Southwest Coast. On route to its final destination in Long Island Sound, water may navigate any of 11 regional basins that reach from Massachusetts nearly all the way to Connecticut's shoreline as shown on Figure 2-4.

The concentration of development next to bodies of water introduced increased risk of flooding and erosion. Flooding from rivers already has dramatic impacts on the region's municipalities, rendering roads impassable and flooding homes and businesses. Coastal catastrophic flood events punctuate the region's historical record and have left indelible marks on the natural and built environment. Flooding is discussed in more detail in Section 3.3.1.

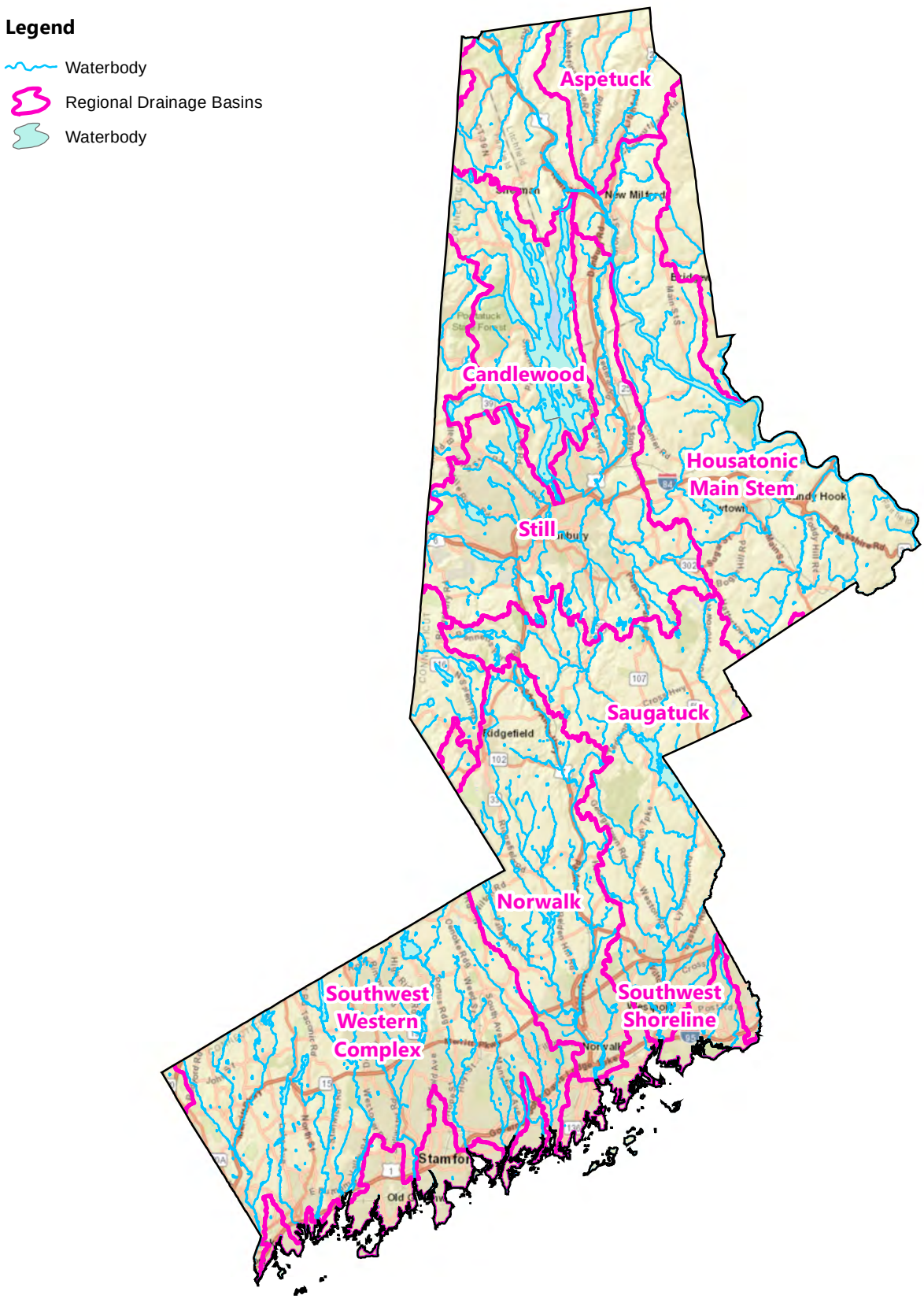

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FIG. 2-4

2.2 Cultural Setting

Many municipalities in the Region exhibit a typical development pattern for New England: dense population centers (often more than one per municipality) clustered around rivers or the shoreline, where mills and other businesses were once located. These population centers may have a rich mix of uses, with additional residential development spiraling outward, creating relatively compact villages. While this historic pattern can result in picturesque community centers, it has also in many cases increased the potential for flood damage. Development in recent decades has largely abandoned the traditional centralized pattern, and followed a more sprawling pattern, with new development radiating out ever further from traditional population centers and filling in the open space and former agricultural fields that once separated village centers.

2.2.1 Demographic Setting and Trends

Population and Aging

The Region is considered one of the most heavily populated and densely developed areas in Connecticut. According to the 2010 U.S. Census, the total population for the Region was 589,135 or 16.5% of the State's total population. Table 2-1 presents the population and population density for each WestCOG municipality. Figure 2-5 presents population density by Census tract.

Table 2-1: 2010 Census Population and Density

Municipality	Population	Land Area (sq. mi.)	Population Density
Bethel	18,584	16.9	1,099.6
Bridgewater	1,727	16.4	105.3
Brookfield	16,452	19.8	835.5
Danbury	80,890	41.9	1,930.5
Darien	20,732	12.7	1,632.4
Greenwich	61,171	47.6	1,285.1
New Canaan	19,738	22.2	889.1
New Fairfield	13,881	20.4	680.4
New Milford	28,142	61.6	456.9
Newtown	27,560	57.7	477.6
Norwalk	85,603	22.9	3,738.1
Redding	9,158	31.5	290.7
Ridgefield	24,638	34.5	714.1
Sherman	3,581	21.9	163.5
Stamford	122,643	37.6	3,261.8
Weston	10,179	19.8	514.1
Westport	26,391	20.0	1,319.6
Wilton	18,062	26.8	674.0
WestCOG	**589,135**	**532.1**	**1,107**
State of CT	**3,574,097**	**4,842.4**	**738.1**

Source: U.S. Census Bureau

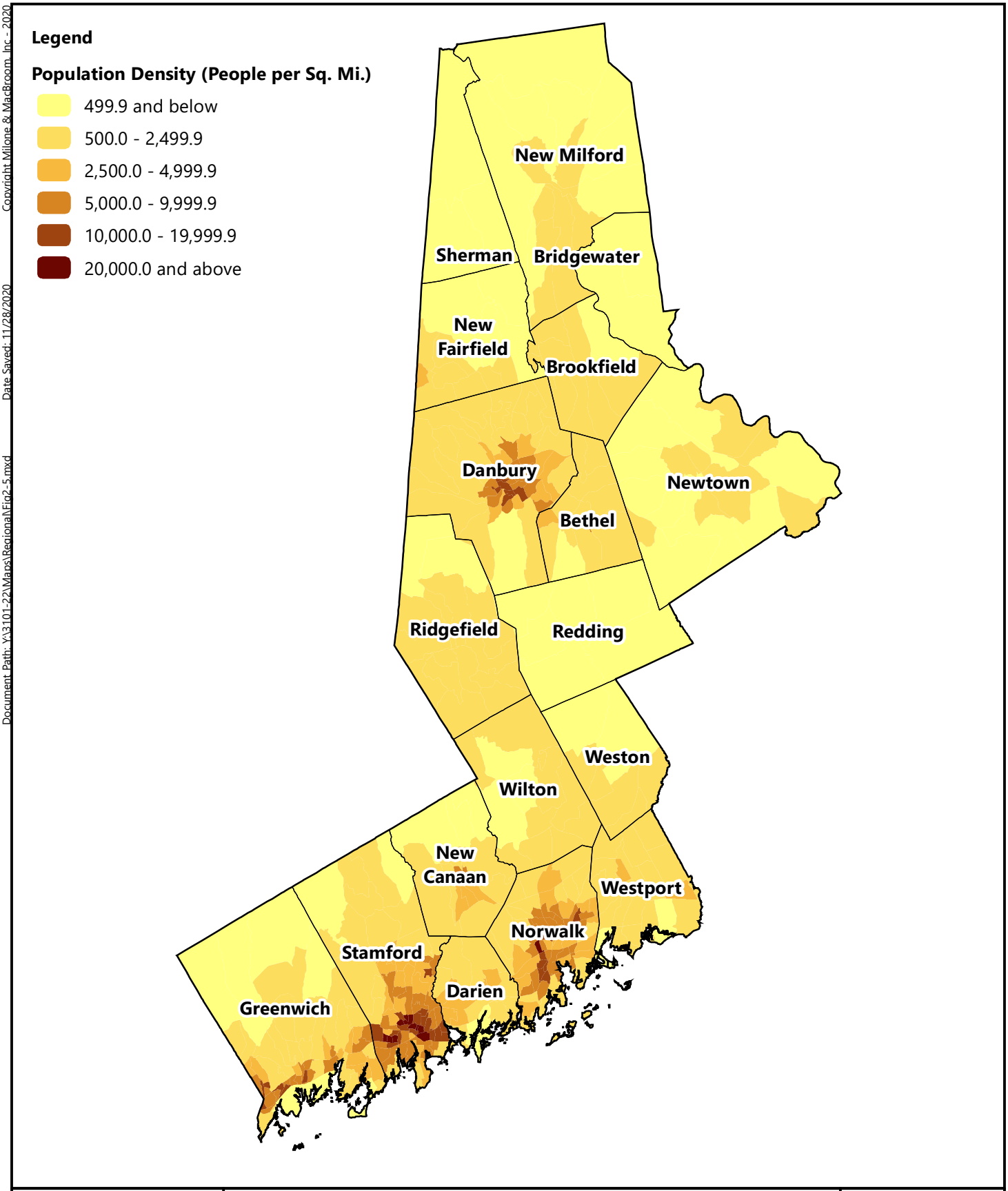
Since 2010, the population of the region has grown by about 3.5% according to the 2018-2019 U.S. Census estimates (Table 2-2). The fastest growth was seen in Westport (7.9% increase). The slowest growth was in New Milford (4.6% decrease in its population). According to the Connecticut State Data Center (CTSDC), the population in the Region is projected to significantly contract by 7.1% over the next 20 years.

Table 2-2: Population Growth

Municipality	2010 Population	2019 Estimate	Percent Change
Bethel	18,584	19,800	6.4%
Bridgewater	1,727	1,706	-1.2%
Brookfield	16,452	16,973	3.2%
Danbury	80,890	84,694	4.7%
Darien	20,732	21,728	4.9%
Greenwich	61,171	62,840	2.7%
New Canaan	19,738	20,233	2.3%
New Fairfield	13,881	13,878	-0.1%
New Milford	28,142	26,805	-4.6%
Newtown	27,560	27,891	1.2%
Norwalk	85,603	88,816	3.7%
Redding	9,158	9,116	-0.3%
Ridgefield	24,638	24,959	1.3%
Sherman	3,581	3,641	1.7%
Stamford	122,643	129,638	5.7%
Weston	10,179	10,252	0.6%
Westport	26,391	28,491	7.9%
Wilton	18,062	18,343	1.7%
WestCOG	**589,135**	**609,804**	**3.5%**
State of CT	**3,574,097**	**3,565,287**	**-0.2%**

Source: U.S. Census Bureau

While the overall Region is expected to lose population, projections for individual municipalities vary as shown in Table 2-3. The population of Danbury is projected to grow by 11.7% over this timeframe, while Bridgewater (-45.2%), Greenwich (-25.0%), New Fairfield (-47.2%), Sherman (-50.5%), and Weston (-31.7%) are projected to lose population. The CTSDC figures are believed to be



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POPULATION DENSITY BY CENSUS BLOCK GROUP

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FIG. 2-5

Table 2-3: Population Projections

Municipality	2019 Estimate	2040 Estimate	Percent Change
Bethel	19,800	15,006	-24.2%
Bridgewater	1,706	935	-45.2%
Brookfield	16,973	14,513	-14.5%
Danbury	84,694	94,604	11.7%
Darien	21,728	22,251	2.4%
Greenwich	62,840	47,129	-25.0%
New Canaan	20,233	18,563	-8.3%
New Fairfield	13,878	7,325	-47.2%
New Milford	26,805	22,720	-15.2%
Newtown	27,891	28,220	1.2%
Norwalk	88,816	90,248	1.6%
Redding	9,116	9,007	-1.2%
Ridgefield	24,959	22,188	-11.1%
Sherman	3,641	1,803	-50.5%
Stamford	129,638	128,829	-0.6%
Weston	10,252	7,006	-31.7%
Westport	28,491	21,690	-23.9%
Wilton	18,343	14,645	-20.2%
WestCOG	**609,804**	**566,682**	**-7.1%**
State of CT	**3,565,287**	**3,653,954**	**2.5%**

Source: U.S. Census Bureau (2019) and Connecticut State Data Center (2040)

misleading for the long-term; most planners believe that populations will remain flat or increase.

While the population of Connecticut has been considered to be aging over the past two decades, projections suggest that this will change over the next two decades. According to the U.S. Census, approximately 23% of the region's total population is 60 years old or older. The CTSDC projects that the population aged 60 and older in every WestCOG municipality will decrease over the next 20 years with the exception of Newtown (Table 2-4). The overall reduction across the region is projected to be approximately 20.6%. The total population of the Region in 2040 is projected to be 566,682, of which 112,521 or 19.9% will be 60 or older. The CTSDC projection differs from WestCOG's in its Regional Plan of Conservation and Development (POCD), which anticipates the senior population to increase in the region.

This demographic shift presents potential difficulties in mitigating and responding to hazardous conditions. Older populations may be less mobile, more dependent on neighbors and family, and less able to evacuate or survive in isolation. They may also be unable to endure extended periods without heat or electricity. Facilities caring for the older populations need to be equipped with supplies that can allow residents to shelter in place. Municipalities must consider added need for medical sheltering. Therefore, resilience plans for an aging population must address protection of critical facilities and vulnerable populations to ensure that all residents are able to weather natural hazard events. However, the projected reduction in population (and by extension, potential municipal revenue) may reduce community capabilities to assist these populations.

Table 2-4: Current and Projected Population Aged 60 and Above

Municipality	2018 Estimate	2040 Estimate	Percent Change
Bethel	4,247	3,983	-6.2%
Bridgewater	674	347	-48.5%
Brookfield	4,192	3,519	-16.1%
Danbury	21,428	15,296	-28.6%
Darien	3,699	2,935	-20.7%
Greenwich	14,287	11,341	-20.6%
New Canaan	4,383	2,417	-44.9%
New Fairfield	3,659	2,104	-42.5%
New Milford	6,440	6,309	-2.0%
Newtown	6,438	7,848	21.9%
Norwalk	20,716	16,169	-21.9%
Redding	2,573	2,484	-3.5%
Ridgefield	6,059	4,421	-27.0%
Sherman	1,169	609	-47.9%
Stamford	29,016	23,960	-17.4%
Weston	2,202	1,422	-35.4%
Westport	6,378	4,618	-27.6%
Wilton	4,207	2,739	-34.9%
WestCOG	**141,767**	**112,521**	**-20.6%**
State of CT	**885,407**	**826,613**	**-6.6%**

Source: U.S. Census Bureau, Connecticut State Data Center

Vulnerable Populations

Vulnerable populations may include not only senior citizens and persons who are less mobile, but also low-income and minority populations, some of whom may have difficulty evacuating or protecting their homes or may miss critical information due to limited ability to speak and understand English. According to the 2010 U.S. Census, more than 15% of the population in three of the region's municipalities do not speak English very well (Table 2-5). Public education efforts must consider each municipality's particular language groups and make sure that information is made available to them, so that

mitigation planning efforts do not systematically discriminate against non-English speaking communities.

Table 2-5: Percentage of English Speakers

Municipality	Speak English "Very Well"	Speak English Less Than "Very Well"
Bethel	94.8%	5.2%
Bridgewater	99.6%	0.4%
Brookfield	95.4%	4.6%
Danbury	78.8%	21.2%
Darien	97.1%	2.9%
Greenwich	91.3%	8.7%
New Canaan	96.2%	3.8%
New Fairfield	98.1%	1.9%
New Milford	96.6%	3.4%
Newtown	97.4%	2.6%
Norwalk	83.2%	16.8%
Redding	98.2%	1.8%
Ridgefield	98.1%	1.9%
Sherman	99.2%	0.8%
Stamford	81.5%	18.5%
Weston	98.6%	1.4%
Westport	97.2%	2.8%
Wilton	96.8%	3.2%

Source: U.S. Census Bureau

Low-income households and individuals may be at greater risk to natural hazards than more affluent neighbors. These populations are more likely to rely on transit for transportation (which can be problematic when a disaster hits), have fewer resources to devote to disaster preparation, and have fewer resources to draw on to aid in recovery. According to the American Community Survey 2014-2018, the per capita income for the United States was $35,672. In Connecticut it was $43,056 (Table 2-6), but in New Milford it was just $42,708. The remaining WestCOG municipalities presently have per capita incomes greater than the state average. The percentage of people below the poverty level is also generally less than half of the state average for most WestCOG municipalities, with only Danbury, Norwalk, and Stamford having percentages near the state average of 10%.

Table 2-6: Income Statistics

Municipality	Median Household Income	Per Capita Income	Percent of People Below Poverty Level
Bethel	$101,473	$46,066	2.9%
Bridgewater	$106,429	$70,043	2.5%
Brookfield	$107,255	$49,856	3.8%
Danbury	$71,672	$34,512	11.7%
Darien	$210,511	$112,096	3.1%
Greenwich	$142,819	$98,467	6.4%
New Canaan	$192,418	$119,180	3.0%
New Fairfield	$107,089	$51,244	4.0%
New Milford	$87,188	$42,708	4.5%
Newtown	$123,974	$55,985	3.1%
Norwalk	$82,474	$47,322	9.7%
Redding	$128,047	$65,491	4.3%
Ridgefield	$158,518	$80,859	1.9%
Sherman	$113,506	$73,827	0.8%
Stamford	$89,309	$55,059	9.3%
Weston	$219,083	$99,698	2.7%
Westport	$187,988	$110,963	4.7%
Wilton	$187,903	$85,151	2.8%
State of CT	**$76,106**	**$43,056**	**10.0%**

Source: U.S. Census Bureau

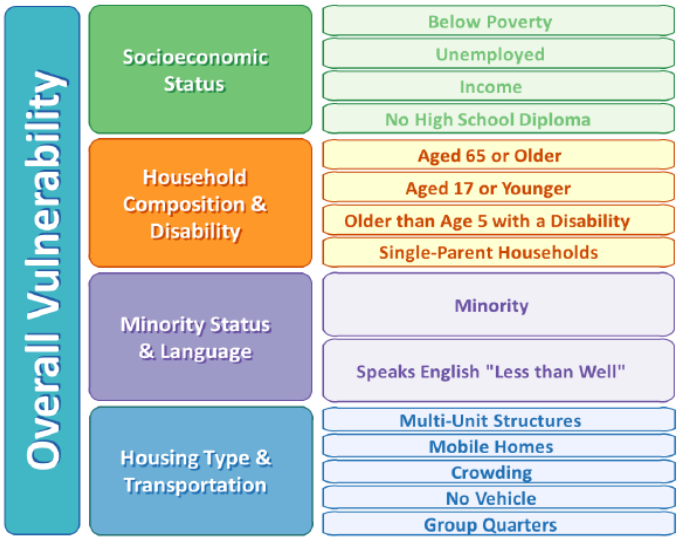
Social Vulnerability Index

The demographics of each WestCOG municipality varies and therefore impacts to these populations will also vary. To better understand the potential impacts and societal vulnerability of the Region, the Center the Center for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI) was used to identify areas with vulnerable populations. This index was developed to supplement a community's natural hazard preparation actions. In order to evaluate social vulnerability, the CDC incorporates 15 factors (Figure 2-6) into the overall calculation under the categories of: socioeconomic status, household composition and disability, minority status and language, and housing type and transportation. These categories and their ranking are based on census statistics. By evaluating these factors and determining a level of social vulnerability, a community can identify specific needs for before, during, and after an event. Such needs may include sheltering capacity, evacuation routes, or to decide how many emergency personnel may be required to respond after an event.

Each census tract in the Region was ranked for overall vulnerability, and category vulnerability, in comparison to other census tracts in Connecticut. This rank, 0 to 1, is based on the percentile rank among all tracts within the State of Connecticut. A value closer to 0 indicates a lower

vulnerability, while a value closer to 1 indicates a higher vulnerability in comparison to the statewide assessment. Table 2-7 summarizes the overall vulnerability for each WestCOG municipality as well as by category. Figure 2-7 presents this information graphically by census tract.

Figure 2-6: CDC Social Vulnerability Index Factors



Source: CDC

Table 2-7: Social Vulnerability Index

Municipality	Overall	SE	HC&D	M&L	H&T
Bethel	0.27	0.32	0.24	0.39	0.28
Bridgewater	0.06	0.11	0.15	0.14	0.16
Brookfield	0.26	0.27	0.50	0.37	0.22
Danbury	0.62	0.62	0.32	0.75	0.62
Darien	0.08	0.11	0.18	0.23	0.11
Greenwich	0.36	0.30	0.41	0.53	0.37
New Canaan	0.15	0.08	0.37	0.23	0.20
New Fairfield	0.13	0.21	0.29	0.21	0.14
New Milford	0.33	0.42	0.20	0.35	0.41
Newtown	0.22	0.20	0.48	0.28	0.27
Norwalk	0.49	0.42	0.34	0.63	0.51
Redding	0.21	0.04	0.34	0.18	0.45
Ridgefield	0.14	0.04	0.43	0.18	0.22
Sherman	0.01	0.01	0.18	0.05	0.07
Stamford	0.48	0.44	0.29	0.70	0.53
Weston	0.01	0.02	0.15	0.30	0.01
Westport	0.19	0.11	0.44	0.28	0.28
Wilton	0.20	0.04	0.43	0.32	0.33

Notes: SE = Socioeconomic, HC&D = Household Composition & Disability, M&L = Minority Status & Language, H&T = Housing Type & Transportation

Source: CDC

Consider the following:

- Communities with a high socioeconomic vulnerability such as Danbury may find it challenging in assisting lower income residents with recovery efforts, dispersing information, or keeping residents and families housed after a large event.

- Communities with vulnerable populations in relation to composition and disability such as Brookfield may find challenges in evacuating populations, maintaining adequate shelters for those with special needs, and ensuring family support services are available for single-parent households during and in the wake of an event.

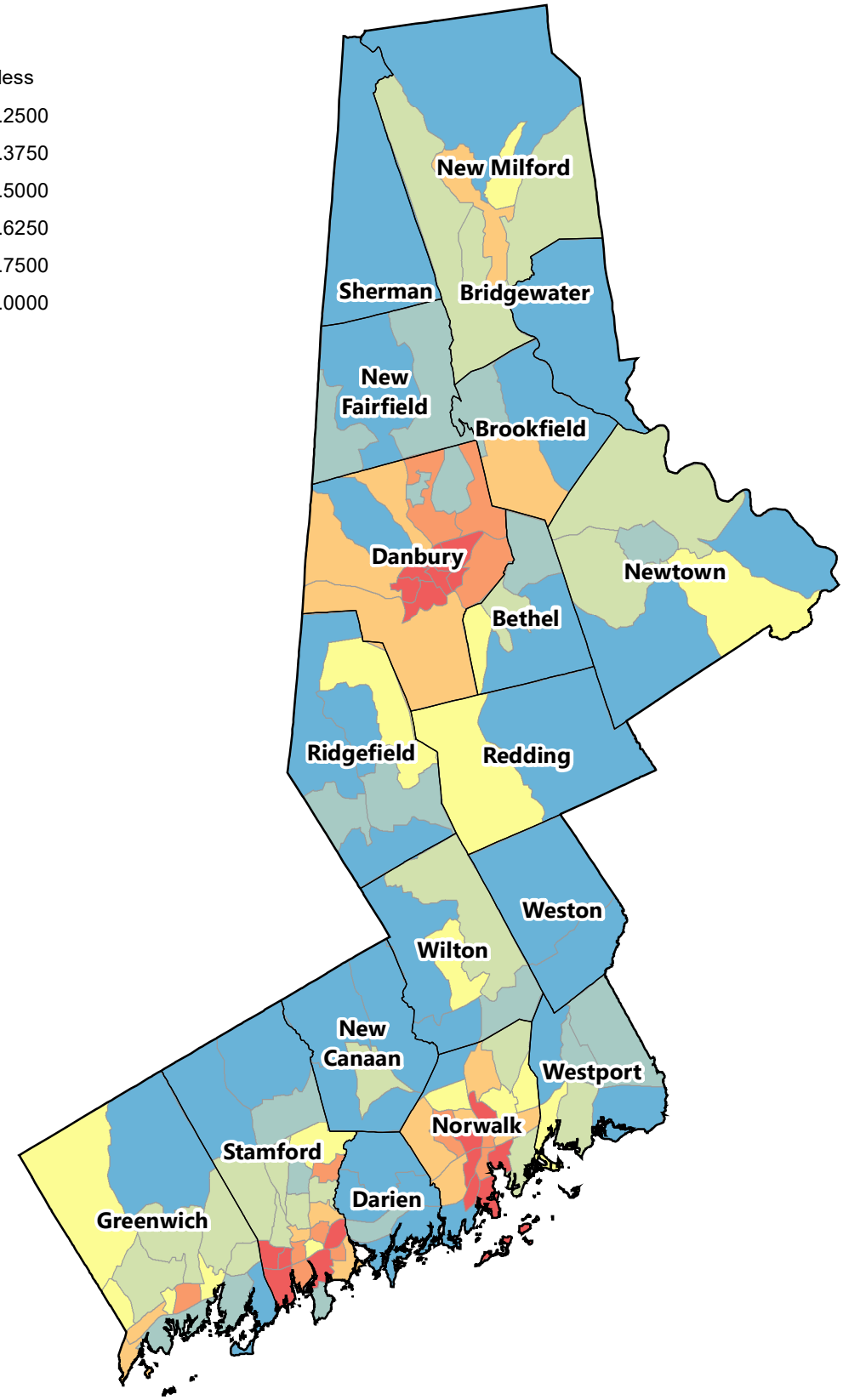
- Municipalities with vulnerable populations who identify as a minority and speak English "less than well" such as Danbury, Stamford, and Norwalk may face the issue of information distribution or access to resources. Multi-language resources and emergency notifications should be developed to disseminate to those communities.

- In addition, some minority populations may also face other socioeconomic issues which ultimately results in challenges such as access to evacuation transportation, safe sheltering during an event, and the financial means for property recovery and repairs.

- Vulnerabilities associated with housing type and transportation capabilities can present challenges due to high density housing and evacuation efforts or emergency response, lack of transportation for preparation and evacuation, or vulnerability in constructions type such as mobile homes.

It is important for municipalities to identify and locate these populations to ensure they are aware of hazards and are able to access the necessary resources for response and recovery.

The EPA defines Environmental Justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."



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CDC SOCIAL VULNERABILITY INDEX (SVI)

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FIG. 2-7

An Environmental Justice community is one where socioeconomic and geographic stressors intersect to increase environmental risk. Such communities are more likely to be exposed to, and less likely to withstand, adapt to, and recover from natural hazards. A Fact Sheet discussing Environmental Justice follows this page.

2.2.2 Economic Profile and Trends

Many WestCOG municipalities have roots dating back to the pre-Revolutionary War era. Agricultural settlements formed near a village or parish center typically located near a major waterway to support a mill. As the industrial revolution took hold, factories were built, watercourses were dammed for water supply, and housing developments were built to support workers. Along the shoreline, ports provided commercial access for goods with railroads eventually built to facilitate transport of goods and materials to and from inland areas. Textile industries (such as the hat industry in Danbury) which employed significant percentages of the region's workforce in the 19th century eventually gave way to the current economic profile of today.

Economic Advantages

The Region is currently endowed with many economic assets and competitive advantages and is home to the headquarters and branches of many large national enterprises that bring recognition to the region. The primary economic strength of the region is its proximity to the New York and Boston major metropolitan markets (Greenwich is 35 miles and Danbury is 68 miles from New York City). The region's cities are well-positioned to support major employers, while the region's larger corporate office parks in Brookfield, Danbury, Darien, Greenwich, Newtown, Redding, Westport, and Wilton provide vital professional and managerial services as well as serving as corporate headquarters for many employers.

WestCOG's Comprehensive Economic Development strategy (CEDS) identifies the Region's strong mix of industry sectors, large number of fortune 500 companies, and diverse educated workforce as strong economic advantages. According to the Regional POCD, the five major industries in the region in terms of percent of estimated employment include educational services and health care (21%); professional, scientific and management and administrative services (17%); finance, insurance, and real estate (14%); retail trade (10%); and arts, entertainment, recreation, and accommodation and food services (8%). Major employers employing more than 1,000 employees include Pitney Bowes, Gartner Inc., Deloitte, and Stamford Hospital in Stamford, Boehringer Ingelheim and Danbury Hospital in Danbury, Norwalk Hospital, and Greenwich Hospital. The 63 largest employees account for approximately 85,000 jobs or nearly a third of all employment in the region. The greatest concentrations of employment are in Danbury, Greenwich, Norwalk, and Stamford.

Commerce and industry both provide employment and heavily support local government services which enables municipalities to reduce the burden of property taxes on homeowners. According to the Regional POCD, in 2017 commercial and industrial land owners accounted for 15% of the region's net grand list, with higher percentages in the cities. Over the last 10 years only Danbury, Norwalk, and Stamford have seen an appreciable increase in their labor force. This trend is likely to continue based on the range of public services, transportation systems, and access these urban centers offer to the regional labor market.

According to the Regional POCD, regionally 67% of residents also worked in the region in 2002, with this percentage dropping to 61% in 2015. In 2015, 26% of the region's residents traveled 25 or more miles to reach work, up from 22% in 2002. Based on the general success that many industries have had with employees working from home during the COVID-19 pandemic in 2020, it is unclear at this point what percentage of workers will continue to commute in the region and what percentage will work primarily from home in the future.

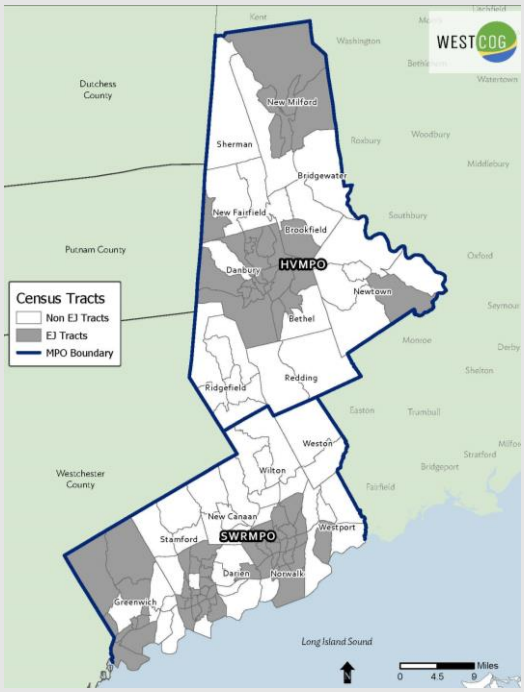
Economic Challenges

Regional challenges related to employment include highway congestion along the Merritt Parkway and Interstate 95, and the occurrence of jobs either distant from, or requiring more skills than the unemployed population presently has acquired.

WestCOG municipalities are either part of the Danbury labor market or the Bridgeport-Stamford labor market. According to the Connecticut Department of Labor, the unemployment rate in these markets was 5.1% and 6.2%, respectively, an improvement over the 10 to 11% rates in

REGIONAL CHALLENGES

ENVIRONMENTAL JUSTICE AND HAZARD MITIGATION



EJ Census Tracts
Image courtesy of WestCOG

WHAT IS THE CHALLENGE?

The EPA defines Environmental Justice (EJ) as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

An EJ community (EJC) is one where socioeconomic and geographic stressors intersect to increase environmental risk. Minority, low-income, non-English-speaking, or immigrant status may contribute to an EJC designation. EJCs are more likely to be exposed to, and less likely to withstand, adapt to, and recover from natural hazards.

Hazard mitigation efforts often overlook, or even harm, EJCs. EJCs may be displaced, or their risk increased, in order to decrease risk elsewhere. Protection may disproportionately help higher-income areas. Adaptation may be framed as a private responsibility rather than a public good, leaving it in the hands (and wallets) of individual residents, and therefore less accessible to lower-income people.

Mitigation actions that do protect EJCs can drive up property values because of the very protection they provide, leaving low-income residents with no choice but to relocate.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

WestCOG municipalities should strive to protect EJCs from hazards without causing undue burden or displacement:

Strengthen Communities: building social equity and community resilience before a hazard event will help communities be resilient to that event.

Reframe Goals: Hazard mitigation aims to protect people and communities; completion of a mitigation project should never cause harm to the community.

Increase Social Service Resilience: like wellness checks, public transit, and healthcare, food, and affordable housing. Support community-based organizations, often the first lines of defense against disasters.

Increase Participation & Awareness: Solicit participation from EJ communities in hazard planning. Including more voices helps address the needs of all populations and raising awareness and appreciation of risks enables people to protect themselves.

Support the Local Economy. A mitigation project is an opportunity to bring state and federal funding into the local economy. Hire local contractors that pay a living wage. Train residents to perform the work, giving them marketable skills.

Focus on Large Scale Projects: Large-scale mitigation infrastructure is less likely to increase property values than a property-specific retrofit project.

Distribute Resources: Incorporate equity into plans and funding mechanisms. Make funding and permitting more accessible. Revisit cost-benefit analyses; conventional methods undervalue low-income areas, discouraging investment.

FOR MORE INFORMATION

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the spring of 2020. In general, unemployment in Connecticut tends to be equal or less than the nationwide unemployment rate. Additional economic challenges identified within the CEDS include a self-perpetuated negative image of Connecticut as unfriendly to business, the high cost of living and salary demands, high taxes, and challenges in obtaining business loans.

Highways and electric power, the life blood of modern production, can be shut down from an extreme weather event thereby halting economic activity. If a business is forced to close because of weather, physical damages, or any other emergency event the forfeited production and forgone wages often represent a permanent economic loss. Anecdotal evidence from local chambers of commerce and business leaders indicates that for a small or medium sized business even a couple days of lost production can be enough to lead to closure. The proportion of local enterprises and jobs that are located in flood zones represent an easily identifiable economic risk.

While the region is well connected with a variety of transportation routes traversing its seven municipalities, it is essential that these routes remain passable during and following a disaster to allow residents to access shelters and also provide efficient and timely recovery of the region's businesses. Evacuation assistance for critical and special needs populations in the 18 municipalities is handled differently in each community.

WestCOG's CEDS provides a plan to remedy employment challenges in the region. The six major goals for the strategy include regional planning and coordination, an improved business climate, an inclusive work force, an improved and maintained transportation and public infrastructure, a more sustainable and resilient region, and a positive regional identity. Priority projects associated with the strategy invest in the region's economic future with selections made based on the ability to create and retain jobs, protect the environment, and have a positive regional economic impact.

2.2.3 Development Trends

The Region hosts significant commercial, industrial, and public properties including regional employment centers, airports and ports, commercial and industrial parks and areas, and major retail developments. According to 2019 equalized net grand list data, the region contains $131.9 billion in taxable real, personal, and motor vehicle property (see Table 2-8 below).

Table 2-8: 2019 Grand List Data by Municipality

Municipality	Total Equalized Net Grand List	R	CIU	PP	O
Bethel	$2,069,253,190	69%	14%	15%	2%
Bridgewater	$380,294,129	87%	1%	7%	5%
Brookfield	$2,294,164,785	70%	15%	13%	2%
Danbury	$7,894,236,562	59%	24%	15%	2%
Darien	$8,563,942,856	86%	8%	5%	1%
Greenwich	$33,413,779,040	82%	14%	4%	<1%
New Canaan	$7,733,939,643	89%	6%	4%	1%
New Fairfield	$1,637,925,631	88%	3%	9%	0%
New Milford	$2,945,850,093	69%	13%	14%	4%
Newtown	$3,231,470,378	77%	9%	12%	2%
Norwalk	$14,671,608,099	64%	25%	10%	1%
Redding	$1,570,538,958	80%	9%	10%	<1%
Ridgefield	$4,883,670,957	81%	11%	7%	1%
Sherman	$695,994,805	92%	<1%	7%	1%
Stamford	$21,966,307,423	63%	24%	11%	2%
Weston	$2,238,404,346	90%	1%	7%	2%
Westport	$11,441,647,210	81%	12%	6%	1%
Wilton	$4,278,912,586	75%	14%	10%	1%
WestCOG	**$131,911,940,691**	**75%**	**16%**	**8%**	**1%**

Source: Connecticut Office of Policy and Management

Not all properties are equally vulnerable to any given natural hazard as location and building materials influence vulnerability; nevertheless, the region risks substantial financial losses from catastrophic natural hazards affecting not only property but also business and government operations.

According to the 2018 5-year American Community Survey, 241,386 housing units are in the Region. Of those, the vast majority are single unit buildings (Table 2-9). The percentage of single-unit buildings varies considerably from town to town, with a low of 45.1% in Stamford and a high of 99.5% in Weston. Statewide, 64.3% of housing structures are single unit.

Table 2-9: Housing Stock

Municipality	1-Unit	2-Units	3+ Units	Mobile or Other
Bethel	75.4%	6.6%	18.0%	0.0%
Bridgewater	96.4%	1.5%	2.1%	0.0%
Brookfield	79.2%	3.2%	17.6%	0.0%

Municipality	1-Unit	2-Units	3+ Units	Mobile or Other
Danbury	53.1%	10.7%	35.0%	1.2%
Darien	91.5%	2.5%	6.0%	0.0%
Greenwich	71.0%	9.5%	19.3%	0.2%
New Canaan	82.4%	3.0%	14.4%	0.2%
New Fairfield	97.7%	0.9%	0.7%	0.7%
New Milford	75.9%	4.8%	18.6%	0.7%
Newtown	90.2%	3.0%	6.0%	0.8%
Norwalk	52.8%	11.0%	35.7%	0.5%
Redding	82.9%	3.9%	11.2%	2.0%
Ridgefield	84.1%	1.5%	13.8%	0.6%
Sherman	98.8%	1.2%	0.0%	0.0%
Stamford	45.1%	8.1%	46.8%	0.0%
Weston	99.5%	0.0%	0.5%	0.0%
Westport	91.0%	3.9%	4.8%	0.3%
Wilton	87.1%	1.3%	11.6%	0.0%

Source: U.S. Census Bureau

The number of housing units in the region has grown at a slower pace than the population. From 2010 to 2018, the number of housing units increased by 2.6% (Table 2-10).

Table 2-10: Change in Housing Units

Municipality	2010 Housing Units	2018 Housing Units	Percent Change
Bethel	7,310	7,706	5.1%
Bridgewater	881	864	-2.0%
Brookfield	6,562	6,593	0.5%
Danbury	31,154	32,493	4.1%
Darien	7,074	7,195	1.7%
Greenwich	25,631	24,234	-5.8%
New Canaan	7,551	7,582	0.4%
New Fairfield	5,593	5,967	6.3%
New Milford	11,731	11,899	1.4%
Newtown	10,061	10,514	4.3%
Norwalk	35,415	36,051	1.8%
Redding	3,811	3,909	2.5%
Ridgefield	9,420	9,602	1.9%
Sherman	1,831	1,760	-4.0%
Stamford	50,573	53,660	5.8%
Weston	3,674	3,938	6.7%
Westport	10,399	10,830	4.0%
Wilton	6,475	6,589	1.7%
WestCOG	**235,146**	**241,386**	**2.6%**
Connecticut	**1,487,891**	**1,512,305**	**1.6%**

Source: U.S. Census Bureau

The fastest growth occurred in Weston and New Fairfield, which both saw greater than 6% increases. Bridgewater, Greenwich, and Sherman appeared to reduce housing units, although this may be within the margin of error for the survey. Meanwhile, as noted above, the population of the region grew by 3.5%.

The household structure is changing in many WestCOG communities (Table 2-11). Smaller households, including singles, non-cohabitating couples, single parents, families with fewer children, and empty nesters are becoming more common. Overall, household sizes in the Region were fairly stable from 2010 to 2018. However, from 2000 to 2018, the average household shrank by more than 0.5 persons in Bridgewater, New Fairfield, Redding, and Sherman.

Table 2-11: Average Household Size

Municipality	2000	2010	2018 Estimate
Bethel	2.76	2.54	2.57
Bridgewater	2.55	1.96	1.97
Brookfield	2.80	2.51	2.57
Danbury	2.64	2.60	2.61
Darien	2.95	2.93	3.02
Greenwich	2.59	2.39	2.59
New Canaan	2.83	2.61	2.67
New Fairfield	3.01	2.48	2.33
New Milford	2.68	2.40	2.25
Newtown	2.90	2.74	2.65
Norwalk	2.51	2.42	2.46
Redding	2.83	2.40	2.33
Ridgefield	2.78	2.62	2.60
Sherman	2.67	1.96	2.07
Stamford	2.54	2.43	2.42
Weston	3.03	2.77	2.60
Westport	2.66	2.54	2.63
Wilton	2.91	2.79	2.78
WestCOG	**N/A**	**2.51**	**2.53**
Connecticut	**2.53**	**2.40**	**2.36**

Source: U.S. Census Bureau

As households get smaller, more units are needed to house the same total population. Not only does this increase the amount of land that is needed for housing, but it spreads the population over a greater area, potentially impacting emergency response times. Such a shift in household formation dynamics impacts the way the WestCOG communities respond to disasters. A greater number of households generally equates to a greater amount of impervious surface cover, which can have negative repercussions for flooding. More

households mean more structures that can be damaged during hurricanes or which contribute to runoff. Furthermore, the population is now spread among a greater number of structures, potentially making rescue operations more difficult. Of note is that New Canaan and Ridgefield have adopted regulations that link impervious coverage to lot size as opposed to assigning a maximum lot coverage requirement.

To provide a narrative characterization of development trends in the Region, each municipality was provided an opportunity during the planning process to comment on development within its borders. Some of the more significant developments noted by communities are presented in Table 2-12.

Almost every community reported small subdivisions and at least a few nominal single-parcel, nonresidential developments and/or redevelopments. Many WestCOG communities also reported renovations or replacements of schools and other municipally owned facilities.

Table 2-12: Notable Developments or Redevelopments

Municipality	Development or Redevelopment
Bethel	More than 450 new housing units over the past decade; potential for transit-oriented development (TOD).
Bridgewater	Single-family homes and some redevelopment.
Brookfield	Town Center District development and redevelopment; potential for TOD.
Danbury	"Reserve" residential development in process, Matrix Corporate Center mixed-use renovation, several hundred new residential units through multiple projects, and other TOD and non-TOD mixed-use developments and redevelopments.
Darien	Three mixed-use developments; some TOD potential.
Greenwich	Continued residential growth; some TOD potential.
New Canaan	Small residential developments; some TOD potential.
New Fairfield	Barn Brook Estates subdivision (23 homes).
New Milford	Bleachery residential project.
Newtown	Single-family homes and condominium / townhouse style developments.
Norwalk	New indoor mall opened in South Norwalk in 2019; significant TOD redevelopment.
Redding	Former Schlumberger site redevelopment; some TOD potential.
Ridgefield	Branchville TOD.
Sherman	None of note.
Stamford	Numerous large mixed-use developments and apartments completed over last decade. 50 three- or four- bedroom homes are planned at Ainslie Square, previously undeveloped land. Additional TOD and non-TOD redevelopment anticipated in the downtown area.
Weston	Periodic single-family homes
Westport	Downtown and commercial redevelopment; some TOD potential.
Wilton	Additional commercial along Route 7, including some TOD.

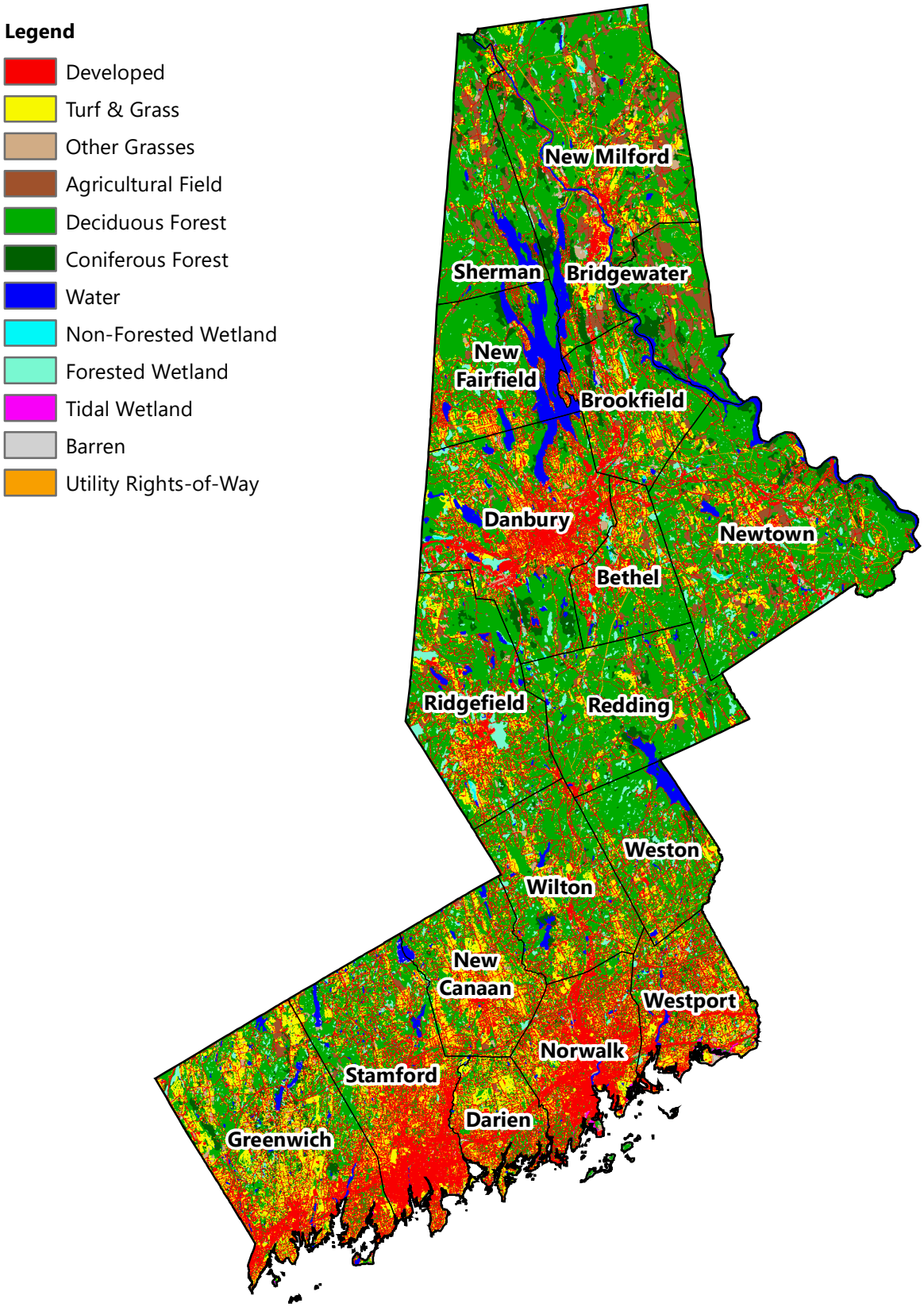
In summary, based on meetings with local planning teams, the communities of Bethel, Brookfield, Danbury, Darien, Greenwich, Newtown, and Ridgefield have experienced the most significant development in the last few years and have the most noteworthy projects approved or pending approval. The communities of Bridgewater, New Canaan, New Milford, and Redding have experienced a somewhat lesser level of development and redevelopment. All remaining communities in the Region have experienced at least nominal development or redevelopment of single properties and parcels.

2.2.4 Land Cover and Land Use

Much of the development the Region has seen since 1985 has come mainly at the cost of its agricultural land and deciduous and coniferous forests. Figure 2-8, derived from the UConn Center for Land-Use Education and Research (CLEAR), shows a snapshot of current (2015) land cover. The rate of land cover change in the Region can be seen in Table 2-13 below. As the table shows, the most endangered land is agricultural land with nearly 43% being lost to development over the last 30 years.

Between 1985 and 2015, the region increased its developed area by 11.4%. During that same period, turf (lawns) increased by 13.5%. At the same time, agricultural land decreased by 42.8%. Deciduous forests lost 6.5% of their area and coniferous forests lost 6.2% of their area.

As development in the region increases, the magnitude of the damage caused by the disasters also increases. Total damages increase for two reasons. First, as noted above



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CHESHIRE, CT 06410
203.271.1773
WWW.MMINC.COM

2015 LAND COVER CLASSES

HAZARD MITIGATION PLAN UPDATE
WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS
1 RIVERSIDE ROAD
SANDY HOOK, CT 06482

N

0 14,000 28,000
Feet

SCALE 1 " = 30,000 '
DATE 12/1/2020
PROJ. NO. 3101-22

FIG. 2-8

Table 2-13: Change in Land Cover

Category	1985 Acreage	2015 Acreage	Percent Change
Developed	80,887	91,344	11.4%
Turf	41,024	47,405	13.5%
Other Grass	4,616	4,620	0.1%
Agriculture	16,310	11,423	-42.8%
Deciduous Forest	163,500	153,566	-6.5%
Coniferous Forest	17,278	16,266	-6.2%
Water	15,418	14,544	-6.0%
Non-Forested Wetland	625	620	-0.8%
Forested Wetland	9,750	9,580	-1.8%
Barren	381	366	-4.1%
Utility	1,569	1,572	0.2%

Source: UConn CLEAR

for population, because there are more homes, businesses, and other assets in a given area, more homes, businesses, and assets are potentially affected by the disaster. Second, impervious surfaces are linked to more severe and rapid flash flooding events. Continued development results in increased impervious surfaces within the region. Therefore, when heavy rain events occur in the region the resulting stormwater quickly flows through storm drains and across parking lots and lawns and into brooks and rivers leading to a higher peak elevation flood surge. This phenomenon, created by development, has likely increased the risk of damage associated with severe weather conditions.

The decrease in population predicted by the CTSDC or the slower growth suggested by community planners suggests that new housing development may slow in the region through 2040. However, it is expected that new single-family homes, new businesses, and redevelopment will be prevalent in each community throughout the next 20 years.

2.2.5 Historic and Cultural Resources

The Region is rich in historic and cultural assets. Efforts have been taken by many to recognize, preserve, and protect these assets. In particular, in 2015 the State of Connecticut launched an initiative aimed at protecting historic resources from natural hazards and climate change. Historic and cultural assets should be considered in mitigation planning whether in efforts to further protect the assets from the impacts of natural disasters or to minimize potential adverse impacts that may affect these assets.

The numerous structures, sites, and districts listed on the State and National Registers of Historic Places in the Region attest to the importance of historic preservation to our communities. Sites on the Registers are significant to our culture. Figure 2-9 displays sites designated as National Historic Landmarks or properties listed on the National Register of Historic Places, the State Register of Historic Places, or local historic districts/local historic properties. The State Historic Preservation Office (SHPO) also maintains a list of State Archaeological Preserves. The Archaeological Preserves in the Region include:

- Putnam Memorial State Park, Redding and Bethel
- Bridgeport Wood Finishing Company, New Milford
- Fort Stamford, Stamford
- West Parish Meeting House, Westport
- Middle Encampment, Redding

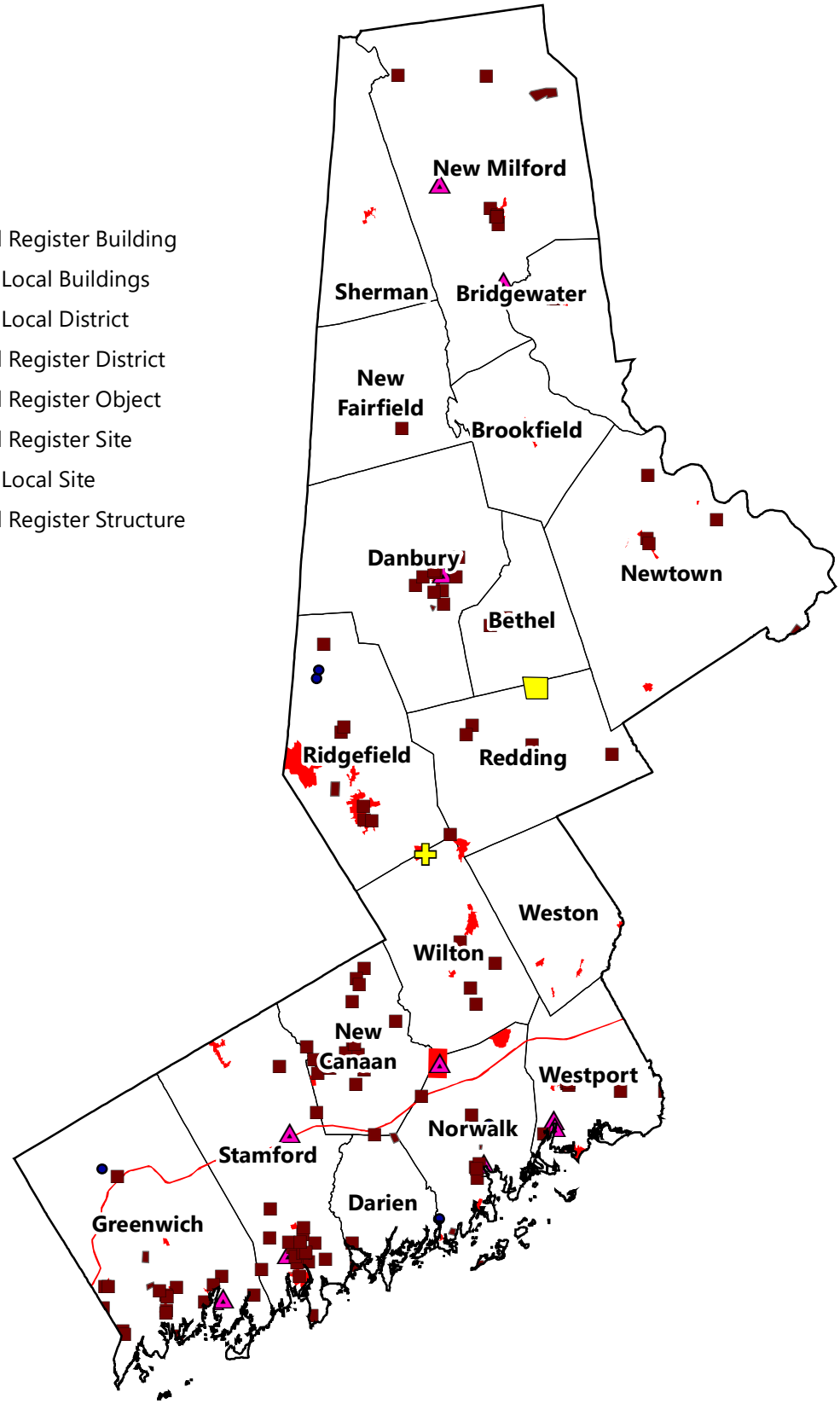
SHPO should be consulted regarding any mitigation projects that could affect buildings or sites on the Registers. Recent efforts by SHPO to identify the risk of historic resources to natural hazards is discussed on the Fact Sheet following this page. Risks to historic and cultural resources are further discussed in Section 3.

2.3 Planning and Regulatory Capabilities

2.3.1 Governmental Structure

WestCOG is a regional planning organization established by the Connecticut Office of Policy and Management that represents its 18 member municipalities. WestCOG provides technical and planning assistance and expertise and provides a forum for its member municipalities to communicate and collaborate on inter-municipal issues and needs.

WestCOG is governed by a council consisting of mayors and first selectman with one vote each. Services and programs are implemented by the Executive Director and



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HISTORIC RESOURCES

HAZARD MITIGATION PLAN UPDATE
WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS
1 RIVERSIDE ROAD
SANDY HOOK, CT 06482

N

0 14,000 28,000
Feet

SCALE 1 " = 30,000 '
DATE 12/1/2020
PROJ. NO. 3101-22

FIG. 2-9

NEW INITIATIVES

ADDRESSING RISKS TO HISTORIC RESOURCES

Norwalk Town House
Photo Norwalk Historical Society

New Milford Historical Society Museum
Photo nmhistorical.org

FOR MORE INFORMATION

Mary Dunne
State Historic Preservation Officer
Certified Local Government & Grants Coordinator
State Historic Preservation Office (SHPO)
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Hartford, CT 06103
(860) 500-2347
Mary.Dunne@ct.gov

WHAT IS THE INITIATIVE?

Recognizing that historic and cultural resources are increasingly at risk to natural hazards and climate change, the State Historic Preservation Office (SHPO) conducted a resiliency planning study for historic and cultural resources from 2016 through 2018. Working with the State's Councils of Government and municipalities, numerous examples were identified where historic and cultural resources were at risk now and could be at risk in the future due to climate change and the identification of more historic resources. Historic resources are difficult to floodproof, elevate, or relocate without potential loss of their historicity. Therefore, a thorough understanding of the options for each set of historic resources is necessary prior to disasters that could damage these resources, in order to avoid irreversible damage during recovery. SHPO's planning process identified eight strategies that can be employed to make historic and cultural resources more resilient:

- Identify Historic Resources
- Revisit Historic District Zoning Regulations
- Strengthen Recovery Planning
- Incorporate Historic Preservation into Planning Documents
- Revisit Floodplain Regulations and Ordinances
- Coordinate Regionally and with the State
- Structural Adaptation Measures
- Educate

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

SHPO has produced three sets of resources that can be used to inform hazard mitigation planning:

- Reports produced for coastal communities (Greenwich, Stamford, Darien, Norwalk, and Westport) include recommendations applicable throughout the region.
- A best practices guide for planning techniques to make historic resources more resilient was made available in 2018.
- The State Historic Preservation Plan was updated in 2018 and provides policy direction to communities.

Because community planners often do not know which resources may be historic or cultural, or which are most likely to be considered historic in the next decade as structures built in the 1950s and 1960s become eligible, it can be difficult to evaluate risks to flooding and other hazards. Therefore, this plan suggests a mitigation action for most WestCOG municipalities to conduct a survey of potential historic resources, focusing on areas within natural hazard risk zones, in cooperation with SHPO. Informing historic-property owners of hazard-resilient retrofitting methods that do not conflict with historic preservation goals is another action suggested for some municipalities.

staff with funding from the federal government, state government, and local sources. Grants and local contributions are used to fund special projects supported by the council.

Each of the 18 WestCOG municipalities has a broad scope of government authorities and powers including the ability to tax; establish laws, ordinances, and regulations; exercise eminent domain; provide police protection; and establish, construct, and maintain public facilities including roads, water mains, sewers, drainage, and utilities. Table 2-14 presents the government structure for each municipality.

Table 2-14: Municipal Government Structure

Municipality	Legislative Body	Chief Executive Officer
Bethel	Town Meeting	First Selectman
Bridgewater	Town Meeting	First Selectman
Brookfield	Town Meeting	First Selectman
Danbury	City Council	Mayor
Darien	Town Meeting	First Selectman
Greenwich	Town Meeting	First Selectman
New Canaan	Town Council	First Selectman
New Fairfield	Town Meeting	First Selectman
New Milford	Town Council	Mayor
Newtown	Legislative Council	First Selectman
Norwalk	Common Council	Mayor
Redding	Town Meeting	First Selectman
Ridgefield	Town Meeting	First Selectman
Sherman	Town Meeting	First Selectman
Stamford	Board of Representatives	Mayor
Weston	Town Meeting	First Selectman
Westport	Representative Town Meeting	First Selectman
Wilton	Town Meeting	First Selectman

Source: Connecticut Secretary of State

Each WestCOG municipality has staff and personnel resources that mitigate and / or respond to the impacts of natural hazards within their professional capacities. Table 2-15 summarizes typical resources and positions.

Table 2-15: Local Administrative and Technical Resources

Skill	Available?	Position
Land Development and Management	Yes	Planning & Zoning, WestCOG
Building Construction	Yes	Building Official
Infrastructure Construction	Yes	Municipal Engineer, Public Works
Understanding of Natural Hazards	Yes	Emergency Management Director, Municipal Engineer, WestCOG
Floodplain Manager	Yes	Planning & Zoning, Municipal Engineer, Building Official
Surveyor	Usually Not	Rarely as part of Public Works
GIS Applications	Yes	Planning & Zoning, WestCOG
Emergency Management	Yes	Emergency Management Director
Grant Writers	Yes	Grant Writer, Staff within municipal departments, WestCOG
Benefit-Cost Analysis for FEMA Grant Programs	Usually Not	Typically contracted out

WestCOG municipalities rely upon a variety of codes, ordinances, and other requirements that help mitigate the potential impacts of natural hazards. Table 2-16 summarizes the typical regulatory requirements of WestCOG communities.

Activities in wetlands areas and watercourses are regulated under Chapter 440 (Sec. 22a-28 – Sec. 22a-45d) of the Connecticut General Statutes. Under this statute, each municipality is required to establish an inland wetlands agency, identify boundaries of inland wetlands and watercourse areas, promulgate regulations to protect the inland wetlands and watercourses within its boundaries, and require that no regulated activities shall be conducted without a permit.

All municipalities in the region have established inland wetlands agencies and have enacted inland wetlands and watercourses regulations. According to CEQ, municipal agencies, which issue 95 percent of all inland wetlands permits in the state, have become more responsive to conserving wetlands in recent years. CEQ attributes this increased protectiveness to the completion of wetlands training programs by municipal agency members and staff.

Table 2-16: Types of Codes, Ordinances, and Requirements

Type	Local Authority	State Mandated	Comment
Building Code	Yes	Yes	State Building Code
Zoning Regulations	Yes	No	
Flood Damage Prevention	Yes	No	Typically in zoning and/or municipal code of ordinances
Subdivision Regulations	Yes	No	
Inland Wetland Regulations	Yes	No	
Post Disaster Recovery Regulations	Yes	No	
Real Estate Disclosures	Yes	Yes	State Requirement
Growth Management	No	No	
Site Plan Review	Yes	No	
Special Purpose Regulations (Flood Management, Critical Areas)	Yes	Yes	State Flood Management Statutes and Regulations

Lastly, WestCOG municipalities rely on a variety of funding streams that allow them to operate and perform natural hazard mitigation actions. These may include, but are not necessarily limited to, the following:

- Authority to levy taxes for specific purposes
- User fees for water, sewer, gas, or electric service
- Incur debt through general obligation bonds
- Incur debt through special tax bonds
- Incur debt through private activity bonds
- Capital improvement project funding
- Community development block grants
- State sponsored grant programs
- Federal grant programs
- Withhold public expenditures in hazard prone areas (allowed by State)
- Development impact fees for homebuyers or developers

2.3.2 Regional and Local Plans

WestCOG municipalities rely upon a variety of planning documents that provide guidance related to natural hazard planning. Table 2-17 presents a summary of the typical plans utilized by WestCOG municipalities.

Table 2-17: Types of Local Planning Documents

Type	Local Authority	State Mandated	Comment
Plan of Conservation and Development	Yes	Yes	POCD Update Every 10 Years
Floodplain or Basin Plan	No	No	
Stormwater Plan	Yes	Yes	MS4
Capital Improvement Plan	Yes	No	
Habitat Conservation Plan	No	No	
Economic Development Plan	Yes	No	GrowSmart (2016)
Emergency Operations Plan	Yes	Yes	LEOP template provided by DEMHS
Shoreline Management Plan	No	No	
Post Disaster Recovery Plan	Yes	Yes	Templates provided by DEHMS
Comprehensive Economic Development Strategy	Yes	No	Update Every 5 Years

WestCOG recently completed an update to its Regional POCD. This document provides guidance on responsible growth strategies, coordination of water and sewer utilities between municipalities, marketing the region as a coordinated jurisdiction, assisting private investment studies, meeting the mandate for land use and transportation coordination, addressing regional inputs to the State POCD, addressing coordination along boundaries, coordinating various aspects of land use regulation, and establishing the fiscal basis for regional management of collectively shared infrastructure. The Regional POCD addresses current challenges facing the region over the next decade with specific goals and objectives presented to meet those challenges.

Regional planning agencies and municipalities are required by state law (Chapter 127, Section 8-35a and Chapter 126, Sec. 8-23, respectively) to update POCDs every 10 years. These plans outline the policies and goals for physical and economic development of the region or municipality. Table 2-18 lists the status of each municipal POCD for the 18 municipalities in the Region as of the end of October 2020. The 11 municipalities with POCD updates occurring in the next five to six years (by 2026) should incorporate information from this HMP into their analysis and recommendations (Section 6.2).

Table 2-18: Municipal Plan of Conservation and Development Status

Municipality	POCD Date	Plan Update in Next Five Years?
Bethel	12/12/2019	No
Bridgewater	7/1/2012	Yes
Brookfield	6/18/2015	Yes
Danbury	6/12/2013	Yes (Ongoing)
Darien	5/24/2016	Will be started
Greenwich	5/12/2009	Yes (Ongoing)
New Canaan	2/23/2016	Will be started
New Fairfield	9/22/2014	Yes
New Milford	7/6/2010	Yes (Ongoing)
Newtown	11/21/2013	Yes
Norwalk	10/23/2019	No
Redding	5/26/2020	No
Ridgefield	6/16/2020	No
Sherman	6/20/2013	Yes
Stamford	12/16/2014	Yes
Weston	6/15/2020	No
Westport	9/28/2017	No
Wilton	9/23/2019	No

Source: Connecticut Office of Policy and Management

Many WestCOG municipalities are considered to be "urbanized areas" that must comply with the US EPA's rules for stormwater management. The MS4 General Permit is used by Connecticut DEEP to track compliance in the region as noted on the Fact Sheet following this page.

2.3.3 Public Information

A variety of means are used in the Region to inform the public about natural hazards, areas and issues of concern, and mitigation measures. These specific outreach efforts are described below.

Reports and Presentations to Local Officials

Municipal local coordinators and other department heads routinely provide briefings to the local legislative body regarding the impact of natural hazards, areas of concern, and new projects that may be necessary to address related issues. Discussions of a regional nature are also held before the WestCOG council. These meetings are public meetings with meeting notices, agendas, and minutes published on the local or regional web site.

Web Pages

WestCOG maintains a Natural Hazard Mitigation Plan page on its website to ensure that all local HMPs are available for download. In addition, many WestCOG communities maintain information on their website with guidance on how to prepare for natural disasters and how to sign up for emergency notifications. Press releases are also posted on most municipal websites that may include information related to natural hazards or mitigation.

Social Media

Many WestCOG communities have embraced the use of social media to inform their residents. Most municipalities have a Facebook account, and some have Twitter feeds. As many residents now have smart phones, social media is an excellent means of disseminating emergency information such as road closures, shelter locations, and evacuation needs.

Traditional Media

Press releases, newspaper articles, emergency notification system broadcasts and sirens, and television and radio announcements have been traditionally used to reach a majority of residents before, during, and after emergencies and natural hazard events. All WestCOG communities have these capabilities.

2.4 Critical Facilities

Numerous public and private facilities and infrastructure are critical to the assessment of risks from natural hazards and are important in mitigating the possible effects of events. According to FEMA, critical facilities include essential facilities, transportation systems, lifeline utility

NEW INITIATIVES

REVISED MUNICIPAL SEPARATE STORMWATER SYSTEM (MS4) GENERAL PERMIT

Image: University of Connecticut

FOR MORE INFORMATION

Department of Energy & Environmental Protection
79 Elm Street
Hartford, CT 06106-5127
(860) 424-3297

Amanda Ryan
Municipal Stormwater Educator
UConn CLEAR
Middlesex County Extension
PO Box 70, 1066 Saybrook Road
Haddam, CT 06438
(860) 345-5231

WHAT IS THE INITIATIVE?

The General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4 General Permit) is the product of a mandate by the U.S. EPA as part of its Stormwater Phase II rules in 1999. This general permit requires municipalities to manage stormwater entering its storm sewer systems to protect watercourses.

DEEP issued a new General Permit in May 2018 (effective July 1, 2019) that applies to 121 towns and all state and federal institutions that operate a stormwater system. All municipalities within an "urbanized area" are required to comply with the General Permit. Sixteen out of eighteen municipalities in the region are required to comply.

Given the complexities of the new permit, the UConn Center For Land Use Education and Research (CLEAR) was charged with providing technical assistance to municipalities. The CLEAR web site (http://nemo.uconn.edu/ms4/index.htm) contains valuable information to help municipal staff navigate permit compliance.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Because watershed boundaries do not coincide with political boundaries, the actions of municipalities upstream can have a significant impact on the downstream municipality's land and water resources. Stormwater management throughout an entire watershed, with commitment from all municipalities, is critical to protecting the health of the State's resources. MS4 compliance is therefore both community-specific and regional at the same time.

The basic requirements of the permit are to

(1) submit a Stormwater Management Plan (SMP) identifying six minimum control measures to prevent and/or treat polluted runoff;
(2) submit annual reports indicating implementation progress; and
(3) monitor the quality of water.

Many municipal planners and engineers have noted that the objectives of the MS4 permit are aligned with the objectives of flood hazard mitigation. Therefore, MS4 compliance is expected to help communities achieve progress with hazard mitigation.

systems, high potential loss facilities, and hazardous material facilities. In the Region, critical facilities include facilities that support responses and recovery efforts, such as governmental offices and public works facilities. In addition, facilities that house vulnerable populations are considered in this category. This includes long-term care facilities, as these house populations of individuals that would require special assistance during an emergency.

Critical infrastructure located in areas of flood risk are subject to flooding and therefore vulnerable to closure in the event of a natural disaster. Flooding is not the only concern, as infrastructure can be directly damaged by wind, fire, or earthquakes or impacted by downed powerlines, trees, and other debris. Critical facilities of regional significance are discussed on the following Fact Sheet.

2.4.1 Essential Facilities

FEMA defines essential facilities as those necessary for the health and welfare of the whole population. These include hospitals, police stations, fire stations, schools, emergency operations centers, and evacuation shelters. The five hospitals in the region include Danbury Hospital, Greenwich Hospital, New Milford Hospital, Norwalk Hospital, and Stamford Hospital. Furthermore, each WestCOG municipality includes at least one police station, fire station, and emergency operations center.

Places where impacted populations can go before or during a natural hazard event and while recovery occurs are essential during an emergency. Most often, schools are used as public shelters as they have gymnasiums that can accommodate large numbers of residents and are structurally capable of withstanding the forces endured during an event. In addition to structural rigidity, schools maintain the necessary facilities such as lavatories, showers, and food service areas as well as other spaces for recreation. Many municipalities also have smaller facilities that are designated as the primary shelter for smaller events that only require housing a few people. Backup generators are usually available, but in some instances may not provide sufficient power for the entire building.

The American Red Cross (ARC) has been chartered by the U.S. Congress to respond to all disasters and be the lead agency for mass care and sheltering. It coordinates emergency services at the local level through its regional chapters. Many WestCOG municipalities certify that their shelters comply with ARC guidelines. However, in most cases municipal staff and volunteers operate local shelters, potentially with or without ARC assistance. During a catastrophic regional event, ARC may provide more oversight and coordination for shelter management including migrating evacuees from harder hit areas into shelters in other communities.

2.4.2 Transportation Systems

The availability of major transportation infrastructure is critical for evacuation and response and to ensure that emergencies are addressed while day to day management of the each WestCOG municipality continues. These include highways, railways, airports, and waterways. In general, none of the waterways in the region are used for commercial navigation.

Major highways in the region include Interstate 84, Interstate 95, the Merritt Parkway (Route 15), and Route 7. These are maintained by the Connecticut Department of Transportation. Other numbered routes in the region are also managed by the Connecticut Department of Transportation (CTDOT), and many of these routes are the principal transportation arteries in the WestCOG municipalities. For example, Route 6 links Newtown and Bethel with Danbury. Local roads are also important, and each WestCOG municipality identifies its public works facility as a critical facility as this facility is needed to ensure that roads are cleared and maintained in the timely manner.

Principal airports in the region include Danbury Municipal Airport which functions as a reliever airport to reduce congestion at larger commercial airports, and Candlelight Farms Airport in New Milford, which functions as a general aviation airport. The sole private use airport is the Flying Ridge Airstrip in Newtown.

The New Haven Line provides railroad service between Greenwich and New Haven, with branch lines between Stamford and New Canaan and between Norwalk and Danbury. Freight rail lines include a railroad from Derby to Danbury that extends west into New York and north into New Milford, and the Housatonic River line from New Milford to Massachusetts. In addition to providing an

REGIONAL CHALLENGES

CRITICAL FACILITIES OF REGIONAL SIGNIFICANCE

Stamford Train Station
Photo: NPR

Wastewater Treatment Plant, Danbury
Photo: H John Voorhees III

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WHAT IS THE CHALLENGE?

During the hazard mitigation planning process, local communities provide lists or descriptions of their "critical facilities." According to FEMA's Local Mitigation Planning Handbook (2013), "Critical facilities are structures and institutions necessary for a community's response to and recovery from emergencies. Critical facilities must continue to operate during and following a disaster to reduce the severity of impacts and accelerate recovery," and "Outreach programs that increase risk awareness, **projects to protect critical facilities**, and the removal of structures from flood hazard areas are all examples of mitigation actions."

Oftentimes, communities are not inclined to list critical facilities that are owned by State or regional entities, despite the fact that the local community is often required to provide emergency response, access, and egress to these facilities; or shares in the benefits provided by these facilities. Furthermore, when these facilities are considered critical and listed in hazard mitigation plans, local communities sometimes are hesitant to offer potential mitigation actions to protect them. This barrier should be addressed when possible, as effective hazard mitigation is often a partnership between communities and critical facility owners.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Many critical facilities of regional significance are located in the region. Examples include the Danbury Municipal Airport, rail facilities for Amtrak and Metro-North, water and wastewater facilities, power generation facilities, CT DOT operations and maintenance facilities, Eversource facilities, and numerous State agency facilities.

These facilities are considered critical facilities in this natural hazard mitigation plan update, though they may not be individual listed or mapped.

Communities can improve their hazard mitigation capabilities by leveraging the presence of regionally-significant critical facilities, and by including those facilities within their planning.

- Coordinate with facility operators on emergency response planning
- Consider facilities in emergency operations plans
- Work with facilities to secure funding for mitigation actions

essential mode of transportation under normal conditions, the availability of passenger and freight rail in the region are of critical importance for the movement of people and supplies following a disaster.

In terms of evacuation, most WestCOG communities do not have set large-scale evacuation plans. Instead, evacuation parameters and guidelines are provided within Local Emergency Operations Plans. This provides local emergency personnel the flexibility to respond as situations warrant. For example, along the shoreline the predicted storm surge may vary based on the timing of tide which may affect what roads must be evacuated and what routes will be necessary. Certain facilities, such as schools, typically have evacuation plans in order to ensure that students are safely taken to another location if an evacuation is needed during the school day.

2.4.3 Lifeline Utility Systems

Lifeline utility systems may include electric power, potable water, wastewater, oil, natural gas, and communication systems. In general, the Region does not have any oil or fuel transmission mains.

Eversource provides electric power to the entire Region. Natural gas service is also provided by Eversource throughout the region, although distribution lines for natural gas are not as extensive as those for electric power. South Norwalk Electric and Water provides electric power to the western and southwestern portion of Norwalk. Both utilities purchase electricity and move it through their distribution network to customers in their service areas.

The Region is served by various public water systems. The most extensive water utility in the region is Aquarion Water Company which provides service to portions of the entire region ranging from small subdivisions to extensive developed areas. Other substantial public water systems include the municipally owned Danbury Water Department, Bethel Water Department in southwestern Bethel, Norwalk First Taxing District in eastern Norwalk, and South Norwalk Electric and Water in western Norwalk and southern Wilton. Supply sources include extensive reservoir systems, stratified drift wells, and bedrock wells. Areas not served by public water systems are generally served by private wells.

According to the Regional POCD, there are 10 major water pollution control facilities in the Region. These include facilities in New Milford, Danbury, Bethel, Ridgefield, Redding, Greenwich, Stamford, New Canaan, Norwalk, and Westport. Sewer service also extends into Brookfield, Darien, and Wilton with treatment occurring in a nearby municipality. Pumping stations with backup power supplies are essential to successful operation of the sewer systems.

Private communication carriers in the region as well as utilities such as Eversource rely upon communication towers which are overseen by the Connecticut Siting Council. These range from rooftop-mounted towers to standalone monopoles. While many towers have battery backups and standby power supplies, loss of power to these facilities can greatly hamper emergency response and restoration activities following a natural disaster as was seen widely in Connecticut following Tropical Storm Irene and Winter Storm Alfred in 2011.

2.4.4 High Potential Loss Facilities

High potential loss facilities include nuclear power plants, high hazard dams, and military installations. There are no nuclear power plants or military installations in the Region, although there are various military training and recruitment centers in Danbury, Newtown, Stamford, and Norwalk.

High hazard dams are therefore the primary type of high potential loss facilities in the region. The potential impacts of dam failure are presented in Section 3.3.9 and in each municipal annex.

2.4.5 Hazardous Materials Facilities

Hazardous materials facilities include producers of corrosives, explosives, flammable materials, radioactive materials, and toxins. Additionally, these facilities may include those industries and businesses which store and use such materials as process chemicals. These facilities are of particular concern for emergency responders in the region. In particular, Danbury emergency personnel maintain lists of all private facilities that house such chemicals in order to be prepared for specialized fire or emergency response. However, as these are typically

privately owned facilities, they are not typically listed in the lists of critical facilities provided in each municipal annex.

The Connecticut DEEP has proposed strategies for municipalities to implement in order to recommend best management practices to prevent pollution from chemicals from being released following a flood or disaster. This is discussed on the Fact Sheet following this page.

NEW INITIATIVES

HELPING SMALL BUSINESSES MITIGATE IMPACTS OF NATURAL HAZARDS

Flooding in New Milford
Photo YouTube

Ct.deep.gov

WHAT IS THE INITIATIVE?

According to FEMA, 40% of businesses affected by disaster never reopen, and 25% that do reopen fail; other studies show that 90% of businesses fail within two years of being struck by a disaster. Natural disasters can result in property damage, loss of inventory, and business interruption; another important risk that many small businesses face is that of environmental contamination and legal liabilities resulting from toxic chemical releases into the environment during or following a disaster.

In an effort to assist small business with natural hazard mitigation, CT DEEP has proposed strategies for towns to implement education and awareness programs with recommendations for best management practices (BMPs) to help business owners and municipalities prevent commercial pollutants from entering the environment.

Such education and awareness programs may help small businesses and the municipalities in which they are located avoid expensive cleanups, reduce legal liability challenges, mitigate potential risks to public health, and accelerate business recovery and reopening – reducing negative impacts to the municipality's economic base.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

The municipalities of the region can benefit from mitigation actions related to mitigating flood impacts to small businesses that use toxic chemicals. A selection from the following actions has been included in each of the municipal annexes, depending on the needs of each community:

- Provide information on the municipal website about CT DEEP training and information around small business chemical management for hazard resilience.
- Use the CT Toxics Users and Climate Resilience Map to identify toxic users located in hazard zones within your community. Contact those users to inform them about the CT DEEP small business chemical management initiative.
- Host a CT DEEP presentation for municipal staff and local businesses about business chemical management for hazard resilience.

CT DEEP has recommended that each municipality be listed as the lead agency for each of these actions, with assistance from CT DEEP noted (CT DEEP will develop information for dissemination). The suggested action priority is "medium", with a completion time frame of one year.

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3.0 Hazard Identification and Risk Assessment

3.1 Natural Hazards Impacting the Region

The 2019 CT NHMP includes a risk assessment of dam failure, winter weather (blizzards, freezing rain, ice storms, nor'easters, sleet, snow, and winter storms), flood-related hazards (riverine, coastal, flash, and shallow flooding), sea level rise, earthquakes, drought, thunderstorms (wind, hail, and lightning), tornadoes, tropical cyclones (hurricanes and tropical storms), and wildland fires. This HMP addresses each of these hazards as well as the risk of related hazards discussed in previous planning efforts in the region. Note that some hazards are not applicable to all WestCOG municipalities; for example, coastal flooding and storm surge do not affect or damage inland communities.

3.1.1 Disaster Declarations

FEMA defines disasters in its Local Mitigation Planning Handbook (2013) as events that "can cause loss of life; damage buildings and infrastructure; and have devastating consequences for a community's economic, social, and environmental well-being." The Region has experienced a range of disasters in recent years. Note that some communities were damaged by disasters even though declarations were not made for Fairfield and Litchfield Counties as presented in Table 3-1.

Table 3-1: Federal Disaster and Emergency Declarations

Number	Event Date	Incident Description	Counties Designated
EM-3535	8/4/2020	Tropical Storm Isaias	Fair., Litch.
DR-4500 EM-3439	1/20/2020, ongoing	COVID-19 Pandemic	Fair., Litch.
DR-4385	5/15/2018	Severe Storms, Tornadoes, and Straight-Line Winds	Fairfield
DR-4106 EM-3361	2/8 to 2/11/2013	Severe Winter Storm and Snowstorm "Nemo"	Fairfield, Litchfield
DR-4087 EM-3353	10/27 to 11/8/2012	Hurricane Sandy	Fairfield, Litchfield
DR-4046 EM-3342	10/29 to 10/30/2011	Severe Storm "Alfred"	Fairfield, Litchfield
DR-4023 EM-3331	8/26 to 9/1/2011	Hurricane Irene	Fairfield, Litchfield
DR-1958	1/11 to 1/12/2011	Snowstorms	Fairfield, Litchfield
DR-1904	3/12 to 5/17/2010	Severe Storms and Flooding	Fairfield
DR-1700	4/15 to 4/27/2007	Severe Storms and Flooding	Fairfield, Litchfield
EM-3266	2/11 to 2/12/2006	Snow	Fairfield
DR-1619	10/14 to 10/15/2005	Severe Storms and Flooding	Litchfield
EM-3200	1/22 to 1/23/2005	Record Snow	Fairfield, Litchfield
EM-3192	12/5 to 12/7/2003	Snow	Fairfield, Litchfield
EM-3176	2/17 to 2/18/2003	Snowstorm	Fairfield, Litchfield
DR-1302	9/16 to 9/21/1999	Hurricane Floyd	Fairfield, Litchfield
DR-1092	1/7 to 1/13/1996	Blizzard of '96	Fairfield, Litchfield
EM-3098	3/13 to 3/17/1993	Severe Winds & Blizzard, Record Snowfall	Fairfield, Litchfield
DR-837	7/10/1989	Severe Storms and Tornadoes	Litchfield
DR-747	9/27/1985	Hurricane Gloria	Fair., Litch.
DR-711	5/27 to 6/2/1984	Severe Storms & Flooding	Fairfield, Litchfield
DR-661	6/14/1982	Severe Storms & Flooding	Fairfield, Litchfield
EM-3060	2/7/1978	Blizzard & Snowstorms	Fairfield, Litchfield
DR-42	8/20/1955	Hurricane, Torrential Rain & Floods "Connie" & Diane"	Fair., Litch.
DR-25	9/17/1954	Hurricanes "Carol"	Fair., Litch.

Source: FEMA

Severe winter storms, hurricanes and tropical storms, tornadoes, and nor'easters contributed to the disaster declarations.

3.1.2 FEMA Public Assistance Reimbursements

Public Assistance reimbursements are maintained by FEMA and are available through the FEMA website. The database contains records of damage reimbursements dating back to August 26, 1998 for municipalities, nonprofit organizations, schools, and state agencies. For Connecticut, the vast majority of losses are related to flooding, wind, or winter storm damage. Total damages from the Public Assistance database are summarized for each community in the table below. The total damage column assumes that the federal reimbursement reported by FEMA represented 75% of the actual damages.

Table 3-2: Damages Since 1998 Based on FEMA Public Assistance Reimbursements

Municipality	Flood	Winter Storm	Wind Event
Bethel	$35,958	$813,379	$222,820
Bridgewater	$49,385	$181,929	$48,077
Brookfield	$33,500	$1,461,428	$2,284,703
Danbury	$929,844	$5,189,183	$1,645,149
Darien	$865,841	$494,648	$343,938
Greenwich	$5,407,534	$1,407,231	$2,046,460
New Canaan	$533,459	$1,196,848	$2,714,228
New Fairfield	$208,097	$595,568	$3,251,010
New Milford	$133,515	$1,677,798	$394,228
Newtown	$143,709	$2,188,446	$3,854,653
Norwalk	$4,971,658	$1,356,155	$2,603,893
Redding	$369,707	$781,113	$614,481
Ridgefield	$373,636	$1,198,109	$1,492,872
Sherman	$241,328	$166,310	$160,629
Stamford	$5,096,024	$2,242,463	$2,192,913
Weston	$1,409,626	$479,388	$567,749
Westport	$2,496,204	$1,115,076	$933,972
Wilton	$331,003	$1,155,228	$1,225,053
WestCOG	**$23,630,030**	**$23,700,301**	**$26,596,828**

Source: FEMA

Annualized loss estimates were prepared based on the Public Assistance data. The damage for each WestCOG municipality due to flooding, wind, and winter storms was summed and divided by the 21 years of available data. The annualized loss for flooding in the region based on these data is $1,125,240, and the annualized loss due to wind from tornadoes and tropical cyclones is $1,266,516. The annualized loss due to winter storm damage in the region from these data is much higher at $1,128,586, suggesting that for public property and property managed by non-profits, the region as a whole is at roughly equal risk of damage and losses from these hazards. This annualized loss information is carried forward into the risk assessment in Section 3.3 as part of the potential loss estimates for each community.

3.2 Local Public Perception of Natural Hazard Risk

3.2.1 Public Information Meeting Polling

Four polls were conducted during the presentations at each public information meeting in order to gauge public interest and awareness of natural hazards. Responses are presented in Table 3-3. Poll results suggested that attendees were most concerned with high wind events and were somewhat or very concerned about climate change. Most attendees had experienced minor delays or inconvenience due to natural hazards, although some had experienced greater impacts. Many attendees had noticed various mitigation projects occurring within their community such as improvements to emergency alerts and emergency services, with increased electric grid resilience being the most desired project.

Table 3-3: Public Information Meeting Poll Responses

Poll #1	Response
What community do you live in?	30% - Bridgewater, New Fairfield, New Milford, or Sherman 10% - Bethel, Brookfield, or Newtown: 10% 20% - Redding, Ridgefield, Weston, or Wilton 40% - Other / No response
What brought you here tonight?	70% - I want to learn more about natural hazards and mitigation 40% - Other / No response: 40%
Poll #2	**Response**
Which natural hazard are you most concerned with?	50% - Riverine flooding 20% - Flash flooding 80% - High wind events 50% - Snow and ice events 20% - Wildfire 30% - Extreme temperatures (hot or cold) 10% - No response
How concerned are you about climate change impacts on natural hazards?	30% - Very concerned 40% - Somewhat concerned 10% - A little concerned 10% - Not at all concerned 10% - No response

Have you been impacted by natural hazards in the past?	40% - Property damage 10% - Displacement (moved / use shelter) 20% - Lost work or income 70% - Minor delays or inconvenience 10% - No response
Poll #3	**Response**
What types of mitigation actions have you seen implemented in your community?	50% - Public education and awareness 90% - Emergency alerts and notifications 70% - Electric grid resilience (tree trimming, burying wires, backup generators, etc.) 50% - Prevention of damages (regulation changes, building codes, etc.) 30% - Structural protection (floodwalls, increased bridge openings, etc.) 10% - Property protection (home elevations, storm shutters or windows, etc.) 70% - Emergency services (improvements to shelters, emergency facilities, etc.) 20% - Natural resource protection (open space acquisitions, wetland protection, etc.) 10% - No response
What types of mitigation actions would you most like to see implemented in your community?	20% - Public education and awareness 20% - Emergency alerts and notifications 50% - Electric grid resilience 30% - Structural projects 30% - Property protection 20% - Emergency services 50% - Natural resources protection 10% - No response
Poll #4	**Response**
Which of the following climate change impacts are you most concerned about for your community?	50% - More frequent and intense rainstorms 90% - More frequent and intense windstorms 30% - More frequent and intense heat events 40% - More severe droughts 20% - Increased wildfire risk 70% - Increased risk of insect-borne illnesses 10% - No response

3.2.2 Public Survey

A public survey was developed using surveymonkey.com and made available to residents and businesses in the Region from June 18, 2020 through November 13, 2020. The primary goal of the survey was to educate local officials of the general public awareness regarding natural hazards, with the secondary goal being to collect information that may lead to potential mitigation strategies. A total of 18 people participated in the 17-question survey. The responses provide an indication of the public perception regarding the level of risk, awareness of natural hazard mitigation planning, and emergency response in the WestCOG municipalities. Some write-in responses were accepted for publication, although some were inapplicable to needs of the planning process and were not carried forward to this document. A Fact Sheet summarizing the public survey is included on the following page.

Question 1 asked "In which community do you live, work, or own property?" Results are presented in Table 3-4. The majority of respondents identified with the communities of Bethel, Bridgewater, New Milford, Stamford, and Westport.

Table 3-4:
In Which Community Do You Live or Own Property?

Municipality	Response Count	Response Percentage
Bethel	3	17%
Bridgewater	2	11%
Greenwich	1	6%
New Milford	2	11%
Newtown	1	6%
Norwalk	1	6%
Stamford	3	17%
Westport	2	11%
Out of Region	3	17%
Total	**18**	**100%**

Question 2 asked "In which community do you work?" Results are presented in Table 3-5. The majority of respondents worked in the communities of Bethel, Norwalk, and Stamford.

Question 3 was for informational purposes, asking "please enter your street of residence or place of business." This information was requested to cross-reference later responses related to a vulnerability for the particular area near the respondents' residence or business. A total of 15 people responded to this question.

OUTREACH EFFORTS

PUBLIC ENGAGEMENT SURVEY

Keywords in Open-Ended Question Responses

Themes Identified in Responses

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WHAT WAS ACCOMPLISHED?

A survey was posted online in the summer of 2020 to solicit input from the public on local mitigation activities and strategies. The survey was opened on June 22 and closed on October 10, 2020. Press releases were carried in numerous news media outlets and municipal web sites. A total of 18 individuals responded.

The survey provided an opportunity for members of the public to participate in the planning process on their own schedules. The survey was comprehensive, asking questions about hazards of concern, vulnerable areas, local capabilities and actions already completed, and preferences in terms of future mitigation actions performed.

The survey consisted of a combination of multiple-choice questions and open-ended response questions that allowed respondents to provide any comments they wished.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Results were tabulated by town and considered in updating municipal challenges and strategies sections. General points drawn from the survey are summarized in the list below.

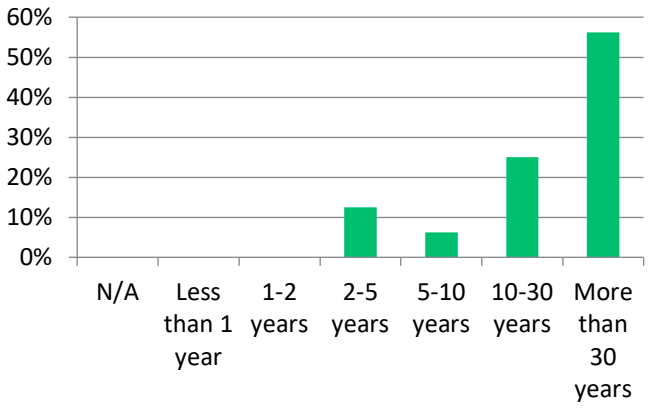
- **Primary Concerns:**
  - Severe thunderstorms
  - Winter Storms
  - Localized Flooding
  - Hurricanes and Tropical Storms
- **High Priority Actions:**
  - Protecting power lines
  - Improving infrastructure
  - Identifying hazard zones
  - Removing buildings from risk areas
  - Assisting vulnerable populations

Table 3-5: In Which Community Do You Work?

Municipality	Response Count	Response Percentage
Bethel	3	17%
Bridgewater	1	6%
Brookfield	1	6%
Danbury	1	6%
Darien	1	6%
Newtown	1	6%
Norwalk	2	11%
Redding	1	6%
Stamford	2	11%
Westport	1	6%
Out of Region	4	22%
Total	**18**	**100%**

Question 4 asked "For how many years have you lived or worked in the region?" Figure 3-1 presents the results. The majority of respondents have lived or worked in the region for more than 30 years.

Figure 3-1: For how many years have you lived or worked in the Region?



Question 5 asked "Did you know that the community where you live or work is covered by an HMP?" Slightly above half (58%) of respondents were aware that their community had an HMP.

Question 6 asked "Which of the following natural hazards have impacted you?" Responses are summarized in Table 3-6. All respondents noted being impacted by winter storms, while most respondents also mentioned being impacted by severe thunderstorms, and hurricanes and tropical storms.

Table 3-6: Which of the Following Natural Hazards Have Impacted You?

Hazard	Response Count	Response Percentage
River flooding	3	17%
Coastal flooding	3	17%
Poor drainage flooding	5	28%
Hurricanes and Tropical Storms	8	44%
Severe Thunderstorms	9	50%
Winter Storms and Blizzards	12	75%
Extreme Cold or Heat	4	22%
Other	1	6%
No response	6	33%
Total	**18**	**100%**

Question 7 asked "How concerned are you about each of those hazards happening in the future?" Table 3-7 summarizes the responses. The hazards considered to pose the highest threat or concern to the majority of respondents include severe thunderstorms and tornadoes, winter storms and blizzards, poor drainage flooding, and hurricanes and tropical storms.

Table 3-7: How Concerned Are You About Each of Those Hazards Happening in the Future?

Hazard	Low (1)	Moderate (2)	High (3)	Average Rating
River flooding	6	5	0	1.5
Coastal flooding	7	1	2	1.5
Poor drainage flooding	3	8	1	1.8
Dam Failure	8	2	0	1.2
Hurricanes and Tropical Storms	4	5	3	1.9
Severe Thunderstorms	2	7	3	2.1
Winter Storms and Blizzards	3	6	3	2.0
Extreme Cold or Heat	6	4	1	1.6
Drought	8	3	0	1.3
Wildfires and Brush Fires	10	1	0	1.1
Landslides	10	1	0	1.1
Other	2	1	0	1.3

Question 8 requested specific areas that were vulnerable to natural hazards. Responses from the public included the following:

- *"Ponding on lower Taylor Avenue in Bethel"*
- *"Dead and poorly trimmed trees damaging powerlines on upper Taylor Avenue in Bethel"*
- *"Constant power losses in downtown Bethel area during storms"*
- *"Saxon Road, Codfish Hill Road, and Long Meadow Road in Bethel"*
- *"Water Street in Norwalk"*
- *"Flooding on Route 202 in New Milford"*
- *"Main Street in South Bridgewater in the glen heading towards bridge"*
- *"Route 133 in Bridgewater and Brookfield"*
- *"Wewauka Brook Road in Bridgewater"*

Question 9 asked "Have you taken any actions to protect your family, home, or business?" Table 3-8 presents the responses.

Table 3-8: Have you taken any actions to protect your family, home, or business?

Hazard	Response Count	Response Percentage
Elevated or floodproofed to reduce flood damage	1	6%
Installed storm shutters or structural braces to reduce wind damage	1	6%
Taken measures to reduce snow build-up on roofs	4	22%
Cut back or removed vegetation from overhead utility lines or roof	2	11%
Replaced overhead utility lines with underground lines	0	0%
Managed vegetation to reduce risk of wildfire	1	6%
Developed a disaster plan	5	28%
Maintain a disaster supply kit	4	22%
Participated in public meetings to discuss relevant plans and regulations	3	17%
Purchased hazard insurance	1	6%
Other	2	11%

The actions most commonly performed by respondents include developing a disaster plan for their home, maintaining a disaster supply kit, taking measures to reduce built-up snow on roofs, and participating in public meetings to discuss relevant plans and regulations. One respondent also purchased winter snow tires.

Question 10 asked respondents to identify whether certain strategies were important to mitigate natural hazards, if those strategies have been successfully used by their communities in the past, and if they should be a priority moving forward. Table 3-9 presents the results.

Table 3-9: Mitigation Tools in Your Community

Mitigation Strategy	Important	Successful	Priority
Identification of areas with risk from hazards	63%	13%	63%
Removal of buildings from areas of risk	63%	25%	63%
Assisting vulnerable populations	50%	30%	60%
Protecting powerlines from trees and wind	67%	33%	56%
Infrastructure improvements	50%	0%	50%
Public outreach and education	75%	13%	50%
Backup power for critical facilities	56%	56%	44%
Ordinances and regulations that reduce risk from hazards	57%	0%	43%
Emergency information and alerts	63%	38%	38%
Infrastructure inspection and maintenance	50%	17%	33%
Flood insurance	57%	29%	29%
"Hardening" critical facilities to make them less vulnerable	71%	0%	29%
Maintaining disaster plans and kits	86%	43%	29%
Emergency response training for municipal staff	43%	29%	29%
Improve firefighting capabilities	40%	40%	20%

Most respondents believed that the most important mitigation actions included maintaining disaster plans and kits, conducting public outreach and education, and hardening critical facilities to make them less vulnerable. However, the current implementation of those strategies was generally not widely considered to be successful. Respondents generally considered projects that installed backup power at critical facilities to be the most successful mitigation project in their communities. In terms of future

mitigation strategies, respondents were most interested in projects to identify areas at risk of hazards, remove buildings from areas of risk, and that assist vulnerable populations. Respondents also suggested that better utilization of first responders is needed in each community, and that the acquisition of open space along the shoreline would be a method to mitigate the potential impacts of climate change on coastal flooding and sea level rise.

Question 11 asked respondents about what resources they believed were available to support or assist with hazard preparation, response, or recovery, and what resources they believed are useful or important. Table 3-10 presents the results. Most responders believed that emergency responders and local governments were the most available resources to support or assist with hazard preparation, response, or recovery, and that additional resources at the state and local government level would be both useful and important for improving hazard mitigation efforts.

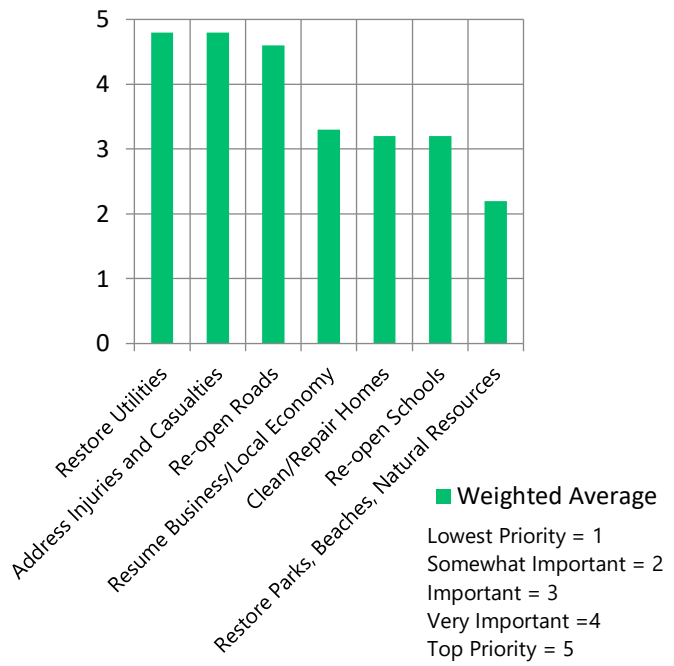
Table 3-10: What Local Resources are Available to Support or Assist with Hazard Preparation, Response, or Recovery? What Resources are or Would be Useful or Important?

Local Resources	Available	Useful / Important
Community groups or neighborhood associations	10%	40%
Local schools	20%	40%
State government	50%	60%
Local government	60%	60%
Higher education institutions	30%	30%
Individual community members or neighbors	30%	30%
Emergency responders	70%	60%
Nonprofit organizations	40%	30%
Religious institutions	30%	20%

Question 12 asked respondents to rank the importance of certain actions typically taken by local communities following a natural hazard event. Results are presented in Figure 3-2. Respondents believed that restoring damaged utilities, addressing injuries and casualties, and reopening roads were the most important restoration measures.

Question 13 noted that scientists expect increased rainfall and frequency of storm events due to climate change and asked respondents to opine on which statement about planning for future changes they were in most agreement. The majority (70%) of respondents indicated that it is appropriate to plan for storm events to become more severe and more frequent in the future.

Figure 3-2: How important is each of the following activities to recovering from a hazard event?



Similarly, Question 14 noted that scientists expect sea level will continue to rise in Connecticut due to climate change and asked respondents to opine on which statement about planning for future sea level rise they were in most agreement. The majority (67%) of respondents indicated that it is appropriate to plan for sea level rise to accelerate dramatically with over two feet of rise by 2050.

Question 15 asked respondents to write in one action to reduce risks from natural hazards in their community. Most responses sought to improve tree trimming programs, and other related responses sought projects to move utilities underground and improve utility coordination and response. Other responses sought to remove flood prone properties and convert the property to open space, particularly in coastal flooding areas. Responses from the public included:

- *"Better coordination of utility response"*
- *"Moving utilities underground"*
- *"Putting maximum effort into power restoration efforts"*
- *"Reducing potential power outages by performing "extreme" tree cutting near powerlines"*
- *"Cutting back trees and branches from powerlines more effectively"*
- *"Reclaiming coastal areas as public open space to mitigate the expected effect of increased coastal flooding"*
- *"Removing properties within the flood zone"*

Question 16 requested additional comments or questions to be addressed as the HMP is updated. Three comments were received:

- *"This survey is a good effort to gather input from residents, but some questions assume high level of knowledge by survey takers (resources available through various entities, increased level of severity in flooding). I would suggest including options for mitigation actions that indicate lack of effectiveness rather than only degrees of positive effectiveness. For example, although this study is funded by FEMA, I do not believe that flood insurance is an effective mitigation measure. It in fact allows continued development of high value real estate in high-risk areas for flooding such as the Compo Beach area of Westport but may limit property improvements in lower value areas such as neighborhoods in South Norwalk. I encourage you to evaluate mitigation actions that focus on reducing development and investment on coastal properties by repurposing coastal property to open space uses. "*
- *"Plan on a method for quick and accurate dissemination of information before, during, and after an occurrence."*
- *"Communities should consider real implementable goals within their Plan and assign someone to pursue those goals."*

Finally, Question 17 asked respondents to provide their email address if they wished to receive updates regarding the status of this planning effort. Four attendees provided their email addresses. These members of the public were included on announcements related to the Plan update.

3.3 Risk Assessment

The following discussion provides an overview of the types of natural hazards that are likely to impact the Region. The section includes a description of each hazard type, discusses the location that can be affected by each hazard, discusses the potential extent of each hazard, provides an historic look at recent disasters and the effects of hazards on the region, analyzes the probability the hazard will strike again, and assesses the impact of each. Specific impacts to each WestCOG municipality are presented in each municipal annex. Emphasis is given to floods, severe winter storms, and tropical cyclones (hurricanes and tropical storms) as these hazards are frequent and/or damaging in the region. Throughout the following sections all estimates of costs and damages given in dollars are not inflation adjusted.

According to the 2019 CT NHMP, "climate change is both a present threat and a slow-onset disaster" that "acts as an amplifier of existing hazards." Extreme weather events appear to be becoming more frequent over recent years and there is no indication that this trend will not continue. Higher hurricane wind speeds and increased rainfall intensity are expected to increase the impact of wind damage and flooding on the Region. Additionally, more intense heat waves may mean droughts and wildfires could be intensified or made more frequent. The impact of climate change on each hazard is discussed in appropriate sections of this Plan update.

Comprehensive estimates of the losses each community faces from specific natural hazards are generally not available and must be developed as part of this planning process. The costs incurred by local communities as a result of the federal disasters shown in Table 3-2 provide a partial indication of potential losses, but these costs do not cover all the costs associated with natural disasters including those experienced by private businesses and citizens.

The equalized net grand list (Table 2-8) provides an estimate of the market value of all taxable property in each community and can give an indication of the total value of property exposed to natural disasters of a town-

wide or region-wide scope. County-wide damages developed in the 2019 CT NHMP are applied in many cases herein by population percentage in order to estimate the potential annualized loss in a community due to a particular natural hazard.

Risk Assessment Terminology

Community assets: The people, structures, facilities, and systems that have value to the community.

Extent: The strength or magnitude of the hazard, based on an established scientific scale or measurement system, speed of onset, and duration. Extent defines the characteristics of a hazard regardless of the people and property if affects, as opposed to impact (below).

Impact: The consequences or effects of a hazard on the community or its assets.

Location: The geographic areas within the planning area that are affected by the hazard.

Natural hazard: Source of harm or difficulty created by a meteorological, environmental, or geological event.

Probability: The likelihood of the hazard occurring in the future.

Risk: The potential for damage, loss, or other impacts created by the interaction of natural hazards with community assets.

Risk assessment: Product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

Vulnerability: Characteristics of community assets that make them susceptible to a given hazard.

Source: FEMA Local Mitigation Handbook, 2013

Computer modeling is another means of analyzing risks from natural disasters. FEMA's HAZUS-MH model version 4.2 was used to evaluate risks and estimate losses the region might face to life and property from flooding, earthquakes, and hurricanes. HAZUS-MH is a software program that can be used throughout the United States and provides standard loss estimations and damage assessments based on historical hazard events, Census data, and other federal and nationally based databases. Level 1 (default data) were used for the analysis as this level of analysis is appropriate for a regional HMP. The HAZUS-MH model uses 2010 Census data and block boundaries as a baseline for analyzing losses along with 10-meter National Elevation Dataset digital elevation model grids to generate flood depths. Because of the limitations of the Census and inventory data used in the HAZUS-MH analyses, the loss estimates should at best be considered approximate.

Note that HAZUS-MH Level 2 and Level 3 Analyses require more extensive and site-specific structure inventory data, hydraulic modeling results, and potentially participation by a wide variety of stakeholders such as utilities and state agencies that is typically not appropriate at a regional scale. For example, higher-level analysis can be used to evaluate the potential benefits of flood mitigation projects to specific neighborhoods. HAZUS-MH Level 2 and Level 3 Analyses were therefore beyond the scope of this HMP.

3.3.1 Exposure Analysis

Whereas certain hazards such as hurricanes may affect the entire Region, other hazards such as flooding typically affect defined areas. Thus, the extent of exposure to a particular natural hazard may vary depending upon the extent of the hazard.

Vulnerable assets were identified by intersecting GIS-based asset inventories and demographic data with hazard risk boundaries to determine the number of parcels, buildings, critical facilities, historic resources, and populations exposed to each hazard. This results in an estimation of exposure by hazard. The exposure analysis for each municipality is presented in the subsections that follow. The following inventories were used to conduct the exposure analysis:

- Coastal erosion exposure was mapped using the 2014 publication Analysis of Shoreline Change in Connecticut by DEEP, Sea Grant, and UConn/CLEAR.

- Dam failure exposure was determined based on dam failure inundation mapping available from Connecticut DEEP for the high and significant hazard dams in the planning area. If inundation mapping was not available, exposure was not estimated.

- Flooding exposure was based on existing digital flood insurance rate maps (FIRMs) for each community.

- Historic resources were mapped using spatial point data developed by SHPO in 2015-2017, except for New Milford and Bridgewater where existing polygons from State data were used.

- Sea level rise extent was mapped using the "bathtub model" methodology, with all land areas below the elevation of Mean Higher High Water plus the 50 cm sea level rise projections developed by CIRCA (see Section 3.3.2 for discussion).

- Storm surge exposure was based on the 2008 Sea, Lake, and Overland Surges from Hurricanes or "SLOSH" analysis prepared by the United States Army Corps of Engineers (USACE). This GIS shapefile is available from Connecticut DEEP.

- Wildfire exposure was determined using a methodology Wildfire exposure was determined using recent mapping developed by the USDA Forest Service and University of Wisconsin-Madison that depict the areas (as of 2010) that intermix or interface with wildland vegetation types. The mapping considers varying densities of vegetation and housing development.

- For the remaining hazards (earthquakes, hurricanes, thunderstorms, tornadoes, winter storms, and terrorism/mass casualty), it was assumed that all buildings and populations were at equal risk. The exposure values are equal to the total exposure of the community.

Table 3-11 presents the exposure analysis for the entire Region. The Region contains a total of 169,495 parcels valuing $164.2 billion. Significant numbers of buildings are vulnerable to flooding and storm surge, including at least 32 critical facilities and 82 historic assets.

Note that drought is not considered in the exposure analysis because this hazard typically does not affect built infrastructure in the same way that other hazards may.

3.3.2 Flooding

Flooding is the most common natural hazard encountered in the Region. Triggered by a variety of events, floods can occur during any season. Heavy precipitation is common throughout the year, and each season brings its own source of floods: From mid-summer through fall, hurricanes bring wind and torrential rain; winter nor'easters pound the region with snow and rain; in spring snowmelt inundates local hydrologic systems; and summer thunderstorms can bring flash floods in minutes. Historical development patterns encouraged dense construction of town centers near water bodies; consequently, many areas with chronic flooding problems are in population centers.

Location

According to FEMA, most municipalities in the United States have at least one clearly recognizable area at risk of flooding around a river, stream, or large body of water including the shoreline. Many communities also have localized flooding areas outside the Special Flood Hazard Area (SFHA). These floods tend to be shallower and chronically reoccur in the same area due to a combination of factors. Such factors can include ponding, poor drainage, inadequate storm sewers, clogged culverts or catch basins, sheet flow, obstructed drainageways, sewer backup, or overbank flooding from minor streams.

Extent

The Region is affected by riverine, flash, shallow or nuisance, and coastal flooding.

Riverine Flooding

According to FEMA, there are several different types of inland flooding:

Table 3-11: Exposure Summary for the Region (Number, or Value in Billions of Dollars)

Hazard	Number of Parcels	Value of At-Risk Parcels	Number of Buildings	Number of Critical Facilities	Number of Historic Assets
Dam Failure	5,017	$3.1	10,948	15	126
Earthquake	169,495	$164.2	682,421	575	5,173
Flooding					
1% Annual	18,996	$35.8	31,765	20	0
0.2% Annual	10,784	$15.2	11,407	12	82
Storm Surge					
Category 1	4,920	$15.6	8,957	8	280
Category 2	5,908	$17.4	14,012	5	231
Category 3	5,615	$16.6	15,138	32	586
Category 4	5,856	$16.1	11,877	12	157
Sea Level Rise	2,704	$10.9	3,009	2	208
Terrorism	169,495	$164.2	682,421	575	5,173
Thunderstorm	169,495	$164.2	682,421	575	5,173
Tornado	169,495	$164.2	682,421	575	5,173
Tropical Cyclone	169,495	$164.2	682,421	575	5,173
Winter Storm	169,495	$164.2	682,421	575	5,173
Wildfire	96,182	$82.1	329,509	83	1,052

- **Riverine Flooding**: Also known as overbank flooding, it occurs when channels receive more rain or snowmelt from their watershed than normal, or the channel becomes blocked by an ice jam or debris. Excess water spills out of the channel and into the channel's floodplain area.

- **Flash Flooding**: A rapid rise of water along a water channel or low-lying urban area, usually a result of an unusually large amount of rain and/or high velocity of water flow (particularly in hilly areas) within a very short period of time. Flash floods can occur with limited warning.

- **Shallow Flooding**: Occurs in flat areas where a lack of a water channel results in water being unable to drain away easily. The three types of shallow flooding include:
  - **Sheet Flow**: Water spreads over a large area at uniform depth.
  - **Ponding**: Runoff collects in depressions with no drainage ability.
  - **Urban Flooding**: Occurs when man-made drainage systems are overloaded by a larger amount of water than the system was designed to accommodate.

While riverine or flash flooding are typically confined to defined channels and adjacent overbank areas, nuisance flooding can occur nearly anywhere as a result of shallow flooding or due to clogged or overwhelmed drainage systems. When drainage systems overflow near areas with steep slopes, or when heavy rainfall occurs on steep slopes, mass wasting events (landslides, mudslides) may occur as has happened in steeper sections of New Milford and Danbury.

Coastal Flooding

Coastal flooding is typically limited to shoreline areas and low-lying areas directly connected to the shoreline. It can occur as a result of astronomically high tide levels along coastal areas and due to storm surge from nor'easters and tropical cyclones. Coastal flooding is also possible from tsunamis as a result of underwater earthquakes or landslides. The effect of wave action poses the greatest threat from coastal flooding as it can damage structures and cause erosion of coastal areas.

Flood Zone Descriptions

In order to provide a national standard without regional discrimination, the 1% annual chance flood has been adopted by FEMA as the base flood for purposes of floodplain management and to determine the need for insurance. The floods are often described in terms of the

annual percentage chance of occurrence. Floodplains have been delineated by FEMA to reflect 1% and 0.2% annual flood events known informally as 100-year and 500-year floods, respectively. The area that has a 1% annual chance to flood each year is delineated as the SFHA for the purposes of the NFIP. The 0.2% annual chance floodplain indicates areas of moderate flood hazard.

Floodplains are lands along watercourses that are subject to periodic flooding; **floodways** are those areas within the floodplains that convey the majority of flood discharge. Floodways are subject to water being conveyed at relatively high velocity and force. The **floodway fringe** contains those areas of the 1% annual chance floodplain that are outside the floodway and are subject to inundation but do not convey the floodwaters at a high velocity.

However, because the 1% annual chance floodplain (or any percent annual chance floodplain) reflects the percentage chance that area will be inundated in any given year, it is possible to observe a 1% flood more than once every 100 years. For example, FEMA and the USACE note that a structure located within a 1% annual chance flood zone has a 26% change of suffering flood damage during the term of a 30-year mortgage. Note that the same home has only a 1% chance of being damaged by fire in the same 30-year period. The USACE has prepared a flood frequency chart (Table 3-12) that demonstrates the percent chance of flooding at various flood frequencies. Note that in many areas, the difference in flood heights between a 10% annual chance event and a 1% annual chance event is less than one foot.

Table 3-12: Description of Flooding Terminology

Flood Frequency (Years)	Chance of Flooding in Any Given Year	Percent Chance of Flooding during 30-Year Mortgage
10-Year	10%	96%
50-Year	2%	46%
100-Year	1%	26%
500-Year	0.2%	6%

Source: USACE Flood Risk Management Program

Furthermore, the 1% flood plain is based on empirical evidence. If more or less floods of a certain magnitude are observed, FEMA may restudy the flood plains and update corresponding insurance maps. This means that there can be a lag between the official risk and the empirical risk. A table of the two terms, x% annual chance flood and their corresponding y-year floods is found in Table 3-13.

Table 3-13: Recurrence Interval vs. Annual Percent Chance

Recurrence Interval	Annual Percent Chance
2-Year	50%
10-Year	10%
25-Year	4%
50-Year	2%
100-Year	1%
500-Year	0.2%

SFHAs in the Region are delineated on a FIRM delineated as part of a Flood Insurance Study (FIS). Major watercourses typically have SFHAs mapped as Zone AE, while smaller tributary streams are mapped as Zone A. Coastal zones include Zone AE, Zone V, and Zone VE. Other small streams have shading as Zone X, and other classifications are also possible. Table 3-14 presents the flood hazard zones mapped on FIRM panels in the Region.

During large storms, the recurrence interval level of a flood discharge on a tributary tends to be greater than the recurrence interval level of the flood discharge on the main channel downstream. In other words, a 1% annual chance flood event on a tributary may only contribute to a 2% annual chance flood event downstream. This is due to the distribution of rainfall throughout large watersheds during storms and the greater hydraulic capacity of the downstream channel to convey floodwaters. Dams and other flood control structures can also reduce the magnitude of peak flood flows if pre-storm storage is available.

Thus, the recurrence interval level of a precipitation event also generally differs from the recurrence interval level of the associated flood. An example would be Tropical Storm Floyd in 1999, which caused rainfall on the order of a 0.4% annual chance event while flood frequencies were only slightly greater than a 10% annual chance event on the Naugatuck River in Beacon Falls, Connecticut. Flood events can also be mitigated or exacerbated by in-channel and soil conditions, such as low or high flows, the presence of frozen ground, or a deep or shallow water table, as can be seen in the historic record.

Table 3-14: Flood Insurance Rate Map Zone Descriptions

Zone	Description
A	An area with a 1% chance of flooding in any given year for which no base flood elevations (BFEs) have been determined.
AE	An area with a 1% chance of flooding in any given year for which BFEs have been determined. This area may include a mapped floodway.
AO	Flood depths of one to three feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
VE	An area with a 1% chance of flooding with wave action in any given year for which BFEs have been determined. The limit of moderate wave action or "LiMWA" separates VE zones from coastal AE zones.
X (Shaded)	An area with a 0.2% chance of flooding in any given year, for which no base flood elevations have been determined. This designation includes areas protected from the 1% annual chance flood by a levee.
X (Unshaded)	An area that is determined to be outside of the 1% and 0.2% annual chance floodplains.

Source: FEMA

NFIP Participation

Each WestCOG municipality participates in the NFIP and plans to continue participating. A more detailed description of this program is provided in Section 4.1.1. The number of policies and the insurance in force for each WestCOG municipality is presented in Table 3-15. The average insurance in force per policy in the region is $280,410.

Table 3-15: National Flood Insurance Program Policies and Insurance in Force

Municipality	Policies in Force	Insurance in Force	Average Insurance Per Policy
Bethel	202	$44,293,800	$219,276
Bridgewater	9	$1,881,600	$209,067
Brookfield	53	$15,876,200	$299,551
Danbury	318	$95,304,600	$299,700
Darien	590	$180,700,800	$306,273
Greenwich	1,705	$516,181,300	$302,746
New Canaan	154	$49,269,300	$319,931
New Fairfield	36	$10,410,000	$289,167
New Milford	113	$27,445,000	$242,876
Newtown	65	$17,827,100	$274,263
Norwalk	2,164	$595,504,500	$275,187
Redding	42	$12,067,700	$287,326
Ridgefield	89	$25,781,400	$289,679
Sherman	17	$4,998,600	$294,035
Stamford	2,696	$673,561,900	$249,838
Weston	135	$40,908,200	$303,024
Westport	1,338	$413,577,900	$309,102
Wilton	201	$58,044,000	$288,776
WestCOG	**9,927**	**$2,783,633,900**	**$280,410**

Source: FEMA

Previous Occurrences

Historically, the region has experienced numerous flooding events. According to the FEMA FIS for Fairfield County, major floods have occurred in 1936, 1938, 1948, August 1955, 1960, and April 2007. The October 1955 flood was the most severe in the region. Dozens of residential and commercial properties were flooded in Brookfield, 14 bridges were washed away or severely damaged in New Canaan, and half of the Buttery Mill was washed away on Silvermine Road in New Canaan. Bear Mountain Road was completely washed away in New Fairfield. A portion of the Merritt Parkway was washed out on the Silvermine River in Norwalk as well as a portion of the main line of the New York, New Haven, and Hartford Railroad on the Five Mile River. Several roads were washed out in Sherman, including Leachhollow Road and Route 37 near Chapel Hill Road. According to the Town of New Milford FIS, the October 1955 flood resulted in $600,000 in damages in New Milford.

In the May of 1964, a series of low-amplitude waves in Long Island Sound were attributed to a submarine landslide. As a result, the Town of Darien identified tsunamis (in the 2016 plan for the former SWRPA region) as a potential hazard effect that causes flooding.

More recent floods noted by the FEMA FIS for Fairfield County include:

- A 1996 storm damaged several dozen unelevated homes in the Compo Beach area of Westport.

- Tropical Storm Floyd in September 1999 brought 11 inches of rain to Danbury causing damage to over 300 homes and a bridge.

- In April 2007, a nor'easter dropped 3.6 to 7.8 inches of rainfall throughout Fairfield County, resulting in major flood damage.

- Localized flooding occurred in the Darien and Stamford area on October 11, 2007 due to five inches of rainfall falling in a short period of time. Damage was extensive but not sufficient for a FEMA disaster declaration.

- Tropical Storm Hanna in September 2008 produced 6.5 inches of rain in Bethel and flooded parts of Ridgefield and Danbury. Three buildings flooded in Danbury in the downtown area. Two feet of water was reported on portions of Sound Beach Avenue and Arcadia Road in Greenwich.

- An unnamed winter storm in March 2011 produced two to four inches of snow and flash flooding that washed out 120 feet of Metro North-Danbury rail line in Danbury, shutting the line down for two weeks. Widespread street and basement flooding were reported in New Milford with sections of Route 7 closed, and a landslide occurred on Grove Street that prompted the evacuation of several families.

- Tropical Storm Irene on August 28, 2011 hit the coastline at high tide, causing a storm surge that flooded roads and homes. In Greenwich, parts of town experienced major flooding, including Route 1 and the eastern sections. In Old Greenwich, nearly every street on the north side of shore road was flooded. In Wilton, the Norwalk River overflowed, flooding two parking lots. In Westport, the combination of stream flow and storm surge on the Saugatuck River caused flooding of Route 1, Riverside Avenue, and Imperial Avenue.

- Connecticut experienced devastating damage due to Superstorm Sandy on October 28, 2012. Surges from Long Island Sound flooded buildings and roads along the shoreline, and coupled with fallen trees, many roads were impassable.
    - Streets close to the water in Westport and Norwalk remained submerged immediately following the storm, and millions of gallons of untreated sewage were discharged into Long Island Sound across the state.
    - Surging floodwaters and downed powerlines and trees trapped firefighters in Greenwich as they tried to battle a fire that destroyed three homes during the height of the storm.
    - In Westport, the surge reached as high as 12 feet sending water down Main Street and damaging many high-end retail shops. In shoreline areas along Compo Beach and Saugatuck Island, many roads remained flooded or were blocked by downed trees and power lines, impeding efforts to assess the full damage.
    - In the Harbor View section of Norwalk, menacing winds and 12-foot waves shredded the sea wall and ripped facades and decks off of homes.

The National Climatic Data Center's (NCDC) Storm Events Database lists numbers of coastal and flash flood events for Fairfield and Litchfield Counties, with records dating back to 1996. The storms listed in NCDC's database present only notable storm events, but unlisted storms also have a significant impact on the region. According to the database, flood events in Fairfield and Litchfield County have resulted in two deaths and $12.2 million in reported damages since 1996.

Focusing on the period of time occurring after the adoption of the most recent hazard mitigation plans covering WestCOG communities, the following information characterizes recent floods in the region:

- May 27, 2014: A severe thunderstorm produced high winds and heavy rainfall that resulted in another landslide that closed Grove Street in New Milford.

- July 14, 2014: Several rounds of storms produced heavy rain that resulted in flash flooding in portions of the region. A vehicle was floating in floodwaters on Elm Street at the Interstate 95 overpass in Stamford. Widespread street flooding was reported in Westport with several roads impassable. One car was stranded in high water on Myrtle Avenue.

- January 23, 2016: Heavy winds, combined with high astronomical tides to cause areas of minor to moderate localized coastal flooding along western Long Island Sound. Minor to moderate flooding was reported in coastal Westport, Connecticut. The Saugatuck River peaked at 6.39' NAVD88, which was about 3 feet of surge above the tide.

- March 14, 2017: A storm brought gale to storm force winds to the area waters, resulting in 2 to 4 feet of surge during the morning high tidal cycle. This resulted in widespread minor to moderate coastal impacts to the region. Erosion impacts to the beachfront were mainly minor.

- April 16, 2018: Heavy rainfall of 2 to 4 inches in a 3- to 4-hour period produced flash flooding in the region. Elm Street was closed between Cherry Street and South State Street in Stamford due to flooding.

- June 28, 2018: Heavy rainfall of 1 to 1.5 inches fell in a short time producing isolated flash flooding in the region. Numerous roads closed due to flooding in Darien including Heights Road, Post Road at Tokeneke Road, Post Road at Thorndal Circle, and Hoyt Street at Briar Brae Road. Interstate 95 was impassible at Exit 16 in Norwalk.

- September 25, 2018: Widespread rainfall amounts of 4 inches or more were reported across southern Connecticut with flash flooding resulting in numerous water rescues. Certain areas such as Hamden (outside the region) measured up to 8.6 inches of rainfall. Several streets flooded in Old Greenwich including Lockwood Avenue, Sound Beach Avenue, and Benjamin Street with at least two feet of standing water making roads impassable. Running mud and water over halfway up car tires was reported at the intersection of Davis Avenue and Bruce Park Drive in Old Greenwich. Both Shady Brook Lane and Midbrook Lane were impassable with up to two feet of water in Old Greenwich. Wesskum Wood Road at Sound Beach Avenue and Harding Road at Laddins Rock Road were closed in Old Greenwich due to continued flooding. Severe street flooding was reported at the intersection of Meadow Street and Wilson Avenue in South Norwalk with a car stranded and submerged halfway. I-95 was closed southbound at Exit 16 (East Avenue) in East Norwalk due to flooding. A car was stuck in the water. A school bus with 31 children was stranded on Dale Street in Stamford due to flooding and had to be rescued. The fact sheet on the following page highlights the event. This flood event resulted in a disaster declaration in Connecticut, but the Region was not included.

- December 21, 2018: Heavy rainfall of 1.5 to 4.5 inches produced flash flooding in the region. Route 53 was closed at Sympaug Park Road in Bethel due to flooding.

- August 19, 2019: Showers and thunderstorms produced isolated flash flooding conditions. A car was stuck in flood waters in Westport on Morningside Drive South just off of Post Road East (Route 1).

Probability of Future Events

Riverine and Flash Flooding

Several recent studies have shown that the amount of rainfall being experienced in Connecticut is increasing over time. Although annual precipitation in Connecticut is approximately 47 inches per year, the average annual precipitation has been increasing by 0.30 inches per decade since the end of the 19th century according to the NCDC.

Like many areas in the United States, the Region experienced a population boom following World War II. This population increase led to concurrent increases in impervious surfaces and the amount of drainage infrastructure. Many post-war storm drainage systems and culverts were likely designed using rainfall data published in "Technical Paper No. 40" by the U.S. Weather Bureau (now the National Weather Service [NWS]) (Hershfield, 1961). The rainfall data in this document dates from the years 1938 through 1958. These figures were the engineering standard in Connecticut many years and still widely used through 2015. This engineering standard was based on the now disproven premise that extreme rainfall series in Connecticut do not change through time such that the older analyses reflect current conditions. This challenge is discussed on the following Fact Sheet.

PAST STORM EVENTS

SEPTEMBER 2018: HEAVY PRECIPITATION & FLOODS

Photo Ctpost.com

Photo Ctpost.com

WHAT WAS THE EVENT?

On September 25, 2018 a slow moving storm traveled across the State resulting in heavy rain across the region. Reported rainfall amounts ranged from 4 inches across southern Connecticut communities, upwards of 8 inches in central and eastern municipalities. While this event was not a FEMA declared disaster in the WestCOG region, it did result in damage and emergency situations.

Some of the emergency reports included:

- A stranded school bus on in Stamford that needed to be rescued.
- Up to 2 feet of water along roadways in Greenwich
- Closure of I-95 due to flooding and stranded vehicles in Norwalk

LINK TO HAZARD MITIGATION

A flash flood is a sudden, localized occurrence, that is typically a result of heavy rain. This specific event, which cause flooding, damage, and emergency rescues across the state, likely caused emergency capacities to be evaluated, and drainage systems to be assessed.

One mitigation strategy to reduce the risks associated with flash flooding is to ensure there is adequate drainage in low lying or highly impervious areas. Some specific strategies may include more aggressive catch basin management, upgrading or repairing present infrastructure, the development of natural runoff retention areas to alleviate stress on hard infrastructure, or possibly reducing impervious surface area.

In addition to flood control, emergency response capabilities are needed for addressing flash floods and other natural hazard events. A municipality should ensure communication systems are up to date and able to withstand outages, emergency response personnel are trained in rescues and other response protocols, shelters and emergency supplies are easily opened or available, and that all responding departments can function during a flood.

REGIONAL CHALLENGES

INTENSE PRECIPITATION

September 26, 2018 Flooding

Osborne Ave, Norwalk

School Bus Rescue, Stamford

Radar Image showing potent line of thunderstorms which caused the flooding of September 26, 2018

FOR MORE INFORMATION

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WHAT IS THE CHALLENGE?

As the climate changes, the total precipitation received by Connecticut over the course of the year is increasing, as is the number of events with total precipitable moisture over 2 inches. Average 1% annual-chance 24-hour rainfall amounts have increased by 1 to 2 inches in southern New England since the 1960s.

This means that storms are becoming more intense, while aging infrastructure has not been, or can not always be, updated in a timely manner to reduce the rising flood risk. As a result, incidences of flash flooding have become a more common occurrence.

On September 26, 2018, a severe thunderstorm complex lingered over Connecticut, dropping as much as 6 inches of rain in the span of several hours. This led to heavy localized flash flooding in several areas of the state. The images to the left show the floodwaters inundating roads and buildings in the Region.

Many drainage structures have been designed using the U.S. Weather Bureau (now the NWS) "Technical Paper No. 40" (TP-40). The precipitation figures used in this paper are based on historic rainfalls between 1938 and 1958. Both precipitation amounts and the extent of impervious surfaces (which increase runoff) have increased since TP-40 was published.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

This hazard mitigation plan update contains actions that the communities plan to take for reducing losses associated with intense precipitation events. One action recommended for most communities is to consider severe precipitation figures that have been updated since the standard (TP-40) figures were developed. Sources include the Northeast Regional Climate Center (NRCC) and the NOAA Atlas 14.

24-hour rainfall amounts for a 4% annual-chance storm (a "25-year storm) in each of these sources is presented in the table to the right (in inches).

Community	TP-40	NRCC	NOAA
Bethel	5.7	6.4	6.8
Bridgewater	5.5	6.2	6.7
Brookfield	5.7	6.3	6.8
Danbury	5.7	6.4	6.8
Darien	5.7	6.4	6.6
Greenwich	5.7	6.4	6.6
New Canaan	5.7	6.4	6.6
New Fairfield	5.7	6.3	6.7
New Milford	5.5	6.2	6.7
Newtown	5.7	6.4	6.9
Norwalk	5.7	6.4	6.5
Redding	5.7	6.4	6.7
Ridgefield	5.7	6.4	6.7
Sherman	5.7	6.1	6.7
Stamford	5.7	6.4	6.6
Weston	5.7	6.4	6.6
Westport	5.7	6.4	6.5
Wilton	5.7	6.4	6.6

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

The Northeast Regional Climate Center (NRCC) has partnered with the Natural Resources Conservation Service (NRCS) to provide a consistent, current regional analysis of rainfall extremes for engineering design (http://precip.eas.cornell.edu/). The increase in precipitation over time is reflected in the changing rainfall magnitudes published by the NRCC. This effort spurred recent work by the National Oceanic & Atmospheric Administration (NOAA) to update its precipitation recurrence figures as published in NOAA Atlas 14. As shown in Table 3-16, the 24-hour storm has increased in magnitude since the previous figures were published by the National Weather Service in 1961, with some variability in the estimates for the more extreme storms.

Table 3-16:
Increase in Total Rainfall (inches) for 24-Hour Storm

Total Rainfall by Storm Recurrence Interval	TP-40 (1961)	NRCC (2008)	NOAA (2019)
2-Year (50% Annual Chance)	3.3	3.4	3.5
10-Year (10% Annual Chance)	5.0	5.1	5.4
25-Year (4% Annual Chance)	5.6	6.4	6.6
50-Year (2% Annual Chance)	6.4	7.6	7.5
100-Year (1% Annual Chance)	7.5	9.1	8.4
500-Year (0.2% Annual Chance)	N/A	13.6	11.2

The National Climate Assessment estimates 5-20% more precipitation will occur during winter and spring months for the northeast by the turn of the next century. The assessment also predicts an increase in severe weather events for the region which may increase the chance of experiencing floods. Additional intense precipitation, combined with an increase in impervious surfaces and thus increase in surface runoff, suggests that the potential for flooding will likely increase in the future. Municipalities can improve their resiliency to flooding by considering the impacts of locally observed severe weather and by exceeding, where necessary, federal, state, and local requirements to meet local needs.

Coastal Flooding

Sea level rise is anticipated to increase the frequency of coastal flood events thereby leading to increased risk of coastal flooding in WestCOG's shoreline communities. Global mean sea level is projected to rise between 0.98 and 8.2 feet over the 21st century. Sea level rise is not consistent around the world, and as noted above is affected by local variations in currents, temperature, and changes in land surface elevation. It has long been expected that the rate of sea level rise in Connecticut will be slightly higher than the global projections due to the effects of regional subsidence. However, more recent studies have asserted that changes in ocean circulation will increase the relative sea level rise along the Atlantic coast even more than previously thought.

CIRCA has developed sea level rise projections for Connecticut. CIRCA has established a "planning threshold" of a 0.5-meter (1.64 feet) rise in sea level expected by 2050 and has defined a caution threshold" of 1.0 meters (3.28 feet) in sea level rise expected in the period 2060-2090. According to the NOAA Technical Report OAR CPO-1, the worst-case scenario for sea level rise by 2100 is a global average of 6.6 feet above the 1992 mean sea level. The WestCOG communities located along Long Island Sound are the most likely to be affected by sea level rise.

Rising sea levels will impact both the natural and man-made coastal environments. It could result in the disappearance of a large portion of Connecticut's tidal wetlands, and the conversion of upstream wetlands to saltwater marshland. Beachfront communities will see increased erosion of the sand and dune structures, which potentially will lead to more extreme and frequent flooding. Dikes and sea walls that are in place now could see a rapid decline in their effectiveness, potentially increasing the frequency and extent of flooding in coastal areas.

As sea levels rise, drainage systems will become less effective, leading to the potential for greater flooding from even moderate rain events. Future storm events, especially those with an accompanying strong storm surge, will pose an even greater threat to coastal and low-lying communities. Storm surges from hurricanes and nor'easters will reach further inland, impacting a greater portion of the region. The flooding and inundation that typically occurs from a Category 3 hurricane could, by the end of this century, result from a Category 1 storm. The

effects of 4 feet of sea level rise for the region as prepared by NOAA is shown in Figure 3-3.

Of great concern is the influence sea level rise will have on the severity of episodic hazard events such as storm surge and coastal flooding, as well as long term coastal erosion. It can be expected that sea level rise will be an amplifier of the magnitude for these other coastal hazards. This is discussed on the following Fact Sheet.

Ice Jams

Ice jam events are most likely to occur during the late winter and early spring months as temperatures begin to warm and there are periods of thawing. With the warming temperatures and increasing precipitation event intensity expected with climate change, conditions that enable ice jams may occur more frequently. This is noted on the following Fact Sheet.

Impacts to Community Assets

Flooding presents several safety hazards to people and property and can cause extensive damage and potential injury or loss of life. The five forces of flooding as described by FEMA include hydrodynamic forces, debris impact, hydrostatic forces, soaking, and sediments and contaminants.

- **Hydrodynamic forces:** These are damages created by moving waters. The three ways these forces can damage a structure include frontal impact (water striking the walls of a structure), drag effect (water running alongside the walls), and eddies or negative pressure (water passing the downstream side of a structure).

- **Debris impact:** These are damages caused by the direct impact of any object that floodwaters can pick up and move to another location.

- **Hydrostatic forces:** This includes the downwards and sideways pressure that standing water exerts on the floor and walls of a structure. Hydrostatic pressure can also cause damage due to buoyancy and floatation which can occur with flood waters.

- **Soaking:** This includes the warping, swelling, and changes to the form of materials and structures as a result of being submerged in floodwaters.

- **Sediments and contaminants:** The sand, sediments, chemicals, and biological contaminants (such as untreated sewage) that floodwaters can move and leave behind after the flood subsides.

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

Furthermore, damp conditions trigger the growth of mold and mildew in flooded buildings, contributing to allergies, asthma, and respiratory infections. Snakes and rodents are forced out of their natural habitat and into closer contact with people, and ponded water following a flood presents a breeding ground for mosquitoes. Gasoline, pesticides, poorly treated sewage, and other aqueous pollutants can be carried by floodwaters and soak into soil, building components, and furniture.

Affected Population

As recorded in the above descriptions of past flooding events, the potential impacts go beyond lost or damaged property and include reducing access to transportation and limiting the movement of economic goods and services. All 18 municipalities in the region are impacted by floods on a regular basis. Impacts from flooding vary according to the severity of each flood event but can range from temporary road closures; to minor damage of personal property, to dam, septic, and sewer system failure; and even the destruction of homes and businesses and loss of lives.

While populations in floodplains or nuisance flooding areas are directly impacted by flooding, indirect impacts are more widespread. When flooding overtops and closes a roadway or an area is affected by a mudslide, it affects larger traffic patterns. When flooding overwhelms a combined sewer system and the capacity of the downstream wastewater treatment plant, the loss of capacity (and potential water quality impacts) can affect an entire community.

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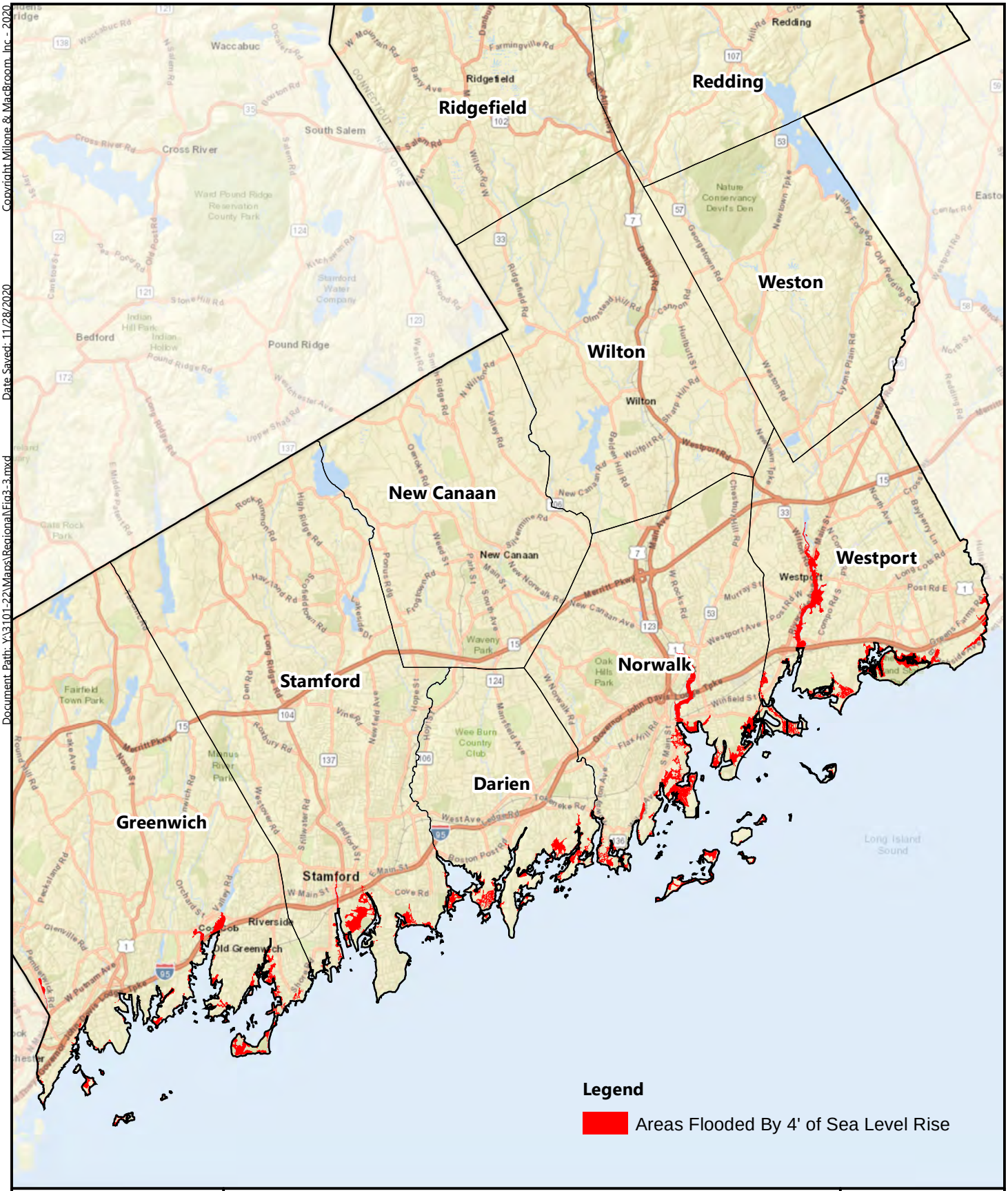

MILONE & MACBROOM
99 REALTY DRIVE
CHESHIRE, CT 06410
203.271.1773
WWW.MMINC.COM

NOAA FOUR FOOT SEA LEVEL RISE PROJECTION

HAZARD MITIGATION PLAN UPDATE
WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS
1 RIVERSIDE ROAD
SANDY HOOK, CT 06482

N

0 6,500 13,000
Feet

SCALE	1 " = 14,000 '
DATE	11/28/2020
PROJ. NO.	3101-22

FIG. 3-3

REGIONAL CHALLENGES

COASTAL FLOODING

City-data.com

Darientimes.com

WHAT IS THE CHALLENGE?

Connecticut's coastlines boast a range of economic and recreational benefits for the state. Unfortunately, increasingly strong storms and densely populated shorelines mean that coastal flooding has been an increasingly common, and unwelcome, guest to our shoreline communities.

Coastal flooding occurs during hurricanes and other strong cyclones including nor'easters. The direction and strength of wind play a role in forcing water into Long Island Sound from the open ocean to the east. The effects of flooding are exacerbated during high tide, and especially astronomically high tide.

Estimates from the previous WestCOG hazard mitigation plan report that economic losses in the region could be as high as $1.1 billion during a 100-year coastal flood event. Clearly coastal flooding has the ability to cause vast economic and commercial destruction in the area if not mitigated. The pictures on the left show coastal flooding in the WestCOG area as a result of storm events

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Coastal flooding is on the rise due to the effects of climate change, so a proactive approach is necessary to ensure the safety and economic security of the region. Historical data is no longer the best way to predict the future extent and ferocity of coastal flood events. The latest modeling and predictions by local and national scientists have been incorporated into the plan in order to better inform WestCOG communities.

This hazard mitigation plan update focuses on a multifaceted approach for mitigating coastal flood impacts. Mitigation is not a one-size-fits-all action. While some buildings may be adequately protected through elevation, other properties may benefit from a FEMA-subsidized buyout.

The hazard mitigation plan's strategies focus on education and outreach, working collectively to initiate change, and looking at past actions to inform future decisions that influence regulations, policies, and enforcement actions that influence behavioral changes to produce tangible results.

FOR MORE INFORMATION

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REGIONAL CHALLENGES

ICE JAMS

Ice jams in New Milford, 2018
Photo: reschuster47, reddit

FOR MORE INFORMATION

The Northeast States Emergency Consortium (NESEC)
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Wakefield MA 01880
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http://nesec.org/ice-jams/

WHAT IS THE CHALLENGE?

Ice jams occur when heavy rain, warm temperatures and snow melt causes rivers to rise and break the surface layer of ice that lies on top. This broken ice then floats downstream until obstructions or constrictions such as bridges, bends, and narrow channels cause it to pile up and form a dam.

Ice jams can cause severe flooding upstream. If suddenly breached, flooding, riverbed and riverbank scouring, and damage to roads and bridges can occur downstream. The presence of floating chunks of ice, as well as cold temperatures, can exacerbate the impacts of any flooding.

Ice jam events are most likely to occur during the late winter and early spring months as temperatures begin to warm and there are periods of thawing. With the warming temperatures and increasing precipitation event intensity expected with continued climate change, conditions that enable ice jams may occur more frequently.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Ice jams can occur along streams and rivers of all sizes. An ice jam formed at Lovers Leap State Park in New Milford in 2018, at the same time a major ice jam was causing flooding upstream in Kent.

Some WestCOG communities are more susceptible to ice jam flooding than others, but all should be aware of the risks and mitigation strategies.

Mitigation strategies can include:

- Identification of locations where ice jams may form (such as bridges, culverts, and stream constrictions).
- Continuous monitoring of streams (particularly ice-jam risk locations as identified above) during early spring months.
- Creation or preservation of open space along streams in areas that may be potentially impacted by ice jam flooding.
- Evaluate options for structural projects such as *tension weirs* or *sloped-block ice control structures*.

Repetitive Loss Properties

Flood damage is often predictable in its location. All but four municipalities in the region have one or more specific properties that are insured and have submitted claims under the NFIP multiple times. These properties are defined by the NFIP (Section 4.1.1) as repetitive loss properties (RLPs) or severe repetitive flood loss properties (SRLPs). A Fact Sheet about RLPs follows.

As of December 31, 2017, the Region had 817 RLPs and 53 SRLPs, with the majority lying within Norwalk and Westport. The number increased to 939 properties as of December 14, 2020. The majority of these properties appear to be residential, while 65 (8.0%) are classified as non-residential. Losses reported to the NIFP as of December 14, 2020 are presented in Table 3-17.

Table 3-17: Payments to Repetitive Loss Properties

Municipality	Number of Properties	Number of Losses	Total Payments
Bethel	5	17	$428,184
Bridgewater	0	0	$0
Brookfield	3	6	$83,569
Danbury	28	83	$2,808,537
Darien	60	169	$8,730,672
Greenwich	139	420	$14,472,273
New Canaan	7	18	$261,884
New Fairfield	0	0	$0
New Milford	16	50	$2,291,317
Newtown	3	8	$65,046
Norwalk	260	767	$23,761,778
Redding	0	0	$0
Ridgefield	6	14	$70,790
Sherman	0	0	$0
Stamford	120	383	$14,842,727
Weston	15	36	$551,430
Westport	261	813	$26,360,206
Wilton	16	45	$914,229
WestCOG	**939**	**2,829**	**$67,272,435**

Source: FEMA

An additional 122 RLPs have been realized in the Region since December 31, 2017 due primarily to coastal flood events in fall 2018. However, a handful of the changes in the numbers are likely due to corrected addresses in the database. Table 3-18 presents the status of RLPs in the region as of December 2020.

Table 3-18: Rep. Loss Properties as of December 2020

Municipality	Number of Properties	Number of Losses	RLP Increase
Bethel	5	17	+2
Bridgewater	0	0	+0
Brookfield	3	6	+0
Danbury	28	83	+3
Darien	60	169	+5
Greenwich	139	420	+22
New Canaan	7	18	+1
New Fairfield	0	0	+0
New Milford	16	50	+3
Newtown	3	8	+0
Norwalk	260	767	+33
Redding	0	0	+0
Ridgefield	6	14	+0
Sherman	0	0	+0
Stamford	120	383	+18
Weston	15	36	+0
Westport	261	813	+34
Wilton	16	45	+1
WestCOG	**939**	**2,829**	**+122**

Source: FEMA

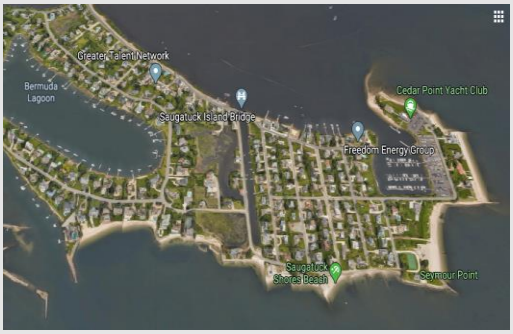
Loss Estimates from HAZUS-MH

Potential impacts from flooding events were evaluated using FEMA's HAZUS-MH loss estimation program. HAZUS-MH can be performed at three levels of analysis each with an increasing level of detail but at the cost of user effort and data sophistication. The analysis herein is a Level 1 analysis which uses the default HAZUS-MH data. Although studies have shown that the Level 1 analysis typically strongly overestimates the amount of damage to a community for flooding (Rozelle, et. al.), the data generated is nonetheless useful for planning purposes. In future updates to this plan, it may be possible to use a higher level of analysis if digital parcel data and building footprints are available, and funding is available to perform the additional effort. HAZUS-MH output is presented in Appendix D.

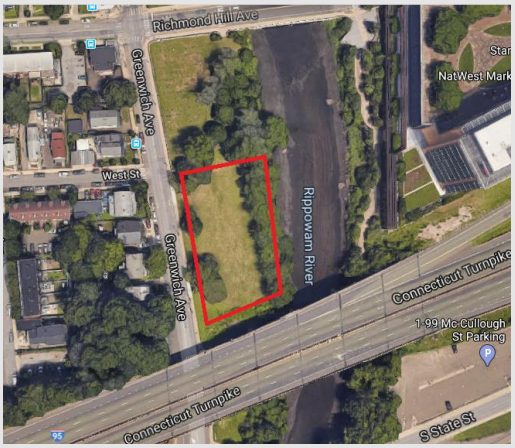
Building damage from flooding was based on a flood depth grid created using HEC-RAS software along major streams and the shoreline in the region. The flood depth was then applied to depth-damage curves and inventory data within HAZUS-MH to estimate damages to buildings expressed as the percent of the building damaged. Table 3-19 presents the results for the region. Local results are presented in each municipal annex.

REGIONAL CHALLENGES

REPETITIVE LOSS PROPERTIES



Coastal RL Area in Westport



Property acquisition in Stamford converted to open space

FOR MORE INFORMATION

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WHAT IS THE CHALLENGE?

FEMA defines a Repetitive Loss (RL) property as any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A total of 938 RL properties are listed in the municipalities that comprise the eighteen-town region. A breakdown is as follows:

Community	Total	Residential				Nonresidential	
		Single Family	2-4 Family	Condo	Other	Business	Other
Bethel	5	4	0	1	0	0	0
Bridgewater	0	0	0	0	0	0	0
Brookfield	3	2	0	0	0	0	1
Danbury	28	9	6	1	2	4	6
Darien	60	45	0	3	0	5	7
Greenwich	139	122	6	1	3	1	6
New Canaan	7	6	1	0	0	0	0
New Fairfield	0	0	0	0	0	0	0
New Milford	16	7	2	1	0	2	4
Newtown	3	3	0	0	0	0	0
Norwalk	259	215	25	4	2	3	10
Redding	0	0	0	0	0	0	0
Ridgefield	6	4	0	0	0	0	2
Sherman	0	0	0	0	0	0	0
Stamford	119	97	8	2	5	2	5
Weston	15	15	0	0	0	0	0
Westport	262	238	1	5	0	4	14
Wilton	16	11	0	0	1	2	2
Region	**938**	**778**	**49**	**18**	**13**	**23**	**57**

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

If a property is not insured against flood losses or is insured but the owner does not submit claims, then the property cannot appear on the RL list. Therefore, the RL list is not an absolute reflection of flood risk in a community. Nevertheless, the RL list can provide a starting point for evaluating flood risk in a community, and it may indicate that flooding is a problem in a specific area even when not obvious upon a cursory review of the setting.

It is important for WestCOG communities to further reduce flood losses, and these efforts must include the RL property losses that strain the NFIP. For a risk evaluation to be effective, each RL list must be accurate. For example, two of the properties located in Norwalk are listed in other WestCOG communities, and one property in Stratford (outside the region) is listed in Bethel.

Communities must carefully check and offer corrections to their individual RL lists. Misplaced properties must be formally transferred to the correct municipality, duplicates must be cleared, and mitigation status should be updated to ensure that resources are directed to the properties with most risk and highest flood losses. **This plan therefore recommends that municipalities with RL properties should work with DEEP to conduct a list validation, making corrections as needed and removing incorrect listings.**

Table 3-19: Building Damage from Flood

Damage	10-Year	25-Year	50-Year	100-Year	500-Year
1-10%	7,901	8,858	9,562	9,992	11,024
11-20%	5,757	6,764	7,793	8,667	10,617
21-30%	1,589	1,913	2,592	3,025	4,186
31-40%	625	781	961	1,290	1,969
41-50%	304	381	633	763	1,209
> 50%	610	860	1,227	1,691	2,962
Total	**16,786**	**19,557**	**22,768**	**25,428**	**31,967**

Source: HAZUS-MH

The HAZUS-MH analysis appears to significantly overestimate the number of structures at risk in the region. For example, a 10-year flood event is not expected to result in significant flooding damage to nearly 16,800 properties in the region.

Economic loss was calculated in HAZUS-MH from both direct property damage and business interruption. Table 3-20 summarizes the combined economic loss for each WestCOG municipality. In general, coastal municipalities in the Region have a greater potential for flood losses due to the greater concentration of residences and businesses near the shoreline. As explained above, the economic loss is significantly greater than would be expected in the region for the various flood events.

Finally, the economic losses presented above were used to generate an annualized loss estimate for each WestCOG municipality due to flooding. Annualized loss estimates from HAZUS-MH are presented in Table 3-21. The economic loss and annualized loss estimates appear to be greater than what would be expected consistent with the assessment above. As such, reported loss estimates are used to estimate annualized losses as presented in the next section.

Table 3-20:
Economic Loss Due to Flood (in Millions of Dollars)

Municipality	10-Year	25-Year	50-Year	100-Year	500-Year
Bethel	$171	$292	$370	$441	$701
Bridgewater	$10	$11	$12	$14	$23
Brookfield	$463	$566	$654	$743	$1,141
Danbury	$1,039	$1,350	$1,723	$2,035	$3,011
Darien	$189	$213	$306	$360	$758
Greenwich	$566	$736	$1,058	$1,296	$1,870
New Canaan	$52	$78	$92	$108	$191
New Fairfield	$13	$23	$27	$33	$53
New Milford	$1,676	$1,948	$2,198	$2,450	$3,060
Newtown	$368	$454	$541	$581	$781
Norwalk	$1,978	$2,356	$3,050	$3,637	$4,945
Redding	$77	$89	$102	$116	$149
Ridgefield	$78	$100	$121	$182	$291
Sherman	$32	$33	$39	$45	$66
Stamford	$2,167	$2,831	$4,053	$4,913	$6,787
Weston	$82	$103	$120	$139	$198
Westport	$1,306	$1,416	$1,742	$1,975	$2,443
Wilton	$838	$965	$1,072	$1,181	$1,488

Source: HAZUS-MH

Table 3-21:
Annualized Loss Due to Flood (in Millions of Dollars)

Municipality	Building & Contents Loss	Business Disruption	Annualized Loss
Bethel	$8.5	$22.0	$30.5
Bridgewater	$0.6	$0.6	$1.2
Brookfield	$20.9	$39.0	$59.9
Danbury	$46.7	$100.7	$147.4
Darien	$9.8	$16.7	$26.6
Greenwich	$38.1	$47.1	$85.2
New Canaan	$3.2	$5.0	$8.2
New Fairfield	$0.8	$1.5	$2.3
New Milford	$106.2	$95.4	$201.6
Newtown	$19.0	$28.2	$47.2
Norwalk	$87.6	$174.1	$261.7
Redding	$3.4	$5.9	$9.3
Ridgefield	$3.1	$8.5	$11.5
Sherman	$1.7	$1.9	$3.7
Stamford	$83.1	$240.9	$324.0
Weston	$4.5	$6.3	$10.8
Westport	$57.6	$96.8	$154.4
Wilton	$31.9	$67.5	$99.4
WestCOG	**$526.7**	**$958.1**	**$1,484.9**

Source: HAZUS-MH

Other Loss Estimates

The NFIP losses track damage to individual (usually private) properties since 1978, while the FEMA Public Assistance reimbursements track damage to municipality and non-profits with records dating back to 1998. These two data sources may be added together to develop an estimated annualized loss to flooding for the region as presented in Table 3-22. The resulting estimated

annualized loss for the Region due to flooding is $5.2 million.

Table 3-22: Annualized Flood Loss from NFIP and FEMA Public Assistance Reimbursements

Municipality	NFIP Losses Paid	PA Losses Paid	Annualized Loss
Bethel	$657,647	$35,958	$17,371
Bridgewater	$12,209	$49,385	$2,642
Brookfield	$164,532	$33,500	$5,513
Danbury	$5,725,544	$929,844	$180,601
Darien	$17,605,266	$865,841	$460,404
Greenwich	$29,109,355	$5,407,534	$950,582
New Canaan	$539,342	$533,459	$38,244
New Fairfield	$41,423	$208,097	$10,896
New Milford	$3,303,981	$133,515	$85,024
Newtown	$212,141	$143,709	$11,894
Norwalk	$43,211,131	$4,971,658	$1,265,582
Redding	$49,118	$369,707	$18,775
Ridgefield	$182,866	$373,636	$22,146
Sherman	$43,222	$241,328	$12,521
Stamford	$23,941,953	$5,096,024	$812,714
Weston	$962,659	$1,409,626	$90,046
Westport	$42,120,815	$2,496,204	$1,121,743
Wilton	$1,387,322	$331,003	$48,794
WestCOG	**$169,270,526**	**$23,630,030**	**$5,155,490**

Source: Connecticut NFIP Coordinator, FEMA

3.3.3 Winter Storms

Winter storms consisting of snow, ice, wind, and other cold weather precipitation, are a regular occurrence in Connecticut. Temperatures during the winter months typically drop below freezing at night and occasionally fall below zero degrees Fahrenheit. Some winter storms are mild and of little consequence. However, other winter storms including blizzards, ice storms, and nor'easters cause large scale and regular disruptions by restricting transportation, causing the loss of electricity, and through direct physical damages due to wind, snow, sleet, ice, and bitter cold.

Location

All areas of the Region are susceptible to winter storms. Areas of the region at higher elevations experience more frequent effects of winter storms than those at lower elevations. In addition, low lying areas (such as floodplains) can experience additional impacts of winter storms such as flooding.

Extent

According to NOAA, there are several types of winter storms and associated precipitation conditions.

- Blizzards include winter storm conditions of sustained winds or frequent gusts of 35 miles per hour (mph) or greater that cause major blowing and drifting of snow, reducing visibility to less than one-quarter mile for three or more hours. Extremely cold temperatures and/or wind chills are often associated with dangerous blizzard conditions.

- Freezing Rain consists of rain that freezes on objects, such as trees, cars, or roads and forms a coating or glaze of ice. Temperatures in the mid to upper atmosphere are warm enough for rain to form, but surface temperatures are below the freezing point, causing the rain to freeze on impact.

- Ice Storms are forecast when freezing rain is expected to create ice build-ups of one-quarter inch or more that can cause severe damage.

- Nor'easters are the classic winter storm in New England, caused by a warm, moist, low pressure system moving up from the south colliding with a cold, dry high-pressure system moving down from the north. The nor'easter derives its name from the northeast winds typically accompanying such storms, and such storms tend to produce a large amount of rain or snow. They usually occur between November 1 and April 1 of any given year, with such storms occurring outside of this period typically bringing rain instead of snow.

- Sleet occurs when rain drops freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects. It can accumulate like snow and cause a hazard to motorists.

- Snow is frozen precipitation composed of ice particles that forms in cold clouds by the direct transfer of water vapor to ice.

- Winter Storms are defined as heavy snow events that have a snow accumulation of more than six inches in 12 hours or more than 12 inches in a 24-hour period.

The Regional Snowfall Index (RSI) is used by NOAA to rank snowstorms that impact the eastern two thirds of the United States by placing them in one of five categories: Extreme, Crippling, Major, Significant, and Notable. The RSI is based on the spatial extent of the storm, the amount of snowfall, and the juxtaposition of these elements with population based on the 2000 census. The use of population in evaluating impacts provides a measure of societal impact from the event. Table 3-23 presents the RSI categories, their corresponding RSI values, and a descriptive adjective.

Table 3-23: Regional Snowfall Index Categories

Category	RSI Value	Event Description
1	1 to 3	Notable
2	3 to 6	Significant
3	6 to 10	Major
4	10 to 18	Crippling
5	18+	Extreme

Source: NOAA

RSI values are calculated within a GIS. The aerial distribution of snowfall and population information are combined in an equation that calculates the RSI score, which varies from around one for smaller storms to over 18 for extreme storms. The raw score is then converted into one of the five RSI categories. The largest RSI values result from storms producing heavy snowfall over large areas that include major metropolitan centers. Approximately 210 of the most notable historic winter storms to impact the Northeast have been analyzed and categorized by RSI through the end of 2019.

Previous Occurrences

According to FEMA's disaster history, five major winter storms in the Region since 1954 have resulted in major disaster declarations. The most severe ice storm in Connecticut on record was Ice Storm Felix on December 18, 1973. This storm resulted in two deaths and widespread power outages throughout the state. The Blizzard of February 1978 brought record snowfall amounts to several areas of Connecticut as heavy snow continued unabated for an unprecedented 33 straight hours. The state was essentially shut down for three days when all roads were ordered closed except for emergency travel. The storm was responsible for over 100 deaths, 4,500 injuries, and $520 million in damages (1978 United States Dollars, or USD). This storm is rated 4th overall in the RSI as an "Extreme" storm.

Overall, a total of nine extreme, crippling, and major winter storms have occurred in Connecticut during the past 30 years. One is listed for each of the years 1993, 1996, 2003, 2007, 2010, 2013, and 2015. More alarmingly, two are listed in the calendar year 2010 along with two more significant storms, a significant storm in 2011, and a single major storm in 2013 and 2015. Considering nor'easters only, 11 major winter nor'easters have occurred in Connecticut during the past 30 years (in 1988, 1992, 1996, 2003, 2006, 2009, 2010, two in 2011, 2013 and 2015).

The following information from NOAA provides an overview of major winter weather events in recent history:

- March 13-14, 1993: A massive, powerful storm dubbed the "Storm of the Century" caused "whiteout" blizzard conditions stretching from Jacksonville, Florida into eastern Canada and affected 26 states, producing 24 inches of snow in Hartford and up to 21 inches of snow in New Haven County. A total of 40,000 power outages and $550,000 in property damage was reported throughout Connecticut, and the state received a federal emergency declaration. The storm had an RSI rating of "Extreme" and is the 2nd highest ranking storm recorded by RSI.

- January 15-16, 1994: A Siberian air mass brought record to near-record low temperatures across Connecticut. Strong northwest winds accompanied the cold and drove wind chill values to 30 to 50 degrees below zero.

- December 23, 1994: An unusual snowless late December storm caused gale force winds across the state. The high winds caused widespread power outages affecting up to 130,000 customers statewide. Numerous trees and limbs were blown down, damaging property, vehicles, and power lines to a total of $5 million in damages. Peak wind gusts of up to 64 mph were reported.

- January 7-8, 1996: Winter Storm Ginger was one of the most significant winter storms to hit southern New England in the past 20 years. Snowfall across the north and northeast portions of the state ranged from 15 to 23 inches. This storm disrupted transportation systems and closed schools and businesses. Connecticut received a federal major disaster declaration. The storm has an RSI rating of "Extreme" and is currently ranked 3rd on the RSI.

- December 7, 1996: This storm brought heavy, wet snow and resulted in widespread power outages. A total of 225,000 electric customers lost power statewide. Power remained out for several days, despite the efforts of dozens of electric company repair crews, many from out-of-state. Many roads remained unplowed until the utility companies could repair fallen wires. Up to 22 shelters were opened across the region and many residents left their unheated and darkened homes. Many vehicles and homes were damaged by falling tree limbs and damage was estimated in the millions of dollars.

- February 17, 2003: A heavy snowstorm caused near-blizzard conditions and produced 24 inches of snow in areas of the state. The storm had an RSI rating of "Crippling" and is the 8th ranked winter storm by RSI. Connecticut received a federal emergency declaration.

- February 12-13, 2006: This nor'easter is ranked 35th overall as a "Significant" storm on the RSI scale. The storm produced 18 to 24 inches of snow across Connecticut, with ten to 16 inches of snow accumulating across southern Litchfield County. Five Connecticut counties received a federal emergency declaration.

- December 11, 2008: Freezing rain created treacherous travel conditions for the evening commute across portions of southern Litchfield County, with ice accretions up to 0.2 inches. An estimated 5,000 customers lost power and many schools and businesses were closed the following day.

- March 13-14, 2010: A nor'easter brought soaking rains and 65 mph winds that caused severe damage across the state. Numerous trees, limbs, and powerlines were downed in the region, closing roads, schools, and businesses, and causing one death in Westport. A reported 64,000 were without power, with 70% of the outages in Norwalk, Stamford, and Greenwich. Emergency shelters were opened in Stamford and Norwalk. It took utility crews and tree workers more than a week to restore power and clear local roads. Individual insurance claims in the region were over $343,000.

- December 2010 through February 2011: A series of significant heavy snow events occurred between December 26, 2010 and February 2, 2011. From February 1st through the 2nd, a total of 6-11 inches of snow fell across Hartford County, with upwards of a quarter inch of ice accumulation for isolated locations. Across Connecticut, numerous roof collapses due to heavy snow load occurred. Snow for the winter season totaled 86.4 inches.

- October 29, 2011: Winter Storm "Alfred" produced high winds and 12 to 18 inches of heavy wet snow across Connecticut. The combination of heavy snow on tree limbs and on fairly saturated ground caused widespread snapping and uprooting of trees and tree limbs. Over 830,000 customers were without power with some outages lasting 11 days or more. The storm resulted in ten deaths and caused over $3 billion in damage in Connecticut. Homes were without electricity for approximately one week or more in many areas, with tree damage and power line damage being the biggest impact in the communities.

- February 7-9, 2013: An historic blizzard deposited tremendous amounts of snow over southern New England. Most locations received 20 to 33 inches of snow. Isolated thunderstorms were common across the region during the height of the storm. During the night, rates of accumulation reaching 2 to 3 inch per hour were common throughout the region. The Connecticut Department of Agriculture reported that more than 140 agricultural structures were damaged or destroyed throughout the state because of the weight of the snow. This event was classified as a "Major" storm and is listed 18th in the RSI ranking.

- January 25-26, 2015: A strong nor'easter brought strong winds and deposited tremendous amounts of

snow over southern New England. Most locations received at least a foot of snow; some received up to three feet. During the night, rates of accumulation reaching 2 to 3 inch per hour were common throughout the region. Snow removal in parts of Connecticut took two to three days. This event was classified as a "Major" storm and is listed 28th in the RSI ranking. This January storm resulted in a federal disaster declaration for the entire state.

- March 14-15, 2017: A very significant snowstorm impacted southern Litchfield County featuring extremely heavy snowfall and blizzard conditions. Storm total reports of 16 to 20 inches were received. The snow fell at 1 to 4 inches per hour for much of the day. There was a widespread extreme public impact, with many roads severely impacted and schools closed. The governor issued a statewide travel ban on state roads. In addition to the snowfall, gusty winds up to 50 mph resulted in near-zero visibility and blizzard conditions across the county. The winds brought considerable blowing and drifting of snow.

- March 7, 2018: A winter storm produced 6 to 12 inches of snow in southern Fairfield County and up to 27 inches of snow in New Fairfield in northern Fairfield County. Strong winds brought down a tree and wires on Creeping Hemlock Drive in Norwalk. A large tree fell on a truck on southbound Merritt Parkway in Greenwich. Trees and wires were brought down across the town of Ridgefield due to heavy wet snowfall and strong winds.

- January 19, 2019: A winter storm produced 3 to 5 inches of snow and 0.37 inches of ice in the Danbury area. Multiple road closures occurred in Newtown due to trees and wires down from ice accretion.

Probability of Future Events

Winter storms of varying levels of severity are fairly common in the region. Data from the weather station in Danbury reveals that in an average year there are 24 days when it snows 0.1 inches or more. Most of those days are during December through March. During this same time period, there are 13 days where snow totals at least 1 inch and 0.5 days on average have a snowfall total of 10 inches or higher. Wintry precipitation such as sleet and freezing rain occurs on additional days each year. These data demonstrate that the Region should expect several heavy snows per year and therefore its municipalities should be adequately prepared for these storms.

According to the 2019 CT NHMP, recent climate change studies predict a shorter winter season for Connecticut (by as much as two weeks) and less snow-covered days with a decreased overall snowpack. These models also predict that fewer, more intense precipitation events will occur with more precipitation falling as rain rather than snow. This trend suggests that future snowfalls will consist of heavier (denser) snow, and the potential for ice storms will increase. Such changes will have a large impact on how the state and its communities manage future winter storms and will affect the impact such storms have on the residents, roads, and utilities in the state.

Impacts to Community Assets

Impacts from severe winter weather can become dangerous and a threat to people and property. Most winter weather events occur between December and March although in 2011 Connecticut experienced a significant October snowstorm that left much of the state without power for a week.

While picturesque, snow and ice can create impassable roads, interrupt utility service, knock down trees and power lines, and isolate people in their homes or workplaces, sometimes without electricity or heat. Melting snow and ice can also cause flooding, as can winter rainstorms that hit when the ground is already frozen.

Transportation Impacts

While the probability of a winter storm occurring is roughly the same in all parts of the region, the risk of damage will vary depending on infrastructure and population density. There is a high probability for traffic accidents and traffic jams during heavy snow and light icing events. Roads may become impassable, inhibiting the ability of emergency equipment to reach trouble spots and the accessibility of medical and shelter facilities.

To a large extent, the areas with the greatest risk of experiencing damage due to winter storms are those with the greatest amount of development and the most extensive networks of roads. Larger and more densely populated cities have the greatest number of miles of

roads than rural towns. The potential snow-removal burden is, therefore, much lower in the rural town, as is the magnitude of travel-related impacts due to the lower road capacity. Conversely, the travelers in rural areas face a potentially greater risk of being affected by the winter storm due to the lower density of roads (which provide fewer alternate routes) as well as the often relatively steep topography.

After a storm, snow piled on the sides of roadways can inhibit sight lines and reflect a blinding amount of sunlight. When coupled with slippery road conditions, poor sightlines and heavy glare create dangerous driving conditions. Stranded motorists, especially senior and/or handicapped citizens, are at particularly high risk of injury or death from exposure during a blizzard.

Like many other types of disasters, winter weather and heavy snowfall can cause localized and widespread road closures. Closures can result from a variety of causes such as poor driving conditions, heavy snow, and drifts, as well detritus like fallen trees and power lines. When a blizzard struck on February 8th, 2013, Governor Malloy called for a traffic ban on all vehicles except for those emergency response and recovery vehicles with the capacity to maneuver in heavy snow for the following day. Events with large impacts on transit also have major economic impacts, like preventing employees from reaching work and halting or delaying shipments and deliveries.

Roof Collapse

Heavy snow and ice accumulation bring the threat of roof collapse and catastrophic damage to the building's occupants. As seen in Table 3-24, snow alone can put a large burden on roofs, however when coupled with rain and sleet, this load per square foot increases.

Table 3-24: Weight of Snow on a Roof

Type	Equivalent Weight to 1" of Water	Load per Square Foot	Maximum Load for Typical Roof
Fresh Snow	10-12"	5 lbs.	4 feet
Packed Snow	3-5"	5lbs.	2 feet

Source: Insurance Institute for Business & Home Safety

Two feet of old snow and two feet of new snow could weigh as much as 60 pounds per square foot (psf) of roof space, which is beyond the typical snow load capacity of most roofs. One inch of ice is equivalent to one foot of fresh snow. A house should be able to support 20 psf of snow (IIBHS, 2020). The winter of 2010-2011 saw many buildings across Connecticut condemned due to snow accumulation collapsing their roofs in January and February 2011, including many in the Region.

Areas with greater levels of development are also at greater risk of business disruptions, loss of life, and damage to structures. Cities have the greatest level of development and the greatest potential risk. For example, with more roofs comes more potential for roof collapse. There are also simply more sidewalks to clear, more homes to heat, and more people to protect.

Burst Pipes

Cold and winter weather not only wreaks havoc outside a building, but inside as well. Frozen pipes can cause severe damage. A complete ice blockage in a pipe causes freezing and expansion which in turn causes water pressure to increase to the faucet. The increase in water pressure leads to pipe failure. In 2013, frozen and broken water pipes ranked second to hurricanes in terms of both the number of homes damaged and the total amount of damages claimed in the U.S. (IINC, 2014). While there are few records of burst pipes in the region, in nearby Farmington at the UConn Health Center, a frozen sprinkler pipe burst. This caused extensive damage, with water leaking into the main floor, the ground floor and a storage room, some labor and delivery rooms, as well as the newborn nursery (Lank, 2014).

Power Outages

Heavy snow and ice can cause tree limbs to fall, bringing power lines down with them. Winter weather frequently causes significant power outages throughout the state, especially in more rural areas. Urban areas, where a greater percentage of power lines are underground, are impacted to a lesser degree. Not only are power outages an inconvenience, but it can cause damage to property, disrupt business, and threaten lives if heating systems are impacted. A Fact Sheet describing power outage concerns in the region can be found on the following page.

REGIONAL CHALLENGES

POWER OUTAGES

Restoring power after a storm
Photo: Matthew Brown

Sign asking for help in Stamford
Photo: John Nickerson

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WHAT IS THE CHALLENGE?

Power loss due to natural hazards is a major concern for communities throughout the state. A power outage may:

- Disrupt communication, water, and transportation infrastructure
- Close retail businesses, grocery stores, gas stations, ATMs, banks and other services
- Cause food spoilage and water contamination
- Prevent use of medical devices

These impacts can disrupt daily life, cause business interruptions, lead to property damage, and even have negative health impacts.

Power outages can be caused by a variety of natural hazards, including:

- High wind events or snow events downing tree limbs onto power lines, or downing power lines themselves
- Flooded soils or erosion undermining utility poles
- Flooding of underground powerlines
- Lightning strikes
- Grid failure during energy use surges in severe heat conditions
- Planned outages during extreme drought to mitigate wildfire risk

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Municipalities can mitigate damages and disruption caused by outages by working to increase the resiliency of the power grid, improving outage response, installing emergency generators in critical facilities, developing local power generation and microgrids, and helping residents and businesses prepare for outages.

Some mitigation actions include the following:

- Coordinate with the local energy utility on efforts to improve grid resiliency and outage response.
- Perform public outreach and education about power outage safety and mitigation.
- Maintain public “comfort stations” for residents without power to keep warm or cool, and recharge electronic devices.
- Create a communications plan that considers power loss, and the possible loss of internet and phone capabilities that may result.
- Maintain a list of residents who rely on powered medical devices to facilitate check-ins and response during power outages.
- Install backup power at critical facilities
- Explore development of local power generation (such as solar panels) and microgrids

Affected Population

Winter storms and cold weather typically affect the entire population of a municipality although impacts may vary by location. According to NOAA, winter storms were responsible for the death of 25 people per year from 2004 to 2013. 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.

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

Loss Estimates

Snow and ice removal have a tremendous impact on municipal budgets. The impact varies by community; some communities use their own staff to clear roads, which may represent savings but diverts such staff from other municipal projects. Other municipalities hire contractors to remove 100% of the snow and ice. The remainder of towns use a combination of municipal staff and contractors. Regardless of staffing, every community is faced with spending between $50,000 and $1 million per year on snow and ice management.

Based on the public assistance reimbursements in Table 3-2, the Region has incurred losses of approximately $23.7 million since 1998 (21 years) from impacts due to winter storms. Based on this information, the annualized loss due to winter storms in the Region is $1,128,586. Annualized losses due to winter storms for each WestCOG community are presented below. These annualized loss estimates should be used with caution and as a minimum loss estimate. Nevertheless, these figures provide useful planning numbers when considering the overall vulnerability of the Region to winter storms.

Table 3-25: Annualized Winter Storm Loss from FEMA Based on Public Assistance Reimbursements

Municipality	PA Losses Paid	Annualized Loss
Bethel	$813,379	$38,732
Bridgewater	$181,929	$8,663
Brookfield	$1,461,428	$69,592
Danbury	$5,189,183	$247,104
Darien	$494,648	$23,555
Greenwich	$1,407,231	$67,011
New Canaan	$1,196,848	$56,993
New Fairfield	$595,568	$28,360
New Milford	$1,677,798	$79,895
Newtown	$2,188,446	$104,212
Norwalk	$1,356,155	$64,579
Redding	$781,113	$37,196
Ridgefield	$1,198,109	$57,053
Sherman	$166,310	$7,920
Stamford	$2,242,463	$106,784
Weston	$479,388	$22,828
Westport	$1,115,076	$53,099
Wilton	$1,155,228	$55,011
WestCOG	**$23,700,301**	**$1,128,586**

Source: FEMA

3.3.4 Tropical Cyclones and Hurricanes

Tropical cyclones are a relatively common occurrence in Connecticut and occur every few years producing heavy winds, heavy rainfall, and flooding. Connecticut typically experiences tropical storms as opposed to hurricanes, but strong hurricanes have caused widespread damage to the state including flooding, and widespread power outages and damages from falling trees and power lines.

Location

The entire Region is susceptible to wind damage from tropical cyclones. Low lying areas (such as floodplains) can experience additional impacts of tropical cyclones such as flooding.

Extent

A tropical cyclone is defined by the National Weather Service as a "rotating, organized system of clouds and thunderstorms that originates over tropical or subtropical waters and has a closed low-level circulation." A tropical cyclone is further classified as a tropical depression, tropical storm, hurricane, or major hurricane, and is most likely to form from June 1 through November 30 each year in the northern Atlantic Ocean.

The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes of Category 3 and higher are considered major hurricanes

because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures. The NWS defines the 5 categories as follows:

- Category 1: Winds of 74-95 mph will produce some damage. Well-constructed frame homes could have damage to roof, shingles, vinyl siding, and gutters. Damaged expected to unanchored mobile homes (mainly pre-1994 construction). Some damage to poorly constructed signs. Loose outdoor items become projectiles, and persons struck by windborne debris risk injury and possibly death. Numerous large tree branches will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days. Hurricane Gloria in 1985 was a Category 1 hurricane at landfall.

- Category 2: Strong winds of 96-110 mph will cause widespread damage. Well-constructed frame homes could sustain major roof and siding damage. Considerable damage to mobile homes and loose outdoor items may become airborne. Persons struck by windborne debris risk injury and possibly death. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss expected with outages that could last from several days to weeks. Hurricane Bob in 1991 was a Category 2 hurricane when it made landfall in Rhode Island.

- Category 3: Dangerous winds of 111-130 mph will cause extensive damage. Well-built frame homes may incur major damage or removal of roof decking and gable ends. Mobile homes and poorly constructed signs likely to be destroyed. Persons struck by windborne debris risk injury and possibly death. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water unavailable for several days to weeks after the storm passes. The 1938 Hurricane was a Category 3 when it made landfall in Connecticut.

- Category 4: Extremely dangerous winds of 131-155 mph will cause devastating damage. Well-built frame homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls, doors, and windows. Complete destruction of mobile homes. Windborne debris will cause extensive damage and persons struck will be injured or killed. Most trees will be snapped or uprooted, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to months. Most of the area will be uninhabitable for weeks or months.

- Category 5: Catastrophic winds greater than 156 mph will cause widespread destruction. A high percentage of framed homes and mobile homes will be destroyed with total roof failure and wall collapse. Severe injury or death likely for persons struck by windborne debris. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months, and most of the area will be uninhabitable for weeks or months.

Previous Occurrences

Tropical cyclones are the most destructive natural disasters that threaten Connecticut due principally to their accompanying storm surge. The Region has experienced damaging tropical cyclones 7 times since 1954 according to Table 3-1. According to NOAA, 33 tropical cyclones have passed within 50 miles of Fairfield County from 1851 to 2020, including 2 Category 3 storms (the 1938 Hurricane and Hurricane Carol in 1954), 2 Category 2 storms (the 1944 Hurricane and Hurricane Donna in 1960), 6 Category 1 hurricanes. Figure 3-4 presents the historical hurricane tracks as presented by NOAA. In general, the tracks trend from the southwest to the northeast across the region.

The wind and rain brought by historic tropical storms and hurricanes caused flooding, property damage, power outages, and left extensive debris and detritus in their wake. The most destructive and powerful recorded hurricane to hit Connecticut struck on September 21, 1938. Named the Great New England Hurricane of 1938, the strongest winds ever recorded in Southern New England occurred during this storm at the Blue Hill Observatory with sustained winds of 121 mph and a peak gust of 186 mph. The worst damage was concentrated on the coast due to massive storm surges of 14 to 18 feet. However, inland communities were not spared. Rainfall of 10 to 17 inches from the hurricane resulted in severe river flooding across Connecticut, washing away road and

sections of the New York, New Haven, and Hartford Railroad lines. The Connecticut River in Hartford reached a level of 35.4 feet, which was 19.4 feet above flood stage. A total of 8,900 homes, cottages and buildings were destroyed, and over 15,000 were damaged by the hurricane. Across Southern New England 564 people died and over 1,700 were injured (NWS Forecast Office, 2005). Due to its destruction, the hurricane of 1938 is often used as a benchmark when assessing the worst-case scenario for future hurricanes to strike the region.

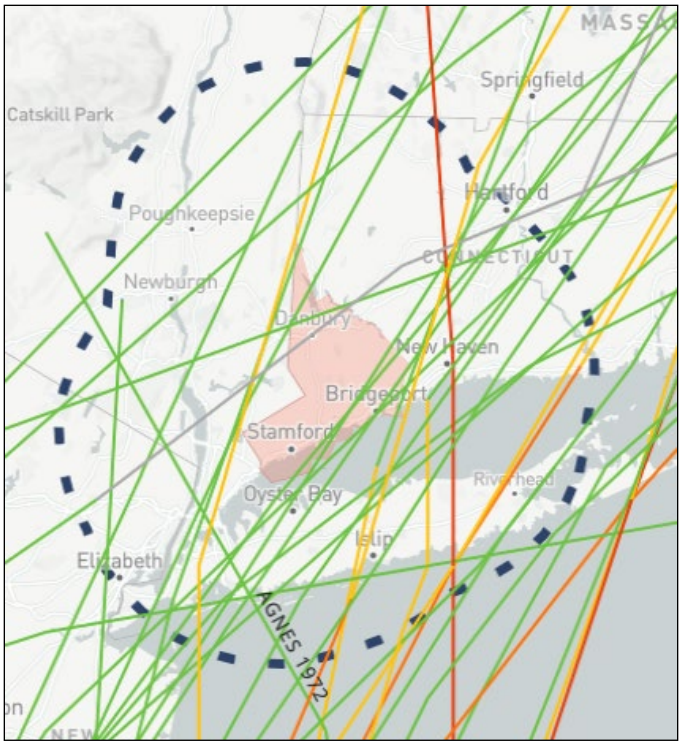


Figure 3-4: Hurricane Historical Tracks
Source: NOAA

While no other hurricane has caused the level of destruction in Connecticut as the 1938 hurricane, other storms of significance have hit the region. The following provides an overview of these recent storms:

- Hurricane Gloria of September 1985 was a Category Three Hurricane when it made landfall in North Carolina and weakened to a Category 1 Hurricane before its center made landfall near Bridgeport. The hurricane struck at low tide, resulting in low to moderate storm surges along the coast. The storm produced up to six inches of rain in some areas and heavy winds that damaged structures and uprooted thousands of trees. The amount and spread of debris and loss of power were the major impacts from this storm, with over 500,000 people suffering significant power outages. Many residents in the region evacuated to emergency shelters, and New Canaan, Westport, and other municipalities set up emergency water distribution centers to provide clear water to residents who did not have electricity to pump water from their wells.

- September 16-21, 1999: Tropical Storm Floyd dropped an average of four to eight inches of rain across the State. Sixteen buildings in the state were utterly destroyed by the storm. The storm caused $2.2 million in damage, widespread power outages throughout New England, and at least one death in Connecticut.

- August 28, 2011: Irene first made landfall in North Carolina as a Category 1 hurricane. By the time it reached the New York area, it was downgraded to a tropical storm. Dropping torrential rain on Connecticut, the storm caused widespread flooding, knocked power out to 754,000 customers, and left many roads impassable. According to the 2019 CT NHMP, "2-3 percent of trees within 50 feet of the centerline of state roads were felled by the storm" and the storm caused over $10 million in fiscal impacts to State infrastructure. Ten deaths were attributed to the storm in Connecticut. The New Canaan branch of Metro North suffered extensive damage.

- October 29, 2012: Tropical Storm Sandy formed in the Caribbean on October 22. Moving up the coast, hitting New Jersey and New York on October 29, 2012, Tropical Storm Sandy caused extensive flooding and damage on Connecticut's coast. The National Hurricane Center Tropical Cyclone Report estimated the death count from Sandy at 147 deaths, including 5 in Connecticut. Sandy was the deadliest hurricane to hit the United States since Hurricane Katrina in 2005. A total of 63% of Stamford was without power following the storm.

- August 3-4, 2020: Tropical Storm Isaias produced wind gusts of up to 70 mph along the coastline and heavy rain to the region, knocking down trees and causing widespread power outages. A tropical storm

warning, flash flood watch, and tornado watch was issued by the NWS for the storm. According to the Connecticut Post, numerous trees were blown down in Danbury, and transformers were damaged on Main Street and Mill Plain Road. Numerous roads were closed throughout the region, including Route 25, Stony Hill Road, and North Mountain Road in Brookfield. Wind damage collapsed part of a building in Bethel, resulting in a major gas leak. A 65-foot sailboat came loose and was thrown onto the rocks on the east side of Dolphin Cove in Stamford. Service was temporarily suspended along Metro North due to trees falling on the tracks. This event was a significant recent reminder of the risks posed by tropical storms; a Fact Sheet on the following page provides more information.

Probability of Future Events

Return periods can be a helpful tool to put risk in perspective. Resident and business leaders should ask themselves, "How often over the course of a 30-year mortgage will a Category 1 hurricane hit Connecticut?" This exercise may help frame these storms as an eventuality to be prepared for rather than a risk that can be avoided.

NOAA has utilized the National Hurricane Center Risk Analysis Program "HURISK" to determine return periods for various hurricane categories at locations throughout the United States. As noted on the NOAA website, hurricane return periods are the frequency at which a certain intensity or category of hurricane can be expected with 75 nautical miles of a given location. For example, a return period of 20 years for a particular category storm means that on average during the previous 100 years a storm of that category passed within 75 nautical miles of that location five times. Thus, it is expected that similar category storms would pass within that radius an additional five times during the next 100 years.

According to NOAA, a Category 1 hurricane can be expected to make landfall in/near Connecticut once every 17 years. A Category 2 hurricane could be expected to make landfall in/near Connecticut once every 39 years, and a Category 3 hurricane has a calculated return period of 68 to 70 years. Based on this, the occurrence of another hurricane to impact the state can be expected within the foreseeable future.

The 2019 CT NHMP also notes that some researchers have suggested that the intensity of tropical cyclones has increased over the last 35 years, with some believing that there is a connection between this increase in intensity and climate change. While most climate simulations agree that greenhouse warming enhances the frequency and intensity of tropical storms, models of the climate system are still limited by resolution and computational ability. However, given the past history of major storms and the possibility of increased frequency and intensity of tropical storms due to climate change, it is prudent to expect that there will be hurricanes impacting Connecticut in the near future that may be of greater frequency and intensity than in the past. This is discussed on the following Fact Sheet.

Impacts to Community Assets

According to the 2019 CT NHMP, hurricanes have the greatest destructive potential of any natural disasters in Connecticut due to the potential combination of high winds, storm surge and coastal erosion, heavy rain, and flooding that can accompany the hazard. It is generally believed that New England is long overdue for another major hurricane strike. Factors that influence vulnerability to tropical cyclones in the Region include building codes currently in place, local zoning and development patterns, and the age and number of structures located in highly vulnerable areas of the communities.

In general, as the residents and businesses of Connecticut become more dependent on the internet and mobile communications, the impact of hurricanes on commerce will continue to increase. A major hurricane has the potential of causing complete disruption of power and communications for up to several weeks, rendering electronic devices and those that rely on utility towers and lines inoperative.

Debris such as signs, roofing material, and small items left outside become flying missiles in hurricanes. Extensive damage to trees, towers, aboveground and underground utility lines (from uprooted trees or failed infrastructure), and fallen poles cause considerable disruption for residents. Streets may be flooded or blocked by fallen branches, poles, or trees, preventing egress. Downed power lines from heavy winds can also start fires during hurricanes with limited rainfall. While moving all utilities

PAST STORM EVENTS

AUGUST 2020: TROPICAL STORM ISAIAS

Eversource outages post-storm
Photo Republican-American

Wind damage in Bethel
Photo Ctpost.com

Damage in Westport
Photo Ctpost.com

WHAT WAS THE EVENT

On August 4, 2020 Tropical Strom Isaias moved through the northeast producing widespread tropical storm conditions. The tropical storm warning included gale forces winds, and possible tornadoes throughout the state.

Anticipated rainfall totals were low for the state of Connecticut with expected accumulations of 1 to 3 inches. However, the storm resulted in wind gusts of up to 70 mph, and sustained winds up to 65 mph. In addition to severe tree and powerline damage, the National Weather Service confirmed an EF1 tornado touched down in the Town of Westport. The tornado likely produced winds between 95 and 105 mph, and traveled roughly 50 yards.

Eversource reported over 632,000 outages, with some customers throughout western Connecticut without power for nine days.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Tropical storms and hurricanes are often tracked long before they make landfall here in Connecticut. These events are typically detected in the southern Atlantic and tracked for days prior to threat in the northeast.

This long-range tracking allows for short term preparation, along with the implementation of long-term mitigation.

Long-term mitigation efforts would include emergency service preparation, flood mitigation, wind mitigation, and public education. It is important a municipality is continuously maintaining and improving emergency services, such as shelters, evacuation plans, and emergency power to critical facilities.

Flood mitigation might include implementing measures at critical facilities or assisting residents with executing the necessary property upgrades.

In addition, wind damage is a huge concern with this type of event. Wind retrofits are critical facilities should be evaluated, along with tree maintenance to reduce risk to electric infrastructure. Public education might include reminding residents of storm preparation at the beginning of hurricane season and disseminating information on where they can receive emergency information and important contact information for the town.

REGIONAL CHALLENGES

CLIMATE CHANGE AND HURRICANES

Boats washed ashore in Norwalk
Photo nancyonnorwalk.com

Post hurricane tree damage in Danbury
Photo CT Post

FOR MORE INFORMATION

Connecticut Institute for Resilience and Climate Adaptation (CRICA)
University of Connecticut
Avery Point Campus
1080 Shennecossett Rd
Groton, CT 06340
860-405-9214
circa@uconn.edu

WHAT IS THE CHALLENGE?

Hurricanes pose a natural hazard risk to both coastal and inland municipalities. Hurricane hazards include storm surge, high winds, and heavy precipitation. Hurricanes can severely impact communities by way of flooding, downed trees or power lines, and other wind related damage.

Researchers have utilized climate change models to evaluate the potential shifts in hurricane occurrences as a result of climate change. It was found that while the global number of hurricane events has not increased in recent years, there has been a notable difference in the location. Since 1980, the number of events has been rising in the North Atlantic and Central Pacific and declining in the Western Pacific and South Indian Ocean.

As the climate continues to change, water ocean temperatures are expected to fuel stronger hurricanes, and to enable these storms to retain their strength further northward (Center for Climate and Energy Solutions, www.c2es.org). Connecticut can expect hurricane strikes to occur more frequently and be more severe.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

The region is comprised of five coastal municipalities and 13 inland communities. Hurricane damages tend to be caused primarily by coastal flooding and high winds.

WestCOG communities should be aware of observed and projected shifts in hurricane patterns, identify vulnerabilities, and prepare for future hurricane events.

The hazard mitigation plan update identifies several hazards mitigation strategies that are applicable throughout the region:

- Work with electric utilities to increase the **resiliency of the power grid**, and improve outage response capabilities
- Install **backup power** at critical facilities or consider **microgrids**
- Implement **flood mitigation** measures for infrastructure and critical facilities that are at risk of inundation during a storm event
- Inventory **hazardous trees** and support aggressive trimming and removal efforts
- Utilize up-to-date precipitation figures or stream continuity standards to **upsize undersized culverts** and bridges that are at risk of failure or washout during large flood events

underground would prevent wind damage to this infrastructure, this activity is too cost-prohibitive to be implemented in a widespread manner.

Affected Population

The population of the entire region is anticipated to be affected when a tropical cyclone strikes. Furthermore, all areas of growth and development increase the region's vulnerability to natural hazards such as hurricanes although new development is expected to mitigate potential damage by meeting the standards of the most recent building code.

Loss Estimates

HAZUS-MH was utilized to perform analysis of potential wind events in order to calculate potential annualized loss for tropical storm wind damage. HAZUS-MH uses a hazard-load-resistance-damage-loss methodology to produce wind loss estimations. Expected buildings losses are estimated using wind models and damage probabilities based on building type.

The default building stock in HAZUS-MH was used for the analysis. According to this database, there are 198,753 buildings in the Region. Table 3-26 presents the numbers of buildings damaged by wind in the region for each probabilistic storm as well as modern recurrences of 1938 hurricane, 1985's Hurricane Gloria, and 2012's Tropical Storm Sandy.

Table 3-26: Number of Buildings Damaged in Region Due to Wind

Return Period or Storm	Minor Damage	Moderate Damage	Severe Damage	Destruction
10-Year	0	0	0	0
20-Year	0	0	0	0
50-Year	175	6	0	0
100-Year	7,224	771	25	2
200-Year	9,498	1,126	41	6
500-Year	10,414	1,218	42	6
1000-Year	47,246	13,997	1,788	759
Sandy	149	5	0	0
Gloria	190	7	0	0
1938	6,314	579	17	1

Source: HAZUS-MH

For the Region, HAZUS-MH did not estimate that any damage would occur for the 10-year and 20-year wind events, and generally estimated each of the historic storms as being less than 100-year wind events.

Essential facilities in the region included in HAZUS-MH include 6 hospitals, 7 EOCs, 45 fire stations, 22 police stations, and 223 schools. These facilities are geolocated within the HAZUS-MH database such that they are susceptible to differing levels of wind damage based on their position in the region. Table 3-27 summarizes the percentage of essential facilities damage for each wind event.

Table 3-27: Average Percent Damage to Essential Facilities Due to Wind

Return Period or Storm	EOC	Fire Depts.	Hospitals	Police Depts.	Schools
10-Year	0%	0%	0%	0%	0%
20-Year	0%	0%	0%	0%	0%
50-Year	0%	0%	0%	0%	0%
100-Year	1%	1%	1%	0%	1%
200-Year	1%	1%	1%	0%	1%
500-Year	1%	1%	1%	0%	1%
1000-Year	6%	3%	3%	3%	6%
Sandy	0%	0%	1%	0%	0%
Gloria	0%	0%	0%	0%	0%
1938	1%	1%	1%	0%	1%

Source: HAZUS-MH

The estimates for the amount of debris generated from wind damage is presented in Table 3-28. The Region is predicted to experience 1.5 million tons of debris in a 100-year wind event and 5.4 million tons of debris in a 1,000-year wind event.

Table 3-28: Debris Generation Due to Wind (Tons)

Return Period or Storm	Brick / Wood	Reinforced Concrete / Steel	Tree Debris	Total
10-Year	0	0	0	0
20-Year	0	0	0	0
50-Year	617	0	29,903	30,520
100-Year	37,780	1	1,472,062	1,509,843
200-Year	45,872	5	1,594,860	1,640,740
500-Year	50,004	8	1,915,661	1,965,670
1000-Year	280,855	1,214	5,150,876	5,432,945
Sandy	443	0	20,909	21,352
Gloria	715	0	33,178	33,893
1938	29,754	0	1,616,766	1,646,520

Source: HAZUS-MH

The HAZUS-MH simulations suggest that sheltering need will be relatively modest in the region for all but the 1,000-year wind event. Potential shelter requirements are presented in Table 3-29.

Table 3-29: Shelter Requirements Due to Wind

Return Period or Storm	Number of Displaced Households	People Needing Short-Term Shelter
10-Year	0	0
20-Year	0	0
50-Year	0	0
100-Year	283	180
200-Year	425	265
500-Year	381	240
1000-Year	4,609	2,750
Sandy	0	0
Gloria	0	0
1938	162	108

Source: HAZUS-MH

HAZUS-MH calculated economic loss based on both direct property damage and business interruption. Direct property damage includes the estimated costs to repair or replace the damaged caused to the buildings and its contents. The business interruption costs are those associated with the inability of a business to function due to the tropical cyclone. Table 3-30 summarizes the economic loss to the region for each scenario.

Table 3-30: Economic Losses in Region Due to Wind (Thousands)

Municipality	Property Loss	Business Interruption (Income) Loss	Total Losses
10-Year	$0	$0	$0
20-Year	$0	$0	$0
50-Year	$16,074	$0	$16,074
100-Year	$514,465	$2,618	$517,083
200-Year	$657,798	$4,244	$662,042
500-Year	$617,630	$3,690	$621,320
1000-Year	$4,185,123	$28,414	$4,213,537
Sandy	$10,692	$0	$10,692
Gloria	$20,461	$0	$20,461
1938	$429,767	$1,815	$431,582

Source: HAZUS-MH

The probabilistic tropical cyclone scenarios presented above were used to generate an annualized loss estimate for each municipality in the Region. Results are presented in Table 3-31.

Table 3-31: Annualized Economic Loss in Region Due to Wind (Thousands)

Municipality	Property Loss	Business Interruption (Income) Loss	Total Annualized Losses
Bethel	$203	$1	$204
Bridgewater	$22	<$1	$22
Brookfield	$199	$1	$200
Danbury	$822	$4	$827
Darien	$763	$2	$765
Greenwich	$1,765	$11	$1,776
New Canaan	$425	$2	$426
New Fairfield	$123	<$1	$123
New Milford	$252	$1	$253
Newtown	$366	$1	$367
Norwalk	$2,353	$17	$2,370
Redding	$126	<$1	$127
Ridgefield	$352	$1	$353
Sherman	$32	<$1	$32
Stamford	$2,757	$24	$2,781
Weston	$167	$1	$168
Westport	$1,314	$9	$1,323
Wilton	$296	$2	$298
WestCOG	**$12,338**	**$79**	**$12,417**

Source: HAZUS-MH

3.3.5 Tornadoes

Tornadoes can be very destructive when they occur. While small tornadoes in outlying areas cause little to no damage, larger tornadoes in populated sections of Connecticut have historically caused significant damage, injury, and death through the destruction of trees, buildings, vehicles, and power lines.

Location

All areas of the Region are susceptible to tornadoes. The likelihood of damage, injury, and death increases dramatically when a tornado occurs in a populated area. Tornadoes typically cause damage in a straight line, although "skipping" tornadoes are also possible where a tornado can pass over portions of its route without causing damage.

Extent

A tornado is a violent, destructive whirling wind storm accompanied by a funnel-shape cloud that progresses in a narrow path over the land as shown in Figure 3-5.

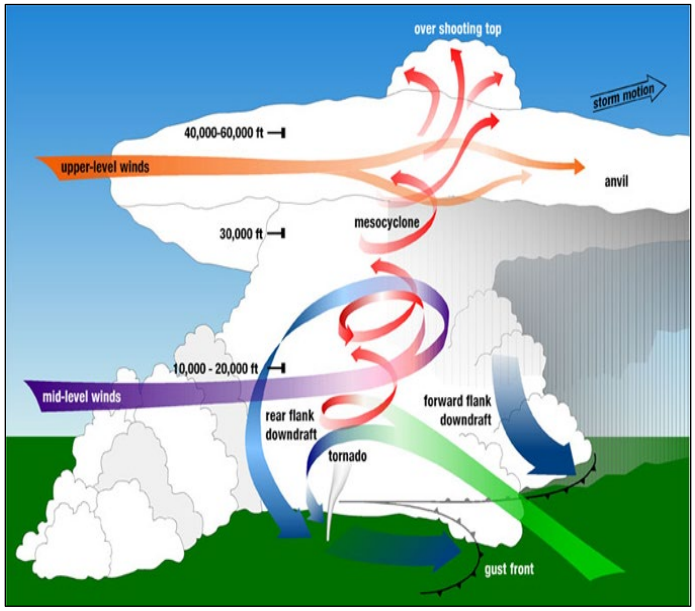


Figure 3-5: Anatomy of a Tornado
Source: NOAA National Severe Storms Laboratory

The strength of tornados is measured based on the Enhanced Fujita scale (EF) released by NOAA in 2007. The EF scale updated the original Fujita (F) scale developed in 1971. The EF scale uses three-second gusts estimated at the point of damage based on a judgement of eight levels of damage to 28 specific indicators. Table 3-32 links EF classifications to estimated three-second wind gusts.

Table 3-32: Enhanced Fujita Scale

F-#	F Scale 3-Second Gust (mph)	EF-#	EF Scale 3-Second Gust (mph)
0	45-78	0	65-85
1	79-117	1	86-110
2	118-161	2	111-135
3	1662-209	3	136-165
4	210-261	4	166-200
5	262-317	5	Over 200

Source: NOAA

Previous Occurrences

Tornadoes are infrequent occurrences in Connecticut and the Region. Sixteen tornadoes have touched down within the region in the past 70 years.

An extensively researched list of tornado activity in Connecticut is available on Wikipedia. This list extends back to 1648 although it is noted that the historical data prior to 1950 is incomplete due to lack of official records and gaps in populated areas. Tornadoes that have impacted the Region are noted below:

- June 19, 1794: A tornado destroyed several structures in New Milford injuring four people, while a separate tornado cut through Branford. A strange incident was recorded where a tree was uprooted and carried, fully upright, along a road in New Milford, along with several other large objects. A barn door was found 10 miles from its source. Some loss of life likely occurred from one or both tornadoes.

- October 8, 1797: A tornado touched down in North Salem, New York, moving into Fairfield County. Six people were injured in Ridgefield, and possible tornado damage continued as far as Long Island Sound in Branford.

- August 1, 1812: A tornado passed from Westchester County, New York into Greenwich.

- August 14, 1820: A tornado touched down east of Norwalk.

- September 27, 1899: A tornado passed from Norwalk to near Ridgefield, causing damage to trees and roofs in a path 50 to 300 feet wide. Some buildings were completely destroyed.

- August 28, 1911: A tornado cut a 3-mile path through New Milford, uprooting trees and damaging roofs.

- July 14, 1950: An F2 tornado touched down in Ridgefield around 7:30 a.m., tearing the roof off the high school and downing trees through the center of town. Three people were injured and $250,000 in property damage reported.

- August 21, 1951: A long-tracked F2 tornado touched down in New Milford, passing more than 40 miles (64 km) well into Hartford County. Nine people were injured.

- August 9, 1968: An F1 tornado briefly touched down near Danbury.
- July 19, 1971: An F2 tornado touched down near Norwalk.
- September 18, 1973: Three tornadoes briefly touched down in Connecticut, including an F1 tornado in Greenwich.
- July 20, 1975: An F1 touched down near New Milford.
- June 29, 1990: An F0 briefly touched down in Danbury. Seven people were injured by flying glass.
- July 5, 1992: An F0 struck near New Fairfield.
- July 1, 2001: An F0 tracked 10 miles across southern Litchfield County, touching down seven times along its path from New Milford to Roxbury.
- May 31, 2002: An F1 touched down in Brookfield.
- June 16, 2002: An F0 briefly touched down in the Lanesville section of New Milford.
- July 12, 2006: The Westchester tornado that produced F2 damage across the border in New York entered Greenwich at 4:01 PM, producing F1 damage on the north side of town. It may have briefly touched down a second time just north of the Merritt Parkway.
- May 16, 2007: Just three months after the switch to the Enhanced Fujita Scale for rating tornadoes, a skipping tornado, rated EF1, tracked 4 to 5 miles from Bethel to Newtown. Widespread wind damage also affected other parts of the state.
- July 1, 2013: An EF0 tornado with winds up to 80 mph touched down in Greenwich and Stamford, causing extensive tree damage along a 3.7-mile path 150 yards wide.
- May 15, 2018:
- October 2, 2018: An EF-1 tornado struck New Canaan with winds of around 100 mph. The path was approximately 300 feet wide. A funnel cloud connected to this same storm was also spotted in eastern Norwalk by workers of a local electronics store.
- August 4, 2020: A waterspout came onto shore in Saugatuck Shores in Westport during Tropical Storm Isaias, causing EF1-scale damage to a house and trees.

Probability of Future Events

According to the 2019 CT NHMP, "The pattern of occurrence and potential locations for tornadoes to occur in Connecticut is expected to remain relatively unchanged in the 21st Century. Based on NOAA's historical data, the northwest area of the state, namely Litchfield and Hartford Counties, have the highest historical incidences of tornadoes and therefore may be considered to have a higher risk for the occurrence of future tornadoes." Based on the data presented in Table 2-84 of the 2019 CT NHMP for Litchfield and Hartford Counties, the Region could experience approximately 0.38 tornado events per year.

However, based on the historic record presented above, the Region has likely experienced 5 EF0, 8 EF1, and 3 EF2 tornadoes over the last 100 years. Therefore, the Region should anticipate the occurrence of a tornado every 6.25 years. NOAA states that climate change has the potential to increase the frequency and intensity of tornadoes, so it is possible that the pattern of occurrence in Connecticut could change in the future.

Impacts to Community Assets

While Connecticut clearly faces some risk from tornadoes, the nature of the storms makes them unpredictable. Tornadoes can strike with very little warning, cause significant to catastrophic damage to homes, vehicles, and businesses, and result in significant injury and death. All towns in the region share equal vulnerability to these events, and although property destruction may be unavoidable, loss of life can be minimized through efficient, coordinated response.

Affected Population

Populations in the direct path of a tornado are most likely to experience damage or injury from a tornado. Therefore, the more populated areas in the Region are more likely to experience damage and casualties than the

less densely populated communities. Indirect effects may also be felt by the larger population in an affected municipality due to closed roads, power outage, and loss of services.

Loss Estimates

Although impacts to Connecticut and the Region from tornadoes are infrequent, tornadoes that have struck the area have had devastating impacts. According to the NCDC Database, 19 people have been injured by tornadoes in the region. The total property damage from these events have cost approximately $2,137,500 since 1990.

Estimates of community impacts have been determined based on data presented in the 2019 CT NHMP. The percentage of the population of each WestCOG municipality as compared to the population of the county was used to adjust the tornado losses reported to the NCDC for each county as presented in Table 2-84 of the 2019 CT NHMP. The annualized loss estimate for tornado damage in each WestCOG municipality is presented in Table 3-33.

Table 3-33: Annualized Tornado Loss Estimates

Municipality	Annualized Loss
Bethel	$2,736
Bridgewater	$14,610
Brookfield	$2,345
Danbury	$11,702
Darien	$3,002
Greenwich	$8,682
New Canaan	$2,795
New Fairfield	$1,917
New Milford	$229,550
Newtown	$3,854
Norwalk	$12,271
Redding	$1,260
Ridgefield	$3,448
Sherman	$503
Stamford	$17,911
Weston	$1,416
Westport	$3,936
Wilton	$2,534
WestCOG	**$324,474**

Source: CT NHMP

3.3.6 Thunderstorms

Thunderstorms are a common occurrence in Connecticut and occur on approximately 20 to 30 days each year. While many thunderstorms produce relatively little damage, stronger "supercell" thunderstorms can produce heavy winds, hail, significant damaging lightning strikes, and even tornadoes. Such storms have historically caused significant damage, injury, and even death through the destruction of trees; damage to buildings, vehicles, and power lines; and direct lightning strikes.

Location

All areas of the Region are susceptible to thunderstorms. The likelihood of damage, injury, and death increases dramatically when a supercell thunderstorm occurs in a populated area. While the heavy winds and tornadoes (see Section 3.3.5) associated with strong thunderstorms are more likely to cause measurable damage near populated areas, hail can cause damage in crops in rural areas as well as damaging vehicles and buildings in populated areas, and lightning can cause injuries or fires in any area.

Extent

The strength of thunderstorms is typically measured in terms of its effects, namely the speed of the wind, the presence of significant lightning, and the size of hail. In general, thunderstorm winds are less than tropical cyclone speeds, but strong winds associated with downbursts can be extremely hazardous and reach speeds up to 168 mph.

Lightning

Lightning is a discharge of electricity that occurs between the positive and negative charges within the atmosphere or between the atmosphere and the ground. According to NOAA, the creation of lightning during a storm is a complicated process that is not fully understood. In the initial stages of development, air acts as an insulator between the positive and negative charges. However, when the potential between the positive and negative charges becomes too great, a discharge of electricity (lightning) occurs.

In-cloud lightning occurs between the positive charges near the top of the cloud and the negative charges near the bottom. Cloud-to-cloud lightning occurs between the

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

Figure 3-6: Lightning Strike
Source: NOAA

Downbursts

A downburst is a severe localized wind blasting down from a thunderstorm. They are more common than tornadoes in Connecticut. Depending on the size and location of downburst events, the destruction to property may be significant.

Downburst activity is, on occasion, mistaken for tornado activity. Both storms have very damaging winds (downburst wind speeds can exceed 165 miles per hour) and are very loud. These "straight line" winds are distinguishable from tornadic activity by the pattern of destruction and debris such that the best way to determine the damage source is to fly over the area.

Downbursts fall into two categories:

Microbursts affect an area less than 2.5 miles in diameter, last five to 15 minutes, and can cause damaging winds up to 168 mph.

Macrobursts affect an area at least 2.5 miles in diameter, last five to 30 minutes, and can cause damaging winds up to 134 mph.

Hail

Hailstones are chunks of ice that grow as updrafts in thunderstorms keep them in the atmosphere. Most hailstones are smaller in diameter than a dime, but stones weighing more than 1.5 pounds have been recorded. NOAA has estimates of the velocity of falling hail ranging from nine meters per second (m/s) (20 mph) for a 1-centimeter (cm) diameter hailstone, to 48 m/s (107 mph) for an eight cm, 0.7-kilogram stone.

Previous Occurrences

Previous occurrences of thunderstorm damage since 1993 are reported in the NCDC Storm Events database for the Region. Recent highlights of this damage are presented below:

- June 23, 2015: Multiple severe thunderstorms passed through southern Connecticut. Multiple trees were reported down in Ridgefield with several upon cars, resulting in $25,000 in damage. Widespread tree damage was reported in Newtown.

- July 21, 2015: A line of showers and thunderstorms produced damaging winds in New Milford. A downed tree fell on a car on Still River Drive, injuring the two occupants and closing the road.

- July 18, 2016: A large tree was struck by lightning, bringing down large branches and power lines on Main Street in Westport.

- August 13, 2016: Severe weather impacted southern Connecticut. Numerous trees and wires were reported down throughout the town of Danbury. Numerous trees were reported down throughout Greenwich. A couple of trees were reported down across the town of Stamford. A large tree limb was reported down on a house on Witch Lane just southeast of Westport. A utility pole was reported down on Granite Drive between Wilton and Westport.

- July 13, 2017: Severe thunderstorms produced tree damage throughout Wilton. A tree was reported down along Mountain Road in northern Wilton, and a tree was reported down on a house on September Lane near Cannondale.

- August 2, 2017: Scattered strong to severe thunderstorms knocked down numerous trees and power lines, produced large hail, and caused isolated

flash flooding in southern Litchfield County. Trees and wires were reported down in Bridgewater.

- May 15, 2018: A severe supercell thunderstorm caused hail up to two inches in diameter, two confirmed tornadoes, and straight-line wind damage. Numerous power outages and several road closures occurred as a result of the storms. Refer to the fact sheet on the following page for details. A total of 20 residences in Bridgewater were damaged by falling trees, and one land of Curtis Road was closed due to fallen wires. Brookfield was hit by a microburst with wind speeds up to 110 mph impacting an area approximately 2.5 miles wide and 5 miles long with significant tree damage reported. A dugout roof collapsed on the baseball field of Henry Abbott Technical High School in Danbury resulting in one serious injury. A man died when a tree fell on a truck in the Candlewood Lake area of Danbury. Numerous trees were damaged near the intersection of Route 37 and Route 39 in New Fairfield, and a tree fell on a car on Brush Hill Road resulting in one death. Several large trees were snapped or uprooted in New Milford, and shingles were town off of New Milford High School. Numerous trees were reported down in Newtown and power lines were reported down at Gelding Hill Road. A tree fell on cars at the Trader Joe's on Route 1, and wires were reported down at Roseville Road in Westport. A Fact Sheet describing this event is included on the following page.

- October 2, 2018: Severe thunderstorms resulted in hail and trees down in New Canaan on the Merritt Parkway near Exit 37. In Norwalk, a large tree fell on West Norwalk Road near Stony Lane, and another tree fell across West Norwalk Road at Ravenwood Road.

- August 3, 2019: Severe thunderstorms damaged trees and power lines throughout the region. Route 202 was closed in New Milford due to a tree down on wires. Wires were downed on Geiger Road in New Milford with people trapped in a car, and nearby Little and Big Bear Roads were also closed due to thunderstorm wind damage.

- August 8, 2019: Severe thunderstorms knocked down multiple trees and wires across the region. A downed tree along with downed tree limbs were reported at the lower boat launch in Squantz Pond State Park in New Fairfield. Fallen trees blocked the intersection at Maplewood Drive and Pleasant View Road, and at Dodd Road and Picket District Road in New Milford.

Probability of Future Events

According to NOAA's National Weather Service, there is an average of 100,000 thunderstorms per year in the United States. An average of 80 people dies per year from lightning strikes in the United States according to the 2019 CT NHMP. Most lightning deaths and injuries occur outdoors, with 45% of lightning casualties occurring in open fields and ballparks, 23% under trees, and 14% involving water activities.

Thunderstorms typically occur on approximately 25 days each year in Connecticut according to NOAA. According to the 2019 CT NHMP, Fairfield County will receive approximately 8.4 damaging thunderstorms each year and Litchfield County will receive approximately 9.4 damaging thunderstorms each year. Furthermore, NOAA reports that there are 10 downburst reports for every tornado report in the United States. This implies that there are approximately 10,000 downbursts reported in the United States each year and further implies that downbursts occur in approximately 10% of all thunderstorms in the United States annually. This figure suggests that downbursts are a relatively uncommon yet persistent hazard. Finally, hailstorms typically occur in at least one part of Connecticut each year during a severe thunderstorm.

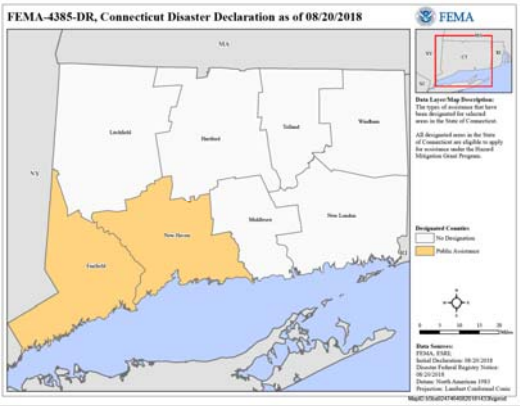
Climate change is expected to increase the frequency and impact of thunderstorms in the future. Thunderstorms are likely to produce both more intense rainfall and more rainfall overall, stronger wind gusts (such as through more frequent downbursts) and have a higher potential to lead to the formation of tornadoes. It is possible that hail may also become more frequent in the future.

Impacts to Community Assets,

All areas of the Region are susceptible to thunderstorms. Fortunately, in Connecticut injury and death due to thunderstorm winds is relatively uncommon. Although thunderstorm damage is expected each year, the majority of events due not cause measurable damage. Most thunderstorm damage is associated with downbursts, which typically have a greater effect on elevated areas

PAST STORM EVENTS

MAY 2018: TORNADO & MACROBURST EVENT



FEMA-4385-DR, Connecticut Disaster Declaration as of 8/20/2018
Photo FEMA.gov

Damage in Brookfield
Photo Ctinsider.com

WHAT WAS THE EVENT?

On May 15, 2018 a macroburst struck the region, causing damages across a 9-mile-long and 3-mile-wide swath of land between New Fairfield and Brookfield. The event had estimated maximum wind speeds of 110 mph.

Many trees were uprooted and snapped, with some of the most significant damage occurring in Brookfield. The storm resulted in two fatalities, and one serious injury.

Eversource reported 288 miles of power lines down as a result of the storm, with almost 140,000 outages at the height of the storm.

Outside of the WestCOG region, there was a confirmed EF1 tornado from Southbury to Oxford, and from Beacon Falls to Hamden, and Winsted. There was also a confirmed microburst from Hamden to Wallingford.

This event was a federally declared disaster for both Fairfield and New Haven counties.

LINK TO HAZARD MITIGATION

The National Centers for Environmental Information (NCEI) has only reported losses from one tornado event in the region since 2014. While this figure indicates that tornadoes and straight-line winds are low-frequency events, the severity of such events when they do occur, as well as the apparent increase in frequency in recent years, warrants prioritization of relevant mitigation actions.

While tornadoes and straight-line winds are can be more severe than other wind events experienced in this region, typical wind-mitigation approaches are applicable. Tree maintenance, including trimming and removal of dead and dying vegetation, is imperative to reducing the risk of downed trees and limbs damaging property and power lines. Development of debris maintenance protocols, including identification of debris staging locations, is another important action. Other power-grid resiliency measures are also important.

Ensuring a community's emergency capabilities are always up-to-date is critical, as a tornado or microburst can occur with limited notice. Regulations and education can promote structural retrofits that improve the wind-resistance a building, allowing it to withstand heavy wind activity.

such as hilltops, ridges, and "wind corridors" within communities. Areas with more trees in close proximity to power lines and structures are more vulnerable to the effects of thunderstorm damage than more urban areas.

While crops are the major victims of hail, larger hail is also a hazard to people, vehicles, and property. Lightning strikes are relatively infrequent in Connecticut but can cause permanent damage or death to a person along with starting fires. Lightning can also occur on any day even if a thunderstorm is not occurring. In general, the economic impact of thunderstorms is much lower than that of tropical cyclones, but still significant because the damage is expected to occur reach year.

Affected Population

The entire population of the Region is anticipated to experience the effects of thunderstorms each year. Damaging impacts are typically defined to smaller areas due to lightning strikes and downbursts. However, an entire community can be affected by impacts from hail, heavy rain, and strong winds, and indirect impacts may also be felt by the entire community if roads or utilities are damaged.

Loss Estimates

Estimates of community impacts have been determined based on data presented in the 2019 CT NHMP. The percentage of the population of each WestCOG municipality as compared to the population of its county was used to adjust the thunderstorm losses reported to the NCDC for each county as presented in Table 2-76 of the 2019 CT NHMP. The annualized loss estimate for thunderstorm damage in each community is presented in Table 3-34.

Table 3-34: Annualized Thunderstorm Loss Estimates

Municipality	Annualized Loss
Bethel	$13,772
Bridgewater	$1,498
Brookfield	$11,806
Danbury	$58,910
Darien	$15,113
Greenwich	$43,709
New Canaan	$14,073
New Fairfield	$9,653
New Milford	$23,532
Newtown	$19,400
Norwalk	$61,777
Redding	$6,341
Ridgefield	$17,360
Sherman	$2,533
Stamford	$90,171
Weston	$7,131
Westport	$19,817
Wilton	$12,759
WestCOG	**$429,354**

Source: CT NHMP

3.3.7 Forest and Wildland Fires

Wildfires are a relatively common occurrence in Connecticut but are typically small and cause little to no damage to populated areas. Structural fires in higher-density areas of the region are not considered herein.

Location

Wildfires typically occur in undeveloped rural forested areas, although smaller fires can also occur along highway medians. Wildfire damage is typically greatest at the wildland interface where low-density suburban/rural developed areas border undeveloped wooded and shrubby areas. These are defined as areas with one structure per 40 acres with extensive vegetation. Wildfires are of particular concern for areas with limited firefighting access, such as outlying areas without public water service and large contiguous forest parcels with limited access. All areas of the Region are susceptible to lightning strikes, and all WestCOG municipalities have areas where fires may be set due to arson or occur due to campfires or open burning getting out of control. Unlike the other hazards described in this Plan, the likelihood of damage due to wildfires typically decreases with increasing population density, meaning that less developed communities such as Bridgewater have a greater risk than heavily developed communities such as Stamford.

Extent

Wildfires are any non-structure fire, other than a prescribed burn, that occurs in undeveloped areas. They are considered to be highly destructive, uncontrollable fires. Although the term brings to mind images of tall trees engulfed in flames, wildfires can occur as brush and

shrub fires, especially under dry conditions. Wildfires are also known as "wildland fires."

According to the National Fire Protection Agency, several elements (known as the fire tetrahedron) must be present in order to have any type of fire:

- **Fuel**: Without fuel, a fire will stop. Fuel can be removed naturally (when the fire has consumed all burnable fuel) or manually by mechanically or chemically removing fuel from the fire. In structure fires, removal of fuel is not typically a viable method of fire suppression. Fuel separation is important in wildfire suppression and is the basis for controlling prescribed burns and suppressing other wildfires. The type of fuel present in an area can help determine overall susceptibility to wildfires. According to the Forest Encyclopedia Network, four types of fuel are present in wildfires:
  - Ground Fuels, consisting of organic soils, forest floor duff, stumps, dead roots, and buried fuels
  - Surface Fuels, consisting of the litter layer, downed woody materials, and dead and live plants to two meters in height
  - Ladder Fuels, consisting of vine and draped foliage fuels
  - Canopy Fuels, consisting of tree crowns

- **Heat**: Without sufficient heat, a fire cannot begin or continue. Heat can be removed through the application of a substance, such as water, powder, or certain gases, that reduces the amount of heat available to the fire. Scraping embers from a burning structure also removes the heat source.

- **Oxygen**: Without oxygen, a fire cannot begin or continue. In most wildland fires, this is commonly the most abundant element of the fire tetrahedron and is therefore not a major factor in suppressing wildfires.

- **Uninhibited Chain Reaction**: The chain reaction is the feedback of heat to the fuel to produce the gaseous fuel used in the flame. In other words, the chain reaction provides the sustained heat necessary to maintain the fire. Fire suppression techniques, such as dry chemical extinguishers, break up the uninhibited chain reaction of combustion to stop a fire.

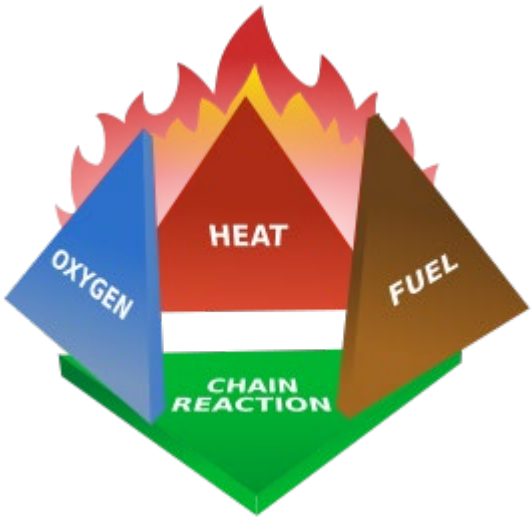


Figure 3-7: The Fire Tetrahedron
Image Provided Wikimedia Commons

The Connecticut DEEP Division of Forestry issues forest fire danger ratings. The ratings are low, moderate, high, very high, and extreme. These are based on an index of how quickly a fire is likely to spread and measures of drought. In addition, the NWS issues "Red Flag" warnings. A Red Flag warning means that if a fire occurs, firefighters can expect it to behave erratically due to weather conditions. Open burning is typically not allowed during Red Flag warnings.

Previous Occurrences

According to the Connecticut DEEP Forestry Division, much of Connecticut was deforested by settlers and turned into farmland during the colonial period. A variety of factors in the 19th century caused the decline of farming in the state, and forests reclaimed abandoned farm fields. In the early 20th century, deforestation again occurred in Connecticut, this time for raw materials needed to ship goods throughout the world. Following this deforestation, shipping industries in Connecticut began to look to other states for raw materials, and the deciduous forests of today began to grow in the State.

During the early 20th century, wildfires regularly burned throughout Connecticut. Many of these fires began accidentally by sparks from railroads and industry while others were deliberately set to clear underbrush in the forest and provide pasture for livestock. A total of 15,000 to 100,000 acres of land was burned annually during this

period. This destruction of resources led to the creation of the position of the State Forest Fire Warden and led to a variety of improved coordination measures described in Section 4.2.6.

In the last 20 years, a handful of wildfires have occurred in the Region. Statewide droughts in 1999 and 1995 resulted in fires in the region and in other locations in the state. In 2012, 577 separate fire events occurred throughout Connecticut. Recent large wildfires in Connecticut include:

- The 2016 drought exacerbated wildfire formation, with over 900 acres burned statewide. A 10-acre fire burned for 3 days in Lovers Leap State Park in New Milford in July. A month-long forest fire smoldered across more than 350 acres in a remote section Cornwall that is the Wyantenock State Forest in September and October. Approximately 100 acres were deliberately set aflame as a "backburn" to manage the blaze. Due to the drought, soil conditions were very dry and the fire burned underground, resurfacing several times.

- In eastern Connecticut, a drought in the summer of 2020 caused a September wildfire that burned 94 acres in the Natchaug State Forest. The North Windham Elementary school needed to close due to smoke concerns.

Probability of Future Events

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

Connecticut experiences three distinct fire seasons: from mid-March to mid-May, prior to leaf-out, when fuels such as grasses, dead leaves, branches and twigs on the forest floor are dried out by the sun; from mid-May to mid-September, depending in precipitation; and from October until the first snowfall, when dead leaves collect on the forest floor. Differences in available fuel and conditions lend different characteristics to fires in different seasons: spring and fall fires tend to spread quickly, burning through readily available fuels on the surface of the forest floor and causing little long-term damage; summer fires burn deeper into the ground and tend to spread less quickly and be more difficult to suppress; they are the most destructive to vegetation.

Wildfire risk in the region is believed to be roughly the same as in the rest of the state. According to the USDA Forest Service Annual Wildfire Summary Report for 1994 through 2003, an average of 600 acres per year in Connecticut was burned by wildfires. The National Interagency Fire Center (NIFC) reports that a total of 4,873 acres of land burned in Connecticut from 2002 through 2019 due to 2,918 wildfires, an average of 1.7 acres per fire and 270 acres per year (Table 3-35).

Table 3-35: Wildland Fire Statistics for Connecticut

Year	Number of Wildland Fires	Acres Burned	Average
2019	88	72	0.8
2018	52	50	1.0
2017	97	243	2.5
2016	268	778	2.9
2015	76	159	2.1
2014	28	69	2.5
2013	76	238	3.1
2012	180	417	2.3
2011	196	244	1.2
2010	93	262	2.8
2009	264	246	0.9
2008	330	893	2.7
2007	361	288	0.8
2006	322	419	1.3
2005	316	263	0.8
2004	74	94	1.3
2003	97	138	1.4
2002	101	184	1.8
Total	**2,918**	**4,873**	**1.7**

Source: National Interagency Fire Center

The Connecticut DEEP Forestry Division estimates the average acreage burned per year statewide to currently be much higher (500 acres per year) in the 2019 CT NHMP, likely because not all small fires are reported to the National Interagency Fire Center. The Connecticut DEEP also states that the primary cause of wildland fires in seven of the eight counties is undetermined, with the secondary cause being arson or debris burning. In general, the wildland fires in Connecticut are small and detected quickly, with most of the largest wildfires being contained

to less than 10 acres in size. While the overall incidence of forest fires is relatively low (an average of 162 fires per year from 2002 to 2014, or slightly less than one fire per Connecticut municipality per year), wildfires are a hazard each WestCOG community must be prepared for each year.

Based on the historic record, the average wildfire in Connecticut in a very dry year (1999) burned an average of five acres per fire, while the average acres burned per fire has been 1.7 acres since 2002. These averages are also reasonable for the WestCOG municipalities, although it is expected that larger wildfires could occur, particularly in relatively undeveloped areas such as watershed lands.

Impacts to Community Assets

The technology used to combat wildfires has significantly improved since the early 20th century. An improved transportation network, coupled with advances in firefighting equipment, communication technology, and training, has improved the ability of firefighters to minimize damage due to wildfires in the state. For example, radio and cellular technologies have greatly improved firefighting command capabilities. Existing mitigation for wildland fire control is typically focused on Fire Department training and maintaining an adequate supply of equipment. Firefighters are typically focused on training for either structural fires or wildland fires and maintain a secondary focus on the opposite category.

Today, most of Connecticut's forested areas are secondary growth forests. According to the Connecticut DEEP, forest has reclaimed over 500,000 acres of land that was used for agriculture in 1914. However, that new forest has been fragmented in the past few decades by residential development. The urban/wildland interface is increasing each year as sprawl extends further out from Connecticut's cities. It is at this interface that the most damage to buildings and infrastructure occurs. The "wildland/urban interface" is where many such fires are fought.

The United States Fire Administration has developed several resources to prepare communities and fire departments for wildfire response. One of these tools, the Wildland Urban Interface (WUI), is a mapping tool used to identify areas in communities where infrastructure and facilities are either intermixed or adjacent to (interface) vegetated areas that are prone to wildfire. Recent WUI maps developed by the USDA Forest Service and University of Wisconsin-Madison, depict the areas in 2010 that intermix or interface wildland vegetation types. These maps consider varying densities of vegetation and housing development.

The Region is comprised primarily of interface, intermix, and non-vegetated or agricultural areas (Figure 3-8). The suburban and rural areas identified as intermix, which is a majority of the region, are communities that are found to have greater than 50% wildland vegetation distributed throughout residentially developed areas. The areas that are classified as interface throughout the region are developed communities that are within a 1.5-mile distance of vegetated areas comprised of 75% or more wildland vegetation. The remaining areas throughout the region could be considered a lower risk as these areas are either non-vegetated or non-WUI vegetated.

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

Wildland areas are subject to fires because of weather conditions and fuel supply. An isolated wildland fire may not be a threat, but the combined effect of having residences, businesses, and lifelines near a wildland area causes increased risk to life and property. Thus, a fire that might have been allowed to burn itself out with a minimum of firefighting or containment in the past is now fought to prevent fire damage to surrounding homes and commercial areas as well as smoke threats to health and safety in these areas.

According to the United States Geological Survey (USGS), wildfires can increase the potential for flooding, debris flows, or landslides; increase pollutants in the air; temporarily destroy timber, foliage, habitats, scenic vistas, and watershed areas; and have long-term impacts such as reduced access to recreational areas, destruction of community infrastructure, and reduction of cultural and economic resources.

Legend

Wildland-Urban Interface (WUI)

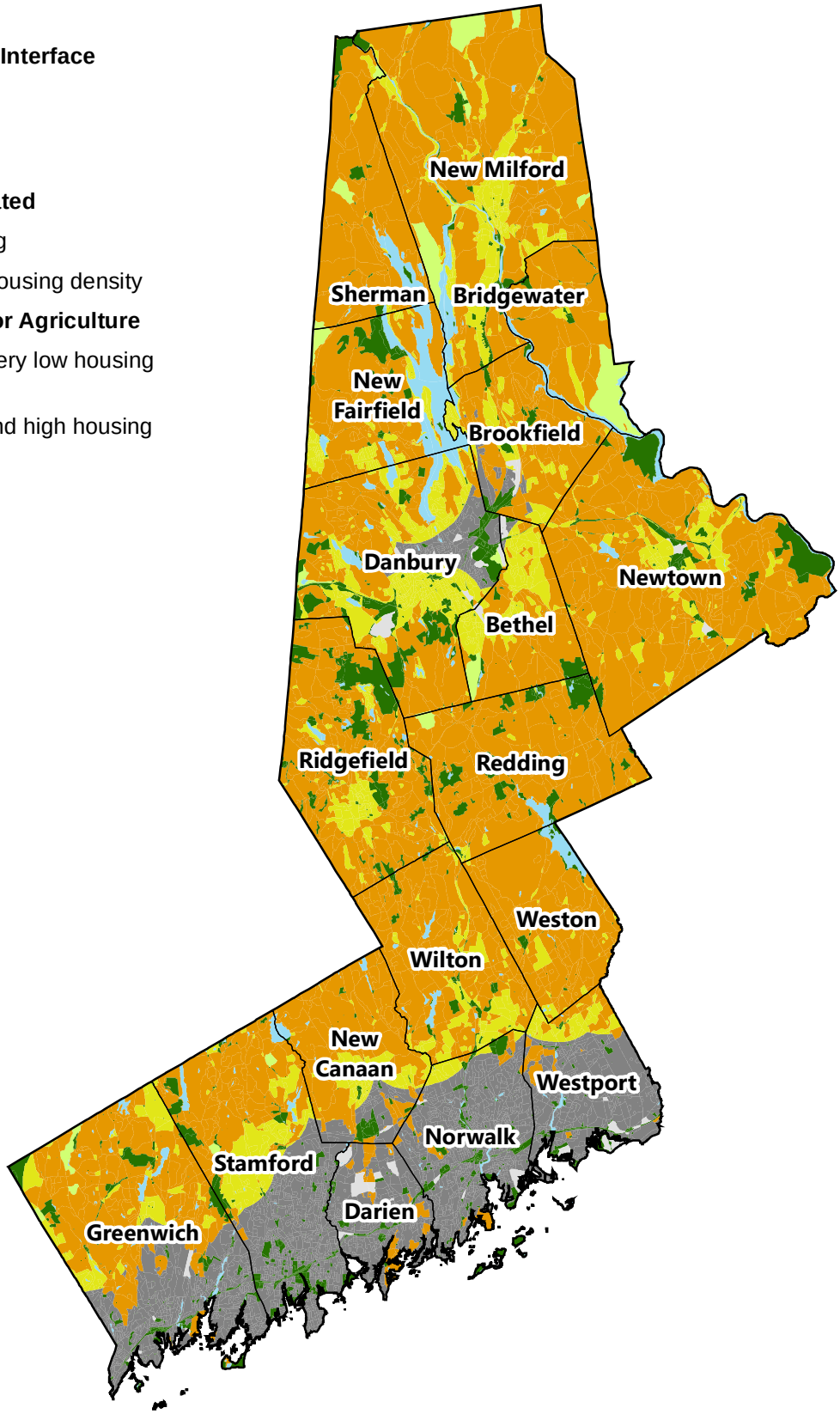
- Interface
- Intermix

Non-WUI Vegetated

- No housing
- Very low housing density

Non-vegetated or Agriculture

- Low and very low housing density
- Medium and high housing density
- Water



MILONE & MACBROOM
99 REALTY DRIVE
CHESHIRE, CT 06410
203.271.1773
WWW.MMINC.COM

WILDLAND URBAN INTERFACE (WUI)

HAZARD MITIGATION PLAN UPDATE
WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS
1 RIVERSIDE ROAD
SANDY HOOK, CT 06482

N

0 14,000 28,000
Feet

SCALE 1 " = 30,000 '
DATE 12/1/2020
PROJ. NO. 3101-22

FIG. 3-8

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

Affected Population

Within the Region, some towns experience a greater risk of wildfire than others, as a result of differing amounts of forest from town to town. Many of the region's municipalities are home to large tracts of forested land such as those owned by water utility companies. Populations along the urban-wildland interface are most likely to be affected by wildfires.

Loss Estimates

The impacts from wildfires on the region have been relatively minimal. According to statistics reported to the National Climatic Data Center, there have been no deaths or injuries, nor damage to property or crops from wildfires in the region from 1996 to 2020. However, it is likely that the relatively small incidents and statistics have gone unreported.

Estimates of annualized loss have been determined based on data presented in the 2014 *Connecticut Natural Hazard Mitigation Plan Update,* as the 2019 CT NHMP does not present county-wide data. The inverse of the population density of each municipality as compared to the population density of the county was used to adjust the wildfire statistics for average fire size and the number of annual events (Table 2-61 of the state plan). An estimated average cost of $2,000 per event was used to determine costs based on previous estimates developed during the former Windham Region Council of Governments HMP update in eastern Connecticut. This method generally allows for larger wildfire losses to be estimated for the communities with a lower population density as these communities are known to generally be more prone to wildfires in Connecticut. Overall, the annualized losses for the Region due to wildfire are relatively modest, with the largest annualized losses being in the relatively rural communities of Bridgewater and Sherman.

Table 3-36: Annualized Wildfire Loss Estimates

Municipality	Annualized Loss
Bethel	$7,160
Bridgewater	$42,070
Brookfield	$9,786
Danbury	$4,150
Darien	$4,903
Greenwich	$6,354
New Canaan	$9,204
New Fairfield	$12,331
New Milford	$10,057
Newtown	$17,354
Norwalk	$2,163
Redding	$28,987
Ridgefield	$11,595
Sherman	$50,456
Stamford	$2,433
Weston	$16,201
Westport	$5,889
Wilton	$12,256
WestCOG	**$253,350**

Source: CT NHMP

3.3.8 Drought

Although Connecticut has a relatively even distribution of precipitation throughout the year, both agricultural and meteorological droughts periodically occur. Lack of precipitation in combination with the typical summer temperatures in the high 80s and low 90s can quickly dry out the soil and streams leading to drought conditions.

Location

All areas of the Region are susceptible to drought, although the likelihood of crop damage and economic loss is generally greater in rural communities. More developed communities are also susceptible to drought, particularly when the drought impacts the availability of public water supply. In general, WestCOG municipalities are likely to be part of a larger regional area affected by drought as opposed to being individually affected.

Extent

There are two types of droughts that are a concern in Connecticut: hydrological and agricultural droughts. Both types of droughts can and often do occur simultaneously.

- **Hydrological Droughts** are characterized by low streamflow, groundwater, and reservoir levels resulting from a lack of precipitation over the course of months. When the presence of rainfall becomes scarce, streams, rivers, and groundwater can suffer, and water utilities can be forced to set restrictions on usage. Wildfires can also be more prevalent during such droughts.

- **Agricultural Droughts** occur during the growing season due to a lack of adequate precipitation and soil moisture to sustain crops. It is determined when the hydration needs of crops are not being sustained by the soil.

The Palmer Drought Severity Index was devised in 1965. It uses temperature and precipitation data to calculate water supply and demand, incorporates soil moisture, and is considered most effective for determining the severity of drought on unirrigated cropland. It primarily reflects long-term drought and has been used extensively to initiate drought relief. The Index ranges from -4.0 (or less) to +4.0 (or more), with an index of 0.0 representing normal conditions. Indexes from -2.0 to -2.9 indicate moderate drought, indexes from -3.0 to -3.9 represent severe drought, and indexes of -4.0 or less indicate extreme drought. Positive indices represent increasing moisture in the soil.

Previous Occurrences

According to the Connecticut Drought Preparedness and Response Plan, droughts have occurred periodically in the state. Serious hydrological droughts were recorded from June 1929 through July 1932. The 1957 drought was both hydrological and agricultural, with the largest impact being on crops. The most recent droughts occurred in 1964-1968, 1981, 1987, 2002, 2007-2008, 2012, 2015-2016, and 2020. The entire Region was considered to be abnormally dry as recently as October 2020 after a relatively wet spring season and the Connecticut Interagency Drought Workgroup had assigned a Stage 1 Drought (Below Normal Conditions) to Fairfield County and Stage 2 (Incipient) Drought to Litchfield County as of November 5, 2020.

Recent water supply incidents in the region occurred in the summer of 2010 and 2015-2016 when local public water utilities needed to declare a water supply emergency. High temperatures combined with spotty rainfall created abnormally dry conditions during these years that persisted into the fall. The dry conditions increased demand for water supply.

Probability of Future Events

The 2019 CT NHMP indicates that Connecticut has a medium-high probability of future drought events. In the northeast, short seasonal droughts lasting one to three months usually occur every two or three years. Longer droughts, with durations exceeding three months, are less frequent and occur every twenty to thirty years. Based on data from 1901 to 2013, the 2016 SWRPA HMP estimated the annual chance of a moderate or greater drought event to be 4.4% per year.

The future frequency of droughts in the region may depend upon the changes in climate and resource use. More details are provided on the following Fact Sheet. As the state's plan notes, predicting the future occurrences of drought within any given time period is difficult. As pointed out in the state plan, climate change, which amplify natural hazards and extreme weather events, have become more frequent over the past half century.

Impacts to Community Assets

Drought impacts are typically felt through economic and environmental consequences rather than as a direct risk to life and property. As an example, a drought may destroy crops, affecting farmers and businesses that depend on farming. Droughts may also lead to losses or destruction of fish and wildlife habitat, loss of wetlands, and lower water levels in reservoirs, lakes, and ponds. The reduction in water levels can also cause private wells to go dry or pumps to fail and may cause dry hydrants to be unusable for fire protection purposes.

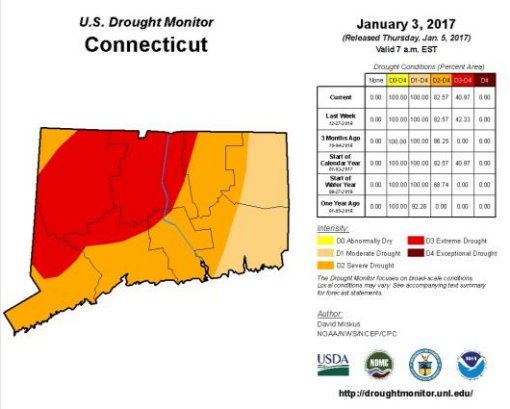
In addition, droughts can increase the severity of flooding as land that has been dry for extended periods of time does not allow water to infiltrate as quickly, which may lead to flash flooding. Droughts also exacerbate the possibility of wildfires due to the very dry conditions.

Climate change can bring more intense heat waves, which may result in more droughts. Also, as the state's plan notes, because human actions can increase the risk of water shortages without any change in meteorological conditions, efforts to conserve water and reduce runoff

REGIONAL CHALLENGES

CLIMATE CHANGE AND DROUGHTS

Saugatuck Reservoir in 2016
Photo: Brian A. Pounds / Hearst CT Media



The US Drought Monitor
Source droughtmonitor.unl.edu

FOR MORE INFORMATION

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WHAT IS THE CHALLENGE?

Hydrologists typically consider a drought to be a period of decrease in both precipitation and streamflow. Droughts can have negative affects on agriculture, the economy, utilities, and the environment. Droughts can also create conditions that enable the ignition and spread of wildfires, while limiting the availability of firefighting water sources.

Under agreement with the Connecticut Institute for Resilience and Climate Adaptation (CIRCA), the University of Connecticut (UConn) prepared climate change projections in connection with a drinking water resiliency study. The projections show an increase in temperature that could increase water loss through evapotranspiration. While the projections also predict an increase in rainfall and storm intensity, this may be coupled with more extreme dry periods between storms, especially during the summer months. Summer droughts are projected to become more frequent and more severe.

In recent years Connecticut has experienced shorter but more intense "flashy droughts," with some resulting in record-breaking low stream flows. Extreme drought conditions occurred in the region between 2001 and 2003, in 2010, from 2015 into early 2017, and in the summer and fall of 2020.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

The region includes urban, suburban, rural, and agricultural areas. Farms in the region may be impacted by droughts, and the extensive inland forests pose a risk of wildfires. Many residents rely on private wells for drinking water and may face challenges during severe drought events. Low water levels in recreational lakes may impact tourism.

Droughts have caused significant losses in the region relative to public water supplies. During the drought of 2015-2017, Aquarion Water Company was mere weeks away from losing supplies in Greenwich and Stamford, and installed temporary piping along the Merritt Parkway to deliver additional water from the Bridgeport System.

Drought mitigation actions may include the following:

- Promoting the use of drought-resistant vegetation in landscaping
- Incorporating climate change projections into the water utility "water supply plans"
- Implementing voluntary and mandatory water conservation measures as needed

can protect our water resources even in non-drought periods.

Affected Population

Farmers and other growers who depend on rainfall are the most likely populations to be affected by drought. During severe droughts, impacts may become more widespread due to private well failures or the need to enact mandatory water restrictions on end users due to public water supply limitations. Such restrictions are commonplace for the southern portion of the Region due to historically high irrigation demands in the summer months.

Loss Estimates

Based on information reported to the NCDC, drought has not caused any damages in Fairfield and Litchfield Counties. However, this may simply be because drought is a persistent hazard when it occurs, and losses occur gradually over time.

According to the Hartford Business Journal, Aquarion Water Company reported $9.5 million in costs incurred by its systems in southwestern Connecticut (Greenwich, Stamford, Darien, New Canaan, Wilton, and Westport) due to drought conditions in 2015-2016. These costs included upgrades to improve the capacity to transfer water between its systems and increase access to its emergency supplies. No other drought losses have been recently reported in online newspaper archives. Therefore, an estimated annualized loss for drought in the region would be a minimum of $475,500 per year if a 20-year period is considered for the above damages.

Estimates of community impacts have been determined based on data presented in the 2019 CT NHMP. The percentage of the population of each WestCOG municipality as compared to the population of its county was used to adjust the drought losses in the form of crop insurance claims reported to the USDA for each county as presented in Table 2-71 of the 2019 CT NHMP. The annualized loss estimate for drought damage in each community is presented in Table 3-37.

Table 3-37: Annualized Drought Loss Estimates

Municipality	Annualized Loss
Bethel	$9,925
Bridgewater	$1,300
Brookfield	$8,508
Danbury	$42,456
Darien	$10,892
Greenwich	$31,501
New Canaan	$10,143
New Fairfield	$6,957
New Milford	$20,433
Newtown	$13,981
Norwalk	$44,522
Redding	$4,570
Ridgefield	$12,512
Sherman	$1,825
Stamford	$64,986
Weston	$5,139
Westport	$14,282
Wilton	$9,195
WestCOG	**$313,127**

Source: CT NHMP

3.3.9 Earthquakes

Although damaging earthquakes are rare in Connecticut, low magnitude earthquakes occur regularly in the state. In addition, very strong, damaging earthquakes have occurred in Connecticut, and the state can also feel the effects of earthquakes that occur several hundred miles away.

Location

All areas of the Region are susceptible to earthquakes, although the likelihood of a damaging earthquake having its epicenter directly below the region is relatively small. In general, the Region is likely to be part of a larger regional area affected by a damaging earthquake as opposed to individual municipalities being affected.

Extent

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

The underground point of origin of an earthquake is called its focus; the point on the surface directly above the

Modified Mercalli Intensity

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

Source: USGS

focus is the epicenter. The magnitude and intensity of an earthquake are determined using various descendants of the Richter Scale, and the Mercalli scale, respectively.

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

The Richter scale was developed in 1395 and was used exclusively until the 1970s. It set the magnitude of an earthquake based on the logarithm of the amplitude of recorded waves. Being logarithmic, each whole number increase in magnitude represents a tenfold increase in measured strength. Earthquakes with a magnitude of about 2.0 or less are usually called "microearthquakes" and are generally only recorded locally. Earthquakes with magnitudes of 4.5 or greater are strong enough to be recorded by seismographs all over the world.

As more seismograph stations were installed around the world following the 1930s, it became apparent that the method developed by Richter was valid only for certain frequency and distance ranges, particularly in the southwestern United States. New magnitude scales that are an extension of Richter's original idea were developed for other areas. In particular, the Moment Magnitude Scale was developed in the 1970s to replace the Richter Scale and has been in official use by the USGS since 2002.

According to the USGS, these multiple methods are used to estimate the magnitude of an earthquake because no single method is capable of accurately estimating the size of all earthquakes. Some magnitude types are calculated to provide a consistent comparison to past earthquakes, and these scales are calibrated to the original Richter Scale. However, differences in magnitude of up to 0.5 can be calculated for the same earthquake through different techniques. In general, Moment Magnitude provides an estimate of earthquake size that is valid over the complete range of magnitudes and so is commonly used today.

Although Moment Magnitude is the most common measure of earthquake size for medium and larger

earthquakes, the USGS does not calculate Moment Magnitude for earthquakes with a magnitude of less than 3.5. Localized Richter Scales or other scales are used to calculate magnitudes for smaller earthquakes such as those that typically occur in Connecticut.

Regionally, the Weston Observatory utilizes two scales to track the magnitude of earthquakes. These include the Nuttli Magnitude Scale for North America east of the Rocky Mountains which is more appropriate for the relatively harder continental crust in Connecticut compared to California. Weston Observatory also utilizes the Coda Duration Magnitude Scale which is based on the duration of shaking at a particular station. The advantages of the Coda Duration Magnitude Scale is that this method can quickly estimate the magnitude before the exact location of the earthquake is known.

The effect of an earthquake on the earth's surface is called the intensity. The intensity scale currently in use, the Modified Mercalli Intensity Scale, consists of a series of key responses such as people awakening, movement of furniture, damage to chimneys, and total destruction. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It is an arbitrary ranking based on observed effects. A comparison of Richter magnitude to typical Modified Mercalli intensity is presented in Table 3-38, while a description of each intensity level is presented below.

Table 3-38:
Comparison of Earthquake Magnitude and Intensity

Richter Magnitude	Typical Maximum Modified Mercalli Intensity
1.0 to 2.9	I
3.0 to 3.9	II to III
4.0 to 4.9	IV to V
5.0 to 5.9	VI to VII
6.0 to 6.9	VII to IX
7.0 and above	VIII to XII

Source: USGS

Previous Occurrences

According to the Northeastern States at Boston College, there have been 150 recorded earthquakes in Connecticut between 1678 and 2014. All of the recorded quakes had a Richter Scale magnitude of less than 5.0, and the vast majority of the earthquakes had a magnitude of less than 3.0. The Northeast States Emergency Consortium reports that only 115 earthquakes were strong enough to be detected by people, and only the 1791 earthquake caused significant damage. Additional instances of seismic activity occurring in and around the Region is noted below based on information in USGS documents, from the Weston Observatory, the 2019 CT NHMP, other municipal hazard mitigation plans, and newspaper articles.

- A devastating earthquake near Three Rivers, Quebec on February 5, 1663 caused moderate damage in parts of Connecticut.
- Strong earthquakes in Massachusetts in November 1727 and November 1755 were felt strongly in Connecticut.
- May 16, 1791: The strongest earthquake in Connecticut history occurred in East Haddam in 1791 and is recorded with intensity VII. According to USGS, the earthquake, which was felt in Boston and New York City, caused stone walls and chimney tops to fall, and latched doors to open. Weston Observatory estimates that this quake had a 4.4 magnitude.
- October 26, 1845: An Intensity V earthquake occurred in Bridgeport and approximated 3.9 to 4.3 on the Richter scale. This event damaged stone fences in Weston and rang a church bell in Westport.
- July 28, 1875: An early morning tremor caused Intensity V damage throughout Connecticut and Massachusetts.
- October 19, 1985: A small earthquake awakened many in lower Fairfield County. The earthquake measured 4.0 on the Richter Scale and its epicenter was located in Westchester County. The quake caused only minor damage such as cracks in windows.
- October 28, 1991: A 3.0-magnitude earthquake was recorded in Greenwich near where the Mianus River meets the Stamford boundary. No damage was reported.
- November 30, 2010: A magnitude 3.9 earthquake occurred 117 miles southeast of Bridgeport, Connecticut. The quake did not cause damage in

Connecticut but was felt by residents along Long Island Sound.

- August 21, 2011: A magnitude 5.8 earthquake struck 38 miles from Richmond, Virginia. The quake was felt from Georgia to Maine and reportedly as far west as Chicago. Many residents of Connecticut experienced the swaying and shaking of buildings and furniture during the earthquake. According to Cornell University, the quake was the largest event to occur in the east central United States since instrumental recordings have been available to seismologists.

- A magnitude 2.1 quake occurred near Stamford on September 8, 2012. Dozens of residents reported feeling the ground move. No injuries were reported.

- The 2015 January and February earthquake swarm in the Plainfield, Connecticut area were the most significant geologic events to occur in the state in some time according to the Connecticut State Geologist. The swarm included earthquakes ranging in magnitude from 2.0 to 3.3. No damage was reported in the Region.

- September 9, 2020: According to Patch.com, a magnitude 3.1 quake centered in New Jersey was felt by residents in Danbury and Stamford as recorded by the USGS.

Probability of Future Events

According to the 2019 CT NHMP, Connecticut experiences less than one earthquake event per year and "may be categorized as having a low or moderate risk for an earthquake greater than or equal to 3.5 occurring in the future and a moderate risk of an earthquake less than 3.0 occurring in the future." When earthquakes are reported in Connecticut, they have most frequently occurred in the southern and eastern parts of the state and not in the Region.

According to the USGS, Connecticut is in an area of moderate to low risk for earthquakes. The USGS prepared Modified Mercalli Intensity hazard maps for the U.S. in 2018 depicting estimates of certain intensities (and types of damage) being exceeded over the next 50 years. The Region has a 50% chance to experience an earthquake with an intensity of III or less in the next 50 years, a 10% change to experience an intensity of IV, and a 2% chance to experience an intensity of V.

Impacts to Community Assets

Unlike seismic activity in California, earthquakes in Connecticut are not associated with specific known faults. Instead, earthquakes with epicenters in Connecticut are referred to as intraplate activity. Bedrock in Connecticut and New England in general is highly capable of transmitting seismic energy; thus, the area impacted by an earthquake in Connecticut can be four to 40 times greater than that of California. For example, the relatively strong earthquake that occurred in Virginia in 2011 was felt in Connecticut because the energy was transmitted over a great distance through hard bedrock. In addition, population density is up to 3.5 times greater in Connecticut than in California, potentially putting a greater number of people at risk.

Surficial earth materials behave differently in response to seismic activity. Unconsolidated materials such as sand and artificial fill can amplify the shaking associated with an earthquake. In addition, artificial fill material has the potential for liquefaction. When liquefaction occurs, the strength of the soil decreases, and the ability of soil to support building foundations and bridges is reduced. Increased shaking and liquefaction can cause greater damage to buildings and structures and a greater loss of life.

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

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

The 2019 CT NHMP identifies the area from Greenwich to New Haven as one of the most vulnerable to potential earthquakes. The built environment in Connecticut includes old non-reinforced masonry that is not

seismically designed. Those who live or work in non-reinforced masonry buildings, especially those built on filled land or unstable soils, are at the highest risk for injury due to the occurrence of an earthquake.

Affected Population

Damaging earthquakes tend to be regional events and the entire region is likely to be affected by such an event. Poorly constructed buildings are most likely to be damaged during such an event, potentially displacing residents and businesses. During more severe events, indirect impacts will be felt by the entire community due to power outages and roadway damage.

Loss Estimates

According to the FEMA HAZUS-MH Estimated Annualized Earthquake Losses for the United States (2008) document, FEMA used probabilistic curves developed by the USGS for the National Earthquakes Hazards Reduction Program to calculate Annualized Earthquake Losses for the United States. Based on the results of this study, FEMA calculated the annualized earthquake loss for Connecticut to be $11,622,000. This figure placed Connecticut 30th out of the 50 states in terms of annualized earthquake loss. The magnitude of this figure stems from the fact that Connecticut has a large building inventory that would be damaged in a severe earthquake.

The 2019 CT NHMP simulated four "maximum plausible" earthquake scenarios (three historical, one potential) within HAZUS-MH to generate the potential earthquake risk to the state of Connecticut. The data from these scenarios were extracted from the HAZUS-MH output for the 2019 CT NHMP to generate potential damages in the Region from those events using the default year 2010 building inventories and census data. The four events are as follows:

- Magnitude 5.7, epicenter in Portland, based on historic event
- Magnitude 5.7, epicenter in Haddam, based on historic event
- Magnitude 6.4, epicenter in East Haddam, based on historic event
- Magnitude 5.7, epicenter in Stamford, magnitude based on USGS probability mapping

While a significant earthquake has never been centered in the Region, the modeling suggests that a significant event in or near the region would have a serious impact. Copies of these HAZUS-MH Earthquake Event Reports are included in Appendix D. These simulations highlight the significance of the location of the epicenter to the damages that could be expected. A moderately strong earthquake centered near a more populated, built-up area would be expected to result in considerably more damage than one located in a more remote area.

While these scenarios are unlikely, each would result in significant damage in the region with the Stamford scenario causing the greatest damage. As Table 3-39 shows, more than 52% of all buildings in the Region would be at least moderately damaged including over 34,500 completely destroyed.

Table 3-39: Number of Buildings Damaged in Region by Earthquake Scenario

Damage Level	East Haddam	Haddam	Portland	Stamford
None	165,865	189,593	189,026	61,461
Slight	23,555	7,293	7,726	33,815
Moderate	8,383	1,727	1,847	40,755
Extensive	857	132	142	28,196
Complete	93	8	9	34,526
% with Moderate or Greater Damage	**5%**	**1%**	**1%**	**52%**

Source: HAZUS-MH

Furthermore, many essential facilities would lose functionality during the first day as shown in Table 3-40. For example, the HAZUS-MH model simulates that only 25% of available hospital beds in the region would be available immediately following the Stamford scenario earthquake, and EOCs in the region would be operating at only 34% functionality on the day following the earthquake. The information suggests that earthquake response would be impacted in the region due to the damage sustained to these facilities.

As expected for an event that causes widespread structure damage, sheltering requirements are also expected to be substantial during the Stamford scenario. Potential shelter requirements are presented in Table 3-41.

Significant outside resources would be needed to cope with the aftermath of the Stamford scenario.

Table 3-40: Average Percent Functionality of Essential Facilities on Day 1 Following Earthquake

Facility	East Haddam	Haddam	Portland	Stamford
EOC	71%	86%	86%	34%
Fire Dept.	72%	87%	86%	44%
Hospitals	73%	87%	87%	25%
Police Dept.	72%	87%	86%	41%
Schools	72%	87%	87%	28%

Source: HAZUS-MH

Table 3-41: Shelter Requirements by Earthquake Scenario

Need	East Haddam	Haddam	Portland	Stamford
Displaced Households	535	121	126	20,016
People Needing Short-term Shelter	320	72	75	11,826

Source: HAZUS-MH

The economic impact from the Stamford scenario would be devastating costing the region over $19.6 billion in damage from building-related and lifeline-related losses. Table 3-42 summarizes the direct economic losses to homes and businesses in the region (not including potential lifeline-related losses to utilities and transportation systems).

Table 3-42: Economic Loss in Region by Earthquake Scenario (Millions)

Municipality	East Haddam	Haddam	Portland	Stamford
Bethel	$29	$6	$7	$97
Bridgewater	$3	$1	$1	$3
Brookfield	$30	$6	$8	$50
Danbury	$120	$25	$27	$419
Darien	$25	$5	$5	$905
Greenwich	$89	$18	$18	$3,504
New Canaan	$27	$5	$5	$1,276
New Fairfield	$14	$3	$3	$28
New Milford	$41	$8	$11	$30
Newtown	$45	$11	$14	$71
Norwalk	$125	$25	$26	$2,800
Redding	$12	$3	$3	$87
Ridgefield	$35	$7	$7	$499
Sherman	$4	$1	$1	$5
Stamford	$174	$35	$35	$8,268
Weston	$14	$3	$3	$126
Westport	$55	$11	$11	$572
Wilton	$35	$7	$7	$817
WestCOG	**$877**	**$179**	**$192**	**$19,557**

Source: HAZUS-MH

HAZUS-MH was also used in the 2019 CT NHMP to simulate a probabilistic earthquake scenario calculating an annualized loss estimate for each municipality. These data were extracted for the WestCOG municipalities. Property losses include building and contents losses, and other losses include inventory, relocation, rental, and wage losses. Results are presented in Table 3-43.

Table 3-43: Annualized Economic Loss in Region Due to Earthquake (Thousands)

Municipality	Property Loss	Income Loss	Other Losses	Total Annualized Losses
Bethel	$62.0	$2.4	$11.8	$76.2
Bridgewater	$4.9	$0.2	$0.8	$5.9
Brookfield	$59.0	$3.2	$12.0	$74.2
Danbury	$270.0	$13.9	$60.4	$344.3
Darien	$80.2	$3.7	$13.4	$97.4
Greenwich	$351.4	$18.5	$66.4	$436.4
New Canaan	$82.1	$3.9	$14.6	$100.6
New Fairfield	$33.3	$0.7	$4.3	$38.4
New Milford	$75.2	$3.8	$15.6	$94.6
Newtown	$78.0	$3.3	$13.7	$95.0
Norwalk	$335.0	$17.3	$69.4	$421.7
Redding	$28.8	$1.2	$4.3	$34.3
Ridgefield	$95.9	$4.5	$16.6	$117.0
Sherman	$9.9	$0.2	$1.2	$11.3
Stamford	$591.7	$29.7	$122.2	$743.6
Weston	$32.2	$1.5	$4.8	$38.6
Westport	$125.6	$7.8	$26.1	$159.6
Wilton	$93.2	$4.7	$17.3	$115.2
WestCOG	**$2,408.4**	**$120.8**	**$475.0**	**$3,004.2**

Source: HAZUS-MH

3.3.10 Dam Failure

Dam failure is generally caused by other natural hazards: floods arising from thunderstorms, spring thaw, and hurricanes; wind damage from hurricanes and tornadoes; damage from ice jams, and forces from earthquakes. Failure due to material fatigue is also possible, but regular

maintenance and dam inspections can detect leaks and other signs of material fatigue before the problem escalates. A Fact Sheet regarding dam hazards is presented on the next page.

Location

Dam failure can only occur at and along the watercourses downstream of dams. Although the effects of dam failure can impact any of the WestCOG municipalities, the actual level of impact can differ based on the number and hazard classification of the dams within and upstream of the community.

In the case of a lower hazard dam, the effect of the failure would likely be constrained within the 1% annual chance floodplain or the 0.2% annual chance floodplain. The failure of a higher hazard dam could produce effects far greater than the 0.2% annual chance flood and could also cause a chain reaction where downstream dams also overtop and fail.

Extent

The Connecticut DEEP administers the statewide Dam Safety Program and designates a classification to each state-inventoried dam based on its potential hazard. The hazard classifications are described in Table 3-44.

According to the Association of State Dam Safety Officials, dam failures are most likely to occur due to one of five reasons:

- **Overtopping** caused by water spilling over the top of the dam due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest. These account for approximately 34% of all U.S. dam failures.
- **Foundation defects** including settlement and slope instability cause about 30% of all U.S. dam failures.
- **Cracking** caused by movements such as the natural settling of a dam.
- **Inadequate maintenance and upkeep.**
- **Piping** when seepage through a dam is not properly filtered and soil particles continue to progress and form sinkholes in the dam. This accounts for approximately 20% of all U.S. dam failures. Seepage often occurs around hydraulic structures such as pipes and spillways, through animal burrows, around roots of woody vegetation, and through cracks in dams, dam appurtenances, and dam foundations.

Table 3-44:
Connecticut DEEP Dam Classifications

Hazard Class	Hazard Potential
AA	**Negligible** hazard potential dam which, if it were to fail, would result in no measurable damage to roadways, land and structures, and negligible economic loss.
A	**Low** hazard potential dam which, if it were to fail, would result in damage to agricultural land, damage to unimproved roadways, or minimal economic loss.
BB	**Moderate** hazard potential dam which, if it were to fail, would result in damage to normally unoccupied storage structures, damage to low volume roadways, or moderate economic loss.
B	**Significant** hazard potential dam which, if it were to fail, would result in possible loss of life; minor damage to habitable structures, residences, hospitals, convalescent homes, schools, etc.; damage to or interruption of the use or service of utilities; damage to primary roadways and railroads; or significant economic loss.
C	**High** hazard potential dam which, if it were to fail, would result in the probable loss of life; major damage to habitable structures, residences, hospitals, convalescent homes, schools, etc.; damage to main highways; or great economic loss.

Source: Connecticut DEEP

Previous Occurrences

There have been a few dam failures in the Region in recorded history, with one noted by the National Performance of Dams Program (NPDP) at Stamford University. Three known dam failures in the Region include:

- January 31, 1869: The icy surface of the frozen Kohanza Reservoir in Danbury broke and caused the upper Kohanza dam to burst, which in turn caused a flood surge on the lower dam. The flood waters carried ice floes, rocks and trees that swept away houses and buildings and destroyed three bridges in a manner of minutes, resulting in 13 deaths and

REGIONAL CHALLENGES

DAM HAZARDS

Shepaug Dam
Photo Wikipedia

Dam removal along the Norwalk River
Photo The Hour

FOR MORE INFORMATION

Dam Safety Regulatory Program
(860) 424-3706
DEEP.DamSafety@ct.gov

WHAT IS THE CHALLENGE?

With precipitation patterns changing, and rainstorms becoming more intense due to climate change, dams may become increasingly stressed as water volumes increase during these heavy storms. Dam failure, especially higher hazard dams, can have serious impacts including loss of life, economic loss, and environmental damage.

Unlike other major infrastructure which is owned and regulated by the government, it is estimated that 56% of U.S. dams are privately owned (FEMA). These privately owned dams are often not maintained and are found to be in poor condition. The ownership status of these dams presents challenges when working to address necessary improvements.

The Connecticut Dam Safety Regulatory Program works to ensure that state dams are operated and maintained both safely and effectively. The program also requires owners of Class C (high hazard) and Class B (significant hazard) dams to develop an Emergency Action Plan (EAP) and periodically update the EAP.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

There are over 800 dams in the region, with 40 of these classified as “High Hazard”.

An EAP can provide critical information for WestCOG municipalities when planning for dam failure and mitigation strategies. Helpful information includes:

- Inundation maps identifying potential inundation areas
- Lists of streets, roadways, addresses and highways that are subject to flooding.
- Identification of emergency evacuation routes.
- Identifying dam operation personnel responsible for monitoring and emergency response.

Any municipality within the region with a Class B or C dam (or downstream of one) should ensure that EAPs have been filed with municipal offices so this critical information is readily available for both planning and emergency response purposes.

$100,000 in damages as recorded in the February 3, 1869 edition of the New York Herald. An etching of the disaster is presented as Figure 3-9.

Figure 3-9: Engraving of the Ruins of the Upper Dam of the Kohanza Reservoir in Danbury
Source: *Harper's Weekly*, February 1869

- According to the NPDP, the Millard Pond Dam in Norwalk on the Five Mile River failed during the 1955 floods.

- A dam failure occurred in Sherman due flooding in April of 2007. Floodwaters at Rogers Pond Dam (Class BB) overtopped the spillway and caused a full failure that drained the pond. Part of the earthen embankment failed, and the floodwaters cut a breach 30 feet wide and 15 feet deep (Figure 3-10). Minimal downstream damage and no injuries were reported. The dam was originally constructed in 1945 and was repaired following the breach.

Other major dam failures in Connecticut have occurred in 1938 and 1955 due to hurricanes, 1961 (Crystal Lake Dam in Middletown), 1963 (Spaulding Pond Dam in Norwich), and June 5-6, 1982 (Bushy Hill Pond Dam in Deep River). The October 7-15, 2005 heavy rainfall caused 14 complete or partial dam failures across northern Connecticut and damage to another 30 dams across the state.

Probability of Future Events

Dam failures are most likely triggered by the occurrence of another natural disaster or hazard and are not likely to occur when regular maintenance and inspections are performed. Therefore, dam failures are less likely to occur than the natural disasters that may trigger them. For example, a 1% annual chance flood will not always cause a dam failure because most spillways are designed to pass a greater discharge (such as some fraction of the probable maximum flood event). However, smaller privately owned dams are typically less inspected and maintained than dams owned by municipalities, utilities, and state government. Therefore, the probability of a major (Class C or Class B) dam failure occurring in the region is believed to be less than 1% in the next 100 years, while the chance of a minor dam failure is believed to be more likely at a 1% annual chance per year.

Figure 3-10: Rogers Pond Dam Breach in Sherman
Source: Town of Sherman

Impacts to Community Assets

Not all dams pose a serious threat; the vast majority of dams in the state impound water bodies that, either because of their size or location, would not cause major destruction in the event of a dam failure. All dams are subject to inspection on a regular schedule mandated by Connecticut DEEP based on hazard classification. Class C and B dams are required to have Emergency Action Plans prepared to guide response personnel in the case a failure is imminent; these plans identify downstream areas at risk.

Of the 825 registered dams in the Region, 40 are Class C. Another 33 are Class B, 120 are Class BB, and the remaining 632 are dams whose failure would have relatively little potential impact on life or property. The 40 class C dams are distributed throughout the region (Table 3-45).

All but four municipalities in the region have at least one Class C dam. Bridgewater, Brookfield, Darien, and

Sherman do not house a Class C dam, but Bridgewater and Brookfield are downstream of Class C dams. Figure 3-11 shows the location and class of each dam in the Region.

Table 3-45: Significant and High Hazard Dams

Municipality	Class B	Class C	Total
Bethel	0	1	1
Bridgewater	0	0	0
Brookfield	0	0	0
Danbury	3	8	11
Darien	1	0	1
Greenwich	2	9	11
New Canaan	1	3	4
New Fairfield	0	1	1
New Milford	3	3	6
Newtown	2	1	3
Norwalk	5	1	6
Redding	0	3	3
Ridgefield	5	1	6
Sherman	2	0	2
Stamford	4	3	7
Weston	1	1	2
Westport	3	1	4
Wilton	1	4	5
WestCOG	**33**	**40**	**73**

Source: Connecticut DEEP

Failure of any of the dams or dikes impounding Candlewood Lake would potentially have a significant impact on areas of Danbury, Bethel, Brookfield, New Milford, and Bridgewater. Candlewood Lake was formed to provide water supply storage for hydroelectric power generation, but also is a significant recreational resource. The Emergency Action Plan (EAP) for the project includes inundation mapping that depicts sunny day and worst-case scenarios. Loss estimates for failure of the Danbury Dike and New Milford Dam were calculated using HAZUS-MH in the previous single-jurisdiction HMPs.

- Under the worst-case scenario failure of the Danbury Dike, over peak flood heights of over 20 feet could be expected downstream in Danbury, and approximately 100 buildings in Brookfield would be substantially damaged or destroyed resulting in $206 million in damage. Additional minor damage would be expected in Bethel along the Sympaug Brook corridor.

- Under the worst-case scenario for the dam in New Milford, approximately 190 buildings in New Milford would be substantially damaged or destroyed resulting in $146 million in damage, approximately 70 buildings in Newtown would be substantially damaged or destroyed resulting in $28 million in damage, additional minor damage would be expected in Bridgewater, and flooding along the Still River would be expected in Brookfield.

Other dams whose failure could potentially cause significant damage in the region include:

- The Samuel Senior Dam, whose failure would affect downstream areas in Weston and Westport. This dam had substantial repairs performed in 2014 and 2015.

- Areas downstream of the Browns Reservoir Dam (in Lewisboro, NY) and the John D. Milne, and Grupes Reservoir Dams in New Canaan in New Canaan, Wilton, and Norwalk. These reservoir dams are owned by the City of Norwalk First Taxing District.

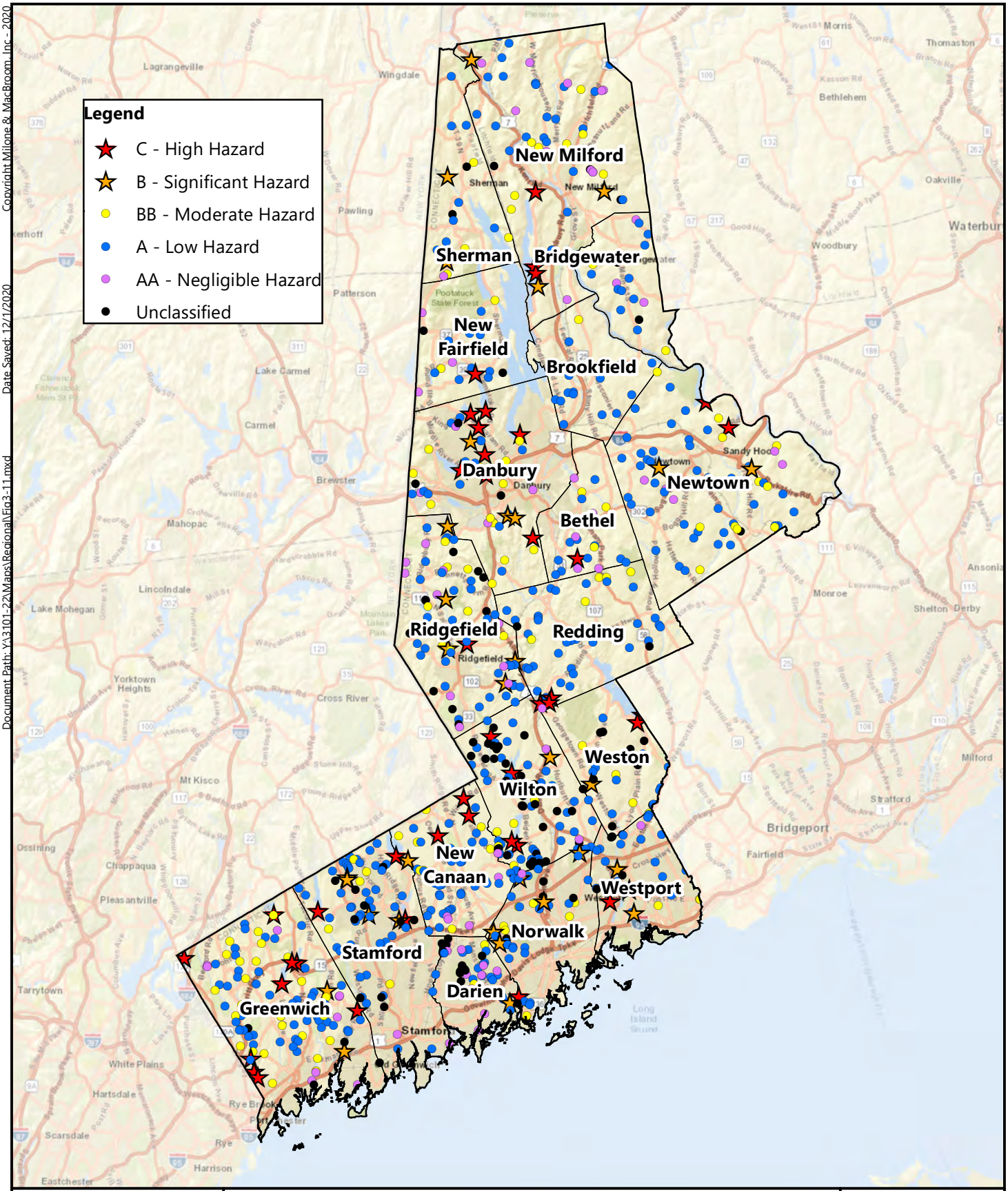
Affected Population

Once a dam collapses, the damage it does is largely dependent upon the sorts of land uses downstream. While the Sherman dam inflicted damage primarily upon undeveloped areas, the Danbury failure was a disaster that greatly impacted developed areas of the city. Not only can buildings downstream be inundated by resulting flooding, but they can be damaged by the violent torrent of water as well, which impacts like a battering ram. Utility connections can be severed, in turn causing fires and power outages; people can be injured or even killed by rushing waters and the ice or debris carried therein.

Furthermore, failure of a reservoir dam could result in a water supply emergency for the affected utility. Refer to the risk assessment section for flooding (Section 3.3.2) for more information.

Loss Estimates

Due to the relatively minimal historic record of dam failure events that estimated or reported damages specific to dam failure, annualized loss estimates could only be generated from the historic record for Fairfield County using the NPDP and other sources. For example, although it is well known that dam failures occurred in Litchfield County during the 1955 floods, the damage specific to dam failure does not appear to have ever been estimated



MILONE & MACBROOM
99 REALTY DRIVE
CHESHIRE, CT 06410
203.271.1773
WWW.MMINC.COM

DAM HAZARD CLASS

HAZARD MITIGATION PLAN UPDATE
WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS
1 RIVERSIDE ROAD
SANDY HOOK, CT 06482

N

0 14,000 28,000
Feet

SCALE	1 " = 30,000 '
DATE	12/1/2020
PROJ. NO.	3101-22

FIG. 3-11

separate from the other flooding impacts. Loss estimates due to dam failure for Bridgewater and New Milford were therefore based on statewide impacts estimated in Table 4-4 of the 2019 CT NHMP.

In both cases, the annualized loss was reduced by the percentage of the municipal population to that of the greater area. The annualized loss estimates due to dam failure in each WestCOG municipality based on this method is presented in Table 3-46.

Table 3-46: Annualized Dam Failure Loss Estimates

Municipality	Annualized Loss
Bethel	$1,968
Bridgewater	$2
Brookfield	$1,083
Danbury	$5,404
Darien	$1,386
Greenwich	$4,010
New Canaan	$1,291
New Fairfield	$886
New Milford	$605
Newtown	$1,780
Norwalk	$5,667
Redding	$582
Ridgefield	$1,593
Sherman	$232
Stamford	$8,272
Weston	$654
Westport	$1,818
Wilton	$1,170
WestCOG	**$38,404**

Source: CT NHMP

3.3.11 Terrorism and Mass Casualty Events

The alarming rise in acts of terrorism and mass casualty events in the past 30 years has demanded that municipalities prepare for them. While international terrorist threats dominated the headlines for the first decade of 21st century, the increase in domestic terrorism and mass violence incidents has quickly come to the forefront.

While outside the purview of the DMA, the issue of terrorism and mass casualty events has become a prominent component of many hazard mitigation and regional planning documents since the September 11, 2001 terrorist attacks. Since that time, events including the 2012 Sandy Hook Elementary School shooting in Newtown have underscored the importance of protecting the most vulnerable populations in our communities from terrorism and mass casualty events.

Location

The Region has a diverse range of geographic and demographic settings, from the heavily urbanized areas of Stamford to the wooded neighborhoods of Ridgefield. Terrorist threats are typically focused on three area types: large population centers, large corporations, or critical infrastructure. As an example, Stamford contains all three of those area types. First, the densely populated downtown means that the direct consequence of a terrorist threat would be multiplied significantly as compared to other areas within the Region. Second, large hedge funds and financial institutions have their headquarters or large satellite offices in the downtown. Lastly, the Metro North railroad station provides a link between Fairfield and New Haven counties and New York City. An attack on this station could create significant economic disruption as well as human casualties.

The Region also has numerous water bodies which are used as public drinking water supplies. These are potential targets as contamination of the reservoir could cause mass panic and economic disruption. However, due to the significant storage in these water bodies, it is unlikely that a reservoir could be sufficiently contaminated quickly enough to cause acute health effects to end users.

The Danbury Municipal Airport is also at potential risk for terrorist attack. Threats to airplanes such as guns, drones, and lasers could put incoming and outgoing aircraft at risk. The airport could also be the source of a hijacked aircraft that could be used to target nearby buildings or infrastructure, or to disperse chemical weapons.

Extent

Terrorism is defined by the U.S. Code of Federal Regulations as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives." Terrorist often seek to cause long term damage to a population's physical and psychological well-being.

Terrorist attacks are ordinarily not targeted at a particular person but at a group of people, events, or infrastructure that symbolically represents an opposing ideology to the terrorist.

While many terrorist events are mass casualty events, some terrorist threats and actions are not directly associated with significant human casualties. Terrorist attacks can involve firearms and knives as well as improvised weapons such as aircraft, vehicles, improvised explosive devices, and chemical weapons. Terrorist events can also target utilities like public water supplies, the electrical grid, or mass transit in order to cause large scale disruption and economic losses. Terrorist attacks are often carried out as part of a coordinated attack, with multiple perpetrators, or at least multiple co-conspirators; however, recent lone-wolf terrorist attacks have garnered national attention as well. According to a 2019 report entitled "Lone Offender" from the FBI, when compared to group terrorist attacks, "lone offender attacks are more deadly, possibly due to strong U.S. counter terrorism capacity for disrupting attacks from cells and organizations." Also, increasingly common are foreign state-sponsored cyber-terrorist threats which exploit software vulnerabilities to cause large scale economic disruption or public safety issues.

A **mass casualty event** is described as an attack causing widespread death and severe injury, often overwhelming emergency services. This plan focuses on purposeful, man-made mass casualty events like mass shootings, vehicle ramming, and other large-scale assaults. Many terrorist events, such as the 9/11 attacks were also mass casualty events. Some recent mass casualty events in the U.S. differ from terrorist attacks in that the perpetrators had no clear motive other than to cause as much damage as possible. Other mass casualty events involve workplace violence, in which the perpetrator feels wronged and targets specific victims or company infrastructure. In both cases, non-terroristic mass casualty events often involve a lone perpetrator, with minimal outside coordination. These types of events are characteristic of the recent school, nightclub, and concert venue shootings. Perpetrators of mass casualty events typically use firearms but can also use unconventional weapons as well.

The DHS also warns of the increasing risk of Domestic Violent Extremists (DVEs). According to the report, "Among DVEs, racially and ethnically motivated violent extremists - specifically white supremacist extremists - will remain the most persistent and lethal threat in the Homeland. Spikes in other DVE threats probably will depend on political or social issues that often mobilize other ideological actors to violence, such as immigration, environmental, and police-related policy issues." Other related threats include an anti-government/antiauthority narrative that has been emboldened by recent police involved shootings in the U.S. According to the report, "These violent extremists, sometimes influenced by anarchist ideology, have been associated with multiple plots and attacks, which included a significant uptick in violence against law enforcement and government symbols in 2020. This ideology is also exploited by hostile nation-states, which seek to promote it through disinformation campaigns and sow additional chaos and discord across American society."

In many cases of Domestic Violent Extremism, the impact of the COVID-19 pandemic is considered to be a confounding factor, as social isolation, anxiety, economic disruption, and the increased time available to many individuals out of work have increased the ability for violent engagement.

Previous Occurrences

The following is a list of mass-casualty and terrorism events in the Region over the past 10 years, which was gathered from local media sources such as the Danbury News Times, CT News 12, the Norwalk Patch, the Stamford Advocate, and others. Bomb threats, which may or may not fall under the explicit definition of terrorism were included as well.

- The best-known recent example of a mass-casualty event in the Region was the Sandy Hook Elementary School shooting in Newtown on December 14, 2012. This tragic event was perpetrated by a 20-year-old Newtown resident who used a Bushmaster XM-15 rifle and a Glock handgun to kill 20 students and six staff members at Sandy Hook Elementary School before killing himself. He also killed his mother at their home prior to the school shooting. The perpetrator was found not to be motivated by any particular ideology, but by a fascination with violence and recent aggravations of long-standing mental illness. The event received national attention and

brought renewed attention to gun violence in schools, high-capacity firearms, and mental illness.

- On October 3, 2013, a bomb threat was phoned in to the Whole Foods grocery store in Darien. The store was evacuated and searched, but no explosives were found.

- On October 1, 2014, the relocated Sandy Hook Elementary School in Monroe was targeted with a bomb threat leading to evacuations.

- On February 18, 2015, a bomb threat was made to Wolfpit Elementary School in Norwalk. Three juveniles were arrested.

- On June 15, 2016, a student at Brookfield High School was arrested for a bomb threat made several months earlier which led to the evacuation of Brookfield High School.

- On March 9, July 11, and December 13, 2016, bomb threats were phoned in to a coffee shop in New Milford. The shop was evacuated and searched each time, but no explosives were found.

- On January 21, 2016, a bomb threat was made to a Home Goods in Norwalk. According to WTNH news, a Bronx man threatened to blow up the store and shoot employees if they did not terminate his ex-girlfriend's employment. The man was arrested a short time later without incident.

- On October 12, 2016, a bomb threat was sent to the headquarters of Bridgewater Associates in Westport. Police evacuated the building but found no explosives.

- On March 28, 2017, a bomb threat was emailed to a school administrator in Nathan Hale Middle School in Norwalk. The threat was not deemed credible and a student was arrested.

- On March 29, 2017, Greenwich High School was placed on lockdown for 6 hours due to an unspecified threat.

- On June 5, 2017, Abbot Technical High School in Danbury was evacuated due to a bomb threat. The threat was later found not to be credible.

- On February 23, 2018, bomb threats were made at Stamford High School and Trailblazers Academy. A few days earlier, Norwalk Police investigated reports of a potential student with a gun in the bathroom which led to the early dismissal of students.

- On December 12, 2018 on the anniversary of the Sandy Hook Shooting, several bomb threats were called in to numerous businesses in the Region and across the state. An email message demanded ransom to diffuse bombs that were supposedly placed in the recipient's buildings.

- On May 15, 2019, a bomb threat caused the evacuation of several buildings in downtown Stamford.

- Recently, a nearby Connecticut regional planning organization's server was impacted by a ransomware attack. This caused significant disruptions to the organization and was time consuming and expensive to remedy. While this did not impact any western Connecticut towns specifically, the entire Region should be aware that municipalities and regional planning organizations are a target for cyber-criminals.

This list is not exhaustive, but it demonstrates that incidents of mass shootings and terrorism, or at least terrorist-like activities are not uncommon in the Region. In general, it is believed that these events are becoming increasingly more common.

Probability of Future Events

Incidents of terrorism are not precisely recorded due to the slightly nebulous definition, which is applied to crimes on a case by case basis. Some incidents of suspected terrorism are later determined not to be, while other incidents perpetrated by individuals with terroristic ideologies are not recorded or discovered to be as such. Additionally, issues like cyber-terrorism and domestic terrorism are relatively new phenomena occurring with increasing frequency. Many news outlets and organizations have released various lists of terrorist

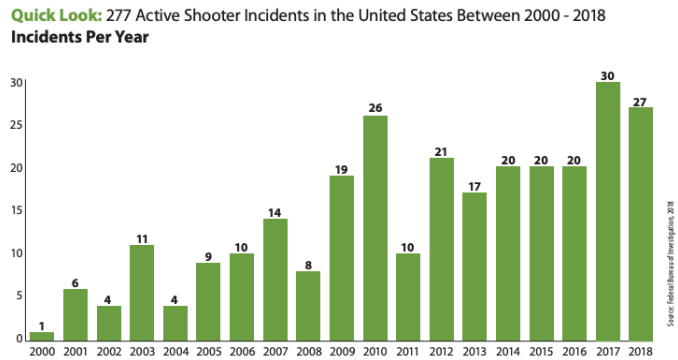
attacks, with dramatically different counts. For example, CNN reports a list of 9 events of terrorism in the U.S. since 9/11 which includes events like the San Bernadino shooting, the Manhattan Bike Path Attack, the vehicle attack on protesters in Charlottesville, and the Orlando Nightclub Massacre. This list omits events like the Boston Marathon Bombing and the Charleston Church shooting that many considered terrorist attacks. Nevertheless, it can be assumed that the western Connecticut region is at more risk than most areas of the United States due to its proximity to New York City and its dense population, which, given the current political climate could lead to more frequent clashes between extremist domestic groups. As a result, the risk of terrorism, both foreign and domestic as well as cyberterrorism should be considered as high, or higher than that of a mass shooting situation.

As is evidenced by the list of previous events, bomb threats are at least a yearly occurrence in the Region. Most of these, however, are of fairly low consequence, with disruptions limited to school evacuations and perhaps a few hours of lost business per event.

Mass shootings have been found to be occurring with greater frequency in the United States. Although the definition of a mass shooting varies, the FBI has created a list of 277 active shooter incidents from 2000 to 2018. The FBI defines an active shooter as, "an individual actively engaged in killing or attempting to kill people in a populated area." This means that while not all active shooter events are mass casualty events, they do have the potential to be so due to the intent of the gunman. The number of confirmed active shooter investigations each year appears to be increasing over time (Figure 3-10) based on data from the FBI.

Over the 19 study years, the total of 277 events averages to approximately 15 events per year. On a per capita basis, this is 4.0 x 10^{-8} events per person, per year. The Region as a whole has about 600,000 residents. Carrying this equation through yields about 0.026 events per year for the regional population. This means that based on the average rate between 2000 and 2018, and with the current population, the region can expect to see an FBI-defined active shooter event within its borders approximately once every 40 years. At 2018 levels of 27 active shooter events per year however, the region could expect an FBI defined active shooter event once every 20 years. Note that these figures were defined in this HMP based on the FBI active shooter list above and are not based on calculations or projections completed by law enforcement, homeland security, or public safety agencies. Nevertheless, any apparent trend should be monitored closely to provide more accurate estimates in the coming years. This estimate also does not account for other variables including demographics, forcing factors such as natural disasters and other external issues, government policies, and mitigation efforts that may result in the Region having different contributing variables than the other occurrences on the nation-wide incident list.

Figure 3-12:



Impacts to Community Assets

The impact to the community varies by the type of terrorist incident. While bomb threats may result in temporary schedule disruptions, unnecessary emergency response, and mental trauma, mass shootings result in lost lives, damage to livelihoods, potential closure of facilities, and widespread mental trauma.

Affected Population

The affected population can include both those directly impacted, such as being injured or killed by a terrorist attack, or as first responders; as well as those indirectly affected such as bystanders, students placed on lockdown, emergency responders, and the community as a whole.

Loss Estimates

Losses from any disaster are complex sum of the human health consequences, direct economic effects, indirect economic effects, search and rescue/first responder costs, infrastructure repair costs, and others. The EPA uses a

complex formula to define the value of a human life and has defined each life as worth $10 million in economic value. Of course, this does not account for the emotional distress and trauma that is left in the wake of a loss of life. But from a most basic standpoint, this is a way to quantify and compare some mass casualty events.

While many of the bomb threats discussed in the previous section were disruptive and caused emotional distress, loss of life or severe economic losses were not a significant consequence in the immediate aftermath. It is important not to minimize the emotional trauma of these events though, as they erode the public trust and can cost companies significant money over the long term as they seek to tighten security. Furthermore, each event likely had a true cost in the thousands or tens of thousands of dollars in emergency response time, lost productivity, lost wages, etc.

The Sandy Hook Elementary School shooting was an enormously damaging event. The most significant loss was the immeasurable damage caused to the families and friends of the victims. The loss of such a large component of a future generation robbed the region of an enormous talent pool of whose potential can now never be realized. While the EPA formula could be applied to this tragic event (at a cost of $260 million), it does not begin to account for the loss experienced. The tragedy also led to the demolition and complete rebuilding of a new elementary school. This rebuilding process was deemed necessary both for emotional and security purposes. The new school allowed the community to rise above the tragedy, while also ensuring that Newtown students had a safe school building without the stigma of the event. This building was constructed with $50 million in state grant funds, which can be thought of as a direct cost of the shooting in material goods.

Assuming a minimum total cost to Connecticut of $310 million over the last 10 years, the annualized loss estimate to the region would be $31 million per year. Applying the percentage of population of each municipality to the State population, the annualized loss estimate by WestCOG municipality is presented in Table 3-47. These estimated annualized losses are substantial in that they are based on the significant Sandy Hook event but will likely be reduced in the coming years as more research can be applied into the historic record regarding incidents and costs.

Table 3-47: Annualized Terrorism Loss Estimates

Municipality	Annualized Loss
Bethel	$171,061
Bridgewater	$14,739
Brookfield	$146,638
Danbury	$731,711
Darien	$187,718
Greenwich	$542,904
New Canaan	$174,802
New Fairfield	$119,899
New Milford	$231,581
Newtown	$240,963
Norwalk	$767,323
Redding	$78,757
Ridgefield	$215,632
Sherman	$31,456
Stamford	$1,120,003
Weston	$88,572
Westport	$246,147
Wilton	$158,474
WestCOG	**$5,268,382**
State	**$31,000,000**

3.4 Overall Hazard Risk

This document has been prepared with the understanding that a single hazard effect may be caused by multiple hazard events. For example, flooding may occur as a result of heavy rains, a hurricane, or a winter storm. Thus, Tables 3-48 and 3-49 provide summaries of the hazard events and hazard effects that impact the Region and include criteria for characterizing the locations impacted by the hazard, the frequency of occurrence of the hazards, and the magnitude or severity of the hazards. The information collected and evaluated in Section 3.1, Section 3.2, and in Section 3.3 were used to quantify the summaries.

Furthermore, it is understood that each natural hazard may have multiple effects; for example, a hurricane causes high wind and flooding. Some hazards can also have similar effects; for example, hurricanes and earthquakes both can potentially cause dam failure. Based on the rankings in Tables 3-48 and 3-49, information regarding

structures and populations at risk, hazard information in the historic record, and the available loss estimates, each hazard is provided an overall qualitative summary rank of risk. This is provided by community in Table 3-50 as some communities may feel lesser effects from certain hazards than others.

Table 3-48: Hazard Event Ranking

Hazard Event	Location[1]	Freq. of Occur.[2]	Magnitude or Severity[3]	Rank
Winter Storms	3	3	2	8
Hurricanes/ Tropical Storms	3	2	3	8
Terrorism/Mass Casualty	1	2	4	7
Drought	3	2	1	6
Earthquakes	3	2	1	6
Thunderstorms	2	3	1	6
Tornadoes	1	2	3	6
Dam Failure	1	0	4	5
Wildfires	1	1	1	3

1. Small (1) affects an isolated to specific area during one event. Medium (2) affects a slightly larger are or multiple areas during one event. Large (3) affects most or all of the community during one event.
2. Unlikely (0) has a less than 1% probability in the next 100 years. Possible (1) has between a 1% and 10% probability, or at least one chance in the next 100 years. Likely (2) has a greater than 10% probability, or at least one chance in the next 10 years. Highly Likely (3) is expected at least once per year.
3. Limited (1) means injuries and/or illnesses are treatable with first aid; minor quality of life loss; shutdown of critical facilities for 24 hours or less; less than 10% of property severely damaged. Significant (2) means injuries and/or illnesses do not result in permanent disability; shutdown of critical facilities for less than 2 weeks; 10% to 25% of property severely damaged. Critical (3) means injuries and/or illnesses result in permanent disability; critical facilities shutdown for more than 2 weeks; 25% to 50% of property severely damaged. Catastrophic (4) means multiple deaths, shutdown of critical facilities for more than 1 month; more than 50% of property severely damaged.

Table 3-49: Hazard Effect Ranking

Hazard Effect	Location[1]	Freq. of Occur.[2]	Magnitude or Severity[3]	Rank
Severe Winds	3	3	2	8
Snow	3	3	2	8
Blizzard	3	2	2	7
Coastal Flooding	2	3	2	7
Riverine Flooding	2	3	2	7
Falling Trees / Branches	2	3	2	7
Hurricane Wind	3	1	3	7
Disruption of Normal Activities	1	3	2	6
Ice	3	2	1	6
Major Dam Failure	2	0	4	6
Ground Shaking	3	1	2	6
Crop Loss	2	2	1	5
Hail	2	2	1	5
Lightning	1	3	1	5
Nuisance Flooding	1	3	1	5
Post-Event Trauma	2	1	2	5
Tornado Wind	1	1	3	5
Extreme Cold	3	1	1	4
Extreme Heat	3	1	1	4
Fire / Heat / Smoke	1	2	1	4
Tsunami	2	1	1	4
Landslide	1	1	1	3
Minor Dam Failure	1	1	1	3

Note: 1, 2, and 3 are the same as the table above.

Table 3-50: Qualitative Summary of Hazard Risk

Municipality	Riverine Flooding	Coastal Flooding	Winter Storms	Tropical Cyclones & Hurricanes	Tornadoes	Thunderstorms	Wildfires	Drought	Earthquakes	Dam Failure	Terrorism
Bethel	M	-	M	H	L	M	L	L	M	L	H
Bridgewater	L	-	L	M	M	L	M	L	L	L	M
Brookfield	L	-	M	H	L	M	M	L	M	L	H
Danbury	H	-	H	H	M	M	L	L	H	L	H
Darien	M	H	M	H	L	M	L	L	M	L	H

Municipality	Riverine Flooding	Coastal Flooding	Winter Storms	Tropical Cyclones & Hurricanes	Tornadoes	Thunderstorms	Wildfires	Drought	Earthquakes	Dam Failure	Terrorism
Greenwich	M	H	M	H	L	M	L	L	H	L	H
New Canaan	M	-	M	H	L	M	L	L	H	L	H
New Fairfield	M	-	M	H	L	M	M	L	M	L	H
New Milford	M	-	M	H	H	M	M	M	M	L	H
Newtown	M	-	H	H	L	M	M	L	M	L	H
Norwalk	M	H	M	H	M	M	L	L	H	L	H
Redding	M	-	M	H	L	L	M	L	M	L	M
Ridgefield	M	-	M	H	L	M	M	L	H	L	H
Sherman	M	-	L	M	L	L	M	L	M	L	M
Stamford	M	H	H	H	M	M	L	L	H	L	H
Weston	M	-	M	H	L	L	M	L	M	L	M
Westport	M	H	M	H	L	M	L	L	H	L	H
Wilton	M	-	M	H	L	M	M	L	H	L	H
WestCOG	**M**	**H**	**M**	**H**	**M**	**M**	**M**	**L**	**H**	**L**	**H**

Note: L = Low, M = Moderate, H = High

Risk is a product of frequency and vulnerability, and sometimes the equation includes consequences. The breakdown of the summary rankings is as follows:

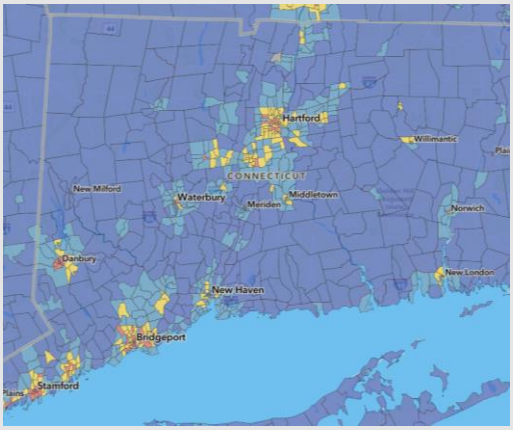
- **High** risk hazards typically affect the entire community and/or have repeated impacts year to year or are less frequent but highly damaging events.
- **Moderate** risk hazards typically affect all or portions of the community and have repeated impacts from year to year that are not particularly damaging.
- **Low** risk hazards typically affect only a limited area of a community or are generally infrequent.

The WestCOG municipalities believe that coastal flooding, riverine flooding, winter storms, tropical cyclones and hurricanes, and terrorism/mass casualty present the highest risk to Region. Thunderstorms, tornadoes, earthquakes, and wildfires present an overall moderate risk. The remaining hazards and effects evaluated in this Plan present a relatively low risk to the region. The number of strategies and actions identified by each community in the annexes tend to be greater for the higher risk hazards than for the lower risk hazards as expected from the level of risk.

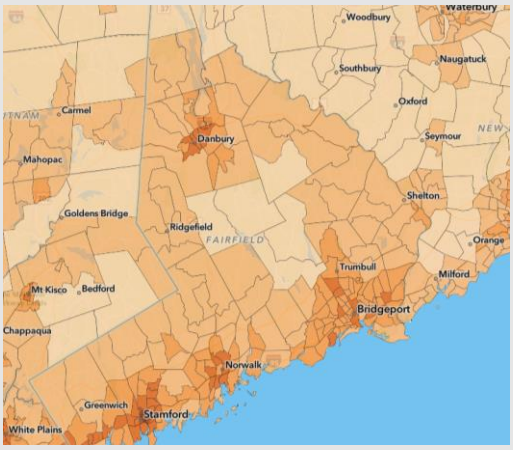
The National Risk Index; see Fact Sheet on the next page) was released by FEMA in 2020. In the coming years, WestCOG communities are encouraged to explore the National Risk Index viewer tool to ground truth the risks presented in the index.

NEW INITIATIVES

NATIONAL RISK INDEX



National Risk Index mapped in CT



Expected Annual Loss mapped in the WestCOG region through the NRI tool

FOR MORE INFORMATION

The National Risk Index
https://www.fema.gov/flood-maps/products-tools/national-risk-index
FEMA-NRI@fema.dhs.gov

WHAT IS THE INITIATIVE?

The National Risk Index (NRI) is a new, online mapping tool from FEMA that identifies the level of risk communities nationwide face from 18 natural hazards.

This mapping tool visualizes natural hazard risk metrics and includes data about expected annual losses, social vulnerabilities and community resilience.

The NRI incorporates physical and social vulnerability data to identify communities more at-risk to the adverse impacts of natural hazards. Data is presented at the county and census-tract level.

NRI allows decision-makers to take a holistic view of community risk to natural hazards via online maps and data. It helps communities before and during the planning process by illustrating which natural hazards pose a risk, and the community's current level of resilience. It can also inform community outreach during the mitigation and community planning process.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

The NRI presents a user-friendly tool for exploring the relative exposure levels of different areas and populations to natural hazards. Many of the loss estimates used to calculate the index, and presented through the NRI mapping product, are similar to those used in the risk analysis performed for the WestCOG Hazard Mitigation Plan update.

The NRI can assist WestCOG communities in:

- Updating emergency operations plans
- Enhancing future hazard mitigation plans
- Prioritizing and allocating resources
- Identifying the need for more refined risk assessments
- Community-level risk communication and engagement
- Educating homeowners and renters
- Supporting adoption of enhanced codes and standards
- Informing long-term community recovery

4.0 Existing Capabilities

Hazard mitigation is accomplished at the federal, state, regional, and local levels. While most activities to mitigate hazard risk take place at the local level, other entities also have an important role to play in reducing vulnerability to natural hazards as well as floodplain management. For example, projects listed in this Plan update may be eligible for certain federal grant programs. The following sections highlight existing capabilities that promote hazard mitigation in the Region.

Capabilities

According to FEMA, each community has a unique set of capabilities, including authorities, policies, programs, staff, funding, and other resources available to accomplish mitigation and reduce long-term vulnerability. These can include both local capabilities as well as planning and regulatory authorities at the regional, state, and federal levels.

4.1 Federal

There are numerous federal strategies in place to mitigate the effects of natural hazards. In addition to the HMA grant programs identified in Section 7.1, grant funding and technical resources are available through the U.S. Fire Administration, the U.S. Fish and Wildlife Service, USACE, and other federal agencies as discussed in Section 7.2 and Section 7.3. Specific federal programs that contribute to mitigation on a daily basis are discussed below.

Of note is that FEMA has prepared the document *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*. This document is available for download from FEMA[1] and provides a resource that communities may use to identify and evaluate a range of potential mitigation actions for reducing risk to natural hazards and disasters. In addition, FEMA[2] has prepared a Risk Management Series brochure outlining various publications related to natural disasters and terrorism.

4.1.1 Flood Mitigation

Mitigation for flooding is provided by programs through FEMA and its NFIP, the NWS, the USACE, and the NRCS.

National Flood Insurance Program

One of the most effective methods of property protection for existing homes is for the homeowner to purchase flood insurance through the NFIP. While insurance does not prevent flooding, insurance payouts assist homeowners in restoring their properties more quickly than could be performed with savings alone. The NFIP was created by the U.S. Congress in 1968 to help provide a means for property owners to financially protect themselves from the impacts of flooding.

For more information about the NFIP, visit https://www.floodsmart.gov/

The NFIP offers flood insurance to homeowners, renters, and business owners if their community participates in the NFIP. Participating communities agree to adopt and enforce ordinances that meet or exceed the minimum federal requirements to reduce the risk of flooding. Each of the WestCOG municipalities has continually participated in the NFIP since the dates the initial Flood Hazard Boundary Maps were developed for their communities as detailed in Table 4-1, and each municipality plans to continue its participation in the NFIP for the foreseeable future using the FIRMs developed by FEMA.

Table 4-1: NFIP Status

Municipality	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date
Bethel	4/5/1974	2/15/1984	6/18/2010
Bridgewater	12/6/1974	11/1/1979	11/1/1979
Brookfield	7/26/1974	6/15/1979	6/18/2010
Danbury	8/2/1974	5/2/1977	6/18/2010
Darien	7/26/1974	1/2/1981	7/8/2013
Greenwich	10/18/1974	9/30/1977	7/8/2013
New Canaan	7/19/1974	5/16/1977	6/18/2010
New Fairfield	1/31/1974	2/15/1974	6/18/2010
New Milford	11/29/1974	4/15/1980	6/4/1987

[1] https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-ideas_02-13-2013.pdf
[2] https://www.fema.gov/sites/default/files/2020-07/rms_pubs_brochure_3_07_0.pdf.

Municipality	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date
Newtown	10/18/1974	6/15/1979	6/18/2010
Norwalk	10/25/1974	4/3/1978	10/16/2013
Redding	8/23/1974	6/15/1982	6/18/2010
Ridgefield	9/13/1974	9/30/1982	6/18/2010
Sherman	2/21/1975	6/18/1987	6/18/2010
Stamford	8/2/1974	1/16/1981	7/8/2013
Weston	3/8/1974	10/17/1978	6/18/2010
Westport	7/19/1974	7/2/1980	7/8/2013
Wilton	3/15/1974	11/17/1982	10/16/2013

Source: FEMA Community Status Book

Homes and buildings in high-risk flood areas, defined by FEMA as areas with a 1% annual chance of flooding and known as SFHAs, are required to have flood insurance if the building is financed with a mortgage from federally regulated or insured lender. Homes and businesses in moderate (0.2% annual chance of flooding) to low-risk areas that have such mortgages are typically not required to have flood insurance, although it may be required at the discretion of the lender. Property owners and renters in these areas may always voluntarily choose to purchase flood insurance. According to the NFIP, over 20% of all NFIP insurance claims and one-third of all federal disaster assistance payouts for flooding come from properties outside of SFHAs.

The NFIP works closely with more than 80 private insurance companies to offer flood insurance because flooding is not covered under standard homeowner's insurance policies. Rates are set nationally and do not differ from company to company or agent to agent, and unlike many types of insurance rates do not increase when claims are made. Property owners should be encouraged to submit claims under the NFIP whenever flooding damage occurs in order to increase the eligibility of the property for projects under the various mitigation grant programs.

A variety of structural-related mitigation strategies, including the use of freeboard, can be applied to new development and substantial redevelopment although these are beyond the minimum requirements of the NFIP. The first-floor elevation is one of the primary components to determining the flood risk of a structure within a SFHA. The minimum national standard under the NFIP for the elevation of the first floor of new and substantially improved structures is to place the floor at or above the base flood elevation. Freeboard requirements (such as those mandated by the State of Connecticut Building Code) provide an additional level of protection to areas at risk of flooding by requiring new development or substantial improvement to be elevated to the base flood elevation plus an additional amount.

The hydrology and hydraulics used to define SFHAs is detailed in a FIS which must be concurrently reviewed to properly interpret FIRMs. FEMA encourages local communities to use more accurate topographic maps to expand upon the FIRMs published by FEMA. This is because many FIRMs were originally created using quadrangle maps prepared by the United States Geological Survey with 10-foot contour intervals, but many municipalities today have contour maps of one- or two-foot intervals that show more recently constructed roads, bridges, and other anthropologic features. An alternate approach is to record high water marks and establish those areas inundated by a recent severe flood to be the new regulatory floodplain. While these maps cannot replace the FIRM for insurance purposes, they may be used to regulate development provided that the mapped area is the same size or larger than that mapped on the FIRM.

Adoption of a different floodplain map is allowed under NFIP regulations as long as the new map covers a larger floodplain than the FIRM. It should be noted that the community's map will not affect the current FIRM or alter the SFHA used for setting insurance rates or making map determinations; it can only be used by the community to regulate floodplain areas. The FEMA Region I office has more information on this topic. Contact information can be found in Section 7.2.

Reductions in floodplain area or revisions of a mapped floodplain can only be accomplished through revised FEMA-sponsored engineering studies or Letters of Map Change. To date, several Letters of Map Amendment and Letters of Map Revision have been submitted for the WestCOG municipalities, which is expected given the relatively developed nature of the local floodplains.

In order to encourage more flood resilient development and assist local communities in implementing the NFIP

regulations, FEMA has developed a variety of training modules and publications as presented below:

- A compilation of flood resistant provisions in the 2018 International Building Code[3]
- A publication to protect building utility systems from flood damage[4]
- A publication to floodproof non-residential buildings[5]
- A publication and flyer[6] for protecting manufactured homes from floods and other hazards
- A Home Builder's Guide to Coastal Construction covering coastal flooding[7]

FEMA defines RLPs as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978. RLPs in the region are discussed in section 3.3.2 of this HMP.

Efforts to reduce flood losses in the region must include the RLP losses that strain the NFIP. For a risk evaluation to be effective, the list of RLPs in the community must be accurate; however, inaccuracies in FEMA RLP lists are prolific nationwide. As a regional example, consider that two of the RLPs located in Norwalk are listed by FEMA as being in other WestCOG communities, and one RLP property located in Stratford (outside the region) is listed by FEMA as being in Bethel. Communities must therefore carefully check and offer corrections to their local RLP lists. Misplaced properties must be formally transferred to the correct municipality, duplicates must be cleared, and mitigation status should be updated to ensure that resources are directed to the properties with most risk and highest flood losses.

This plan therefore includes the following actions in the municipal annexes, as appropriate:

- Request the current list of RLPs from the State NFIP Coordinator each year. Work with CT DEEP to validate and/or correct the RL list and update the mitigation status of each listed property.
- Contact the owners of Repetitive Loss Properties and nearby properties at risk to inquire about mitigation undertaken and suggest options for mitigating flooding in those areas. This should be accomplished with a letter directly mailed to each property owner.

Community Rating System

FEMA's Community Rating System (CRS) is a voluntary program that offers discounts of flood insurance premiums to communities that undertake activities beyond minimum flood insurance standards. Activities include public outreach and information regarding flood protection, open space protection, stormwater management, and floodplain mitigation. Newtown (Class 9, 5% discount), Stamford (Class 7, 15% discount), and Westport (Class 8, 10% discount) presently participate in the CRS program. Due to the rigorous requirements of the CRS program, this HMP will be monitored, evaluated, and updated under CRS activity 510.

The CRS program requires that communities with 10 or more RLPs (Category C communities) prepare a floodplain management plan that covers the RLP areas. Category C communities in the Region include Danbury, Darien, Greenwich, New Milford, Norwalk, Stamford, Weston, Westport, and Wilton.

Multi-jurisdictional HMPs that are prepared in accordance with the CRS Floodplain Management Planning process qualify for floodplain management planning credit in the CRS Program under CRS activity 510. Each CRS community is awarded approximately 200 points for adopting this HMP. CRS Program requirements for this HMP post-adoption include:

- An annual evaluation report on progress towards Plan implementation must be prepared and submitted with the community's annual CRS recertification. This report must be submitted to the governing body, released to the media, and made available to the public.

[3] https://www.fema.gov/sites/default/files/2020-08/fema_2018-i-codes-flood-provisions.pdf
[4] https://www.fema.gov/sites/default/files/2020-07/fema_p-348_protecting_building_utility_systems_from_flood_damage_2017.pdf
[5] https://www.fema.gov/sites/default/files/2020-07/fema_p-936_floodproofing_non-residential_buiildings_110618pdf.pdf
[6] https://www.fema.gov/sites/default/files/2020-07/fema85_flyer_052219.pdf
[7] https://www.fema.gov/sites/default/files/2020-08/fema499_2010_edition.pdf

- If a community is receiving credit as a result of participation in a multi-jurisdictional HMP, the annual evaluation report must discuss the individual strategies and actions for that community. This can be performed by participating in a multi-jurisdictional annual plan review committee or through separate submittals by each community. A community will not receive credit if it was not present at the regional meeting. Therefore, the submittal needs to record attendance and show who participated in preparation of the report.

- The community must update the HMP every five years.

As public information activities are an important and required component of the CRS, the public participation requirements and recommendations of this HMP regarding public education and awareness can be implemented through the CRS program.

National Weather Service

The NWS issues a Flood Advisory, Flood Watch, Flood Warning, or Flash Flood Warning to advise citizens when hazardous flooding conditions may occur. State and local governments typically rely on NWS forecasts to prepare for and respond to flooding events.

- A **Flood Advisory** is issued when a specific weather event that is forecasted to occur may become a nuisance, but when flooding is not expected to be bad enough to issue a warning.

- A **flood watch** or a **flash flood watch** is issued for an area when conditions in or near the area are favorable for a flood or flash flood, respectively. A flash flood watch or flood watch does not necessarily mean that flooding will occur, but that people should be prepared for a warning to be issued.

- A **flood warning** or a **flash flood warning** is issued for an area when parts of the area are either currently flooding, highly likely to flood, or when flooding is imminent. People in areas at risk of flooding should move immediately to high ground.

United States Army Corps of Engineers

USACE has designed, constructed, and operates flood protection projects in a variety of communities across Connecticut. According to the FIS for Fairfield County, within the Region, the USACE:

- Constructed a local protection project in Danbury consisting of approximately 3,625 feet of concrete conduit and 2,695 feet of enlarged and realigned riprapped trapezoidal channel on the Still River downstream from Triangle Street to upstream of the railroad yards. The project required rebuilding four railroad bridges, constructing two highway bridges, and removing a privately owned bridge. The project protects a major industrial area in Danbury.

- Constructed a hurricane barrier (functionally, a levee) that protects low-lying development on 640 acres in the south end of Stamford from flooding caused by hurricanes or severe coastal storms of the 0.2% annual chance recurrence interval. This area is generally located between the Rippowam River and Cummings Park.

The USACE also oversees levee certification for all levees in the region. Other leveed areas include:

- The southeastern junction of Route 7 and the Merritt Parkway in Norwalk just north of the confluence of the Norwalk and Silvermine Rivers. This levee protects approximately 26 acres and extends 0.45 miles along the bank of the Norwalk River.

- Two levees are located in Greenwich on the Byram River in the vicinity of Pemberwick Park. The two levees protect an area of approximately 14.3 acres total.

The USACE has performed many studies of potential flood protection projects in the region, such as at Lovers Leap Gorge New Milford, that ultimately were not constructed as they did not appear to be cost-effective. The USACE also has provided dam evaluation services, with a significant number of Phase I and Phase II dam assessments completed in the late 1970s throughout Connecticut. Furthermore, the USACE reviews and accredits levee systems such as those in Norwalk along the Norwalk River and in Stamford as described above.

Natural Resource Conservation Service

The also NRCS designs and funds flood mitigation projects through its Emergency Watershed Protection (EWP) program. According to the FIS for Fairfield County, following the 1955 floods the NRCS designed an entire system of flood control structures for the Norwalk River watershed, including five floodwater retarding structures and three lengths of channel modifications. Only two of the related dams were constructed – one on Ridgefield Brook in Ridgefield and the other on Spectacle Brook, a tributary to Comstock Brook, in Wilton. The sections of channel modification have not been completed as the remaining three dams were never constructed.

More recently, the NRCS EWP program focuses on funding projects to address debris-clogged stream channels, undermined and unstable streambanks, jeopardized water control structures and public infrastructure, wind-borne debris removal, and damaged upland sites stripped of protective vegetation by fire or drought. Landowners must have a project sponsor (typically a local government) support any EWP grant application.

4.1.2 Winter Storms

FEMA's Building Sciences division regularly prepares guidance materials for construction in areas impacted by winter storms. For example, FEMA[8] has produced a Snow Load Safety Guidance Document.

4.1.3 Tropical Cyclones and Hurricanes

NOAA issues an annual hurricane outlook to provide a general guide to each upcoming hurricane season based on various climatic factors. However, it is impossible to predict exactly when and where a hurricane will occur. NOAA believes that "hurricane landfalls are largely determined by the weather patterns in places the hurricane approaches, which are only predictable within several days of the storm making landfall." Tracking of hurricanes has advanced to the point where areas often have one week of warning time or more prior to a hurricane strike.

Connecticut is located in FEMA Zone II regarding maximum expected wind speed. The maximum expected wind speed for a three-second gust is 160 mph. This wind speed could occur as a result of either a hurricane or a tornado. The American Society of Civil Engineers recommends that new buildings be designed to withstand this peak three-second gust.

FEMA has also prepared multiple publications regarding mitigating potential wind damage, including the following presented below:

- A wind retrofit guide and flyer[9] for residential buildings
- Detailed guidelines for conducting wind vulnerability assessments of existing critical facilities[10]
- A compilation of the wind resistant provisions of the 2018 International Building Code[11]

4.1.4 Tornadoes and Thunderstorms

Provision of effective warnings is the primary method of existing mitigation for tornadoes and thunderstorm-related hazards. The NOAA NWS issues watches and warnings when severe weather is likely to develop or has developed, respectively. Table 4-2 lists the NOAA Watches and Warnings, respectively, as pertaining to actions to be taken by emergency management personnel in connection with thunderstorms and tornadoes.

Both the FEMA and the NOAA websites contain valuable information regarding preparing for and protecting oneself during a tornado as well as information on a number of other natural hazards. Available information from FEMA includes:

- Design and construction guidance for creating and identifying community shelters

[8] https://www.fema.gov/sites/default/files/2020-07/fema_snow_load_2014.pdf
[9] https://www.fema.gov/sites/default/files/2020-07/p-804_wind-retrofit-guide-residential.pdf
[10] https://www.fema.gov/sites/default/files/2020-07/guidelines-wind-vulnerability.pdf
[11] https://www.fema.gov/sites/default/files/2020-07/2018-ibc-compliation-wind-resistant-provisions.pdf

- Recommendations to better protect a business, community, and home from tornado damage, including construction and design guidelines for structures
- Ways to better protect property from wind damage
- Ways to protect property from flooding damage
- Construction of safe rooms within homes

Table 4-2: NOAA Watches and Warnings

Weather Condition	Meaning	Action
Flash Flood Watch	It is possible that rains will cause flash flooding in your area.	Notify personnel to watch for street or river flooding.
Flash Flood Warning	Flash flooding is occurring or imminent in your area.	Watch local rivers and streams. Be prepared to evacuate low-lying areas. Take appropriate actions listed in emergency plans.
Severe Thunder-storm Watch	Severe thunderstorms are possible in your area, with winds greater than 58 mph, or hail 0.75-inches in diameter, or a tornado likely to develop	Notify personnel and watch for severe weather.
Severe Thunder-storm Warning	Severe thunderstorms are occurring or are imminent in your area based on spotters or as indicated by weather radar.	Notify personnel and watch for severe conditions or damage (i.e., downed power lines and trees). Take appropriate actions listed in municipal emergency plans.
Tornado Watch	Tornadoes are possible in your area.	Notify personnel and be prepared to move quickly if a warning is issued.
Tornado Warning	Tornadoes are occurring or are imminent in your area.	Notify personnel, watch for severe weather, and ensure personnel are protected. Take appropriate actions listed in emergency plans.

Source: NOAA

More information is available from:

FEMA: http://www.fema.gov/library/

NOAA: https://www.nssl.noaa.gov/education/svrwx101/

NOAA information includes a discussion of family preparedness procedures and the best physical locations during a storm event. NOAA encourages all residents to purchase a NOAA weather radio containing an alarm feature.

4.1.5 Wildfires

The National Weather Service issues a Red Flag warning when winds will be sustained or there will be frequent gusts above a certain threshold (usually 25 mph), the relative humidity is below 30%, and precipitation for the previous five days has been less than one-quarter inch. Such conditions can cause wildfires to quickly spread from their source area.

FEMA has produced a "Defensible Space" Technical Fact Sheet for Construction in Wildfire Zones[12].

4.1.6 Drought

The National Integrated Drought Information System available at https://www.drought.gov/drought/ is a multi-federal agency effort that tracks drought conditions throughout the United States. A variety of resources are available related to planning and preparedness, education, and recovery from droughts. This site incorporates current data developed by the United States Drought Monitor that can be accessed through https://droughtmonitor.unl.edu/.

4.1.7 Earthquakes

FEMA has produced a fact sheet[13] that addresses seismic building code provisions for improving earthquake resilience in new buildings that can be downloaded at:

[12] https://www.ready.gov/sites/default/files/2020-03/home-builder-guide-construction-defensible-space.pdf
[13] https://www.fema.gov/sites/default/files/2020-10/fema_seismic-building-code-provisions-new-buildings-create-safer-communities_fact-sheet.pdf

4.1.8 Dam Failure

FEMA has prepared a fact sheet[14] to increase awareness of potential dam risk.

The Association of State Dam Safety Officials provides a variety of resources related to dam management primarily aimed at state dam safety officials but also useful for dam owners, stakeholders, and the public. This information can be accessed from https://www.damsafety.org/.

4.1.9 Terrorism and Mass Casualty Events

The U.S Department of Homeland Security uses the National Terrorism Advisory System to issue alerts and bulletins about current threats to the United States. This replaced the color-coded Homeland Security Advisory System which was in place until 2011. For example, the most recent bulletin was issue on January 18, 2020 and expired on March 18, 2020. This bulletin warned of increasing cyber-security related threats from Iran. The bulletin stated, "Iran maintains a robust cyber program and is capable, at a minimum, of carrying out attacks with temporary disruptive effects against critical infrastructure in the United States." These bulletins are updated periodically as new information on current credible threats is gathered by U.S. intelligence.

The U.S. Department of Homeland Security released its inaugural Homeland Threat Assessment in October of 2020. This report highlights the emerging risk of state sponsored cyber-terrorism from countries like Russia, China, North Korea, and Iran which seek to disrupt critical infrastructure, steal national security information, or create economic disruption and civil unrest.

The Joint Commission on Accreditation of Healthcare Organizations prepared the document *Standing Together: An Emergency Planning Guide for America's Communities* in partnership with the Illinois Department of Public Health, the Maryland Institute of Emergency Medical Services Systems, and the National Center for Disaster Preparedness at Columbia University. Recommendations of the report[15] include 13 essential components of an effective community-based emergency management planning process that could be used by WestCOG as a whole or any individual community:

1. Define the Community
2. Identify and Establish the Emergency Preparedness and Response Team
3. Determine the Risks and Hazards the Community Faces
4. Set Goals for Preparedness and Response Planning
5. Determine Current Capacities and Capabilities
6. Develop the Integrated Plan
7. Ensure Thorough Communication Planning
8. Ensure Thorough Mental Health Planning
9. Ensure Thorough Planning Related to Vulnerable Populations
10. Identify, Cultivate, and Sustain Funding Sources
11. Train, Exercise, and Drill Collaboratively
12. Critique and Improve the Integrated Community Plan
13. Sustain Collaboration, Communication, and Co-ordination

FEMA encourages local communities to prepare for terrorist incidents as part of their emergency operations planning. FEMA prepared the document *Developing and Maintaining Emergency Operations Plans: Comprehensive Preparedness Guide (CPG) 101 Version 2.0* in November 2010. This document[16] has planning guidance related to all hazards including terrorism.

Public water systems have often been thought of as a possible target for terrorist attacks, especially after the events of September 11, 2001. While the risk of significant acute health effects from an attempted terrorist attack on a water system is quite low, a terrorist could still damage sources of supply or disrupt service to customers, causing widespread inconvenience and economic loss. The psychological effect of contaminating a water supply is also especially damaging, as Americans have come to expect safe, clean public drinking water from their taps.

America's Water Infrastructure Act (AWIA) of 2018 requires community water systems serving over 3,300 people to manage public water system risk through a Risk

[14] https://www.fema.gov/sites/default/files/2020-08/damsafety_awareness_factsheet4.pdf
[15] https://www.jointcommission.org/-/media/deprecated-unorganized/imported-assets/tjc/system-folders/topics-library/planning_guidepdf.pdf?db=web&hash=8E6E07ED42CD196E626CA8051B0691FD
[16] https://www.fema.gov/sites/default/files/2020-07/developing-maintaining-emergency-operations-plans.pdf

and Resilience Assessment. The law also requires these same utilities to create and maintain an Emergency Response Plan. These two activities together supersede the requirements of the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, a 9/11 era piece of legislation that primarily aimed to safeguard public water systems from terrorism and sabotage. This new bill implores public water systems to create a Risk and Resilience Assessment which considers how both natural and man-made hazards could impact the water system. This ensures that all public water systems are routinely preparing for assaults on their system. Ideally, this encourages the water systems to increase redundancy and harden infrastructure in order to increase resiliency.

4.2 State

There are numerous state capabilities in place to mitigate the effects of natural hazards in Connecticut. The Connecticut Department of Emergency Services and Public Protection (DESPP), Connecticut DEMHS, the Connecticut DEEP, the CTDOT, and other agencies provide funding and technical assistance related to mitigation as discussed in Section 7.3. Specific state programs that contribute to mitigation on a daily basis are discussed below.

4.2.1 Multiple Hazards

Hazard Mitigation Planning

The State HMP (2019 CT NHMP) is updated every five years by Connecticut DEMHS as required by FEMA. The document examines statewide impacts of natural hazards, compares impacts between counties, examines state capabilities, and outlines new initiatives for hazard mitigation planning at the state level that is to be enacted at the local level over the next five years.

The Connecticut State Colleges and Universities has also prepared a HMP for its campuses. In the Region, the 2014 Multi-Campus Hazard Mitigation Plan covers Western Connecticut State University in Danbury, and Norwalk Community College in Norwalk as shown on the Fact Sheet below.

Codes and Design Standards

The Connecticut Department of Administrative Services, Division of Construction Services includes the Office of the State Building Inspector. This office maintains the current (2018) state building code. Each WestCOG municipality has adopted the Connecticut Building Code as its building code, and literature is generally available regarding design standards in each local Building Department office. The code includes design standards for wind, snow load, earthquakes, and other hazards.

The new code is significant relative to flood mitigation. Adherence to the State Building Code requires that the foundation of structures will withstand flood forces and that all portions of the building subject to damage are above or otherwise protected from flooding. It requires 1 foot of freeboard in all A, AE, and VE zones (VE zones have a risk of significant wave action and tend to be found along coastlines). Coastal A zones (A or AE zones occurring waterward of the limit of moderate wave action) are regulated like VE zones in certain cases; flood openings are required in breakaway walls; and essential facilities must be elevated 2 feet above the BFE or to the 0.2% annual chance flood elevation. Refer to the Fact Sheet below for more details.

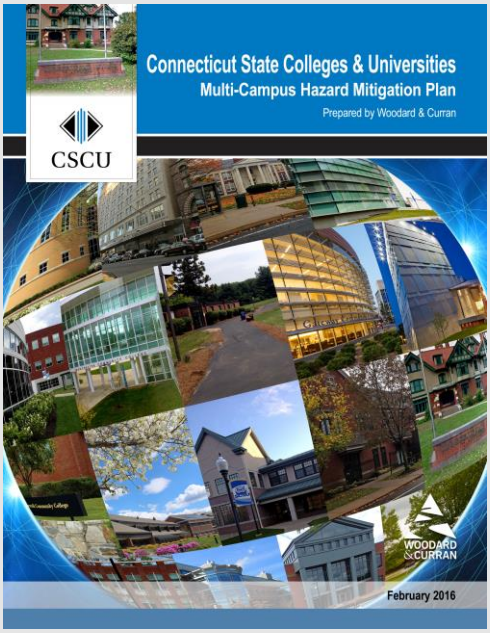
Monitoring and Alert Systems

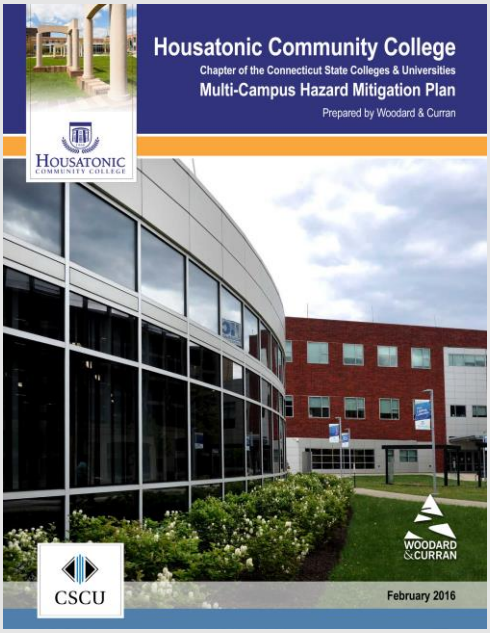
DESPP maintains the statewide "CT Alert" Emergency Notification System. This system uses the State's Enhanced 9-1-1 database for location-based notifications to the public for life-threatening emergencies. Emergency notification systems are extremely useful for natural hazard mitigation, as a community warning system that relies on radios and television is less effective at warning residents during the night when the majority of the community is asleep. Each of the WestCOG municipalities receives regular weather updates through DEMHS Region 1 or Region 5 email alerts as well as watches and warnings issued by the NWS.

DEMHS is a division of DESPP. DEMHS administers the FEMA HMA grant programs in Connecticut and also oversees the statewide hazard mitigation planning process. This includes both the State HMP and the development of local and regional plans including this Plan update.

NEW INITIATIVES

CONNECTICUT STATE COLLEGES AND UNIVERSITIES HAZARD MITIGATION PLAN





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WHAT IS THE INITIATIVE?

In 2014, the Connecticut State Colleges & Universities (CSCU) began a process to develop a Multi-Campus Hazard Mitigation Plan (MCHMP) for each of the CSCU campuses to fulfill federal, state, and local hazard mitigation planning requirements. The purpose of the CSCU MCHMP is to institute a consistent hazard mitigation planning approach across all campuses and understand past and potential risks associated with natural hazard events.

Hazard mitigation is important to CSCU because of the susceptibility to many types of natural hazard events of its campuses, assets, and people involved in its operations. Major activities involved in the development of this plan included hazard identification and rankings, hazard event profiles, hazard vulnerability assessments and loss estimates, development of hazard mitigation goals and objectives, and formulation of hazard mitigation projects.

Western Connecticut State University (WCSU) is a four-year public State University at 181 White Street in the City of Danbury. WCSU offers associates degrees, 38 bachelors degrees, 15 masters degrees, and two doctoral degree programs. Between campus and online, there are over 90,000 enrolled students. Norwalk Community College (NCC) is a two-year public community college at 188 Richards Avenue in the City of Norwalk. Currently, NCC offers 50 associate degree programs and has an enrollment of approximately 13,000 students.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

The WCSU and NCC Chapters of the MCHMP addresses hazards, vulnerabilities, and mitigation actions specifically for each campus. WCSU is comprised of two campuses with 29 buildings including academic buildings, residence halls, a nature center, amphitheater, and administration buildings, covering a total of 398 acres. Eleven of these buildings are included on the State Historic Register.

NCC covers just over 31 acres and is comprised of two adjacent campuses, East and West, with one main building located at each campus. These buildings house classrooms, laboratories, dining facilities, administrative offices, and other student resources.

Mitigation actions recommended in the plans include the following:

Western

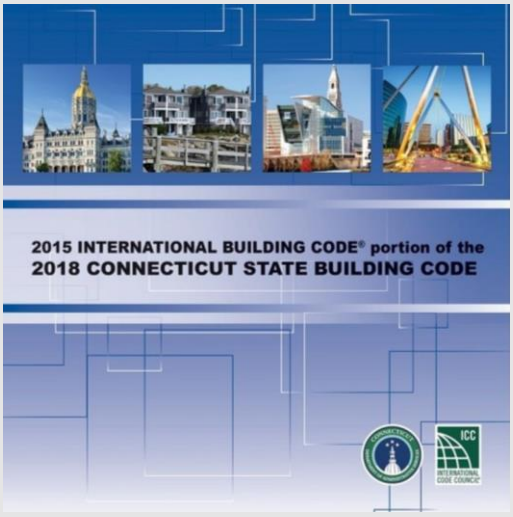
- Develop a shelter in place plan and provide associated training
- Improve fire pump systems on Westside Campus to connect to City fire pump system.

Norwalk

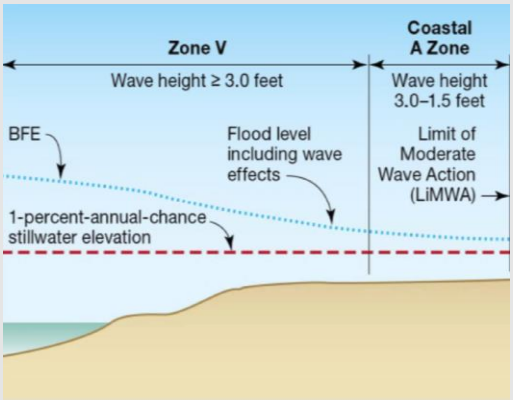
- Develop a campus-wide evacuation plan
- Build redundancy in communications systems.

NEW INITIATIVES

STATE BUILDING CODE AND FLOOD REGULATIONS



V Zone versus Coastal A Zone
FEMA



V Zone versus Coastal A Zone
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WHAT IS THE INITIATIVE?

The State of Connecticut adopted an updated State Building Code effective October 1, 2018. The 2018 Connecticut State Building Code incorporates a suite of national and international model codes, including the 2015 International Building Code (IBC), and 2015 International Residential Code (IRC), both of which include provisions for flood mitigation.

The 2015 IBC includes flood-resistant construction standards for non-residential structures (Appendix G), while the 2015 IRC includes such standards for residential structures (Chapter 3, Section R322).

Key flood-resistance provisions in the 2018 Connecticut State Building Code include:

- Structures in all flood hazard areas (including A Zones) must have the lowest floor elevated to the BFE plus 1 foot.
- Structures in Coastal High Hazard Areas (V Zones *and* Coastal A Zones [A zones subject to wave heights between 1.5 ft and 3 ft]) must have the bottom of the lowest horizontal structural member elevated to the BFE plus 1 foot.
- Critical facilities in hazard zones must be meet the above requirements to BFE plus 2 feet.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

The Connecticut State Building Code is enforced statewide; however, updating local zoning regulations can support municipal efforts to bring the local building-stock up to code.

Model Floodplain Regulations have been developed by the state for both inland and coastal communities. These model regulations outline the changes municipalities need to make to incorporate the new State Building Code language.

Simply implementing the State Building Code locally without updating the flood damage prevention regulations may be insufficient, as the permitting and building approvals are not always parallel. Updating local regulations to incorporate State Building Code requirements will avoid confusion, aid enforcement, and make inspections more effective.

Specific hazard mitigation actions related to the State Building Code update were suggested for municipalities in this plan. These actions include the following, depending on the current regulations of each municipality:

- Revise floodplain zoning regulations to reflect the new State Building Code requirements for one foot of freeboard for construction in the 1% annual-chance flood zone.
- Compare local floodplain regulations with Revised State Model Flood Regulations to identify any remaining opportunities for improvement

The CTDOT has implemented the Statewide Roadway Weather Information System (RWIS). Each of the 13 RWIS sites communicate real-time and historical weather information to CTDOT staff and weather services. This information is used to monitor the impacts of heavy rainfall and to inform a variety of winter maintenance activities. An additional 23 additional priority sites have been identified to expand the system from the existing 13 sites.

State-Sponsored Grant Programs

The Connecticut Office of Policy and Management manages the Small Town Economic Assistance Program (STEAP) which provides grant funding through the State Bond Commission for projects such as constructing, reconstructing, or repairing roads access ways, and other site improvements. STEAP-eligible communities in the Region include all municipalities except Danbury, Norwalk, and Stamford. Example hazard mitigation projects that have been funded since 2005 include construction and renovation of facilities to also be used as shelters, bridge and culvert replacements, road reconstructions, water main replacements, critical facility upgrades including generators, solar power arrays, and drainage improvements.

The Local Transportation Capital Improvement Program administered by CTDOT provides state funds to municipal governments in urbanized areas in lieu of Federal funds otherwise available through Federal transportation legislation. This program has fewer constraints and requirements than currently exist when using certain types of federal funds.

The Connecticut Farm Services Agency provides a variety of programs to assist the state's agricultural producers. The Supplemental Revenue Assistance or "SURE" program provides crop disaster assistance to eligible producers on farms that have incurred crop protection or crop quality losses due to natural disasters. The Emergency Assistance for Livestock, Honey Bees & Farm-Raised Fish or "ELAP" program covers losses from disaster not adequately covered by other disaster programs. The Livestock Indemnity Program or "LIP" provides 75% market value in benefits to livestock producers for livestock deaths in excess of normal mortality caused by adverse weather. The Noninsured Crop Disaster Assistance Program or "NAP" provides financial assistance to producers of non-insurable crops when low yields, loss of inventory, or prevented planting occurs due to natural disasters. Emergency Farm Loan funds are also available for counties receiving a presidential disaster or emergency declaration.

Open Space Acquisition

The permanent preservation of undeveloped land can help support natural hazard mitigation efforts by preventing development in areas prone to natural hazards such as floodplains and wildland/urban interfaces. The State of Connecticut has established a goal of preserving 21 percent (or 673,210 acres) of the state's land area for open space for public recreation and natural resource conservation and preservation by 2023. According to the Connecticut Council on Environmental Quality (CEQ), to date, the state has preserved 259,022 acres throughout Connecticut as state land. In addition, a review by the CEQ in 2015 of published landholdings of land trusts showed nearly 60,000 acres held in fee and close to 30,000 in easements. The 2017 CEQ annual report indicates that Connecticut is not on track for meeting its open space preservation goal. Full counts of open space assets are not presently available in Connecticut but should be made available in an upcoming statewide Open Space Plan.

The statute governing open space preservation, CGS Section 23-8, divides responsibility for meeting this goal between the state (10% or 320,576 acres) and municipalities, nonprofit land conservation organizations, and water utilities (11% or 352,634 acres). The state provides financial assistance to municipalities, conservation organizations, and water utilities to help them acquire land under a competitive grant program. Funding through the Connecticut DEEP Open Space and Watershed Land Acquisition Grant Program is usually available every 2 years. According to the CEQ 2017 Annual Report, in 2017, State grants helped municipalities and land trusts acquire 895 acres while in 2016 the number was 2,200 acres. WestCOG assists municipalities and land trusts in their efforts to secure grants by writing letters of support on their behalf to the Connecticut DEEP.

The state grant program requires a local match be provided. Some municipalities have passed bond referenda, and some local trusts have established fund-raising programs to provide local resources for open space acquisition. These resources are used to provide the

local match for the state grant or are used to acquire lands without state assistance.

Sustainable CT

Sustainable CT is a voluntary certification program created by the Connecticut Conference of Municipalities (CCM) to recognize thriving and resilient Connecticut communities. Sustainable CT is an independently-funded, grassroots, municipal effort designed to support all Connecticut municipalities, regardless of size, geography, or resources. Sustainable CT empowers municipalities to create high collective impact for current and future residents.

Sustainable CT provides a wide-ranging menu of best practices for building sustainable municipalities. Municipalities choose Sustainable CT actions from this "Master Action List," implement them, and earn points toward certification. Many actions are consistent with the goals of hazard mitigation and, if accomplished, may demonstrate progress with hazard mitigation. One such action is to conduct a Climate Vulnerability Assessment, identifying how climate change will impact the community. A regional Climate Vulnerability Assessment is provided in Appendix E. Each municipality in the region has incorporated projected climate change impacts within its respective annex of the Hazard Mitigation Plan.

Sustainable CT also provides opportunities for grant funding to help communities promote economic well-being and enhance equity, all while respecting the finite capacity of the natural environment. The initiative specifically encourages consideration of low-income residents and their vulnerability to extreme weather events.

Resilient Connecticut

The Connecticut Institute for Resilience and Climate Adaptation (CIRCA) began the Resilient Connecticut initiative in 2018. Resilient Connecticut aims to establish resilient coastal communities through the Resilience Framework, which includes:

- Supporting healthy buffering ecosystems
- Fostering critical infrastructure that is adapted to withstand occasional flooding
- Establishing resilient and strong connections between critical services, infrastructure, and transport hubs
- Increasing investment in identified "Resilience Zones" that will increase economic resilience by strongly tying-back to regional transportation networks and economic opportunities

The initiative is currently in Phase II, which consists of regional and municipal resilience planning and engagement efforts built around the Resilience Framework. Resilient Connecticut is working to make the planning components of Phase II well-aligned with municipal hazard mitigation strategies.

Resilient Connecticut specifically focuses on communities with major highways and passenger rail lines, and communities with TOD potential. In the region, these communities are Danbury, Bethel, Ridgefield, Redding, Wilton, Westport, New Canaan, Norwalk, Darien, Stamford, and Greenwich. The municipal annex of each community noted above includes an action to collaborate with CIRCA on the Resilient Connecticut project. This action may be accomplished by:

- Participating in Resilient Connecticut engagement efforts
- Recognizing "zones of shared risk" that may not follow political boundaries
- Participating in the development of climate adaptation/resilience projects that benefit the region
- Visiting the https://resilientconnecticut.uconn.edu website to learn more

Historic Resources

Recognizing that historic and cultural resources are increasingly at risk to natural hazards and climate change, SHPO embarked on a resiliency planning study for historic and cultural resources beginning in 2016. Working with the state's Councils of Government and municipalities throughout the planning process, numerous examples were identified where historic and cultural resources were specifically at risk now, could be at risk in the future, and could help generate consensus for resiliency actions. Historic resources are difficult to floodproof, elevate, or relocate without potential loss of their historicity. Therefore, a thorough understanding of the site-specific options for each set of historic resources is necessary prior

to disasters that could damage these resources in order to avoid damage during recovery.

The five coastal COGs in Connecticut hosted historic resources resiliency planning meetings in June 2016. During winter 2016-2017, individual meetings were held with the shoreline communities. Reports were issued to these communities in late 2017 based on the COG meetings and the local meetings. These reports outline eight strategies that can be employed to make historic and cultural resources more resilient. They are:

- Identify Historic Resources
- Revisit Historic District Zoning Regulations
- Strengthen Recovery Planning
- Incorporate Historic Preservation into Planning Documents
- Revisit Floodplain Regulations and Ordinances
- Coordinate Regionally and with the State
- Structural Adaptation Measures
- Educate

A best practice guide for planning techniques to make historic resources more resilient was distributed in 2018. This guide can be used by all jurisdictions in Connecticut when undertaking development of hazard mitigation plans. Resiliency concepts were added to the update of the State Historic Preservation Plan in 2017-2018, with the goal of helping all of the state's communities making historic resources more resilient.

4.2.2 Flooding

Ice Jam Monitoring

The Connecticut DEEP monitors the occurrence of ice jams throughout the state. Ice jam flooding last occurred in Connecticut since 2018, with ice jams historically occurring in the region along the Housatonic River and West Aspetuck River in New Milford and the Saugatuck River in Westport.

Codes and Design Standards

The CTDOT has standards for the design of culverts and bridges on State roads, and these standards are often used by local communities. CTDOT uses the NOAA-published Volume 10, Version 3.0 of the "NOAA Atlas 14, Precipitation-Frequency Atlas of the United States" for the northeastern states for its runoff calculations.

Connecticut Public Act 18-182 updated the flood design standards for state-funded critical facilities. This Public Act requires use of the most updated sea level rise scenarios (such as those developed by CIRCA or others) to be considered under local and regional planning in the state. Example facilities covered by the act include schools, elderly housing facilities, residences, and hazardous waste facilities. The base flood elevation for such facilities is the 0.2% annual chance flood elevation. Furthermore, for critical facilities within the coastal boundary, any floodproofing must exceed the base flood elevation by two feet plus any increase necessary to account for the most recent sea level rise scenario.

Stormwater and Erosion Control

Per Connecticut General Statute Section 22a-325 – 22a-329, all municipalities in Connecticut are required to adopt regulations pertaining to soil erosion and sediment control, and all applications for proposed development that will disturb more than a half-acre must include a soil erosion and sediment control plan. The Connecticut DEEP has guidelines that serve as the technical standard for compliance with the statute. The *Connecticut Stormwater Quality Manual* provides guidance on site planning, source control, and stormwater practices, including the design, construction, and maintenance of stormwater systems, to protect the quality of Connecticut waters. The practices detailed in the manual aim to reduce the volume of urban runoff and pollutant discharges, recharge groundwater, and control peak flows. These types of stormwater best practices not only protect water quality but also minimize flooding risks. The *Connecticut Guidelines for Erosion and Sedimentation Control* also detail specific measures that can reduce the damages and pollution associated with erosion and sedimentation while simultaneously reducing flooding risks.

In 2012, the Connecticut DEEP updated the manual and guidelines to incorporate appendices on Low Impact Development (LID). LID manages stormwater by designing with nature in mind. LID techniques seek to retain stormwater close to where it falls thus keeping runoff out of pipes that drain to waterways. WestCOG encourages its member municipalities to adopt and enforce regulations that would require new development to implement these types of best practices in as far as is possible.

LID and the use of green infrastructure are often considered first by the urban and suburban communities of a region. LID is also useful for rural communities. With funding from CIRCA, the Northwest Hills Council of Governments conducted a study of how LID can be used for advancing resilience in rural communities and commissioned the development of a LID design manual. The Fact Sheet following this page describes rural resiliency.

The *Low Impact Sustainable Development Design Manual* developed for the Town of Morris by Trinkaus Engineering, LLC with funding from CIRCA presents techniques designed to help properly capture, infiltrate, and manage stormwater, which in turn recharges groundwater, reduces erosion, and protects sensitive habitats. The manual provides a framework to improve water quality through engineering specifications, enforcement tools and development standards to reduce erosion and impacts from pollution on aquatic and natural environments.

The development of the manual focuses on strategies achievable by rural municipalities, which tend to have different challenges as compared to urban communities. Rural municipalities across the region can benefit from using the manual to guide implementation of stormwater runoff mitigation actions.

Helping Small Businesses Mitigate Impacts

According to FEMA, 40% of businesses affected by disaster never reopen, and 25% that do reopen fail; other studies show that 90% of businesses fail within two years of being struck by a disaster. Natural disasters can result in property damage, loss of inventory, and business interruption; another important risk that many small businesses face is that of environmental contamination and legal liabilities resulting from toxic chemical releases into the environment during or following a disaster.

In an effort to assist small business with natural hazard mitigation, Connecticut DEEP has proposed strategies for towns to implement education and awareness programs with recommendations for best management practices (BMPs) to help business owners and municipalities prevent commercial pollutants from entering the environment. Such education and awareness programs may help small businesses and the municipalities in which they are located avoid expensive cleanups, reduce legal liability challenges, mitigate potential risks to public health, and accelerate business recovery and reopening – reducing negative impacts to the municipality's economic base.

The municipalities of the region can benefit from mitigation actions related to mitigating flood impacts to small businesses that use toxic chemicals. A selection from the following actions has been included in each of the municipal annexes, depending on the needs of each community:

- Provide information on the municipal website about CT DEEP training and information around small business chemical management for hazard resilience.
- Use the CT Toxics Users and Climate Resilience Map to identify toxic users located in hazard zones within your community. Contact those users to inform them about the CT DEEP small business chemical management initiative.
- Host a CT DEEP presentation for municipal staff and local businesses about business chemical management for hazard resilience.

CT DEEP has recommended that each municipality be listed as the lead agency for each of these actions, with assistance from CT DEEP noted (CT DEEP will develop information for dissemination). The suggested action priority is "medium", with a completion time frame of one year.

4.2.3 Winter Storms

The CTDOT is responsible for maintenance and plowing along state roadways, and local communities coordinate with the CTDOT when problems need to be addressed.

The amended Connecticut Building Code specifies that a pressure of 30 to 40 psf be used as the base "ground snow load" for computing snow loading for different types of roofs. The psf is set by municipality, with shoreline municipalities in the Region being assigned 30 psf and

NEW INITIATIVES

LOW IMPACT DEVELOPMENT FOR RURAL RESILIENCY

Images: nrcs.usda.gov

FOR MORE INFORMATION

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WHAT IS THE INITIATIVE?

Low-impact development (LID) prioritizes minimally invasive design, construction, and site operation techniques to reduce stormwater runoff quantity, undesirable water quality, and the corresponding negative impacts to receiving waters. Strategies such as reducing impervious services, installing infiltration systems, and zone-specific standards are used to address environmental impacts that come from typical development approaches such as extensive parking areas, box-building construction, and rapid stormwater removal from a site. LID helps to increase local resilience to climate change by mitigating the impacts of drought, protecting drinking water reserves, reducing flooding, and reducing stress on infrastructure.

A joint initiative between Northwest Hills Council of Governments, Northwest CT Conservation District, and CIRCA resulted in development of a municipal-scale manual for a sustainable approach to protect water sources and historic development patterns in rural communities. The manual presents techniques designed to help properly capture, infiltrate, and manage stormwater, which in turn recharges groundwater, reduces erosion, and protects sensitive habitats. The manual provides a framework to improve water quality through engineering specifications, enforcement tools and development standards to reduce erosion and impacts from pollution on aquatic and natural environments.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

LID can increase the resilience of communities to the impacts of climate change on the natural, built, and human environments. The installation of LID infrastructure increases small and rural community resiliency in many ways, including:

- protecting drinking water supplies, streams, rivers and other water resources throughout the watershed
- protecting natural vegetation, hydrology and other resources on development sites
- reducing damage to local roads, bridges, the built environment, as well as to agricultural resources and human environments.

The development of a LID Manual for rural communities focuses on strategies achievable by rural municipalities, which tend to have different challenges as compared to urban communities. Municipalities in the region such as Bridgewater and Redding can benefit from mitigation actions related to increasing resiliency through LID.

inland municipalities assigned 35 psf. The International Building code specifies the same pressure for habitable attics and sleeping areas and specifies a minimum pressure of 35 psf for all other areas.

4.2.4 Tropical Cyclones and Hurricanes

Wind loading requirements are addressed through the state building code. The 2018 Connecticut State Building Code specifies the design wind speed for construction in all the Connecticut municipalities, with the addition of split zones for some towns. The ultimate design wind speed is assigned by municipality, and within the Region varies from 110 mph to 130 mph depending on the risk category of the structure.

The Connecticut Public Utility Regulatory Authority (PURA) piloted a "micro-grid" program following storms Irene, Alfred, and Sandy designed to provide backup power supplies to small areas critical to public supply distribution such as supermarkets, gas stations, and pharmacies. These infrastructure improvements will allow for small areas of the power grid to be isolated and operated independently through emergency generators. Presently underway at PURA in 2020 is consideration of three policy tracks considering reliability and system resilience metrics and targets, non-wire alternatives, and the state's clean and renewable energy program as part of its review of grid modernization efforts.

4.2.5 Tornadoes and Thunderstorms

According to the 2019 CT NHMP, the occurrence of tornadoes in Connecticut is not considered frequent enough to justify the construction of tornado shelters at this time. Instead, the state has provided NOAA weather radios to all public schools as well as many municipalities for use in local government buildings. These radios provide immediate notification of a weather watch or warning such that the community can advise students or residents to take appropriate precautions. In addition, the Connecticut State Building Code includes guidelines for the proper grounding of buildings and electrical boxes.

4.2.6 Wildfires

Connecticut enacted its first statewide forest fire control system in 1905, when the state was largely rural with very little secondary growth forest. By 1927, the state had most of the statutory foundations for today's forest fire control programs and policies in place such as the State Forest Fire Warden system, a network of fire lookout towers and patrols, and regulations regarding open burning. The severe fire weather in the 1940s prompted the state legislature to join the Northeastern Interstate Forest Fire Protection Compact with its neighbors in 1949.

There are procedures in place for requesting assistance or other resources to aid in responding to all hazards including forest and wildland fires. The first responding authority would be the local jurisdiction. If there is a need for additional aid or resources beyond the local capabilities, the Intrastate Mutual Aid Compact (Connecticut General Statute Sec. 28-22a) outlines the process for requesting assistance. If regional resources are depleted, Connecticut DEEP's Division of Forestry may be requested to assist local fire departments in suppressing wildland fires.

The Forestry Division maintains an active forest fire prevention program and a specially trained force of firefighting personnel to combat fires that ravage an average of 1,300 acres of forestland per year. During the spring fire season and at other times of high or above fire danger, the division broadcasts daily predictions of fire danger and issues advisories to state park staff, municipalities, fire departments, and the media. The division also has crews ready to assist the U.S. Forest Service in controlling large fires across the nation.

The Forestry Division at the Connecticut DEEP keeps close watch over areas with below normal precipitation and utilizes precipitation and soil moisture data to compile and broadcast daily forest fire probability forecasts. Forest fire danger levels are classified as low, moderate, high, very high, or extreme.

The Connecticut DEEP has an Open Burning Program for municipalities. The program requires individuals to be nominated by the Chief Executive Officer in each municipality that allows open burning. Nominees must take an online training course and exam to become certified by the Connecticut DEEP as a local "Open Burning Official." Permit template forms were also revised that provides permit requirements so that the applicant / permittee is made aware of the requirements prior to,

during and after the burning activity. The regulated activity is then overseen by the certified local official.

4.2.7 Drought

The State of Connecticut maintains a website at https://portal.ct.gov/Water/Drought/Drought-Home that is the drought information center maintained by the Interagency Drought Work Group. Links are provided to various information sources such as the U.S. Drought Monitor; groundwater, streamflow, and reservoir levels; and the Palmer Drought Severity Index. As such, State officials are well-positioned to track the occurrence of droughts in Connecticut and assist local communities.

As a planning mitigation effort developed after the 2002 drought that affected the state, the National Drought Mitigation Center through the Interagency Drought Work Group prepared a "Connecticut Drought Preparedness and Response Plan". The purpose of this plan is to help assess and reduce the impact a drought has over an area by conserving essential water use during water shortages. These two mitigation practices may make the difference in the severity of a period of drought across the region. The Connecticut Drought Preparedness and Response Plan was last updated in 2018 using the lessons learned during the 2015-2016 drought.

The Connecticut Department of Public Health completed the Water Utility Coordinating Committee process in 2018 and prepared a Statewide Coordinated Water System Plan. This process identified future public water supply needs in Connecticut and the utilities best suited to meet those needs. The impacts of drought on the availability of water supply (and to a lesser extent, control of wildfires through evaluation of fire protection) is listed as one of the top ten considerations for the State's public water suppliers.

The Forestry Division at the Connecticut DEEP keeps watch over areas exhibiting below normal precipitation, because of the increased risk of fires in times of drought. The Connecticut Farm Services Agency manages the Livestock Forage Disaster Program or "LFP" which provides compensation to eligible livestock producers that have suffered grazing losses for covered livestock on land that is native or improved pastureland with permanent vegetative cover or is planted specifically for grazing. The grazing losses must be due to a qualifying drought condition as measured by the U.S. Drought Monitor during the normal grazing period for the county.

The Connecticut Farm Services Agency manages the Livestock Forage Disaster Program "LFP", which provides compensation to eligible livestock producers that have suffered grazing losses for covered livestock on land that is native or improved pastureland with permanent vegetative cover or is planted specifically for grazing. The grazing losses must be due to a qualifying drought condition as measured by the U.S. Drought Monitor during the normal grazing period for the county.

4.2.8 Earthquakes

CTDOT has indicated that one of its long-term goals is to design and retrofit earthquake resistant roads and bridges. In addition, the 2018 Connecticut State Building Code includes seismic design criteria for buildings. New construction in each of the WestCOG municipalities is required to meet the requirements of Seismic Design Category B or C depending on site soil class.

4.2.9 Dam Failure

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

The dam safety requirements are codified in Sections 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 and set requirements for the registration, classification, and inspection of dams. Connecticut Public Act 83-38 (incorporated into Connecticut General Statute 22a-401 through 22a-411) required that the owner of a dam or similar structure provide information to the Commissioner of Connecticut DEEP by registering their dam by July 1, 1984.

Important dam safety program changes have occurred in Connecticut over the past decade. Act No. 13-197, An Act Concerning the Dam Safety Program and Mosquito Control, passed in June 2013 and implemented new requirements for dams related to registration, maintenance, and EAPs. This act required owners of certain unregistered dams or similar structures to register them by October 1, 2015. The Act generally shifts regularly scheduled formal inspection and reporting requirements from the Connecticut DEEP to the owners of dams (Table 4-3). The act also makes owners generally responsible for supervising and inspecting construction work and establishes new reporting requirements for owners when the work is completed.

Table 4-3: Dam Inspection Schedule

Hazard Classification	Inspection Frequency
AA – Negligible Hazard	At least once
A – Low Hazard	Every 10 years
BB - Moderate	Every 7 years
B – Significant Hazard	Every 5 years
C – High Hazard	Every 2 years

Source: Connecticut DEEP Dam Safety Division

Dams found to be unsafe under the inspection program must be repaired by the owner. Depending on the severity of the identified deficiency, an owner is allowed reasonable time to make the required repairs or remove the dam. If a dam owner fails to make necessary repairs to the subject structure, the Connecticut DEEP may issue an administrative order requiring the owner to restore the structure to a safe condition and may refer noncompliance with such an order to the Attorney General's Office for enforcement. As a means of last resort, the Connecticut DEEP Commissioner is empowered by statute to remove or correct, at the expense of the owner, any unsafe structures that present a clear and present danger to public safety.

Dams permitted by the Connecticut DEEP must be designed to pass the 1% annual chance rainfall event with one foot of freeboard, a factor of safety against overtopping.

Significant and high hazard dams are required to meet a design standard greater than the 1% annual chance rainfall event.

EAPs are used in the event of a breach to reduce damage and loss of life by having a set plan of response for the event. Effective October 1, 2013, the owner of any high or significant hazard dam (Class B and Class C) must develop and implement an EAP. The EAP shall be updated every two years, and copies shall be filed with Connecticut DEEP and the chief executive officer of any municipality that would potentially be affected in the event of an emergency. Regulations adopted by the Connecticut DEEP established the requirements for such EAPs, including but not limited to (1) criteria and standards for inundation studies and inundation zone mapping; (2) procedures for monitoring the dam or structure during periods of heavy rainfall and runoff, including personnel assignments and features of the dam to be inspected at given intervals during such periods; and (3) a formal notification system to alert appropriate local officials who are responsible for the warning and evacuation of residents in the inundation zone in the event of an emergency.

To date, dam failure analyses have been prepared for many of the high hazard dams, and these are included in the EAPs. The inundation limits portrayed in the dam failure analysis maps represent a highly unlikely, worst-case scenario flood event and should be used for emergency action planning only. As such, they are appropriate to identify properties for which contact information should be included in the local emergency notification database. These analyses should not be interpreted to imply that the dams evaluated are not stable, that the routine operation of the dams presents a safety concern to the public, or that any particular structure downstream of the dam is at imminent risk of being affected by a dam failure.

The Connecticut DEEP also administers the Flood and Erosion Control Board program, which can provide noncompetitive state funding for repair of municipality-owned dams. Funding is limited by the State Bond Commission. CGS Section 25-84 allows municipalities to form Flood and Erosion Control Boards, but municipalities must take action to create the board within the context of the local government such as by revising the municipal charter. In many cases (particularly for small towns), a Town's Flood and Erosion Control Board is the Board of Selectmen.

4.2.10 Terrorism and Mass Casualty Events

Connecticut DEMHS and the Connecticut State Police share responsibility for counter terrorism efforts in Connecticut. According to Connecticut DEMHS, the purpose of counter terrorism activities is to utilize all resources available to state government to develop unified safety and security measures to prevent, mitigate, and manage incidents threatening the quality of life of the citizens of Connecticut.

The Connecticut Intelligence Center Unit collects, analyzes, and disseminates criminal and terrorism-related intelligence to law enforcement officials through the state as well as pertinent vetted information to authorized and appropriate agencies within the first responder and private sectors. Each DEMHS region in Connecticut has a Regional Intelligence Liaison Officer to coordinate with local law enforcement and other appropriate partners.

In general, it is recommended that an EAP be developed for all sensitive facilities such as schools, hospitals, corporate buildings, and government buildings.

4.3 Regional

While hazard mitigation activities take place at the local level, WestCOG and other regional entities also have an important role to play in reducing vulnerability to natural hazards as well as floodplain management. Descriptions of regional projects and plans is presented below.

4.3.1 Regional Hazard Mitigation Planning

WestCOG and its precursor agencies have long promoted hazard mitigation planning in the region. It is generally expected that WestCOG will help to facilitate HMP maintenance and also coordinate the next regional HMP update prior to the expiration of this Plan.

4.3.2 Regional Emergency Planning Team and Emergency Support Functions

WestCOG communities are part of Connecticut DEMHS Region 1 and Region 5 which include Regional Emergency Planning Teams that facilitate emergency management and hazard mitigation efforts in those areas. The DEMHS regions utilize areas representatives with a diverse variety of experience to comprise Emergency Support Functions that support overall DEMHS goals while providing in-depth insight and guidance for certain emergency areas. For example, ESF-6 deals with all emergency operations as it relates to regional mass care. The chairs of ESF-6 are responsible for providing and ensuring adequate amounts of regional assets are available in the event of an emergency, for providing annual training and exercises for volunteer staff and municipalities and ensuring emergency preparedness at the regional level.

WestCOG also serves on ESF-1 which deals with transportation matters with regards to emergency management planning. WestCOG has assisted in the review of diversion route maps and developing an inventory of transit resources for emergency and evacuation planning. ESF-1 meets for both DEMHS regions 1 and 5 and includes WestCOG, NVCOG, NHCOG, and MetroCOG.

4.3.3 Salt Marsh Studies

WestCOG worked with The Nature Conservancy to prepare Salt Marsh Advancement Zone Assessments for its shoreline communities in 2014. Each document describes potential areas where salt marshes may advance due to sea level rise, and by extension demonstrates areas at potential risk of being inundated by sea level rise.

4.3.4 Unified Planning Work Program

This program includes several studies related to hazard mitigation, particularly resilience efforts to analyze, assess, and improve the transportation system's vulnerability to natural hazards such as flooding and storm surge. The most recent documents for the Region were released on May 16, 2019.

4.3.5 Regional Viewer

WestCOG maintains a Regional Viewer consisting of property data and aerial imagery. Future improvements will be aimed at including regional zoning layers, FEMA flood zones, wetland data, and stormwater features. All of this information is useful evaluating the potential effects of hazards.

4.3.6 Regional Stormwater Management Planning

One requirement for municipalities under the MS4 program is to map all stormwater infrastructure, which is a challenge for many WestCOG communities due to infrastructure age, lost records, submerged infrastructure, and staff and funding availability. WestCOG has assisted its municipalities by prioritizing watersheds for mapping as noted on the following Fact Sheet.

4.3.7 Regional Plan of Conservation and Development

The Regional POCD 2020-2030 encourages infrastructure and climate resiliency as well as development patterns that avoid exacerbating runoff and flooding. The document includes a discussion on climate change (including sea level rise and the potential effects on stormwater management, surface water quality, erosion and sedimentation, and other issues. The POCD notes that many FIRMs are already obsolete because of changing rainfall patterns.

The Regional POCD notes that common priorities exist in the region's previous hazard mitigation plans that must be built upon to ensure a consistent regional approach to hazard mitigation. Numerous goals and policies in the Regional POCD are related to hazard mitigation, although some policies are more practical and/or achievable in the 5-year timeframe of this HMP than others. Potential projects that should be pursued by WestCOG in the next five years as noted in the Regional POCD include:

- Develop sample zoning language for adoption by WestCOG municipalities to address impervious surfaces, building coverage, model streambelts, tower siting, and Green Area cover standards
- Request that FEMA update FIRMs in the region with updated hydrological data. Note that this may be occurring as part of the updated FEMA studies underway.

4.3.8 Regional CRS Support

The NFIP CRS recognizes and rewards community floodplain management activities exceeding the minimum NFIP standards (see Section 4.1.1). By implementing local mitigation, floodplain management, and outreach activities that exceed the minimum NFIP requirements, communities can improve their CRS "class" and receive a discount on flood insurance premium rates within the community.

The Regional CRS Program supports member communities in their efforts to join the CRS, and to improve their CRS class rating once they have joined. Support available to communities through WestCOG include:

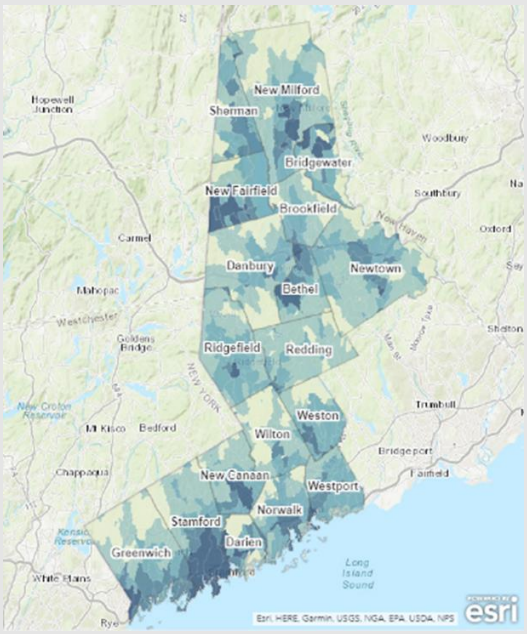
- Securing FEMA and CRS informational pamphlets for public locations, such as municipal offices or public libraries
- Development of a regional and community-based website
- Regional flood information GIS databases
- A flood information web map hosted by WestCOG
- Analysis of regional open space parcels within flood zones
- Regional CRS coordination, file sharing, and tracking

For example, WestCOG secured funding from CIRCA to assist Greenwich, Darien, Norwalk, and Danbury with applying to FEMA's CRS program. These communities have the four largest totals of paid flood insurance premiums in the region that are not in the CRS program. Entrance of these communities into the CRS program is anticipated to save on average $75 to $150 for each policyowner annually.

For this HMP, certain communities have a CRS-related action included in their municipal annexes. Communities that are already members of the CRS program have, in many cases, actions that explicitly or implicitly will help maintain or improve their CRS scores if implemented. Three communities have an action to pursue enrollment in the CRS program. A Fact Sheet describing the regional support program is included following this page.

MITIGATION SUCCESS STORY

CASE STUDY: WestCOG MS4 MAPPING PRIORITY



ArcGIS online map of WestCOG basins prioritized by impervious surface percentage

WHAT IS IT?

The General Permit for the Discharge of Stormwater for Small Municipal Separate Storm Sewer Systems, or the MS4 General Permit, requires municipalities to take necessary steps to ensure that water entering the stormwater system is clean before discharged into water bodies.

One requirement for municipalities is to map all stormwater infrastructure. Resources to achieve this requirement vary between municipalities, therefore making it challenging for all communities to have all systems mapped.

In order to assist communities with this challenge, WestCOG developed a map identifying priority areas that should be the initial focus of efforts. Prioritization was performed at the CT DEEP Subregional Basin scale based on the percentage of each Subregional Basin that is covered in impervious surfaces. Impervious surfaces (or paved surfaces) are those that do not allow water to percolate downward into the ground, leading to direct runoff into waterbodies during precipitation events; this in turn leads to water quality degradation and flooding.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

In addition to a Subregional Watershed prioritization for MS4 activities, this collaborative initiative developed resources such as:

- The UConn NEMO MS4 Guide, which provides informational resources and support
- Impervious Cover Statistics
- Stormwater GIS data
- Impervious Cover Webmap

Understanding the geography of impervious surfaces can help communities plan for mitigation of flooding exacerbated by such surfaces. Additionally, efforts to map stormwater infrastructure, as well as to complete other MS4 activities, can help improve municipal capabilities around flood mitigation.

All WestCOG communities are encouraged to review the resources available through this initiative. Those communities with high percentages of impervious surface are encouraged to complete stormwater infrastructure mapping and collaborate with WestCOG.

FOR MORE INFORMATION

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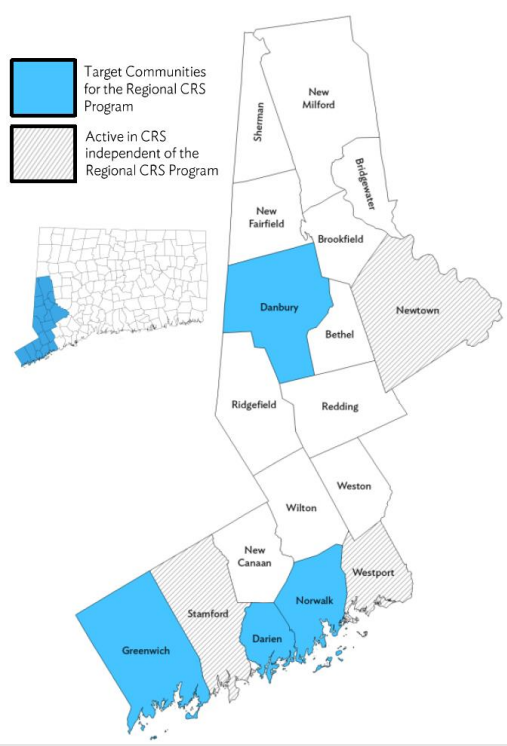
NEW INITIATIVES

REGIONAL COMMUNITY RATING SYSTEM SUPPORT



Regional CRS Target Communities
Image: WestCOG

WHAT IS THE INITIATIVE?

The National Flood Insurance Program (NFIP) Community Rating System (CRS) recognizes and rewards community floodplain management activities exceeding the minimum NFIP standards. Any community in full compliance with the minimum NFIP floodplain management requirements may apply to join the CRS.

The three goals of the CRS are:

1. Reduce flood damage to insurable property
2. Strengthen and support the insurance aspects of the NFIP
3. Encourage a comprehensive approach to floodplain management.

By implementing local mitigation, floodplain management, and outreach activities that exceed the minimum NFIP requirements, communities can improve their CRS "class" and discount flood insurance premium rates within the community.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

The WestCOG Regional CRS Program supports member communities in their efforts to join the CRS, and to improve their CRS class rating once they have joined. Support available to communities through WestCOG include:

- CRS outreach information that has been placed at public libraries
- FEMA informational pamphlets for municipal offices
- Development of a regional and community-based website
- Regional flood information GIS databases
- A flood information web map hosted by WestCOG
- Analysis of regional open space parcels within flood zones
- Regional CRS coordination, file sharing, and tracking

FOR MORE INFORMATION

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Associate Planner
Western CT Council of Governments
1 Riverside Rd.
Sandy Hook, CT 06482
(475) 323-2071
nsullivan@westcog.org

4.3.9 Road-Stream Crossing Survey Program

The Housatonic Valley Association (HVA) has been surveying and monitoring culverts throughout the Housatonic Valley in order to identify perched, undersized, and shallow culverts which both impede fish passage and are issues for flood conveyance. Work is ongoing, but thus far 15% of the surveyed culverts are expected to overtop during a 25-year flood event. HVA's program prioritizes the crossings at most risk and helps municipalities to find funding to upgrade such crossings. HVA is also creating Road-Stream Crossing Management Plans specific to municipalities to assist communities with identifying replacements, and also, in coordination with its project partners such as Trout Unlimited, can provide design assistance to reduce project costs.

4.3.10 WestCOG Economic Development Strategy

The Western Connecticut Economic Development District is a federally recognized economic development district within the Region. WestCOG produced, maintains, and implements an economic development strategy (known as the CEDS) which considers resilience and mitigation efforts in its goals, strategies, and projects. Goal 5 within the CEDS, "A More Sustainable and Resilient Region", is dedicated to promoting responsible strategies that contribute to both environmental sustainability and economic development.

Strategies in the CEDS include:

- Providing businesses resources for disaster recovery, educating businesses about disaster preparation and recovery
- Working with municipalities to make recovery frameworks for businesses
- Planning for the impacts of seas level rise, and coastal and riverine flooding
- Studying the impacts of sea level rise, and coastal and riverine flooding
- Prioritizing projects which mitigate the impacts of flooding

4.4 Municipal

Local mitigation capabilities generally fall within the six categories of Prevention, Property Protection, Emergency Services, Public Education and Awareness, Natural Resource Protection, and Structural Projects. An individual action could fall within one or more of these categories. Typical general local mitigation capabilities are discussed below.

4.4.1 Prevention

In general, preventative strategies are those that will keep a problem from getting worse. These often include adoption of regulations or conducting planning studies to better understand a vulnerability and potential solutions. The Fact Sheets on the following pages describe examples of flood and drought plans and studies that serve as hazard prevention strategies.

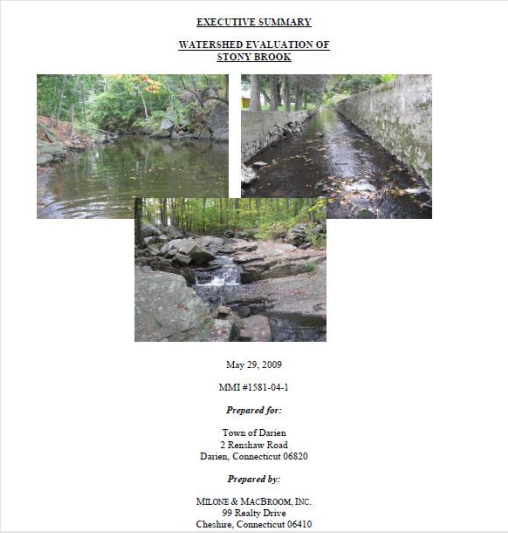
Prevention capabilities in the region include zoning regulations and subdivision regulations that restrict development in areas at risk of flooding or other unsafe areas, provide design criteria for development in certain zones, and require open space to be set aside. In Connecticut, the local ordinance designed to meet the minimum standards of the NFIP is often contained directly within the zoning regulations. However, recall from Section 4.2.1 that the State Building Code is more restrictive than the minimum NFIP standard. Local enforcement of the State Building Code is also a preventative measure overseen by the local Building Official. The Connecticut State Building Code is enforced statewide.

However, simply implementing the 2018 State Building Code locally without updating the flood damage prevention regulations may be insufficient, as the permitting and building approvals are not always parallel. Updating local regulations to incorporate State Building Code requirements will avoid confusion, aid enforcement, and make inspections more effective. Furthermore, updating local zoning regulations can support municipal efforts to bring the local building-stock up to code.

Connecticut DEEP has designed a model ordinance that incorporates the higher regulatory standards required by the State Building Code. The model ordinance includes provisions for both inland and coastal communities as discussed in Section 4.2.1. These model regulations outline the changes municipalities need to make to incorporate the current State Building Code language.

MITIGATION SUCCESS STORY

FLOOD STUDIES IN DARIEN



EXECUTIVE SUMMARY

WATERSHED EVALUATION OF STONY BROOK

May 29, 2009

MMI #1581-04-1

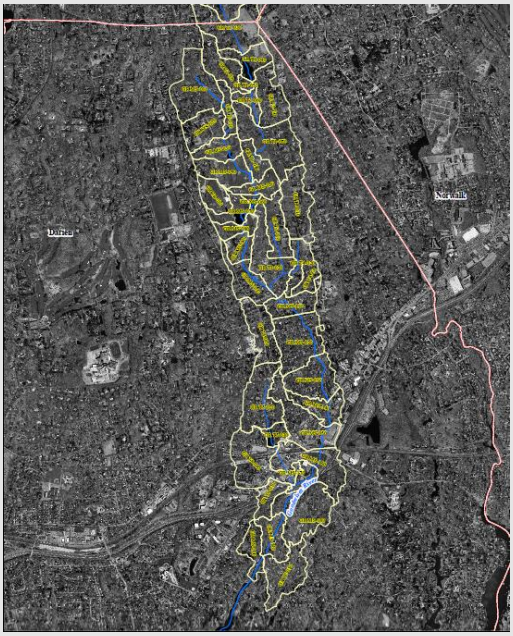
Prepared for:

Town of Darien
2 Renshaw Road
Darien, Connecticut 06820

Prepared by:

MILONE & MACBROOM, INC.
99 Realty Drive
Cheshire, Connecticut 06410

Cover Page for the Stony Brook Study



Goodwives River Watershed Map

FOR MORE INFORMATION

Jeremy Ginsberg
Planning & Zoning Director
Town of Darien
2 Renshaw Road
Darien, CT 06820

WHAT IS IT?

The Town of Darien hired a consultant to evaluate flooding conditions along several watercourses within the community, including the Stony Brook, Goodwives River, and Noroton River watersheds. Residents have experienced significant flooding within these watersheds. The flood studies performed present evaluations of hydraulic conditions and recommendations for mitigation where possible.

The flood studies consisted of:

- Hydrologic evaluations of the watersheds
- Hydraulic analysis of river channels
- Evaluation of mitigation measures
- Development of a master plan for long-term improvements

The final reports included summaries of flooding concerns and locations, detailed flood maps and hydraulic information, and site-specific flood mitigation recommendations.

Since completion of the studies, Darien has been able to implement mitigation activities recommended in the reports.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

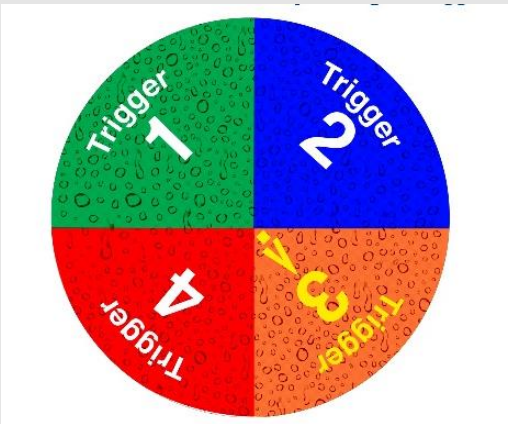
WestCOG municipalities can perform detailed flood studies that cover the entire communities, or that focus on specific watersheds that have known flood challenges.

Performing studies that evaluate flooding on the watershed scale allows for a more comprehensive understanding of that area's hydrology and hydraulic setting, which will enable implementation of more successful and sustainable solutions.

As climate change alters precipitation patterns and accelerates sea level rise, these kinds of flood studies may become even more important.

MITIGATION SUCCESS STORY

AQUARION DROUGHT PLANNING AND ALERTS



Aquarion Drought Trigger Framework
Image: Aquarion Water Company

Sign announces water ban
Photo: CT Post

WHAT IS IT?

Aquarion Water Company publishes weekly water supply updates for the water systems in the WestCOG region. The weekly status reports summarize water demand, reservoir status, and rainfall trends, thereby providing key data to municipalities to help inform decision-making about activities such as water restrictions.

To simplify the information, Aquarion assigns current conditions as one of four "Drought Triggers." Each trigger level calls for successively more significant water conservation measures, such as voluntary or mandatory irrigation restrictions. Water conservation measures recommended by Aquarion include:

- Cut your grass taller: taller grass shades roots and retains soil moisture
- Water less: grass roots will respond by growing deeper
- Adjust your sprinklers so that they're not watering the street or sidewalk
- Use hand watering or drip irrigation for shrubs and flowers
- Inspect your irrigation system for leaks, breaks, or blockages
- Turn off the water while soaping, shaving, or brushing and minimize baths and the amount of water you use for each; trim a minute off your showers
- Wash only full loads in your dishwasher and washing machine
- Reuse dehumidifier, shower, or other water to water plants

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Aquarion and its member communities sustained severe losses in the drought of 2015-2017. Reactionary water use bans and restrictions imposed on new developments caused economic disruptions, and emergency measures such as the temporary pipeline along the Merritt Parkway cost Aquarion millions of dollars in unplanned expenditures.

Lessons learned during the drought have contributed to permanent changes such as alternate-day lawn watering restrictions in southwest Fairfield County. These changes, in turn, have fostered judicious water use that allow economic activity and avoid emergency water supply expenditures. These avoided losses are aligned with the goals of hazard mitigation and reduce costs going forward, allowing the communities and Aquarion to sustain subsequent flashy droughts like the one experienced in 2020.

FOR MORE INFORMATION

Aquarion Water Company
200 Monroe Turnpike
Monroe, CT 06468
1-800-732-9678
www.aquarionwater.com/conservation

Local inland wetlands and watercourses regulations provide an additional layer of local oversight over activities that may encroach upon wetlands and watercourses. Local regulations are typically enforced by a Zoning Enforcement Officer or a Land Use Inspector, a municipal employee who provides a liaison to the applicable commissions. Prevention capabilities also include regular inspections of dams by the property owner.

Each WestCOG municipality has a local POCD. Several goals of these plans are pertinent to hazard mitigation, including conservation goals such as protecting natural resources, addressing drainage problems, preserving open space and greenways, and infrastructure goals such as addressing community facility and utility needs. POCDs typically identify watercourses, steep slopes greater than 25%, wetlands, and the SFHA as resources to preserve and avoid to the extent possible. A typical goal identified in local POCDs is to encourage future development away from sensitive natural resources and to minimize potential impacts. A variety of goals and objectives related to hazard mitigation have been identified in the local POCDs which are discussed in the annexes for each community.

4.4.2 Property Protection

Property protection strategies typically address the vulnerability of individual buildings. This can include methods to make one building or a series of nearby buildings more resilient.

Many property protection measures, such as elevation to reduce the impact of flooding, are costly and may require acquisition of grant funding to successfully complete. Details of a successful home elevation in Greenwich are presented on the following Fact Sheet. WestCOG municipalities have experience in preparing grant applications such that this effort can be performed when applicable. Other resources are available to assist with grant applications, including WestCOG staff and private consultants.

Each WestCOG municipality has a tree warden who encourages residents to cut trees that may be dangerous to power lines, and who identifies trees on municipal property and along rights-of-way that require trimming. While local public works staff can perform ground-level trimming, most elevated trimming is contracted out in the region.

The SHPO historic resource resiliency planning initiative is described in more detail in Section 4.2.1. Most municipal annexes in this HMP include at least one action related to this initiative.

Because community planners often do not know which resources may be historic or cultural, or which are most likely to be considered historic in the next decade as structures built in the 1950s and 1960s become eligible, it can be difficult to evaluate risks to flooding and other hazards. Therefore, this HMP suggests that several WestCOG municipalities conduct a survey of potential historic resources that focuses on areas within natural hazard risk zones. Some municipalities should also seek to inform owners of historic property regarding retrofitting methods that are hazard resilient but do not conflict with historic preservation goals.

4.4.3 Emergency Services

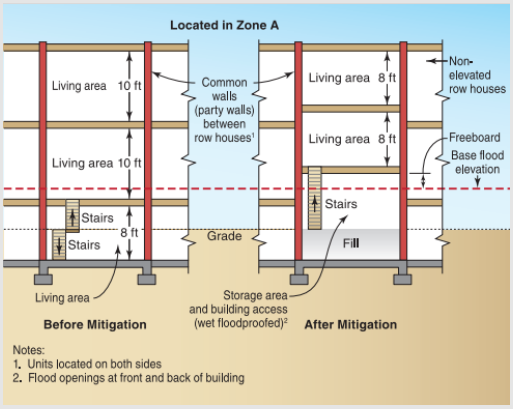
Emergency services strategies are typically aimed at strengthening or protecting emergency services before, during, or immediately after an occurrence. Mitigation measures related to emergency services typically involve increasing lead times prior to the occurrence of an event and ensuring that adequate facilities and supplies are available to property respond to an event including backup supplies such as generators. An example where New Canaan improved its emergency power capabilities is presented on a Fact Sheet following this page.

Local emergency management directors are typically responsible for monitoring local weather warnings and advising local personnel, and work with the owners of large dams to ensure there is lead time to enact the EAP if a failure was imminent. Mitigation strategies that protect reservoirs and wellfields which are used to provide fire protection water also fall under emergency services.

Each WestCOG municipality maintains a community-wide Emergency Operations Plan (EOP) that is currently updated annually. Under Public Act 15-20, beginning on January 1, 2017 local EOPs must be updated and filed with DEMHS every other year. This plan may include evacuation procedures for certain parts of a community,

MITIGATION SUCCESS STORY

HOME ELEVATIONS: GREENWICH



Home elevation example, FEMA

Greenwich home elevation
Photo Helen Neafsey / CT Post

FOR MORE INFORMATION

Dan Warhoza
Emergency Management Operations Coordinator
Town of Greenwich
Daniel.Warhoza@greenwichct.org

WHAT IS IT?

Home elevation generally refers to the retrofit of a residential property so that all livable spaces are raised above flood levels. This is completed by converting the lower levels of a structure into an enclosure that is flood resistant or completely floodable, in compliance with FEMA guidelines. While there are several techniques for home elevation, typically an existing structure is lifted off of its existing foundation and placed onto a new, higher foundation. New construction built above flood elevations is also referred to as being elevated.

Home elevation projects must adhere to local zoning regulations and ordinances. These include requirements to be elevated above the local Base Flood Elevation (BFE) and freeboard (additional elevation requirements above the BFE, typically instituted as a safety precaution), and compliance with local height restrictions (some communities offer flexible height restrictions in the case of home elevations performed to meet floodplain zoning regulations.

Home elevation is the only flood mitigation activity permissible by FEMA for private properties in flood zones.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Flood damages and repairs can be extremely costly depending on the event and severity of impairment. Therefore, homeowners are urged to seek mitigation strategies to help ease the financial burden of flood recovery.

Property owners throughout the region with homes vulnerable to flooding, in either coastal or riverine flood zones, can consider elevation as a mitigation strategy. While it can be costly, grant funds can be utilized for elevation projects.

The town of Greenwich was able to obtain FEMA funding to partially fund elevations along the shoreline. Damages from Superstorm Sandy in conjunction with a change to municipal codes encouraged residents to elevate.

Other WestCOG municipalities have successfully elevated homes over the past few decades including Westport and Newtown.

MITIGATION SUCCESS STORY

RESILIENT LOCAL POWER SYSTEMS IN NEW CANAAN

Turning on the Town Hall Solar Array
Photo: Grace Duffield

New Canaan WWTF

FOR MORE INFORMATION

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WHAT IS IT?

The Town of New Canaan has been working to mitigate the impacts of large-scale power outages on its local operations. Their efforts have consisted of expansion of emergency power systems, construction of small-scale combined heat and power (CHP; also called cogeneration) plants, and installation of solar panels.

New Canaan has acquired a trailer to transport a portable generator to provide backup power to shelters, and is currently looking into acquiring a second, larger trailer. The Town is actively pursuing installation of a CHP at the Wastewater Treatment Facility (WWTF), the Middle School, the High School, the YMCA (a shelter), and the Highway Garage.

The Town has installed solar panels at four municipal buildings and the South School, and is currently solarizing East School. The Town also has plans to solarize parts of the Middle School, High School, and WWTF, as well as the YMCA and Waveny Care Network. Solar power is already located at the Town Pool and Nature Center.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Power-outages caused by the effects of winter storms, hurricanes, lightning, and other natural hazards is one of the most cited impacts of natural disasters in the region. Such outages can have direct impacts on health, safety, and the economy, as well as indirect impacts on hazard response and recovery efforts.

New Canaan's multifaceted approach to increasing local power generation (by acquiring generators, constructing more significant CHP palnts, and installing solar power) enhances local power resiliency.

Communities can also consider developing microgrids that encompass critical facilities. A microgrid is a localized electric system that includes both electricity sources (such as power plants, generators, fuel cells, or solar panels) and electricity users. Under normal conditions, a microgrid is connected to regional electric grids, but during regional power outages a microgrid is able to act in "island mode," maintaining power to connected users.

such as mobile parks, campgrounds, or areas subject to flooding. It may also identify areas that may be difficult to access with emergency vehicles, such as narrow roads or steep roads that may be difficult to pass during winter storms. In addition, each community is party to other emergency planning documents, such as EAPs for significant and high hazard dams. These EOPs and EAPs provide a framework for responding to emergencies. Note that local emergency management directors are also typically responsible for maintaining mutual aid agreements with surrounding communities.

All municipalities currently utilize the state supported WebEOC, an interactive web application, for their incident management functions. The software enables the state, region, and its municipalities to track and monitor data as well as resources. WebEOC capabilities include event reporting, data repositories, and situational awareness. The latter creates the ability to communicate resource requests to mobile or field devices so long as an internet connection is provided. The software requires diligence from the user end with a need for continuous updating and sending of information.

One measure taken each winter is plowing. Local public works departments typically perform local plowing with assistance from local park departments and outside contractors. Pre-storm treatment is applied in most communities to mitigate the impacts to driving, and parking bans can be declared in each WestCOG municipality to ensure that access can be maintained for plows. Most communities have standardized plowing routes that prioritize access to critical facilities.

The WestCOG municipalities rely primarily on radio, television, area newspapers, the internet, local emergency notification systems such as CodeRED, and the state CT Alert emergency notification system to notify residents of oncoming storm danger and to announce the availability of shelters. Some communities are small enough that the creation of informational displays in local municipal buildings and high traffic businesses (such as supermarkets) can be performed. Other local capabilities are described in each annex. Prior to severe storm events, WestCOG municipalities ensure that warning and notification systems and communication equipment are working properly and prepare for the possible evacuation of impacted areas.

Several WestCOG communities have Local Emergency Planning Committees that focus on preparedness. Committee roles may include identification and cataloguing of potential hazards, identifying available resources, mitigating hazards when feasible, and preparation of emergency plans. These committees are structured to anticipate and plan the initial emergency response for foreseeable disasters but not to participate in the response.

In addition, some communities have Community Emergency Response Teams composed of local citizens who are trained to aid emergency responders. Local emergency staff typically review new development projects for emergency response access concerns and encourage the creation of through streets to ensure multiple modes of egress and encourage private property owners to widen access for emergency equipment. Finally, the purchase of any new emergency response equipment (such as all-terrain vehicles to access remote wildfires) would fall under this category.

The 18 WestCOG communities have made many improvements to mitigate the ever-present threat of violence through regular training and the purchase of appropriate protective equipment. Only with continued vigilance can the region continue to strengthen its preparations and ensure the well-being of their communities.

4.4.4 Public Education and Awareness

Public education strategies seek to inform State officials, local officials, or the general public about ways to protect oneself from the effects of natural hazards, ways to increase resiliency to natural hazards, or to increase coordination between groups to achieve a common goal. For example, the WestCOG municipalities each make available a variety of pamphlets related to hazard mitigation and/or have website sections dedicated to discussing emergency preparedness. A Fact Sheet included on the following page describes an example of an informational brochure developed by the City of Stamford and sent to property owners in flood zones. Local building departments also have information available regarding design standards.

MITIGATION SUCCESS STORY

STAMFORD FLOOD PROTECTION INFORMATION BROCHURE

Stamford Flood Brochure Cover

FOR MORE INFORMATION

City of Stamford
Environmental Protection Board
888 Washington Boulevard
Stamford, CT 06901
203-977-4028
www.bepreparedstamford.org

WHAT IS IT?

The City of Stamford produces an annual brochure full of useful information for residents and property owners related to flood hazards and mitigation. The brochure covers identification of flood zones, natural and beneficial functions of the floodplain, flood warning systems, the National Flood Insurance Program, property protection, relevant laws, and ways to get assistance.

The annual brochure is distributed to properties within mapped flood zones, and is available at municipal buildings and through the city's website.

Production and distribution of the brochure helps meet FEMA Community Rating System (CRS) requirements. Through the CRS, communities can earn points for actions that go above and beyond minimum FEMA mitigation requirements, and reduce federal flood insurance premiums for local property owners.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Public communication, education, and outreach about flood and other natural hazard risks is an important part of a comprehensive hazard mitigation strategy.

These efforts must be performed on a regular basis, and should target a wide audience.

Public engagement programs can include:

- Brochures mailed to residents
- Informational websites
- Social media campaigns
- Workshops, seminars, or webinars
- Educational materials at municipal buildings

A variety of federal agencies (FEMA, NOAA, etc.) have information available on family preparedness procedures and the best physical locations to be during each type of storm event. This information is made available by each WestCOG municipality when pamphlets are available.

Each municipal annex of this HMP includes at least one action related to the Sustainable CT initiative. Annexes of communities that are not already registered with Sustainable CT have an action to register. Annexes of communities already registered have an action calling for the community to pursue one of the following Sustainable CT strategies relevant to hazard mitigation:

- Identify, or create and disseminate, a toolkit for pre-disaster business preparedness and for post-disaster conditions.
- Review and revise regulations to encourage and promote LID.
- Review the POCD and adopt a revised POCD that includes the Hazard Mitigation Plan goals and at least three other sustainability concepts.

4.4.5 Natural Resource Protection

Natural resource protection strategies focus on protection of natural resources, often through the acquisition of open space to prevent future development. Preservation or enhancement of open space could, for example, allow floodplain functions to be able to be performed unimpeded by development. A common natural resource protection strategy is the acquisition of property at risk of flooding and converting that property to open space, but undeveloped land could also be purchased and so assigned. Subdivision regulations typically require open space set-asides to provide a measure of natural resource protection, and local POCDs typically either have or reference and Open Space Plan that prioritizes future open space acquisition, development of trails and greenways, and funding sources for open space. Of particular interest to many communities is that recreational uses on open space are encouraged within SFHAs. Communities often work directly with local land trusts to accomplish common conservation and floodplain management goals related to land acquisition. An example of a property acquisition mitigation success story in Stamford is described on the following Fact Sheet.

Communities that control large areas of forests and brush land occasionally conduct controlled burns to minimize the amount of low-lying combustible materials that could lead to dangerous wildfires during dry conditions. Such burns are often conducted under the guidance of the Connecticut DEEP.

The availability of the *Low Impact Sustainable Development Design Manual* presents an opportunity to guide local flood hazard mitigation actions. Strategies such as reducing impervious services, installing infiltration systems, and zone-specific standards can address environmental impacts that come from typical development approaches such as extensive parking areas, box-building construction, and rapid stormwater removal from a site.

LID can increase the resilience of communities to the impacts of climate change on the natural, built, and human environments. Installation of LID infrastructure increases small and rural community resiliency in many ways, including:

- Protecting drinking water supplies, streams, rivers and other water resources throughout the watershed
- Protecting natural vegetation, hydrology and other resources on development sites
- Reducing damage to local roads, bridges, the built environment, as well as to agricultural resources and human environments.

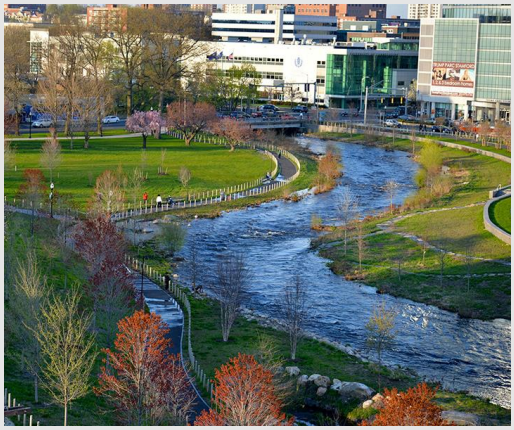
Mitigation actions that promote the use of LID techniques were incorporated into many of the municipal annexes of this HMP. Primarily, this was done through the action related to Sustainable CT, which includes a sub-action to "Revise regulations to promote LID".

4.4.6 Structural Projects

Structural project strategies typically include construction of a capital improvement that reduces vulnerability to natural hazard damage, such as dams, floodwalls, or access roads into outlying areas. Drainage systems and

MITIGATION SUCCESS STORY

MILL RIVER PARK PROPERTY ACQUISITONS IN STAMFORD



High flows in Mill River Park
Photo: The Olin Studio

Aerial design drawing of the park
Image: The Olin Studio

FOR MORE INFORMATION

Stamford Planning & Zoning
888 Washington Boulevard
7th Floor
Stamford, CT 06901
(203) 977-4711

WHAT IS IT?

The Mill River Corridor Project is an ambitious effort that has added some 19 acres of parkland along both sides of the Rippowam (Mill) River and upgraded seven acres of parkland.

Creation of the park included dam removal, dredging, planting and landscape design, and acquisition of properties and easements to preserve open space. Property acquisitions included the purchase and removal of existing structures, as well as acquisition of open space in order to prevent development on those lots.

Overall, the project has cost over $20 million, over half of which has come from federal funding. The Mill River Corridor Project has mitigated dam failure hazard through dam removal, and mitigated flood hazards by creating floodplain storage and preventing development within an area of flood risk. It has also created social and ecological benefits.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Property owners that experience flooding regularly may be interested in relocating or may struggle to sell their property as values drop. Municipalities may want to avoid the costs of ongoing maintenance, mitigation, and emergency response activities.

In such situations, municipalities can support owners by acquiring their at-risk properties and enabling them to relocate. Flooding can be further mitigated by removing structures on such properties and preserving them as open space.

State and federal grants are often available for property acquisition and open space creation, bringing money into the community and supporting the local economy.

public water systems are the most typical structural projects in place in most WestCOG communities.

Structural projects related to flood mitigation are aimed at drainage system installation and maintenance and increasing conveyance at culverts and bridges. Local public works departments are typically responsible for maintenance of municipal drainage systems while the CTDOT maintains those for state roads. This maintenance includes programs to clean out blockages caused by growth and debris. An example of a recent drainage project funded in Brookfield and road drainage improvements in New Milford are presented on the following Fact Sheets.

Other structural project strategies can include the installation of new water mains to provide fire protection to outlying areas, or installation of dry hydrants for the same purpose. Storage tanks can also be installed in new developments in outlying areas to provide a source of firefighting water. Such structural projects are also typically emergency services projects.

MITIGATION SUCCESS STORY

BROOKFIELD DRAINAGE PROJECT

Flooding in the Meadowbook Manor neighborhood Photo Newstimes (Hearst Connecticut Media)

Construction on Meadowbrook Road Photo Carol Kaliff / Newstimes (Hearst Connecticut Media)

FOR MORE INFORMATION

Ralph Tedesco, P.E.
Director of Public Works
Town of Brookfield
(203) 775-7300
www.brookfieldct.gov/public-works

WHAT IS IT?

Meadowbrook Manor in Brookfield has been plagued by flooding for more than five decades. In addition to direct damage to property and the blocking of roads, severe flooding events in Meadowbrook Manor resulted in contaminated septic water flowing into homes.

Through an evaluation of flooding within the Still River Corridor, the Town identified a cause of the flooding to be the insufficient drainage infrastructure in the neighborhood.

In 2016, the town successfully implemented a conveyance and drainage improvement project at Meadowbrook Manor.

The project used $1.3 million in FEMA funding, as well as a local match, to install a new stormwater drainage system with increased capacity to reduce flooding from Lime Kiln Brook.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Municipalities across the region struggle with flooding attributed to inadequate drainage and undersized culverts and bridges.

Drainage systems may not be sufficient for current flow conditions because of a combination of expanding impervious surfaces over time (which leads to increase peak flow volumes), rising precipitation magnitudes related to climate change, degradation and lack of maintenance, or inadequate initial design standards.

In order to address this challenge, communities can upgrade or construct new drainage and sewer systems are appropriately sized to pass high flow events under current conditions. Sizing culverts and bridges so that debris can pass unimpeded can have additional benefits in terms of performance, longevity, and local ecosystems.

MITIGATION SUCCESS STORY

ROAD DRAINAGE IMPROVEMENTS IN NEW MILFORD

Photos of the roads before repair
Photo: New Milford

WHAT IS IT?

The Town of New Milford performed a road repaving and repair project on Squire Hill Road and Long Mountain Road.

The project included drainage upgrades, erosion damage repairs and mitigation, and improvements to the road surface.

While not explicitly pursued as a hazard mitigation action, the project mitigated flood and erosion concerns and improved emergency services capabilities by reducing the risk of these roads becoming impassible.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Communities are always pursuing capital improvement projects and may not realize that many of those projects also have hazard mitigation benefits. Drainage improvements on roadways can mitigate flood damages to the roadway and downstream, reduce pollution to downstream waterbodies, and maintain important transportation connectors to allow emergency access and egress.

Municipalities should review their capital improvement plans to identify projects that achieve, or can be revised to achieve, hazard mitigation goals. Those projects can then be included in the hazard mitigation plan and may be eligible for FEMA funding.

FOR MORE INFORMATION

New Milford Highway Department
6 Young's Field Rd
New Milford, CT 06776
public_works@newmilford.org
(860) 355-6045

5.0 Mitigation Strategies

5.1 Types of Mitigation Strategies

Potential mitigation strategies are numerous and varied. Not all mitigation strategies are appropriate for every community, and some communities have greater capacity to institute mitigation strategies than others. The general mitigation strategies below should be considered by each WestCOG municipality whenever conditions are appropriate. These are in addition to the specific strategies and actions outlined in each municipal annex.

5.1.1 Prevention

Example preventative mitigation strategies for natural hazards can include:

- Strengthen flood mitigation provisions in local land use regulations to be, at a minimum, consistent with those in the 2018 State Building Code.
  - Structures in all inland SFHAs (including A zones) must have the lowest floor elevated to the BFE plus 1 foot
  - Structures in coastal SFHAs must have the bottom of the lowest horizontal structural member elevated to the BFE plus 1 foot
  - Critical facilities must meet the above requirements to the BFE plus 2 feet

- Strengthen flood mitigation provisions in local land use regulations by adopting "No Adverse Impact" policies, and/or lengthening the timeframe utilized for substantial improvement calculations to two or more years

- Develop and/or strengthen stormwater management regulations and programs, such as by reducing stormwater runoff from new development sites and adoption of impervious surface limitations

- Prepare watershed management plans

- Join FEMA's CRS program

- More effectively use FEMA Elevation Certificates to ensure compliance with flood regulations (as required for the CRS program)

- Conduct hydrologic and hydraulic studies to evaluate risks and potential flood mitigation strategies.

- Develop stream buffer ordinances

- Assess vulnerability of structures and infrastructure in shoreline areas to the sea level rise scenarios prepared by CIRCA

- Prohibit reconstruction and redevelopment in areas susceptible to chronic flooding

- Utilize a tracking program to track natural events and responses in order to help prioritize potential future projects.

Regarding terrorism and mass casualty events, it is recommended that an EAP be developed for all sensitive facilities such as schools, hospitals, corporate buildings, and government buildings. Such a plan will perform the following critical functions:

- Identify critical first responder contacts such as police, fire departments and hazardous materials crews

- Develop proper evacuation protocols to enable occupants to evacuate the building as quickly as possible

- Identify areas in the building where occupants can hide if evacuation is not possible such as windowless storage closets or designated safe areas

- Identify local hospitals and treatment centers for potential victims

- Develop training exercises, which may consist of seminars and even active shooter drills and perform one at least once annually.

New codes and regulations may also be useful at deterring terrorist attacks:

- Building codes for new schools and municipal buildings should require bullet resistant glass for low-lying windows and doors in order to restrict unauthorized access

- Codes for new school and municipal buildings should also discourage windows closer than six feet to the ground outside of the building. Windows at this height would still allow for a safe exit in an emergency but would make it more difficult for an intruder to climb in with weapons. If windows must be placed lower, protective metal grates with interior emergency release latches can stop unlawful entry.

Finally, enhancing local planning is a key step in being prepared to respond to terrorist incidents. The formation of subcommittees should be pursued at the local and regional level to focus on the ability of local communities to respond to the threat of terrorism, sabotage, and mass casualty events.

5.1.2 Property Protection

A variety of property protection strategies can be implemented at the local level to prevent damage to individual properties. These can include:

- Elevating and floodproofing for homes and businesses, particularly RLPs

- Creation of flood walls to protect one or more buildings

- Inspection of trees and tree-trimming along power lines (by Eversource) and near vulnerable structures

- Locating utilities underground

- Insulating pipes to protect against freezing and bursting

- Removing snow from flat roofs or using heating coils to melt snow

- Temporarily hardening homes and businesses in advance of heavy wind events (boarding windows, closing shutters, moving small items inside)

- Performing wind damage retrofit projects (installing shutters, wind-resistant windows, code plus projects (those that exceed the local building code), roof projects, and load path projects)

- Strengthening and retrofitting non-reinforced masonry buildings and non-ductile concrete facilities that are particularly vulnerable to ground shaking

- Encouraging property owners to remove deadfall in wooded areas of their properties, and to trim back overgrowth encroaching on structures

- Hardening of critical facilities and infrastructure

- Installing surge protection on critical electronics

Property protection for terrorism and mass casualty consists of improvements that can serve as a deterrent to unauthorized entrance.

- Computer systems should be adequately backed up, protected by firewalls, and encrypted to prevent costly ransomware attacks and other cyberterrorism risks from international terrorist groups.

- Where space permits schools and other sensitive facilities should have either a guard building or other means of screening incoming traffic before entering the facility grounds.

- Door cameras installed at the entrances to buildings can allow receptionists to screen visitors before entering the building and remotely allow access.

- Magnetic door releases that can be activated by security staff could isolate an active shooter or threat in one area of the building, potentially reducing long stretches of open hallways which could be exploited by a gunman.

- Driveway alarms can alert staff in the building if an unauthorized vehicle is entering the driveway.

5.1.3 Emergency Services

Example mitigation actions related to emergency services may include:

- Floodproofing critical facilities, such as wastewater treatment plants, police and fire stations, EOCs, and emergency shelters
- Relocating critical facilities to locations outside of flood prone areas
- Requiring new municipal critical facilities to comply with the State of Connecticut design standards for critical facilities regardless of funding source
- Upgrade or install generators to ensure adequate backup power is available to critical facilities
- Improve coordination with local utilities, particularly "Make Safe" crews for clearing of tree debris near powerlines
- Improve emergency access to critical facilities
- Encourage or perform public water supply infrastructure upgrades for areas with substandard fire protection, and extensions into areas with without adequate fire protection
- Install dry hydrants or cisterns in areas where public water supply is not available
- Purchase equipment to fight forest fires in remote areas

Many schools and high-risk targets have found that an armed security or resource officer provides not only a deterrent to potential threats, but a more immediate response in the event that an attack does occur. According to a report from the CT Office of Legislative Research, of the 113 school districts in Connecticut, 70 (approximately 62%) report using school resource officers. The report states that, "Generally [these officers] are funded by the board of education or provided by local police departments through memoranda of understanding with the school district." Compensation for these officers varies by time spent at the school, number of schools covered by the officer, and school budgets.

Buildings critical to public health and safety, or of great economic interest should be retrofitted with emergency generators or tied into local microgrids (Section 5.1.6) in case of a terrorist attack on the power grid.

Finally, emergency training is critical for local responders to be properly prepared to respond to natural hazards, terrorism, and mass casualty events. An action to annually conduct an emergency operations exercise related to a local terrorism, sabotage, or mass casualty event has been added to each municipal annex.

5.1.4 Public Education and Awareness

Example mitigation actions related to public education and awareness may include:

- Perform outreach regarding flood risk, sea level rise, and safety, particularly to flood prone neighborhoods and owners of RLPs.
- Encourage property owners and renters in flood prone areas to purchase flood insurance
- Hold workshops to facilitate dissemination of information on technical assistance programs
- Add pages to municipal websites dedicated to natural hazard event preparation and safety during power outages
- Add seasonal pages to municipal websites to address preparation for typical natural hazard events such as winter storms, hurricanes, and thunderstorms
- Disseminate informational pamphlets and brochures to public locations such as municipal buildings and libraries
- Distribute wildfire risk information to properties along the wildland-urban interface.

Regarding terrorism and mass casualty, the need for more robust community preventative mental health services has been suggested as a way to reach community members who might be suffering from illnesses that predispose them to commit act of violence against the community. After the Sandy Hook shooting, the CT Office

of the Child Advocate published a 114-page report. Among many other findings regarding the perpetrator, it noted that "his severe and deteriorating internalized mental health problems were combined with an atypical preoccupation with violence. Combined with access to deadly weapons, this proved a recipe for mass murder" and "this report suggests the role that weaknesses and lapses in the educational and healthcare systems' response and untreated mental illness played in [the perpetrator's] deterioration."

Other public education and awareness strategies for reducing the threat of terrorism and mass casualty may include the following:

- The public should be made aware of the U.S. Department of Homeland Security "Active Shooter Booklet," which is a guide of best practices to preserve human life and avoid mass casualties during an active shooter situation. The DHS advises that someone should first attempt to evacuate the area when a mass shooting is taking place, they should hide out if evacuation is not possible, and confront the shooter only if evaluating and hiding out are not viable options.
- The mental health services offered by communities should be consolidated and released as a booklet which is sent to each parent of children in local school districts.
- Those who work in or visit potential target buildings should be advised as to how to avoid security breaches like propped doors and "tailgating" through restricted entrances.
- Community members should be encouraged to practice situational awareness and report suspicious activities to local authorities.

5.1.5 Natural Resource Protection

Example projects may include:

- Acquisition of property at risk of flooding (particularly RLPs) and conservation to permanent open space
- Protection and restoration of natural flood mitigation features such as wetlands, riverbanks, and dunes
- Establish riparian or vegetative buffers to prevent erosion, slow drainage, and improve water quality
- Establish a green infrastructure program
- Implement beach nourishment programs
- Acquire land in potential salt marsh advancement areas

5.1.6 Structural Projects

Structural projects may include bracing and hardening for critical equipment such as generators or retrofitting a dam to pass a larger flood event without causing damage to the dam. Other example projects may include:

- Increase capacity of stormwater drainage systems
- Separate combined storm sewer and sanitary sewer systems
- Increase capacity of detention and retention ponds and basins
- Elevate roads, bridges, and other infrastructure above the base flood elevation and/or potential sea levels
- Construct berms and dikes of erosion-resistant material to protect vulnerable buildings and areas
- Install bioengineered bank stabilization techniques
- Establish debris management and clearing capabilities

Power-outages caused by the effects of winter storms, hurricanes, lightning, and other natural hazards is one of the most cited impacts of natural disasters in the region. Such outages can have direct impacts on health, safety, and the economy, as well as indirect impacts on hazard response and recovery efforts.

Municipalities can mitigate damages and disruption caused by outages by working to increase the resiliency

of the power grid, improving outage response, installing emergency generators in critical facilities, developing local power generation and microgrids, and helping residents and businesses prepare for outages.

A microgrid is a localized electric system that includes both electricity sources (such as power plants, generators, fuel cells, or solar panels) and electricity users. Under normal conditions, a microgrid is connected to regional electric grids, but during regional power outages a microgrid is able to act in "island mode," maintaining power to connected users – typically critical facilities and nearby commercial nodes such as gas stations, pharmacies, and grocery stores.

Every municipal annex in this HMP includes some mitigation actions related to increasing the resiliency of the electric grid. Some mitigation actions include the following:

- Coordinate with the local energy utility on efforts to improve grid resiliency and outage response.
- Perform public outreach and education about power outage safety and mitigation.
- Maintain public "comfort stations" for residents without power to keep warm or cool, and recharge electronic devices.
- Create a communications plan that considers power loss, and the possible loss of internet and phone capabilities that may result.
- Maintain a list of residents who rely on powered medical devices to facilitate check-ins and response during power outages.
- Install backup power at critical facilities
- Explore development of local power generation (such as solar panels) and microgrids

Regarding terrorism and mass casualty, structural projects can serve as a deterrent to the unauthorized entrance into a property:

- Stormwater biorientation basins and swales can prevent unauthorized vehicular access to grounds by blocking easy off-road access to the grounds. These also serve to delay or discouraged unauthorized foot traffic as well and may provide flood mitigation co-benefits depending on sizes and positions.
- A fenced in perimeter with an access gate would keep a malevolent actor from driving a vehicle close to the building. This would require a perpetrator to carry potentially bulky weapons over the barrier in order to inflict damage on the target, increasing the odds of detection and giving the staff more time to respond.
- Bollards can be installed in front of school playgrounds and building entrances to keep malevolent actors from using vehicles to target people and ram access points. Modern retractable bollards can be raised and lowered as necessary during emergencies.
- Existing buildings can be retrofitted with bullet resistant glass, exterior metal window grates, and other means of preventing unlawful entry.

5.2 Mitigation Challenges

The following challenges faced by local communities in implementing hazard mitigation measures are common to most municipalities in the region. In the discussion of mitigation strategies that follows, some additional challenges unique to certain communities may be included; however, the following challenges apply to most WestCOG municipalities. These challenges can impact the effectiveness of existing authorities, policies, programs, and resources; however, it should be noted that local governments have a number of procedures and tools available that can allow them to adjust, over time, their programs, procedures, and resources to mitigate natural hazards more effectively.

5.2.1 Limited Resources

Local communities, as well as state and federal governments, private enterprise, nonprofit organizations, and households all face financial limitations which can restrict their ability to fully implement measures and activities that are in their best interest. At the local level,

most financial resources are provided through property tax revenue with additional support from state and federal governments through various programs and grants. The lingering effects of the Great Recession have severely tightened most local budgets. State budget limitations also affect local resources.

Through the local political and planning processes and budget deliberations, municipalities routinely reevaluate local programs and policies and adjust spending priorities. Expenditures on programs that support natural hazard mitigation may not always be considered by a community and its citizens as high a priority as expenditures related to schools or other local initiatives as well as those related to mandated programs and expenditures. The lack of, or limits on funding can lead to reduced effectiveness in a municipality's capability to accomplish hazard mitigation.

At the regional level, WestCOG's ability to implement mitigation activities is also tied to financial limitations. Funding is derived primarily from state and federal grants and programs and municipal dues. As these various levels of governments face financial cutbacks and changes in spending priorities, financial support to WestCOG can be impacted.

Finally, as discussed throughout Sections 4.1, 4.2, and 4.3, there are numerous ongoing federal, state, and regional programs ongoing that compete for the attention of local staff, boards, and commissions. As noted in those sections (and also in Section 5.1), there are numerous potential actions for WestCOG municipalities derived from these initiatives that are relevant to the goals of this HMP. Specific actions related to these programs have been incorporated as noted above into each municipal annex. Furthermore, Section 5.3 recommends that WestCOG actively facilitate completion of several objectives related to these programs over the next 5 years.

5.2.2 Multiple Jurisdictions

Hazard mitigation requires coordination among the multiple federal, state, and local agencies that influence development, maintenance, and emergency response activities. At the local level, some municipalities have difficulties getting their inland wetlands commissions and public works staff to agree on the appropriateness of drainage maintenance activities to reduce flooding risk. In addition, some communities face flooding risks from natural and/or man-made influences located in other communities, requiring interlocal coordination and communication. Finally, it can be difficult for a community to take full advantage of available federal and state resources for mitigation activities because programs are spread among different departments and agencies such as FEMA, the U.S. Department of Agriculture, Connecticut DEEP, and DEMHS.

Most WestCOG municipalities are active in regional organizations such as WestCOG, the Connecticut Conference of Municipalities, and the Connecticut Council of Small Towns, which provide a variety of services such as management and technical assistance, training, and coordination among various agencies; lobbying for changes in state legislation; use of shared resources; and negotiating for competitive contracts for a variety of goods and services. These organizations can help improve the effectiveness of many local efforts including hazard mitigation.

5.2.3 State Infrastructure

Many WestCOG municipalities have previously identified stormwater management as a high priority natural hazard mitigation concern. This concern continues. Many communities have specific locations subject to periodic flooding that result from state road drainage systems. Resolving minor flooding problems on state roads is difficult for municipalities because they have no purview over improvements on state infrastructure. Some such flooding areas pose emergency access risks while others present minor property damage concerns. Several towns also identified difficulties with the state's response to storm, snow, and accident cleanup on state roads.

In the aftermath of the two storms of 2011, Irene and Alfred, the Governor appointed a Two Storm Panel to review how the storms were handled and to make recommendations for future disaster preparedness and response. Among the panel's recommendations were a number calling for improvements in state infrastructure and disaster preparedness including developing "new engineering standards that will better protect the built environment from the effects of extreme weather," improved GIS mapping and analysis, and planning for the

issues rising sea levels will have on combined sewer overflows and dam safety.

5.2.4 Vulnerability to Power Outages

The widespread and lengthy power outages resulting from downed wires and damages to transmission lines due to Irene and the October snowstorm in 2011 brought attention to the need for tree maintenance in utility rights-of-way and along roadways and the need for better coordination and communication between Eversource and municipal officials. Among the Two Storm Panel's recommendations were calls for improved coordination among electric and telecommunications utilities, municipalities, and state agencies in dealing with tree maintenance; a comprehensive study of the feasibility, cost, and reliability of undergrounding utilities; and the establishment of a state working group to improve municipal and utility collaborations. Coordination issues occurred in many communities during Tropical Storm Isaias in August 2020 suggesting that coordination improvements have yet to be fully established.

5.3 Ranking of Mitigation Strategies

To prioritize recommended mitigation actions, it is necessary to determine how effective each measure will be in reducing or preventing damage. A set of criteria commonly used by public administration officials and planners was applied to each proposed strategy. The method, called STAPLEE, is outlined in FEMA planning documents such as Developing the Mitigation Plan (FEMA 386-3) and Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5). STAPLEE stands for the "Social, Technical, Administrative, Political, Legal, Economic, and Environmental" criteria for making planning decisions.

Criteria were divided into potential benefits (pros) and potential costs (cons) for each mitigation strategy. The following questions (Table 5-1) were asked about the proposed mitigation strategies:

Benefit-cost review was emphasized in the prioritization process by double ranking technical feasibility and economic considerations. Another consideration is the potential social costs of a project. FEMA encourages communities to consider issues of environmental justice when considering mitigation projects. This is because

Table 5-1. STAPLEE Benefit-Cost Overview

Benefit (Pro)	Cost (Con)
Social	
Is the proposed strategy socially acceptable to the community?	Are there any equity issues involved that would mean that one segment of the community could be treated unfairly? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower-income people? Is the action compatible with present and future community values?
Technical	
Will the proposed strategy work? Will it reduce losses in the long term with minimal secondary impacts?	Is the action technically feasible? Will it create more problems than it will solve? Does it solve the problem or only a symptom?
Administrative	
Does the project make it easier for the community to administrate future mitigation or emergency response actions?	Does the community have the capability (staff, technical experts, and/or funding) to implement the action, or can it be readily obtained? Can the community perform the necessary maintenance? Can the project be accomplished in a timely manner?
Political	
Is the strategy politically beneficial? Is there public support both to implement and maintain the project? Is there a local champion willing to see the project to completion? Can the mitigation objectives be accomplished at the lowest cost to the community (grants, etc.)?	Have political leaders participated in the planning process? Do project stakeholders support the project enough to ensure success? Have the stakeholders been offered the opportunity to participate in the planning process?

Benefit (Pro)	Cost (Con)
Legal	
Is there a technical, scientific, or legal basis for the mitigation action? Are the proper laws, ordinances, and resolutions in place to implement the action?	Does the community have the authority to implement the proposed action? Are there any potential legal consequences? Will the community be liable for the actions or support of actions, or for lack of action? Is the action likely to be challenged by stakeholders who may be negatively affected?
Economic	
Are there currently sources of funds that can be used to implement the action? What benefits will the action provide? Does the action contribute to community goals, such as capital improvements or economic development?	Does the cost seem reasonable for the size of the problem and the likely benefits? What burden will be placed on the tax base or local economy to implement this action? What proposed actions should be considered but be tabled for implementation until outside sources of funding are available?
Environmental	
Will this action beneficially affect the environment (land, water, endangered species)?	Will this action comply with local, state, and federal environmental laws and regulations? Is the action consistent with community environmental goals?

certain types of mitigation projects may disproportionally affect lower income areas or higher income areas as opposed to helping all members of a community.

Each proposed mitigation strategy presented in this plan was evaluated and quantitatively assigned a "benefit" score and a "cost" score for each of the seven STAPLEE criteria, as outlined below:

- For potential benefits, a score of "1" was assigned if the project will have a beneficial effect for that particular criterion; a score of "0.5" was assigned if there would be a slightly beneficial effect; or a "0" if the project would have a negligible effect or if the questions were not applicable to the strategy.
- For potential costs, a score of "-1" was assigned if the project would have an unfavorable impact for that particular criterion; a score of "-0.5" was assigned if there would be a slightly unfavorable impact; or a "0" if the project would have a negligible impact or if the questions were not applicable to the strategy.
- Technical and Economic criteria were double weighted (multiplied by two) in the final sum of scores as noted above.
- The total benefit score and cost score for each mitigation strategy was summed to determine each strategy's final STAPLEE score.

An evaluation matrix with the total scores from each strategy can be found appended to each municipal annex. The highest scoring is determined to be of more importance economically, socially, environmentally, and politically and, hence, is prioritized over those with lower scoring. Scoring is translated into rankings of "High", "Medium", or "Low" relative to range of scores for that community. The mitigation strategy is divided into objectives and tasks at the end of each community section with the priority of each task clearly identified.

An implementation strategy and schedule are included for each strategy and action, detailing the responsible department and anticipated time frame for the specific recommendations listed throughout each annex. Funding sources for proposed strategies and actions are also listed. More information about potential funding sources is provided in Section 7.0.

The cost of each strategy and action has been estimated into ranges. Exact costs estimates were not developed for this planning document. A cost estimate of "Minimal" implies that the total cost should be less than $1,000; an estimate of "Low" implies a total cost of less than $10,000; an estimate of "Moderate" implies a total cost of less than $100,000; and an estimate of "High" implies a total cost that is greater than $100,000.

5.4 Regional Mitigation Strategies

As presented in Section 1.2, WestCOG's goal for this HMP is to reduce loss of life, damage to property and infrastructure, costs to residents and businesses, and

municipal service costs due to the effects of natural hazards and disasters. Education of residents and policymakers and the connection of hazard mitigation planning to other community planning efforts are key to achieving this goal, as is the enhancement and preservation of natural resource systems in each member community.

In order to meet this goal, WestCOG has developed the following objectives and strategies that it will attempt to implement over the next five years. These objectives are primarily aimed at implementation of state planning goals and assistance to WestCOG municipalities related to implementation of their strategies and actions. Note that these strategies (in Table 5-2) are not ranked per the STAPLEE process described above but rather in order of importance to WestCOG.

Finally, WestCOG has identified that there are shared strategies for many of its municipalities where there may be an opportunity to visualize regional solutions. A summary table of common themes is presented as Table 5-3, and a summary table of specific common strategies is presented as Table 5-4.

WestCOG's goal for this HMP is to reduce loss of life, damage to property and infrastructure, costs to residents and businesses, and municipal service costs due to the effects of natural hazards and disasters. Education of residents and policymakers and the connection of hazard mitigation planning to other community planning efforts are key to achieving this goal, as is the enhancement and preservation of natural resource systems in each member community.

Table 5-2: WestCOG Mitigation Strategies for 2021-2026

Objective 1: Assist with HMP implementation and maintenance

Strategies and Actions:

1.1 Notify municipalities of the availability of funding sources and provide guidance for grant applications.	
Action Description:	Notify member communities of the annual opportunity to apply for HMA grand funding and the opportunity to apply for HMGP funding whenever applicable. Provide letters of support when appropriate. Provide a seminar (with assistance from DEMHS) or other guidance to assist with preparation of grant applications.
Lead:	WestCOG
Priority:	Moderate
Estimated Cost:	Low
Potential Funding Source(s):	WestCOG operating budget
Timeframe:	Annually or more frequently as grant opportunities are available

1.2 Host an annual meeting to encourage HMP maintenance	
Action Description:	WestCOG will host an annual meeting of local coordinators to discuss the status of regional initiatives, collect feedback on implementation of local strategies and actions, provide a forum to discuss implementation challenges, and to share ideas. WestCOG will request that local coordinators hold an internal meeting to track progress on local mitigation actions, and add new actions if appropriate, prior to attending the regional meeting.
Lead:	WestCOG
Priority:	Moderate
Estimated Cost:	Low
Potential Funding Source(s):	WestCOG operating budget
Timeframe:	Annually

1.3 Secure funding for regional projects	
Action Description:	WestCOG will help secure funding for regional projects that may benefit more than one community. Example projects included in the Regional POCD include encouraging FEMA to update the hydrology used to generate FIRMs for riverine flooding in the region, advocating for adoption of streambelt regulations, and working with communities to reduce the impact of impervious surfaces.
Lead:	WestCOG
Priority:	Low
Estimated Cost:	Varies
Potential Funding Source(s):	WestCOG operating budget, grants
Timeframe:	As needed

1.4 Encourage local communities to participate in the CRS program by hosing an informational workshop	
Action Description:	WestCOG can organize an informational workshop to present the CRS program to its member municipalities. Speakers from FEMA and ISO will be requested to present, and existing CRS communities will be asked to provide lessons learned.
Lead:	WestCOG
Priority:	Low
Estimated Cost:	Low
Potential Funding Source(s):	WestCOG operating budget
Timeframe:	2022

1.5 Secure funding for HMP update	
Action Description:	WestCOG will secure funding in a timely manner in order to ensure that the next HMP update is completed and adopted before expiration of this HMP.
Lead:	WestCOG
Priority:	High
Estimated Cost:	Low
Potential Funding Source(s):	WestCOG operating budget
Timeframe:	2024-2025

Objective 2: Assist WestCOG municipalities in implementing State of Connecticut planning goals

Strategies and Actions:

2.1 Assist local communities regarding identification of historic and cultural resources and potential mitigation actions	
Action Description:	As WestCOG communities move to implement the SHPO recommendations related to historic and cultural resources, WestCOG will assist with identification of historic resources, review of floodplain and historic preservation regulations and ordinances, regional and state coordination, incorporation of historic preservation into planning documents, recovery planning, adaptation measures, and education. This will particularly be important for the two Litchfield County communities where SHPO has not performed a detailed study.
Lead:	WestCOG
Priority:	Low
Estimated Cost:	Low
Potential Funding Source(s):	WestCOG operating budget
Timeframe:	As requested

2.2 Encourage participation in the Sustainable CT program	
Action Description:	The Sustainable CT program is a potential way for WestCOG communities to help track sustainability goals and actions and there are many parallels for hazard mitigation. WestCOG will encourage enrollment in the program and provide technical assistance and guidance to assist communities with enrollment.
Lead:	WestCOG
Priority:	Low
Estimated Cost:	Low
Potential Funding Source(s):	WestCOG operating budget
Timeframe:	As requested

2.3 Assist small businesses in the region to better prepare for natural hazards	
Action Description:	WestCOG will coordinate with its members and local chambers of commerce to prepare a presentation aimed at assisting small businesses in the region to prepare for and mitigate the impact of natural hazards. This includes recommendations for improved chemical safety practices to protect the environment and public health following natural hazard events. A seminar will be provided with requested speakers from DEEP and other agencies focused on business needs.
Lead:	WestCOG
Priority:	Low
Estimated Cost:	Low
Potential Funding Source(s):	WestCOG operating budget
Timeframe:	2023

2.4 Work with municipalities to create recovery frameworks for businesses	
Action Description:	When a disaster strikes, municipalities often provide recovery centers for citizens. A similar type of service or facility could also be dedicated to meet business needs. In an emergency, space could be allocated that provides electricity and an internet connection so that some businesses can still maintain operations even at a diminished capacity. The Western Connecticut Economic Development District will work with municipalities to designate these recovery services and/or facilities. This strategy is included in the WestCOG CEDS.
Lead:	WestCOG
Priority:	Low
Estimated Cost:	Low
Potential Funding Source(s):	WestCOG operating budget, U.S. Economic Development Administration Grants
Timeframe:	2023

2.5 Provide technical assistance regarding the MS4 program	
Action Description:	Municipal separate storm sewer permit registrations and compliance remains an important consideration for many WestCOG municipalities. As compliance may achieve parallel hazard mitigation actions, WestCOG will provide technical assistance to its communities related to compliance as requested.
Lead:	WestCOG
Priority:	Low
Estimated Cost:	Low
Potential Funding Source(s):	WestCOG operating budget
Timeframe:	As requested

Table 5-3: Common Themes and Number of Related Municipal Strategies and Actions for WestCOG Region

Strategy or Action Theme	Number of Municipalities with Theme	Bethel	Bridgewater	Brookfield	Danbury	Darien	Greenwich	New Canaan	New Fairfield	New Milford	Newtown	Norwalk	Redding	Ridgefield	Sherman	Stamford	Weston	Westport	Wilton
Historic Resource Mitigation	18	1	1	2	2	2	2	1	1	1	2	2	2	2	1	2	1	2	2
Terrorism & Mass Casualty Mitigation	18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Emergency Response Capabilities	15			1	2	1		1	2	2	1	1	1	1	2	8	2	3	2
Energy Resiliency & Backup Power	15	2	1	3	1			6	3	1	3	2	1	1	6	1	2	2	
Floodplain Management Regulations	15	2	2	1		1	1	2	1	3	2	2		3		2	1	5	2
Repetitive Loss Properties	14	2		2	2	2	2	2		2	2	2		2		1	2	2	2
Sustainable CT Projects	14	1		1	1	1	1	1		1	1	1		1		1	1	1	1
CT DEEP Small Business Chemical Management	13	3		3	3	3	3	3		3	3	3		3		3		3	3
Stormwater and Drainage Projects	12	3	1	1	6			4		2	4		3	1	2	4			2
Resilient Connecticut	11	1			1	1	1	1				1	1	1		1		1	1
Bridge & Culvert Projects	10					1		1			2		5	1	1	2	3	5	3
Flood Studies	10	1	1	2	4	1	3				1			10		1		2	
Municipal Capacity Improvement	10	3	1	2						1	1		1	3		1		1	1
Outreach and Education	10				1	1	2		1	1	1	2			2		2	3	
Critical Facility Mitigation	6			1		1	2			3		3						2	
Tree Management	6	1			1											3	1	1	3
Update Precipitation Amounts for Drainage Calculations	6	1			1					1	1		1	1					
Wildfire Fighting Capacity	6			1						2			3		1		2		1
Dam Safety	5								1		1		1		1				1
Open Space Creation and Preservation	5	1		1				1			2							2	
Roadway Maintenance and Mitigation	5			1							2						2	1	1
Property Floodproofing & Elevation	4			1			1							2				1	
Structural Protection	4					1				1	1					6			
Drought Mitigation	3						1										1	1	
FEMA Community Rating System	3			1	1								1						
Integrate with other Planning Documents and Efforts	3				1					2	1								

Note: The second column summarizes the number of WestCOG municipalities implementing at least one action under the theme listed in that row. The numbers in each municipality's column indicates the number of actions that fall within each theme that the given community is implementing. Cells are highlighted for convenience, with blue cells indicating the five of more related strategies and actions proposed by that municipality.

Table 5-4: Summary of Common Municipal Strategies and Actions

Common Strategy or Action	Number of Municipalities with Strategy or Action	Bethel	Bridgewater	Brookfield	Danbury	Darien	Greenwich	New Canaan	New Fairfield	New Milford	Newtown	Norwalk	Redding	Ridgefield	Sherman	Stamford	Weston	Westport	Wilton
Annually conduct an emergency operations exercise for a local terrorism, sabotage, or mass casualty event.	18	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Coordinate with CT SHPO to conduct historic resource surveys, focusing on areas within natural hazard risk zones (flood zones, wildfire hazard zones, steep slopes) to identify historic resources at risk and support the preparation of resiliency plans across the state.	17	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Use the CT Toxics Users and Climate Resilience Map to identify toxic users located in hazard zones within your community. Contact those users to inform them about the CT DEEP small business chemical management initiative.	13	X		X	X	X	X	X		X	X	X		X		X		X	X
Host a CT DEEP presentation for municipal staff and local businesses about business chemical management for hazard resilience.	13	X		X	X	X	X	X		X	X	X		X		X		X	X
Compare local floodplain regulations with Revised State Model Flood Regulations to identify any remaining opportunities for improvement	13	X		X		X	X	X		X	X	X		X		X	X	X	X
Contact the owners of Repetitive Loss Properties and nearby properties at risk to inquire about mitigation undertaken and suggest options for mitigating flooding in those areas. This should be accomplished with a letter directly mailed to each property owner.	13	X		X	X	X	X	X		X	X	X		X			X	X	X
Work with CT DEEP to validate and/or correct the RL list and update the mitigation status of each listed property.	13			X	X	X	X	X		X	X	X		X		X	X	X	X
Provide information on the Town website about CT DEEP training and information around small business chemical management for hazard resilience.	12	X		X		X	X	X		X	X	X		X		X		X	X
Coordinate with CT SHPO to conduct outreach to owners of historic properties to educate them on methods of retrofitting historic properties to be more hazard-resilient while maintaining historic character.	11			X	X	X	X				X	X	X	X		X		X	X
Collaborate with CIRCA on the "Resilient Connecticut" project	10	X			X		X	X				X	X	X		X		X	X
Take one of the following actions that will mitigate natural hazard risks while also meeting Sustainable CT objectives: - Disseminate a toolkit for pre-disaster business preparedness. - Revise regulations to promote Low Impact Development. - Include the goals of this Hazard Mitigation Plan, and at least three other sustainability concepts, in your next Master Plan update.	8			X		X	X			X				X		X		X	X

Common Strategy or Action	Number of Municipalities with Strategy or Action	Bethel	Bridgewater	Brookfield	Danbury	Darien	Greenwich	New Canaan	New Fairfield	New Milford	Newtown	Norwalk	Redding	Ridgefield	Sherman	Stamford	Weston	Westport	Wilton
Revise floodplain zoning regulations to reflect the new State Building Code requirements for one foot of freeboard for construction in the 1% annual-chance flood zone.	4	X								X				X					X
Register as a Sustainable CT community and make progress with the hazard mitigation goals associated with registration.	5	X			X			X			X	X							
Require consideration of the most recent Northeast Regional Climate Center rainfall statistics (precip.eas.cornell.edu) when developing alternatives for culvert and bridge replacement designs and sizes.	5	X								X	X		X	X					
Increase Substantial Damage and Substantial Improvement lookback periods to two or more years.	4		X					X	X					X					
Ensure that the appropriate municipal personnel are trained in flood damage prevention methods by becoming a Connecticut Association of Flood Managers member, and/or by attending DEEP, FEMA-deployed, or CAFM trainings.	3			X									X	X					
Work with Eversource to identify municipal actions to improve electric grid resiliency.	3										X		X			X			
Ensure that the appropriate municipal personnel are trained in flood damage prevention methods by becoming a CAFM member, and/or by attending DEEP, FEMA-deployed, or CAFM trainings.	3			X									X	X					

Note: The second column summarizes the number of WestCOG municipalities planning to implement the common strategy or action listed in that row. An "X" indicates municipalities that plan to implement the common strategy or action.

6.0 Plan Implementation

6.1 Plan Adoption

Upon receipt of FEMA's conditional approval on 8/2/2021, each municipality's governing body as well as WestCOG's council formally adopted the Plan Update (with an initial adoption date of 8/16/2021). Copies of each municipal adoption resolution is included in Appendix F.

6.2 Plan Implementation

Implementation of the strategies contained within this plan will depend largely on the availability of resources. Each municipality and WestCOG will have to consider the costs, availability of funding, and economic and other impacts of each mitigation action individually. In general, preference should be given to accomplishing tasks that have positive benefit-cost ratios, and those that are ranked high priority. The groundwork has been set for initiating the proposed mitigation activities: responsible agencies, implementation time frames, and potential funding sources have been identified for each proposed action.

Following adoption, copies of this Plan update will be made available to all community departments by the chief elected official and the local coordinator of each municipality as a planning tool to be used in conjunction with existing plans, regulations, budgets, capital improvement programs, day-to-day operations, and other processes and projects. It is expected that revisions to other community plans and regulations will reference this Plan update and its updates. Specific community plans that could be updated to include references to this Plan update are discussed within each community annex, but could include the following existing programs and activities:

- FEMA CRS– Many mitigation strategies can contribute positively toward a community's score in this program, which can lower flood insurance rates for properties in the community.

- Regional POCD – Each municipality is included in the development and update of a regional plan which is intended to guide future development throughout each community in the planning region. Municipalities should take steps to ensure consistency between the regional POCD and this Plan update.

- Local EOPs – EOPs are part of an overall emergency management program and provide specific details on how a community will respond to emergencies. These plans are updated annually. Information contained within this Plan update will help to inform specific strategies and actions within local Emergency Operations Plans.

- Long-Range Transportation Plan – Each municipality is included in the development and update of the transportation plan, which is intended to help meet the needs of the region's residents for safety, mobility, and a healthy economy effectively and efficiently, while preserving the region's quality of life and its historical, man-made, and natural/environmental resources. Municipalities should take steps to ensure consistency between roads and bridges in need of repair in the regional transportation plan and this Plan.

- Local Bridge Program – This program provides for financial assistance from the state to municipalities for the removal, replacement, reconstruction, or rehabilitation of local bridges. Municipalities should take steps to ensure consistency between bridges in need of repair listed in the local bridge program and in this Plan.

- Capital Improvement Program – Each municipality should consider including projects identified in this HMP in its municipal CIP.

- Local POCD – Each municipality has a POCD that guides development in the community. Information contained within this Plan should be utilized to encourage growth and development in areas that are less susceptible to natural hazards and to encourage safe development practices. Information in this Plan update will be incorporated or referenced in the next POCD update in each community as well as other planning documents.

- Water Conservation Plans and Emergency Contingency Plans – Water systems that serve more than 1,000 people are required by State law to develop these plans. They provide current information regarding long-term supply and demand management as well as short-term emergency planning for the utility, including instructions on how to proceed when water supplies are curtailed by drought. The information in this Plan update may help inform these plans by identifying vulnerable areas.

- Water System Vulnerability Assessments – Water systems that serve more than 3,300 people are required by Federal law to develop these plans. They are used by water systems to plan, prepare, and respond to damage from natural hazards, accidents, and terrorist attacks. The information in this Plan update may help inform such plans by identifying vulnerable areas and linkages between local and utility response planning.

WestCOG will be responsible for encouraging that local plan updates incorporate pertinent information from this HMP. In some cases, the specific incorporation of the information in previous HMPs to other community plans has occurred as listed in each municipal annex. In all cases, the most recent HMP was utilized as an additional reference to provide guidance to community staff.

6.3 Plan Monitoring

The plan maintenance process includes monitoring, evaluating, and updating the Plan update. This process is detailed below.

6.3.1 Plan Maintenance Oversight

Future monitoring, evaluating, and updating of the overall Plan update will be coordinated by WestCOG. Each community has assigned a Local Coordinator who will be responsible for monitoring the successful implementation of this Plan update at the local level. As individual strategies and actions of this Plan update are implemented, they must be implemented by the municipal departments that oversee these activities. The Local Coordinator and/or designee will provide the linkage between the multiple municipal departments involved in hazard mitigation at the local level. As this Plan update will be adopted by the local government, coordination is expected to occur without significant barriers. The Local Coordinator for each community in this Plan update is identified as the Municipal Contact at the bottom of page ii and is responsible for Plan maintenance as discussed in the remainder of Section 6.3.

6.3.2 Site Reconnaissance for Specific Suggested Actions

The Local Coordinator and/or designee, with the assistance of appropriate department personnel, will perform regular reconnaissance-level inspections of sites that are associated with specific actions (such as culvert and bridge replacements, home elevations, vegetation clearing areas, etc.). This will ensure that the suggested actions remain viable and appropriate. The worksheet in Appendix G will be filled out for specific project-related actions as appropriate. This worksheet is taken from the *Local Mitigation Planning Handbook*.

The Local Coordinator and/or designee will be responsible for obtaining a current list of RLPs in the community each year. This list is available from the State NFIP Coordinator with Connecticut DEEP. The RLPs shall be subject to a windshield survey at least once every two years to ensure that the list is reasonably accurate relative to addresses and other basic information. Some of the reconnaissance-level inspections could occur incidentally during events such as flooding when response is underway.

6.3.3 Annual Reporting and Meeting

The Local Coordinator and/or designee is responsible for holding a local annual meeting to review the Plan update. Matters to be reviewed on an annual basis include the goals and objectives of the Plan update, hazards or disasters that occurred during the preceding year, mitigation activities that have been accomplished to date, a discussion of reasons that implementation may be behind schedule, and suggested actions for new projects and revised activities. Results of site reconnaissance efforts will be reviewed. A meeting should be conducted at least two months before the annual application cycle for grants under the HMA program. This will enable a list of possible projects to be circulated to applicable local

departments to review and provide sufficient time to develop a grant application. The Local Coordinator and/or designee shall prepare and maintain documentation and minutes of each review meeting. This meeting will also prepare Local Coordinators for the regional meeting of Local Coordinators to be held by WestCOG as noted in Section 5.4.

6.3.4 Post-Disaster Reporting and Meeting

Subsequent to federally-declared disasters in Connecticut that includes the county of the participating community (Fairfield County for all communities except Bridgewater and New Milford which are in Litchfield County), a meeting shall be conducted by the Local Coordinator with representatives of appropriate departments to develop a list of possible projects for developing an HMGP application. The Local Coordinator shall prepare a report of the recent events and ongoing or recent mitigation activities for discussion and review at the pre-HMGP application meeting. This report may be consistent with any post-event reports required by FEMA. Public outreach may be solicited for HMGP applications at a *separate* public meeting that could be combined with a community meeting to discuss the Plan update.

6.3.5 Continued Public Involvement

Continued public involvement will be sought regarding the monitoring, evaluating, and updating of this Plan.

- The public is invited to send written comments about the Plan for consideration for future Plan updates. Written comments should be addressed to the Local Coordinator in each community.
- Each community will seek public involvement regarding Plan maintenance through a combination of community meetings, presentations on local cable access channels, and/or input to web-based information gathering tools. Each Local Coordinator will be responsible for publicizing the request for public comment including notifications posted on the municipal web site.
- Each community will be responsible for making public comments available for consideration during the Plan review process.

6.4 Plan Updates

As noted in Section 5.4, WestCOG intends to secure the funding required to update the multi-jurisdictional HMP in a timely manner such that the current Plan will not expire while the Plan update is in development.

To update the Plan, the Local Coordinator will coordinate the appropriate group of local officials consisting of representatives of many of the same departments solicited for input to this plan update. In addition, local business leaders, community and neighborhood group leaders, relevant private and non-profit interest groups, and the neighboring municipalities will be solicited for representation.

The project action worksheets prepared by the local coordinator and the reports described above will be reviewed. In addition, the following questions will be asked:

- Do the mitigation goals and objectives still reflect the concerns of local residents, business owners, and officials?
- Have local conditions changed so that findings of the risk and vulnerability assessments should be updated?
- Are new sources of information available that will improve the risk assessment?
- If risks and vulnerabilities have changed, do the mitigation goals and objectives still reflect the risk assessment?
- What hazards have caused damage locally since the last edition of the HMP was developed? Were these anticipated and evaluated in the HMP or should these hazards be added to the plan?
- Are current personnel and financial resources at the local level sufficient for implementing mitigation actions?
- For each mitigation action that has not been completed, what are the obstacles to

implementation? What are potential solutions for overcoming these obstacles?

- For each mitigation action that has been completed, was the action effective in reducing risk?
- What mitigation actions should be added to the plan and proposed for implementation?
- If any proposed mitigation actions should be deleted from the plan, what is the rationale?

Future HMP updates may include deleting suggested actions as projects are completed, adding suggested actions as new hazard effects arise, or modifying hazard vulnerabilities as land use changes. For instance, several prior actions were removed while preparing this Plan update because (1) they had become institutionalized capabilities, (2) they were successfully completed, (3) they were no longer necessary, or (4) they were subsumed by more specific local or State actions.

6.5 Summary of Local Coordinator Responsibilities

The above Local Coordinator responsibilities are summarized below:

- Facilitate local adoption of HMP.
- Provide guidance to municipal departments regarding incorporating data from the HMP into other municipal planning documents.
- Obtain the list of RLPs from the State NFIP Coordinator every two years and conduct a windshield survey to ensure that the provided list is reasonably accurate. Provide corrections to the State NFIP Coordinator if necessary.
- Perform regular reconnaissance level reviews of potential project areas identified in the municipality's strategies and actions to ensure that the proposed actions continue to be applicable.
- Hold an annual meeting, typically in the summer of each year, to review the HMP and strategies with affected municipal departments. Provide necessary information for the municipal grant writer to apply for HMA and other grants.
- Participate in the annual WestCOG workshop for Local Coordinators to discuss the HMP and progress to date on mitigation actions.
- Following a disaster, make a list of possible projects for potential implementation using HMGP grants. Solicit public comment on the list through the use of a public meeting or other methods.
- Secure continued public involvement in the planning process by requesting comment on the HMP as well as in advance of the next HMP update.
- Coordinate with WestCOG and other municipal departments regarding the 5-year HMP update.

7.0 Resources and References

Technical and financial resources to assist with implementation of this plan can be found herein. In particular, local adoption of this Plan enables each participating community to access the HMA grant programs described in Section 7.1.

7.1 HMA Grant Programs

7.1.1 Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (HMGP) is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not "lost" during the recovery and reconstruction process after a disaster. The "5% Initiative" is a subprogram that provides the opportunity to fund mitigation actions that are consistent with the goals and objectives of the state and local mitigation plans and meet all HMGP requirements, but for which it may be difficult to conduct a standard benefit-cost analysis (BCA) to prove cost effectiveness.

7.1.2 Flood Mitigation Assistance (FMA) Program

The FMA program was created as part of the National Flood Insurance Reform Act or "NFIRA" of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the NFIP. The NFIP provides the funding for the FMA program. FEMA provides FMA funds to assist states and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, homes, and other structures insurable under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities. The FMA program is subject to the availability of appropriation funding, as well as any program-specific directive or restriction made with respect to such funds.

7.1.3 Building Resilient Infrastructure and Communities

The Building Resilient Infrastructure and Communities (BRIC) program aims to categorically shift the federal focus away from reactive disaster spending and toward research-supported, proactive investment in community resilience. The BRIC program replaced the previous Pre-Disaster Mitigation funding program in 2020. FEMA anticipates BRIC funding projects that demonstrate innovative approaches to partnerships, such as shared funding mechanisms, and/or project design. For example, an innovative project may bring multiple funding sources or in-kind resources from a range of private and public sector stakeholders or offer multiple benefits to a community in addition to the benefit of risk reduction.

7.1.4 Eligible Activities

The HMA grant programs may provide between 75% to 100% funding for eligible projects depending on the project type. Note that 100% funding is only typically available for severe repetitive loss properties and most grants receive a 75% federal share. HMGP and FMA grants have traditionally had a maximum federal share of $3 million, while the BRIC grants may have a maximum federal share of $50 million in 2020.

Table 7-1 presents potential mitigation project and planning activities allowed under each HMA grant program described above as outlined in the most recent

HMA Unified Guidance document. Many of the strategies and actions developed in this plan fall within this list of eligible activities.

Table 7-1: HMA Eligible Activities

Eligible Activities	HMGP	FMA	BRIC
Property Acquisition and Structure Demolition or Relocation	X	X	X
Structure Elevation	X	X	X
Mitigation Reconstruction	X	X	X
Dry Floodproofing of Historic Residential Structures	X	X	X
Dry Floodproofing of Non-residential Structures	X	X	X
Generators	X	X	
Localized Flood Reduction Projects	X	X	X
Non-Localized Flood Reduction Projects	X	X	
Structural Retrofitting of Existing Buildings	X	X	X
Non-structural Retrofitting of Existing Buildings and Facilities	X	X	X
Safe Room Construction	X	X	
Wind Retrofit for One- and Two-Family Residences	X	X	
Infrastructure Retrofit	X	X	X
Soil Stabilization	X	X	X
Wildfire Mitigation	X	X	
Post-Disaster Code Enforcement	X		
Advance Assistance	X		
5% Initiative Projects	X		
Miscellaneous / Other	X	X	X
Hazard Mitigation Planning	X	X	X
Planning Related Activities	X		
Technical Assistance			X
Management Cost	X	X	X

Source: 2015 HMA Guidance, BRIC Website

7.1.5 Benefit-Cost Analysis

According to FEMA, BCA is a method that determines the future risk reduction benefits of a hazard mitigation project and compares those benefits to its cost. The result is a benefit-cost ratio (BCR). A project is considered cost-effective when the BCR is 1.0 or greater. HMA grant applicants (states) and sub-applicants (municipalities) must use FEMA-approved methodologies and tools – such as the BCA Toolkit - to demonstrate the cost-effectiveness of their projects.

The current BCA Toolkit[17] is an Add-On for Microsoft Excel. FEMA provides both online study courses and classroom courses to train users on the BCA Toolkit, and encourages local officials to contact the State Hazard Mitigation Officer for assistance reviewing and performing a BCA. Consultants are also available to assist communities in the preparation of BCAs. For example, Level 2 HAZUS-MH Analysis can be used to generate project benefits for more complicated projects with effects spanning entire neighborhoods or larger areas.

In addition, effective August 15, 2013 acquisition and elevation projects are automatically considered cost-effective if the project costs are less than $276,000 and $175,000, respectively. Structures must be located in the SFHA (the 1% annual chance floodplain) to qualify. For these structures, the BCA will not be required.

One potentially important recent change to the HMA grant programs is that "green open space and riparian area benefits can now be included in the project BCR once the project BCR reaches 0.75 or greater." The inclusion of environmental benefits in the project BCR is limited to acquisition-related activities. These additional benefits can often raise a BCR above 1.0 for eligibility purposes.

7.2 Technical and Financial Resources

This section is comprised of a list of resources that may potentially provide technical and financial assistance for completion of the actions as described in this HMP. This list is not inclusive of all resources and should be updated periodically. In most cases, any grant funding provided by these agencies will have cost-sharing requirements requiring funding through local capital improvement or operating budgets.

[17] https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis

7.2.1 Federal Resources

Environmental Protection Agency – Region I
1 Congress Street, Suite 100
Boston, MA 02114-2023
(888) 372-7341

EPA offers grants for restoration and repair and for educational activities, including:

- **Capitalization Grants for State Revolving Funds** that can be used for low interest loans to governments to repair, replace, or relocate wastewater treatment plants damaged in floods. The grants do not apply to drinking water or other utilities.

- **Clean Water Act Section 213 Grants** to state agencies that can be used for funding watershed resource restoration activities including wetlands and other aquatic habitats (riparian zones). Only activities that control non-point source pollution are eligible. The cost-share grants are administered through Connecticut DEEP.

Federal Emergency Management Agency (Region I)
99 High Street, 6th Floor, Boston, MA 02110
(617) 956-7506) http://www.fema.gov

FEMA provides funding for mitigation activities through several programs including the HMA programs described above. Each WestCOG municipality is eligible to apply for funding through the State of Connecticut as a subgrantee. The State of Connecticut (as well as online resources) can provide application development and project eligibility assistance.

Federal Insurance and Mitigation Administration
The Federal Insurance and Mitigation Administration is comprised of three divisions that administer FEMA's hazard mitigation programs.

- The **Risk Analysis Division** applies engineering and planning practices in conjunction with advanced technology tools to identify hazards, assess vulnerabilities, and develop strategies to manage the risks associated with natural hazards. FEMA programs administered by the Risk Analysis Division include:
  - Flood Map Modernization Program: Maintains and updates NFIP mapping.
  - National Dam Safety Program: Provides state assistance funds, research, and training in dam safety procedures.
  - National Hurricane Program: Conducts and supports projects and activities that help protect communities from hurricane hazards.
  - Multi-Hazard Mitigation Planning Program: A process for states and communities to identify policies, activities, and tolls that can reduce or eliminate long-term risk to life and property from a hazard event.

- The **Risk Reduction Division** works to reduce risk to life and property through the use of land use controls, building practices, and other tools. These activities address risk in both the existing built environment and in future development, and they occur in both pre- and post-disaster environments. FEMA programs administered by the Risk Reduction Division include:
  - HMA Grant Programs: Provides grants to states and local governments to implement long-term hazard mitigation measures as described in Section 7.1.
  - CRS Program: A voluntary incentive program under the NFIP that recognizes and encourages community floodplain management activities.
  - National Earthquake Hazards Reduction Program: Works in conjunction with state and regional organizations to support state and local programs designed to protect citizens from earthquake hazards.
  - Rehabilitation of High Hazard Potential Dam Grant Program: Provides technical, planning design, and construction assistance in the form of grants for rehabilitation of eligible high hazard potential (Class C) dams. Each eligible state may submit one grant application per year. To be eligible, the dam must have an approved EAP and fail to meet the minimum state dam safety standards and therefore pose an unacceptable risk to the public as determined by the State Dam Safety Program.

- The **Risk Insurance Division** helps reduce flood losses by providing affordable flood insurance for property owners and by encouraging communities to adopt and enforce floodplain management regulations that mitigate the effects of flooding on new and improved structures. FEMA programs administered by the Risk Analysis Division include:
  - NFIP: Enables property owners in participating communities to purchase flood insurance, assists communities in complying with the requirements of the program, and publishes FIRMs and FISs to determine areas of risk.
  - Office of Response & Recovery: As part of the National Disaster Recovery Framework, the Office of Response & Recovery provides information on dollar amounts of past disaster assistance including Public Assistance, Individual Assistance, and Temporary Housing. Information on retrofitting and acquisition/relocation initiatives is maintained by the division. The Office also provides mobile emergency response support to disaster areas, supports the National Disaster Medical System, and provides urban search and rescue teams for disaster victims in confined spaces. Federal disaster assistance programs are coordinated by this Office, including:
    - *Public Assistance Grant Program*: Provides 75% grants for mitigation projects to protect eligible damaged public and private nonprofit facilities from future damage.
    - *Individuals and Family Grant Program*: Provides "minimization" grants at 100% costs.
    - The *HMGP* and *Fire Management Assistance Grant Program*. The Assistance to Firefighters Grant helps local fire departments non-affiliated emergency medical service organizations meet emergency response needs.
  - Emergency Management Performance Grants Program: Provides resources to assist state, local, tribal, and territorial governments in preparing for all hazards. Allowable costs support efforts to build and sustain core capabilities across the prevention, protection, mitigation, response, and recovery mission areas.

Small Business Administration (Region I)

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

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

U.S. Army Corps of Engineers

New England District
696 Virginia Road
Concord, MA 01742-2751
(978) 318-8520

USACE provides 100% funding to states and local governments for floodplain management planning and technical assistance under several flood control acts and the Floodplain Management Services Program. The Flood Risk Management Program provides 50% funding for eligible floodproofing and flood preparedness projects. The Levee Program provides information on levee safety, risk assessment, and risk reduction.

U.S. Department of Agriculture

Natural Resources Conservation Service
Connecticut State Office
344 Merrow Road, Suite A
Tolland, CT 06084-3917
(860) 871-4011

The NRCS works cooperatively with landowners, conservation districts, federal, state, and local governments, and citizens from urban and rural communities to restore and enhance the landscape. NRCS soil conservationists, soil scientists, agronomists, ecologists, engineers, planners, and other specialists promote land stewardship by providing technical

assistance through teams to address surface and groundwater quality; wetlands, riparian areas, and biodiversity; aquatic and terrestrial habitat; and impacts of land use changes. The Emergency Watershed Protection and Watershed and Flood Prevention Operations Programs provide technical and financial assistance to reduce or prevent flood damage, reduce soil erosion, and improve water quality.

U.S. Department of Commerce
National Weather Service
Northeast River Forecast Center
445 Myles Standish Boulevard
Taunton, MA 02780
(508) 824-5116 http://www.nws.noaa.gov

The NWS provides weather, water, and climate data, forecasts and warnings for the protection of life and property and the enhancement of the national economy.

U.S. Economic Development Administration
Philadelphia Regional Office
900 Market Street, Room 602
Philadelphia, PA 19107
(215) 597-8723 https://www.eda.gov/

The Administration assists local governments affected by disasters by providing technical assistance and grant funding.

U.S. Department of Housing and Urban Development
20 Church Street, 19th Floor
Hartford, CT 06103-3220
(860) 240-4800 http://www.hud.gov

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

U.S. Department of the Interior
National Park Service
Rivers, Trails, & Conservation Assistance
15 State Street
Boston, MA 02109
(617) 223-5123 http://www.nps.gov/rtca

The National Park Service provides communities with technical assistance to conserve rivers, preserve open space, and develop trails and greenways and assists with the identification of nonstructural options for floodplain development.

U.S. Fish & Wildlife Service
New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087
(603) 223-2541 http://www.fws.gov

The U.S. Fish and Wildlife Service provides technical and financial assistance to restore wetlands and riparian habitats through the North American Wetland Conservation and Partners for Fish and Wildlife programs.

7.2.2 State Resources

Connecticut Department of Administrative Services
Division of Construction Services
Office of the State Building Inspector
450 Columbus Boulevard, Suite 1303
Hartford, CT 06103
(860) 713-5900
https://portal.ct.gov/DAS/Office-of-State-Building-Inspector/Office-of-State-Building-Inspector

The Office of the State Building Inspector is housed under the Division of Construction Services. The Office is responsible for administering and enforcing the Connecticut State Building Code and is also responsible for the municipal Building Inspector Training Program.

Connecticut Department of Economic and Community Development

505 Hudson Street
Hartford, CT 06106-7106
(860) 270-8000 https://portal.ct.gov/DECD

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

Connecticut Department of Emergency Services & Public Protection

25 Sigourney Street, 6th Floor
Hartford, CT 06106-5042
(860) 256-0800 https://portal.ct.gov/DEMHS

DESPP houses DEMHS which oversees statewide emergency preparedness, response and recovery, mitigation, and an extensive related training program. The State Hazard Mitigation Officer is responsible for hazard mitigation planning and policy, and oversight and administration of the HMA Grant programs, also has the responsibility for ensuring the CT NHMP is updated every five years.

Connecticut Department of Energy & Environmental Protection

79 Elm Street
Hartford, CT 06106-5127
(860) 424-3000 https://portal.ct.gov/DEEP

The Connecticut DEEP provides technical assistance to sub-applicants for planning efforts and hazard mitigation assistance projects. The department includes several divisions with various functions related to hazard mitigation:

- The **Bureau of Water Protection and Land Reuse, Inland Water Resources Division** is generally responsible for flood hazard mitigation in Connecticut, including administration of the NFIP.
- The **State NFIP Coordinator** provides floodplain management and flood insurance technical assistance, floodplain management ordinance review, substantial damage/improvement requirements, community assistance visits, and other general flood hazard mitigation planning including the delineation of floodways.
- The **Flood & Erosion Control Board Program** aids municipalities with active Flood and Erosion Control Boards to solve flooding, beach erosion, and dam repair problems. The program empowers local municipalities to construct and repair flood and erosion management systems. Certain nonstructural measures that mitigate flood damages are also eligible. Funding is provided to communities that apply for assistance through a Flood & Erosion Control Board, with allocations determined by priority when funds are available.
- The **Inland Wetlands and Watercourses Management Program** provides training, technical, and planning assistance to local Inland Wetlands Commissions and reviews and approves municipal regulations for localities. Also controls flood management and natural disaster mitigation.
- The **Dam Safety Program** is charged with the responsibility for administration and enforcement of Connecticut's dam safety laws. The program regulates the operation and maintenance of dams in the state. Permits the construction, repair, or alteration of dams, dikes, or similar structures and maintains a registration database of all known dams statewide. This program also operates a statewide inspection program.
- The **Clean Water Fund** provides funding and grants under the Clean Water Act involving sewage treatment plant construction and upgrades, combined sewer overflow remediation, nutrient removal and non-point source pollution control projects that protect Long Island Sound, collection system improvements, water pollution control, and river restoration.
- The **Bureau of Water Management Planning and Standards Division** administers the Section 319

nonpoint source pollution reduction grants and municipal facilities program, which deals with mitigating pollution from wastewater treatment plants.

- The **Office of Long Island Sound Programs** administers the Coastal Area Management Act program and Long Island Sound License Plate Program.

Connecticut Department of Transportation
2800 Berlin Turnpike
Newington, CT 06131-7546
(860) 594-2000 https://portal.ct.gov/DOT

CTDOT administers the federal surface transportation bill Fixing America's Surface Transportation Act or "FAST Act" that includes grants for projects that promote alternative or improved methods of transportation. Funding through grants can often be used for projects with mitigation benefits such as preservation of open space in the form of bicycling and walking trails. CTDOT is also involved in traffic improvements and bridge repairs that could be mitigation related. The Local Bridge Program provides 50% funding for bridges that are structurally deficient or have other issues eligible for funding under the program.

Connecticut Institute for Resilience & Climate Adaptation
UConn Avery Point Campus
1080 Shennecosett Road
Groton, CT 06340
(860) 405-9171 https://circa.uconn.edu/

CIRCA is a multidisciplinary center of excellence that brings together experts in the natural sciences, engineering, economics, political science, finance, and law to provide practical solutions to problems arising as a result of a changing climate. The institute helps coastal and inland floodplain communities in Connecticut and throughout the Northeast better adapt to changes in climate and also make their human-built infrastructure more resilient while protecting valuable ecosystems and the services they offer to human society. Initiatives focus on living shorelines, critical infrastructure, inland flooding, coastal flooding, sea level rise, and policy and planning.

CIRCA runs a research program as well as an external grants program for Connecticut municipalities and partners in resilience. CIRCA has awarded grants for projects through its Municipal Resilience Grants Program to municipalities and regional councils of governments. Additional grants were awarded to municipalities, nonprofits, academic researchers, a land trust, and a conservation district to assist them with meeting the match requirement for federal or foundation grants programs. The CIRCA research program has received funding from Connecticut DEEP, CTDOT, the Connecticut Department of Housing, and NOAA. Research projects cover sea level rise and storm flooding statistics, green infrastructure and living shorelines evaluation, economic modeling, and policy analysis and planning.

Connecticut Office of Policy & Management
450 Capitol Avenue
Hartford, CT 06106
(860) 418-6355
https://portal.ct.gov/OPM/Bud-Other-Projects/STEAP/STEAP_Home

This agency manages STEAP grants to small towns for economic development, community conservation, and quality-of-life capital projects for localities. Grants are administered by various state agencies depending upon the project type.

Connecticut State Historic Preservation Office
Certified Local Government & Grants Coordinator
(860) 500-2356
https://portal.ct.gov/DECD/Services/Historic-Preservation

SHPO provides technical assistances related to projects that may affect historic resources, and provides grants to support identification, preservation, protection, and restoration of historic buildings and sites.

7.2.3 Private and Other Resources

AmeriCorps
1-800-942-2677
https://www.nationalservice.gov/programs/americorps

AmeriCorps provides grants to national and local nonprofits, government agencies, faith-based and other

community organizations and other groups committed to strengthening their communities through volunteering. Service project teams may be available to assist with projects such as surveying, tree planting, restoration, construction, and environmental education.

Association of State Dam Safety Officials

450 Old Vine Street
Lexington, KY 40507
(859) 257-5140 http://www.damsafety.org

This is a nonprofit organization of state and federal dam safety regulators, dam owners and operators, dam designers, manufacturers and suppliers, academia, contractors, and others interested in dam safety. Their mission is to advance and improve the safety of dams by supporting the dam safety community and state dam safety programs, raising awareness, facilitating cooperation, providing a forum for the exchange of information, representing dam safety interests before governments, providing outreach programs, and creating a unified community of dam safety advocates.

Association of State Floodplain Managers

8301 Excelsior Drive
Madison, WI 53717
(608) 828-3000 http://www.floods.org

This is a professional association with a membership of over 7,000 that provides education to assist state and local governments with the NFIP, CRS, and flood mitigation. The Association has developed a series of technical and topical research papers and a series of proceedings from their annual conferences. Many "mitigation success stories" have been documented through these resources and provide a good starting point for planning.

Connecticut Association of Flood Managers

P.O. Box 270213
West Harford, CT 06127
ContactCAFM@gmail.com http://www.ctfloods.org

The Connecticut Association of Flood Managers is a professional association of local and state floodplain managers, consultants, academics, and experts in related fields that provides training and outreach regarding flood management and mitigation techniques. An educational annual conference is held in Connecticut each year. It is the local state chapter of Association of State Floodplain Managers.

Connecticut Land Conservation Council

27 Washington Street
Middletown, CT 06457
(860) 852-5512 http://www.ctconservation.org/

The Council serves Connecticut's land trusts by representing their interests to state government, connecting them to training and guidance resources on both statewide and local levels, and providing direct assistance to aid in achieving conservation goals. Land trusts may be interested in providing funding to preserve land as open space. Land Trusts operating in the Region include:

- Aspetuck Land Trust, Inc.
- Audubon Connecticut
- Bethel Land Trust, Inc.
- Bridgewater Land Trust, Inc.
- Brookfield Open Space Legacy, Inc.
- Candlewood Valley Regional Land Trust
- Connecticut Audubon Society
- Connecticut Forest & Park Association
- Darien Land Trust
- Dogwood Park Association, Inc.
- Eversource Land Trust
- Greenwich Land Trust, Inc.
- Highstead Foundation
- Housatonic Valley Association
- Land Conservancy of Ridgefield, Inc.
- New Canaan Land Trust
- Newtown Forest Association, Inc.
- Northwest Connecticut Land Conservancy, Inc.
- Norwalk Land Trust
- Redding Land Trust, Inc.
- Roxbury Land Trust, Inc.
- Stamford Land Conservation Trust, Inc.
- Steep Rock Association, Inc.
- The Nature Conservancy – CT Chapter
- The Trust for Public Land
- Wildlife in Crisis Land Trust
- Wilton Land Conservation Trust

Eversource Energy Center
University of Connecticut
Storrs, CT 06269-3037
860-486-6806 https://www.eversource.uconn.edu/

The Center researches and develops new technologies and science-based solutions for increasing the reliability of the electric grid from impacts of storms and climate change. Predictive models include outage predictions, vegetation mapping and mapping of tree risk, electric grid reinforcement modeling, and renewable energy research.

Insurance Institute for Business and Home Safety
4775 East Fowler Avenue
Tampa, FL 33617
(813) 286-3400 http://www.ibis.org

The institute conducts objective, scientific research to identify and promote effective actions that strengthen homes, businesses, and communities against natural disasters and other causes of loss. The institute advocates the development and implementation of building codes and standards nationwide and may be a good source of model code language.

Multidisciplinary Center for Earthquake Engineering and Research
University at Buffalo
State University of New York
Red Jacket Quadrangle
Buffalo, NY 14261
(716) 645-3391 http://mceer.buffalo.edu

Originally a source for earthquake statistics, research, engineering and planning advice, the Center's mission has expanded from earthquake engineering to the technical and socioeconomic impacts of a variety of hazards, both natural and man-made, on critical infrastructure, facilities, and society.

National Association of Flood & Stormwater Management Agencies
1301 K Street, Suite 800 East
Washington, DC 20005
(202) 218-4122 http://www.nafsma.org

The Association is an organization of public agencies whose function is the protection of lives, property and economic activity from the adverse impacts of storm and flood waters. The Association advocates public policy, encourages technologies, and conducts education programs which facilitate and enhance the achievement of the public service function of its members.

National Emergency Management Association
P.O. Box 11910
Lexington, KY 40578
(859) 244-8000 http://nemaweb.org

The National Emergency Management Association provides national leadership and expertise in comprehensive emergency management, serves as a vital emergency management information and assistance resource, and advances continuous improvement in emergency management through strategic partnerships, innovative programs, and collaborative policy positions.

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

The Natural Hazards Center advances and communicates knowledge regarding hazard mitigation and disaster preparedness, response, and recovery. Using an all-hazards and interdisciplinary framework, the Center fosters information sharing and integration of activities among researchers, practitioners, and policy makers from around the world, supports and conducts research, and provides educational opportunities for the next generation of hazards scholars and professionals. The Floodplain Management Resource Center is a free library and referral service of the Association of State Floodplain Managers for floodplain management publications.

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Appendix A

Municipal Planning Process

This Appendix has
been provided as a
separate digital file.

Appendix B

Regional Workshops

This Appendix has
been provided as a
separate digital file.

Appendix C

Public Outreach

This Appendix has
been provided as a
separate digital file.

Appendix D

HAZUS-MH Output

This Appendix has
been provided as a
separate digital file.

Appendix E

Sustainable CT Climate Vulnerability Analysis

This Appendix has
been provided as a
separate digital file.

Appendix F

Adoption Resolutions

CERTIFICATE OF ADOPTION
TOWN OF BETHEL BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of Bethel 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Bethel Board of Selectmen approved the previous version of the Plan in 2015; and

WHEREAS, the Town of Bethel and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Bethel; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Bethel, 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 Bethel eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of Bethel;
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 Board of Selectmen.

Adopted this 17th day of 8, 2021 by the Board of Selectmen of Town of Bethel, Connecticut

First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Bethel this 18 day of Aug., 2021.

Town Clerk

TOWN of BETHEL SEAL CONNECTICUT

CERTIFICATE OF ADOPTION
TOWN OF BRIDGEWATER BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of Bridgewater 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Bridgewater Board of Selectmen approved the previous version of the Plan in 2015; and

WHEREAS, the Town of Bridgewater and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Bridgewater; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Bridgewater, 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 Bridgewater eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of Bridgewater;
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 Board of Selectmen.

Adopted this 12th day of October 2021 by the Board of Selectmen of Town of Bridgewater, Connecticut

First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Bridgewater this 13 day of Oct, 2021.

Town Clerk

CHERYL L. PINKOS
NOTARY PUBLIC
MY COMMISSION EXPIRES APRIL 30, 2025

CERTIFICATE OF ADOPTION
TOWN OF BROOKFIELD BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of Brookfield 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Brookfield Board of Selectmen approved the previous version of the Plan in 2014; and

WHEREAS, the Town of Brookfield and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Brookfield; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Brookfield, 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 Brookfield eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of Brookfield;
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 Board of Selectmen.

Adopted this 13th day of September, 2021 by the Board of Selectmen of Town of Brookfield, Connecticut

First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Brookfield this 16th day of September 2021.

Town Clerk

RESOLUTION

CITY OF DANBURY, STATE OF CONNECTICUT

Sept. 9 A.D. 2021

RESOLVED BY THE CITY COUNCIL OF THE CITY OF DANBURY

WHEREAS, the City of Danbury 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 Danbury City Council approved the previous version of the Plan in 2017; and

WHEREAS, the City of Danbury and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 regarding the development and review of the Natural Hazard Mitigation Plan Update 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the City of Danbury; and

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

WHEREAS, adoption of this Plan will make the City of Danbury eligible for funding to alleviate the impacts of future hazards.

NOW THEREFORE BE IT RESOLVED THAT:

1. The Plan is hereby adopted as an official plan of the City of Danbury.

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 City Council.

CITY OF DANBURY
OFFICE OF THE CITY COUNCIL
THIS DOCUMENT IS A CERTIFIED COPY
OF THE ORIGINAL ON FILE IN THE
OFFICE OF THE CITY COUNCIL

LEGISLATIVE ASSISTANT DATED 10-4-21

JAYME J. STEVENSON
FIRST SELECTMAN

CHARLES A. KOONS
DAVID R. MARTIN
MONICA M. McNALLY
SARAH D. NUEMANN

TOWN OF DARIEN

OFFICE OF THE SELECTMEN

CERTIFICATE OF ADOPTION

TOWN OF DARIEN BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS

MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of Darien 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Darien Board of Selectmen approved the previous version of the Plan in 2016; and

WHEREAS, the Town of Darien and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Darien; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Darien, 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 Darien eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of Darien;

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.

An annual report on the progress of the implementation elements of the Plan shall be presented to the Board of Selectmen.

Adopted this 16th day of August, 2021 by the Board of Selectmen of Town of Darien, Connecticut

Jayme J. Stevenson Jayme J. Stevenson

First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Darien this 17 day of August, 2021.

Christa A. McNamara

Town Clerk

TOWN OF
GREENWICH

Office of the First Selectman · 203.622.7710 · Fax: 203.622.3793
Town Hall · 101 Field Point Road · Greenwich, CT 06830
Email: Fred.Camillo@GreenwichCT.org

Fred Camillo
First Selectman

CERTIFICATE OF ADOPTION
TOWN OF GREENWICH BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of Greenwich 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Greenwich Board of Selectmen approved the previous version of the Plan in 2016; and

WHEREAS, the Town of Greenwich and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Greenwich; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Greenwich, 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 Greenwich eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of Greenwich;
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 by the designated local coordinator to the Board of Selectmen.

Adopted this 9th day of September, 2021 by the Board of Selectmen of Town of Greenwich, Connecticut.

First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Greenwich this 22nd day of Oct., 2021.

Town Clerk

CERTIFICATE OF ADOPTION
TOWN OF NEW CANAAN BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of New Canaan 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of New Canaan Board of Selectmen approved the previous version of the Plan in 2016; and

WHEREAS, the Town of New Canaan and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 by WestCOG regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of New Canaan; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of New Canaan, 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 New Canaan eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of New Canaan;
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 Board of Selectmen.

Adopted this 7 day of Sept, 2021 by the Board of Selectmen of Town of New Canaan, Connecticut

First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of New Canaan this 22 day of OCT, 2021.

Claudia A Weber

Town Clerk

Town of New Fairfield

Selectmen's Office
4 Brush Hill Road
New Fairfield, Connecticut 06812

CERTIFICATE OF ADOPTION
TOWN OF NEW FAIRFIELD BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of New Fairfield 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of New Fairfield Board of Selectmen approved the previous version of the Plan in 2016; and

WHEREAS, the Town of New Fairfield and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of New Fairfield; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of New Fairfield, 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 New Fairfield eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of New Fairfield;
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 Board of Selectmen.

Adopted this 12th day of August, 2021 by the Board of Selectmen of Town of New Fairfield, Connecticut

Patricia del Monaco
First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of New Fairfield this 17th day of August 2021.

Pamela J. Dohan
Town Clerk

TOWN OF NEW MILFORD

Roger Sherman Town Hall
10 Main Street
New Milford, Connecticut 06776
Telephone 860-355-6010 • Fax 860-355-6002
Office of the Mayor
Pete Bass

CERTIFICATE OF ADOPTION
TOWN OF NEW MILFORD TOWN COUNCIL

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of New Milford 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of New Milford Board of Selectmen approved the previous version of the Plan in 2015; and

WHEREAS, the Town of New Milford and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of New Milford; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of New Milford, 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 New Milford eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of New Milford;
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 Board of Selectmen.

Adopted this 9th **day of** Aug**, 2021 by the Town Council of the Town of New Milford, Connecticut**

Mayor

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of New Milford this 12th day of August 2021.

Town Clerk

SEAL

CERTIFICATE OF ADOPTION
TOWN OF NEWTOWN BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of Newtown 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Newtown Board of Selectmen approved the previous version of the Plan in 2015; and

WHEREAS, the Town of Newtown and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Newtown; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Newtown, 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 Newtown eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of Newtown;
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 Board of Selectmen.

Adopted this 9th day of September, 2021 by the Board of Selectmen of Town of Newtown, Connecticut

Daniel C. Rosenthal, First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Newtown this 13th day of Sept, 2021.

Debbie Aurelia Hatstead

Town Clerk

Date: August 5, 2021
Subject: *Adoption of the WestCOG Multi-Jurisdiction Hazard Mitigation Plan Update, 2021-2026".*

Resolution:
Authorize the Mayor, Harry W. Rilling, to adopt the 'Western CT Council of Governments (WestCOG)) Multi-Jurisdiction Hazard Mitigation Plan Update 2021-2026' as prepared by the WestCOG and approved by the Federal Emergency Management Agency (FEMA)

Background
Municipalities and States are required to have a FEMA approved Hazard Mitigation Plan on file. This plan enables municipalities to apply for additional funding streams following disasters. The Western CT Council of Governments (WestCOG) receives funds to update and maintain this plan for the jurisdictions it serves. Once adopted by all municipalities, the plan will be in place until 2026.

FEMA Region 1 has completed its review of the *WestCOG Multi-Jurisdiction Hazard Mitigation Plan Update, 2021-2026* and found it meets the requirements under 44 CFR 201. The WestCOG HMP has received conditional approval pending adoption by each individual municipality.

The final documents that were approved by FEMA are on the WestCOG website: Hazard Mitigation | Western Connecticut Council of Governments (westcog.org), and below for download:

Plan: https://filetransfer.slrconsulting.com/link/okXzVXIK3x4B65hXj6DiKC
Appendices: https://filetransfer.slrconsulting.com/link/2TmffvEu4DzuiXTaYn7ZNo
Municipal Annexes: https://filetransfer.slrconsulting.com/link/86xtZHyOqjrEzZUIFFPhrH

Below is the Norwalk resolution that should be placed on City letterhead:

CERTIFICATE OF ADOPTION
CITY OF NORWALK COMMON COUNCIL

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the City of Norwalk 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the City of Norwalk Common Council approved the previous version of the Plan in 2016; and

WHEREAS, the City of Norwalk and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management

Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the City of Norwalk; and

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

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

RESOLVED by the Common Council:

1. **The Plan is hereby adopted as an official plan of the City of Norwalk;**
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 City Council.**

Adopted this 25th day of October, 2021 by the Common Council of City of Norwalk, Connecticut

Harry W. Rilling

Mayor

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the City of Norwalk this 25th day of October, 2021.

Damaris Rios

City Clerk

Julia Pemberton
First Selectman

Phone: 203-938-2002
Fax: 203-938-8816

Town of Redding

CERTIFICATE OF ADOPTION
TOWN OF REDDING BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of Redding 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Redding Board of Selectmen approved the previous version of the Plan in 2015; and

WHEREAS, the Town of Redding and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Redding; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Redding, 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 Redding eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of Redding;
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;

100 Hill Road, PO Box 1028, Redding, CT 06875
www.townofreddingct.org

Julia Pemberton
First Selectman

Phone: 203-938-2002
Fax: 203-938-8816

Town of Redding

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 Board of Selectmen.

Adopted this 27TH day of OCT., 2021 by the Board of Selectmen of Town of Redding, Connecticut

First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Redding this 27TH day of OCT, 2021.

Town Clerk MICHELE R. GRANDE

100 Hill Road, PO Box 1028, Redding, CT 06875
www.townofreddingct.org

TOWN OF RIDGEFIELD
Office of the First Selectman

CERTIFICATE OF ADOPTION
TOWN OF RIDGEFIELD BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of Ridgefield 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Ridgefield Board of Selectmen approved the previous version of the Plan in 2015; and

WHEREAS, the Town of Ridgefield and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Ridgefield; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Ridgefield, 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 Ridgefield eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of Ridgefield;
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 Board of Selectmen.

Adopted this 22 **day of** September **, 2021 by the Board of Selectmen of Town of Ridgefield, Connecticut**

Rudy Marconi
First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Ridgefield this 24th day of Sept., 2021.

Wendy Sannon Fiorotti
Town Clerk

400 Main Street • Ridgefield, CT 06877
Phone: (203) 431-2774 • Fax: (203) 431-2311 • selectman@ridgefieldct.org

www.ridgefieldct.org

CERTIFICATE OF ADOPTION
TOWN OF SHERMAN BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of Sherman 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Sherman Board of Selectmen approved the previous version of the Plan in 2017; and

WHEREAS, the Town of Sherman and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Sherman; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Sherman, 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 Sherman eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of Sherman;
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 Board of Selectmen.

Adopted this 26th day of August, 2021 by the Board of Selectmen of Town of Sherman, Connecticut

First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Sherman this 7th day of Sept, 2021.

Town Clerk

30TH BOARD OF REPRESENTATIVES
CITY OF STAMFORD

RESOLUTION NO. 4108
ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the City of Stamford 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the City of Stamford Board of Representatives approved the previous version of the Plan in 2016; and

WHEREAS, the City of Stamford and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026 (the "Plan"); and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the City of Stamford; and

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

WHEREAS, adoption of this Plan will make the City of Stamford eligible for funding to alleviate the impacts of future hazards.

NOW THEREFORE BE IT RESOLVED by the 30TH Board of Representatives that:

1. The Natural Hazard Mitigation Plan Update, 2021-2026, is hereby adopted as an official plan of the City of Stamford;
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.

GOVERNMENT CENTER, 888 WASHINGTON BLVD. P.O. BOX 10152, STAMFORD, CT 06904
TEL: (203) 977-4024 • FAX: (203) 977-5503 • E-MAIL: BDREPS@CI.STAMFORD.CT.US

4. An annual report on the progress of the implementation elements of the Plan shall be presented to the Board of Representatives.

This resolution was approved on the Consent Agenda at the Regular Meeting of the 30th Board of Representatives held on Monday, October 4, 2021.

Matthew Quinones, President
30th Board of Representatives

Susan Nabel, Clerk
30th Board of Representatives

cc: Mayor David R. Martin
Kathryn Emmett, Esq., Law Department
Lyda Ruijter, Town & City Clerk
Jay Fountain, Director of OPM
Sandra L. Dennies, Director of Administration
Mark McGrath, Director of Operations
Ted Jankowski, Director of Public Safety, Health & Welfare
Thomas Madden, Director of Economic Development
Erin McKenna, Senior Planner

CERTIFICATE OF ADOPTION
TOWN OF WESTON BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of Weston 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Weston Board of Selectmen approved the previous version of the Plan in 2016; and

WHEREAS, the Town of Weston and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44.CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Weston; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Weston, 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 Weston eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of Weston;
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 Board of Selectmen.

Adopted this 28 **day of** Oct**, 2021 by the Board of Selectmen of Town of Weston, Connecticut**

First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Weston this 28th day of Oct, 2021.

Town Clerk

CERTIFICATE OF ADOPTION
TOWN OF WESTPORT BOARD OF SELECTMEN

Notice is hereby given that the Westport Board of Selectmen, at its regular meeting of August 11, 2021 held at 9:00 am in Westport Town Hall Auditorium, upon motion by James Marpe, seconded by Melissa Kane and passing by a vote of 3-0, did unanimously approve the following:

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of Westport 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Westport Board of Selectmen approved the previous version of the Plan in 2016; and

WHEREAS, the Town of Westport and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Westport; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Westport, 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 Westport eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of Westport.
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 Board of Selectmen.

Adopted this 11th day of August, 2021 by the Board of Selectmen of Town of Westport, Connecticut

James S. Marpe, First Selectman

IN WITNESS WHEREOF, the undersigned has affixed their signature and the corporate seal of the Town of Westport this 12 day of August, 2021.

~~Jeffrey Dunkerton, Town Clerk~~ Deputy Town Clerk

CERTIFICATE OF ADOPTION
TOWN OF WILTON BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WESTERN CONNECTICUT COUNCIL OF GOVERNMENTS MULTI-JURISDICTION HAZARD MITIGATION PLAN UPDATE, 2021-2026

WHEREAS, the Town of Wilton 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, droughts, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Wilton Board of Selectmen approved the previous version of the Plan in 2016; and

WHEREAS, the Town of Wilton and Western Connecticut Council of Governments developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for the Natural Hazard Mitigation Plan Update, 2021-2026 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held and public input was sought in 2020 and 2021 regarding the development and review of the Natural Hazard Mitigation Plan Update, 2021-2026; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Wilton; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Wilton, 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 Wilton eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Board of Selectmen:

1. The Plan is hereby adopted as an official plan of the Town of Wilton;
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 Board of Selectmen.

Adopted this 13th **day of** Sept**, 2021 by the Board of Selectmen of Town of Wilton, Connecticut**

First Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Wilton this 14th day of Sept., 2021.

Town Clerk

Appendix G

FEMA Mitigation Strategy Worksheets

This Appendix has
been provided as a
separate digital file.