2019 Natural Hazard Mitigation Plan Update

Prepared on Behalf of the Municipalities of the MetroCOG Region

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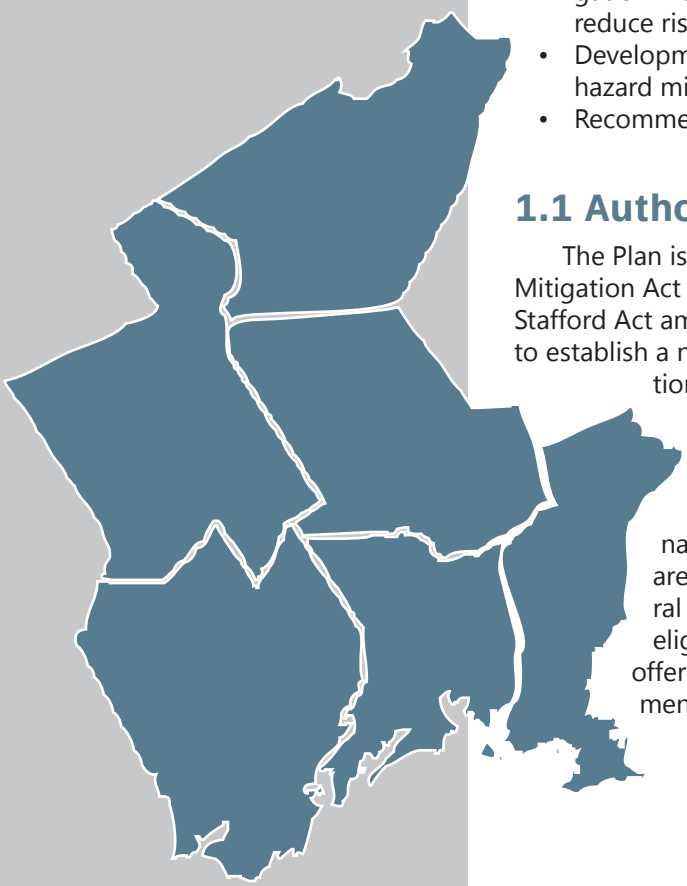
Notice to Readers

This document was prepared under a grant from the Federal Emergency Management Agency. Points of view or opinions expressed in this document are those of MetroCOG and its member communities and do not necessarily represent the official position or policies of the Federal Emergency Management Agency.

CONTENTS

1 Purpose & Regional Overview

The purpose of the multi-jurisdictional update to the Natural Hazard Mitigation Plan (NHMP) is to reduce the loss of life, personal injury and damage to property, infrastructure and natural, cultural and economic resources from a natural disaster in the Greater Bridgeport Region. The Plan emphasizes actions that can be implemented now to reduce or prevent damage from a future natural disaster. The assessments and evaluations are based on extensive data collection and outreach efforts to obtain information on the physical setting of the region, existing hazards, and the occurrence, frequency, duration and potency of probable hazards.



The components of the Plan include:

- Identification of natural hazards that could occur in the region – inland flooding, coastal flooding, hurricanes, sea level rise, summer storms, winter storms (ice and blizzards), tornadoes, earthquakes, wildfires, and dam failure;
- Evaluation of vulnerabilities to structures and populations;
- Assessment of current mitigation measures included in the 2014 NHMP to determine which have been implemented and whether or not they have been effective in reducing vulnerabilities and risks;
- Identification and evaluation of potential mitigation measures that could be implemented to reduce risks and vulnerability;
- Development of response strategies to address hazard mitigation; and
- Recommendations for future mitigation actions.

1.1 Authority

The Plan is authorized under the federal Disaster Mitigation Act of 2000 (DMA), also known as the 2000 Stafford Act amendments. The purposes of the DMA are to establish a national program for pre-disaster mitigation and streamline administration of disaster relief. The Act encourages the development of disaster preparedness and mitigation plans and the implementation of measures to reduce the effects of natural hazards. Under DMA, communities are required to develop and submit a Natural Hazard Mitigation Plan as a condition of eligibility for certain funding opportunities offered by the Federal Emergency Management Agency (FEMA), including the Pre-Disas-

ter Mitigation (PDM) Program and post-disaster Hazard Mitigation Grant Program (HMGP).

1.2 Background

This plan update builds on the 2014 Update to the original 2006 NHMP for the former Greater Bridgeport Regional Planning Area, developed in cooperation with the City of Bridgeport and the Towns of Easton, Fairfield, Monroe and Trumbull. The consulting firm of Milone & MacBroom, Inc. was hired to provide technical assistance and conduct required vulnerability and risk assessments. The NHMP for the former Greater Bridgeport area was adopted and approved by FEMA in January 2007. Subsequent to its adoption, the Plan was amended to include the NHMP for the Town of Stratford (Annex, 2008).

FEMA requires that all local and multi-jurisdictional (regional) plans be updated every five years to remain valid. The original NHMP for the Greater Bridgeport Region expired on January 29, 2012. A NHMP Update was prepared by the Greater Bridgeport Regional Council and was approved by FEMA on July 22, 2014 with an expiration date of July 2019. Since the time the NHMP Update was adopted, the Greater Bridgeport Regional Council has been renamed the Connecticut Metropolitan Council of Governments (MetroCOG), with the composition of member municipalities unchanged.

Changes to Planning Process and NHMP Document

Numerous modifications were incorporated into the update of the NHMP. The following is a list of the key changes. Each is addressed in the appropriate section of the document.

- The current version of HAZUS-MH was utilized.
- The plan incorporates loss estimates from the State of Connecticut NHMP (2019) and other sources.
- The plan incorporates estimated population and housing unit data for the year 2017 to augment demographic data from the last U.S. census of 2010.
- The plan incorporates the sea level rise projection of 50 centimeters by 2050 as mandated by Connecticut Public Act 18-82.
- The plan includes updates to the historical record of many hazards including the severe riverine flooding of September 25, 2018 and the significant coastal flooding of October and November 2018.
- The plan incorporates a new exposure analysis that tabulates parcels and structures exposed to the risks profiled in the plan.
- The plan adds "Fact Sheets" to make the document livelier and give community planners the flexibility to pull stand-alone pages out of the plan document when pursuing specific projects, grants, etc.:
  - Regional Challenges: Intense Precipitation
  - Regional Challenges: Sea Level Rise
  - Regional Challenges: Coastal Flooding
  - Regional Challenges: Repetitive Loss Properties
  - New Initiative: Regional Framework for Coastal Resilience
  - New Initiative: Resilient Bridgeport
  - New Initiative: Connecticut State Collages and Universities Hazard Mitigation Plan
  - New Initiative: Hazardous Spills at Businesses
  - New Initiative: Risks to Historic Resources
  - New Initiative: Municipal Separate Stormwater System (MS4)
  - New Initiative: Low Impact Development (LID) for Rural Resiliency
  - New Initiative: Sustainable CT
  - Mitigation Successes: Property Acquisitions in Trumbull
  - Mitigation Successes: Microgrids
  - Mitigation Successes: Fairfield Green Infrastructure
- The plan describes new Community Resilience Building (CRB) workshops conducted for five of the six communities. The Workshops included Chief Elected Officials, Board/Commission members, municipal staff and other local and regional stakeholders.
- With the completion of new CRB workshops, the action-by-action risk matrices developed in the previous CRBs were retired from the NHMP. Mitigation actions were addressed in two simplified sets of tables. The first set of tables provides the status of each mitigation action proposed in the 2014 NHMP. The second set of tables lists the current proposed actions for 2019-2024, including some actions carried forward and/or updated from the 2014 NHMP.
- The list of proposed mitigation actions for each community has been reduced relative to the 2014 edition of the plan by eliminating similar or redundant actions, retiring

completed and ongoing actions, and focusing on actionable items for the next five years.
- The plan adds a new appendix, "Critical Facilities" (Appendix A) to provide a starting point for municipalities to check and amend every 5 years. Critical facility information is often vital for developing mitigation actions and completing FEMA benefit-cost analysis.
- The plan adds a new appendix, "Historic Resources" (Appendix B) to provide a starting point for municipalities to understand where to focus resources on risk assessments and new historic resource surveys in accordance with new mitigation actions about historic resources.

1.3 Natural Hazard Mitigation Plan

This NHMP is divided into five sections. Section One describes the purpose of the plan, the MetroCOG Region and municipalities of the MetroCOG Region. Section Two details the planning process and the process of developing the NHMP. Section Three provides an identification and assessment of risks. Section Four describes development of mitigation strategies and documents the progress on previous mitigation strategies for the Region. Concluding the NHMP, Section Five presents current mitigation strategies for the Region, addresses how mitigation actions will be implemented, and describes the process of maintaining the plan.

The Update of the NHMP:
- Reflects the standards contained within Section 322 of DMA 2000;
- Expands on the previous hazard identification and risk assessments;
- Incorporates FEMA's current grant programs;
- Incorporates potential impacts due to climate change;
- Includes updated information; and
- Reassesses the goals, objectives, and activities presented in the 2014 NHMP.

The updated NHMP addresses only natural hazards and disasters and does not directly address terrorism, sabotage, human induced emergencies (structure fires, hazardous material spills, contamination and disease) or disaster response and recovery. However, efforts were undertaken to coordinate with the Region's emergency management directors.

1.4 Profile of the MetroCOG Region & Jurisdictions

The MetroCOG Region is located in Fairfield County, in Southwestern Connecticut, about fifty miles east of New York City and 150 miles west of Boston, Massachusetts. The NHMP is a multi-jurisdictional plan, encompassing the six municipalities of the region. Each community actively participated in the preparation of the NHMP Update and the hazards likely to impact each were identified and assessed. The six municipalities are:

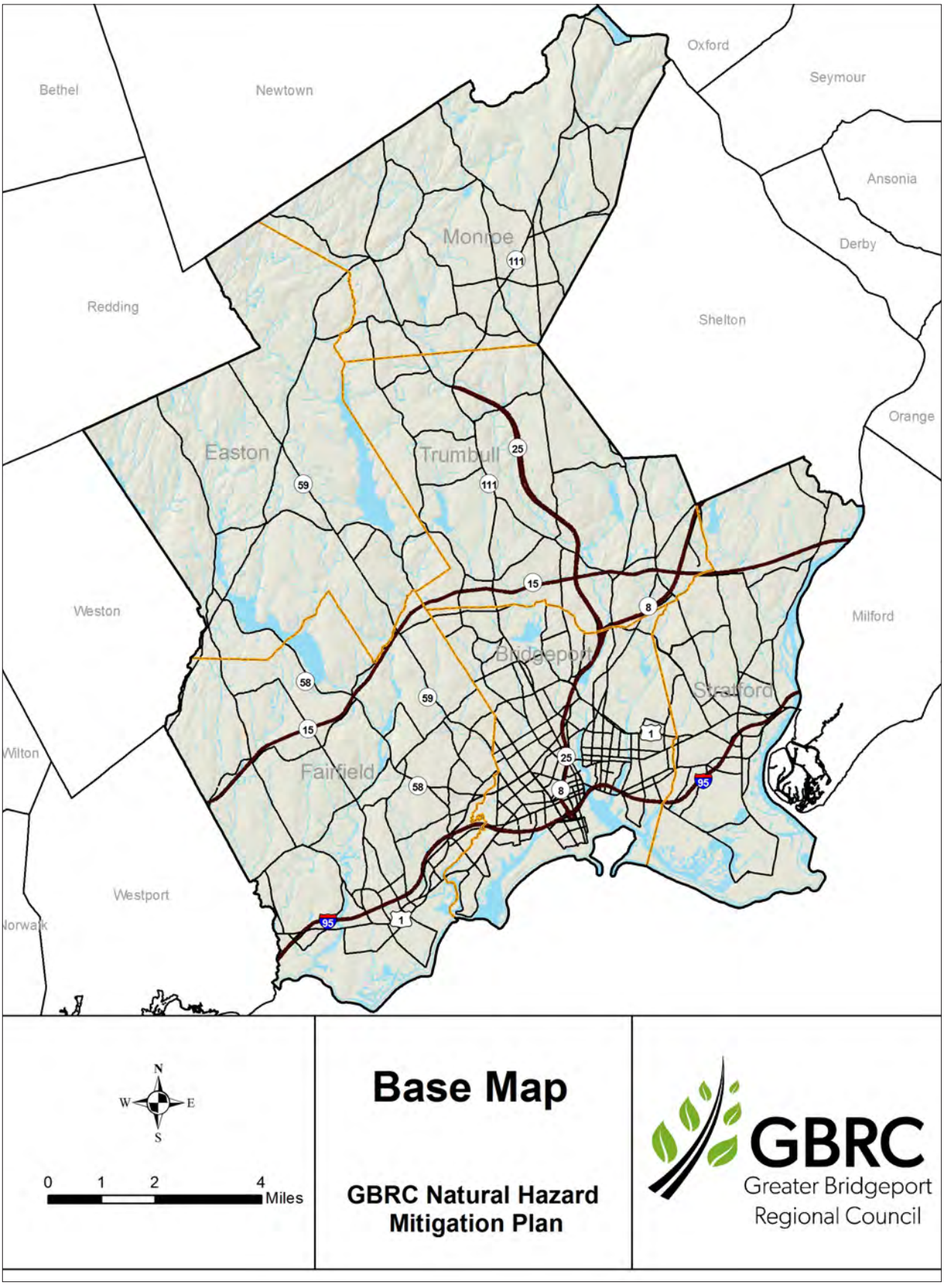
City of Bridgeport
Town of Easton
Town of Fairfield
Town of Monroe
Town of Stratford
Town of Trumbull

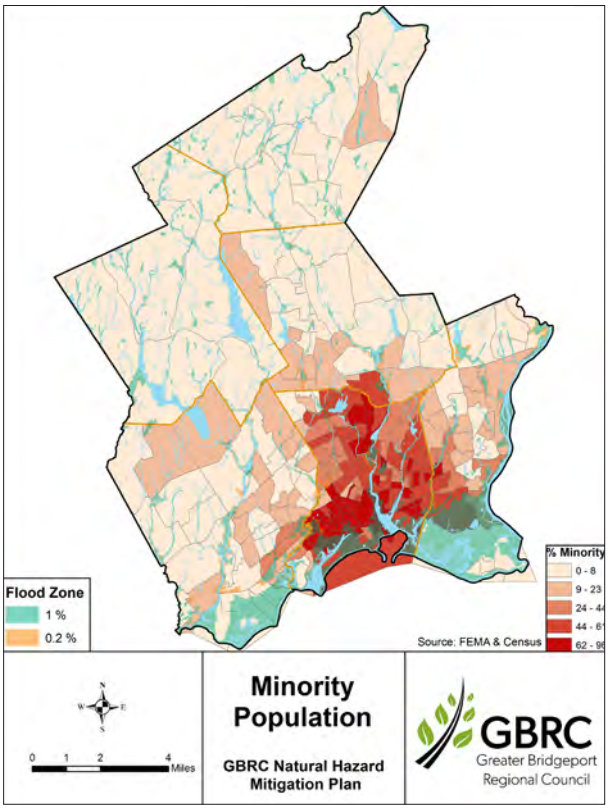
This section presents demographic information for the Region and its communities. The demographic information presented herein represents 2010 United States Census data where more recent estimates developed from the 2013-2017 American Community Survey (ACS) are not available. Occasionally other estimates are presented such as from the Connecticut Data Collaborative (CTDC) for comparison purposes.

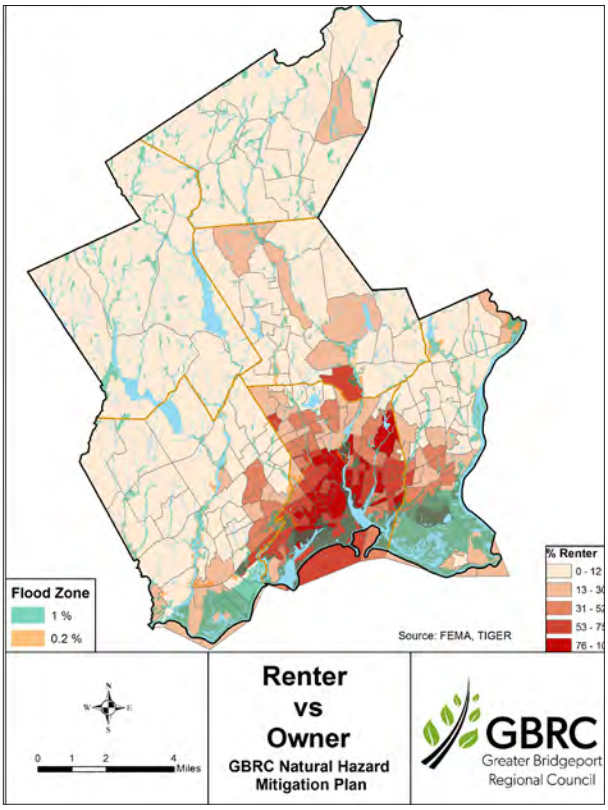
Together, the MetroCOG communities encompass about 145 square miles with a combined population of over 325,000 people. The population density is the highest of any planning region in Connecticut. This density is reflected in the fact that almost all of the land lies within the designated urbanized area and about 98% of the residents live in the urban area. Bridgeport, Fairfield and Stratford are coastal communities, situated along Long Island Sound, and the inland communities to the north are Easton, Monroe and Trumbull (2017 CTDC Population Estimates & 2013-2017 ACS).

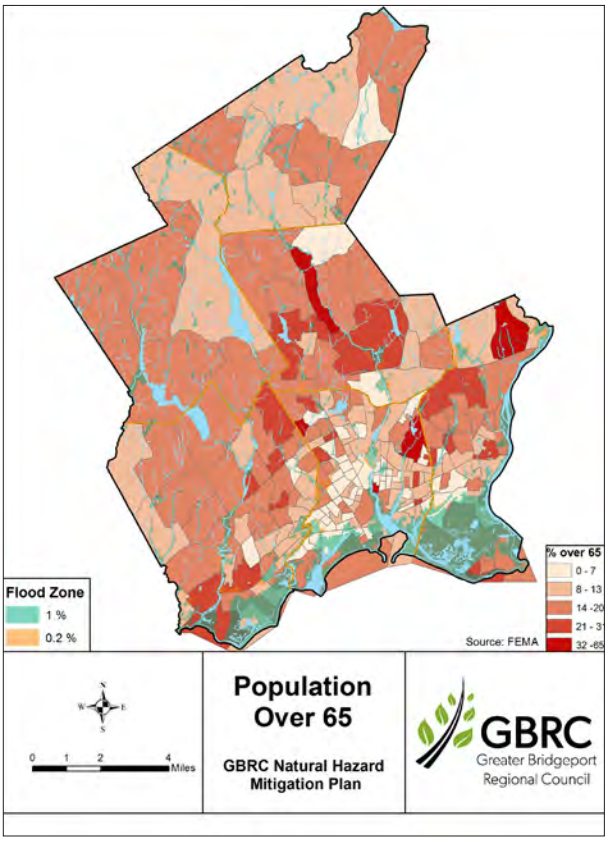
Despite the urban character of the Region, land use patterns vary. The coastal communities are more developed and urban in character. The inland communities and the northern part of Fairfield are more residential and exhibit rural characteristics.

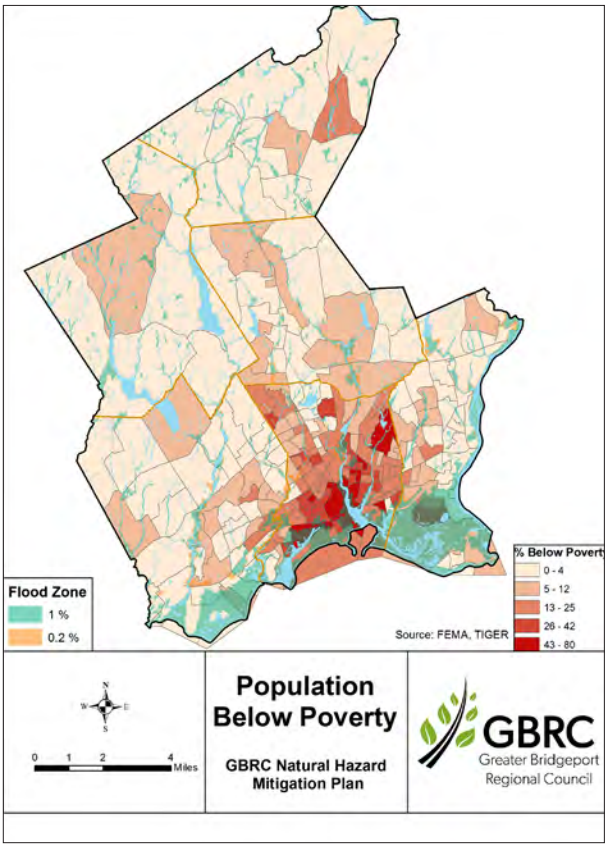
The Region is ethnically diverse as about 47% of the population is estimated as belonging to an ethnic minority. Approximately 61% of the minority population is classified as African American. Persons of Hispanic or Latino ethnicity account for about


Bethel
Newtown
Oxford
Seymour
Ansonia
Derby
Monroe
Redding
Shelton
Orange
Easton
Trumbull
Weston
Milford
Bridgeport
Stratford
Wilton
Fairfield
Westport
Norwalk
N
W
E
S
0 1 2 4 Miles
Base Map
GBRC Natural Hazard Mitigation Plan
GBRC
Greater Bridgeport Regional Council


Flood Zone
1 %
0.2 %
% Minority
0 - 8
9 - 23
24 - 44
44 - 6
62 - 9
Source: FEMA & Census
0 1 2 4 Miles
Minority Population
GBRC Natural Hazard Mitigation Plan
GBRC
Greater Bridgeport Regional Council


Flood Zone
1 %
0.2 %
% Renter
0 - 12
13 - 3
31 - 5
53 - 7
76 - 1
Source: FEMA, TIGER
0 1 2 4 Miles
Renter vs Owner
GBRC Natural Hazard Mitigation Plan
GBRC
Greater Bridgeport Regional Council


Flood Zone
1 %
0.2 %
% over 65
0 - 7
8 - 13
14 - 20
21 - 3
32 - 65
Source: FEMA
0 1 2 4 Miles
Population Over 65
GBRC Natural Hazard Mitigation Plan
GBRC
Greater Bridgeport Regional Council


Flood Zone
1 %
0.2 %
% Below Povert
0 - 4
5 - 12
13 - 25
26 - 42
43 - 80
Source: FEMA, TIGER
0 1 2 4 Miles
Population Below Poverty
GBRC Natural Hazard Mitigation Plan
GBRC
Greater Bridgeport Regional Council

23% of the Region's population. Although this data suggests diversity throughout the Region, minority populations are concentrated in Bridgeport and parts of Stratford (2013-2017 ACS).

The median age of the Region's residents is about 38.1 years old. This is a younger population than the state-wide median age of 40.9 years (2010 Census). About 19% of the Region's population is younger than 15 years old and 14.3% are 65 years or older (2013-2017 ACS).

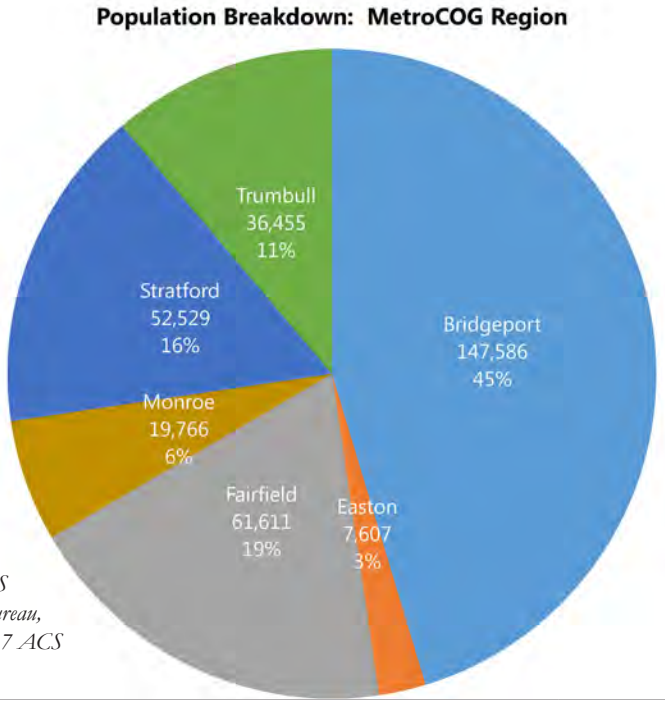
There are nearly 113,000 occupied housing units in the Region, with the majority (65.3%) owner occupied. About 9% of the Region's housing units are vacant (2013-2017 ACS). Seasonal or recreational units account for almost 10% of vacant units (2010 Census).

On average, the Region is a relatively wealthy area with an estimated annual median family income of $96,099. This is slightly higher than the state-wide estimate of $93,800. The per capita income is less than $38,000 annually, as compared to the state-wide estimate of $41,365. About 9,530 families or 12.1% of the total number of families in the Region earn less than $25,000 per year. 9.3% of all families in the Region earn an income that is below the poverty level. State-wide, only about 9.4% of all families earn less than $25,000 per year and the percentage of families that earn an income below the poverty level is about 7.0% (2013-2017 ACS).

The following sections describe the physical setting, population, demographics and generalized land use of each jurisdiction involved in the NHMP.

City of Bridgeport

The City of Bridgeport is the most populous city in Connecticut



Source: US Census Bureau, 2013-2017 ACS

Demographic Profile: MetroCOG Region		
Population		
Total Population	325,554	100.0%
White	171,129	52.6%
African American	58,796	18.1%
Other Race	21,490	6.6%
Hispanic or Latino	74,139	22.8%
Age		
Median Age	38.1	
< 15 years old	61,518	18.9%
> 65 years old	46,677	14.3%
> 75 years old	22,048	6.8%
Housing		
Total Housing Units	124,531	100.0%
Owner Occupied	73,747	65.3%
Renter Occupied	39,148	34.7%
Total Occupied Housing Units	112,895	100.0%
Vacant Units	11,636	9.3%
Seasonal Units	844	0.7%
Income		
Median Family Income	$96,099	
Per Capita Income	$37,952	
Families with Income <$25,000	9,530	12.1%
Families Below Poverty Level	7,292	9.3%

US Census Bureau, 2010 Census & 2013-2017 American Community Survey

with a population of 147,586 people (2013-2017 ACS). The CTDC (2017) estimates that the population is 146,579, generally consistent with the ACS. Bridgeport is the central city in the MetroCOG region and is bordered by Fairfield to the west, Trumbull to the north and Stratford to the east. Long Island Sound is located along the city's southern border. The city has a land area of 16 square miles, a waterfront of 22 miles and an elevation that reaches to 310 feet in the northwest corner.

Bridgeport is the most urban, densely populated and diverse municipality in the Region, as it accounts for about 45% of the Region's population. The city is home to the majority of the Region's non-white population and persons of Hispanic or Latino ancestry. African American residents make up 33% of the city's population and 46% of the city's population is another, non-white race. Persons of Hispanic or Latino descent comprise about 39% of Bridgeport's population (2013-2017 ACS).

The median age of people living in Bridgeport is about 33.8 years old, making the city a relatively young place (2013-2017 ACS). The proportion of residents younger than 15 years old is not significantly higher than the Region or state, indicating that the lower median age is partly due to a higher number of persons between the ages of 20 and 40 years old. The proportion of elderly living in Bridgeport (11%) is lower than that of the Region (2013-2017 ACS).

The city has a total of 58,124 housing units, with about 13% listed as vacant (2013-2017 ACS). The majority of these housing units are renter-occupied. Although owner-occupied housing accounts for only about 42% of the total, this proportion is higher than the cities of Hartford and New Haven. A total of 163 units, 0.3% of the total, are considered seasonal or recreational (2010 Census).

The entire city meets the definition of an economically distressed area, due to both low per capita income and the high unemployment rate. The per capita income for Bridgeport workers is approximately $22,806 per year. About 30% of the city's families earn less than $25,000 per year. The median family income for Bridgeport is about $50,356 per year (2013-2017 ACS).

While the economies of the Region are interdependent, there is a significant disparity between Bridgeport and the other towns of the MetroCOG Region. The per capita income for the Region as a whole is about $37,952 per year. When the Bridgeport population is subtracted, the Region's per capita income rises to $50,512 annually, thus indicating that the city's per capita income is 75% of the rest of the Region. The disparity in median family income is also pronounced, with a regional estimate of $128,763 per year without the inclusion of Bridgeport's median family income.

Historically, Bridgeport experienced rapid growth in the late nineteenth and early twentieth centuries, increasing from approxi-

Demographic Profile: City of Bridgeport

Population		
Total Population	147,586	100.0%
White	31,603	21.4%
African American	48,807	33.1%
Other Race	9,256	6.3%
Hispanic or Latino	57,920	39.2%
Age		
Median Age	33.8	
< 15 years old	29,405	19.9%
> 65 years old	15,757	10.7%
> 75 years old	7,156	4.8%
Housing		
Total Housing Units	58,124	100.0%
Owner Occupied	21,138	42.0%
Renter Occupied	29,203	58.0%
Total Occupied Housing Units	50,431	100.0%
Vacant Units	7,783	10.1%
Seasonal Units	163	0.3%
Income		
Median Family Income	$50,536	
Per Capita Income	$22,806	
Families with Income <$25,000	7,303	22.3%
Families Below Poverty Level	5,737	17.5%

Source: US Census Bureau, 2010 Census & 2013-2017 American Community Survey

mately 29,000 residents in 1880 to 143,000 residents in 1920. Population growth came primarily from immigration, with most immigrants coming from Europe before World War I and African American and Hispanic migrants coming from the Southern United States during later periods. The population peaked in the 1950s, but steadily decreased throughout the late twentieth century as a result of suburban growth and the decline of industry in the area. This declining trend was reversed between 2000 and 2010, as the current population increased by about 3%.

Bridgeport was originally a part of the towns of Fairfield and Stratford and was incorporated in 1821. Because of access to Long Island Sound, shipbuilding and whaling were important early industries. Bridgeport has a rich history as a manufacturing center. With the construction of railroad lines and good harbor access, the city experienced rapid industrialization. The railroad lines connected Bridgeport to New York to the west, New Haven to the east and Pittsfield, Massachusetts to the north. Various goods were produced in Bridgeport and shipped around the world. Products included brass fittings, sewing machines, carriages, and ammunition.

The city has a rich diversity of housing styles that were built to support the rise of the industrial sector. Much of this housing is typical of the mid-to-late Victorian era, including the Italianate Villa and Queen Anne styles. Colonial Revival and neoclassic styles are also well represented. Work force housing was provided in "workers" cottages, brick "Philadelphia style" row houses and triple deckers.

Today, land use in the city reflects its industrial past. While many of the industrial plants have been demolished or left vacant, remnants of this past endures. Residential neighborhoods are close-knit and retain historic configurations. Many residential areas were built in proximity to factories so as to attract and retain the workers needed by industry. Commercial activities are interspersed within neighborhoods. Downtown Bridgeport remains a banking center and is home to Federal, State, and County courthouses. Bridgeport is a major center of medical care due to the presence of St. Vincent's Medical Center and Bridgeport Hospital. Three colleges are located in Bridgeport: the University of Bridgeport in the South End (just north of Seaside Park and Long Island Sound), Housatonic Community College in Downtown, and Sacred Heart University on upper Park Avenue.

Bridgeport remains a major transportation hub. Commuter (Metro North) and intercity (Amtrak) rail service is provided at the Bridgeport rail station, located at the Bridgeport Intermodal Transportation Center in Downtown. Connected to the rail station by an overhead, covered walkway, Greater Bridgeport Transit's main bus terminal is also located in the Downtown. Bus service radiates from the downtown terminal throughout Bridgeport and into Fairfield, Stratford and Trumbull. Interstate 95 traverses the southern half of the region and has an interchange with the Route 8/25 Expressway in Bridgeport.

The Port of Bridgeport, classified as a commercial harbor, is one of three deep water ports in Connecticut. Activities within the harbor include recreational boating and support facilities, commercial fishing, dry dock and boat repair facilities, tug boat docking and passenger and vehicle ferry service. The Bridgeport and Port Jefferson Steamboat Company operates the ferry service to Long Island and leases the Water Street Dock for loading and unloading. The Water Street Dock is strategically located in Downtown and is functionally connected to the Intermodal Transportation Center.

Future land use in Bridgeport is anticipated to reflect existing land uses, with potential mixed use development on large vacant and underutilized parcels of land that had previously supported industrial uses.

Town of Easton

The Town of Easton has the smallest population of all municipalities in the Region with a population of 7,607 people (2013-2017 ACS). The Town is located in the Region's northwest and is bordered by the MetroCOG communities of Fairfield (to the south), and Monroe and Trumbull (to the east). The towns of Redding and Newtown (to the north) and Weston and Westport (to the west) are served by the Western Connecticut Council of Governments (WestCOG).

Easton is one of the Region's three inland communities. With a land area of 28.8 square miles, the Town consists largely of rolling, hilly terrain. Elevations range from 110 feet at the Fairfield border to approximately 740 feet at the northern boundary with Newtown.

Easton is not ethnically diverse, as only 7.9% of the Town's residents report an ethnicity other than white and only 4.9% of residents are of Hispanic or

Latino ancestry. Easton's population has the highest median age of the Region at 49.0 years old, but the proportion older than 65 is not significantly higher than the Region or other member communities (2013-2017 ACS).

The total number of occupied housing units in Easton is 2,762, with 94.5% of units occupied by the owner. Rental units account for 5.5% of the Town's housing. About 2.7% of the housing stock is vacant (2013-2017 ACS), with 50 units classified as seasonal or recreational, about 1.8% of total units (2010 Census).

Easton is a wealthy community, as indicated by the annual median family income of $159,044. The Town's per capita income of $66,658 per year is among the higher income levels in the state. Only 2.7% of families in the Town of Easton were listed as having an income below the poverty line; 115 families earned less than $25,000 per year (2013-2017 ACS).

The Town is almost exclusively a residential community and is primarily composed of single-family houses on large lots. About 0.1% of land in Town is used for commercial purposes. The Town does not have a specific concentrated commercial area and no industry is located within the corporate limits. Over one third of Easton is preserved as either current water company owned lands or former water company property. Four public supply reservoirs (Easton, Aspetuck, Hemlock and Saugatuck) are partially or wholly located in the town.

About 2,300 acres of the Centennial Watershed State Forest are located in Easton. The Centennial Watershed State Forest was formed in 2002, with the primary function and purpose to protect water quality, wetlands and woodlands. The State of Connecticut, in partnership with The Nature Conservancy (TNC), acquired ownership of roughly 6,000 acres of public supply watershed lands, as well as conservation and public access easements on an additional 9,000 acres. The Centennial Watershed State Forest is a patchwork of hundreds of scattered parcels throughout mostly Fairfield County of varying size.

As Easton is devoted to maintaining a pure water supply, future land development will be limited.

Town of Fairfield

The Town of Fairfield has a population of 61,611 people (2013-2017 ACS). Fairfield is bordered by the MetroCOG communities of Easton (to the north), and Bridgeport and Trumbull (to the east). The western border is with the Town of Westport, which is located in the WestCOG Region. Long Island Sound makes up the Town's southern border. The Town has a land area of 30.6 square miles, rising to the north from its shoreline to an elevation of approximately 450 feet at Hoyden Hill near the northern border with Easton.

Demographic Profile: Town of Easton

Population		
Total Population	7,607	100.0%
White	7,008	92.1%
African American	1	0.0%
Other Race	228	3.0%
Hispanic or Latino	370	4.9%
Age		
Median Age	49.0	
< 15 years old	1,389	18.3%
> 65 years old	1,347	17.7%
> 75 years old	513	6.7%
Housing		
Total Housing Units	2,837	100.0%
Owner Occupied	2,610	94.5%
Renter Occupied	152	5.5%
Total Occupied Housing Units	2,762	100.0%
Vacant Units	75	2.6%
Seasonal Units	50	1.8%
Income		
Median Family Income	$159,044	
Per Capita Income	$66,658	
Families with Income <$25,000	115	5.3%
Families Below Poverty Level	58	2.7%

Source: US Census Bureau, 2010 Census & 2013-2017 American Community Survey

Fairfield's population is predominately white, with 85.0% of residents reporting to be white. Approximately 15.0% of the Town's residents claim a race other than white. Persons of Hispanic or Latino descent comprise 6.3% of the population. The median age of Fairfield residents is 41.2 years old, with the proportion older than 65 years old accounting for about 15.6% of the population (2013-2017 ACS).

The total number of occupied housing units is 20,365, with 82.8% owner-occupied. The 17.2% of renter occupied units account for a higher proportion of housing units as compared to Easton, Monroe and Trumbull. Vacant housing units comprise 5.8% of the total housing stock (2013-2017 ACS) with 1.6% of the units classified as seasonal or recreational (2010 Census).

Fairfield is a wealthy community, as indicated by an annual median family income of $154,937, only slightly less than the median family income in Easton. The per capita income is $62,541 per year, a relatively high amount. About 3.0% of the total families are estimated to have an income below the poverty line. Families earning less than $25,000 per year accounted for 4.3% of all families (2013-2017 ACS).

Fairfield is a town with two distinct development patterns. Although the Town is a predominantly residential community, more intense development patterns are concentrated in the eastern and southern areas of the Town and along the Metro-North New Haven Line and the Interstate 95 corridors. The major business and industrial areas are located along US Route 1 and the southern portion of Route 58 (Black Rock Turnpike and Tunxis Hill Road). The northwestern part of town is relatively rural with a concentration of large lot, single family homes. Residential distribution is denser in the eastern portion of the community. Coastal development is primarily residential and includes beaches and private marinas. Two colleges are located in Fairfield: Fairfield University and Sacred Heart University.

Fairfield is served by three commuter rail stations on the Metro-North New Haven Line: Fairfield Metro Center, Fairfield Center and Southport. Local bus service, oriented to and from Downtown Bridgeport is provided along the US Route 1 (Kings Highway East to the Post Road) and Route 58 corridors. In addition to Interstate 95, the Merritt Parkway (Route 15) passes through the northern part of Fairfield.

Town of Monroe

The Town of Monroe is the fastest growing community in the MetroCOG Region, with a population of 19,766 people (2013-2017 ACS). Monroe is located in the northern part of the Region and is bordered by the MetroCOG communities of Easton to the west and Trumbull to the south. To the east, the Town shares a border with Shelton, which is represented by the Naugatuck Valley Council of Governments (NVCOG). On the northeast, Monroe

Demographic Profile: Town of Fairfield

Population		
Total Population	61,611	100.0%
White	52,369	85.0%
African American	875	1.4%
Other Race	4,458	7.2%
Hispanic or Latino	3,909	6.3%
Age		
Median Age	41.2	
< 15 years old	12,120	19.7%
> 65 years old	9,634	15.6%
> 75 years old	4,796	7.8%
Housing		
Total Housing Units	21,615	100.0%
Owner Occupied	16,867	82.8%
Renter Occupied	3,498	17.2%
Total Occupied Housing Units	20,365	100.0%
Vacant Units	1,250	5.8%
Seasonal Units	353	1.6%
Income		
Median Family Income	$154,937	
Per Capita Income	$62541	
Families with Income <$25,000	655	4.3%
Families Below Poverty Level	457	3.0%

Source: US Census Bureau, 2010 Census & 2013-2017 American Community Survey

borders the Town of Oxford (NVCOG) along Lake Zoar and the Housatonic River. The land area of Monroe is 26.4 square miles and the Town has a high elevation of approximately 600 feet.

The ethnic mix of Monroe's population is similar to that of other suburban communities in the Region. The population is predominately white with 88.8% of residents reporting to be white. Approximately 11.2% of the Town's residents report a race other than white. Persons of Hispanic or Latino descent comprise 4.2% of the population. The median age of Monroe's residents is 44.5 years old. The proportion of the population older than 65 accounts for about 14.6% of the population and is lower than other communities in the region (2013-2017 ACS).

The total number of occupied housing units in Monroe is 6,865, with 90.2% of units occupied by the owner. This percentage is comparable to other similarly sized towns in the Region, such as Easton and Trumbull. Rental units account for 9.8% of total occupied units. Vacant housing units comprise 6.1% of the all housing units (2013-2017 ACS). Only 27 units are classified as seasonal or recreational (2010 Census).

The annual median family income for Monroe is $133,253, similar to the Region's average without considering income levels in Bridgeport. The per capita income is $47,991 per year. About 138 families or 2.7% of all families earn an income below the poverty line and 2.9% of the households earn less than $25,000 per year (2013-2017 ACS).

Monroe is a predominantly residential community comprised of single family, detached units on one to three acre lots. Several condominium complexes provide a higher concentration of housing. Commercial activities are concentrated along the Route 25 and Route 111 corridors, and several industrial parks are located along Pepper Street in the northern part of town. Future land use in Monroe is anticipated to be consistent with existing development patterns.

Demographic Profile: Town of Monroe

Population		
Total Population	19,766	100.0%
White	17,558	88.8%
African American	33	0.2%
Other Race	1,338	6.8%
Hispanic or Latino	837	4.2%
Age		
Median Age	44.5	
< 15 years old	3,759	19.0%
> 65 years old	2,894	14.6%
> 75 years old	1,228	6.2%
Housing		
Total Housing Units	7,312	100.0%
Owner Occupied	6,192	90.2%
Renter Occupied	673	9.8%
Total Occupied Housing Units	6,865	100.0%
Vacant Units	447	6.1%
Seasonal Units	27	0.4%
Income		
Median Family Income	$133,253	
Per Capita Income	$47,991	
Families with Income <$25,000	148	2.9%
Families Below Poverty Level	138	2.7%

Source: US Census Bureau, 2010 Census & 2013-2017 American Community Survey

Town of Stratford

The Town of Stratford has a population of 52,529 people (2013-2017 ACS). Stratford is bordered by the MetroCOG communities of Bridgeport and Trumbull to the west. The Town borders the City of Shelton (NVCOG) to the north and the City of Milford (South Central Region Council of Governments) to the east. Long Island Sound makes up the town's southern border. The Housatonic River flows between Stratford and Milford. The land area of Stratford is 19.6 square miles. Rising north from the Town's shoreline, the Oronoque section of town has an elevation of approximately 240 feet.

The Town of Stratford's population is more ethnically diverse than the MetroCOG Region's other suburban communities. Although the population is predominately white at 64.4% of residents, 26.1% of the population is made up of ethnic minorities. Persons of Hispanic or Latino descent comprise about 15.3% of the population. The median age

of Stratford's residents is 44.1 years old, similar to other communities in the Region and the state average. The proportion of the population older than 65 is higher than several other communities in the Region, accounting for about 19.5% of the population. Similarly, the percentage of younger age persons is the lowest, comprising 14.7% of the population (2013-2017 ACS).

The total number of occupied housing units in Stratford is 20,179 with 79.7% owner-occupied. This percentage is lower than the Region's northern communities but comparable with that of Fairfield. Rental units account for 20.3% of total occupied units. Vacant housing units comprised 7.2% of total units (2013-2017 ACS), with 172 units classified as seasonal or recreational (2010 Census).

The annual median family income for Stratford is $90,718, the second lowest income in the Region. The per capita income is $36,043 annually, lower than that of Fairfield County and slightly lower than the state-wide median family income. About 834 families, or 6.1% of the total were listed as having an income below the poverty line and 8.4% of families earned less than $25,000 per year (2013-2017 ACS).

Although Stratford is a predominantly residential community, the Town has significant commercial and industrial corridors. Commercial activities are concentrated along the U.S. Route 1 (Barnum Avenue), U.S. Route 113 (Main Street), as well as in the vicinity of Route 110 (East Main Street, Barnum Avenue Cutoff, and Ferry Boulevard) and Route 130 (Stratford Avenue). Prime industrial areas are located in the south end of Stratford in Lordship and near the Sikorsky Memorial Airport. The Sikorsky Aircraft plant (Lockheed Martin) is located along the northern section of Route 110.

There is a wide range of housing types in Stratford. Medium density housing is prevalent in the central and southern areas of town, while the northern part has typical low density developments. Future land use plans include transit oriented and mixed use development, as well as light industrial and office park development.

Stratford is served by one commuter rail station on the Metro-North New Haven Line, located in Stratford Center. Local bus service is provided throughout the Town and provides access to most areas of activity. Interstate 95 traverses the southern half of Stratford and the Merritt Parkway is located in the northern part. The Sikorsky Airport, the Region's only airport, is located in the Lordship section of town. The airport is classified as a General Aviation airport, serving primarily private aircraft.

Town of Trumbull

The population of the Town of Trumbull is made up of 36,455 people (2013-2017 ACS). The Town is located in the center of the Region, bordered by the City of Bridgeport to the south, the Town of Easton to the west, the Town of Monroe

Demographic Profile: Town of Stratford

Population		
Total Population	52,529	100.0%
White	33,813	64.4%
African American	7,531	14.3%
Other Race	3,139	6.0%
Hispanic or Latino	8,046	15.3%
Age		
Median Age	44.1	
< 15 years old	7,738	14.7%
> 65 years old	10,233	19.5%
> 75 years old	4,844	9.2%
Housing		
Total Housing Units	21,745	100.0%
Owner Occupied	16,080	79.7%
Renter Occupied	4,099	20.3%
Total Occupied Housing Units	20,179	100.0%
Vacant Units	1,566	7.2%
Seasonal Units	172	0.8%
Income		
Median Family Income	$90,718	
Per Capita Income	$36,043	
Families with Income <$25,000	1,146	8.4%
Families Below Poverty Level	834	6.1%

Source: US Census Bureau, 2010 Census & 2013-2017 American Community Survey

to the north, and the Town of Stratford to the east. Trumbull is also bordered by the City of Shelton (NVCOG) to the east. The land area of Trumbull is 23.3 square miles and consists of low hills and steep ridges that rise above well-defined valleys. The highest elevation in the Town is approximately 520 feet, recorded in both Tashua and Booth Hill.

The ethnic mix of Trumbull's population is similar to that of the Region's other suburban communities. The population is predominately white: 78.9% of residents report to be white and 21.1% of residents report a race other than white. Persons of Hispanic or Latino descent comprise 8.4% of the Town's population. The median age of Trumbull residents is 43.5 years, making the Town's population slightly younger than other communities in the Region. The proportion of the population older than 65 is among the highest in the Region, accounting for about 18.7% of the population. The number of residents younger than 15 years old accounts for about 19.5% of the population and is similar to other communities in the Region (2013-2017 ACS).

The total number of occupied housing units in Trumbull is 12,383, with 87.7% owner-occupied households. Renter occupied units make up about 12.3% of total occupied units. These rates are comparable to other similarly sized towns in the Region. Approximately 4.0% of all housing units in the Town are vacant (2013-2017 ACS). Seasonal or recreational housing units make up about 1% of the total housing stock (2010 Census).

The annual median family income for Trumbull is $132,188 which is slightly higher than the average for the Region without considering income levels in Bridgeport. The per capita income is at $49,030 per year. About 68 families or 0.7% of families earn an income below the poverty line and 1.7% of all households earn less than $25,000 per year (2013-2017 ACS).

Demographic Profile: Town of Trumbull

Population		
Total Population	36,455	100.0%
White	28,778	78.9%
African American	1,126	3.1%
Other Race	2,468	6.9%
Hispanic or Latino	3,057	8.4%
Age		
Median Age	43.5	
< 15 years old	7,107	19.5%
> 65 years old	6,812	18.7%
> 80 years old	2,443	6.8%
Housing		
Total Housing Units	12,898	100.0%
Owner Occupied	10,860	87.7%
Renter Occupied	1,523	12.3%
Total Occupied Housing Units	12,383	100.0%
Vacant Units	515	4.0%
Seasonal Units	79	0.6%
Income		
Median Family Income	$132,188	
Per Capita Income	$49,030	
Families with Income <$25,000	163	1.7%
Families Below Poverty Level	68	0.7%

Source: US Census Bureau, 2010 Census & 2013-2017 American Community Survey

Trumbull is a predominantly residential community, comprised mostly of single-family houses on one half to one acre lots, with the smaller lots sizes located in the older parts of town. Several condominium complexes are scattered throughout the town. Commercial, office and industrial activities are concentrated in large parks with single accesses from main road corridors. The two largest shopping malls in the Region are located in Trumbull. Future land use in Trumbull is expected to maintain and enhance the existing colonial New England, residential character of the Town with some limited and managed vertical growth in industrial areas.

Local bus service is provided along main road corridors and is oriented to and from the Trumbull–Westfield Shopping Mall. The Merritt Parkway and Routes 8 and 25 pass through Trumbull.

1.5 Land Use

The land area of the region

is approximately 145 square miles. Land cover statistics were derived from data provided by the UConn Center for Land Use Education and Research (CLEAR).

The coastal towns, especially along the Interstate 95 corridor, are the most developed areas in the region. Overall, 40% of the region is developed. The inland communities, especially Easton and Monroe, are more forested. Overall, 38% of the region is forested. There is some agriculture but it is less than 2% of the entire region.

1.6 Development Trends

As mentioned in Section 1.4, the MetroCOG Region has the highest population density in the State of Connecticut. The majority of the population (45%) lives in the City of Bridgeport. Following the previous 2014 NHMP, estimates suggest that all towns have increased in population but that development trends have been relatively flat. The majority of new housing permits were in the coastal communities of Fairfield, Bridgeport, and Stratford which have been hard hit by previous coastal storms such as Superstorm Sandy. Thus an increase in development in these towns likely resulted in more people exposed to natural hazards.

From 2000 to 2010 the Region's population increased by 10,397 people. Again, Bridgeport and Fairfield had the largest increase in population, while Monroe and Easton had the smallest. The towns of Stratford and Trumbull also grew by over 1,400 people. From 2010 to 2017, the Region's population is estimated to have increased by 7,550 people, primarily in the coastal communities of Bridgeport, Fairfield, and Stratford. The coastal increase in population has put more people in

Source: UConn, CLEAR

2015 Land Cover

Land Cover	Area (acres)	%
Developed	36,630	39.9
Turf & Grass	13,228	14.4
Other Grasses	1,143	1.2
Agriculture	1,513	1.6
Deciduous Forest	31,088	33.9
Coniferous Forest	1,656	1.8
Water	2,514	2.7
Non-Forested Wetland	57	0.1
Forested Wetland	2,026	2.2
Tidal Wetland	977	1.1
Barren Land	708	0.8
Utility ROWs	154	0.2
Total	**92,692**	**100**

Source: US Census Bureau, 2010 Census, 2013-2017 ACS

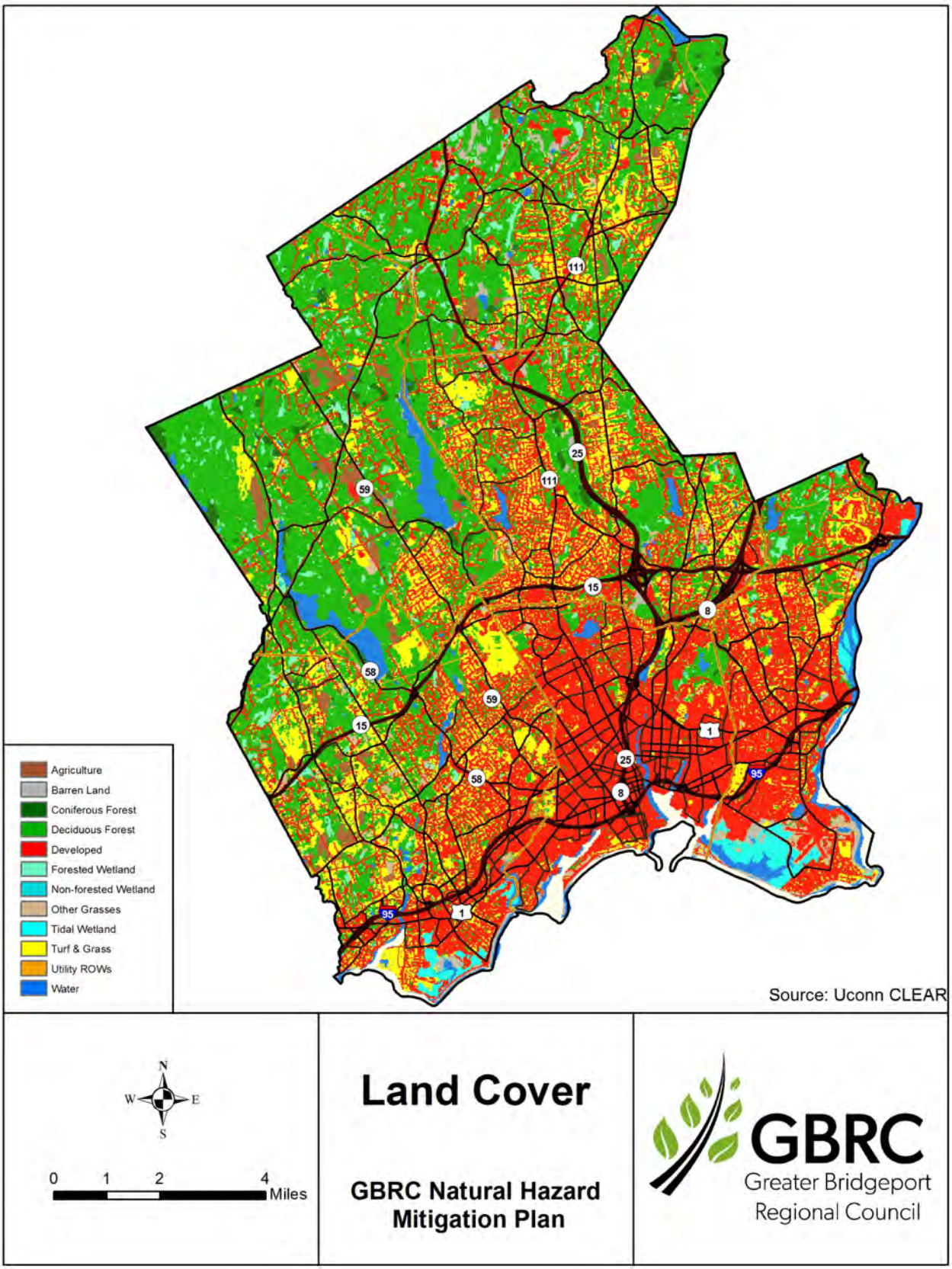
Population Change

Municipality	2000	2010	2017 Est.	Change, 2010-17
Bridgeport	139,529	144,229	147,586	3,357
Easton	7,272	7,490	7,607	117
Fairfield	57,340	59,404	61,611	2,207
Monroe	19,247	19,479	19,766	287
Stratford	49,976	51,384	52,529	1,145
Trumbull	34,243	36,018	36,455	437
Region	**307,607**	**318,004**	**325,554**	**7,550**

Source: Connecticut Department of Economic and Community Development

Housing Permit Data From 2012-2017

Municipality	2012	2013	2014	2015	2016	2017	Total
Bridgeport	175	16	134	119	69	31	544
Easton	3	8	5	5	6	7	34
Fairfield	50	154	111	98	258	111	782
Monroe	4	16	3	5	10	17	55
Stratford	9	270	13	37	25	84	438
Trumbull	7	11	4	8	8	6	44
Region	**248**	**475**	**270**	**272**	**376**	**256**	**1,897**


Agriculture
Barren Land
Coniferous Forest
Deciduous Forest
Developed
Forested Wetland
Non-forested Wetland
Other Grasses
Tidal Wetland
Turf & Grass
Utility ROWs
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Source: Uconn CLEAR
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Land Cover
GBRC Natural Hazard Mitigation Plan
GBRC
Greater Bridgeport Regional Council

danger of coastal storms which have been occurring regularly over the last decade.

City of Bridgeport

The previous NHMP noted that the primary land use objective for the City of Bridgeport was redevelopment. The focus was on infilling former manufacturing lots that have been left vacant, of which many are Brownfield sites. In addition, the City is working to develop Transit Oriented Development (TOD) in East Bridgeport with emphasis on multi-modal transit.

The City has continued to focus on redevelopment over the past five years. Notable projects include:

- A number of redevelopment projects are underway Downtown.
- The Ballpark at Harbor Yard is being converted to an amphitheater in 2019-2020.
- Public Service Enterprise Group (PSEG) constructed a new generating unit ("Unit 5"). This new plant has been elevated on fill material above the 0.2% flood elevation.
- Steele Point is being built out on land that is protected by new bulkheads and an elevated ground surface that exceeds the base flood elevation. Projected buildout of Steele Point is 10 to 15 years from 2019, extending into the timeframes of future hazard mitigation plan updates. A new site at the southern extent of Steele Point ("Dockmaster Building") is complete and ready for mixed use in 2019.
- Marina Village, a public housing complex consisting of two-story row-house buildings located near Seaside Park in the South End, is in the process of being rebuilt. The new development will include compliance with floodplain development standards, as the site is partially in the SFHA. The project will begin on the east side outside the flood zone and then extend to the west into the flood zone.
- "Civic Block" refers to an entire block on Stratford Avenue which is being redeveloped with a new library, grocery store, retail and other uses.
- The former Remington site at 60 Main Street will eventually be redeveloped in the coastal flood zone.
- The former ferry terminal site will eventually be redeveloped in the coastal flood zone, but not until after the ferry service completes its terminal relocation. This will likely occur in the five-year timeframe of this plan, between 2019 and 2024.
- The University of Bridgeport is planning for a variety of redevelopment projects in the south end.
- Both wastewater treatment facilities will be undergoing upgrades in their respective coastal flood zones in the next five years.
- Redevelopment is possible along and near Cedar Creek in the West End planning area.
- Cherry Street development near the railroad tracks is outside the flood zone.
- BMW is building a new building in the floodway that will be floodproofed. This area flooded in September 2018, and the redevelopment will likely lead to lower future damages at the site.
- Development is ongoing along the Seaview Avenue corridor north of Barnum Avenue.

To the extent necessary, some of the above redevelopment projects will intersect with components of Resilient Bridgeport which is the result of the Rebuild by Design (RBD) and National Disaster Resilience Competition (NDRC) awards. For example, RBD is primarily leading to elevation of Iranistan Avenue at Marina Village, which will necessarily impact the Marina Village redevelopment. NDRC is leading to elevation of University Avenue and construction of other segments of flood protection in the South End, which will impact properties such as the former Remington site at 60 Main Street. The City will need to continue coordinating its review of development projects with participation of the Resilient Bridgeport team.

Finally, the City of Bridgeport has also been investing in new community resources such as schools. The City has a new high school located at 840 Old Town Road. The City annexed this land from the Town of Trumbull. The City also built Harding High School at 379 Bond Street which opened in August 2018. Finally, various school renovations have also been completed during the timespan between the adoption of the 2014 NHMP and development of this update.

Town of Easton

The previous NHMP noted that the Town of Easton continued to preserve low residential character and ample amounts of public water supply watershed lands. It continued to encourage commercial and service growth in central areas while preserving open space.

The Town of Easton noted that major development is not underway as of 2019. The Town remains rural and wishes to retain its rural character.

Town of Fairfield

The 2014 NHMP noted that since the 2006 NHMP there were several completed developments in the Town of Fairfield. The Metro Center Train Station was constructed in December 2011. Fairfield University and Sacred Heart University constructed new dormitories and educational buildings. A Whole Foods Development and strip mall was completed as well as a Green Infrastructure "Delmar" mixed development project. There has also been construction of a joint Town and privately owned recreational complex. Finally, there was "in filling" of vacant lots and construction of minor subdivisions.

While the majority of Fairfield is residential, the Commerce Drive area represents an opportunity for development. In May 2011, the Town Planning and Zoning commission adopted an amendment to the Town Plan of Conservation and Development to implement new zoning regulations for the Commerce Drive area surrounding the new Metro Station to guide new development.

The Town has attempted to alleviate its vulnerability to natural hazards. There has been an increase in the number of houses being elevated after coastal storms Irene and Sandy. The Town of Fairfield has also continued to limit development on the Pine Creek side of Fairfield Beach Road due to its vulnerability to coastal natural hazards such as hurricanes and storm surge. Over the past five years, new resilient construction is underway throughout the town, with residential tear-down and reconstruction projects resulting in more than 100 elevated homes and approximately 200 replacement flood compliant structures.

Transit-Oriented Development (TOD) is ongoing as of 2019 in the vicinity of the Fairfield Metro Railroad Station. This development including 101 new housing units plus 160 housing units coming online soon. New resilient construction is underway throughout the town, and residential tear-downs/reconstruction projects are resulting in elevated homes where flood risks are present. A new solar farm was recently constructed on the closed landfill, as a result of increased interest in solar generation throughout New England.

Town of Monroe

The 2014 NHMP noted that since the 2006 NHMP there had been minor development in the Town of Monroe. Approximately 40% of the Pepper Street Industrial park was developed, leaving about 30% undeveloped (remaining) at this point. There has also been expected (typical) infilling and redevelopment along the Route 25 and Route 111 commercial corridors. Some sections of Route 25 will be elevated in 2019 to address flooding. There were no significant changes in residential development (subdivisions), with only one subdivision requiring a floodplain development permit since 2014.

As of 2019, the Town reported that very little development is occurring in floodplains. Backyards typically approach floodplains, but not structures. Pending projects include the following which are not located in areas of flood risk:

- New bulk propane storage
- A three-lot subdivision
- A two-lot subdivision
- Expansion of a non-residential use

By comparison, projects approved in 2018 included a five-lot industrial subdivision, a new distribution center, and a new gasoline service station. Prior to 2018 and 2019, the last residential subdivision approved by the town was in 2015, and the size was only ten lots.

Town of Stratford

The 2014 NHMP noted that since the 2008 Stratford NHMP, there had been several development projects completed. New apartment complexes designed by Forest City Enterprises were completed on Stratford Avenue and on Main St. The Stratford Avenue apartments were completed in September 2013. In addition, construction had begun on the Avalon Bay apartment complex located on Cutspring Road in the northern section of the Town.

In addition to development, the Town has removed structures as well. Sixty-three cottages on Long Beach West were removed in 2010-2011. These cottages were abandoned when the only vehicular bridge connecting the community to the mainland was lost to a fire. Instead of rebuilding the bridge, the Town opted to remove the structures to increase open space and environmental conservation. These structures were located on a barrier island, susceptible to coastal flooding, so

there removal reduces the Town's overall risk to natural hazards.

The Town of Stratford remains for the most part, built out. The majority of development will be in-fill residential development and redevelopment of existing industrial and commercial areas. The Town has also developed a updated Open Space Inventory designed to highlight potential open space acquisitions over the next several years.

As of 2019, development in the Transit Oriented Development District for mixed uses is a significant focus in the town. About 300 to 400 units are approved within ¼ mile of the railroad station. The Town believes this momentum will continue. Other projects include:

- Contract Plating on Honeyspot Road has been demolished and will be redeveloped.
- Large-scale warehouse development along Lordship Boulevard may continue.

Of particular interest to flood hazard risk reduction, the U.S. Army has selected a preferred developer for the former Army Engine Plant which is entirely in the coastal flood zone. Redevelopment of this large parcel will require compliance with regulations that control development in flood zones. Similarly, the former Shakespeare property is located partially in the flood zone and is planned for redevelopment.

Finally, the town believes that some development will be spurred by nearby development in Bridgeport (i.e. Steele Point).

Town of Trumbull

The 2014 NHMP noted that changes in development since 2006 included significant new building construction on Monroe Turnpike and Quarry Road. There were two to three other places in town where existing commercial buildings were significantly expanded during that time. Also, new subdivisions were built between 2006 and 2009, primarily in the northwestern part of Town.

According to Town staff, recent development since 2014 has avoided floodplains. Numerous apartment units are in development, and a new medical office building was recently developed.

Summary of Development Trends

As noted on page 1-14, an increase in development in the three coastal communities of the region likely resulted in more people exposed to natural hazards, and the moderate region wide increase in population has put more people in danger of storms. However, much of this development is occurring as redevelopment, and all of the development (new or otherwise) is regulated by current zoning and flood damage prevention regulations as well as the State Building Code.

Therefore, the region's mitigation goals, objectives, and strategies (described in Sections 4.2 and 4.3) were deemed appropriate and needed only minor revisions. Three objectives were added as noted on Pages 4-14 and 4-15. These are related to "code plus" construction, shoreline infrastructure, and robust public outreach through CRS participation. Significant revisions of this NHMP were not necessary for addressing development trends in the region.

2 Planning Process

Section Two documents the process of preparing the NHMP and the involvement of each MetroCOG municipality. Outreach to and engagement with neighboring communities, regional agencies and the public is described. Details of existing plans, policies, programs and government structures provides insight into the capacity of each community to plan for natural hazards and implement strategies that will mitigate the impacts of natural hazards.

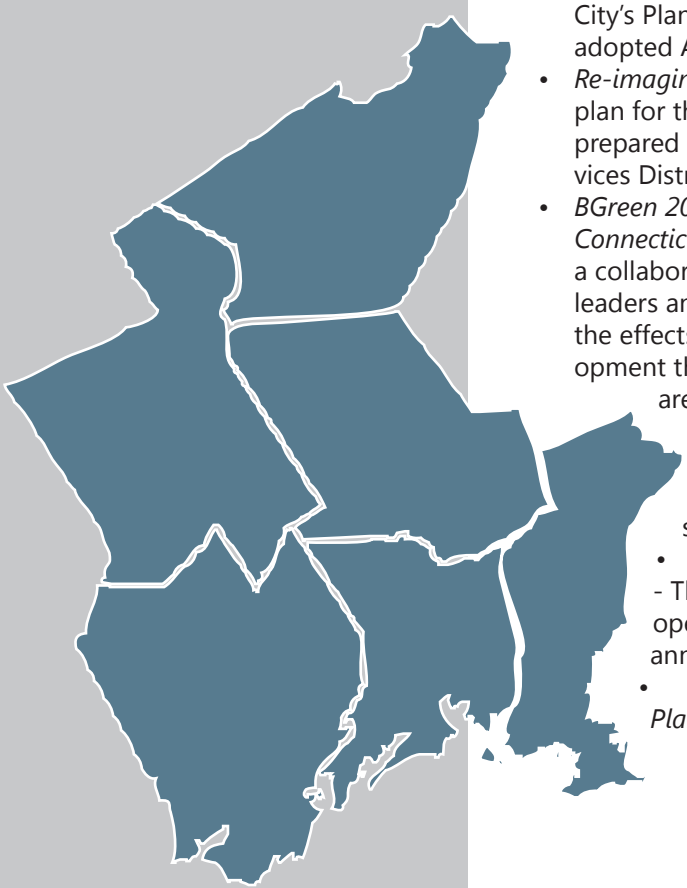
2.1 Review of Existing Plans

The existing Plans of Conservation and Development (POCD) for each of the six communities of the MetroCOG Region were reviewed. In addition, other pertinent reports or plans were examined for their relevance to developing the NHMP.

City of Bridgeport

The City has prepared and adopted several master plans to guide future development and use of land. Plans reviewed include the following:

- *Plan Bold - Plan Smart - Plan Bridgeport* - The City's Plan of Conservation and Development; adopted April 22, 2019.
- *Re-imagining Downtown Bridgeport* - A master plan for the revitalization of the downtown area; prepared in 2007 by the Downtown Special Services District.
- *BGreen 2020: A Sustainability Plan for Bridgeport, Connecticut* - The Plan was developed through a collaboration of city departments, community leaders and the business community to address the effects of climate change, encourage redevelopment that is sustainable, revitalize distressed areas of Bridgeport, implement renewable energy projects and programs, increase recycling and composting, and focus mobility on a transit first and complete streets policy.
- *All Hazards Emergency Operations Plan* - The current version of this plan was developed in 2011 and is reviewed and updated annually.
- *Pequonnock River Watershed Based Plan* - The Pequonnock River watershed is



located within the City of Bridgeport and the Towns of Trumbull and Monroe. The goal of the Plan is to identify actions that will address water quality impairments in the Pequonnock River and Bridgeport Harbor. While water quality is the primary focus of the plan, many recommendations to restore water quality will also mitigate flooding throughout the watershed. The Plan was adopted in 2011.

- *Rooster River Watershed Based Plan* - The goals and strategies of the Rooster River Plan are similar to those of the Pequonnock River Plan. The Rooster River flows from the Town of Trumbull to form the border between the Town of Fairfield and the City of Bridgeport. Via the Ash Creek Estuary, the River ultimately flows into Black Rock Harbor and Long Island Sound. The Plan was adopted in 2014.
- *Feasibility Study and Master Plan for Pleasure Beach Park* - Pleasure Beach Park is located on the largest portion of a barrier beach that extends from Stratford to Bridgeport. The Plan balances active and passive recreation uses with the park's value as a habitat for native and endangered species.
- *Waterfront Bridgeport Plan* - The Waterfront Plan focuses on recreating and transforming Bridgeport's waterfront from its industrial past to one focused on public access and resiliency. The Plan was adopted in 2017.
- *Regional Plan Association Fourth Regional Plan* - This Plan is intended to guide or inform improvements to various aspects of the region with a focus on the changing coastline and restoration of natural systems. This Plan was adopted in 2017.

Plan Bold - Plan Smart - Plan Bridgeport

The City's POCD presents several guiding principles for the next 10 years related to being a livable city, having a robust economy, being an equitable city, being a healthy community, valuing nature, and being a regional center. The goals and strategies presented in the plan are also aligned with four main strategic themes including waterfront, TOD, housing, and neighborhoods.

The POCD encourages waterfront redevelopment efforts while recognizing the risk of coastal storms and flooding. Redevelopment objectives include development of a 3.5-mile linear trail along the waterfront and 200 acres of redevelopment in the area. The POCD further encourages the City to support coastal resilience efforts either through barriers, elevation of structures, or reintroduction of marshes.

Another goal is to concentrate dense, mixed use and walkable development around upgraded multimodal transportation infrastructure. The POCD recommends that the City improve pedestrian and bicycle access, construct Barnum rail station in East Bridgeport, and set a development goal of 4,300 housing units within one-half mile of Bridgeport station (Downtown). The development of housing is considered a critical need as 40% of the existing housing stock in the city is more than 70 years old, and the existing housing stock is too expensive for many families to afford. To this end, new development will be encouraged through zoning changes, while redevelopment is encouraged for blighted and vacant properties.

Numerous goals and strategies in the POCD are related to hazard mitigation, including (but not limited to) enhancing the resiliency of Bridgeport's neighborhoods by encouraging development of neighborhood specific coastal resiliency plans, restricting development in high risk flood plains, and supporting development of a comprehensive flood protection system for the South End neighborhood. Other strategies include implementation of the Pequonnock River Watershed Based Plan, the Rooster River Watershed Based Plan, and the Ash Creek Estuary Master Plan.

Re-imagining Downtown Bridgeport

The Downtown Master Plan was incorporated as part of the previous 2008 POCD. The Plan's vision is to transform Downtown Bridgeport into an urban alternative for young adults through a dynamic mix of entertainment, recreation, restaurants, employment opportunities and housing. The key element of the Plan is to leverage the Downtown's assets, historic buildings and architectural qualities to attract real estate development and investment. The Plan's recommendations include the installation of green infrastructure to provide better storm water management and capacity, modified landscaping to reduce the amount of hard and impervious surfaces, and the creation of a greenway along the harbor and waterfront.

The BGreen 2020: A Sustainability Plan for Bridgeport, CT

The BGreen 2020 plan was developed to guide the City's future development and land use

policies. The BGreen Plan's intent is to establish goals and objectives to promote and encourage development that would reduce the City's carbon footprint, rely on alternative energy sources and change how people move about the City. The plan's overriding theme stresses that climate change and rising sea levels are occurring and will continue in the future. The City will face long term consequences that include stronger storm surges and greater coastal flooding. These hazards will threaten the City's infrastructure and vulnerable populations. While the Plan does not specifically address natural hazard mitigation, it includes a number of actions and strategies to reduce storm water runoff, increase resiliency to climate change, sea level rise and storm surges, and encourage sustainable development. Recommended actions include:

- Increase waterfront access opportunities;
- Expand street tree planting and urban forest programs;
- Limit storm water flows into the waste water system;
- Maintain the storm water system to prevent and reduce flooding; and
- Develop green building guidelines and install green infrastructure.

Pequonnock River Watershed Based Plan

In 2010, a partnership between the City of Bridgeport and the Towns of Monroe and Trumbull was formed to develop the Pequonnock River Watershed Based Plan. The Pequonnock River flows through the three municipalities and the watershed covers about 29 square miles. While degraded water quality is a prime issue, flooding along the river is common. In Bridgeport, flooding occurs because of intense urban development along the river. Steep slopes and limited floodplain storage capacity worsens flooding in Trumbull, while lowlands adjacent to the upper reaches of the Pequonnock River in Monroe flood.

In general, the priority actions for the Pequonnock River watershed are intended to improve the water quality. However, many actions will have the secondary benefit of reducing flooding and the associated impacts. These include the installation of green infrastructure to increase the storage capacity of storm water runoff and efforts to protect, preserve and expand buffers and setbacks from wetlands and the river channel.

Rooster River Watershed Based Plan

The Rooster River Watershed Based Plan (Approved 2013) was developed through a partnership with the City of Bridgeport, the Towns of Fairfield and Trumbull, the Southwest Conservation District and the Connecticut Department of Energy and Environmental Protection. The watershed management goals, and supporting actions to restore the water quality of the Rooster River are similar to those of the Pequonnock River Plan. Actions that will mitigate flooding and possibly other hazards include:

- Reduce the impacts of storm water on hydrology and water quality through the use of Low Impact Development (LID) practices and Green Infrastructure approaches.
- Implement municipal storm water management programs to comply with state and federal permit requirements.
- Identify and remove illicit wastewater and non-storm water discharges into the Rooster River and its tributaries.
- Protect and enhance forested areas and urban tree canopy within the watershed.
- Address flooding issues through a coordinated, watershed-wide approach.
- Preserve and protect existing open space and continue to protect/acquire open space that meets resource protection and recreational goals.

Feasibility Study and Master Plan for Pleasure Beach Park

The Feasibility Study and Master Plan for Pleasure Beach Park includes a site analysis of this environmentally valuable barrier beach, as well as a vision plan and list of projects for the park. Recommendations related to hazard mitigation include:

- Reduce impervious surfaces.
- Support surface conveyance, infiltration and natural treatment of storm water.
- Remove invasive plant material and plant native and non-invasive species.

Waterfront Bridgeport Plan

The Waterfront Bridgeport Plan (WBP) focuses on recreating and transforming Bridgeport's waterfront which still resembles the city's industrial past. The goals of this plan are to increase public access, create jobs and economic prosperity, repurpose vacant or abandoned properties, encourage water-based recreation and an active waterfront, and to boost resiliency against effects of climate change.

The plan was developed with input from the City of Bridgeport, public officials, community members, and waterfront stakeholders. The WBP is meant to be a guide for action rather than just a summary of design ideas.

The framework for the plan will play a role in decisions regarding land use, public space and access, neighborhood connections, pathway characteristics, and much more. This framework and its important elements are critical to the success of the revitalization projects. The overall framework includes strategies regarding zoning and compliance, economic development, public access and amenities, design standards, natural restoration and resiliency, and waterfront advocacy and programming.

As part of the zoning and compliance aspect of this plan, it was suggested that a Waterfront Overlay Zone (WOZ) be created. Properties located within this zone would be subject to certain WOZ requirements. These regulations would come into effect when there is construction or placement of a structure, when a site being filled is significantly changed, a change in property or structure use, demolition of structures, or alterations or renovations of existing buildings. The proposed WOZ regulations address both the goals and design standards of the WBP.

The natural restoration and resilience aspect of this plan aims to restore the functional ecology of the shoreline and protect inland development with the implementation of green infrastructure approaches. The plan also looks to integrate resiliency into all redevelopment projects along the waterfront area, not just intermittently. The plan references the regulatory changes made in 2013 by New York City, which passed a Flood Resilience Zone Text Amendment. It was also suggested that existing zoning in Bridgeport be modified to allow for storm protections, such as elevating buildings above FEMA flood levels.

Regional Plan Association Fourth Regional Plan

The Regional Plan Association (RPA) Fourth Regional Plan was developed to guide or inform improvements to various aspects of the Region including economic development, climate change adaptation, sustainable communities, and transportation and infrastructure. This plan is guided by four core values: equity, health, prosperity, and sustainability. Bridgeport is a part of the Region addressed by the Fourth Regional Plan, and RPA selected Bridgeport as one of the Region's Nine Flagship Places along with communities in New York City, Long Island, the Hudson Valley, and New Jersey.

This plan acknowledges the changes and effects that have already been experienced across the region related to climate change. These recommendations revolve around adapting to a changing coastline, bringing nature into communities, improving the natural and built systems, and to create a greener energy system with more capacity.

For the region to adapt to the changing coastline, multiple recommendations are made.

- One is to protect the densely populated communities that are vulnerable to storms and flooding. Two aspects of exposure are considered for this recommendation: physical and social. Many residents situated on the vulnerable shoreline are elderly, low-income, or otherwise socially vulnerable. Some ways to improve resiliency and protect these communities is to complete projects that are underway, provide support to municipalities or communities conducting their own resilience planning, and to create a long-term adaptation plan.
- There is also the recommendation to migrate away from places that likely cannot be protected. By improving buyout programs, implementing long term adaptation plans, and knowing what is at risk, costly outcomes can be avoided, such as infrastructure and property damage. The concept of migrating away from areas that cannot be protected could be considered.

The second set of recommendations made fall under the category of bringing nature into the community.

- One suggestion is to end the discharge of raw sewage into waterways. To reduce such discharges, municipal building and zoning requirements should be set to incorporate green infrastructure approaches, stormwater utility fees could be implemented, and studies should be conducted to also evaluate the applicability of green districts. The elimination of combined sewer outflows would help alleviate pollution, and in turn improve the health of surrounding ecosystems.
- There is also the recommendation to restore the region's harbors and estuaries. Methods of doing so include maintaining the existing

habitats, restoring lost habitat, provide space for wetland migration, and to clean contaminated sites. These methods could result in improved wetland health, regulations that promote wetland migration, and protection from storms and flooding.
- Another aspect of bringing nature into our communities is to cool our communities. By cooling the communities through green approaches and green infrastructure requirements, we are preparing for rising temperatures, reducing stormwater runoff, reducing heat stress, and creating more attractive communities.

By improving the natural built systems, communities can become more connected and sustainable.
- One method is prioritizing the protection of land to help adapt to a changing climate. To establish these prioritizations, there should be an increase in state funding, and collaborations should be pursued between government and community-based groups. It is suggested that this option is the most cost effective from both an economical and environmental perspective. It could also have positive effects on drinking water, air quality, and economic impacts.
- It is also recommended to build a regional trail system. This system would improve community connectedness throughout the region, which could boost habitat migration, have positive economic impacts to surrounding communities, and provide easier access to green and open space to millions of people. Another method of adaptation is to upgrade infrastructure to high standards of resilience. Older facilities that are being upgraded and replaced should incorporate climate change resiliency into their plans. Also, projects should be prioritized that include more natural solutions. By increasing the standards of resilience, critical infrastructure will be more prepared for future inundation.

The final category for climate change adaptation is to create a greener energy system with more capacity.
- This first recommendation is to modernize the electric grid. Increasing populations will soon overtax the outdated system across the region, therefore relying on increased fossil fuel usage. Plans should be developed to create a more renewable region. A tri-state task force could be created to join stakeholders and consider new alternatives, the existing grid should be adapted to be cleaner and renewable, pricing can be used to smooth energy demands, and enhance energy storage. By implementing upgrades and alternatives, a more reliable and cleaner grid would be available.
- Also, it is recommended to scale up renewable energy sources. The region has a goal of greenhouse gas reduction of 80% by 2050. Local communities should collaborate to promote renewable energies through land use planning and organization. New Jersey and Connecticut should follow the precedence New York set and require utilities to generate a minimum of 50% of their energy from renewable sources, and larger cities and public authorities should pursue renewable energy to power their operations and influence the market.
- To create a greener energy system, demand should be managed with energy efficient buildings and variable pricing. Building energy efficiency codes should be strengthened, and pricing and smart technology can be used to manage demand. By encouraging energy reductions, and adopting stricter efficiency regulations could improve air quality, reduce greenhouse gas emissions, and would promote renewable energy across the region.
- The final recommendation is to electrify buildings and vehicles. Large, old buildings across the region play a major role in greenhouse gas emissions, therefore a cap should be implemented on large, urban buildings therefore promoting efficiency and reducing emissions. Also, electric vehicles should be increasingly promoted with regional incentive programs, and make the vehicle charging network more extensive. By electrifying cars and buildings, in conjunction with a cleaner grid, there would be a reduction in emissions, and subsequently limiting the effects of climate change.

Town of Easton

The Town of Easton is a low density residential community. The newly adopted POCD (2018) notes that in the previous ten years population has aged, school enrollments have declined, and housing values have risen while demand has changed.

Due to the high proportion of land that is set

aside as public water supply watershed areas, the Town's land pattern provides substantial natural open spaces, wetlands and watercourse buffers and limited impervious surface land cover. Flooding problems are limited to certain areas along the Aspetuck River, but the flooding is generally limited due to the existing land patterns.

The POCD discusses various natural hazards that may affect the Town, including wind storms, flooding, drought, and other events such as winter storms. The Plan includes recommendations for regulations that will increase oversight and the control of activities within the floodplain, limiting the possibility of flooding and related damage to properties. The Plan also states that the Town is committed to collaborating with MetroCOG in the Regional Hazard Mitigation Planning process.

Town of Fairfield

The Fairfield POCD was last adopted in 2016 to incorporate a variety of local and regional planning efforts. However, as the majority of the current POCD is carried over from the 2000 POCD with respect to goals and policies, a more comprehensive POCD update is currently underway with the goal of completion in 2020.

As a coastal community with a substantial and diverse shore area, the possible consequences from sea level rise and more extensive storm surges are considered an imminent threat to the Town. These concerns were incorporated into the 2000 POCD by integrating the recommendations of the Town's Shoreline Advisory Committee and its Shore Area Management Plan (2000) and subsequently were carried forward into the 2016 POCD.

The Fairfield POCD recognizes the inherent dangers from flooding and erosion of beach areas. A long list of actions to help protect the shoreline and reduce damage to property and personal injury is included in the POCD. The key goals and objectives from the POCD relating to the shoreline area are preserving existing natural resources, limiting development in sensitive areas, protecting tidal and shoreline inland wetlands, acquiring sensitive parcels, and continuing participation in the National Flood Insurance Program.

While the POCD recommends non-structural actions where possible, several physical systems have been installed to help stabilize beaches and to protect and stabilize waterfront properties. The POCD recognizes the value of these systems and recommends their maintenance. Furthermore, the POCD recommends that certain coastal developments begin to take precautions to mitigate vulnerabilities.

Town of Monroe

Monroe's POCD was drafted in March of 2010. The Town anticipates beginning an update in 2019. The following discussion is based on the 2010 edition of the POCD.

The Plan describes the Town as containing a large quantity of inland wetlands, streams, lakes and rivers. To designate the minimum regulatory jurisdiction of the Monroe Inland Wetlands Commission for any disturbances and alterations, an upland review area was added around these features. Any activity that might have an impact on wetlands, including excavation, filling, building, obstructions, potential pollution sources, clearing and grading is regulated, whether or not the activity occurs in the wetland itself or on land adjacent to the wetland.

One of the key goals of the Plan is to exercise stewardship over Monroe's natural features, such as wetlands, streams and Lake Zoar. The Plan recommends the protection and conservation of natural resources including wetlands, as they function as a natural storage basin for floodwaters. The responsibility for reviewing and regulating activities within and adjacent to these natural resources is vested in Monroe's Planning and Zoning Commission (P&Z) and Inland Wetlands Commission.

While the Plan focuses on actions to ensure the character of the Town and guide future land development, many of the recommendations also mitigate adverse impacts caused by extreme weather events. Establishing undisturbed buffers and setbacks along river edges and wetlands and discouraging impervious surfaces provides storage capacity for flood waters, limits damage to property and reduces the hazards and costs associated with flooding. In addition, the Plan recommends restricting the types of land uses that may be located within the designated 100 year flood elevation. Floodplains and wetlands would be retained in their natural state to the maximum extent possible so as to preserve water quality, protect water retention capabilities, and facilitate flood flow levels.

The Plan includes a section on sustainable de-

velopment. While many of the suggested policies are not specifically targeted at mitigating natural hazards, they have a beneficial impact on Monroe and will help reduce flooding and storm damage.

Town of Stratford

Stratford on the Housatonic

The Town of Stratford POCD was adopted in 2014. Reflecting current perspectives and recent events, the draft Plan includes a chapter on "Climate Change Action & Preparedness." With 14 miles of waterfront along the Housatonic River and Long Island Sound, the Town is concerned with the possible effects of sea level rise and excessive storm surges and is actively considering actions to lessen potential impacts. A recommended action step included in the Plan is to work with MetroCOG and other regional entities on addressing climate change and hazard mitigation issues to ensure an environmentally sustainable region.

Inland and coastal flooding and impacts from storm surges are specifically addressed in the Town of Stratford's POCD. The Plan indicates that flooding along the Housatonic River is generally limited to adjacent properties and does not extend far inland. Heavy rain events cause some flooding along Bruce Brook, Pumpkin Ground Brook and Raven Brook. The coastal area of Stratford experiences flooding from storm surges. However, the Lordship section is generally not impacted because of higher base elevations.

Several actions are included in the Plan to increase awareness of the potential impacts from climate change and to mitigate these impacts:

- Minimize impacts of development upon natural landscapes, habitats and watercourses;
- Protect and preserve the Great Salt Marsh, Long Beach, Short Beach and area between Stratford Point and Short Beach;
- Develop and adopt a town sustainability plan and identify critical areas at risk from the impacts of climate change;
- Prioritize acquisition of land and conservation easements for habitats most at risk from climate change;
- Acquire land and conservation easements to provide upslope "advancement zones" to accommodate rises in water levels adjacent to tidal marshes;
- Remove threatened structures from vulnerable shorelines, especially those exposed to the Long Island Sound;
- Implement the recommendations contained in the Natural Hazard Mitigation Plan; and
- Perform engineering studies to determine the best way to protect infrastructure subject to extreme flooding.
- Work with MetroCOG and other regional entities to address climate change and hazard mitigation issues to ensure an environmentally-sustainable region
- Enroll in the FEMA Community Rating System (which has occurred).

Stratford Coastal Community Resilience Plan

The Stratford Coastal Community Resilience Plan (2016) presents an overview of coastal flooding hazards facing the town in the future, including sea level rise, tidal flooding, and extreme flooding. The vulnerability and risk assessment identifies that the employment growth district and the South End neighborhood are at high risk of being affected by sea level rise. Other components at risk of sea level rise include sanitary sewer infrastructure, stormwater management systems and tide gates, hazardous materials facilities, state and primary roads, vulnerable populations, and natural resources. Specific flood mitigation projects are identified within the three resiliency strategies of Retreat, Accommodate, and Protect.

Roosevelt Forest Management Plan

The 2011 Plan was developed to guide management of the 401-acre Roosevelt Forest in northern Stratford. At the time of the plan, the forest had not received any active forest management for more than 40 years. Major recommendations include improving trailheads and signage, development of management techniques for controlling growth with timber harvesting, and development of cooperative agreements with other groups for maintenance and public education activities.

Town of Trumbull

The POCD for the Town of Trumbull was adopted in 2014. The Plan contains a section devoted to minimizing impacts from flooding and natural hazards, describing such practices as avoiding the placement of new development in vulnerable areas, avoiding placing vulnerable populations in vulnerable areas, and ensuring critical facilities are accessible during an emergency. Additional strategies discussed that are related to hazard mitigation

include the importance of protecting wetlands, limiting development within buffers as a flood control measure, green infrastructure, low impact development and a more reliable and resilient electrical system.

The Plan describes the Town as a largely built-up, residential community. The main goal of the Plan is to preserve the current high quality of life valued by Town residents. As an inland community, Trumbull is more often affected by flooding caused by severe and extensive rain events. The Plan encourages the promotion of greenway trails (such as the Pequonnock River Trail) to interconnect parks and open spaces. Ensuring adequate waste water capacity to meet future development is also emphasized in the Plan.

The Plan provides improved design guidance and an improved design review process. Property owners are encouraged to preserve and maintain historic structures. A village style and walkable development patterns at the Town Hall area, Town Center and Long Hill Green are emphasized. In office parks, a campus-style development is promoted and allowing taller buildings in appropriate areas may also be considered. A "complete streets" approach to accommodate pedestrians, bicycles, and transit, and to address access management and transit improvements is also recommended in the POCD. The Plan also recommends that Trumbull enter into the FEMA Community Rating System, which subsequently occurred.

2.2 Review of Municipal Websites

Each municipality of the MetroCOG region has developed and maintains a website highlighting their community, town services and other important information. The websites were examined to understand how residents are informed about natural hazards and disasters and about how to prepare for, plan for and endure an event. In general, each municipality has established an office or department of emergency management with the responsibility for preparing and handling a wide range of emergencies, including natural hazards.

The webpages that describe emergency procedures vary in detail and are provided either as a direct link on the municipal website or as link to another department's website, usually the fire department.

City of Bridgeport

The City of Bridgeport has Department of Emergency Management and Homeland Security, headed by a Director of Emergency Management and Homeland Security. The main webpage for the department provides an overview of its mission and lists current alerts and updates. Additional links are provided for various emergency planning resources, including the following:

Bridgeport 311: This system allows citizens and city employees to automatically and immediately contact the department responsible for an issue, such as to request a recycling bin, report a pothole or confirm a tax payment.

City of Bridgeport Hazards: This webpage lists a series of links to one to two page pamphlets that explain how to prepare for a hazard and how to endure one. Among the natural hazards covered are:

- Earthquakes
- Extreme Heat
- Extreme Cold
- Flood Planning and Preparedness
- Severe Storms
- Thunderstorms and Lightning
- Tornadoes
- Winter Storm Planning and Preparedness
- Hurricane Storm Surge (SLOSH) Map
- Flood Zone Map

Planning Toolkits

This webpage provides links to a series of one to two page pamphlets on how to prepare for a disaster, reasons to prepare and how to cope with a disaster. The webpage includes an emergency supply checklist.

Emergency Registration

The City operates a Reverse 911 (R911) system that notifies residents of an emergency, including natural disaster alerts. The webpage explains why and how to register a home landline telephone number to receive notification. Registration is especially important for those with special needs.

Hurricane Preparedness

This webpage provides links to various news and press releases by the Emergency Operations Center (EOC) and the Mayor's Office in advance of, during and after a hurricane. Links are provided to the websites of the National Weather Service, United Illuminating Company and Southern Con-

necticut Gas Company.

The Emergency Management and Homeland Security webpage may be accessed under the listing of Departments on the City's main webpage (www.bridgeportct.gov).

Town of Easton

Contact information for the Town's Emergency Management Director is posted online. The Town's website provides links for the National Weather Service, CT Alerts, United Illuminating, the American Red Cross, and other agencies.

Town of Fairfield

Emergency information for the Town of Fairfield is provided on the Town website (www.fairfieldct.gov) under the major heading "Public Safety". The Public Safety page provides links to the Community Emergency Response Team, CodeRED (R911), Emergency Management, Emergency Medical Services, Emergency Preparedness Resources, the Fairfield Citizen Corps Council, Storm Information, the Fire Department, and the Police Department. Some of these have extensive pages described in detail below:

Emergency Management

The Emergency Management Team webpage describes the Emergency Management Team, the town's Emergency Operations Center, and advertises the Town emergency information hotline that residents can call to hear recorded messages (203-254-4899).

Emergency Preparedness Resources

This section outlines the various public notification methods used by the town to notify residents in case of emergency, including CodeRED (R911), the Storm Information page, email list, and the Town emergency information hotline. The page also provides links to various emergency information brochures and pamphlets on disaster planning, severe weather preparation, power failures, and public health emergencies as well as providing links to a variety of informational websites.

Storm Information Page

This page provides a feed of announcements related to Town office closing information, and a real-time road closure map updated with information reported to the Town's Emergency Operations Center. Links are also provided for information on storm preparedness, power outages, downed cable and telephone lines, and general storm-related resources.

Flood Protection Page

This page (https://fairfieldct.org/floodprotection) provides links to various flooding-related resources. It explains how residents can access FEMA flood insurance information as well as providing information on the town's Flood and Erosion Control Board and other flood control measures. The also provides links to recent efforts conducted under FEMA grant programs.

Town of Monroe

Emergency information for the Town of Monroe is provided on the Town website (www.monroect.org) under the major heading "Public Safety". The Public Safety page provides links to the Police Department, Fire Departments, Emergency Medical Services, and the Community Emergency Response Team.

An additional page dedicated to Emergency Preparedness encourages residents to sign up for emergency notifications through the CodeRED (R911) system, check the town webpage for urgent messages scrolling in a red banner at the top of the page, and to sign up for the Town's *News and Announcements* email list. The page also provides links to various emergency information brochures and pamphlets on disaster planning, severe weather preparation, power failures, and public health emergencies as well as providing links to a variety of informational websites.

Town of Stratford

Emergency information for the Town of Stratford is provided under the Emergency Management Director heading under the Town Hall section of the website (www.townofstratford.com). This page provides a variety of information about the Emergency Management Director's role, as well as a variety of fire safety tips and information. The page also provides instructions for how to compile a basic emergency kit, as well as downloadable pamphlets regarding preparing for, surviving, and recovering from floods, winter storms, extreme cold, hurricanes, power outages, and using a generator.

The Town has a dedicated page for flood-

ing (http://www.townofstratford.com/content/39832/39846/39911/40359.aspx) that discusses major causes and types of flooding. The webpage also provides guidance on preparing for floods, what to do during a flood, and how to recover from a flood.

Town of Trumbull

Emergency information for the Town of Trumbull is provided on the Town website (www.trumbull-ct.gov) under the major heading "Public Safety". The Public Safety page describes the Office of Emergency Management and encourages residents to sign up for the Trumbull Citizen Alert Emergency and Community Notification (R911) program. The page also provides links to the Community Emergency Response Team, Emergency Management Office, Emergency Medical Services, Fire Departments, and Police Department. Additional pages are also dedicated to Emergency Preparedness and Storm Information as described below. Note that parking bans, closing information, and other cancellations due to storms are posted in a red banner in the header of the Town's website.

Emergency Preparedness Information

This section encourages residents to sign up for the R911 program as well as alerts from the local electric utilities (United Illuminating and Eversource). The page also provides instructions on preparing for a disaster by creating a first aid kit, stockpiling food, gathering tools and supplies, making a family emergency plan, and protecting your possessions. Links are also provided for assistance in preparing for extreme cold or heat.

Storm Information Page

This page provides a series of links to where to find information regarding forecast information, town closures and cancellations, utility outages, and links to other general storm-related resources.

2.3 Government Structure

The government structure of each MetroCOG jurisdiction varies, as the structure typically relates to the respective size and complexity of the community.

City of Bridgeport

The City of Bridgeport has a Mayor-Common Council form of government. The Mayor is the Chief Executive Official, while the twenty members of the City Council act as the legislative body for the City. The two major responsibilities of the Council are enacting ordinances necessary to govern the City and adopting the annual budget. Members of the City Council serve and are elected for two-year terms, while the Mayor is elected for a four-year term.

The Chief Administrative Officer, appointed by the Mayor is responsible for coordinating department management and operational policies. The following departments have jurisdiction and responsibility for ensuring the health, safety and welfare of the City's residents:

Building Department

The Building Department issues permits and inspects work done to all buildings and other structures. Applications for permits are reviewed for conformance to all applicable laws, codes and ordinances. Permits and inspections ensure public safety, health and welfare insofar as they are affected by building construction, through structural strength, adequate exit facilities, fire safety, light and ventilation and sanitary equipment.

Emergency Management & Homeland Security

The mission of the Office of Emergency Management is to protect the lives and property of citizens in the City of Bridgeport. This is accomplished through providing 24-hour emergency assistance by mobilizing and deploying personnel and resources, updating emergency operations plans and strategies, training emergency personnel, managing the emergency operations system, and warning and informing the public of emergencies and disasters.

Engineering Department

The Engineering Department provides engineering services to the City's Departments and Commissions to ensure a safe and efficient traffic system. The Engineering Department makes recommendations, administers public improvement projects, provides technical data, assistance, survey, and design and prepares and maintains City record maps.

Health Administration & Social Services

The mission of the Health Administration is to promote and protect the health of the people of Bridgeport through the provision of essential health services, monitoring of programs, enforcement of laws and ordinances, and collection of health information. Social Services provides for the social and economic well-being of Bridgeport's indigent and working poor residents.

Parks & Recreation Department

The Parks Department provides well-maintained, enjoyable park grounds and facilities to enhance the quality of life for City residents and visitors. The department's goals are to preserve and protect open spaces, provide opportunities for active and passive recreation, and maintain the landscapes, structures, streams, and woodlands within these areas.

Office of Planning & Economic Development

The Office of Planning & Economic Development (OPED) is a multi-disciplinary organization responsible for economic development, neighborhood revitalization, business development, planning and zoning, historic districts, land use, design review, building permits and inspections and related issues.

Public Facilities Administration

The mission of Public Facilities is to provide residents with the services that are required to ensure a clean, safe and healthy environment for the City of Bridgeport.

Planning & Zoning Commission & Zoning Board of Appeals

The mission of the Planning and Zoning Commission and the Zoning Board of Appeals is to promote health, safety, quality of life and the overall general welfare of the community through the enforcement of Bridgeport's Zoning Regulations.

Park City Communities

Formerly known as the Bridgeport Housing Authority, Park City Communities (PCC) was created in 1936 to address poor housing conditions in Bridgeport and to develop and maintain affordable housing. The PCC provides nearly 2,600 public housing equivalent units that serve low income families, seniors, and people with disabilities. The PCC is diversifying its housing stock by developing new housing for low and moderate income residents.

Water Pollution Control Authority

The Water Pollution Control Authority (WPCA) operates Bridgeport's two wastewater treatment facilities and maintains the City's sewer system.

Town of Easton

The Town of Easton is governed by a Board of Selectmen, made up of three Selectmen elected together for two-year terms. The Board is responsible for the administration of town affairs. The First Selectman serves as the Town's Chief Administrative Officer and highest elected official. Easton does not have a town charter and is governed by the Connecticut General Statutes. An annual Town Meeting is held to decide budgetary matters. The annual budget, prepared by the Board of Finance, is adopted at the Annual Town Meeting. Special town meetings may be called throughout the year by the Board of Selectmen or by petition of town residents.

Various town departments and commissions have jurisdiction and responsibility for ensuring the health, safety and welfare of its residents:

Building Department

The Building Department issues permits and inspects work done to all buildings and other structures. All types of new construction are reviewed and permitted by the Building Department. The Building Department ensures buildings are constructed in conformance to all applicable laws, codes and ordinances.

Public Works Department

The mission of Public Works Department is to maintain and improve the town's road system and perform responsibilities that include snow and ice removal, street sweeping, roadside mowing, tree and brush removal, drainage installation and catch basin cleaning.

Planning & Zoning Commission & Planning Department

The Planning and Zoning Commission enforces the Town's Zoning and Subdivision Regulations and studies and debates proposed revisions to the regulations.

Conservation Commission

The Conservation Commission acts as the Town's Inland Wetlands and Watercourses Agency and enforces the State's regulations pertaining to wetlands and watercourses. The Conservation Commission reviews applications to conduct activities in regulated areas.

Parks & Recreation Commission

The Parks and Recreation Commission oversees and manages parks and open spaces. The goals of the Commission are to preserve and protect open spaces and provide opportunities for active and passive recreation.

Town of Fairfield

The Town of Fairfield operates under a Representative Town Meeting (RTM) form of government. RTM members are elected to two year terms by the residents of the Town's voting districts. There are ten voting districts and each district elects five members to the RTM. The Board of Selectmen is Fairfield's executive policy board and is comprised of three members. The First Selectman serves as the Chief Elected Official for a four year term. The other two members are elected to two year terms.

Various town departments and commissions have jurisdiction and responsibility for ensuring the health, safety and welfare of residents:

Fairfield Citizen Corps Council

The Citizen Corps Council is comprised of volunteer residents and representatives from the Police, Fire, and Health Departments, as well as from the First Selectman's Office. The Council was established as part of ongoing homeland security plans to educate the public on public safety procedures, help citizens take active roles in protecting themselves during events and provide information on what to do in an event. The Council also works with the American Red Cross. A partner group of the Citizen Corps is the Community Emergency Response Team (CERT). This team is a group of volunteers who have completed basic FEMA training on how to assist and support emergency personnel and participate in the response to a major event or disaster.

Office of Emergency Management

The Office of Emergency Management coordinates resources for Fairfield's first responders and plans and trains for response to extended situations. The Office prepares local emergency plans.

Conservation Department

The Conservation Department addresses the Town's broad environmental quality goals through work to enhance and restore Fairfield's natural resources, as well as to educate the public concerning the natural environment. Efforts include the restoration of stream water flows, water polluted by industrial wastes, and public trust lands. The Conservation Department cooperates with community groups in removing debris and trash from coastal waters and establishing outreach projects.

Public Works Department

The Public Works Department maintains and improves the town's road system and performs other responsibilities that include snow and ice removal, street sweeping, roadside mowing, tree and brush removal, drainage installation and catch basin cleaning.

Office of Community & Economic Development

The Office of Community & Economic Development develops and administers programs to stimulate and encourage economic development, revitalize and strengthen neighborhoods, facilitate and promote affordable housing and preserve and enhance the overall well-being of the community.

Engineering Department

The Engineering Department provides engineering services to other Town Departments and Commissions to ensure a safe and efficient traffic system by making recommendations, administering public improvement projects, providing technical data, assistance, survey and design and the preparation and maintenance of Town record maps.

Parks & Recreation Department

The Parks Department manages and maintains various recreational facilities, including 170 acres of active parks and five miles of beaches. The Department's facilities provide enjoyable park grounds that enhance the quality of life for Town residents.

Town Plan & Zoning Department

The Town Plan and Zoning Department (TPZ)

works with the development community to guide them through the Town's regulatory processes, neighborhood and redevelopment plans, and other siting issues associated with investment opportunities. The TPZ is responsible for preparing and maintaining the Town's Plan of Conservation and Development. The TPZ also administers the Town's floodplain management requirements and coordinates the Town's Community Rating System applications and recertifications.

Town of Monroe

The Town of Monroe is governed by a First Selectman and a nine-member Town Council, all of whom serve two-year terms. The First Selectman serves as the Chief Executive Officer of the Town and is responsible for the administration and supervision of all departments, agencies and offices of the Town. The First Selectman also holds all of the executive powers vested by law or by the Town Charter. The Town Council serves as the Legislative Branch and has the power to enact, amend and repeal ordinances and the power to create or abolish by ordinance boards, commissions, departments and offices of the Town, in addition to other general powers and duties.

Various town departments and commissions have jurisdiction and responsibility for ensuring the health, safety and welfare of Monroe's residents. Town departments typically provide reviews and reports to the Boards and Commissions upon request.

Building Department

The mission of the Building Department is to maximize building safety for the general public and uphold the State Building Code, efficiency and public relations. The Building Department conducts plan reviews, issues permits and Certificates of Occupancies, performs inspections and coordinates all Town department approvals to achieve the maximum building safety for the general public.

Economic Development Commission

The Monroe Economic Development Commission (EDC) conducts research into economic conditions and trends, makes recommendations to the appropriate officials and agencies and promotes economic development and assists with business development, recruitment and retention.

Emergency Management Department

The Emergency Management Department coordinates resources for Monroe's first responders and plans and trains for responding to extended situations. The Emergency Management Department also prepares local emergency plans.

Public Works Department

The mission of Public Works Department is to enhance the quality of life of Monroe residents and maintain and improve the town's road system.

Planning & Zoning Commission & Planning Department

The Planning and Zoning Commission is responsible for the physical, social and economic planning and coordinated development of Monroe. The Commission prepares, adopts, and implements a Plan of Conservation and Development, reviews and recommends municipal improvements, and adopts and amends both zoning and subdivision regulations.

Engineering Department

The Engineering Department provides technical assistance to the public and other town departments relating to development within the town, traffic issues, drainage and utility work.

Inland Wetlands Commission

The Inland Wetlands Commission enforces the provisions of the State's Wetlands and Watercourses Act pertaining to wetlands and watercourses. The Commission reviews applications to conduct activities in regulated areas, issues permits and considers amendments to the Town's regulations. The Commission also provides enforcement and educational services.

Conservation Department

The Conservation Department addresses the Town's broad environmental quality goals through its work to enhance and restore Monroe's natural resources.

Parks & Recreation Department

The Parks Division oversees and manages parks and open spaces. The Department's goals are to preserve and protect open spaces and provide opportunities for active and passive recreation.

Town of Stratford

Stratford has a Mayor-Town Council form of government, with the Mayor designated as the Chief Executive Officer. The Town Council acts as the Town's legislative body and is comprised of ten members whom serve two year terms. The Mayor is elected to a four-year term.

Various town departments and commissions have jurisdiction and responsibility for ensuring the health, safety and welfare of Stratford's residents:

Building Division

The Building Division is responsible for the enforcement of all construction and building codes and issues building permits and Certificates of Occupancies. Flood zone information is available through this office.

Office of Economic Development

The Office of Economic Development promotes goals, strategies and plans for attracting and retaining businesses to Stratford. The Office reviews and evaluates proposed projects.

Office of the Mayor/Chief Administrative Officer

The Chief Administrative Officer heads mitigation efforts and is responsible for coordinating with the Emergency Management Director in the Emergency Operations Center (EOC), which opens during major events to coordinate resources and response. The Emergency Management Director acts as the liaison between the Chief Administrative Officer/Office of the Mayor, first responders, local businesses, other cities and towns and the State.

Public Works Department

The mission of the Public Works Department is to maintain and improve the infrastructure of the Town of Stratford. The Department includes several offices and divisions, including engineering, highways, conservation, parks, and inland wetlands.

Planning & Zoning Department

The Planning and Zoning Department has the primary responsibility for managing land use in Stratford. The office handles applications for zoning compliance, changes and waivers, reviews plans for the subdivision of land, coastal site plan reviews, erosion and sedimentation control actions, and special case approvals. The office is involved in long-range planning and prepares the Town's Plan of Conservation and Development.

Health and Community Services Departments

The Stratford Health and Community Services Departments are responsible for health emergency preparedness and planning efforts, and coordinates these efforts with state, regional and local agencies responsible for emergency planning.

Engineering Division

The Engineering Division is responsible for construction administration and the management of municipal capital improvement projects, plan reviews, map record keeping, permitting and inspection for work relating to sewers, roads, sidewalks and curbs.

Highway Division

The Highway Division is responsible for maintaining the Town's highway system, including the pavement structure, storm drains, drainage inlets and outlets, and sanitary sewers.

Inland Wetlands and Watercourses Agency

The Inland Wetlands and Watercourses Agency enforces the provisions of the State's Wetlands and Watercourses Act pertaining to wetlands and watercourses. The Agency reviews applications to conduct activities in regulated areas, issues permits and considers amendments to the Town's regulations.

Parks Division

The Parks Division provides clean, safe and aesthetically pleasing areas where the public can enjoy outdoor activities. The mission of the Parks Department is to improve the appearance and the functionality of park facilities, fields, playgrounds and beaches. The Division has responsibility for maintaining all town trees.

Stratford Public Schools

Several Stratford Public School facilities are used as shelters, in the event residents have to evacuate an area.

Stratford Housing Authority

The Stratford Housing Authority is independent of the Town of Stratford. This quasi-public corporation owns and manages 514 family and

elderly apartments, and, through the Federal Housing Choice Voucher Program, assists another 280 families residing in private apartments in the Town of Stratford.

Town of Trumbull

The Town of Trumbull is governed by a Town Council and a First Selectman, each serving two year terms. The administration of town affairs lies with the twenty-one elected members of the Town Council. The First Selectman is Trumbull's Chief Administrative Officer and highest elected official.

Various town departments and commissions have jurisdiction and responsibility for ensuring the health, safety and welfare of Trumbull's residents:

Building Department

The Building Department reviews construction documents for compliance with State Building Codes and issues building permits.

Economic and Community Development

The Economic and Community Development Department promotes goals, strategies and plans for attracting and retaining businesses to Trumbull and strengthens the Town's economic base in a manner with the Town's goals and vision.

Office of Emergency Management

The Office of Emergency Management (OEM) develops plans for preparing for and responding to natural and man-made emergencies. Responsibilities include documenting emergency response plans and procedures, training personnel, acquiring equipment, and coordinating with other departments. In the event of an emergency, the OEM mobilizes and deploys personnel and resources, notifies the public and manages the emergency event to maximize resources and minimize any negative impact.

Public Works Department

The mission of the Public Works Department is to maintain and improve the infrastructure of the Town of Trumbull.

Planning & Zoning Department

The Planning and Zoning Department handles all administrative functions of the Planning and Zoning Commission and the Zoning Board of Appeals and has the primary responsibility for managing land use in the Town. The Department is involved in long-range planning and prepares Trumbull's Plan of Conservation and Development.

Engineering Department

The Engineering Department is the technical service advisory division of the Public Works Department and provides adequate controls to ensure responsible construction within the Town. The Department designs projects carried out by the Highway Department, provides technical advice to the Planning and Zoning Commission and Inland Wetlands and Watercourses Commission (IWWC), and provides engineering services and advice to other Town departments.

Inland Wetlands and Watercourses Commission

The Inland Wetlands and Watercourses Commission evaluates Trumbull's wetlands and acts on any permit requests that affect designated wetlands. The Commission conducts field investigations of all properties in question and enforces the provisions of the State's Wetlands and Watercourses Act.

Conservation Commission

The Conservation Commission is a science-based advisory commission that oversees the protection and supervision of natural resources in Trumbull. The Commission acts in an advisory capacity to the Town's regulatory land use boards and makes recommendations regarding open-space, watershed plans, and natural resource preservation.

Parks Department & Commission

The Trumbull Parks Commission and Department are responsible for the care, management and control of all parks and grounds used for park and recreational purposes and all structures thereon. Together with other municipal departments, their mission is to maintain and enhance park and recreational facilities.

2.4 Planning Teams

MetroCOG is the Council of Governments (COG) and Regional Planning Organization (RPO) for the Greater Bridgeport Region. MetroCOG is composed of six member municipalities:

City of Bridgeport Planning Team

Name	Title
Lynn Haig	Director of Planning
Jon Urquidi	City Engineer
Megha Jain	Engineering

Town of Easton Planning Team

Name	Title
Adam Dunsby	First Selectman
Ed Nagy	Director, Public Works/Engineer

Town of Fairfield Planning Team

Name	Title
William Hurley	Town Engineer
Laura Pulie	Assistant Town Engineer
Brian Carey	Conservation Director
Emmeline Harrigan	Planning & Zoning
Jim Wendt	Planning Director
Dennis McCarthy	Emergency Management Director
Joseph Michelangelo	Director, Public Works

Town of Monroe Planning Team

Name	Title
Ken Kellogg	First Selectman
Scott Schatzlein	Town Engineer
Keith White	Police Department
Dave York	Emergency Management Director
William Agresta	Planning & Zoning Administrator
Chris Nowacki	Director of Public Works
Rick Schultz	Town Planner
James Sandor	Chief Building Official

Town of Stratford Planning Team

Name	Title
Laura Hoydick	Mayor
Jay Habansky	Planning and Zoning Administrator
Susmitha Attota	Town Planner
John Casey	Town Engineer
Larry Ciccarelli	Director of Public Safety
Mary Dean	Economic Development Director
Thomas Albert	Public Works Director
Christina Batoh	Conservation Administrator
Michael Downes	Chief of Staff to Mayor

Town of Trumbull Planning Team

Name	Title
Frank Smeriglio	(Former) Town Engineer
William Maurer	Assistant Town Engineer
Rob Librandi	Land Use Planner

- City of Bridgeport
- Town of Easton
- Town of Fairfield
- Town of Monroe
- Town of Stratford
- Town of Trumbull

At the onset of the planning process, MetroCOG contacted local coordinators to assemble local planning teams to coordinate and provide direction in the development of the regional NHMP update and to provide local input into the plan, including updates to the lists of critical facilities (Appendix A). The tables on the next page present the Planning Teams from each community. They provided information, data, studies, reports, and observations; and were involved in the development of the Plan update.

In contrast to the 2014 NHMP Update, the Planning Teams were smaller in each community with the exception of Monroe. See Appendix C for a description of the previous planning process. This downsizing is attributable to the Region's two previous NHMPs and other planning initiatives that are being implemented at the local or regional level. Additionally, MetroCOG also worked with The Nature Conservancy to host Community Resilience Building (CRB) Workshops, which provided Planning Team members and other key stakeholders the opportunity to provide input into the NHMP Update.

An extensive data collection, evaluation, and outreach program was undertaken to compile information about existing hazards and mitigation efforts in the Region. Direct input from the local Planning Teams, which typically included municipal engineers, planners, public safety officials, chief

elected officials, and other applicable staff was essential to identifying priority areas for hazard mitigation.

2.5 Conservation Technical Advisory Committee

The Conservation Technical Advisory Committee (CTAC) is an advisory body to the MetroCOG. The primary responsibility of the CTAC is to serve as the regional forum for consideration of any activity related to the enhancement of the natural environment within the region. These include the maintenance and implementation of the recommendations within the Pequonnock River Watershed Management Plan, guidance on brownfield projects, monitoring of coastal resilience initiatives and other activities as they relate to the protection and conservation of the natural environment within the region. Each MetroCOG municipality is formally represented on the CTAC with a member of the local Conservation Commission and a staff member with responsibilities related to conservation. Meetings of the CTAC are held quarterly and are open to the public. In addition to the appointed members, meeting attendees typically include local conservation organizations, residents, staff of the Connecticut Department of Energy and Environmental Protection and other regional stakeholders.

Throughout late 2018 and 2019, MetroCOG staff provided continuous updates regarding the NHMP Update at each CTAC meeting. CTAC members and attendees were able to provide comments, feedback and guidance as the NHMP Update was being drafted. Members typically commented on the progress but also suggested points of contact and areas of specific concern. Once the NHMP Update was drafted, CTAC was provided an opportunity to review the narrative and mitigation strategies and members submitted feedback and other potential mitigation strategies.

2.6 Hazard Mitigation Workshops

In response to recent extreme events, the need to increase resilience and adapt to these events has become more apparent, especially for coastal communities. As part of the NHMP Update, MetroCOG partnered with The Nature Conservancy (TNC) to sponsor and conduct Community Resilience Building (CRB) Workshops. The Workshops were held to provide a more robust planning process and to also offer an opportunity for key stakeholders to provide valuable input into the development of the NHMP Update. Workshops were held on the following dates:

- Fairfield: February 26, 2019
- Bridgeport: March 12, 2019
- Easton, Monroe, & Trumbull: March 13, 2019

Municipal staff and key stakeholders were invited to participate in the workshops for each respective community. The focus was on engaging those most involved in planning for and responding to natural hazards in conversations about risks and vulnerabilities. Through this effort, concerns and challenges facing the municipalities were discussed and vulnerable populations and locations were identified. By focusing on the concerns and challenges that face each community, workshop participants identified and prioritized actions to mitigate the impact of natural hazards, and identified opportunities to collaboratively advance actions to increase community resilience. Summary reports from each workshop provide an overview of the top hazards affecting each community, the current concerns and challenges, current strengths, and proposed actions.

The key element of the workshops was breaking participants into small groups to facilitate discussions and the exchange of ideas, concerns and perspectives. This approach was successful in producing rich information and experiences on recent natural events and recommendations to improve resilience to natural hazards.

Copies of the 2019 CRB reports are presented in Appendix C.

The CRB workshops were also conducted in 2013 to support the 2014 NHMP. Based on positive feedback from public officials, municipal staff, and local stakeholders, MetroCOG decided to conduct the CRB Workshops during this NHMP Update. The narrative below has been updated to support the current CRB findings.

City of Bridgeport

The workshop in the City of Bridgeport was held on March 12, 2019. Staff from TNC and MetroCOG facilitated the workshop and ensured interactive discussions about the natural hazard risks facing the Town. A total of 11 people attended the workshop. These participants represented a wide

City of Bridgeport CRB Attendees

Name	Title or Affiliation
Ellie Angerame	Green Village Initiative
Scott Appleby	City of Bridgeport Director of Emergency Management and Homeland Security
Jim Gilroy	PSEG Power Connecticut, LLC
Lynn Haig	Director of Planning
Megha Jain	Engineering Department
Ed Lavernoich	Bridgeport Economic Development Corp., Bridgeport Regional Business Council
Kris Lorch	Alloy Engineering Co., Inc.
Lauren Mappa	Water Pollution Control Authority
Joe Provey	Seaside Village
Kai Starn	Seaside Village
Steve Tyliszczak	Bridgeport Landing Development

range of city departments, non-government organizations, private sector interests, and residents as presented below.

The participants were asked to identify natural hazards that impact and affect Bridgeport. The hazards identified were based on the experiences and knowledge of recent events. Recent events influenced the discussions and most spoke about the impacts of storm surge from hurricanes, inland flooding from intense precipitation events such as the September 2018 storm, nor'easters, and heat waves.

These and other events have had direct and severe impacts on several neighborhoods and natural areas of the city. Neighborhoods most vulnerable to natural disasters were the Black Rock, South End, East End, East Side, and Chopsey Hill sections of the City. Impacts to natural features and ecosystems were mostly found along the shoreline, including Ash Creek, Johnson's Creek, Seaside Park and Pleasure Beach, as well as Rooster River, Island Brook, and the Pequonnock River. Because of the urban and built-up character of Bridgeport, various facilities and infrastructure are at risk from the effects of extreme storms. Concerns were raised about damage to cultural facilities, such as museums, libraries and schools; vital infrastructure, such as oil tank farms, transportation systems, marinas and waste water treatment plants, and critical care facilities, such as hospitals, nursing homes, low income housing and shelters.

Because of recent experiences, many attendees voiced concerns related to the potential impacts from extreme events. A key concern identified by the group was the ability of the City to respond effectively. Access to certain areas of the city is limited or restricted due to flooding of major transportation routes. The issue presents a particular challenge to emergency responders evacuating at-risk populations, including the high proportion of disabled persons and elderly living in vulnerable neighborhoods. The issue is further complicated by the diversity of the city's population and the need to communicate in different languages.

While Bridgeport faces challenges during extreme weather events, it has addressed these challenges and benefits from a highly professional and skilled emergency response team. The City of Bridgeport has been recognized by the National Weather Service as a "Storm Ready Community," the first in Connecticut, and has rigorous protocols and operations plans in place that are activated and followed from the first indication of an approaching storm. The City's new, state-of-the-art Emergency Operations Center (EOC) is capable of monitoring the response to any event and directing resources effectively and efficiently. At the neighborhood level, strong social service networks, including faith-based institutions, provide resources and communication that can assist at-risk population with awareness, sheltering and vital supplies.

Top recommendations from the workshop included:

- Seek to complete and implement the "West End Resiliency Plan" and leverage to other at-risk neighborhoods and locations across the city
- Look to aggregate engineering studies and other resource materials for all inland rivers and waterways across City (i.e. Ox Brook, Rooster River, Island Brook, etc.) and initiate a comprehensive identification, assessment, and prioritization of flood reduction projects that integrate immediate and longer-term vulnerabilities and strengths of infrastructure such as bridges and culverts
- Secure additional funding to implement priority flood reduction projects involving city infrastructure (bridges and culverts), roadways, and parks.
- Continue commitment and progress towards the complete separation of combined sewer

system to eliminate overflows by 2039
- Continue to strengthen communications channels to ensure all segments of Bridgeport's population are reached in times of crisis
- Continue to plan for economic growth in Bridgeport by redeveloping or developing amenities and housing that is attractive to a diverse demographic (young professionals to retired) to ensure a resilient and engaged community
- Continue to maintain and look for ways to strengthen evacuation plans and procedures for residents, businesses, and vulnerable populations
- Install green infrastructure including rain gardens, bioswales, and trees in many priority locations across Bridgeport to reduce the impacts of inland flooding and heat effects
- Replicate designs and utility approaches that can reduce flooding impacts at critical power substations in the city
- Continue to see ways to minimize the long term implications to various neighborhoods due to flooding that build on previous examples (Seaside Village)

Town of Fairfield

The workshop in the Town of Fairfield took place on February 26, 2019. Staff from TNC and MetroCOG facilitated the workshop and ensured interactive discussions about the natural hazard risks facing the Town. A total of 24 people attended the workshop. These participants represented a wide range of elected officials, town departments, boards and commissions, committees and task forces, and community organizations as presented below.

Town of Fairfield CRB Attendees

Name	Title or Affiliation
Beverly Balaz	Chamber of Commerce
Mark Barnhart	Director of Community & Economic Development
David Becker	Board of Finance
Misty Beyer	Forestry Committee
Ed Bomen	Asst. Director of Public Works
Becky Bunnell	Flood & Erosion Control Board
Nancy Carberry	Chief of Staff to First Selectman
Sands Cleary	Director of Health
Joe D'Avanzo	Community Emergency Response Team, WPCA
Dick Dmockowski	Flood & Erosion Control Board
Kyran Dunn	Deputy Fire Chief
Emmeline Harrigan	Assistant Planning Director
Mary Hogue	Sustainable Fairfield Task Force
William Hurley	Engineering Manager
Dave Kelley	Information Technology Director
Cristin McCarthy Vahey	State Representative
Cindy O'Neill Vitale	Community Emergency Response Team
Laura Pulie	Engineering Department
Don Smith	Police Department
Mike Tetreau	First Selectman
Bob Wall	Sustainable Fairfield Task Force
Jim Wendt	Planning Director
John Wynne	Strategic Plan Committee
Patti Zecchi	Fairfield Beach Peninsula Assn.

The participants were asked to identify the natural hazards that most frequently impact Fairfield. The answers were influenced by experiences and knowledge of recent events. The two events that had the most impact on the Town were Tropical Storm Irene (August, 2011) and Super-storm Sandy (October, 2012). The top hazards related to those events were:
- Severity and extent of storm surge flooding along the shoreline, especially the Fairfield Beach, Southport Center and Town Center areas;
- Inland flooding along the Mill River and Ash Creek related to tropical storms and hurricanes; and
- Power outages from downed trees and power lines.

Those events had direct and severe impacts on several neighborhoods and natural areas of the Town. Fairfield has two different and distinct areas. The coastal areas are prone to coastal flooding from storm surges. The most significant concerns in the rural and suburban northern sections of the Town are downed trees and power outages. Neighborhoods most vulnerable to a storm surge are the Town Center, Southport and Fairfield Beach. The Greenfield Hill area north of the Merritt Parkway is substantially affected by downed trees

and power lines, causing extensive power outages. Isolation was a great concern as the downed trees prevented or severely restricted access into and out of the area. Residents experienced difficulty in obtaining necessary supplies and recovery crews were hindered in their efforts to clear blocked streets and restore power.

Impacts to natural features and ecosystems were mostly found along the shoreline, including Ash Creek, Mill River, Marina Channels and the Fairfield, Jennings and Penfield Beaches. Various facilities and infrastructure were at risk from the effects of these extreme storms, including the police headquarters, fire station, sewage treatment plant and public works garage, all of which are located in flood prone areas. Concerns were also raised about the vulnerability of at risk populations. Several senior centers, long term care facilities and affordable housing complexes are also located in areas susceptible to a high storm surge.

Other top hazards of concern for Fairfield include winter storms, inland flooding, flash floods from high precipitation events, extreme heat and drought, and high wind events. Winter storms drop excessive snow, knocking out power and isolating residents and neighborhoods. More frequent and intense rain events such as the September 25, 2018 storm are leading to more inland flooding concerns. There was a general concern among participants that emergency contingency planning needs to account for worst-case scenarios at varying times of the year due to changing climate.

Some coastal areas are protected by a system of Army Corps of Engineers (ACOE) dikes and berms. These barriers help prevent flood waters from reaching the South Pine Creek neighborhood. However, erosion is evident along the creek side of the dikes, indicating a need to improve and repair the structures. Attendees also suggested that the height of some dikes need to be increased to handle higher than expected flood elevations and wave runup, and the need for better pre- and post-storm coordination to remove built-up debris behind the 31 tide gates in town was identified.

According to attendees, inland flooding is occurring more often under both routine and extreme rain events. In particular, the September 25, 2018 storm was noted as a high-impact event that awakened the need to reexamine flood risks in the Town's riverine corridors. It was noted that the Town's Information Technology (IT) facilities are located in the Town Hall basement, and that the basement experiences water damage during extreme rain events. The increased potential for dam failure from more intense rain events was also discussed.

Other threats identified include:

- Roads made impassible due to temporary flooding or falling trees
- Single access choke-points which can be blocked and restrict access to entire neighborhoods
- The vulnerability of coastal resources to sea level rise
- The need to support inland advancement of salt marsh and beaches
- The vulnerability of power lines from trees along travel corridors

Workshop participants emphasized the need for further protection of the Town's wastewater treatment facility. The facility is located within a flood hazard area and there was consensus that the berm surrounding the facility needs to be raised to improve protection against storm surge and sea level rise. The secondary concern is that the facility's capacity to process sewer inflows is overwhelmed during heavy precipitation events, resulting in the bypass of untreated sewage to Long Island Sound.

Top recommendations from the workshop included:

- Relocate 9-1-1 Center from the floodprone basement of the Police Station
- Continue to advance the installation of flood reducing measures at the wastewater treatment plant
- Encourage removal of structures from floodways
- Relocate IT services and equipment from Town Hall basement
- Improve the reach of the Code Red reverse 9-1-1 communication services
- Develop a longer-term plan to proactively address the increasing threat of more intense and frequent storms and sea level rise, including the longer-term needs for road elevation
- Conduct a detailed study of Rooster River to determine flood mitigation solutions
- Strengthen emergency management planning to enhance recovery of social services following a disaster
- Improve access to critical facilities such as public works, school bus yard, fire/police

training area, and transfer station following extreme weather events
- Better coordination with Aquarion Water Company regarding contingency planning for dam failure
- Perform an engineering assessment to reduce viaduct flooding
- Contribute to regional dialogues regarding transportation resilience for interstate highway and rail
- Advance and complete South Benson stormwater pump station improvements

Town of Stratford

The Town of Stratford planned to hold a CRB Workshop to support this NHMP update on March 6, 2019, but TNC needed to cancel the workshop. It was ultimately not possible to reschedule the CRB Workshop during the NHMP planning period, but the Town of Stratford would like to have one before the next NHMP update. The following discussion describes the 2013 CRB Workshop presented in the 2014 NHMP.

The one day hazard mitigation workshop held in the Town of Stratford took place on October 4th. Staff from TNC facilitated the workshops and ensured interactive discussions about the risks facing the Town. A total of 17 people attended the workshop. These participants represented a wide range of town departments, boards and commissions, including:

Town of Stratford Departments and Offices:

- Emergency Management & Homeland Security
- Conservation Department
- Fire Department
- Health Department
- Environmental Health Services
- IT Department
- Community Services
- Community Development Department
- Economic Development Department
- Public Works Department
- Highway Department
- Recreation Department
- Building Department
- Planning & Zoning Department
- Engineering Department

A list of attendees is attached in Appendix C.

The participants were asked to identify the natural hazards that most frequently impact and affect the Town. There was general consensus that coastal and inland/riverine flooding are major issues facing Stratford. The top hazards identified by participants were:

- Coastal flooding, especially in the South End area bounded by Surf Avenue, South Avenue, Main Street, Access Road and Lordship Boulevard. This area is home to the more vulnerable populations and includes housing operated by the Stratford Housing Authority.
- Inland flooding along Bruce Brook, Tanner's Brook and Ferry Creek. Sections of watercourses through the Town Center area have been channelized or buried. This exacerbates flooding potential as the infrastructure cannot handle large volumes of runoff during heavy rain events.
- Ice storms create problems related to power outages, frozen pipes, and mobility, which causes difficulty traveling on Interstate 95. Ice build-up on the electrical wires along the New Haven rail line disrupts train service.
- Wind causes tree limbs to fall and can cause power outages.

While the Town of Stratford was less severely impacted by the recent storm events, widespread flooding resulted from both Tropical Storm Irene and Super-Storm Sandy. The South End was affected by both storms and is vulnerable to coastal flooding, even from a moderate storm surge or during a storm that produces heavy rain. Access is limited to the South End and flooding on these routes essentially cuts off the area from the rest of the Town. A sizeable vulnerable population lives in the South End which includes seniors, disabled persons and low income families. Flooding of the South End also impacts operations at the Sikorsky Memorial Airport. Base elevations at the airport are approximately 10 feet, which makes the area susceptible to flooding from a major event. In addition, the Lordship Boulevard area is the location of one of the Town's main commercial-enterprise districts. Several industrial buildings are located in the district and are adjacent to the Great Salt Marsh and Lewis Gut.

By contrast, the Lordship area, located in close proximity to Long Island Sound, lies on an upland bluff and is at a high enough base elevation that it is not prone to flooding. However, the access routes into the area are subject to closure during a storm, which isolates the area.

The workshop attendees discussed inland flooding in the Town Center. The Town Center is

susceptible to flooding because it lies in a low, flat area that had historically been made up of wetlands and crossed by several streams and creeks. Channelization projects from the 1930s to the 1950s altered the flow of these watercourses and the infrastructure is unable to handle rapid increases in runoff.

Potential impacts to the town's infrastructure were also identified. The wastewater treatment plant is located within the recently modified flood hazard area. A berm was built in the 1970s to protect the plant from flood waters but there is a concern that the berm's height is insufficient to accommodate more intense coastal flooding. In addition, the Town operates 16 pump stations; seven of these are located in flood prone areas, including one at the end of Oak Bluff Road near Long Beach and the Great Salt Marsh and one on Sniffens Lane, close to the Housatonic River. Flooding is a concern at underpasses for the New Haven rail line especially at Bruce Avenue, King Street, West Broad Street, Main Street and East Main Street. The Interstate 95 underpass on Surf Avenue also regularly floods.

Workshop attendees suggested actions to address the vulnerabilities and risks facing Stratford. The recommendations focused on infrastructure improvements as well as better information and communications, as the 2008 Annex had. However, the vulnerability of the waste water treatment plant, pumping stations in flood prone areas and the need for adequate generators in shelters received a significant amount of attention from attendees – three areas of concern that were not detailed in the 2008 Annex. Like the workshops in neighboring communities, participants also emphasized the importance of the natural environment as a mitigation measure and a tree management plan, two shifts in focus when compared with the 2008 Annex.

Key recommendations included:

- Improve and expand existing infrastructure:
- Consider increasing the height of the berm surrounding the wastewater treatment plant.
- Harden pump stations or set up barriers to protect from flood waters.
- Reconstruct New Haven rail line underpasses to eliminate flooding either by raising the road or installing pumps to handle the runoff.
- Ensure community shelters have up-to-date and adequate alternate electrical power generation. Attendees mentioned that the generator at Bunnell High School (the Town's main public shelter) is undersized and inadequate.
- Provide adequate generators for the housing authority.
- Enhance building codes and encourage homeowners to flood proof their houses and if possible, increase the base elevation.

Enhance and improve the natural environment:

- Prepare a natural resources management plan or an urban forest canopy study to address the existence of Norway Maples throughout town and in Roosevelt forest. This species is especially susceptible to damage from high winds.
- Implement a tree removal and maintenance program to reduce trees susceptible to high

Towns of Easton, Monroe, and Trumbull CRB Attendees

Name	Title or Affiliation
Shaquaisha Andrews	Trumbull Health Inspector
Karen Burnaska	Monroe Conservation Comm.
Rhonda Capuano	Trumbull Health Director
Jeanne Gibbs	Trumbull Economic & Community Development Comm.
Rich Infante	Trumbull Public Works Dept.
Ken Kellogg	Monroe First Selectman
Mary Ellen Lemay	Trumbull Conservation Comm.
Shelby LeVino	Trumbull Economic & Community Development Comm.
Bill Maurer	Trumbull Town Engineer
Fred Micha	Trumbull WPCA Administrator
Megan Murphy	Trumbull Emergency Management Director
Joanne Parsons	Trumbull Conservation Comm.
Dale Parsons	Trumbull Resident
Richard Post	Trumbull Conservation Comm.
Tony Schirillo	Trumbull Deputy Director of Emergency Management
Tatiana Smotritskaya	Trumbull Engineering Department
Vicki Tesoro	Trumbull First Selectman
Don Watson	Trumbull Resident
David York	Monroe Emergency Management Director

winds.
- Long Beach acts as a barrier between Long Island Sound and the South End. The beach is separated from the mainland by Lewis Gut and the Great Salt Marsh.
- Conduct a cost benefit analysis for beach replenishment of the engineered beach at Short Beach. The beach is susceptible to coastal erosion from an excessive storm surge.
- Increase the stream channel along flood prone watercourses, especially Bruce Brook, to better manage water flow.

Towns of Easton, Monroe and Trumbull

A CRB Workshop was held for the towns of Easton, Monroe and Trumbull. Because these communities are inland, they are less vulnerable to the coastal effects of tropical storms and hurricanes. The workshop took place on March 13, 2019. Staff from TNC and MetroCOG facilitated the workshops and ensured interactive discussions about the risks facing the three communities. A total of 20 people attended the one-day workshop, including three attendees from the Town of Monroe; and 17 attendees from the Town of Trumbull (one did not sign in). Workshop attendees represented a wide range of town departments, boards and commissions, and residents as presented below.

The participants were asked to identify the natural hazards that most frequently impact and affect their respective town. As these towns are inland from Long Island Sound and do not suffer as severe effects from hurricanes, tropical storms or storm surges, the primary hazard impacting the area is inland flooding caused by excessive rain events. Wind damage was also a common hazard identified, as well as winter nor'easters.

The following areas of concern were identified by participants:

Inland flooding:
- Monroe: along Route 25 adjacent to the West Branch of the Pequonnock River, and street access to the Jockey Hollow and Chalk Hill Middle School complex.
- Trumbull: Long Hill drainage corridor parallel to Route 111 (Main Street) between Lake Avenue and the Merritt Parkway; and along the Pequonnock River in Trumbull Center, especially at Daniels Farm Road, in the Twin Brooks Park neighborhood, and in the vicinity of Quarry Road and the residential neighborhood west of Route 127 (White Plains Road).
- Because of the land use patterns and the fact that much of Easton is either water company owned lands or former water company lands that have been permanently preserved, inland flooding is not a special concern in Easton. Watercourses susceptible to flooding lie within large areas of undeveloped land.
- Other flooding concerns in all three communities included storm drains clogged with debris and flooding of septic systems.

Wind, ice and winter storms:
- Ice storms and freezing rain create problems related to downed trees and result in power outages and inaccessible roads. Easton, Monroe and Trumbull are susceptible to these problems due to the extensive tree coverage and age of the urban forest. The hazard potential is greater when leaves are still on the trees.
- Wind was identified as a critical hazard as it can cause trees to fall which then cause power outages and closed streets. The problems in these communities are exacerbated by the age of trees and extensive tree cover. As a result of Super-Storm Sandy, about 130 acres of forested lands of predominantly white pine owned by the Aquarion Water Company were severely damaged and required emergency timber removal. These lands were located along Route 58 in the vicinity of the Aspetuck and Hemlock Reservoirs. Because of the extensive damage, the Aquarion Company worked with the DEEP on conducting an emergency timber cutting and salvage program.
- Winter storms: The February 2013 blizzard resulted in snow accumulations of up to 36 inches. In general, the towns were able to adequately handle the event and clear roads in a reasonable time period. The primary concern during the storm was access to vital emergency services, especially hospital facilities in Bridgeport.

While the three communities have a lot of common experiences, there were several specific hazards that participants identified. The principal concern in the Town of Easton is maintaining the supply of public drinking water, as the Town is home to three public supply reservoirs that are the primary source of drinking water in the Region. A large filtration plant, located at the base of

the Easton Lake Reservoir dam, was built several years ago to ensure clean and safe water. The Easton Emergency Management Director's primary concern is to ensure the plant remains operational during any hazard.

Monroe's elderly population was identified as the primary vulnerable population in the Town. The Town operates a senior center and senior housing facility. During past events, evacuation of the senior housing facility has not been necessary and the facility have been able to remain self-sufficient. However, if evacuation were required, a severe strain would be placed on the Town's resources and there would be some difficulty in accommodating facility residents.

All properties in Monroe are served by on-site septic systems. During heavy rains and subsequent flooding, on-site septic systems close to the Pequonnock River and the river's branches may fail, resulting in increased pollutants entering the river. Increased water may not cause flooding or property damage but could be sufficient to prevent septic systems from operating properly. There was some discussion on the need to install public sewers to serve the main parts of town, especially along Route 25 and Route 111.

In Trumbull, undersized culverts at several locations prevent adequate flow during heavy rain events. Locations that consistently flood include Daniels Farm Road near Trumbull Center, Lake Avenue near the north end of Canoe Brook Lake and Melrose Avenue. Culverts under the Merritt Parkway (Route 15), Route 8 and Route 25 also create "pinch" points of stream flows and cause flooding upstream of the culverts.

The Trumbull Public Works staff voiced concern that several of the town's sewer pump stations are located in flood hazard areas. Attendees from Trumbull also expressed a concern regarding the potential hazard posed by dam failures. Pinewood Lake is privately owned and the Pinewood Lake Association is responsible for maintaining the lake's dam. While the Association has permission to release water prior to a storm, the flood gate on the dam is broken. Failure of the dam has the potential to devastate approximately 100 homes downstream. Attendees felt that this potential dam failure poses a high risk to the safety of residents.

Attendees agreed that pre-disaster planning and good communication during a natural disaster were key to mitigation. Most residents are unaware that they live in a watershed or flood hazard area. Better education and outreach is needed. Coordination and communication with utility companies and crews is essential. Improved coordination between public works crews and electrical power crews is needed to make safe areas with downed trees and allocate resources to priority locations. Attendees agreed that some improvement has occurred since the difficulties and problems experienced after Tropical Storm Irene and Super-storm Sandy, but more needs to be done. Discussions with the Aquarion Water Company should be held about possibly increasing the diversion of the Pequonnock River to the Easton Lake Reservoir in advance of a storm, as well as the release of water from reservoirs to provide storage capacity.

All three communities have had past problems from downed trees because of high winds, ice or heavy wet snow. Tree maintenance programs need to be implemented that remove dead and diseased trees and branches on an on-going basis. Residents should be educated about maintaining trees on their property. The towns also need to coordinate with utility tree trimming programs. Proper tree maintenance on public and private land, enhanced communications with utilities and access to emergency services (on roads blocked by downed trees, as well as snow) have received increased attention from these three communities in recent years.

Higher priority recommendations for all three communities included:

- Conduct watershed-wide assessment of flooding extent and causes and seek to prioritize activities in each community based on local and watershed needs.
- Identify, catalogue, assess and prioritize replacement, repairs, and retrofits for all culverts across each community in the context of future rain events with increased intensity, frequency, and magnitude. Ensure the study focuses on culverts that cause back-up and subsequent flooding of roadways and structures as well as floodwater storage opportunities via better land use and/or open space protection.
- Work directly with utilities to develop a tree management plan for powerlines across each community and adjoining municipalities along critical corridors to ensure continuity of power and quicker recovery during major storm events.
- Continuously increase the effectiveness of the each town's evacuation plan.

Higher priority recommendations specific to Monroe included:

- Continue to encourage self-reliance amongst residents resulting in the ability to shelter in place for extended periods during major events.
- Upgrade communications to better reach residents and busineses during emergencies

Higher priority recommendations specific to Trumbull included:

- Look to establish a communications recovery and response plan between the Town and the seven communications companies that service Trumbull.
- Continue to communicate and facilitate grant applications to make improvements for two private dams (Pinewood and New Brook).
- Look to establish back-up Emergency Operations Center to increase service continuity in the event of an unprecedented disaster.
- Look to install or make available alert radios to help improve emergency communications to municipal buildings, particularly the high school and Senior Center.
- Conduct routine extreme weather communications and emergency drills, and provide extreme weather training courses for teachers and administrators at schools, day care facilities, and after school programs.
- Secure an entirely new radio system for emergency communications and coordination to help increase reliability and effectiveness for first responders during major events.

2.7 Community Outreach

In an effort to develop a more comprehensive and publicly supported Multi-Jurisdictional NHMP, MetroCOG followed a proactive public involvement process. This process included creating a page on the MetroCOG website, developing an online survey and holding a series of public information meetings. MetroCOG's website presented an overview of the purpose of the NHMP and summary of the plan development process. MetroCOG also posted the Press Releases, a Survey link, and Public Meeting Information.

Screen shots of the webpage are included as Appendix D.

Web-based Survey

A public survey was posted online through the website www.surveymonkey.com. The goals of the survey were to inform local officials of the general public awareness regarding natural hazards, and to collect information that may lead to potential mitigation strategies. The survey was posted from January 16 through March 14, 2019, and a total of 171 survey responses were received.

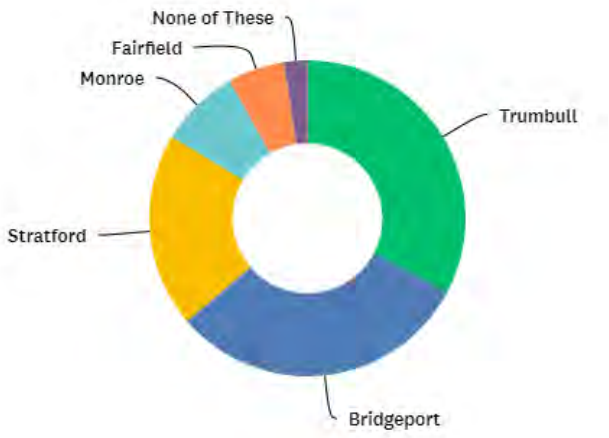
The responses provide an indication of the public perception regarding the level of risk, awareness of natural hazard mitigation planning, and emergency response in the MetroCOG region. Some write-in responses deemed relevant to this plan are included in this summary.

Summary of Respondents

Of the 171 survey respondents, 56 (33%) live or own property in Trumbull, 53 (31%) in Bridgeport, 34 (20%) in Stratford, 14 (8%) in Monroe, and ten (6%) in Fairfield. No residents or property-owners in Easton participated in the survey. A majority of respondents (80%) have lived in or worked in the MetroCOG region for more than 10 years. Four respondents (2%) live outside the region in New Haven, Shelton, and Oxford.

The number of respondents who work within the MetroCOG region is 106 (37%), and an additional 20 (12%) indicated that they are retired or do not work. The remaining 43 individuals who responded to this question (25% of respondents) commute outside the region for work.

Only 40 respondents (27% of those who answered this question) were aware that MetroCOG maintains a Natural Hazard Mitigation Plan for the region. An additional 21 individuals skipped this question.



Hometown of Respondent

Participants were asked which recent events, if any, have generated awareness of natural hazards. The table below summarizes the responses. The majority of respondents reported that they were already aware of the danger of natural hazards, and no recent events have increased that awareness. Seventy-one respondents (50%) reported that their awareness had been increased by Superstorm Sandy in October 2012.

Many respondents noted other events or trends that had raised their awareness; these write-in responses included:

- Rainstorm and flooding (specifically of the Rooster River) in Bridgeport and Fairfield on September 25, 2018 (multiple respondents referred to this event)
- Constant flooding at Seaside Village
- Chronic flooding along Iranistan Avenue and Burnham Street in Bridgeport
- Historic events including the 1938 hurricane
- Nor'easters in general
- Impacts to personal properties from flooding and storms
- Street flooding during rain events
- My awareness has not increased, but my concern has.

Note that the responses above have been edited and consolidated for clarity and are not necessarily verbatim.

Perceived Risk from Natural Hazards

The next question asked responders to rate hazards on a scale of 1 (low threat) to 3 (high threat), indicating the level of perceived threat or concern each presents to their homes or to the functions of their businesses.

The hazards with the highest perceived threat for the majority of respondents include hurricanes and tropical storms, flooding due to poor drainage, winter storms and blizzards, and sea level rise. Earthquakes, wildfires, dam failure, and drought were ranked as the lowest perceived risk.

Respondents wrote-in additional or more specific hazards of concern, including:

- Failure of tide gates
- Falling trees and branches
- Beach erosion
- Rooster River flooding
- Climate change
- Floods causing contamination of lake water
- Sewer back-up

The follow-up question asked which hazards have affected the participant or their businesses. A majority of respondents reported being affected by hurricanes and tropical storms (65%), by winter storms and blizzards (61%), and by flooding due to poor drainage (60%). Severe thunderstorms, flooding from rivers, extreme cold weather, and sea level were also reported to have impacted many respondents (over 25% for each). The reported experiences of respondents closely match

Survey Question: Which recent events have made you more aware of the dangers of natural hazards?

Answer	Percentage
I was already aware; my awareness has not increased	51%
I did or do not think that natural hazards pose a threat to the region	3%
Statewide tornadoes of 2018	19%
Winter storms of 2017-2018	24%
Winter storms of January 2015	16%
Winter Storm Nemo in February 2013	21%
"Superstorm" Sandy in October 2012	48%
Tropical Storm Irene in August 2011	32%
Other (please specify)	11%

Survey Question: How concerned are you about each of the following natural hazards impacting your home, business, or community?

Answer	Weighted Average (1 is low concern, 3 is high concern)
Hurricanes and Tropical Storms	2.53
Flooding due to Poor Drainage	2.41
Winter Storms (including snow or ice) and Blizzards	2.28
Sea Level Rise	2.19
Tornadoes and other High Wind Events	2.18
Severe Thunderstorms (including hail and lightning)	2.11
Flooding from Rivers	2.06
Extreme Cold Weather	2.00
Extreme Hot Weather	1.78
Drought	1.50
Dam Failure (could be caused by other hazards)	1.43
Wildfires and Brush Fires	1.37
Earthquakes	1.23

the levels of concern reported.

97 respondents entered answers when asked if any specific areas of their communities were vulnerable to any of the above hazards. The top mentions were:

- Seaside Village and Lower Iranistan Avenue in Bridgeport
- Breakwater Key and Sniffens Lane, in Stratford
- Bridgeport's South End, generally
- The Black Rock neighborhood in Bridgeport
- The Ash Creek area of Bridgeport and Fairfield
- Trumbull Center

Survey takers were asked what actions they had taken to protect their own families, homes, or businesses. Specific actions taken by respondents include:

- Removed large oak tree to prevent wind from felling it onto home
- Removed hot water tank in basement, put tankless water heater on first floor
- Relocated furnace to attic
- Added extra caulking around windows & doors facing the water
- Acquired a backup generator (multiple responses)
- Participated in Resilient Bridgeport efforts
- Increased insulation in attic, insulated in-home water pipes, updated weatherproofing.
- Constantly clear and repair drainage ditches
- Purchased a home at a high elevation
- Participated in Rebuild by Design meetings
- Installed a sump pump (many responses) and french drain
- Purchased flood insurance
- Communicated with municipal officials to make the town aware of concerns
- Keep brush cut back
- Installed tidal gates and channels
- Changed the grade of back yard
- Minor improvements to drainage on property

Note that the responses above have been edited and consolidated for clarity and are not necessarily verbatim.

Important Tools for Hazard Mitigation

Survey takers were presented a list of common hazard mitigation tools and asked to note which they believed were important, which they had believed had been used successfully in the past, and which they believed should be a priority moving forward.

The top-ranked actions in terms of importance to mitigation were public outreach and education, tree trimming and removal, risk zone identification, and land-use regulations.

The top ranked actions in terms of priority moving forward were drainage improvements, public outreach and education, risk zone identification, back-up power for critical facilities, emergency alerts, emergency response training, and land-use regulations.

Fewer than 50% of respondents selected any specific action as having been used successfully in the past. Nevertheless, the top ranked action in terms of being used successfully in the past were emergency alerts, tree trimming and removal, and snow clearing.

Public outreach / education was the most commonly selected action as being important to hazard mitigation (72 selecting) and for being a priority moving forward (78 selecting), but was also ranked near the bottom for having been used successfully in the past (15 selecting). Similarly-ranked actions (highly important, a priority moving forward, but successful use in the past) include drainage improvements, land-use regulations, and floodproofing.

Availability and Use of Local Resources

The survey asked respondents to note which local resources are important and which were available to support or assist with hazard preparation, response, or recovery.

Local Government, followed by State Government, were identified as the most useful or important (74% and 70% of respondents), and 48% of respondents also indicated those resources are available to them. Emergency responders were also identified as being important (68% of respondents), and were also identified by most respondents as being available (61% of respondents).

Higher Education institutions were ranked lowest in terms of availability (23% of respondents) while being considered important by about half (46%) of respondents. Nonprofit organizations and community or neighborhood associations were both ranked relatively low in availability (31% and 32% selecting, respectively) but somewhat higher in importance (53% and 55% selecting, respectively).

Survey Question: Which response activities are priorities?

Answer	Weighted Average (9 is highest priority, 1 is lowest priority)
Address Injuries and Casualties	7.75
Continue Operation of Medical Facilities	7.08
Restore Utilities (electric, water, wastewater, communication)	6.63
Re-open Roads	6.21
Re-open Gas Stations & Grocery Stores	4.77
Clean/Repair Home	3.89
Re-open Schools	3.77
Resume Business/Tourism Activities	2.97
Restore Parks, Beaches, and other Natural Resources	2.42

Survey-takers were asked to rank a set of recovery activities from most important (1) to least important (9). The inverse of the average rating of each action was taken to calculate the overall importance of each.

Addressing injuries and casualties, continuing operation of medical facilities, restoring utilities, and re-opening roads are seen as the most important actions after a hazard event.

Sea Level Rise and Climate Change

Survey-takers were also asked about their thoughts about planning for climate change and sea level change. Most respondents (74%) believe that it is appropriate to plan for storm events to become more severe and more frequent in the future.

The opinions of responders were less distinct with regards to planning for sea level rise. 25% feel it is appropriate to plan for sea level rise to continue at the current rate, 32% for sea level rise to accelerate, and 43% for it to accelerate dramatically, with several feet of rise by 2100.

Thoughts on Flood Insurance

Responders were asked about their thoughts on flood insurance, specifically with regards to increasing insurance premiums. Most respondents were interested in lowering premiums.

In the comments section, two respondents indicated that flood insurance rates should more accurately reflect risk and be less subsidized, to discourage development in hazard zones.

Potential Projects

Participants were asked what one action could be taken in their community to reduce risks of natural hazards. Drainage improvements and education and awareness actions were the most commonly suggested.

Finally, participants were asked for additional comments, which included:

- "Create a booklet of emergency resources for homeowners."
- "Sewer and storm drains need to be separated in the South End of Bridgeport."
- "Towns like Fairfield affected by natural disasters like Sandy should evaluate their responses to that disaster and determine how they can do better the next time."
- "Organize an evacuation plan specific to each community."
- "There is only one street to access the condo complex where I live. It has been known to flood, making it impassible. Emergency responders need to be aware of this."
- "Drainage systems are flooding every time it rains. Areas for temporary water storage during storms should be created throughout the community."
- "Identify older, mentally/physically ill, and veterans and check on them first."
- "Ensure shelters are prepared to sustainably provide for communities vulnerable to environmental hazards."
- "Outflow pipe at end of Sniffens Lane needs repair. Street becomes flooded during full moon high tides due to water from the river being pushed up the outflow pipe."
- "Fix drainage system in Seaside Village."
- "Mandate that homeowners affected by hazards be given preparedness training."
- "A robust and actionable plan is key not only for safety but also for fiscal stability and economic development."
- "Create both a short-term plan (5 - 10 years) as well as a long term plan (50 years)."
- "Communities such as Seaside Village need a consultant to help us create a recovery plan for storm surges."
- "Storm drain failure proved to be an issue in Trumbull in September 2018. Efforts should be made to improve structures and ensure they remain free of debris."
- "Send out mailings to make the community more aware of issues."
- "Get as many community members and or-

ganizations as possible to participate in this reflection. It is informative for them as well as your organization."

- "Work to get our State Legislature to put statutes in place that prioritize protection of existing residential properties (our municipal tax base) from severe storms."
- "Expanding community education about the risks, solutions, and plans to deal with climate change is a priority for me."
- "It will be increasingly important to prioritize safety improvements and hazard mitigation efforts while respecting environmental law and regulations. However, it should be understood that improvements must take place and should not be hindered by unnecessary or overly conservative environmental constraints."
- "Get the state back on solid financial ground before looking for places to spend additional money. Eliminate entitlements to pay for hazard mitigation."
- "Drainage in the town of Trumbull should be looked at."
- "Reduce conversion of pervious land to impervious surfaces."
- "Educate the public on which department to reach out to at Town Hall for each type of disaster."
- "Snow, hurricanes and high wind storms pose a unique threat to the New England area. The high populations of trees in our region have the potential to cause havoc on our roads and utility systems. Extensive tree damage could require weeks to clear, holding up numerous other emergency services. Our communities must begin aggressively thinning tree populations in close proximity to roads and utilities."

Public Requests for Follow-up

A total of 44 participants provided contact information and expressed interest in following the progress of this plan update.

Summary and Key Takeaways

From the responses above, a number of key patterns and takeaways can be seen:

- Superstorm Sandy: Half of the respondents noted that Superstorm Sandy had increased their awareness of natural hazards – these are communities that are clearly still affected by that storm.
- Flooding: primary concerns for respondents were flood events, including those caused by including hurricanes and tropical storms, poor drainage, and sea level rise. Winter storms and blizzards were also a common concern.
- Bridgeport: Many respondents reported that the Seaside Village, South End, Black Rock, and Ash Creek areas of Bridgeport are at risk from hazards
- Other At-Risk Areas: The Breakwater Key area of Stratford, Ash Creek in Fairfield, and Trumbull Center were all commonly identified as having high natural hazard risk.
- Outreach and Education: Based on survey responses, public outreach and education should be a focus for the region moving forward; it was commonly identified as being important and a priority, but was not noted as being used successfully in the past. Many respondents listed outreach and education actions in the open-ended Question 18.
- Drainage Improvements: As with outreach and education, drainage improvements were often pointed to as important actions that should be prioritized moving forward.

Based on this survey, communities in the MetroCOG region should strongly pursue public outreach and education programs as well as encouraging local communities to seek improvements to drainage systems. It will also be important to perform studies and assessments to identify best practices for hazard mitigation, and to improve the region's evacuation planning. It is important to note that, despite the relatively high response rate, this survey only represents a small segment of the region's population, and the needs and interests of the rest of the area's residents should be solicited and addressed.

The survey is attached in Appendix D.

Public Outreach

MetroCOG provided the public an opportunity to learn about the Regional Natural Hazard Mitigation Plan and the value of mitigation planning. In addition to a web-based approach, MetroCOG hosted two Regional Public Information Meetings. The 1st meeting was held on January 17, 2019 at the Margaret E. Morton Government Center in Bridgeport. The 2nd meeting was held on April 25th, 2019 at the Fairfield Regional Fire School in Fairfield.

Advertising and Promotion

To advertise and promote the series of Public Information Meetings, a Press Release and article was prepared and published in the Connecticut Post (https://www.ctpost.com/local/article/Officials-discuss-preparing-for-disaster-13517729.php). The Connecticut Post has a wide, regional circulation and is the primary source for printed news and information in the region. The article was in the Tuesday, January 8, 2019 edition of the newspaper.

The Press Release of each Public Information Meeting was also sent to the Chief Elected Official of each municipality as well as members of the Planning Teams. These municipal representatives were asked to post the Press Release to their municipal website and place the Meeting Notice at visible locations in City/Town Hall and other key locations. In addition, some communities put out an e-mail blast to their listserv, reaching hundreds, if not thousands of residents across the Region.

Web-based advertising was also undertaken. The times, dates and locations of the public meetings were listed in a sidebar on the main MetroCOG News webpage and featured on the MetroCOG Events page. Links for more information were embedded. Social media was utilized by posting public meeting information on the MetroCOG Facebook page.

For each forum, a member of the MetroCOG staff presented on the process of updating the Regional Natural Hazard Mitigation Plan, as well as the impacts from recent events. Hazard profiles and the likelihood of events happening in the future were also discussed. The primary focus of the public meetings was to solicit information and comments from the public on how the community should address natural hazards and what actions, strategies and projects should be implemented to reduce the effects of future natural hazards.

01/04/19

Natural Hazard Mitigation Press Release

Public Input Needed on Reducing Impacts of Natural Disasters

Natural Hazard Mitigation Plan Update Underway

Elected officials in Bridgeport, Easton, Fairfield, Monroe, Stratford, and Trumbull are seeking public input on ideas for preparing for natural disasters such as the flood of September 25, 2018. Events such as floods, hurricanes, thunderstorms, winter storms, and other natural hazards affect residents and businesses every year. These events damage property, cause power outages, block roads, and can cause injuries.

The Connecticut Metropolitan Council of Governments (MetroCOG), which represents the six municipalities in the region, is in the process of updating the multi-jurisdiction Natural Hazard Mitigation Plan. A Natural Hazard Mitigation Plan is a tool that helps communities understand risks and take specific steps to reduce property damage, injuries, and loss of life. This plan discusses the occurrence and consequences of floods, coastal changes, winter storms, tornadoes, hurricanes and tropical storms, earthquakes, and dam failure. The plan identifies activities that communities can perform before natural hazards occur in order to minimize property damage, risk of life, and the costs that are shared by all. This update will identify significant changes in risks, vulnerabilities, capabilities, and mitigation actions that have developed since adoption of the previous plan in 2014.

MetroCOG is offering an opportunity for the public to attend an informational meeting where residents can learn about the plan, ask questions, and provide input. The meeting will be held on January 17, 2019, 6 PM, Bridgeport City Hall, 45 Lyon Terrance, Bridgeport, CT 06604.

Additionally, all are encouraged to share their thoughts through an online survey available at https://www.surveymonkey.com/r/metrocoghazards

Comments or questions can also be emailed to Patrick Carleton at pcarleton@ctmetro.org.

Town of Fairfield News

4/8/2019 - Public Meeting on Regional Natural Hazard Mitigation Plan

The Connecticut Metropolitan Council of Governments (MetroCOG), which represents the municipalities of Bridgeport, Easton, Fairfield, Monroe, Trumbull and Stratford is pleased to invite residents, local businesses and other stakeholders to a Public Meeting on the Regional Natural Hazard Mitigation Plan!

The Public Meeting will occur on Thursday, April 25th at 7:00PM at the Fairfield Regional Fire School, 205 Richard White Way, Fairfield, Connecticut 06824 (entrance to Richard White Way across from Veteran's Park on Reef Road).

A Natural Hazard Mitigation Plan is a tool that helps a community understand risks and take specific steps to reduce property damage, injury, and loss of life. This plan discusses the occurrence and consequences of floods, coastal changes, winter storms, tornadoes, hurricanes and tropical storms, earthquakes, and dam failure. The plan identifies activities that communities can perform before natural hazards occur in order to minimize property damage, risk of life, and the costs that are shared by all. This update will identify significant changes in risks, vulnerabilities, capabilities, and mitigation actions that have developed since adoption of the previous plan in 2014.

The Public Meeting will include a presentation of the some of the proposed mitigation actions for 2019 – 2024. All interested parties and members of the public will have an opportunity to participate as well as voice their opinions and provide feedback on the Plan.

Fairfield First Selectman Mike Tetreau, who serves as Chairman of MetroCOG, stated: "I encourage the public to attend this important meeting to give your input on our Region's Natural Hazard Mitigation Plan. It is especially important for coastal communities like Fairfield to continue to be proactive in our mitigation efforts and have the best, most up-to-date information available to help prepare and protect our community in the wake of a natural hazard event."

The Natural Hazard Mitigation Plan Update is a result of a FEMA Pre-Disaster Mitigation Grant that was awarded to MetroCOG by the State of Connecticut's Department of Emergency Management and Homeland Security.

Anyone interested in the Regional Natural Hazard Mitigation Plan is encouraged to attend the Public Meeting. For further information, please contact Patrick Carleton at MetroCOG at pcarleton@ctmetro.org.

MetroCOG Logo Source: http://ctmetro.org/

Public Information Meeting Notices

Public Information Forums

January 17, 2019 – City of Bridgeport

The meeting was held in City Hall. Kenneth Flatto, Finance Director for the City of Bridgeport was the only attendee. MetroCOG staff and Milone & MacBroom, Inc. presented an overview of the purpose and need for updating the Regional NHMP. Discussion following the presentation focused on plan implementation and funding of projects.

April 25, 2019 - Town of Fairfield

The meeting was held at the Fairfield Regional Fire School in Fairfield. Thirteen people attended and participated in the discussion (attendance list is attached in Appendix E). The attendees included members of the Fairfield Flood and Erosion Control Board, Fairfield Beach Residents Association, Fairfield Fire Department, and members of the public. Participants were not limited to those from Fairfield. A resident of the Black Rock neighborhood of Bridgeport and a resident of the Town of

Stratford also attended this meeting. Residents from other communities expressed interest in the meeting to MetroCOG staff via e-mail but ultimately did not attend the meeting.

The Town of Fairfield First Selectman, MetroCOG staff, and Milone & MacBroom, Inc. presented an overview of the purpose and need for updating the Regional NHMP. At the conclusion of the presentation, the discussion focused on answering questions and addressing concerns expressed by attendees. Discussion topics following the presentation included microgrid installation in Fairfield, implementation of the Riverside Drive / Ash Creek Flood Protection Study, using the NHMP to acquire grant funding for projects, and flooding along Pine Creek. Following the meeting, there was additional discussion regarding a CIRCA study that considered the differences in wind shear for elevated vs. non-elevated homes.

Contact with Adjacent Communities

The involvement of other communities and regions was accomplished by direct contact with the municipal staff of adjacent cities and towns. The MetroCOG region is bordered by seven municipalities:

- City of Milford: Borders Stratford along the Housatonic River.
- Town of Newtown: Borders Easton and Monroe. The watersheds of the Aspetuck River, Halfway River and Pootatuck River overlap the town boundaries. The Housatonic River forms the eastern border of Newtown.
- Town of Oxford: Borders Monroe along the Housatonic River.
- Town of Redding: Borders Easton. The watersheds of the Aspetuck River and Saugatuck River overlap the town boundaries.
- City of Shelton: Borders Monroe, Trumbull and Stratford. The watersheds of the Booth Hill Brook, Farmill River, Means Brook, and Pumpkin Ground Brook overlap the town boundaries. The Housatonic River forms the eastern border of Shelton.
- Town of Weston: Borders Easton. The watersheds of the Aspetuck River and Saugatuck River overlap the town boundaries.
- Town of Westport: Borders Fairfield. The watersheds of the Aspetuck River and Sasco Brook overlap the town boundaries.

Letters were sent to each of the surrounding seven communities listed above requesting input into the hazard mitigation planning process. The letters also advised the towns of the availability of the public survey. Letters were also sent to the Western Connecticut Council of Governments, Naugatuck Valley Council of Governments and the South Central Regional Council of Governments in January 2019 requesting input from the adjacent COGs.

Copies of the letters are attached in Appendix E..

None of the surrounding communities or COGs provided input during the planning process.

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3 Hazard Identification and Risk Assessment

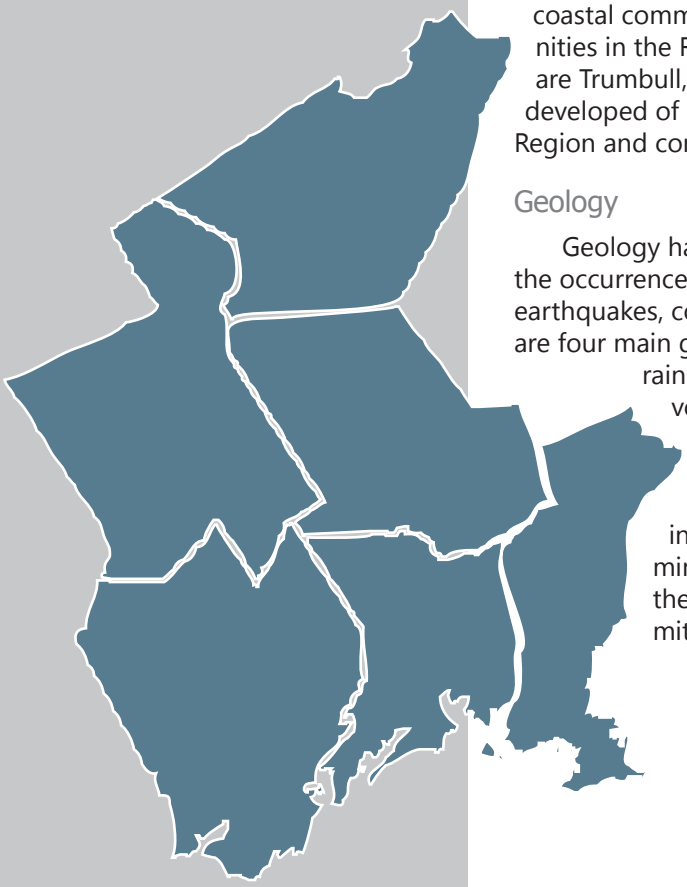
This risk assessment provides sufficient information to enable each jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. The natural hazards that have the potential of affecting the region were identified through the planning process via the respective planning teams.

In this chapter, the location and extent of the natural hazards is described. Information on previous occurrences of hazard events was collected through a review of NOAA databases, interviews with municipal staff and research of historical records and archives. Based on this research, the probability of future hazard events was determined.

3.1 General Description of Region

Physical Setting

The Region consists of six communities located in Fairfield County, in Southwestern Connecticut. There are three coastal communities; the City of Bridgeport, the Town of Fairfield, and the Town of Stratford. These coastal communities are the most populated communities in the Region. The inland towns in the Region are Trumbull, Monroe and Easton. Easton is the least developed of all the communities. Figure 3.1 shows the Region and corresponding road network.



Geology

Geology has an important role in understanding the occurrence and severity of natural hazards such as earthquakes, coastal flooding and inland flooding. There are four main geologic forces that have shaped the terrain within the MetroCOG Region: tectonic, volcanic, glacial and human activity. Glacial and human activities have significant impacts on large scale and natural hazards. Tectonic and volcanic activity, discussed in the Bedrock Geology section below, have minor significance as natural hazards, as the only hazard of importance can be easily mitigated.

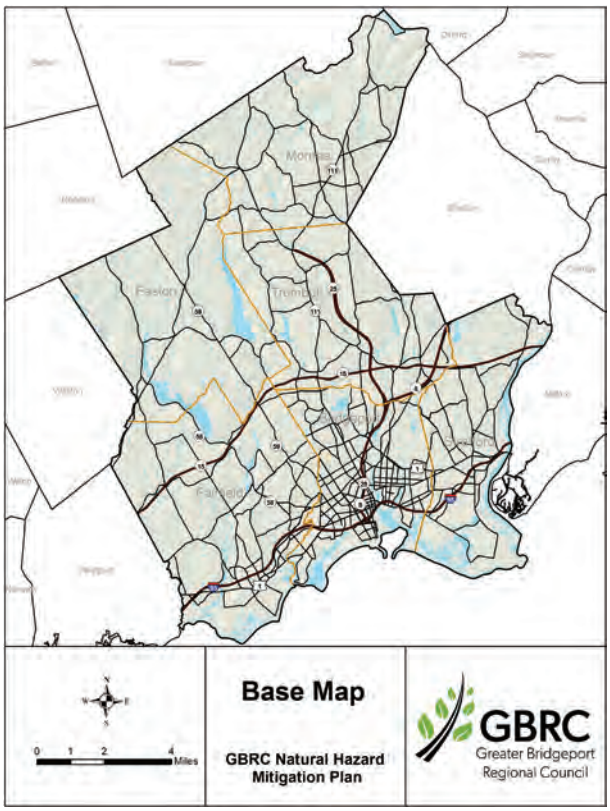


Figure 3.1: Base map of the Region.

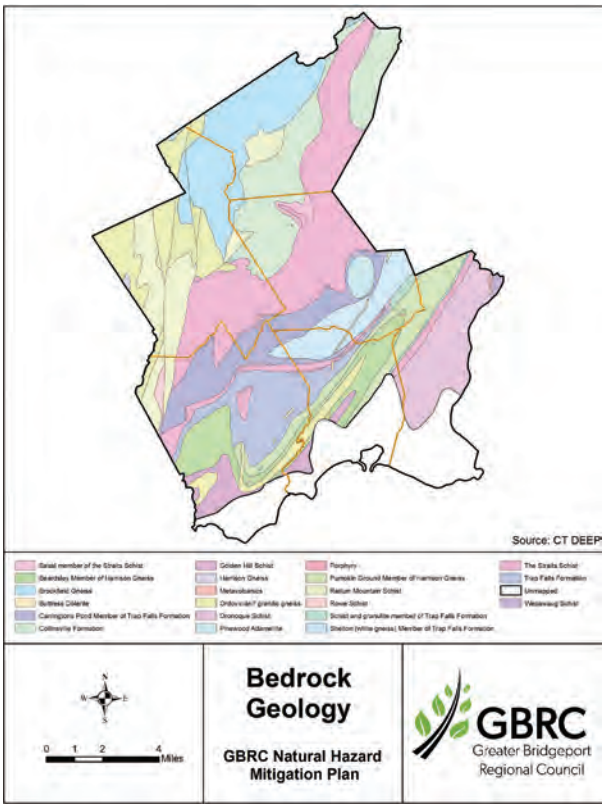


Figure 3.2: Bedrock Geology. Source: CTDEEP.

Bedrock Geology

The region is currently within a stable portion of the North American tectonic plate. This means that at present time, the region does not experience significant earth moving events that generate earthquakes or volcanic activity. In the geologic history of the region, this is not the case. Evidence of this is seen in the bedrock geology of the region which consists of two major geologic terranes. The primary terrane is the Iapetos Terrane which consists of Ordovician Silurian and Devonian (360-500 million year old) metamorphic schists and gneiss created during a period of tectonic activity. The majority of these metamorphic rocks have a sedimentary and igneous beginnings indicating near shore formation prior to deformation into metamorphic rocks. The predominant direction of faults, bedrock contacts and rock cleavage trends northeast to southwest. These faults are no longer active and thus pose little earthquake hazard. There is one bedrock outlier within the predominantly gneiss/schist Iapetos Terrane: the Pinewood Adamelite formation in Trumbull. This is a light-gray, medium-grained granite with a chemical makeup that tends to produce high levels of Radon. The other terrane is the product of volcanic activity that formed the large trap rock ridges of central Connecticut. The Buttress Diorite dike is a northeast to southwest trending Jurassic age (140-205 million years ago) formation created by the remnants of the cooling magma that once fed the major volcanic activity occurring in the present central Connecticut valley. The bedrock in the Region can be seen in Figure 3.2. Town maps of bedrock can be found in Appendix F.

In terms of natural hazards, the occurrence of Radon bearing rocks has a significant risk factor over long periods of exposure but can be easily mitigated. Radon (chemical symbol Rn) is a colorless, odorless, heavy gas that seeps up to the surface out of the rocks of the earth. Radon is a product of the decay of uranium (U), which is present in most rocks in small amounts, but U is also fairly concentrated in some areas of granite, pegmatites, and mineral veins in Connecticut. Although radon is quite radioactive, it is not very dangerous itself because it has a neutral electromagnetic charge (not ionic), so it does not stick well to other molecules. You breath it into your lungs, but you also breath it back out again. However, radon has a short half-life (3.8 days), meaning it rapidly breaks down into other radio-

active elements, which are ionic and do stick to your lung cells. Some of these "daughter" ions are radioactive isotopes of lead, bismuth, and polonium. Being so close up to your lung cell DNA, the radioactive particles can and do cause damage that eventually leads to tumors.

We need to pay more attention to radon, because it probably causes most of the lung cancer deaths that are not directly due to smoking. The National Academy of Science concluded in 1998 that about 15,400 to 21,800 lung cancer deaths per year in the United States are caused by breathing high levels of indoor radon, meaning hundreds of deaths in Connecticut every year. In addition, there may be other problems such as stomach and esophagus cancer leading to years of pain and misery or death. Figure 3.3 shows potential indoor risk levels from radon in various areas of our state, based on many measurements of radon in water wells and in the air of our buildings. No matter where you are on the map, you will not know if your house has high radon until you test for it, which is pretty cheap and easy.

Over the course of geologic history, glaciers and the polar ice caps have grown and contracted with changes in climate and geologic conditions. The glacial history of the region is evident to only the last 100,000 years or so. The advance and retreat of the continental glaciers often create new glacial landforms and erase the evidence of previous glacial epochs. The glaciers that have formed have a core in eastern Canada and over a period of several thousand years, the glaciers grew and extended southward into New England and other northern states. The glacier acts as a bulldozer, breaking down bedrock and pushing debris on its forward moving side but unlike a bulldozer, some debris is incorporated into a flowing glacier. Beneath the glacier, bedrock is plucked and scraped, then the debris is broken down into finer and finer material. When combined with melting glacial water, the debris smears the remaining bedrock with a variable thickness veneer of hard-pan or glacial till. Some glacial till formations are larger and thicker, creating spoon shaped hill formations oriented in the direction the glaciers flowed, called drumlins. There are drumlins throughout the region, with prominent examples along the shoreline such as Sasco Hill in Fairfield and Grover Hill in Bridgeport. The drumlins keep those areas out of harm's way from rising tides and storm

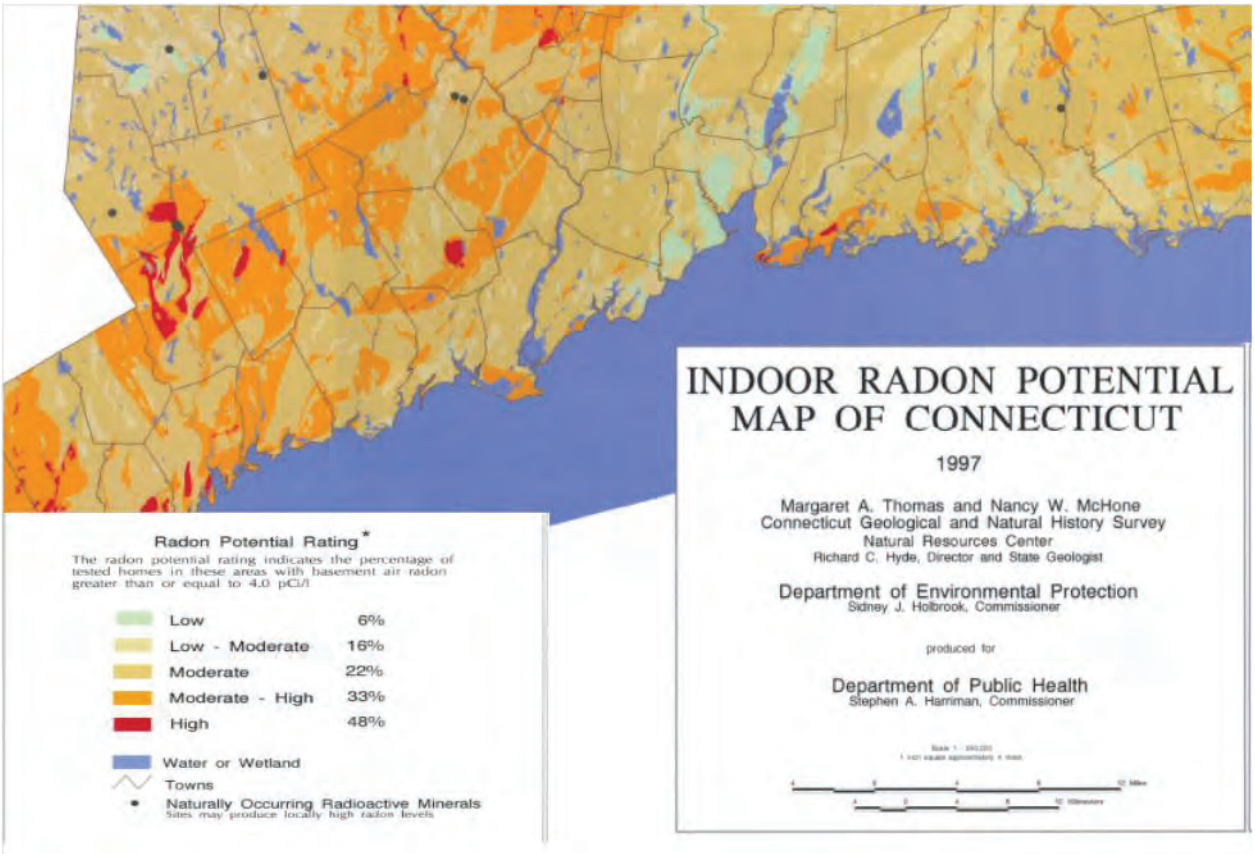


Figure 3.3: Radon in Connecticut. Source: http://www.ct.gov/deep/lib/deep/geology/radon/RadonPotential.pdf

surges. After a glacier reaches its peak size and begins to retreat back north, glacier melt-waters, gush out of the glacier from below, above and from the interior of the glacier. The melting waters contain the glacial debris that form stratified sand and gravel formations commonly found along current rivers and waterways. These outwashes led to present day Long Island Sound, once a fresh water lake called Glacial Lake Connecticut. There are underwater formations in Long Island Sound that attest to this history. Once Glacial Lake Connecticut transitioned to Long Island Sound, tidal action reworked existing glacial deposits and outgoing fluvial sediments, forming post-glacial beach deposits at Southport Harbor, Fairfield Beach, Black Rock Harbor, and Pleasure Beach. Important Salt Marshes developed in conjunction with the post-glacial beach building activities. Figure 3.4 shows the surficial geology of the Region. Town maps of surficial geology can be found in Appendix F.

Human Activity

We have shaped our environment and terrain since we have inhabited the region beginning the early 1600s. These have included constructing dams for mill operations, filling in salt marshes, wetlands and other low-lying areas to allow increases in the amount of developable land and constructing homes in areas that will be most likely be wiped out in the next major storm. Unfortunately, these feats of engineering have come at a price, whether it was compromised fisheries with the closure of spawning habitat from dam construction or the loss of valuable flooding buffers salt marshes provide. We have a record of these filling activities through the USGS Topographic Quadrangles, starting with the initial set produced around 1893 through versions in 1950s, 1960s, 1970s, 1980s and current GIS information. These show salt marshes and open water being transformed into land for development purposes. Much of the filling occurred prior to the 1970s and the National Flood Program.

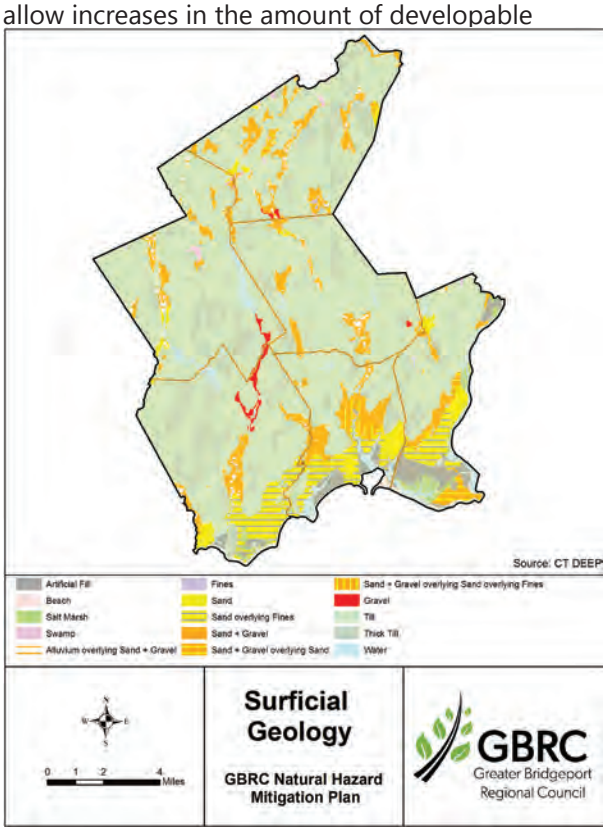


Figure 3.4: Surficial Geology for the Region. Source: CT DEEP

Climate and Climate Change

Climate is defined as the expected frequency of specific states of the atmosphere, ocean, and land including variables such as temperature (land, ocean, and atmosphere), salinity (oceans), soil moisture (land), wind speed and direction (atmosphere), current strength and direction (oceans), etc. Climate encompasses the weather over different periods of time and also relates to mutual interactions between the components of the earth system. Weather, on the other hand, is defined as the state of the atmosphere at a given time and place, with respect to variables such as temperature, moisture, wind speed and direction, and barometric pressure.

The Region has a moderate climate with distinct seasons. Based on observations at the weather station located at Bridgeport/Sikorsky Airport, the average temperature between 1980 and 2012 was approximately 52.5 degrees Fahrenheit (F), with summer temperatures averaging nearly 72 degrees and winter temperatures in the low 30s. Extreme conditions may raise summer temperatures to near 100 degrees and winter temperatures to below zero. However, the Region averages only about eight days a year with temperatures over 90 degrees and one day a year with temperatures below zero degrees.

Figure 3.5 plots the annual average temperature from 1980 to 2018 and shows an increasing temperature trend. The range in annual temperatures was between 50.5 degrees and 55.6 degrees. Figure 3.6 plots the average maximum and minimum temperatures over the same period.

By comparison, the statewide annual average temperature over the same time period was 49.5 degrees, or three degrees cooler on average. As is

the case with the data from the Bridgeport-Sikorsky Airport, annual average temperatures for Connecticut are trending upwards.

Over the course of a year, the region receives, on average, 43.1 inches of precipitation. Annual totals have ranged from a low of 33 inches in 1995 to a high of 60.2 inches in 2018. Mean snowfall amounts are approximately 27 inches per year, with a high total recorded in 2003 of 68.5 inches. Figure 3.7 charts the annual precipitation.

The average precipitation total for Connecticut was 50.5 inches per year or over seven inches more precipitation fell state-wide than on the Region. Total annual precipitation in Connecticut, as well as for the Region, has increased over time.

Subsequent to the development of the 2014 NHMP, the Connecticut NHMP Updates (2014 & 2019) were adopted with enhanced discussions relative to climate change; the State established the Connecticut Institute for Resilience and Climate Adaptation (CIRCA); and the Water Planning Council supervised the development of the State Water Plan (2018) with a chapter devoted to Climate Change. The conclusions of the Connecticut Natural Hazard Mitigation Plan Update and State Water Plan include statements regarding the impacts of climate change on floods, droughts, tropical storms and hurricanes, severe winter storms, thunderstorms, and wildfires. This information is presented in the subsections of this chapter within the discussion of each hazard.

The State Water Plan (2018) includes an analysis associated with four scenarios (warm/wet, warm/dry, hot/wet, and hot/dry) and notes that "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 (higher percentiles), including extreme wet months. It follows, then, that the seasonality plots show that winter and

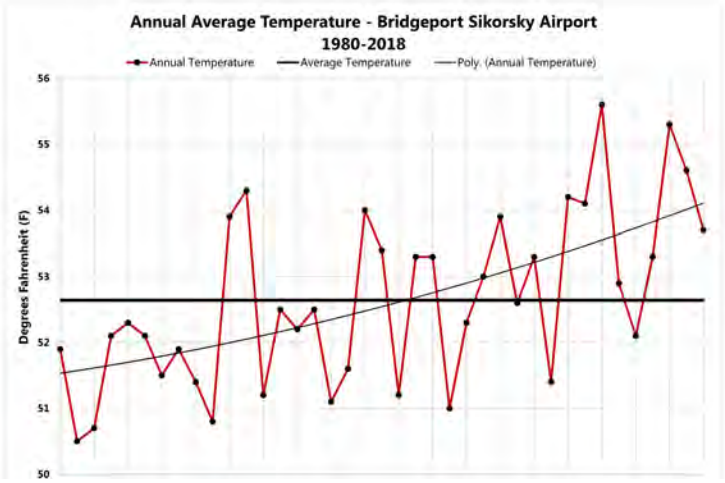


Figure 3.5: Average annual temperature at Bridgeport Sikorsky Airport. Source: NOAA

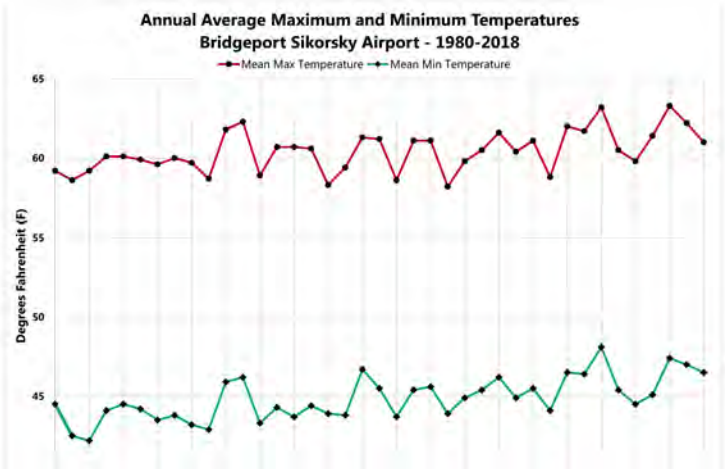


Figure 3.6: Average annual maximum and minimum temperatures. Source: NOAA

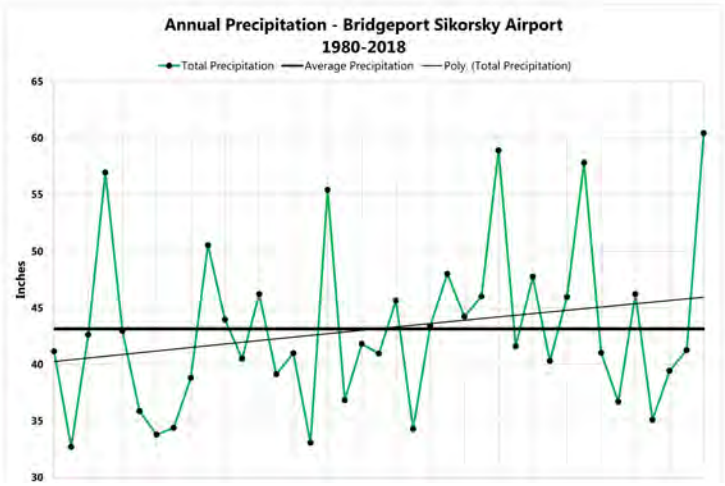


Figure 3.7: Annual precipitation at Bridgeport/Sikorsky airport. Source: NOAA

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." The State Water Plan further notes that "The largest increases in streamflow are generally projected for the winter months (Dec. - Feb.), for all four climate ensembles. This is likely attributable to a combination of both greater winter precipitation and reduced snow accumulation."

Hydrology

The MetroCOG region lies within four regional drainage basins: the Housatonic River, the Saugatuck River, the Southwest Shoreline and the Southwest Eastern basin. The basins drain the numerous rivers and streams that flow through the Region, primarily in a north-to-south direction, and eventually empty into Long Island Sound.

Four sub-regional drainage basins cover the City of Bridgeport, relating to the Ash Creek/ Rooster River, Pequonnock River, the Yellow Mill Channel and Bruce Brook/Johnsons Creek. In addition, Bridgeport's coastal areas lie within the direct drainage basin of Long Island Sound, referred to as the Southwest Shoreline sub-regional drainage basin. It includes the Cedar Creek inlet, Black Rock Harbor, Bridgeport Harbor, Lewis Gut and Johnsons Creek.

The Town of Easton lies primarily within three sub-regional drainage basins corresponding to the Aspetuck River, Saugatuck River and Mill River. In addition, very small areas of the town are within the drainage basins of the Pootatuck River, in the north part of town, and Sasco Brook, in the southwestern part.

The Town of Fairfield is drained by the Saugatuck River, Sasco Brook, Mill River, and Ash Creek/Rooster River. In addition, coastal areas of Fairfield are within the direct drainage basin of Long Island Sound. This area includes Pine Creek.

Seven sub-regional drainage basins flow through parts of the Town of Monroe. The river systems include the Pootatuck River, Halfway River, Mill River, Pequonnock River, Farmill River, Means Brook, and Housatonic River. A large portion of Monroe (approximately 8.4 square miles) is drained by the Pequonnock River, comprising much of the developed part of the Town.

Much of the land area of the Town of Stratford drains towards the Housatonic River, including the sub-regional drainage corresponding to the Farmill River and Pumpkin Ground Brook. The other drainage basins are associated with Bruce Brook, the Yellow Mill Channel, and Lewis Gut. The immediate shoreline along Long Island Sound is part of the Southwest Shoreline basin.

The Town of Trumbull lies within seven sub-regional drainage basins corresponding to the Mill River, Ash Creek/Rooster, Pequonnock River and its tributaries, the unnamed tributaries of Yellow Mill Channel, Booth Hill Brook, Farmill River, and Pumpkin Ground Brook.

The regional drainage basins are comprised of sub-regional and local basins. These are described in Table 3.1 on the next page and shown in Figure 3.8. Town maps of drainage basins can be found in Appendix F.

Housatonic River Main Stem Regional Basin

The Housatonic River is one of Connecticut's largest rivers, extending about 139 miles from its source in Massachusetts to its mouth at Long Island Sound. The watershed and its component river systems are classified as a Major drainage basin, draining an area of about 1,939 square miles in Connecticut, Massachusetts, and New York. The regional Housatonic River basin is about 932.66 square miles.

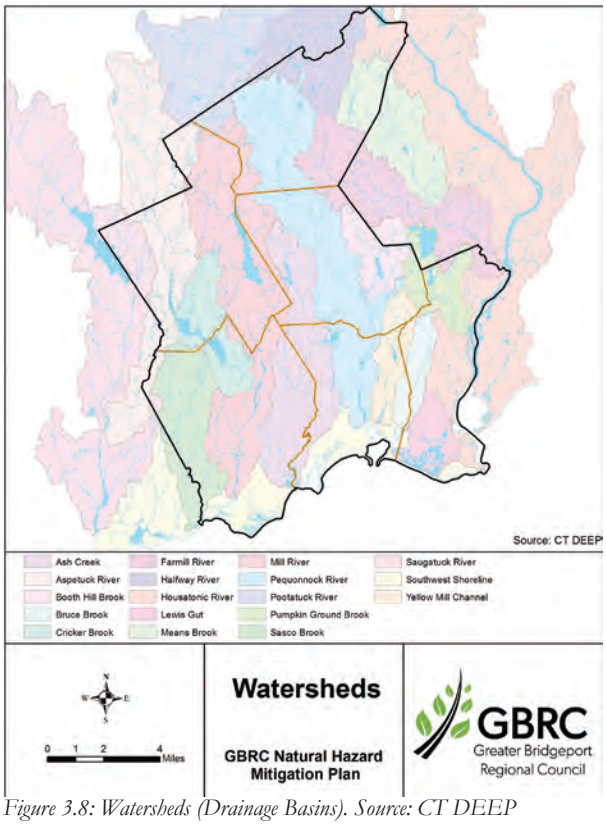


Figure 3.8: Watersheds (Drainage Basins). Source: CT DEEP

The drainage basins associated with the Pootatuck River, Halfway River, Farmill River, Pumpkin Ground Brook, and Means Brook flow into and are sub-regional basins of the Housatonic main stem. The lower sections of the Housatonic River are designated as a sub-regional drainage basin.

Housatonic River

In the Region, the Housatonic River forms the northeast boundary between Monroe and the Town of Oxford and is the municipal boundary between Stratford and the City of Milford.

The Stevenson Dam impounds the river and forms Lake Zoar. The lake is long and narrow and provides flood control, recreational opportunities, and hydroelectric power to the area. The Stevenson Dam is one of the largest dams in the Region, and the largest in Monroe. Downstream of the Stevenson Dam the river flows in a southerly direction through the City of Shelton and Stratford before entering Long Island Sound.

One perennial watercourse known as Boys Halfway River drains the far eastern end of Monroe, an area of 0.7 square miles, and joins Lake Zoar near the Stevenson Dam. Most of the east-central part of Stratford, as well as the lands immediately adjacent to the river, drain directly to the Housatonic River.

Farmill River

The Farmill River begins in south-central Monroe and flows in a southeasterly direction into Shelton and forms the town line between Stratford and Shelton. Combined with its Beardsley Brook tributary, the Farmill River drains about three square miles in the town. The area drained by the Farmill River comprises much of the developed part of Monroe. As a result, a number of chronic flooding problems do occur along the river and its tributaries.

The Farmill River does not flow through Trumbull and only a small portion of the northern part of the Town is in its drainage basin. The river ultimately joins the Housatonic River. The drainage area of the Farmill River totals about 15 square miles.

Halfway River

The Halfway River begins in Rowledge Pond, just north of the Monroe town line in the Town of Newtown. The Pine Swamp area of Monroe also drains into the river. From its source, the river flows

Table 3.1: Drainage basins. Source: CT DEEP

REGIONAL AND SUB-REGIONAL DRAINAGE BASINS - METROCOG PLANNING REGION

Regional Basin	Sub-Regional Drainage Basin	Towns	Size (Square Miles)
Housatonic Main stem	Farmill River	Monroe & Trumbull	15.09
Housatonic Main stem	Halfway River	Monroe	10.68
Housatonic Main stem	Housatonic River	Monroe & Stratford	623.54
Housatonic Main stem	Means Brook	Monroe	10.95
Housatonic Main stem	Pootatuck River	Monroe & Easton	20.78
Housatonic Main stem	Pumpkin Ground Brook	Trumbull & Stratford	5.94
Saugatuck	Aspetuck River	Easton & Fairfield	71.60
Saugatuck	Saugatuck River	Easton & Fairfield	71.60
Southwest Coastal Eastern	Ash Creek/Rooster River	Bridgeport & Fairfield	15.33
Southwest Coastal Eastern	Booth Hill Brook	Trumbull	5.09
Southwest Coastal Eastern	Bruce Brook/Johnsons Creek	Stratford & Bridgeport	3.44
Southwest Coastal Eastern	Lewis Gut	Stratford & Bridgeport	3.98
Southwest Coastal Eastern	Mill River/Cricker Brook	Monroe, Easton & Fairfield	32.02
Southwest Coastal Eastern	Pequonnock River	Monroe, Trumbull & Bridgeport	24.03
Southwest Coastal Eastern	Sasco Brook	Fairfield	10.21
Southwest Coastal Eastern	Yellow Mill Channel	Trumbull, Stratford & Bridgeport	4.52
Southwest Coastal Shoreline	Pine Creek (Local)	Fairfield	2.00
Southwest Coastal Shoreline	Southwest Shoreline	Fairfield, Bridgeport & Stratford	7.80

in a northeasterly direction, eventually forming the boundary between Newtown and Monroe. The Halfway River joins the Housatonic River at Lake Zoar. The Halfway River has a total drainage area of about 10.5 square miles.

The Copper Hill Brook and its tributary Smith Pond Brook drain the central part of Monroe, with a combined drainage area of roughly 2.5 square miles, before joining the Halfway River.

Means Brook

Means Brook begins in eastern Monroe near Boys Halfway River, where Hurds Brook was diverted from Boys Halfway River to Means Brook. It has a total drainage area of 11 square miles. Upstream of Means Brook, the drainage area includes Hurds Brook, which is approximately two square miles. The portion of the Means Brook drainage basin in Monroe is relatively rural. Means Brook flows to the south, and most of its drainage area lies in Shelton, where it joins the Farmill River upstream of the Housatonic River.

Pootatuck River

The Pootatuck River is one of the few rivers with a drainage area in the Region that flows in a northerly direction. The river rises in the far west corner of Monroe near the Easton town line, and flows north through Newtown to the Housatonic River. A tributary of the river drains the far west section of Monroe, including the area around Guskie Pond. The total size of the drainage basin is about 21 square miles, with only about one square mile located in Monroe.

Pumpkin Ground Brook

The northwest corner of Stratford and southeast corner of Trumbull lie in the Pumpkin Ground Brook drainage basin. The brook begins in the Trap Falls Reservoir in southern Shelton, and flows generally in a southeasterly direction through Shelton and Stratford before joining the Housatonic River. A majority of the area flows through Beaver Dam Lake. A number of short, unnamed brooks flow into the Pumpkin Ground Brook system. The total drainage basin is 6 square miles.

Saugatuck River Regional Basin

The Saugatuck River regional basin lies along the western edge of the Region and covers mostly the towns of Redding, Weston and Westport. The basin drains 89.5 square miles.

The drainage areas associated with the Aspetuck River and Saugatuck River are two of the three sub-regional basins comprising the Saugatuck River Regional Basin.

Saugatuck River

The Saugatuck River drainage basin encompasses about 48.5 square miles, with headwaters in Danbury and Ridgefield. The river flows in a southerly direction and enters the Saugatuck Reservoir, a public water supply reservoir. The reservoir lies along the western edge of Easton. Downstream of the reservoir, the Saugatuck River flows through the Town of Weston and the Town of Westport before entering Long Island Sound. Adjacent land in Easton drains either directly into the reservoir or into the Saugatuck River downstream of its dam. Most of the land is preserved as open space, either as water-company owned lands or as parts of the Centennial Watershed state forest.

Aspetuck River

The Aspetuck River has its headwaters in southwestern Newtown and flows in a southwesterly direction toward the Saugatuck River. It forms the southwest border between the Town of Easton and the Town of Weston as well as the northwest border of the Town of Fairfield with the Town of Weston. The west side of Easton and northwest corner of Fairfield are drained by the Aspetuck River. The total size of the drainage basin is 23 square miles.

The river flows through the Aspetuck Reservoir, a public water supply reservoir, and joins the Saugatuck River downstream of Easton in the Town of Westport. Several unnamed streams flow into the Aspetuck River.

The areas drained by the Aspetuck River are very rural, and flooding problems are infrequent. Land use in this part of the watershed is typical of Easton and the northern part of Fairfield: large lot residential.

Southwest Eastern Regional Complex Basin

The Southwest Eastern Regional Complex is a part of the Southwest Coastal Major Basin that drains most of Fairfield County. The regional complex covers most of the Region, except for the eastern half of Monroe and northeast part of Stratford. It is associated with Ash Creek, Booth Hill Brook, Bruce Brook, Cricker Brook, Lewis Gut (Great Salt Marsh), the Mill River, the Pequonnock River, Sasco Brook and the Yellow Mill Channel. The drainage area is about 98.5 square miles.

Ash Creek/Rooster River

Ash Creek is the tidal estuary of the Rooster River and is coincident with the boundary between Fairfield and the Black Rock section of Bridgeport. The watercourse is known as Rooster River upstream of the New Haven rail line bridge. The entire drainage basin includes the tributaries Ox Brook and Horse Tavern Brook and has an area of roughly 15.5 square miles.

The section of the watercourse named Rooster River is only two miles in length, formed by the junction of Horse Tavern Brook and Londons Brook in the eastern section of Fairfield. Londons Brook begins in northeast Fairfield and flows in a southerly direction through Fairfield, having a drainage area of 1.5 square miles. In Trumbull, the area associated with the Ash Creek/Rooster River drainage basin surrounds the Horse Tavern Brook. Horse Tavern Brook begins at Canoe Brook Lake in Trumbull and flows in a southerly direction through southwest Trumbull, the northwest corner of Bridgeport, and eastern Fairfield, having a drainage area of almost six square miles

The Horse Tavern Brook watershed is densely developed in Trumbull, and it flows in a culvert under the Westfield/Trumbull Shopping Mall before crossing the town line into the northwest corner of Bridgeport. Horse Tavern Brooks joins Londons Brook in Fairfield to form the Rooster River.

Ox Brook is a tributary of Rooster River, rising at the municipal boundary between Trumbull and Bridgeport. The brook flows in a southerly direction only 500 feet from Horse Tavern Brook in northern Bridgeport, passes through residential neighborhoods, and joins Rooster River in the western section of Bridgeport, with a total drainage area of a little more than two square miles.

The flow of Rooster River was modified in the past to reduce flooding. It is directed into a culvert beneath Laurel Avenue, bypassing the bend in the channel. This culvert rejoins the river a short distance downstream, leaving the channel dry except during storms.

Ox Brook has been modified along its entire length. Many sections of the brook are underground in culverts, and the exposed portions of the brook have been heavily channelized. The lowest section of the brook is directed into a nine-foot diameter culvert beneath Capitol Avenue that joins the Rooster River culvert. The bypassed sections of the brook channel located downstream of Capitol Avenue have been filled or remain as disjointed dry segments.

Booth Hill Brook

Booth Hill Brook is a larger tributary of the Pequonnock with a total drainage area of five square miles. Most of this area is within Trumbull, with a small area located in Shelton. Booth Hill Brook begins in the north eastern part of Trumbull near the Farmill River watershed. It flows in a southerly direction and through Pinewood Lake before merging with the Pequonnock River.

Bruce Brook

Bruce Brook rises in northwest Stratford and flows in a southerly direction from its headwaters. It forms the border between Bridgeport and Stratford from about US Route 1 to a small dam immediately upstream of the New Haven rail line crossing. Downstream of the railroad tracks, the outlet is protected by a tide gate maintained by the Connecticut Department of Transportation. At this point, Bruce Brook becomes Johnson's Creek, which flows into Bridgeport Harbor and is the tidal estuary of Bruce Brook.

The Bruce Brook drainage area is almost 3.5 square miles, with most of its area within Stratford. A small area is located in Bridgeport. The watershed is densely developed with primarily residential property but with some commercial development in the southern portion.

Lewis Gut

The Lewis Gut watershed is located in the South End of Stratford and consists of land draining directly to or through unnamed streams to the Great Salt Meadows, a component of the Stewart McKinney National Wildlife Refuge. The area is densely developed with residential and commercial properties and includes the Sikorsky Airport and Lordship section of town. The total area is approximately four square miles and the area drains in several locations to the salt marsh. Besides the Lordship area, which is higher in elevation, a majority of this watershed is flat land lying, below the base flood elevation and subject to coastal flooding.

Mill River and Cricker Brook

The Mill River begins in the vicinity of the town line between Monroe and Easton, very close to the headwaters of the Pootatuck River and flows in a southerly direction forming the Easton Reservoir, a public water supply. Downstream of the reservoir, it

serves as a short section of the town line between Fairfield and Easton, and then flows through the central part of Fairfield before ending at Southport Harbor. The entire drainage area for the Mill River is 32 square miles.

Only the extreme west side of Monroe is drained by the Mill River. The northwest section of Trumbull drains to the east side of the reservoir via a number of small streams and as overland flows. The entire eastern half of Easton and the central part of Fairfield lie within the Mill River watershed.

Main tributaries of the Mill River include Browns Brook and Cricker Brook. Both join the Mill River in Fairfield. Cricker Brook begins in the center of Easton. The impoundment of Cricker Brook created the Hemlock Reservoir, a public water supply reservoir. The northern half of this reservoir is located in Easton, with the southern half in Fairfield. Cricker Brook has a drainage area of approximately 7 square miles and Browns Brook has a drainage area of about 1.5 square miles.

Pequonnock River

In the Town of Monroe, the West Branch and East Branch of the Pequonnock River join to form the main stem. The river flows in a southerly direction through the Town of Trumbull and the City of Bridgeport, forming the Bridgeport Harbor and emptying into Long Island Sound. The total drainage of the Pequonnock River area is 24 square miles.

In north-central Bridgeport, a dam on the river forms Bunnells Pond, a 33-acre lake. The dam has been reinforced and is designed to safely overtop during peak flows. The pond is relatively small in relation to the flow rate of the river.

The Pequonnock River has a number of tributaries over its entire length. In Bridgeport, the primary tributary is Island Brook. This brook begins in Ehrsam Pond in Trumbull, flows in a southerly direction into Lake Forest, and then continues through central Bridgeport to the Pequonnock River. Island Brook has a total drainage area about 2.5 square miles, with roughly half of the area upstream of Lake Forest in Trumbull.

Island Brook has been modified along its entire length, although to a lesser extent than nearby Ox Brook. Some upstream sections of the brook are underground in culverts, as is the lower section between Park Cemetery and its outlet to the Pequonnock River. Several exposed portions have been channelized.

Much of the area drained by the Pequonnock River and its tributaries are highly developed, including the central part of Monroe and most of Bridgeport. As a result, a number of chronic flooding problems do occur along the river and its tributaries. The Pequonnock River floodplain is largely undeveloped in Trumbull, as the river flows through a step-walled valley and several town parks. Land use is predominantly suburban residential on large lots.

Sasco Brook

Sasco Brook rises in northern Fairfield and flows in a southerly to southwesterly direction, forming the boundary with the Town of Westport closer to its outlet on Long Island Sound. Sasco Brook has a number of tributaries in Fairfield, including Great Brook. It drains roughly the western third of the Town. The entire drainage area for the Sasco Brook and its tributaries is about ten square miles. Land use within the watershed is rural to suburban. Flooding problems are infrequent and limited to sections of Great Brook.

Yellow Mill Channel

Yellow Mill Channel is a tidal estuary extending from Bridgeport Harbor to the New Haven rail line, just under a mile in length. The watercourses that flow into the Yellow Mill Channel begin as two streams in the southeast corner of Trumbull. Each stream begins just north of the Merritt Parkway, flows in a southerly direction through residential areas and under the Route 8 expressway, and enters the northeast corner of Bridgeport and Success Lake. Only a small portion of the watershed is located in Stratford.

Downstream of Success Lake, the Yellow Mill Channel Stream flows through a very heavily industrialized section of Bridgeport; including the former Remington Arms munitions grounds and the former Remington Arms factory. The area around Success Lake has been designated as the site of the proposed Lake Success Eco-Business Park. The stream is constricted at four locations; one just north of Boston Avenue (US Route 1) that forms Stillman Pond and at Grant Street, Barnum Avenue and Crescent Avenue. Collectively these latter three impoundments are referred to as the Pembroke Lakes. The stream passes under the New Haven rail line through a culvert before entering the Yellow Mill Channel.

The total drainage area of the channel is 4.5 square miles.

Southwest Shoreline Complex Basin

The Southwest Shoreline basin consists of the lands immediately adjacent to and along the coastline. It stretches from the Town of Greenwich at the New York state line to Housatonic River. The drainage area is about 41.5 square miles.

Along the coast in the Region, areas that are included in the Southwest Shoreline basin include:

- Southport Center and land west of Southport Harbor, totaling 0.5 square miles. Land use is predominately residential with commercial use in the center area and adjacent to the harbor.
- Fairfield Town Center and the lands associated with Pine Creek. Pine Creek is a tidal estuary that begins as a small watercourse in the Town Center area. It has a drainage area of roughly 3 square miles. Although the area remains relatively undeveloped, the Pine Creek tidal wetlands area has been extensively modified by drainage canals, tide gates and dikes. Where the creek flows parallel to and behind a barrier beach, the floodplain has been extensively altered with bulkheads due to dense residential development.
- Black Rock and South End neighborhoods in Bridgeport, including land on both sides of Black Rock Harbor. The area stretches to the north to encompass the eastern half of the West End and parts of the Hollow neighborhoods. Land use is highly developed with medium-to-density housing and commercial strips along the main road arteries. The area includes Cedar Creek and Seaside Park. The drainage area totals about three square miles.
- Steele Point peninsula in Bridgeport. This area juts into Bridgeport Harbor and is surrounded by the Pequonnock River on the west and the Yellow Mill Channel on the east. The site is undergoing redevelopment into a mixed-use complex on the property, including a new marina.
- Lower East End in Bridgeport. The area is adjacent to Bridgeport Harbor and is bordered by the Yellow Mill Channel on the west and Johnson's Creek on the east. The eastern half of the area is predominately medium density housing and the western half is controlled by the Bridgeport Port Authority. The Cilco Terminal and other port facilities are located on this side. It is about 0.5 square miles.
- East side of Johnson's Creek in Stratford. This small area, about 0.2 square miles, covers an industrial area of Stratford.
- Long Beach, including Pleasure Beach in Bridgeport, and the Lordship section of Stratford. This area is comprised of the barrier beach that separates Long Island Sound from the Great Meadows Salt Marsh. About half of the barrier beach drains directly to Long Island and the other half is associated with the Lewis Gut sub-regional basin. The eastern part of the drainage area is comprised mainly of residential units. Most of this area of Lordship is located on high ground and less susceptible to storm surge flooding. However, coastal properties were initially built as seasonal dwellings and many have been converted to year-round use. The area is about 0.5 square miles.

Critical Infrastructure and 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. Critical structures include facilities that support responses and recovery efforts, such as, police headquarters, emergency management operations centers, fire stations, hospitals, medical centers, and governmental offices. In addition, facilities that house vulnerable populations are considered in this category. This category includes long-term care facilities, as these house populations of individuals that would require special assistance during an emergency. Educational institutions are often considered critical facilities, as these are often used to house persons displaced from their homes.

The City of Bridgeport is the central city of the Region. It serves as the transportation hub and is home to several essential and critical facilities that serve the Region. The State of Connecticut's Emergency Operations Center (EOC) is located in the Troop G State Police barracks in Downtown. The EOC for the City is the back-up facility for the State EOC and can handle regional emergency response as necessary. The Region's main medical facilities are Bridgeport Hospital and St. Vincent's Medical Center, both located in Bridgeport.

Major transportation infrastructure is critical for evacuation and response, and to ensure that emergencies are addressed while day-to-day management of the Region continues. Critical infrastructure located in flood prone areas 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 impacted by downed powerlines, trees, and other debris.

Commuter rail service offers a vital transportation mode for travel within and beyond Connecticut, especially lower Fairfield County and New York City. The Metro-North Railroad operates commuter trains through the Bridgeport on the electrified New Haven Main Line (NHL-ML). The NHL-ML runs east-west along the southwestern shoreline of the state between New Haven and New York City. The Region has five rail stations:

- Stratford Center at 2520 Main Street, Stratford
- Bridgeport at 525 Water Street, Bridgeport
- Fairfield Metro Center at 61 Constant Comment Way, Fairfield
- Fairfield Center at 165 Unquowa Road, Fairfield
- Southport at 400 Center Street, Fairfield

The state also operates the East Bridgeport Rail Yard located at 664 Hollister Avenue. The rail yard is used to store rail cars not in use and is the location of its Maintenance of Way facility. This area is also the site of the proposed Barnum Station, the second rail station in Bridgeport.

Fixed-route and demand responsive public bus service is provided by Greater Bridgeport Transit (GBT) to five of the six towns in the Region. The only town with no public transit service is Easton. The local, fixed-route bus system consists of 19 routes, with various route extensions and branches to extend coverage. The system is radial in that most routes begin, end, or pass-through Downtown. The downtown terminal, located at 710 Water Street, acts as a pulse point to facilitate transfers between routes and better coordinate operations. The GBT's Maintenance Garage and Administrative Offices are located at 1 Cross Street.

Places where impacted populations can go before, during and while recovery occurs are needed and 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. Emergency back-up power generation is usually available, but in some instances may not provide sufficient power for the entire shelter.

The American Red Cross (ARC) has been chartered by the US 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. The municipalities of MetroCOG are served by the Mid-Fairfield Chapter. Depending on the extent and duration of the emergency, the mass care of residents may be handled through the activation of local shelters for routine incidents or the municipality may request ARC assistance. At that point, the municipal shelter may become a Red Cross shelter, and serve a regional function.

The ARC conducts assessments of shelter facilities to determine effectiveness in providing for the needs of residents during an emergency. The assessment evaluates site accessibility, capacity, utilities available, and lavatory and food service capacity. While the assessment provides an opportunity for determining the appropriateness of the facility to function as a shelter, it does not mean that the facility would be operated by the Red Cross. For instance, in specific scenarios a shelter may be staffed and managed by the municipality or a private organization, but with a level of ARC assistance. In other situations, the ARC may be the responsible party for providing supplies such as cots, shelter kits, etc.

By ARC policy, Red Cross shelters do not restrict access by residence status. Conversely, shelters operated by municipal authorities retain and often exercise the right to restrict access to local residents only. Therefore, any ARC shelter could be viewed as a "regional" shelter. Whereas most disasters are of limited scope, the distinction between local and regional shelters is seldom of concern. During a catastrophic regional event, however, this distinction may have more relevance.

The Region has approximately 44 designated emergency shelters, capable of accommodating approximately 18,200 individuals. The town by town breakdown of these shelters can be seen in Table 3.2. Note that these figures are approximate and subject to change. Many communities only intend to use these facilities on a temporary basis for providing shelter until hazards such as hurricanes diminish. However, there may be instances that longer term sheltering is required.

The City of Bridgeport has the most emergency shelters and has the capability of housing the highest number of residents. Nearly 30 shelters

Table 3.2: Shelters in the Region
Numbers and Capacities Approximate

Bridgeport	
Number of Shelters	29
Capacity	13,000
Easton	
Number of Shelters	1
Capacity	200
Fairfield	
Number of Shelters	8
Capacity	3000
Monroe	
Number of Shelters	1
Capacity	200
Stratford	
Number of Shelters	4
Capacity	1,000
Trumbull	
Number of Shelters	1
Capacity	800
Region	
Number of Shelters	44
Capacity	18,200

are located in Bridgeport, mostly in schools. These shelters can accommodate about 13,000 people. In addition, Bridgeport has designated some of its shelters to accommodate persons with special needs. One of the shelters is located within a flood zone.

Critical infrastructure can be found in the FEMA Flood Maps in Appendix F and as a list in Appendix A.

3.2 Natural Hazards

This 2019 NHMP Update includes hazards identified in the 2014 NHMP as well as additional hazards that were identified during the planning process, including meetings with the local Planning Teams, the CRB Workshops, and through feedback provided via our online survey and Public Information Meetings.

The first step in assessing risks from extreme weather events or other natural disasters was to identify the hazards that might affect the region and determine which are most likely to occur. The term hazard means *"an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agriculture loss, damage to the environment, interruption of business, or other harm or loss"* (Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, Federal Emergency Management Agency, 1997).

The original 2006 NHMP identified the following natural hazards that can potentially affect the Region:

- Inland and Coastal Flooding
- Sea Level Rise
- Summer and Winter Storms
- Earthquakes
- Dam Failure

The risk assessment of these hazards was based on the understanding that a single hazard may be caused by multiple events. For example, flooding may occur as a result of heavy rains, a hurricane/tropical storm, or a winter storm. And the extent of the flooding problem may differ depending on the event. The problems of inland and coastal flooding were addressed separately, as the extent, cause and risks associated with each varies.

The 2014 NHMP Update used the above list as a starting point. Additional natural hazards were defined through holding hazard mitigation and resiliency workshops, public outreach (meetings and surveys), and research and documentation of recent events.

Participants at the workshop held in the City of Bridgeport identified the top hazards facing the City as:

1. Frequency and severity of coastal and inland flooding
2. Storm surge from tropical storms and hurricanes
3. Sea level rise and rising groundwater
4. Snow, ice, rain and wind storms
5. Drought and extreme heat
6. Tornados and earthquakes

From the Fairfield workshop, the top hazards were similar:

1. Coastal flooding
2. Inland flooding
3. Storms (including wind, rain, ice, and snow)
4. Sea level rise
5. Extreme precipitation events
6. Extreme temperature events (heat and cold)

For the workshop that included stakeholders from Easton, Monroe and Trumbull, the principal hazards were:

1. Inland flooding caused by extreme precipitation events
2. Wind damage that downs trees and power lines

From the workshop held in Stratford, the top hazards were similar to the other coastal communities:

1. Coastal flooding
2. Sea level rise
3. Storm surge from tropical storms and hurricanes

Based on the discussions at various workshops, the following natural hazards were assessed:

- Hurricanes
- Inland flooding
- Coastal flooding
- Sea level rise
- Summer storms/tornadoes
- Winter storms (blizzards/ice storms)
- Earthquakes
- Dam failures

While extreme heat and cold were considered potential hazards that might affect the region, these events were not assessed in detail as the Region is not susceptible to prolonged periods of excess temperatures or temperatures below zero degrees Fahrenheit. Climate data for the Region available from the National Climate Data Center were reviewed. Since 1895, the average temperature during July is 69.5 degrees and the mean temperature during January is 23.2 degrees. The Region averages only about eight days with temperatures over 90 degrees and only about one day with a temperature below 0 degrees.

For the 2019 Plan Update, the existing list of hazards addressed in the plan were compared to those addressed in the 2019 Connecticut NHMP Update. Two hazards addressed in the State NHMP that were not previously addressed in the MetroCOG Region NHMP are wildfires and droughts.

In general, drought is considered to be a minimal hazard in the region, as only 1.6% of the region is in agriculture. The largest consideration for drought is its effect on Aquarion Water Company's ability to provide water service to customers in the region, but the utility has drought management measures in place as part of its Water Supply Plan on file with the Connecticut Department of Public Health. A detailed discussion of drought is therefore not included herein.

As more than 40% of the region is forested, a discussion of wildfires was considered appropriate for the plan. A new section has been added to discuss the wildland-urban interface and the potential impacts of wildfires in the region.

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 on 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 (Appendix A), historic resources (Appendix B), and populations exposed to each hazard. This results in an estimation of exposure by hazard. Tables 3.3 through 3.8 present vulnerable assets for each MetroCOG community. 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 DEEP for the high hazard dams in the planning area.
- Flooding exposure was based on existing digital flood insurance rate maps (DFIRMs) for each community. Note that the 0.2% annual chance flood areas include the areas mapped under the 1% annual chance flood areas.
- Historic resources were mapped using spatial data developed by SHPO in 2015-2017.
- Sea level rise extent was mapped using the "bathtub model" methodology, with all land areas below the elevation of Mean Higher High Water (MHHW) plus the sea level rise projections developed by CIRCA (see Section 3.7 for projections).
- Storm surge exposure was based on the 2008 Sea, Lake, and Overland Surges from Hurricanes (SLOSH) analysis prepared by the United States Army Corps of Engineers. This GIS shapefile is available from DEEP.
- Wildfire exposure was determined using a methodology that highlights land cover, extent of contiguous forested or grassed areas, and distance from water sources. Starting with the entire land area of each community,

Table 3.3: Exposure Summary for Bridgeport
Number or Value (Millions)

Hazard	Number of Parcels	Value of At-Risk Parcels	Number of Buildings	Value of At-Risk Buildings	Number of Critical Facilities	Value of At-Risk Critical Facilities	Number of Historic Assets	Value of At-Risk Historic Assets
Dam Failure	735	$154	399	$51	0	$0	47	$3
Coastal Erosion	75	$69	99	$26	0	$0	21	$5
Earthquake	36,275	$7,909	39,549	$5,951	83	$1,364	1,804	$580
Flooding								
1% Annual	5,304	$2,153	3,147	$1,678	15	$710	258	$88
0.2% Annual	7,190	$2,513	4,243	$1,900	19	$730	323	$95
Storm Surge								
Category 1	1,426	$1,295	482	$1,094	5	$599	97	$25
Category 2	3,187	$1,797	1,765	$1,461	12	$699	354	$46
Category 3	4,685	$2,234	2,789	$1,808	20	$867	760	$69
Category 4	5,164	$4,245	3,308	$3,415	27	$873	1,318	$121
Hurricane / Tropical Storm	36,275	$7,909	39,549	$5,951	83	$1,364	1,804	$580
Sea Level Rise	744	$537	123	$421	6	$33	36	$4
Thunderstorm	36,275	$7,909	39,549	$5,951	83	$1,364	1,804	$580
Tornado	36,275	$7,909	39,549	$5,951	83	$1,364	1,804	$580
Winter Storm	36,275	$7,909	39,549	$5,951	83	$1,364	1,804	$580
Wildfire	363	$79	$395	$60	0	$0	18	$6

Table 3.4: Exposure Summary for Easton
Number or Value (Millions)

Hazard	Number of Parcels	Value of At-Risk Parcels	Number of Buildings	Value of At-Risk Buildings	Number of Critical Facilities	Value of At-Risk Critical Facilities	Number of Historic Assets	Value of At-Risk Historic Assets
Dam Failure	75	$48	24	$34	0	$0	0	$0
Earthquake	3,247	$1,331	5,311	$648	8	$12	45	$12
Flooding								
1% Annual	567	$207	130	$44	0	$0	12	$6
0.2% Annual	700	$278	168	$150	0	$0	20	$11
Hurricane / Tropical Storm	3,247	$1,331	5,311	$648	8	$12	45	$12
Thunderstorm	3,247	$1,331	5,311	$648	8	$12	45	$12
Tornado	3,247	$1,331	5,311	$648	8	$12	45	$12
Winter Storm	3,247	$1,331	5,311	$648	8	$12	45	$12
Wildfire	3,247	$1,331	5,311	$648	8	$12	45	$12

Table 3.5: Exposure Summary for Fairfield
Number or Value (Millions)

Hazard	Number of Parcels	Value of At-Risk Parcels	Number of Buildings	Value of At-Risk Buildings	Number of Critical Facilities	Value of At-Risk Critical Facilities	Number of Historic Assets	Value of At-Risk Historic Assets
Dam Failure	3,007	$1,537	3,048	$643	3	$56	224	$234
Coastal Erosion	226	$468	94	$145	0	$0	5	$12
Earthquake	19,597	$10,407	29,973	$4,783	49	$251	411	$422
Flooding								
1% Annual	6,269	$1,070	5,489	$408	7	$182	211	$211
0.2% Annual	8,530	$1,929	6,542	$808	7	$235	264	$232
Storm Surge								
Category 1	3,308	$1,709	2,878	$633	0	$0	130	$135
Category 2	3,367	$1,841	5,692	$698	7	$50	212	$212
Category 3	4,547	$3,449	7,425	$1,375	11	$61	256	$263
Category 4	6,143	$4,833	9,021	$1,982	14	$120	353	$331
Hurricane / Tropical Storm	19,597	$10,407	29,973	$4,783	49	$251	411	$422
Sea Level Rise	1,471	$931	773	$330	9	$87	57	$75
Thunderstorm	19,597	$10,407	29,973	$4,783	49	$251	411	$422
Tornado	19,597	$10,407	29,973	$4,783	49	$251	411	$422
Winter Storm	19,597	$10,407	29,973	$4,783	49	$251	411	$422
Wildfire	6,859	$3,642	10,491	$1,674	0	$0	144	$148

Table 3.6: Exposure Summary for Monroe
Number or Value (Millions)

Hazard	Number of Parcels	Value of At-Risk Parcels	Number of Buildings	Value of At-Risk Buildings	Number of Critical Facilities	Value of At-Risk Critical Facilities	Number of Historic Assets	Value of At-Risk Historic Assets
Dam Failure	22	$41	19	$36	0	$0	3	$31
Earthquake	7,827	$2,100	11,546	$1,369	14	$72	134	$102
Flooding								
1% Annual	1,548	$431	236	$326	6	$58	20	$34
0.2% Annual	1,691	%519	281	$387	8	$60	27	$67
Hurricane / Tropical Storm	7,827	$2,100	11,546	$1,369	14	$72	134	$102
Thunderstorm	7,827	$2,100	11,546	$1,369	14	$72	134	$102
Tornado	7,827	$2,100	11,546	$1,369	14	$72	134	$102
Winter Storm	7,827	$2,100	11,546	$1,369	14	$72	134	$102
Wildfire	7,827	$2,100	11,546	$1,369	14	$72	134	$102

Table 3.7: Exposure Summary for Stratford
Number or Value (Millions)

Hazard	Number of Parcels	Value of At-Risk Parcels	Number of Buildings	Value of At-Risk Buildings	Number of Critical Facilities	Value of At-Risk Critical Facilities	Number of Historic Assets	Value of At-Risk Historic Assets
Dam Failure	3,561	$1,109	3,422	$711	2	$71	168	$84
Coastal Erosion	297	$83	144	$43	0	$0	2	$1
Earthquake	22,868	$4,839	26,719	$3,162	27	$196	416	$138
Flooding								
1% Annual	7,449	$1,820	4,586	$1,274	3	$103	105	$76
0.2% Annual	7,941	$2,070	4,759	$1,449	4	$107	105	$76
Storm Surge								
Category 1	1,801	$782	798	$495	1	$56	18	$57
Category 2	3,253	$1,075	2,431	$677	3	$71	61	$67
Category 3	6,186	$2,118	4,800	$1,329	3	$71	162	$73
Category 4	8,648	$2,975	6,538	$1,848	5	$75	246	$82
Hurricane / Tropical Storm	22,868	$4,839	26,719	$3,162	27	$196	416	$138
Sea Level Rise	1,061	$478	87	$305	1	$56	13	$4
Thunderstorm	22,868	$4,839	26,719	$3,162	27	$196	416	$138
Tornado	22,868	$4,839	26,719	$3,162	27	$196	416	$138
Winter Storm	22,868	$4,839	26,719	$3,162	27	$196	416	$138
Wildfire	5,717	$1,210	6,680	$791	7	$49	104	$35

Table 3.8: Exposure Summary for Trumbull
Number or Value (Millions)

Hazard	Number of Parcels	Value of At-Risk Parcels	Number of Buildings	Value of At-Risk Buildings	Number of Critical Facilities	Value of At-Risk Critical Facilities	Number of Historic Assets	Value of At-Risk Historic Assets
Dam Failure	451	$118	271	$64	0	$0	1	$0
Earthquake	14,048	$4,215	18,175	$2,498	33	$158	154	$25
Flooding								
1% Annual	1,509	$752	466	$218	1	$15	0	$0
0.2% Annual	2,731	$1,395	935	$377	2	$31	0	$0
Hurricane / Tropical Storm	14,048	$4,215	18,175	$2,498	33	$158	154	$25
Thunderstorm	14,048	$4,215	18,175	$2,498	33	$158	154	$25
Tornado	14,048	$4,215	18,175	$2,498	33	$158	154	$25
Winter Storm	14,048	$4,215	18,175	$2,498	33	$158	154	$25
Wildfire	3,512	$1,054	4,544	$625	8	$40	39	$6

areas of land, impervious surfaces, areas served by public water systems, and water bodies (rivers, streams, lakes, ponds) were removed. Contiguous areas of 50 acres or more were then identified and analyzed against 2010 CT ECO land cover data, with areas classified as a type of forested or grassed area selected as wildfire risk areas. These areas, plus a 50-foot buffer, represented the exposure area for wildfires.
- For the remaining hazards (earthquakes, hurricanes, thunderstorms, tornadoes, and winter storms), it was assumed that all buildings and populations were at equal risk. The exposure values are equal to the total exposure of the community.

3.3 Loss Estimates

Annualized loss estimates by community were developed for each natural hazard likely to impact the MetroCOG region. These were developed based on existing loss information collected by the communities, data published by FEMA or other sources, derived from county-wide data developed for the 2019 Connecticut NHMP Update, or developed using HAZUS-MH.

HAZUS-MH is a multi-hazard loss estimation model developed by the FEMA and the National Institute of Building Sciences (NIBS). It is run as an extension in ArcGIS, a Geographic Information System (GIS), and is designed to assist communities in identifying and reducing risk from natural hazards. In particular, HAZUS-MH is used to estimate the physical, economic, and social impacts of earthquakes, hurricanes, and floods.

A Level 1 analysis was performed using the HAZUS-MH Hurricane, Flood and Earthquake models. Level 1 analysis uses HAZUS-MH provided inventory and hazards information. HAZUS-MH has a robust inventory from which numeric estimation of loss from modeled hazards can be calculated. The inventory is from 2010 census data and includes information about buildings, population distribution and other community specific data represented by census tract and census blocks. In addition, it contains site-specific data such as emergency operation centers, fire stations, police stations, schools and medical care facilities. Results from HAZUS-MH and the corresponding loss estimates will be discussed in appropriate Hazard Profiles. Specific results can be found in Appendix G.

Annualized loss estimates were prepared for each hazard using the following methods, with results presented in Table 3.9:

- Dam failure data was downloaded from the National Performance of Dams (NPDP) for the Region for 1877 through present and adjusted for inflation. The regional damage was divided by the number of years of data (141) to develop annualized loss, which was attributed by the percentage of the population of each community to the region.
- Earthquake annualized loss was developed using HAZUS-MH.
- Flooding annualized loss was developed based on National Flood Insurance Program (NFIP) damage data for 1978 through 2018 for each community, plus the requested FEMA Public Assistance grants for each community attributable to flooding divided by the years of record available.
- Hurricane wind annualized loss was calculated from probabilistic simulations in HAZUS-MH. The equation presented in the FEMA HAZUS-MH Technical Manual was used to process the probabilistic data into annualized loss for each community.
- Thunderstorm and tornado annualized loss was calculated based on county-wide damages for each hazard presented in the 2019 State NHMP, which was attributed by the percentage of the population of each community to the county.

Table 3.9: Annualized Loss Estimates by Natural Hazard

Value (Thousands)

Hazard	Bridgeport	Easton	Fairfield	Monroe	Stratford	Trumbull	**Region**
Dam Failure	$8	$0	$3	$1	$3	$2	**$17**
Earthquake	$470	$30	$270	$70	$190	$140	**$1,170**
Flooding	$376	$6	$1,697	$4	$364	$24	**$2,472**
Hurricane Wind	$3,651	$127	$2,040	$322	$1,764	$729	**$8,635**
Thunderstorm	$102	$5	$43	$14	$36	$25	**$226**
Tornado	$20	$1	$9	$3	$7	$5	**$45**
Winter Storm	$143	$23	$107	$30	$99	$85	**$487**
Wildfire	$1	$30	$4	$11	$3	$5	**$55**

- Winter storms annualized loss was based on the requested FEMA Public Assistance grants for each community attributable to winter storms divided by the years of record available.
- Wildfire annualized loss was calculated based on average fire size and number of events per year for Fairfield County in the 2014 State NHMP, an estimated average response cost of $2,000 per event, and the population density of each community compared to the county.

3.4 Hazard Profile – Hurricanes and Tropical Storms

Setting

Hurricanes and tropical storm systems threaten Connecticut residents with the possibility of storm surges, powerful winds, and heavy rains. These elements can lead to devastating inland and coastal flooding, as well as the loss of power and structural damage to homes and businesses. The coastal communities of the Region (Bridgeport, Fairfield & Stratford) are the municipalities most at risk to inundation from a tropical event. Both our coastal and inland communities are also vulnerable to inland flooding and wind damage that could be associated with hurricanes and tropical systems. Further repercussions from tropical systems include substantial and widespread property damage, and loss of utility services, including electricity, water, telephone, cell service, sewage, and internet.

Hazard Assessment

Hurricanes and tropical storms fall under the broader class of storm systems known as tropical cyclones. A tropical cyclone is defined by the National Weather Service as a non-frontal, large scale, low pressure system that has developed over tropical or subtropical water and has a definite organized circulation. Tropical cyclones are categorized based on the speed of the sustained (1-minute average) surface winds near the center of the storm. These categories are:

- Tropical Depression – winds less than 39 mph,
- Tropical Storm – winds 39-to-74 mph, inclusive, and
- Hurricanes – winds at least 74 mph.

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

Storm Surge

Storm surge can be the greatest threat to human life and property from a hurricane or tropical system. While other storm types can bring a surge, they are most notably associated with systems of tropical origin. According to the National Hurricane Center, storm surge is an abnormal rise of water generated by a storm system that is over and above the predicted astronomical high tide levels. This rapid and occasionally extreme rise in water can cause substantial inundation along coastal areas, especially when it coincides with the astronomical high tide. When this occurs, a storm tide of up to twenty feet or more can occur. A storm tide is the combination of the tide elevation and the storm surge.

The storm surge is generated through water being pushed ashore by the force of winds moving cyclonically around the storm system. The magnitude of a storm surge within a coastal basin is governed by both the meteorological parameters of the hurricane and the physical characteristics of the basin. The meteorological aspects include the hurricane's size, measured by the radius; the intensity, measured by sea level pressure and maximum surface wind speeds at the storm center; the path, or forward track of the storm; and the storm's forward speed. Furthermore the ocean floor can play a major role with regards to the impact of a storm surge event.

While Long Island does buffer Connecticut from the open ocean, the geomorphology of Long Island Sound causes the basin to be particularly vulnerable to storm surge. The configuration of Long Island and the Connecticut coast causes a natural funneling influence on ocean waters as they are driven east to west into the Sound by a tropical event, amplifying surges.

The Saffir-Simpson Scale

While storm surge may have great impact

in coastal areas, wind is still the defining characteristic of tropical cyclones. The Saffir-Simpson Hurricane Scale, which has been adopted by the National Hurricane Center, categorizes hurricanes based upon their intensity. The Scale uses the sustained surface winds (1-minute average) near the center of the system to classify hurricanes into one of five categories:

Category 1

Sustained winds of 74-to-95 mph and has the potential to generate a storm surge four-to-five feet above predicted tide levels. Well-constructed frame homes may suffer damage to roofs, shingles, vinyl siding, and gutters. Large branches will break and shallowly rooted trees will likely be uprooted. Widespread damage to power lines and poles will likely cause power outages that could last from several days to a week or more. Additionally, minor to moderate coastal flooding is to be expected.

Category 2

Sustained winds of 96-to-110 mph. A storm surge from a Category 2 Hurricane is generally six-to-eight feet above predicted tide levels. Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted, posing a threat to structures, vital infrastructure and making roads impassable. Extensive power outages would be expected, with outages lasting up to a week or more. Low-lying coastal areas could flood two-to-four hours before the arrival of the storm. Damage to small craft and moored vessels should also be expected.

Category 3

Sustained winds of 111-to-130 mph, with a storm surge generally nine-to-twelve feet above predicted tide levels. Well-constructed frame homes may incur severe damage, including the removal of roof decking and gable ends. A large portion of trees will be either snapped or uprooted, leading to property and infrastructure damage. Electricity and water could be unavailable for several weeks. Low-lying coastal areas could flood three-to-five hours before the system's landfall. Inundation from flood waters will be extreme, causing damage to structures and property. Shoreline evacuations should be mandated to prevent loss of life.

Category 4

Sustained winds of 131-to-155 mph. A storm surge generally 13-to-18 feet above predicted tide levels is to be expected. Well-constructed frame homes will likely incur severe damage, with loss of most of the roof structure along with possible damage or loss of exterior walls. A majority of trees will either be snapped or uprooted. Almost universal power outages and impassable roads will isolate communities. Power could be unavailable for weeks or months, and hard hit areas will not be habitable for the same length of time.

Category 5

Sustained winds in excess of 155 mph and a storm surge generally greater than 18 feet above predicted tide levels. A majority of framed homes will be destroyed, with roof failure and wall collapse. Recovery of utilities could take from several weeks to months, with many areas uninhabitable during that period. Low-lying areas closest to the shore could be inundated by rising waters three–to-five hours before land fall. Major damage to lower floors of all structures located less than 15 feet above sea level and within 500 yards of the shoreline is to be expected. Large scale evacuations of low lying coastal communities within five-to-ten miles of the shoreline should be enforced.

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

Historic Record

Through research efforts by NOAA's National Climate Center in cooperation with the National Hurricane Center, records of tropical cyclone occurrences within the Atlantic Cyclone Basin have been compiled from 1851 to present. Forty-five hurricanes and tropical systems have passed within a 65 mile buffer of the City of Bridgeport between 1851 and 2018, and 123 hurricanes and tropical storms passed within a 200 mile buffer. Based on these data, the Bridgeport area is impacted by a close tropical event or hurricane once every 3.7 years, and could be impacted by a tropical event or hurricane tracking farther afield every 1.4 years.

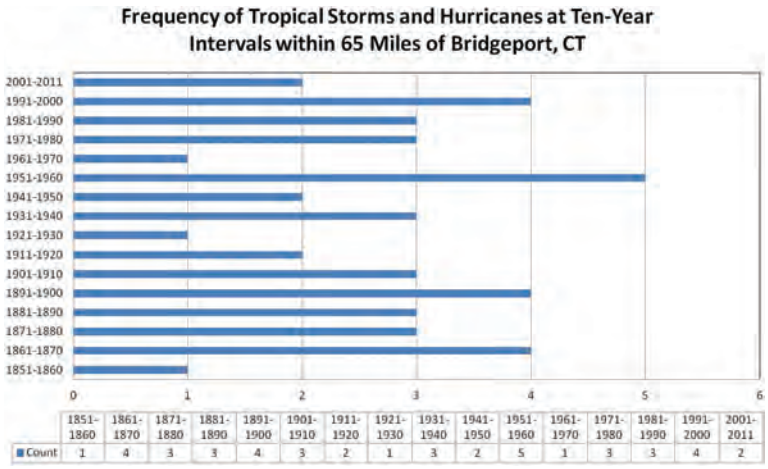


Figure 3.9: Tropical Cyclone Frequency. Data courtesy of NOAA's National Hurricane Center

While it is difficult to predict when a tropical storm or hurricane will strike the area, there is some consistency in the frequency of these storms. Figure 3.9 shows the historical record which has a range of 1-5 storms every 10 years.

Of the 45 tropical storms and hurricanes that have passed within 65 miles of Bridgeport, the majority (35 storms) have been classified as either a tropical storm or a tropical depression at landfall. However, six of the hurricanes made impact as either Category 2 or 3.

The storm tracks of the each hurricane event are displayed in Figure 3.10.

The following are detailed historical accounts of the major tropical storm systems that have affected the state of Connecticut. The accounts are compiled from the National Oceanic and Atmospheric Administration (NOAA). The records cover events from 1900 until present.

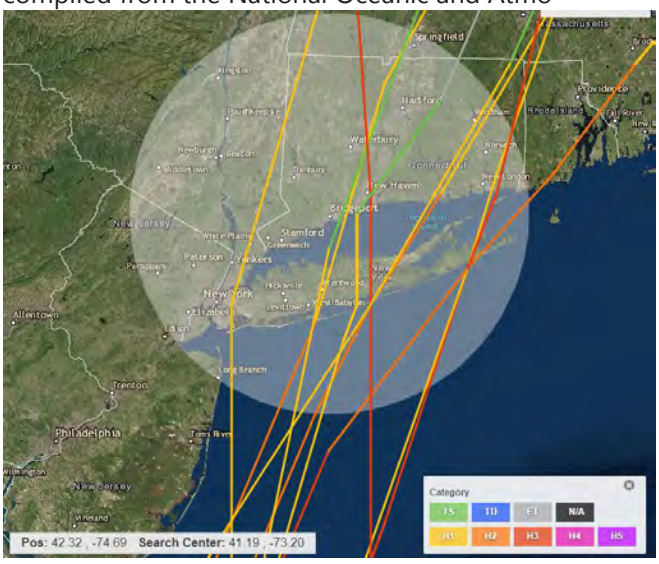


Figure 3.10: Historical hurricane and tropical storm tracks from NOAA

September 21, 1938

While this storm has no official name, it is often referred to as the Great New England Hurricane. It was classified as a Category 3 hurricane when it made landfall in Milford, Connecticut and is regarded as the most intense hurricane to ever strike Connecticut during the twentieth century. Sustained winds of 91 mph and gusts to 121 mph were reported on Block Island in Rhode Island. In Connecticut, high winds caused downed power lines in many areas and resulted in two catastrophic fires in New London and Mystic. While three-to-six inches of rain fell across most portions of the state, isolated amounts of 14-to-17 inches were reported in central Connecticut. The Connecticut River rose close to 20 feet above flood stage in Hartford as a result of the heavy rains. Further damage was caused from storm tides that reached up to 25 feet in portions of eastern Connecticut, while western sections saw storm tides of 14-to-18 feet. Many of the shorelines homes and cottages were destroyed, with far more experiencing varying degrees of damage.

September 14 and 15, 1944

Due to the system's large size and immense strength, the Miami Hurricane Warning Office named this storm the "Great Atlantic Hurricane". While there was no direct landfall made over Connecticut many places across the state saw hurricane force winds, with a gust of 109 mph being reported in Hartford, Connecticut. However, it was the heavy rain, not strong winds that produced the greatest storm impact for the state. More than ten inches of rain fell in the City of Bridgeport, which was the highest total in the State.

August 31, 1954

Hurricane Carol arrived as a Category 3 system and was the most destructive tropical system to strike southern New England since the Great New England Hurricane of 1938. The storm made land fall near the mouth of the Connecticut River in Old Saybrook. The system brought sustained winds of 80-to-100 mph across much

of the shoreline and through Rhode Island, and Cape Cod in Massachusetts. Heavy devastation occurred from large numbers of uprooted and snapped trees, and miles of downed power lines. Along Connecticut's coast, storm surge values varied greatly from five-to-eight feet in the west, to ten-to-fifteen in eastern portions of the state. There was also heavy crop damage, with 40 percent of apple, corn, peach, and tomato crops being destroyed along portions of eastern Connecticut to Cape Cod. It is reported that 48 people lost their lives and damages to possessions and property exceeded one billion dollars (in 1954 dollars) for the Northeast.

August 11 and 12, and 18 through 20, 1955

In an unusual occurrence, two named hurricanes, Connie and Diane, passed within proximity of the state within nine days. While neither storm directly struck Connecticut, their combined impact was immense.

Hurricane Connie was the first system, passing to the west. The system produced four-to-six inches of rain across southern New England. The rain saturated the ground and caused river and reservoir water levels to be well above normal.

When Hurricane Diane impacted Connecticut, the State's watercourses were already inundated from Connie and the ground was unable to absorb the additional rainfall. Over the two day period, up to 20 inches of rain fell in parts of the State. At the headwaters of the Farmington River, 18 inches of rain within a 24-hour period was recorded. This resulted in arguably the most devastating inland floods to ever hit the state. Roads and bridges were washed out across the state, residents lost drinking water and public utilities were inoperable. More than 90 people were confirmed dead from the storm and another dozen were missing and presumed dead. The damage was estimated to have exceeded 1.5 billion dollars (1955 dollars).

September 27, 1985

Hurricane Gloria formed off Cape Verde on September 15, 1985. It reached tropical storm status on the September 17th but was downgraded to a tropical depression as optimal conditions deteriorated. The storm continued its west-northwest movement and strengthened to a major hurricane by September 24th. As the storm tracked further northward along the Atlantic coast it weakened significantly. Gloria was downgraded from a Category 4 hurricane near the Bahamas, to a Category 2 storm by the time it made landfall on the Outer Banks of North Carolina. Gloria maintained its strength through landfalls on Long Island, New York, and Bridgeport, Connecticut. It was only downgraded to Category 1 after passing to the west of Hartford, Connecticut. Gloria brought devastation to the state primarily in the form of heavy wind damage. The storm toppled thousands of trees and caused major structural damage statewide. Relatively light rain from the storm meant that there was little flooding accompanying the wind damages and the power outages.

September 16, 1999

Torrential and record rainfall brought from Tropical Storm Floyd caused widespread urban, small stream, and river flooding. Fairfield, Hartford and Litchfield Counties were declared disaster areas. Serious wide spread inland flooding throughout low elevation and poor drainage areas was prevalent, and resulted in the closure of numerous roads and the flooding of many basements.

Recent Events

Connecticut and the Greater Bridgeport Region were impacted by two recent events that occurred in back-to-back years: Tropical Storm Irene and Superstorm Sandy.

August 28, 2011

Irene began as a tropical wave, moving off the coast of western Africa on August 15, 2011. After passing over Puerto Rico on August 22nd, Irene gained hurricane status and reached to Category 3 on August 24th with peak wind intensities of 120 mph.

As the storm proceeded north it passed offshore of Florida and Georgia, weakening along the way. Irene made landfall as a Category 1 near Cape Lookout, North Carolina on August 27th. After moving offshore, Irene tracked further north-northeastward along the Delmarva Peninsula making its second US landfall near Atlantic City, New Jersey as a tropical storm with maximum sustained winds of 69 mph. The system tracked up the Hudson River Valley before turning east across the northern Litchfield Hills of Connecticut on August 28th.

In Connecticut, Irene had been predicted to make landfall as a strong Category 1 or weak Category 2 hurricane, but it had been downgraded to a tropical storm by the time it reached the state.

Irene produced average maximum wind gusts of 52 mph and downed approximately one-to-two percent of the trees in Connecticut. The extensive number of downed trees resulted in over 800,000 power outages. Restoration of power took up to twelve days. Heavy rains, up to six inches, caused widespread coastal flooding. Damage and inundation of seawater along the coast was worsened by a large wind envelop that pushed water into western Long Island Sound. Although Irene was a tropical storm by the time it reached Connecticut, it created a storm surge of about four feet, which is consistent with a Category 1 or 2 hurricane.

On September 2, 2011, President Obama issued a presidential disaster declaration for the entire state as a result of the damage caused by Tropical Storm Irene.

October 29, 2012

Sandy was considered to be a classic late-season Caribbean hurricane, originating from the remnants of a tropical wave that moved westward from the west coast of Africa. It made landfall in Jamaica as a Category 1 and increased in strength to a Category 3 east of Cuba. Despite weakening to a Tropical Storm as it moved out of the Caribbean Sea, it continued to grow in size. As it continued north-northwest and parallel to the US coast, Sandy re-strengthened into a Category 1 hurricane.

As Hurricane Sandy moved northward, several other atmospheric conditions affected it size, direction and damage potential. Typically, a high pressure system is established over Bermuda that causes tropical storms to veer to the northeast away from land. This high was not present to deflect the storm away from the Northeast. Secondly, a low pressure frontal system was forming in the central US. This pattern typically creates conditions for a nor'easter to form. Instead, this trough combined with Sandy to increase its size and intensity. Finally a large high pressure system built-up over northeastern North America and blocked Sandy from moving out to sea turning it westerly toward the Mid-Atlantic coast. It accelerated at an average forward speed of 23 mph, but, at the same time, the colder waters weakened the system and caused Sandy to lose its tropical characteristics. As shown in Figure 3.11, it made landfall in New Jersey as a post-tropical (extratropical) storm with maximum sustained winds of about 65 mph. However, because of its size, Sandy created a catastrophic storm surge into the New York and New Jersey coastlines.

In Connecticut, highest storm tide and greatest inundation occurred along western sections of the Connecticut coast. The National Oceanic Service tide gauge in Bridgeport measured the storm surge at 9.83 feet above normal tide levels. The average surge along the Fairfield County coast was between four-and-six feet, with inundation up to six feet above ground level. Various estimated values of flood water inundation based on USGS high-water marks and storm tide pressure sensors are listed below (Tropical Cyclone Report Hurricane Sandy, National Hurricane Center, February 2013):

- Fairfield: Estimated Inundation = 4.3 feet
- Southport: Estimated Inundation = 4.0 feet
- Bridgeport (South End): Estimated Inundation = 3.5 feet
- Bridgeport (South End): Estimated Inundation = 3.2 feet
- Bridgeport (Enterprise Zone): Estimated Inundation = 3.1 feet
- Bridgeport (South End): Estimated Inundation = 3.0 feet
- Stratford (Lordship): Estimated Inundation = 2.8 feet
- Bridgeport (Black Rock): Estimated Inundation = 1.3 feet
- Stratford: Estimated Inundation = 1.4 feet
- Stratford (Lordship): Estimated Inundation = 1.2 feet

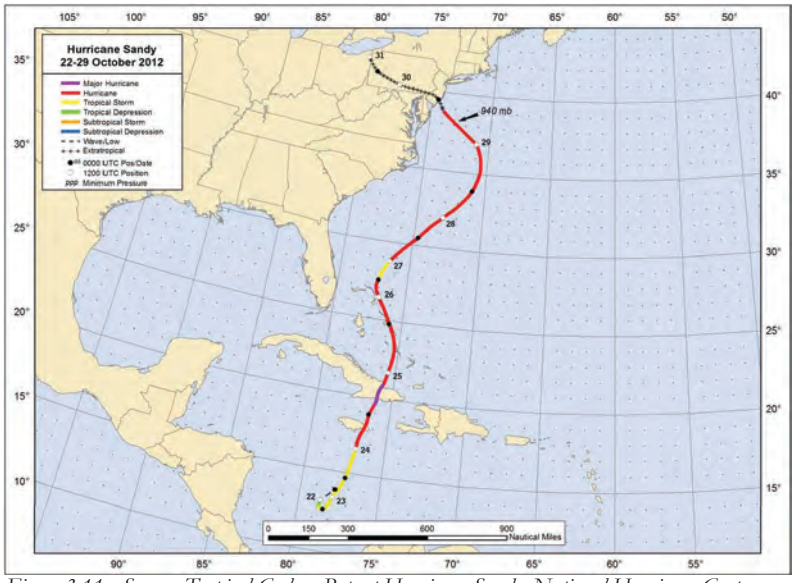


Figure 3.11 - Source: Tropical Cyclone Report Hurricane Sandy, National Hurricane Center, February 2013 - Figure 2: Best Track Positions for Hurricane Sandy, 22 – 29 October 2012.

In Connecticut, Superstorm Sandy was responsible for the deaths of five people and caused damage to approximately 3,000 homes. The preliminary estimated value of the damage was about $360 million state-wide.

Hazard Probability

Based on review of historical records, Connecticut and the Greater Bridgeport Region are likely to be hit and severely impacted by a tropical storm or hurricane at least once every 3.7 years, and may be moderately affected by such a storm every 1.4 years. According to Figure 2.61 in the Connecticut 2019 Natural Hazard Mitigation Plan, a Category 1 hurricane can be expected to hit Connecticut every 17 years, a Category 2 every 39 years and Category 3 every 58-70 years. Despite these rates, it remains a possibility that a destructive storm will hit the area anytime during the hurricane season and the frequency of these storms is independent of when the last storm occurred. As historical examples, the Region has experienced severe tropical events in each of the past two years, and in 1955 the state was impacted by two hurricanes within a nine day period. Because of the Region's location on Long Island Sound, the area lies in the path of tropical systems and is susceptible to their destructive forces.

According to the Geophysical Fluid Dynamics Laboratory (GFDL) at NOAA, tropical cyclone intensities are expected (greater than 66% chance) to increase 1% to 10% globally due to global warming and to also bring higher rainfall rates. More intensive tropical cyclones are likely to have higher wind speeds and storm surges. Fortunately, according the GFDL, overall frequency of tropical cyclones in the North Atlantic does not appear to be increasing at this time.

Risk Assessment

Tropical storms and hurricanes impact Connecticut with heavy rains, storm surge, and strong winds. Heavy rains can lead to flooding which will be covered more in-depth in subsection 3.6. Storm surge and devastating winds, while not unique to hurricanes and tropical storms, have the largest impact when associated with tropical events. Therefore we will discuss impacts from these conditions in this section.

Storm Surge

When a tropical storm or hurricane passes through the Region, it will impact the entire area. However, because these storms have the capability of producing excessive surge of water, inundation of coastal areas is more likely, and, as a result, these areas are more vulnerable and at a greater risk. Hurricane storm surge maps depict the inundation of flood waters that would be expected from a worst case scenario of different categories of hurricane. Further detail on property damage will be discussed in subsection 3.6.

Hurricane surge inundation maps for Bridgeport, Fairfield and Stratford are included in Appendix F. Please note that storm surge zones depicted on these maps are not necessarily cumulative. Based on these maps and other GIS data developed by MetroCOG, the exposure of parcels, buildings, historic resources, and critical facilities has been developed for each storm surge zone. Tables 3.3, 3.5, and 3.7 presented the exposure for the coastal towns of Bridgeport, Fairfield, and Stratford, respectively. Note that the inland towns of Easton, Monroe, and Trumbull do not have any areas that lie within storm surge zones.

In Fairfield (Figure 3.12), a Category 1 hurricane is likely to cause widespread flooding along the shoreline south of Old Post Road between Sasco Hill Road and Ash Creek. Parts of Southport would be inundated by flood waters during a Category 2 or 3 storm. Small areas along the Mill River would be affected by more severe hurricanes and the Town Center area along US Route 1 would become flooded as the result of a Category 3 or 4 hurricane. Although many coastal properties in Fairfield have elevated their homes since Superstorm Sandy in 2012 to mitigate damage from coastal flooding and storm surge, a recent CIRCA study found that elevated homes are more susceptible to wind shear damage. Potential risks from wind are presented in the next section.

In Stratford, a Category 1 hurricane would cause flooding throughout the majority of the South End, including the industrial areas along Route 113 (Lordship Boulevard and Main Street), the Sikorsky Memorial Airport and the residential neighborhoods bounded by Interstate 95, Lordship Boulevard, Access Road, Main Street and South Avenue. A Category 2 hurricane would expand the extent of flooding in these areas. The only part of the South End unaffected by a Category 1 hurricane would be the Lordship neighborhood,

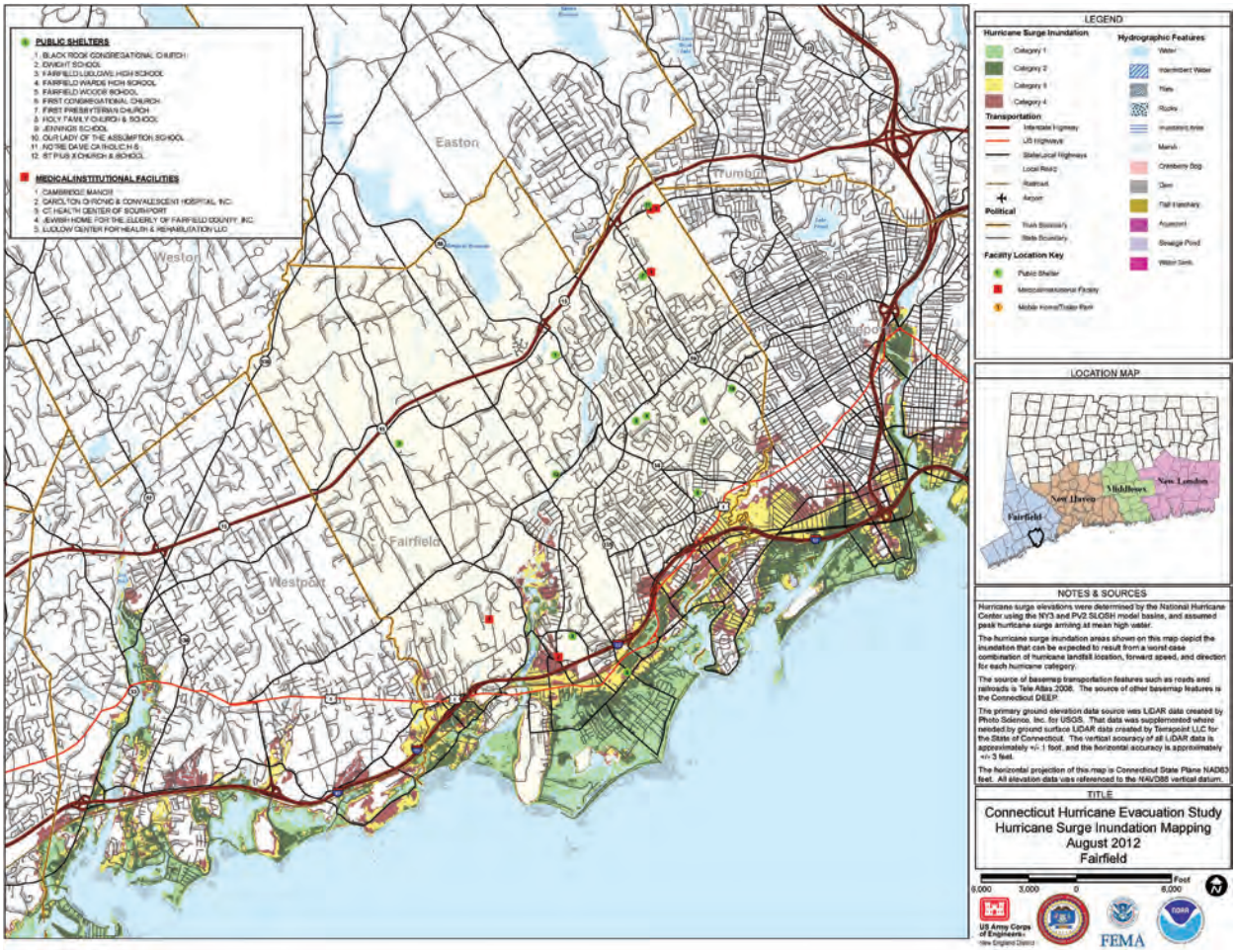


Figure 3.12: Hurricane Surge Inundation Map for Fairfield, CT

because of its higher elevation. A Category 3 or 4 hurricane would cause flooding north of Interstate 95 and within Stratford Center. Areas in the northern part of Stratford would be flooded by various categories of hurricane, but the extent of the damage would be limited to existing marsh areas. A severe hurricane has the potential to impact the Sikorsky Aircraft Manufacturing Plant.

In Bridgeport, most of the South End and West End would be flooded from a Category 1 hurricane. In addition, the shorelines of the Black Rock, East Side, and East End neighborhoods would be inundated with flood waters. Steele Point, which is a peninsula, was previously prone to flood waters but the area has since been raised. The extent of flooding in those areas would be somewhat limited to the immediate shore area. If the City were hit by a Category 3 or 4 hurricane, flooding would extend farther north from the shore and impact neighborhoods and commercial properties along Fairfield Avenue and State Street in the West End and along Route 130 (Connecticut Avenue and Stratford Avenue) in the East End. Flood waters would also extend along the Pequonnock River, reaching as far north as the US Route 1 and Route 8/25 interchange area, and along the Yellow Mill Channel, as far north as US Route 1. Flooding would also occur along the Rooster River.

Wind

Wind damage from tropical cyclones affects the entire Region. To quantify the impact of these storms the HAZUS-MH 4.2 Hurricane Model was utilized.

HAZUS-MH does not estimate damage based on hurricane category but rather runs a probabilistic analysis similar to terminology associated with flooding. For hurricanes, probabilistic scenarios of 10, 20, 50, 100, 500, and 1000 year wind events were separately modeled for each municipality.

Building Damage

The default building stock from HAZUS-MH was used for all the HAZUS-MH analyses in this report. According to this database there are 95,528 buildings in the Region. Bridgeport has the most buildings with 31,041.

HAZUS-MH uses a hazard-load-resistance-damage-loss methodology to produce loss estimations. Using wind models along with damage probabilities, expected building losses were estimated. The descriptions of damage can be found in Table 3.10.

Table 3.10: Damage description from Hazus-MH Hurricane Model Technical Manual

Damage State	Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
0	**No Damage or Very Minor Damage** Little or no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof over, with no or very limited water penetration.	≤2%	No	No	No	No	No
1	**Minor Damage** Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.	>2% and ≤15%	One window, door, or garage door failure	No	<5 impacts	No	No
2	**Moderate Damage** Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water	>15% and ≤50%	> one and ≤ the larger of 20% & 3	1 to 3 panels	Typically 5 to 10 impacts	No	No
3	**Severe Damage** Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.	>50%	> the larger of 20% & 3 and ≤50%	>3 and ≤25%	Typically 10 to 20 impacts	No	No
4	**Destruction** Complete roof failure and/or, failure of wall frame. Loss of more than 50% of roof sheathing.	Typically >50%	>50%	>25%	Typically >20 impacts	Yes	Yes

In the Region, no buildings were damaged in a 10 year event and severely damaged buildings were first estimated in a 50 year event. The coastal communities had the highest number, as well as, highest percentage of buildings damaged.

Table 3.11 aggregates the data for a regional projection. Town specific projections can be found in Appendix G. The numbers of buildings damaged by wind in the region is less in the current version of HAZUS-MH than was estimated under the previous version in 2014. In the region, 201 buildings are at least moderately damaged in a 100-year event but that number increases to over 7,400 buildings at least moderately damaged in a 1000-year event with 286 buildings being completely destroyed.

Essential Facilities Damage

The essential facilities in the region were provided in the HAZUS-MH default dataset. Therefore there may be some facilities that were not included in this analysis. In the Region, HAZUS-MH models 2 Emergency Operation Centers (EOC), 16 fire stations, three hospitals (Bridgeport Hospital, Saint Vincent's Medical Center, and Southwest Connecticut Mental Health System), 16 police stations and 130 schools. Table 3.12 summarizes the number of essential facilities damaged for each wind event.

HAZUS-MH provided data on damage to essential facilities as well as loss of use estimates. Loss of use refers to the inability of the essential facility to provide its normal function to the community. For example, schools are closed to students. After hurricanes this is normally due to loss of electricity. Town-specific results can be found in Appendix G. Results showed that schools were the only facilities that experienced loss of use, with the majority of schools being closed for more than one day for a 500-year event or greater.

Debris Generated

HAZUS-MH generated estimates for the

Table 3.11: Hazus-MH building damage from hurricane impact

# of Buildings Damaged

Damage (2014)	10 yr	20 yr	50 yr	100 yr	200 yr	500 yr	1000 yr
None	99,625	99,536	98,483	92,764	80,386	55,290	38,210
Minor	0	84	1,053	6,128	15,918	30,899	35,921
Moderate	0	4	83	718	3,049	11,018	18,541
Severe	0	0	4	27	193	1,645	4,637
Destruction	0	0	0	4	55	774	2,304
Damage (2019)	**10 yr**	**20 yr**	**50 yr**	**100 yr**	**200 yr**	**500 yr**	**1000 yr**
None	95,528	95,454	95,143	93,209	88,173	75,380	64,654
Minor	0	76	360	2,119	6,517	16,480	23,458
Moderate	0	3	23	192	795	3,333	6,429
Severe	0	0	2	9	37	243	702
Destruction	0	0	0	0	6	92	286

Table 3.12: Hazus-MH essential facility damage from hurricane impact

# of Facilities Damaged

Damage (2014)	Total	10 yr	20 yr	50 yr	100 yr	200 yr	500 yr	1000 yr
EOC	2	0	0	0	0	0	0	0
Fire	16	0	0	0	0	0	0	0
Hospitals	4	0	0	0	0	3	3	3
Police	16	0	0	0	0	0	0	0
Schools	130	0	0	0	5	114	130	130
Damage (2019)	**Total**	**10 yr**	**20 yr**	**50 yr**	**100 yr**	**200 yr**	**500 yr**	**1000 yr**
EOC	2	0	0	0	0	0	0	0
Fire	16	0	0	0	0	0	0	0
Hospitals	3	0	0	0	0	0	0	0
Police	16	0	0	0	0	0	0	0
Schools	130	0	0	0	0	0	72	106

Table 3.13: Hazus-MH debris generated from hurricane impact

Debris Generated (tons)

Damage (2014)	10 yr	20 yr	50 yr	100 yr	200 yr	500 yr	1000 yr
Bridgeport	0	233	5,120	19,193	43,198	102,998	172,667
Easton	0	28	259	7,891	12,765	35,975	68,845
Fairfield	0	244	2,547	13,878	27,550	72,897	128,989
Monroe	0	99	602	8,954	13,463	36,906	66,468
Stratford	0	212	3,011	10,737	23,949	62,343	110,031
Trumbull	0	36	689	8,166	15,554	44,908	74,897
Total	**0**	**852**	**12,228**	**68,819**	**136,479**	**356,027**	**621,897**
Damage (2019)	**10 yr**	**20 yr**	**50 yr**	**100 yr**	**200 yr**	**500 yr**	**1000 yr**
Bridgeport	0	16	2,931	12,391	28,497	62,556	94,461
Easton	0	7	287	1,186	10,210	14,646	24,295
Fairfield	0	71	1,481	6,053	16,284	34,440	50,772
Monroe	0	3	462	1,488	9,752	15,111	23,555
Stratford	0	172	1,777	6,876	13,917	30,347	43,347
Trumbull	0	10	304	3,169	9,297	17,157	28,511
Total	**0**	**279**	**7,242**	**31,163**	**87,957**	**174,257**	**264,941**

amount of debris generated from wind damage. Table 3.13 provides the total debris generated for the various probabilistic events. The current HAZUS-MH model estimates less debris will be generated than the previous model. Bridgeport had the most debris generated in each hurricane scenario. The Region was projected to have 31,163 tons of debris in a 100- year event and 264,941 tons in a 1000-year event.

Shelter Needs

HAZUS-MH generated the number of households displaced due to damage and loss off electricity and water. The number of people requiring shelter was a fraction of those displaced households and can be found in Table 3.14. The current HAZUS-MH model estimates that less people will need shelter than the previous HAZUS-MH model. Bridgeport, expectably due to its high population, has the highest shelter needs. Overall, only 1 person requires shelter in a 100-year event or less. However, 1,044 people could require shelter in a 1000-year event.

Economic Loss

Economic loss was calculated from both direct property damage and business interruption. Direct property damage includes the estimated costs to repair or replace the damage 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 hurricane. The breakdown of economic loss in these categories can be found in Appendix G. Again, these estimates are from wind damage only.

Table 3.15 summarizes the combined economic loss for each town. The current HAZUS-MH model estimates less damages overall for the region than the previous model. The combined economic loss for the region from the 100-year wind event was estimated at $169.6 million, while the combined economic loss from the 1000-year wind event was estimated at $1.86 billion.

Table 3.14: Hazus-MH shelter needs from hurricane impact

People Requiring Shelter

Damage (2014)	10 yr	20 yr	50 yr	100 yr	200 yr	500 yr	1000 yr
Bridgeport	0	0	0	3	55	462	1,322
Easton	0	0	0	0	0	0	0
Fairfield	0	0	0	0	0	13	93
Monroe	0	0	0	0	0	0	1
Stratford	0	0	0	0	1	35	234
Trumbull	0	0	0	0	0	1	18
Total	**0**	**0**	**0**	**3**	**56**	**511**	**1,668**
Damage (2019)	10 yr	20 yr	50 yr	100 yr	200 yr	500 yr	1000 yr
Bridgeport	0	0	0	1	47	381	953
Easton	0	0	0	0	0	0	0
Fairfield	0	0	0	0	0	2	16
Monroe	0	0	0	0	0	0	0
Stratford	0	0	0	0	1	15	66
Trumbull	0	0	0	0	1	6	9
Total	**0**	**0**	**0**	**1**	**49**	**404**	**1,044**

Table 3.15: Hazus-MH economic loss to the region from hurricane impact.

Economic Loss (in thousands of dollars)

Damage (2014)	10 yr	20 yr	50 yr	100 yr	200 yr	500 yr	1000 yr
Bridgeport	$0	$1,226	$22,419	$90,810	$242,139	$761,937	$1,549,089
Easton	$0	$9	$814	$3,167	$7,441	$26,975	$62,130
Fairfield	$0	$630	$11,519	$38,585	$107,356	$377,908	$823,051
Monroe	$0	$63	$2,111	$7,689	$18,673	$66,306	$143,184
Stratford	$0	$525	$9,902	$35,397	$104,330	$402,300	$885,214
Trumbull	$0	$81	$4,269	$15,295	$42,487	$171,402	$354,233
Total	**$0**	**$2,534**	**$51,034**	**$190,944**	**$522,427**	**$1,806,828**	**$3,816,901**
Damage (2019)	10 yr	20 yr	50 yr	100 yr	200 yr	500 yr	1000 yr
Bridgeport	$0	$82	$16,122	$69,590	$172,900	$454,157	$802,611
Easton	$0	$23	$613	$2,661	$6,061	$14,852	$26,858
Fairfield	$0	$386	$13,294	$42,148	$89,460	$234,741	$410,133
Monroe	$0	$101	$1,789	$6,855	$15,759	$36,201	$63,784
Stratford	$0	$208	$9,689	$33,266	$72,827	$210,106	$400,688
Trumbull	$0	$95	$3,924	$15,061	$33,328	$82,588	$157,021
Total	**$0**	**$894**	**$45,432**	**$169,581**	**$390,334**	**$1,032,645**	**$1,861,095**

3.5 Hazard Profile – Inland Flooding

Setting

Inland flooding is a well-documented natural hazard that threatens many areas and neighborhoods throughout the Region. It is one of the most commonly occurring natural hazards and has the potential to damage property and disrupt the quality of life for many residents. An in depth review and analysis of records and feedback from residents indicates that inland flooding affects the Region with moderate to frequent regularity. It should also be noted that flooding affects the Region with varying degrees of intensity, dependent on season, setting, and recent weather pattern.

Bridgeport

Although Bridgeport is a heavily developed urban environment, waterways still exist within its limits and have the potential to pose inland flooding concerns. Furthermore, due to the urban nature of the City, much of the water courses have undergone large-scale channel modifications or have been buried. This has resulted in many unintentional constrictions that have the potential to create flooding issues during heavy precipitation events. Of particular concern are the channels of Island Brook and Ox Brook, along with several tributaries of the Yellow Mill River in the northeastern section of the City. In addition, smaller more localized areas experience flooding, such as the Rooster River, Ash Creek, and Bruce Brook. Flooding is also typical along the banks of the Pequonnock River downstream of Bunnells Pond.

The areas in Bridgeport at risk to inland flooding from 1% and 0.2% probability storms are depicted in FEMA Firm maps, included in Appendix F.

Easton

Unlike the other towns in the Region, Easton has a very low population density. Large-lot zoning regulations and a large portion of the town being preserved as water company-owned lands have reduced property damage from flooding. Roadway flooding can be handled using barricades and signs to prevent loss of life, and alternate routes are available in almost every case.

Specific problem areas include flooding from the Aspetuck River at Silver Hill Road and at Wells Hills Road, Morehouse Brook at Morehouse Road, Cricker Brook at Beers Road, and Cricker Brook at Morehouse Road. In addition, flooding occurs at the headwaters of Patterson Brook at Route 136 and Tatetuck Brook at Route 59.

Flood risk areas in Easton, based on FEMA Firm data, are depicted on the map located in Appendix F.

Fairfield

The Town of Fairfield contains four primary drainage basins that flow in a primarily north to south direction. The system most susceptible to inland flooding is along the Mill River, which flows from the Easton Reservoir through the center of the Town. Extensive flooding is caused by a 1% storm as well as from a more severe storm. Inland flooding is also a problem along the Rooster River and Ash Creek and their tributaries. To a lesser extent, inland flooding poses a threat during extreme weather events along Great Brook and Saco Brook.

Much of the property directly abutting the Mill River falls within the 1% flood contour, while a smaller portion falls within the 0.2% flood contour. These flooding concerns extend the length of river and remain a very real threat. With regards to the Rooster River and Ash Creek, flooding is more commonly caused by man-made constriction. A specific location is where the river passes under Interstate 95. The flow is controlled by a culvert system. During times of heavy precipitation, the culvert can be overwhelmed and flooding can occur in the neighborhood surrounding Royal Avenue and Camden Street. Homes in this neighborhood are in the floodplain, and a viaduct is the only way in and out. Further specific flooding concerns exist where Metro-North New Haven Line bridges cross the river. The bridges tend to have low vertical clearances and narrow horizontal spans. These features can act as a constriction point and cause flooding of neighborhoods up river. Low-lying homes adjacent to London's Brook and downstream of the Fairchild Wheeler Golf Course are also prone to flooding. Great Brook can flood in the area of Merwins Lane.

Flood risk areas in Fairfield are depicted on the FEMA Flood Zone map attached in Appendix F.

Monroe

The areas of Monroe which are most frequently subject to flooding are adjacent to the Pequonnock River. This river consistently overflows its banks from major storm events. Flooding also occurs in areas along the West Branch of the Pe-

quonnock River and along the Farmill River.

Flooding occurs along the West Branch of the Pequonnock River in a variety of locations. The Aquarion Water Company operates several reservoirs throughout Fairfield County and owns extensive tracts of land around these reservoirs. A small impoundment is located along Route 25 about mid-way between Judd Road and Pepper Street. Water is diverted from the impoundment through a pipeline to Easton Reservoir. It lies only a few feet below the roadway elevation and flooding occurs during heavy rain events. Stop logs are in place at the dam that can be removed to allow for greater water flow, either during or before a severe weather event. While this measure is in place to help mitigate flooding, it does not remove the possibility of flood occurrences entirely. The impact felt by flooding in this area is limited to roadway closures, as there are no homes or businesses within the vicinity. Although traffic has the potential to be impacted, no homes or buildings would be affected by flooding in this area.

Another critical flooding area is where the West Branch crosses under Old Newtown Road. The river has a tendency to back up at the under sized culvert resulting in repetitive losses for many properties near Chuck's Corner. However, there are secondary roads that could be taken in the event of flooding to circumvent the blocked or impassable roadways.

In addition to the flooding associated with the Pequonnock River and the West Branch, many of its other tributaries experience flooding as well. The neighborhood bounded by Pastor's Walk and Wiltan Drive is subject to backyard flooding and drainage problems. A swale, or intermittent stream, flows parallel to the roads through the backyards. The swale was likely constructed when the neighborhood was developed. Additionally, a low-gradient stream under Bart Road and along Verna Road has virtually no gradient and is only a few feet below backyard elevations. During heavy precipitation events the potential exists for the stream to over flow its banks and inundate the area. Lile the streams in the Pastor's Walk and Wiltan Drive area, this stream was likely constructed when the neighborhood was developed. A very small diameter culvert at Bart Road may cause upstream flooding during high flows. The culvert under Cottage Street near Brookside Trail, on the Boys Halfway River, may be also under capacity.

Flood risk areas in Monroe are depicted on the FEMA Flood Zone map attached in Appendix F.

Stratford

Inland flooding in Stratford occurs with moderate to frequent regularity, with major events being seen on average once every five years. Areas that are most frequently reported flooded during rain events include Main Street at Stratford Center, Broadbridge Avenue, Terrill Road, Hamilton, Reed Street, Bunnell Avenue, and Parkwood Road.

Flooding can also occur in localized areas from storm drains backing up. Areas affected from this variety of inland flooding include the regions of Albert Avenue and Albright Avenue where several residents have reported repeated flooding, with one resident having to file multiple flood insurance claims. Additional flooding is also experienced in the areas of Reed's Lane, St. Michael's Avenue, Tyrone Place and West Avenue in the vicinity of Barnum Avenue. However, it appears that the problems in these areas are not widespread.

Properties along the Pumpkin Ground Brook also experience frequent flooding, especially in the area of Cutspring Road and Chapel Street. Flooding impacts the Oronoque Village condominium complex, an over-55 community consisting of 929 homes spread across about 300 acres. The property is crossed by the Freeman Brook and a small unnamed brook. Both have buried sections through the Village. During more severe rain events these streams tend to overflow and cause flooding, primarily in the FEMA designated flood zones. Property damage from these events has exceeded $300,000 with loss of vehicles, furnaces, hot water heaters and damage to basements/lower levels and garages.

The areas in Stratford where inland flooding typically occurs are depicted in FEMA Flood Zone map included in Appendix F.

Trumbull

Trumbull contains fewer waters courses than the other towns in the Region; however, inland flooding remains a concern as the Town is traversed by the Pequonnock River, Horse Tavern Brook, and Island Brook. The most frequent flooding occurs along sections of Horse Tavern Brook, especially where it crosses under Chestnut Hill Road and Blackhouse Road. Severe flooding occurs from major rail events along sections of the Pequonnock River from about Daniels Farm Road, through the Twin Brooks Park area and the neigh-

borhoods between the river and White Plains Road near the town line with Bridgeport.

Horse Tavern Brook flows through a fairly developed section of Trumbull on its southwestern corner. The brook and its tributaries cause moderate flooding during periods of heavy rain. A comprehensive flood control study has been completed for this area that addresses recurring flooding and recommends mitigation actions.

With regards to the Pequonnock River, the neighborhood along Manor Drive is especially susceptible to flooding. This section of town is in a low-lying flat area directly abutting the river. The houses in the area are very close to the river's elevation, which only augments their flood risk. Furthermore, the gradient of the floodplain along Route 127 causes flooding at the bend in the river.

The flood risk areas in Trumbull are depicted in the FEMA Flood Zone map included in Appendix F.

Hazard Assessment

Flooding, whether coastal or inland represents the most common and costly natural hazard in Connecticut. The state typically experiences flooding in early spring due to snowmelt and heavy spring rains and then again in late summer to early autumn when tropical storms are most active. This pattern has been evident in the past with Tropical Storm Irene arriving in late August of 2011 and Superstorm Sandy impacting the area in late October of 2012, as well as other coastal storms. However, severe thunderstorms are possible throughout the summer months and have the potential to produce substantial rainfall totals over short periods of time. In addition, weather patterns can produce low pressure systems that form over the ocean and cause north-easterly wind patterns. These "nor'easters" can result in heavy rain and high winds.

In order to provide a national standard without regional discrimination, the 100-year flood and the 500-year flood, which had been the standard adopted by FEMA as the base flood for flood plain management purposes, has recently been revised. In order to eliminate the idea that a 100-year flood will only occur once every hundred years, FEMA has since adopted the 1% flood. This means that during any given year there is a 1% chance that a storm of sufficient precipitation flood will occur that will cause flooding and that it will reach or exceed FEMA's base flood levels. Similarly, the 500-year flood designation has been converted to a 0.2% flood, meaning that in any given year there is a 0.2% chance of a flood at that magnitude occurring.

Flood plains are lands along watercourses that are subject to periodic flooding; floodways are those areas within floodplains that convey floodwaters. The floodways are subject to water being carried through them at relatively high velocities and forces. Beyond the floodway, lies the floodway fringe, this is an area that remains in the floodplain yet is out of the floodway. The floodways and floodplains are the areas within the region that are vulnerable to flooding.

In certain areas of the region flooding occurs with greater frequency than documented by FEMA mapping. In these instances the higher rate of flooding is due to a combination of heavy rainfall with insufficient drainage.

Repetitive Loss Properties

Properties that experience damage from recurring flooding and have made multiple claims under the National Flood Insurance Program (NFIP) are referred to as "repetitive loss" properties. Due to the multiple claims under the NFIP, these properties are considered costly to insure and a strain on FEMA resources. The FEMA offers grant programs to assist communities and states in implementing actions that reduce or eliminate the long-term risk of flood damage to focus on repetitive loss properties. The primary objective of these programs is to eliminate or reduce the damage to residential property caused by repeated flooding. Funds are provided to implement various mitigation measures that will reduce future flooding losses. Possible mitigation actions include acquisition or relocation of severe repetitive loss properties and elevating existing structures.

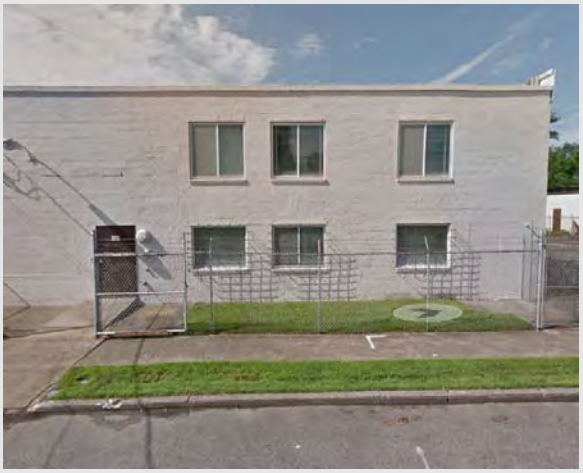
A Fact Sheet on the next page provides more detailed information regarding repetitive loss properties in the region. FEMA has defined two classes of repetitive loss properties:

A Repetitive Loss (RL) property is defined as a residential property that is covered under an NFIP flood insurance policy and meets one of the following criteria:

1. Has incurred flood-related damage on two occasions, in which the cost of the repair, on the average, equaled or exceeded 25% of the market value of the structure at the time of each such flood event; and

REGIONAL CHALLENGES

REPETITIVE LOSS PROPERTIES



Typical non-residential RL property in Bridgeport

RL property in Trumbull that has been acquired and converted to open space

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WHAT IS THE CHALLENGE?

According to FEMA, a Repetitive Loss (RL) property is 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 409 RL properties are listed in the municipalities that comprise the six-town MetroCOG region. A breakdown is as follows:

- Bridgeport – 94 RL properties
- Easton – 1 RL property
- Fairfield – 210 RL properties
- Monroe – 1 RL property
- Stratford – 77 RL properties
- Trumbull – 26 RL properties

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 may be a problem in a specific area even when not obvious upon a cursory review of the setting.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Examination of the RL list may indicate that flooding is a problem in a specific area. For a risk evaluation to be effective, each RL first must be accurate. 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 updated to ensure that resources are directed to the properties with most risk and highest flood losses. Examination of the current list reveals that the RL property in Monroe is likely not located in the Town of Monroe.

It is important for MetroCOG communities to further reduce flood losses, and these efforts must include the RL property losses that have represented a strain on the NFIP. Before targeting specific properties for technical assistance, each municipality must know with certainty which RL properties are accurately represented by the information on the list. 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 such as the property listed in Monroe.

2. At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.

A Severe Repetitive Loss (SRL) property is defined as a residential property that is covered under an NFIP flood insurance policy and meets one of the following criteria:

1. Has had at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or
2. For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building; and
3. For both criteria, at least two of the referenced claims must have occurred within any ten-year period.

A list of RL properties was obtained from the CTDEEP. These data were used to identify general areas where properties are susceptible to recurring flooding that cause repetitive losses. These properties are discussed in more detail in the Risk Assessment sections for inland and coastal flooding.

In total, 407 properties in the Region have experienced repetitive losses, and 14 of these met the criteria for SRL properties. Not surprising, the vast majority of the RL properties are located the coastal communities:

- Bridgeport has 95 RL properties (23.3% of total), of which 11 are non-residential and 84 are residential.
- Easton has one residential RL property (0.2% of total).
- Fairfield has 209 RL properties (51.4% of total), of which eight are non-residential and 201 are residential.
- Stratford has 76 RL properties (18.7% of total), of which 10 are non-residential and 66 are residential.
- Trumbull has 26 RL properties (6.4% of total), of which one is non-residential and 25 are residential.

Of the 14 SRL properties, 9 are in Fairfield, four are in Stratford, and one is in Trumbull. All of the SRL properties in the region are residential.

Note that there are no RL properties in Monroe. While disclosure regulations prohibit the identification of the addresses of RL properties, areas that have experienced repeated flooding that has resulted in losses have been mapped. These were then aggregated into Census blocks to maintain property anonymity but allow the aggregated data to be displayed in Figure 3.13.

Historical Record

On average, severe flooding occurs approximately once every five years throughout the region, with minor flooding events occurring more frequently. Since the early 1900s there have been eleven major flooding events to impact the state and particularly the MetroCOG region. These events occurred in March 1936, September 1938, August 1955, October 1955, June 1982, May and June 1984, October 2005, April 2007, August 2011, and September of 2012 on two separate occasions. The 1955 flood has been estimated to be a two percent to a 0.2% flood event across Connecticut, with flood frequencies of greater than a one percent storm in southwestern Connecticut. The other storms had variable effects, depending on the location.

The Pequonnock River flows through the Region and drains into Long Island Sound at Bridgeport. Rain events typically cause the river to overflow its banks and subject the Region to occasional flooding, with some being severe. Based

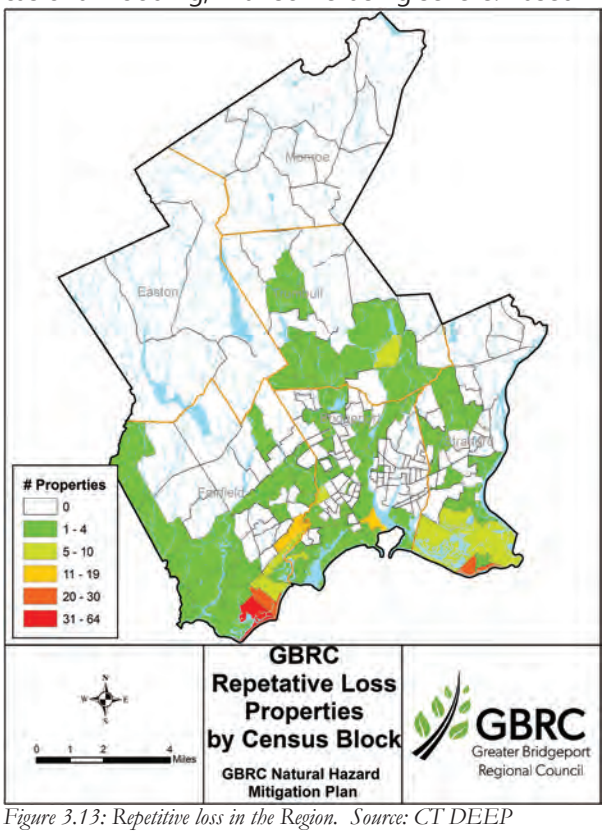

Figure 3.13: Repetitive loss in the Region. Source: CT DEEP

on the Federal Emergency Management Agency (FEMA) Federal Insurance Study (FIS), the largest flood events occurred in July 1897, July 1905, March 1936, September 1938, December 1948, August 1955, October 1955 and April 2007.

Due to the generally steep topography of Trumbull, waterways in the Town are subject to rapid rates of rise at high velocities. This geographical factor combines with the river system's relatively large drainage area to produce augmented flood levels. Major floods occurred in 1905, 1936, 1938, 1955, and 1972.

In the Town of Monroe the upper reaches of the Pequonnock River are subject to overtopping their banks with every major precipitation event. In March of 1936, two closely occurring storms combined with a considerable amount of snowmelt produced major flooding. The flood of October 1955 far exceeded any prior flood on record in Monroe. Certain low lying areas directly adjacent to the Pequonnock River and the West Branch of the Pequonnock River experienced high levels of devastation from that event.

The flood of October 1955 also exceeded any prior recorded flood within the Town of Easton. Due to the minimal quantity of developed land along the stream, little is known of the exact severity of the flooding that took place during this storm. However, through resident reports, a general idea of the level of damage can be ascertained. According to Easton citizens, the 1955 flood washed out the bridges on Valley Road and Center Road which crossed the Aspetuck River, upstream of the Aspetuck Reservoir. The Mill River overtopped its banks destroying public and private property. However, according to the Aquarion Water Company, none of the four water supply reservoirs (Easton, Aspetuck, Hemlock, or Saugatuck) were in danger of overtopping during the flood of October 1955.

Recent Events

The following are additional descriptions and examples of more recent major flooding events in the Region. These examples are drawn from the National Climatic Data Center, Storm Events Database, and from correspondence with municipal officials.

April, 1980: A spring rainstorm caused severe flooding along all watercourses in the Town of Easton. Due to the frozen ground the heavy precipitation had no way of penetrating the surface and combined with excessive snowmelt to create extensive flooding. As reported by town residents, the Aspetuck River overflowed its banks and flooded Route 136 downstream of the Aspetuck Reservoir.

September 16, 1999: Torrential and record rainfall brought by Tropical Storm Floyd caused widespread urban, small stream, and river flooding. Fairfield County was declared a disaster area, along with Hartford and Litchfield Counties. Serious wide spread inland flooding throughout low elevation and poor drainage areas was prevalent, and resulted in the closure of numerous roads and the flooded basements.

April 21, 2000: A series of intense thunderstorms moved north to northeast across Southeast Fairfield and New Haven Counties. The thunderstorms were accompanied by torrential rainfall that produced widespread flooding of small streams, brooks, rivers, and low-lying and poorly drained areas. They also produced lightning strikes. Rainfall amounts ranged from around 2-to-4 inches. Significant and widespread ponding of water caused road flooding in Stratford and Milford. Selected rainfall amounts for southeast Fairfield County included 3.57 inches at Bridgeport and 3.56 inches in Stratford. Cost estimates of property damage were unavailable.

August 11 and 12, 2000: From the east side of Bridgeport and through Stratford, torrential rain caused widespread and extreme flooding in low lying and poor drainage areas along area streams and rivers. Rainfall totals from the event ranged from 4.0-to-7.5 inches in under two hours. The heavy rains were reported to fall in "sheets" at a rate estimated by the National Weather Service (NWS) of between 3.5-to-4.0 inches per hour. Property damage from the event was extensive with a total of 471 residents experiencing flooding. The flood waters deposited up to several feet of water into 447 residents' basements, and another 24 reported flooding of their first floors.

August 21, 2004: Severe thunderstorms developed to the west over the Hudson Valley and moved into Connecticut through the afternoon. The storm systems produced heavy rainfall and caused significant street flooding.

September 18, 2004: The remnants of Hurricane Ivan pushed across the state producing heavy rain, totaling up to five inches in certain spots. The result was localized flash flooding of roadways.

June 29, 2005: Slow moving thunderstorms

developed over Connecticut on the afternoon of June 29th in association with a slow moving front. The atmosphere was very moist, which allowed the thunderstorms to produce significant hourly rainfall rates of greater than two inches. In a matter of 2-to-4 hours, some locations in Fairfield County picked up anywhere from 3-to-5 inches of rain.

August 2, 2008: A stationary low in the region produced severe thunderstorms with torrential downpours. This resulted in flash flooding, with many streets in the East End of Bridgeport inundated, and properties damaged. Sections of Fairfield and Stratford experienced similar flooding from this event.

August 7, 2008: Strong thunderstorms produced heavy rainfall, causing flash flooding across portions of southwest Connecticut. The Town of Stratford was particularly hard hit. Some of the worst flooding occurred on sections of Terrill Road, where water levels were close to two feet high. Residents used kayaks along with other small floatation devices to navigate through the flooded streets. The same event brought flooding along East Main Street and Crescent Avenue in Bridgeport. In this location a car became stranded under high flood waters and the two occupants had to be rescued by local firefighters. Additionally, a school on Waterview Avenue in Bridgeport was flooded.

November 1, 2010: A low pressure system tracking up the eastern seaboard combined with the remnants of Tropical Storm Nicole to produce heavy rain and flooding throughout portions of Fairfield and New Haven Counties. Sections of Route 25 in Monroe, along with roads in the vicinity of Interstate 95 at Exit 33 in Stratford, were closed due to flooding.

June 23, 2011: Several rounds of thunderstorms produced heavy rain across portions of southern Connecticut. This resulted in localized flash flooding; specifically, the intersection of State Street and Iranistan Avenue in Bridgeport was closed due to three feet of standing water.

June 7, 2013: In Bridgeport, the intersections of Iranistan Ave. and State St., and Fairfield Ave. and Railroad Ave., as well as Bishop Ave., River St., Savoy St. and Amsterdam Ave. were all closed due to flooding. Total reported rainfall amounts in Fairfield County ranged from 3.34 inches in Stamford to 4.60 inches at Sikorsky Airport in Stratford.

July 14, 2014: A car was stuck in high water under an overpass at the intersection of Bishop St. and Connecticut Ave. in Bridgeport. In Fairfield, the Rooster River flooded nearby streets.

April 16, 2017: Fire departments responded to a water rescue call at the intersection of Barnum Avenue and Bishop Avenue in the Mill Hill area of Bridgeport.

April 16, 2018: The intersection of Bruce Avenue and Stratford Avenue and the intersection of King Street and Broadbridge Avenue in Stratford were impassable due to flooding.

July 17, 2018: A vehicle was trapped in floodwaters under the railroad overpass on West Broad Street between Knowlton Street and Linden Avenue in Stratford.

September 25, 2018: Rain developed ahead of an approaching warm front, resulting in rainfall amounts of four inches or more across southern Connecticut. A total of 7.32 inches of rain was recorded in Trumbull. Widespread flash flooding occurred throughout the region. For more details regarding information on the September 25, 2018 storm, please refer to the Fact Sheet on the next page.

- Flooding occurred along the Rooster River, Island Brook, and the Pequonnock River in Bridgeport. A few homes in Bridgeport flooded during the storm and foundation damage was reported. A total of 15 water rescues for people trapped in vehicles were performed by local emergency management personnel.
- Congress Street was flooded in Easton by the Mill River for the first time since 1982. Dogwood Drive in Easton was overtopped in two locations by Morehouse Brook and a tributary. Two homes were directly flooded in Easton, and 50 water rescues were performed by Easton emergency personnel per the NCDC Storm Event database.
- Flooding occurred along the Rooster River, Mill River, and other streams town-wide in Fairfield, with bank erosion occurring in many areas. Numerous people were trapped in vehicles on Bennet Street and at the intersection of Brookside Drive and Samp Mortar Drive due to flood waters.
- In Monroe, flooding occurred along Hurds Brook at East Village Road west of Robin Road, on Route 25 in front of the Fire Department, and on Hattertown Road west of Knapp Street along tributaries to the Mill River.
- Localized flooding occurred in Stratford.

REGIONAL CHALLENGES

CASE STUDY: INTENSE PRECIPITATION

Flood of September 26, 2018
Pictures sourced from social media

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

WHAT IS THE CHALLENGE?

Precipitation events have become increasingly intense over the last several decades. The total precipitation received over the course of the year has increased, as has the number of events with total precipitable moisture over 2". This means that storms are becoming more intense, while aging infrastructure has not, 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 parking lots and buildings in the Town of Trumbull.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

The communities in the MetroCOG region are united in their concerns about flooding related to intense precipitation events. All six of the municipalities were heavily impacted by the flooding of September 26, 2018, whether rural or urban in character. Even before this event, the communities were taking actions to reduce flood losses. For example:

- Three of the communities have joined the CRS program (Fairfield, Trumbull, and Stratford) and Bridgeport has submitted a letter of interest to FEMA regarding the program.
- Fairfield is evaluating areas of flood storage in the Rooster River watershed.
- Trumbull has teamed with property owners to apply for FEMA funds to acquire properties.
- Easton has upsized stream crossings and drainage infrastructure.

This hazard mitigation plan update contains additional actions that the communities plan to take for reducing losses associated with intense precipitation events.

FOR MORE INFORMATION

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- All mapped floodplains in Trumbull experienced flooding. Overwhelmed drainage systems contributed to widespread basement flooding, and Route 111 was overtopped by the Pequonnock River. A sewer pumping station on Reservoir Avenue was flooded and offline due to pump chamber damage. The flash flooding restricted access to Daniels Farm Road from Route 127.

Photos of flooding during this event, as well as impacts following this event are shown on the next page.

Hazard Probability

Based on the review of historical records, severe rain storms that result in moderate-to-severe inland flooding occur at fairly frequent rate. The occurrence of these flood-producing rain totals between 2000 and 2018 suggest that one such storm has the potential to happen once every year.

According to the discussion in the State Water Plan (2018), the modeled scenarios project a generally wetter future, with the largest precipitation increases projected for the winter and spring months. Summer and autumn months are projected to remain about the same in terms of both frequency and rainfall level. The models suggest that the region may be at risk of increased winter and spring flooding in the future due to climate change.

Risk Assessment

RL properties in the region provide one method of quantifying the risk of inland flooding in the region. Out of the 407 RL properties in the region, 128 appear to have experienced losses from inland flooding along streams and rivers, or from other sources such as poor drainage:

- Bridgeport has the most RL properties susceptible to inland flooding (41). Nine of these RL properties are non-residential and 32 are residential.
- Easton has one residential RL property susceptible to inland flooding.
- Fairfield has 38 RL properties susceptible to inland flooding, with five of the RL properties being non-residential and 33 residential.
- Stratford has 22 RL properties susceptible to inland flooding, with five of the RL properties being non-residential and 17 residential.
- Trumbull has 26 RL properties susceptible to inland flooding, with one of the RL properties being non-residential and 25 being residential.

Of the 14 SRL properties in the region, only two (one residential property in Fairfield and one residential property in Trumbull) appear to be due to inland flooding. As noted previously, Monroe does not have any RL properties.

Losses experienced by RL properties is only a portion of the total flooding damage experienced by the region. Annualized loss estimates were prepared for flooding for each community as presented in Section 3.3.

A "Level 1" analysis was modeled using the HAZUS-MH version 4.2 flood model in order to quantify potential damages from inland flood events of specific magnitudes. Analyses were run separately for each town and riverine flooding was modeled independently of coastal flooding. The analysis used HAZUS-MH stock inventory as well as National Elevation Dataset (NED) Digital Elevation Models (DEMs) to model hydrology.

Estimated damages generated by HAZUS-MH version 4.2 (2019) are presented herein in comparison to the results generated by a previous version of HAZUS-MH for the 2014 NHMP. Some of the results differ significantly than those estimated for the 2014 NHMP. It is believed that the differences are due to the updated methodology for estimating flood damages in version 4.2 as well as the updated base data used for the analysis.

Building Damage

Building damage was based on a flood depth grid that was created by overlaying the flood depth by the DEM. This flood depth was then used with a depth-damage curve to estimate damages to buildings expressed as percent of the building damaged. Table 3.16 shows the results for the region. The current HAZUS-MH results generally show that more buildings in the region are susceptible to damage than the previous model, but that the percentage of damage expected is lower than previously modeled. Town specific data can be found in Appendix G.

Essential Facilities Damage

Damage, as well as loss of use estimates, was generated for all essential facilities. Damage was calculated in the same method as building damage. Loss of use estimates were calculated by assuming a default depth of flood to which the

Flooding at Sacred Heart University - September 25, 2018 Storm.
Photo contributed to NBC Connecticut

Bank Erosion along Rooster River from September 25, 2018 Storm.
Photo by Town of Fairfield

Flooding on Cartright Street in Bridgeport - September 25, 2018 Storm.
Photo by Daniel Morcarski contributed to New Haven Register

Flooding at Trumbull Music Studios - September 25, 2018 Storm.
Photo Posted on Social Media by Trumbull Music Studios

Flooding at Trumbull Music Studios - September 25, 2018 Storm.
Photo Posted on Social Media by Trumbull Music Studios

Flooding Debris along Rooster River from September 25, 2018 Storm.
Photo by Town of Fairfield

Table 3.16: Hazus-MH building damage from inland flooding
Region (All Towns) Building Damage

Damage (2014)	10 yr	25 yr	50 yr	100 yr	500 yr
1-10%	1	1	0	1	1
11-20%	18	21	24	25	29
21-30%	4	5	8	11	16
31-40%	37	51	56	59	100
41-50%	31	48	63	70	106
>50%	53	53	66	76	104
Total	**144**	**179**	**217**	**242**	**356**
Damage (2019)	10 yr	25 yr	50 yr	100 yr	500 yr
1-10%	215	239	270	397	943
11-20%	142	165	205	280	441
21-30%	29	36	48	60	65
31-40%	4	4	6	11	12
41-50%	2	2	1	4	3
>50%	2	2	3	3	7
Total	**394**	**448**	**533**	**755**	**1,471**

facility may close. This depth threshold for functionality is different for each essential facility type. Loss of use projections can be found in Table 3.17. Town specific results can be found in Appendix G. Very few essential facilities are affected by any inland flooding event. Only four schools in Fairfield and one police station in Easton were impacted.

Debris Generated

HAZUS-MH generated estimates for the amount of debris generated from inland flooding. The overall debris generated is in Table 3.18. The current HAZUS-MH results generally show that less debris is generated from inland flooding than the previous model. Bridgeport had the most debris generated with 2,510 tons in a 1% event, while Trumbull had the most debris generated for a 0.2% event with 2,880 tons. Overall, the Region is projected to have 8,682 tons of debris in a 1% flood and 9,725 tons in a 0.2% flood.

Shelter Needs

Shelter needs were generated in HAZUS-MH by the number of households displaced due to the flood and potential evacuation. Displaced houses include not only areas in the flood but near the flood in potential evacuation zones. The number of people requiring shelter was a fraction of those displaced households and can be found in Table 3.19. The current HAZUS-MH results generally show that less people will require shelter than the previous model.

Table 3.17:
Hazus-MH essential facility damage from inland flooding
Number of Facilities Damaged

Damage (2014)	Total	10 yr	25 yr	50 yr	100 yr	500 yr
EOC	2	0	0	0	0	0
Fire	16	0	0	0	0	0
Hospitals	4	0	0	0	0	0
Police	16	0	0	0	1	1
Schools	130	0	0	0	0	2
Damage (2019)	Total	10 yr	25 yr	50 yr	100 yr	500 yr
EOC	2	0	0	0	0	0
Fire	16	0	0	0	0	0
Hospitals	3	0	0	0	0	0
Police	16	1	1	1	1	1
Schools	130	0	2	3	3	4

Table 3.18: Hazus-MH debris generated from inland flooding
Debris Generated (tons)

Damage (2014)	10 yr	25 yr	50 yr	100 yr	500 yr
Bridgeport	1,316	1,437	1,664	1,786	2,222
Easton	615	733	860	980	1,290
Fairfield	7,864	8,297	8,806	9,307	10,166
Monroe	364	556	737	864	1,375
Stratford	547	717	915	1,031	1,469
Trumbull	1,340	1,516	1,816	2,095	3,112
Total	**12,046**	**13,256**	**14,798**	**16,063**	**19,634**
Damage (2019)	10 yr	25 yr	50 yr	100 yr	500 yr
Bridgeport	1,090	1,199	1,404	2,510	2,039
Easton	291	433	549	839	960
Fairfield	1,058	1,367	1,755	2,116	1,984
Monroe	180	236	289	379	679
Stratford	724	821	927	1,029	1,183
Trumbull	1,244	1,425	1,628	1,769	2,880
Total	**4,587**	**5,481**	**6,552**	**8,642**	**9,725**

Economic Loss

Economic loss was calculated from both direct property damage and business interruption. Table 3.20 summarizes the combined economic loss for each town. The current HAZUS-MH results predict more economic loss due to flood damage than the

Table 3.19: Hazus-MH shelter needs from inland flooding

People Requiring Shelter

Damage (2014)	10 yr	25 yr	50 yr	100 yr	500 yr
Bridgeport	720	816	1,002	1,055	1,964
Easton	20	24	31	32	44
Fairfield	867	1,041	1,165	1,270	1,738
Monroe	196	243	278	313	483
Stratford	743	915	1,001	1,053	1,565
Trumbull	124	146	177	213	428
Total	**2,670**	**3,185**	**3,636**	**3,936**	**6,222**
Damage (2019)	10 yr	25 yr	50 yr	100 yr	500 yr
Bridgeport	65	71	80	146	172
Easton	0	0	0	0	0
Fairfield	9	11	14	19	135
Monroe	1	1	2	2	7
Stratford	18	22	23	28	43
Trumbull	6	8	8	12	16
Total	**99**	**113**	**127**	**207**	**373**

Table 3.20: Hazus-MH economic loss from inland flooding

Economic Loss (in millions of dollars)

Damage (2014)	10 yr	25 yr	50 yr	100 yr	500 yr
Bridgeport	$56.5	$64.2	$70.8	$74.2	$78.3
Easton	$10.7	$12.9	$14.9	$16.5	$19.6
Fairfield	$74.1	$85.1	$94.9	$103.6	$120.0
Monroe	$14.3	$21.0	$26.1	$30.2	$42.5
Stratford	$34.6	$42.4	$51.2	$57.8	$76.6
Trumbull	$43.1	$51.6	$59.8	$65.5	$88.5
Total	**$233.2**	**$276.3**	**$317.6**	**$347.8**	**$425.4**
Damage (2019)	10 yr	25 yr	50 yr	100 yr	500 yr
Bridgeport	$96.6	$106.3	$118.1	$171.9	$173.3
Easton	$15.0	$19.0	$22.0	$28.9	$31.5
Fairfield	$67.8	$77.3	$99.9	$125.7	$269.2
Monroe	$25.7	$31.5	$39.0	$50.2	$61.1
Stratford	$67.3	$81.2	$92.3	$106.2	$129.9
Trumbull	$60.2	$71.9	$82.6	$110.7	$147.4
Total	**$332.6**	**$387.2**	**$453.8**	**$593.6**	**$922.4**

previous model. Fairfield could expect the most losses of any MetroCOG municipality. Overall, the Region can expect $594 million dollars in loss from a 1% annual chance event and $922 million from a 0.2% annual chance event.

3.6 Hazard Profile – Coastal Flooding

Setting

Coastal flooding is a natural hazard that threatens the MetroCOG Region. Much like inland flooding, coastal flooding represents a common naturally occurring event that causes damage to property and residents' quality of life. The three member communities that are directly impacted by coastal flooding are the City of Bridgeport and the Towns of Fairfield and Stratford.

Bridgeport Harbor is one of three deep water harbors in Connecticut. The harbor is fed by three main tributaries, the largest being the Pequonnock River, followed by the Yellow Mill Channel, and Johnson's Creek/Lewis Gut. The Harbor area includes the United Illuminating plant and a City-owned marina, and many residential neighborhoods lay near the harbor's edge and two marinas exist along the banks of Johnson's Creek. Since the adoption of the 2014 NHMP Update, Steele Point redevelopment is underway on land that is protected by new bulkheads on an elevated ground surface that exceeds the base flood elevation. The redevelopment effort is expected to extend into the 2030s.

Much of Fairfield's population resides south of the Interstate 95 corridor. The neighborhoods within the vicinity of Fairfield Beach and Pine Creek have undergone a monumental shift over the recent decades, transitioning from summer cottages to full time residences. This increased the region's year-round population density, which in turn increased concerns for public safety and possible damage inflicted from a coastal flooding event.

A significant portion of the population of Stratford lives along the shoreline and, much like the shift seen in Fairfield, many of Stratford's shoreline cottages have been converted to year round residencies. Cottages located on Long Beach, a barrier beach connecting Stratford with Pleasure Beach in Bridgeport, were removed and the area converted to permanent open space. In addition to the immediate shoreline along Long Island Sound, the threat of coastal flooding exists for residents that reside along the lower reaches of the Housatonic River.

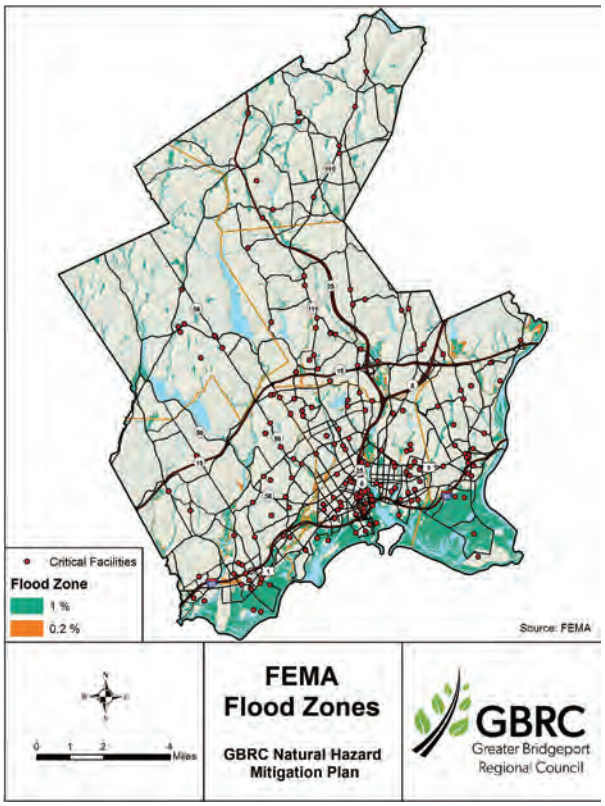

Figure 3.14: Flood zones and critical facilities

Hazard Assessment

In Bridgeport, Fairfield and Stratford, severe flooding can result from astronomically high tide levels along coastal areas. Commonly these extreme high tide events are brought on by a "nor'easter." Characterized by slow moving low-pressure zones, this storm system can occur throughout the year, although it most often occurs during the winter months. Further events can be brought on by tropical systems of varying intensities that pass through the area.

The extent of coastal flooding is depicted in the Figure 3.14. It is based on the flood zones relating to a 1% and a 0.2% storm event, as determined by FEMA. Town maps for coastal flooding with enhanced critical facilities can be found in Appendix F.

As explained in the previous section, a 1% flood means that in any given year there is a one percent chance that there will be a storm that will cause a certain level of flooding. Similarly, the flooding associated with a 0.2% flood has 0.2% chance of occurring in a year, and would affect a greater area than the 1% flood.

The majority of the Region's coastal flooding occurs from storm systems that move up the Atlantic Coast and carry heavy precipitation. This includes tropical storms, hurricanes, and nor'easters. These systems typically carry very low pressure gradients and strong winds. The direct coastal flooding associated with these storms can migrate into tidal and estuarine stream systems.

In addition, floods of smaller magnitudes can occur with more frequent regularity. For example, areas within the Region that are proximate to low-lying coastline may be more prone to flooding from unusually high tides. While these events can occur with greater frequency, they are typically far less severe in duration and impact. This type of flooding is discussed in more detail in Section 3.7 (Sea Level Rise).

The Fact Sheet on the next page provides more information regarding coastal flooding in the region.

Historical Assessment

As mentioned above, flooding, whether coastal or inland, represents the most common and costly natural hazard in Connecticut. The FEMA FIS identifies the coastal storm events that had the most effect on Fairfield, Stratford and Bridgeport as occurring in 1815, 1938, 1944, 1954, 1955, 1960, 2011, and 2012. The major unnamed hurricane of September 21, 1938, was estimated to cause 600 deaths in New England. Another unnamed hurricane hit the Connecticut coast in September 1944, and Hurricane Carol struck the Connecticut coast in August of 1954. In the following year, 1955, back-to-back hurricanes Connie and Diane caused torrential rains in Connecticut, with up to 12 inches of rainfall in areas from Connie and an additional 10 to 20 inches of rain from Diane.

Recent Events

More recently, flooding and winds associated with hurricanes and storm events have caused extensive shoreline erosion and related damage. In 1985, Connecticut was impacted by Hurricanes Bob and Gloria, with Gloria directly hitting the coastline. Tropical and extratropical storms have produced periods of locally heavy rainfall. These events have been recorded on June 4 through 7, 1982, May 16, 1989, October 31, 1991, December 10 through 12, 1992, and May 27-June 2, 1994.

Recent events have also demonstrated that the extent of coastal flooding has exceeded the limits indicated on FEMA mapping. Inundation of flood

REGIONAL CHALLENGES

CASE STUDY: COASTAL FLOODING

Fairfield Daily Voice Photo

Hartford Courant Photo

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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, but 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 hazard mitigation plan report that economic losses in the MetroCOG region could be as high as $2.4 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 MetroCOG area in the wake of Hurricane Sandy.

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 MetroCOG 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 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.

waters from both Tropical Storm Irene and Superstorm Sandy extended farther inland than expected. Furthermore, the Town of Fairfield reports that the need to plow sand from roads is becoming more frequently necessary due to deposition from coastal floods. This occurred three times in 2018, whereas in previous years it was not necessary at all.

The following are additional descriptions and examples of more recent major flooding events in the region. These examples are drawn from the National Climatic Data Center Storm Events Database, as well as from discussions with municipal stakeholders.

March 19, 1996

A strong low pressure system moving northeast off the Delmarva Coast brought strong winds of 40 to 50 MPH across much of the region. The strong winds pushed water inland producing tides two-to-four feet above normal. This resulted in a moderate flooding along much of western Connecticut's shoreline.

October 19, 1996

A system that developed over the Delmarva Peninsula brought easterly gale force winds (40 mph) across Long Island that persisted from late Friday through Saturday. This caused tides to exceed their astronomical means, and produced tide levels of three-to-five feet above normal. In turn, varying amounts of coastal flooding were reported along with varying degrees of beach erosion. In Stratford, roadways were covered with up to three feet of water leaving residents stranded. The Fairfield Beach area also experienced flooding. Sand was pulled from the beaches and deposited yards away in the basements and first floors of residential homes.

March 13, 2010

The right combination of high and low pressure in the region created a prolonged period of strong easterly winds. This resulted in tidal heights of three to five feet above normal, with many locations reporting higher levels than seen in 20 years. The National Oceanic Service (NOS) tidal gauge in Bridgeport reported a maximum tide level of 10.4 feet. This produced moderate flooding which closed many roads close to the shoreline. Roads crews had to be brought in to remove sand and debris from roadways.

October 29, 2012

Superstorm Sandy produced a storm surge of 8-to-9 feet along much of western Long Island Sound, with its effects further exacerbated by its coincidence with the high tide. This produced up to two to five feet of inundation that spread several blocks inland in many places. In certain areas the inundation reached north of Interstate 95, including areas along the Pequonnock River in Bridgeport and along Ash Creek and the Mill River in Fairfield.

February 27, 2013

Strong onshore winds were produced from a complex low tracking northeast system through the Ohio Valley. The winds produced a two to three foot storm surge for much of southwest Connecticut, resulting in widespread minor to locally moderate flooding. The Birdseye Marina in Stratford experienced moderate inundation of up to three feet; similar flooding was experienced along Housatonic River.

April 16, 2018

The entrance ramp to Interstate 95 from Surf Avenue in Stratford was closed due to flooding.

October and November, 2018

Bridgeport, Fairfield, and Stratford were subject to many coastal flood watches and warnings in 2018, with flooding reported during storms on October 27 and November 26. In Fairfield, vehicles such as passenger cars and a mail truck were lost to coastal flooding. In Stratford, the flooding associated with the November 26, 2018 storm approached the limits of flooding sustained during Tropical Storm Irene.

Hazard Probability

Based on the review of historical records, storms that result in moderate-to-severe coastal flooding occur about once every three-to-four years. According to the NOAA GFDL, the effects of climate change will also include changes to the magnitude of tropical storms.

Risk Assessment

Coastal flooding may result in direct flooding damage to properties and infrastructure as well as result in coastal erosion that may result in additional areas becoming floodprone overtime.

RL properties in the region provide one method of quantifying the risk of coastal flooding in the region. Out of the 407 RL properties in the region, 279 have losses from coastal flooding along the shoreline or along the tidal sections of streams and rivers:

- Bridgeport has 54 RL properties susceptible to coastal flooding, with 2 of the RL properties being non-residential and 52 residential.
- Fairfield has 171 RL properties susceptible to coastal flooding, with 3 of the RL properties being non-residential and 168 residential.
- Stratford has 54 RL properties susceptible to coastal flooding, with 5 of the RL properties being non-residential and 49 residential.

Of the 14 SRL properties in the region, 12 (eight in Fairfield and four in Stratford) appear to be due to coastal flooding. All are residential.

Losses experienced by RL properties is only a portion of the total flooding damage experienced by the region. Annualized loss estimates were prepared for flooding for each community as presented in Section 3.3.

A Level 1 HAZUS-MH analysis was run using the HAZUS-MH 4.2 flood model. The analysis used HAZUS-MH stock inventory as well as NED DEMs to model hydrology. The NED DEM is a low resolution (30 meter) dataset. This low resolution may have led to overestimation of damage from small events which is evident in the following results. The coastal flooding model was run independently for the three coastal communities (Bridgeport, Fairfield, Stratford).

Building Damage

Building damage was assessed using the same methodology described in subsection 3.5. Town specific damage can be found in Appendix G. Table 3.21 summarizes the damage for the Region. In general, the current HAZUS-MH results predict that fewer buildings will be damaged by coastal flooding than the previous model. The model estimates that more than 100 buildings would be more than 50% damaged from a 1% annual chance coastal flood and nearly 300 buildings in a 0.2% annual chance coastal flood event.

Essential Facilities Damage

Essential Facility damage and loss of use estimates were calculated in the same method described above in subsection 3.5. Town specific loss of use projections can be found in Appendix G. As apparent in Table 3.22 essential facilities are impacted in every flood scenario. In general, the HAZUS-MH results show that less essential facilities are at risk of coastal flooding than the previous model. Schools were the most impacted by coastal flooding.

Table 3.21: Hazus-MH building damage from coastal flooding.

Region (Coastal Towns) Building Damage

Damage (2014)	10 yr	25 yr	50 yr	100 yr	500 yr
1-10%	8	9	8	8	2
11-20%	307	337	265	235	236
21-30%	820	1,052	970	794	537
31-40%	458	771	1,604	1,283	899
41-50%	385	657	1,500	2,195	2,063
>50%	36	136	500	1,000	3,406
Total	**2,014**	**2,962**	**4,847**	**5,515**	**7,143**
Damage (2019)	10 yr	25 yr	50 yr	100 yr	500 yr
1-10%	91	90	201	253	132
11-20%	152	154	493	798	1,071
21-30%	51	49	197	469	979
31-40%	2	2	57	101	458
41-50%	0	0	9	36	168
>50%	7	6	42	107	291
Total	**303**	**301**	**999**	**1,764**	**3,099**

Table 3.22: Hazus-MH essential facility damage from coastal flooding

Region (Coastal Towns)
Essential Facilities (Loss of use)

Damage (2014)	Total	10 yr	25 yr	50 yr	100 yr	500 yr
EOC	2	0	0	0	0	0
Fire	16	0	0	2	2	2
Hospitals	4	0	0	0	0	0
Police	16	1	1	3	4	3
Schools	130	2	3	7	8	14
Damage (2019)	Total	10 yr	25 yr	50 yr	100 yr	500 yr
EOC	2	0	0	0	0	1
Fire	16	0	0	0	0	2
Hospitals	3	0	0	0	0	0
Police	16	1	1	1	1	3
Schools	130	1	1	2	2	7

Debris Generated

HAZUS-MH generated estimates for the amount of debris generated from coastal flooding. The amount of debris generated was much larger than those from inland flooding hazards, but less than hurricane wind. Table 3.23 summarizes the debris generated from different flooding scenarios. In general, the current HAZUS-MH model estimates significantly less debris will be generated than the previous model.

Table 3.23: Hazus-MH debris generated from coastal flooding

Debris Generated (tons)

Damage (2014)	10 yr	25 yr	50 yr	100 yr	500 yr
Bridgeport	1,415	4,324	11,168	25,449	110,450
Fairfield	39,215	63,245	107,645	172,718	272,594
Stratford	9,536	16,252	43,665	83,154	229,056
Total	**50,166**	**83,821**	**162,508**	**281,321**	**612,100**
Damage (2019)	10 yr	25 yr	50 yr	100 yr	500 yr
Bridgeport	162	162	1,125	2,755	10,870
Fairfield	2,848	2,820	16,361	38,033	102,259
Stratford	976	976	4,729	10,112	33,377
Total	**3,986**	**3,958**	**22,215**	**50,900**	**146,506**

Shelter Needs

Shelter needs were generated in HAZUS-MH by the number of households displaced do to the flood and potential evacuation. Displaced houses include not only areas in the flood but near the flood in potential evacuation zones. The number of people requiring shelter was a fraction of those displaced households and can be found in Table 3.24. In general, the current HAZUS-MH results predict a lower sheltering need in the region from coastal flooding than the previous model results.

Table 3.24: Hazus-MH shelter needs from coastal flooding

People Requiring Shelter

Damage (2014)	10 yr	25 yr	50 yr	100 yr	500 yr
Bridgeport	1,901	3,356	6,819	9,677	18,511
Fairfield	5,512	6,187	7,069	7,578	9,442
Stratford	4,646	5,943	7,638	8,597	9,904
Total	**12,059**	**15,486**	**21,852**	**25,852**	**37,857**
Damage (2019)	10 yr	25 yr	50 yr	100 yr	500 yr
Bridgeport	**4**	**4**	**235**	**442**	**1,037**
Fairfield	**169**	**165**	**347**	**403**	**458**
Stratford	**60**	**60**	**339**	**493**	**664**
Total	**233**	**229**	**921**	**1,338**	**2,159**

Economic Loss

Economic loss was calculated as in the subsection 3.5. Table 3.25 summarizes the combined economic loss for each town. Overall, the current HAZUS-MH model predicts less economic loss due to coastal flooding than the previous model, with the greatest economic loss predicted for Fairfield. The Region is projected to lose over $1.6 billion in a 1% annual chance coastal flood event and over $2.9 billion in a 0.2% annual chance coastal flood.

Table 3.25: Hazus-MH results for economic loss from coastal flooding

Economic Loss (in millions of dollars)

Damage (2014)	10 yr	25 yr	50 yr	100 yr	500 yr
Bridgeport	$55.4	$11.4	$357.6	$645.8	$1,343.5
Fairfield	$247.5	$394.5	$655.9	$795.2	$1,257.2
Stratford	$320.0	$486.5	$764.4	$967.1	$1,198.3
Total	**$642.9**	**$1,000.5**	**$1,777.9**	**$2,408.1**	**$3,799.1**
Damage (2019)	10 yr	25 yr	50 yr	100 yr	500 yr
Bridgeport	$23.0	$23.0	$142.0	$340.7	$896.4
Fairfield	$148.6	$143.3	$423.0	$661.7	$1,092.6
Stratford	$91.7	$91.7	$427.0	$635.1	$957.6
Total	**$263.3**	**$258.0**	**$992.0**	**$1,637.5**	**$2,946.6**

3.7 Hazard Profile – Sea Level Rise

Setting

Sea level rise has the potential to impact all low-lying areas near the shore and unlike other natural hazards, is one that is constant and ongoing.

Hazard Assessment

Sea level rise results from thermal expansion of seawater and the melting of land based ice sheets and glaciers. The Intergovernmental Panel on Climate Change (IPCC) estimated that the global mean sea level rose by 17 centimeters (~6.7 inches) in the 20th Century. The IPCC also reported an observed rate increase of 1.8 millimeters/year (~0.07 inches) between 1961 and

2003, while the rate was almost double from 1993 to 2003 to an average yearly rise at 3.1 millimeters (~0.12 inches).

Local sea level change, which is of more direct concern to coastal communities, is caused by a combination of global sea level rise, changes in local and global ocean currents, and local changes in land elevation. Weakening Atlantic currents and local land subsidence accelerate the rate of sea level rise occurring in Long Island Sound. Coastal communities experiencing increases in mean sea level are at greater risk to the effects of coastal flood hazards as natural, protective buffers such as coastal wetlands and dunes are lost and property and infrastructure become more exposed to the frequency and severity of coastal flood and storm surge inundation.

As sea level rises, tidal marshes and barrier islands will be the first areas to experience damage. Within the MetroCOG Region, the three coastal communities of Bridgeport, Fairfield and Stratford, will be highly susceptible to damage from sea level rise. These municipalities have a coastline that extends about 15.5 miles and contain many tidal marshes, inlets, embayments, rivers and creeks, all of which will be affected by sea level rise.

Historic Record

Sea levels have been constantly rising since then end of the last ice age. However, it is only in the last 20 years that this change has been increasing at a more rapid rate, and its threat realized. Along the Atlantic Coast, it is estimated that by the end of the century sea levels could rise anywhere from 20-to-40 inches, with higher amounts possible depending on the effect of melting polar ice.

Connecticut is experiencing a relative sea level rise greater than that of the rest of the globe. During the past ice age much of the northern hemisphere was covered in up to a mile of ice. The immense size of these glaciers warped the Earth's crust, causing the northeast to be slightly uplifted. Since the ice has melted, the crust is slowly evening out, leading to Connecticut sinking at approximately 0.76-to-0.89 millimeters per year (≈0.03-to-0.035 inches). This only further complicates assessing and predicting the long term effects of continued sea level rise.

The IPCC concluded that there has been a global mean rise in sea level between 10 and 25 centimeters (~4-to-10 inches) over the last 100 years. Relative sea level rise in Connecticut in the same time period is estimated between 15 and 30 centimeters (~6-to-12 inches). The IPCC further estimates that global sea level will rise 9 to 88 centimeters (~3.5 to 34.5 inches) during the 21st century.

A long-term tide gauge has been operated by the National Oceanic and Atmospheric Administration (NOAA) at Steele Point in Bridgeport since 1964. The historic mean sea level trend at that gauge has been a rise of 2.83 millimeters per year (0.93 feet in 100 years) with a 95% confidence interval of plus-or-minus 0.44 millimeters per year, based on monthly mean sea level data from 1964 to 2016.

Risk Assessment

Sea level rise is a slow onset hazard, and its severity or magnitude is measurable only over long periods of time as further described below. "Nuisance flooding" refers to the inundation of low-lying areas under "blue sky," non-storm conditions; this phenomenon has already been noted in Fairfield and will continue to become a problem with regards to access and asset-degradation as water more regularly renders roads impassable and affects structures and infrastructure systems.

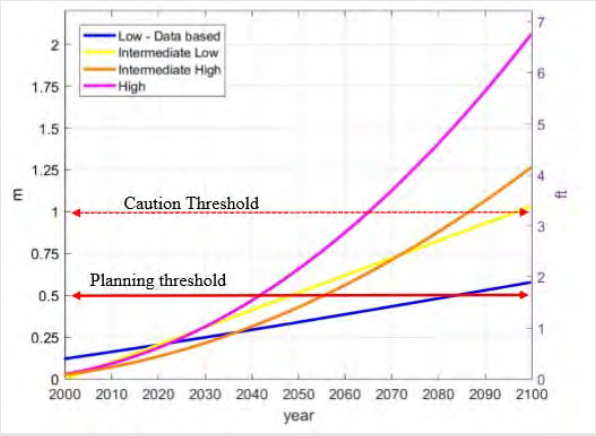
Global mean sea level is projected to rise between 0.98 and 8.2 feet over the 21st century. Sea level rise is not consistent around the world, and as noted above is affected by local variations in currents, temperature, and changes in land surface elevation. It has long been expected that the rate of 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.

The Connecticut Institute for Resilience and Climate Adaptation (CIRCA) has developed sea level rise projections for use in Connecticut. A Fact Sheet discussing these projections follows. 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.

Rising sea levels will impact both the natural and man-made coastal environments. It could

REGIONAL CHALLENGES

SEA LEVEL RISE



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

Flooding in Fairfield County, Photo by Daily Voice

FOR MORE INFORMATION

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WHAT IS THE CHALLENGE?

Global sea level rise (SLR) is occurring at an increasing rate due to the melting of land ice and the expansion of ocean water due to heat absorption associated with climate change. Global sea level represents a global mean; regional variations need to be considered for local planning. Observations and extrapolations show that the sea level in Long Island Sound is rising at a more rapid rate than the global SLR projections.

The Connecticut Institute for Resilience and Climate Adaptation (CIRCA) has conducted regional projections for Connecticut, and has recommended that planning anticipates a 0.5 m (1ft 8 inch) rise in sea level by 2050. There is significant diversion between projections after 2050; for 2050, the difference between the lowest and highest projection is approximately 0.3 m, and for 2100 the difference is almost 1.5 m.

Sea level rise (SLR) impacts both human development and the environment. With rising seas comes increased flooding events along the coast, and along water bodies connected to the coast. This flooding affects homes, business, utilities and infrastructure, and can seriously affect a municipality during a large enough event.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

The region is comprised of three coastal towns, which may become increasingly impacted by sea level rise. Bridgeport, Fairfield and Stratford, the three coastal communities in the MetroCOG region, already experience nuisance flooding as tide levels rise.

As tides begin to further inundate the coastline on a regular basis, storms may result in an increased level of flooding. Mitigation actions should be continuously identified and implemented in order to minimize damages during storms and high tide events.

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 when planning, and also requires municipalities to consider sea level rise scenarios when preparing hazard mitigation plans.

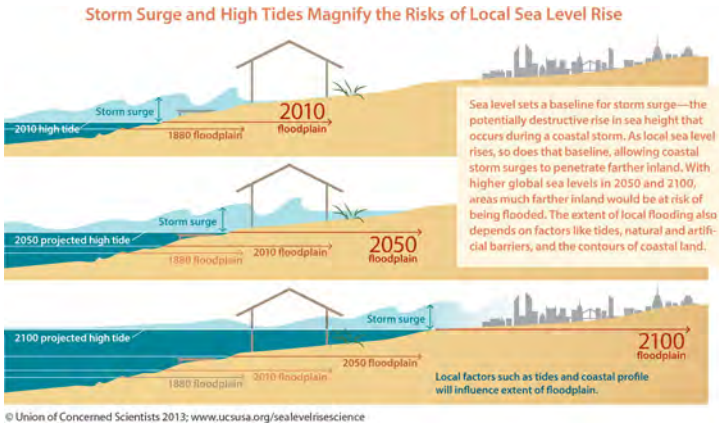


Figure 3.15: Effects of sea level rise on storm surge. Source: Union of Concerned Scientists 2013

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 of coastal areas.

As sea levels rise, drainage systems will become less effective, leading to the potential for greater flooding from even moderate rain events. Bridgeport already experiences problems with inadequate storm drainage in coastal neighborhoods; a higher water table will only exacerbate this problem. 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. This phenomenon is portrayed in Figure 3.15. Sea level rise for the Region is shown in Figure 3.16. Town specific sea level rise maps can be found in Appendix F.

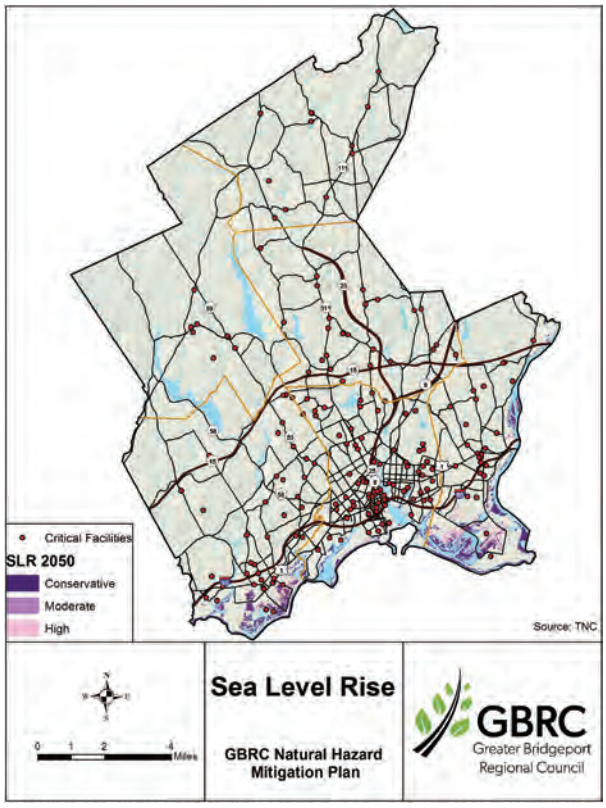


Figure 3.16: Sea level rise projections. Source: The Nature Conservancy

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.

Annualized loss estimates were prepared for sea level rise for each coastal community as presented in Section 3.3.

3.8 Hazard Profile – Winter Storms

Setting

Winter weather affects the Region indiscriminately, bringing not only the typical threats of snow, wind, and ice, but concerns of extreme cold and flooding. Furthermore, the results of any one these events can create tertiary hazards as well; these include loss of power and heat. While severe winter weather is commonly associated with the months of December, January, and February, the potential exists for occurrences from late September through mid-May.

Although the entire Region is susceptible to winter storms, the geography, topography and its location along Long Island Sound influence the severity of different events. Because of their proximity to Long Island Sound, the coastal and low lying areas receive less snow amounts then the more northern reaches. However, the tempera-

ture variations can affect precipitation mix during a winter storm. Warmer temperatures can create changeable conditions. Along the coast, it is not uncommon for a mixture of snow, sleet and freezing rain to occur, while most of Easton, Monroe and Trumbull are receiving only snow. These conditions affect driving conditions, damage to trees and power distribution.

Hazard Assessment

Winter storms and weather range from blizzards, ice storms, heavy snow, sleet, freezing rain and extreme cold. Most deaths from winter storms result from traffic accidents on icy roads and hypothermia from prolonged exposure to cold. Damage to trees and tree limbs and the resultant downing of utility cables are a common effect of these types of events. Secondary effects include loss of power and heat.

The possible weather events that can impact the region are described below:

Blizzard

The main characteristic of a blizzard is that it has conditions of sustained winds or frequent gusts of 35 mph or more. The high winds cause blowing and drifting of snow and reduction of visibility. By definition, visibility is reduced to less than one-quarter mile for three or more hours. Extremely cold temperatures are often associated with blizzard conditions.

Winter Storm

A heavy snow event results in a snow accumulation of more than six inches in twelve hours, or more than twelve inches in twenty-four hours. Unlike a blizzard, a heavy snow event does not have the high, sustained winds that can cause reduced visibility and down trees and power lines.

Freezing Rain

Temperatures at higher levels are warm enough for rain to form but surface temperatures are below 32 degrees. The rain freezes on contact and coats objects such as trees, cars or roads, forming a glaze of ice. Freezing rain is generally associated with an approaching warm front and cold air is trapped at lower levels in the atmosphere. When a substantial amount of freezing rain occurs and at least one-quarter inch of ice accumulates, it is referred to as an "Ice Storm." The freezing rain from an ice storm can create hazardous walking and driving conditions, and cause trees and branches to break from the weight of built-up ice. Power lines are susceptible to spanning from the weight of ice build-up.

Nor'easter

The classic winter storm in New England is the nor'easter. It forms as a low-pressure disturbance along the south Atlantic coast, moves northeast along the Middle Atlantic and the New England coasts and collides with a cold, dry high pressure system moving down from the north. Strong northeast winds are created and wind driven waves can batter the coastline, causing flooding and severe beach erosion. Coupled with a high tide, the low pressure of a nor'easter can have an effect similar to a storm surge from a hurricane. During the winter months and if the temperatures are right, heavy snow totals are possible.

Sleet

Unlike freezing rain, sleet is formed by water droplets that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects. However, it can accumulate like snow and cause a hazard to motorists. It typically falls as a mix of snow and freezing rain.

Historical Record

The National Oceanic and Atmospheric Administration (NOAA) has developed a Regional Snowfall Index (RSI) for the northeast that rates winter storms into five descriptive categories by score: Extreme, Crippling, Major, Significant, and Notable. The index considers the impact the storm had on the area and is based on snowfall amounts, size of the area impacted and the population within the path of the storm. Winter storms from 1956 to 2018 were reviewed. During that time period, 64 high impact snowstorms that affected the northeast were identified and rated:

Two were rated Extreme:

- March 12, 1993
- January 6, 1996

Ten were rated Crippling:

- February 14, 1958
- March 2, 1960
- February 2, 1961
- January 11, 1964
- December 25, 1969

- January 19, 1978
- February 10, 1983
- February 15, 2003
- January 21, 2005
- January 22, 2016

Twenty-two were rated Major:

- December 11, 1960
- January 18, 1961
- January 29, 1966
- February 22, 1969
- February 18, 1972
- February 5, 1978
- February 17, 1979
- January 21, 1987
- February 8, 1994
- February 12, 2006
- February 12, 2007
- February 4, 2010
- February 9, 2010
- February 23, 2010
- December 24, 2010
- January 9, 2011
- February 1, 2011
- February 7, 2013
- January 29, 2014
- February 11, 2014
- January 29, 2015
- March 12, 2017

Fourteen were rated Significant:

- March 18, 1958
- December 23, 1966
- February 5, 1967
- February 8, 1969
- April 6, 1982
- January 24, 2000
- December 18, 2009
- March 15, 2007
- March 4, 2013
- December 13, 2013
- December 30, 2013
- January 25, 2015
- March 5, 2018
- March 11, 2018

Sixteen were rated Notable:

- March 18, 1956
- January 25, 1987
- February 22, 1987
- February 2, 1995
- March 31, 1997
- December 30, 2000
- March 1, 2009
- January 26, 2011
- October 29, 2011
- January 20, 2014
- November 26, 2014
- December 9, 2014
- February 8, 2015
- January 3, 2018
- March 1, 2018
- March 20, 2018

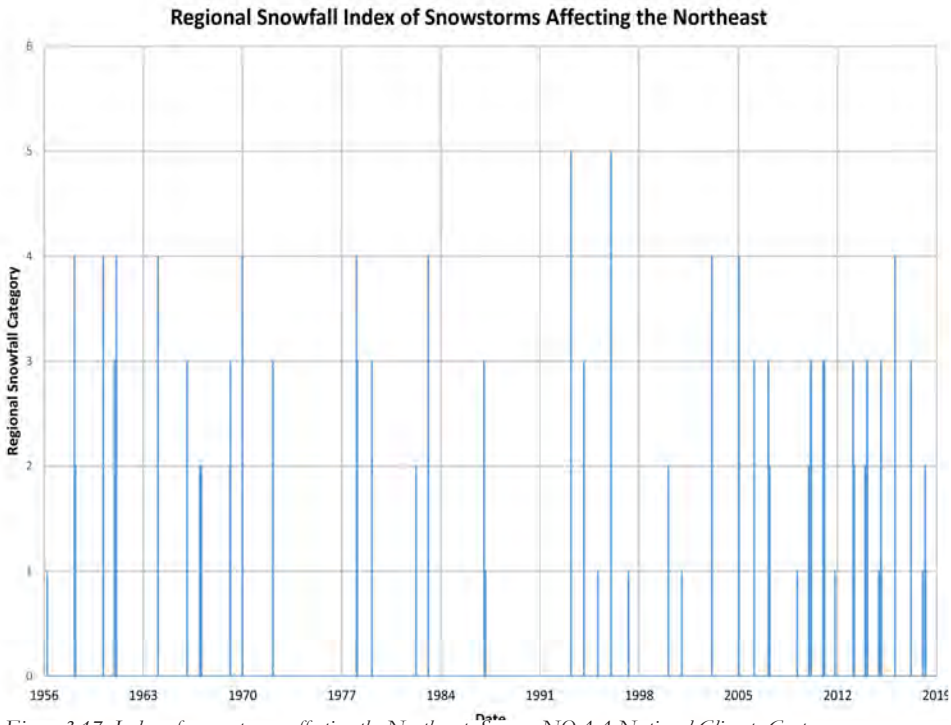


Figure 3.17: Index of snowstorms affecting the Northeast. Source: NOAA National Climate Center

The start date for these events are illustrated in Figure 3.17. In general, there has been an increased frequency of occurrence of notable or stronger winter storms over the last 15 years as compared to the earlier parts of the RSI record.

Severe winter storms can produce an array of hazardous weather conditions, including heavy snow, blizzards, freezing rain and ice pellets and extreme cold. Based on the RSI, nearly one-quarter of

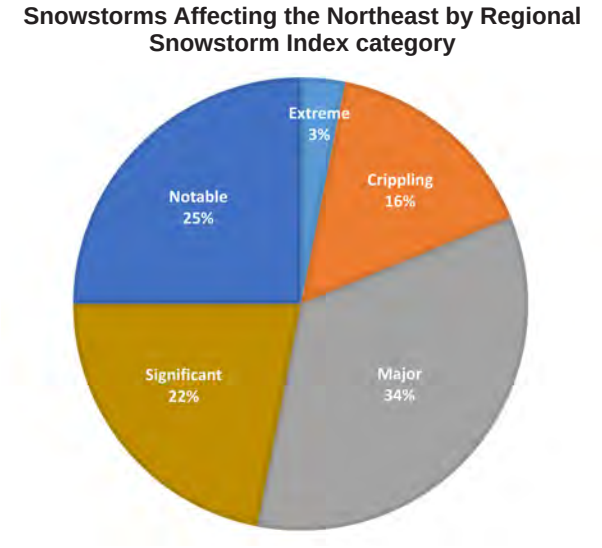


Figure 3.18: RSI rating for winter storm occurrences. Source: NOAA

the snowstorms were considered either extreme or crippling to the Northeast, while the majority were categorized as major. The remainder of the snowstorms were listed as significant or notable as seen in Figure 3.18.

Recent Events

On February 11th and 12th, 2006, Connecticut received record snowfall from a relatively minor system that started along the southern Appalachian range. It intensified over the Atlantic and developed into a nor'easter and became known as the North American Blizzard of 2006. State highways were closed to facilitate clean-up and the state was declared a federal disaster area. About 27.8 inches of snow was recorded in Fairfield as seen in Figure 3.19.

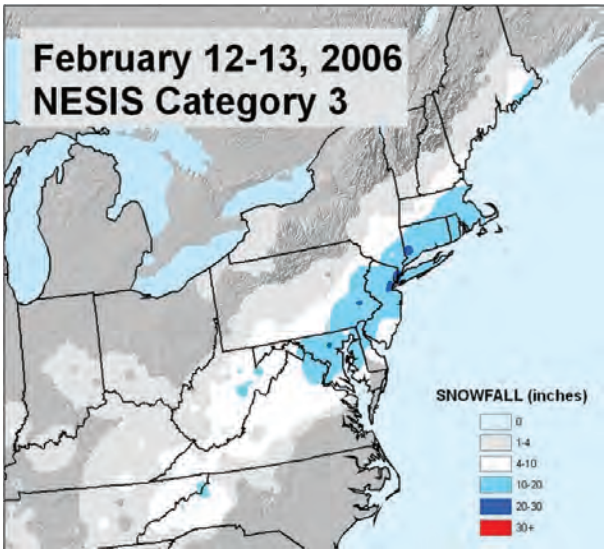


Figure 3.19: Snowfall totals from NOAA for February 2006 storm

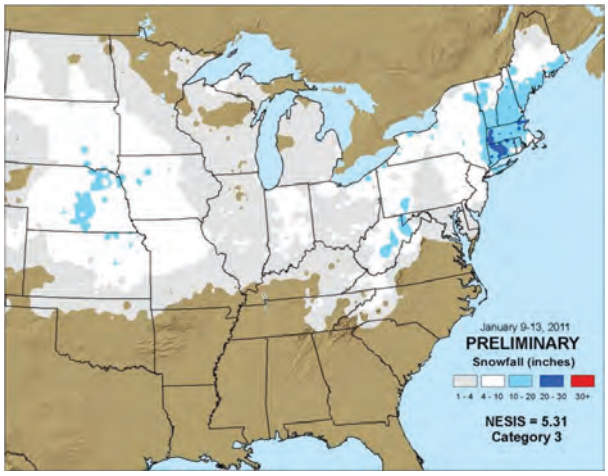


Figure 3.20: Snowfall totals from NOAA for January, 2011 storm

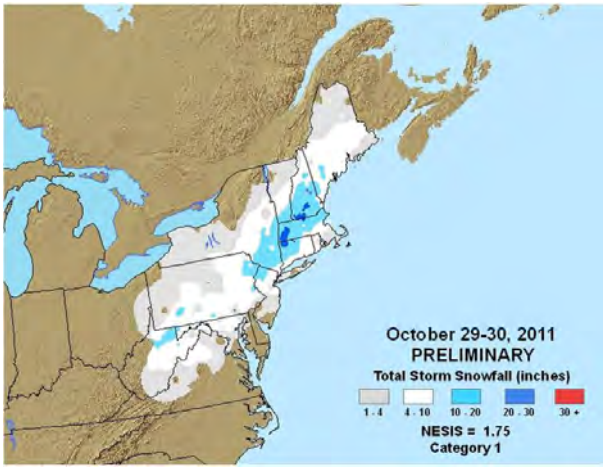


Figure 3.21: Snow totals from NOAA for Winter Storm Alfred

On January 9, 2011, Connecticut was hit by a winter storm that dropped up to two feet of snow, with 24.1 inches recorded in Danbury, 29 inches in Newtown and 22.5 inches in Hartford. In the Region, snowfall amounts totaled 16.5 inches in Bridgeport and were up to 20 inches in several northern areas as seen in Figure 3.20. Colder-than-expected temperatures resulted in the higher snowfall totals.

In late October 2011, a historic and unprecedented early-season winter storm impacted the area with up to 18 inches in some parts of Connecticut as seen in Figure 3.21. This was the first time a winter storm of this magnitude occurred in October. The storm is often referred to as the 2011 Halloween nor'easter or Storm Alfred. The combination of high winds and wet, heavy snow caused trees and power lines to snap. About 830,000 customers lost power throughout the state, and

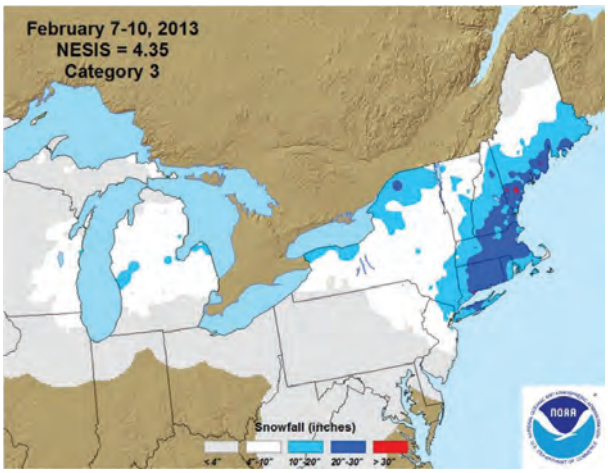


Figure 3.22: Snow totals from NOAA for Winter Storm NEMO

many remained without electricity for over a week. Almost the entire state was declared a federal disaster area; New London County was the only exception.

The February 2013 nor'easter, commonly referred to as Winter Storm Nemo, developed from the combination of two areas of low pressure, one originating in the northern plains and the other forming over Texas. The National Weather Service issued blizzard warnings for all of Connecticut on February 7th and Governor Malloy declared a state of emergency on February 8th and ordered the closure of all limited access highways. The snowstorm resulted in heavy snowfall and blizzard force winds. The highest amounts were recorded in Hamden at 40 inches, while 30-to-36 inches blanketed the Region as seen in Figure 3.22. During the evening and overnight, snow was falling at an extreme rate of six inches per hour.

Recent winter storms over the last five years have produced up to 16 inches of snow and occasionally freezing rain or ice throughout the region. However, such storms have generally been more manageable than the more severe storms described earlier in the historic record.

Hazard Probability

Connecticut experiences at least one severe winter storm every five years. However, a variety of small and medium snow and ice storms occur nearly every winter. The probability of a nor'easter or any other winter storm occurring in any given winter is likely. The data from the NCDC suggest that the Northeast experiences a severe snowstorm every 1.2 years or, effectively, the area can expect at least one notable snow event every year.

According to the climate change models performed for the State Water Plan (2018), Connecticut is expected to experience higher temperatures during the winter months in the future as well as increased rainfall during the winter. This may result in fewer snow events overall and more wintry-mix storms consisting of snow, sleet, freezing rain, and potentially ice. However, given the increased overall precipitation, there may be a potential for higher snowfall amounts during the snowstorms that do occur.

Risk Assessment

The entire Region is vulnerable to the impacts of winter storms. While there may be damage to structures directly from the winter weather, the tertiary effects are what impact the Region the most.

Transportation is severely impacted by winter storms as heavy snowfall and icy conditions can make roadways dangerous and in some cases impassible. This greatly restricts access to hospitals and other medical care facilities which puts everyone at risk during an event. People in more rural areas of the Region are also more impacted as travel is mostly limited to personal vehicles. In addition, rural areas often take longer to clear the roads often forcing people to stay in their homes. Even when roads are cleared, vulnerable populations such as the elderly and disabled may be unable to clear their own walks and driveways, leaving them trapped inside.

In addition to travel impediment, winter storms also have the potential to knock out power in the Region. Without power many individuals will be without heat, again putting certain populations such as the elderly more at risk.

Annualized loss estimates were prepared for winter storms for each community as presented in Section 3.3.

3.9 Hazard Profile – Summer Storms and Tornadoes

Setting

Unlike many other natural hazard events that are more likely to affect only certain portions of the Region, summer storms and tornadoes have the potential to affect the Region indiscriminately. These systems can bring with them torrential rains, damaging winds, dangerous lighting, and large

hail. Furthermore, due to the complex nature of these storms, the affected area from an event could be very small, perhaps only a few blocks within a single town, or a system could impact the entire Region.

Hazard Assessment

Severe summer storms include tornadoes, downbursts, lightning, high winds, heavy rain and hail. These weather systems can cause flash floods, as well as, downed trees and power lines. The possible weather events that can impact the region are described below:

Summer Storms

The development of a thunderstorm occurs in several stages. These stages include growth, development, electrification, and finally dissipation. For all of these stages to occur a precise combination of atmospheric conditions must be present. The formation of these storm cells often begins early in the morning when the sun's rays begin to warm the lower levels of the atmosphere; this warmer air mass begins to rise. It is these rising pockets of warm air that produce cumulus clouds. As the day progresses and the atmosphere warms further the clouds grow vertically, creating towering cumulus clouds. The rapid vertical growth is the first sign that a potentially severe thunderstorm is developing. The final maturation of the cloud structure occurs when the very top of the cloud expands outward, producing a cloud that resembles mushroom or an anvil.

To help warn residents to the arrival of potentially severe and destructive storms systems the National Weather Service utilizes a system of watches and warnings to designate the potential for damaging weather. The following definitions are pulled directly from the National Oceanic and Atmospheric Administration's webpage.

Severe Thunderstorm Watch

A Severe Thunderstorm Watch outlines an area where organized episodes of hail one inch in diameter or larger, and/or damaging winds are expected during a three-to-eight hour period. Winds for a severe thunderstorm must be in excess of 58 miles per hour or 50 knots. Typical watches cover about 25,000 square miles.

Severe Thunderstorm Warning

A Severe Thunderstorm Warning outlines an area where organized episodes of hail one inch in diameter or larger, and/or damaging thunderstorm winds have developed and are occurring, or are imminent. Winds for a severe thunderstorm must be in excess of 58 miles per hour or in excess of 50 knots. Unlike a watch, a Severe Thunderstorm Warning is generally only issued for small areas where the severe weather is likely to impact the region in the very near future.

Hail

Hail is a severe weather phenomenon that can occur within strong thunderstorms where large updrafts are present. Water droplets at the base of the cloud structure are carried upwards by strong updrafts where much colder temperatures at the top of the cloud freeze the droplets. As they fall back down towards earth the droplets are caught again by an updraft and carried to the upper level of the cloud structure. With each trip from the bottom to the top of the cloud the frozen droplets become larger, forming the hailstones. This process repeats itself until the mass of the hailstones exceeds the capacity of the updraft to carry it aloft once more. This means that the stronger the updraft within a storm, the larger hailstones it is capable of producing.

Hail has the potential to be extremely devastating; with hail above ¾ of an inch in diameter capable causing significant damage to crops, persons, and property. While correlations can be drawn between the presence of hail and a tornado, primarily because of the updrafts and downdrafts required for both to occur. The presence of hail does not mean a tornado is imminent nor does its absence mean there is no risk of a tornado.

Lightning

Lightning is an exceptionally dangerous hazard that is most commonly associated with thunderstorms. According to NOAA, It is reported to have killed 17 Connecticut residents from 1959 to 2016, ranking the state 41st in the country for the number of lightning fatalities out of 51 (50 states and Washington D.C.) during this period.

A lightning strike is the product of a completed circuit between positive and negative charges within the thunderstorm cloud or between that thunderstorm cloud and the ground. Initially the atmosphere acts as an insulator between the positive and negative charges, however when the potential between the two becomes too great a rapid discharge of electricity occurs, producing a

lightning strike.

Lightning can occur, primarily, in two different forms. Intra-cloud lightning occurs between oppositely charged particles within the thunderstorm cloud structure. Because the discharge occurs within the cloud structure, it poses little threat to human life or destruction of property. The second form of lightning is cloud-to-ground lightning. This form occurs either between negatively charged particles at the base of the cloud and positively charged particles on the ground; or positively charged particles at the top of the thunderstorm structure and negatively charged particles on the ground. Unlike the intra-cloud lightning mentioned, cloud-to-ground lightning can pose a great threat to both human life and property.

Downbursts

Downbursts are a severe weather occurrence that occasionally accompany a severe thunderstorm. While much of a thunderstorm's life cycle is dominated by strong updrafts that carry warm, moist, and unstable air aloft, a downburst develops when large portions of unstable air mass begin to fall, creating a downdraft. As the air mass falls it begins to gain immense speed. When the air mass contacts the ground it expands outwards rapidly forming the actual downburst. These straight line winds can easily exceed 100 mph. Downbursts can occur in two forms depending on their size: 1) if the affected area is less than 2.5 miles in diameter the occurrence is categorized as a microburst, and 2) for those occurrences that affect an area greater than 2.5 miles in diameter, it is categorized as a macroburst.

Tornadoes

In meteorological terms defined by NOAA, "a tornado is a violently rotating column of air, usually pendant to a cumulonimbus [cloud structure], with circulation reaching the ground. It nearly always starts as a funnel cloud and may be accompanied by a loud roaring noise. On a localized basis, it is the most destructive of all atmospheric phenomena." Tornadoes are the product of a severe thunderstorm that has progressed in such a way to produce the low level rotation needed for tornado development. Since the last adaptation of the Regional Natural Hazard Mitigation Plan, the scale by which the severity of a tornado is measured has been modified. The original scale was created in 1971 by Dr. Ted Fujita, a University of Chicago severe storms research scientist. This original scale was dubbed the F-scale, from F-0 to F-5, with the severity of a tornado based upon wind speed. While the current scale is similar to the F-scale, the wind speeds and parameters by which the damage is assessed have been greatly improved. The severity of a tornado is now measured using the Enhanced Fujita scale which ranks tornados based on their estimated wind speeds and the reported damage from the event. The scale ranks tornadoes from EF-0 to EF-5, with an EF-0 being the least severe and an EF-5 being the most severe as seen in Table 3.26. The new scale uses 28 damage indicators that are each assigned a value of 1 through 8.

Table 3.26: Enhance Fujita Scale.
Source: National Weather Service

ENHANCED FUJITA SCALE FOR TORNADOES

EF Scale	Intensity	Wind Speed (mph)
EF-0	Gale	65-85
EF-1	Weak	86-110
EF-2	Strong	111-135
EF-3	Severe	136-165
EF-4	Devastating	166-200
EF-5	Incredible	>200

Historic Record

Severe Thunderstorms

Records of severe thunderstorm events within the Region were gathered from NOAA's National Climatic Data Center, Storm Events Database. The data provides detailed information on the events and their affects and is for time period from January 1, 1996 to present. Of special note is the severe thunderstorm that occurred on June 24, 2010. This storm caused severe damage throughout the Region.

On June 24, 2010 a cold front and strong upper level trough moved across New England, and this unstable air mass spawned lines of severe thunderstorms across southwestern Connecticut during the afternoon hours. The accompanying super-cells and squall lines produced an EF-1 tornado in Bridgeport and severe winds and hail across the remainder of the region. The extent of the damage from this single event was vast.

The City of Bridgeport was impacted more greatly than the remainder other parts of the Region. The devastation was caused by exceptionally powerful straight line winds, believed to be in excess of 100 mph, along with a small EF-1 tornado.

This led to the total collapse of five buildings and severe damage to at least nine other structures, including the Morton Government Center and Barnum Museum in the downtown area. Damage also included a billboard being blown off the roof of an apartment building, blown out windows, building façade damage, and over-turned vehicles on Interstate 95 and Route 8/25, including a tractor trailer. The vicious storm was also responsible for the downing of hundreds of trees, with two falling on a house.

At the Sikorsky Memorial Airport a wind gust tore a roof off of a hanger, shattering the structure's windows and cracking its foundation. Several planes suffered minor damage from the incident. The winds also caused structural damage to the old terminal building. Debris from the two buildings also damaged a local bar adjacent to the property. The damage sustained to the airport totaled $50,000.

The National Weather Service (NWS) determined that an EF-1 tornado did impact the City, in a very localized area to the north of Interstate 95 from about Route 8/25 to Pembroke Street. The NWS survey found signs of rotation in the area, including blown-in windows, pealed-off exterior façades from homes, and sheared off trees tops. Reports from eyewitnesses described near zero visibility, with a rain wrapped tornado surrounded by swirling debris. Three residents were directly injured from the tornado. The sum of this damage led to the partial closure of at least 57 streets, and the displacement of around two dozen residents. The cost of the damage in the City totaled $3,200,000.

In Easton, significant tree damage resulted from straight line winds believed to be in excess of 80 mph. Some of the toppled trees damaged residents' homes, causing in excess of $30,000 in damages.

While the Town of Monroe was hit far less severely by the thunderstorms, winds believed to be around 60 mph sporadically toppled trees and downed power lines.

Hundreds of trees were lost in Stratford, with the Lordship and Paradise Green sections being hardest hit. Fallen trees were reported to have damaged a number of homes and several cars. One resident was injured while in their car when it was stuck by a fallen limb. Strong winds were reported, believed to be close to 90 mph. The cost of the damage totaled $100,000.

In Trumbull, sporadic damage from winds believed to be around 70 mph was reported, mainly from downed trees and power lines. A falling tree struck a car on Daniels Farm Road, injuring the vehicle's occupant. In addition, two homes were damaged when trees fell on them. The damages from the event totaled $40,000.

Other recent severe thunderstorm events and tornadoes that produced damage within the Region are listed below.

May 16, 2007

Severe thunderstorms developed ahead of an approaching cold front across the region and produced potent straight line winds along with an EF-1 tornado in northern Fairfield County. The Town of Easton experienced exceptional winds which downed countless trees throughout the town. The extent of the damage from these downed trees is unknown; however it is likely that power outages occurred in certain areas.

August 07, 2008

Unstable, moist air spawned several severe thunderstorms in southwestern Connecticut. This line of storms delivered a microburst in the Town of Stratford, where shingles were torn from homes, and many trees and power lines were downed. Several of the downed trees fell on residents' vehicles.

July 31, 2009

An approaching cold front approaching the Region spurred a cluster of severe thunderstorms that caused damage in the southern Fairfield area. Further damage was caused from straight line winds. Two tornados were produced from the system, but occurred outside of the Region.

July 19, 2010

A cold front crossing through the northeast corridor spawned several clusters of severe thunderstorms across southern Connecticut. This led to sporadic tree damage in the Nichols section of Trumbull, including a tree that fell on a house.

June 06, 2011

Atmospheric instability spawned wide spread clusters of severe thunderstorms across the majority of southern Connecticut. Many trees were brought down by the strong winds associated with the storms in Stratford, along with sporadic tree loss in Monroe.

July 26, 2012

An approaching mass of warm air produced a cluster of severe thunderstorms in Fairfield and New Haven Counties. This led to downed tree limbs in Bridgeport and reports of a downed tree in Monroe.

September 6, 2014

High winds downed trees and wires that closed multiple roads throughout the town of Fairfield.

June 23, 2015

Widespread trees were reported down across the northern portion of Monroe. Several roads were closed.

July 25, 2016

Multiple trees and wires were reported down throughout Bridgeport.

July 22, 2018

Trees and powerlines were downed on Barnum Avenue during an overnight storm in Stratford. Tree limbs fell on a transformer on Pearl Street in the Success Hill portion of Bridgeport, resulting in a power outage.

Lightning and Hail

Severe thunderstorms that produce cloud-to-ground lightning strikes are listed below. Hail producing storms occur infrequently in the Region and NOAA records are limited. However, the potential exists for severe thunderstorms to produce hail and cause widespread damage. Instances of hail are included in the lightning records.

May 31, 1998

A line of severe thunderstorms formed in moist and unstable air ahead of an approaching cold front. The storms produced hail, a substantial number of lightning strikes, heavy rain, and powerful winds. At the Trumbull Police Headquarters, a lightning strike travelled down into the building through a telephone wire injuring a Communications Officer and damaging the radio system, rendering it temporarily useless.

August, 10, 2001

Several lines of severe thunderstorms developed across the state during the afternoon hours. These intense storms toppled trees, produced isolated flooding, and caused numerous power outages. Frequent cloud-to-ground lightning strikes occurred, with two lightning related injuries reported statewide. In Trumbull, lightning struck a nearby communications tower and travelled through a phone line into the Police Headquarters, injuring a police officer, who was working dispatch during the storms.

June 08, 2008

Several clusters of severe thunderstorms developed across the state producing strong winds, and numerous cloud-to-ground lightning strikes. A home in Stratford was hit by lightning, causing a fire.

August 07, 2008

Several severe thunderstorms developed in the southwestern part of the state during the afternoon hours and brought torrential rains, strong winds, and lightning. In the Nichols section of Trumbull lightning struck a tree behind a home, creating a hole in the exterior concrete wall of the home's basement.

May 24, 2009

An approaching cold front triggered small clusters of severe thunderstorms during the afternoon hours in southern portions of the state. Cloud-to-ground lightning from one of the storms injured three people who were camping at Webb Mountain Park in the Stevenson section of Monroe.

July 26, 2009

A strong cold front brought strong thunderstorms to portions of Fairfield County, creating numerous cloud-to-ground lightning strikes, two of which struck homes in the Sport Hill section of Easton, producing fires at both locations.

May 08, 2008

An area of low pressure moved northeast across the state bringing with it a cold front. This resulted in tightening pressure gradients as the system moved away from the Region and spawned several thunderstorms along this pressure gradient. Numerous cloud-to-ground lightning strikes were produced. Three men, who were fishing on a jetty in Seaside Park in Bridgeport, were struck by lightning. One of the men was killed.

June 03, 2010

A slow moving cold front brought scattered thunderstorms to southern Connecticut. A light-

ning strike from this line of storms struck the Stratfield Elementary School in Fairfield. A large portion of the school's chimney was knocked out of the surrounding structure.

May 22, 2014

A lingering trough of low pressure triggered multiple rounds of showers and thunderstorms. Lightning struck a tree in Easton, which resulted in damage to a garage and a portion of the associated house.

Tornadoes

The state and region are not highly susceptible to tornadoes, and, when they do occur, the severity tends to be at the lower end of the Fujita scale. Since 1950, 14 tornadoes have occurred in Fairfield County, with the most severe storm, rating an F-2, occurring in 1950. Four tornadoes struck somewhere in the Region, hitting Fairfield in 1958, Trumbull in 1992, Monroe in 1996 and Bridgeport in 2010. Table 3.27 shows confirmed tornadoes impacting Fairfield County; the data was extracted from the NOAA's National Climatic Data Center Storm Events Database.

Hazard Probability

Based on the review of recent events, the likelihood of a severe summer storm occurring in the Region is fairly high. Weather systems that spawn severe thunderstorms are prevalent in the area and the conditions needed for severe weather are fairly common during the summer months. However, these weather patterns tend not to result in extreme conditions that produce tornadoes or hail. Since 1950, only 4 tornadoes have been recorded in the Region. This indicates that the probability of the Region experiencing a tornado is about one every 15 years. Damaging hailstorms are more frequent but these events are also relatively rare. The risks from severe summer storms are related to thunderstorms that produce torrential rain that causes inland flooding or high winds that can cause downed trees and power lines.

Based on the climate change modeling performed for the State Water Plan (2018), summer temperatures are projected to increase. Combined with the projection for more precipitation, it is likely that there will be higher-intensity summer storms and thunderstorms that contribute to flash flooding interspersed with longer dry periods during the summer. The higher intensity storms are expected to contribute to an increased frequency of tornadoes over time.

Risk Assessment

These systems pose a great threat to the Region most notably from the torrential rains, damaging winds, dangerous lighting, and large hail that can be associated with a system of this type.

Table 3.27: Tornado activity in the region. Source: Storm Events Database, NCDC, NOAA

METROCOG REGION

Date	Location	Fujita Scale	Property Damage	Wind Speed
14-Jul-50	Ridgefield	F-2	$250,000	113-157
15-Aug-58	Fairfield	F-1	$3,000	73-112
9-Aug-68	Danbury	F-1	0	73-112
19-Jul-71	Norwalk	F-2	$25,000	113-157
18-Sep-73	Greenwich	F-1	0	73-112
29-Jun-90	Danbury	F-0	$3,000	40-72
5-Jul-92	New Fairfield	F-0	0	40-72
4-Aug-92	Trumbull	F-1	0	73-112
9-Jul-96	Monroe	F-1	0	73-112
31-May-02	Brookfield	F-1	0	73-112
12-Jul-06	North Greenwich	F-1	$2,000,000	73-112
16-May-07	Newtown	EF-1	0	86-110
31-Jul-09	Pine Rock Park, Shelton	EF-1	$10,000	86-110
24-Jun-10	Bridgeport	EF-1	$3,200,000	86-110

From this trees and power lines can be toppled, causing structure damage and the loss of power. Larger hail can crack windshields and dent the roofs of cars along with causing damage to homes and other structures. Finally, the torrential rains can produce flash flooding that has the potential to damage homes and strand motorists. Along with the physical impacts of summer storms, these systems arrive with incredible speed and ferocity. Residents can be unprepared and stranded in locations without adequate shelter.

Annualized loss estimates were prepared for each community for thunderstorms and tornadoes as presented in Section 3.3.

3.10 Hazard Profile – Earthquakes

Setting

An earthquake is a sudden rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. The entire Region is susceptible to earthquakes; however, the effects may be felt differently in some areas based on the type of geology. The US Geological Survey (USGS) monitors and reports on earthquake activity. Their records indicate a lack of historical and instrumental reports of strong earthquakes in Connecticut. This suggests that the State experiences only very minor seismic activity, even when compared to other States in the northeast region.

Hazard Assessment

Earthquakes can occur at any time without warning. Damage to buildings can range from minor cracking of walls and foundations to complete collapse. Earthquakes can cause disruption of utility services, landslides, flash floods, fires, avalanches, and tsunamis.

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

The Richter Scale was developed in 1935 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 (Mw) 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, Mw provides an estimate of earthquake size that is valid over the complete range of magnitudes and so is commonly used today.

Although Mw is the most common measure of earthquake size for medium and larger earthquakes, the USGS does not calculate Mw for earthquakes with a magnitude of less than 3.5. Localized Richter Scales or other scales are used to calculate magnitudes for smaller earthquakes. This is often the case in Connecticut.

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

The effect an earthquake has on the surface is

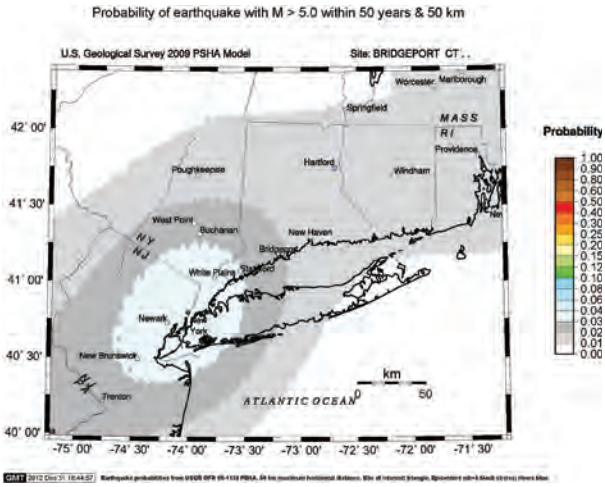


Figure 3.23: Earthquake probability. Source: United States Geological Survey, Earthquake Hazards Program, website

referred to its intensity. While numerous intensity scales have been developed over the last several hundred years, the current scale used in the US is the Modified Mercalli Intensity Scale. It consists of a series of key responses to an earthquake, ranging from how it was felt by people (at the low end of the scale) to observed structural damage. Unlike the Richter Scale, the Modified Mercalli Intensity Scale is an arbitrary ranking based on observed effects, with a more intense earthquake simply described as having a greater effect than a less intense earthquake, but not by how much. The scale is composed of 12 increasing levels of intensity that range from imperceptible shaking felt by very few people to catastrophic destruction.

Earthquakes in Connecticut are not associated with specific known faults, like in California, and are referred to as intra-plate activity. Bedrock in Connecticut and New England in general, is highly capable of transmitting seismic energy; thus, the area impacted by an earthquake in Connecticut can be four-to-40 times greater than that of California. In addition, the population density of Connecticut can potentially put a great number of people at risk. The built environment in Connecticut includes old, unreinforced masonry that is not seismically designed. People who live or work in unreinforced masonry buildings, especially those built on filled land or unstable soils, are at the highest risk for injury from an earthquake. However, the Region is unlikely to experience an earthquake in any given year and is not susceptible to an earthquake with a high magnitude or intensity. Figure 3.23, from the USGS indicates that the Region has only about a three percent probability of experiencing a 5.0 or greater magnitude earthquake within 50 years.

Historic Record

According to the USGS Earthquake Hazards Program, Connecticut is a region of very minor seismic activity. However, the New England states regularly register seismic events and earthquakes have occurred in the Region. Based on the USGS archives, there have been 137 earthquakes recorded in Connecticut between 1598 and 1990. However, only two are considered notable. Both were recorded in the Moodus/East Haddam areas, one in 1568 and the other in 1791. The most severe earthquake in Connecticut's history occurred at East Haddam on May 16, 1791. Stone walls and chimneys were toppled during this quake. In October 1845, an Intensity V earthquake occurred in Bridgeport.

As seen in Table 3.28, 49 earthquakes have been recorded in Connecticut between 1976 and 2016, ranging in magnitude from 1.1 to 3.8 on the Richter Scale, with only two having a magnitude greater than 3.0. These are relatively minor earthquakes. Although magnitude and intensity measure different characteristics, the USGS has related the magnitude of an earthquake to the typical intensity as measured by the Modified Mercalli Intensity Scale. Generally, the earthquakes that have occurred in Connecticut produce very little noticeable shaking, and are not felt by very many people. However, it is notable that 32 earthquakes occurred in Connecticut between 2012 and 2016, with the majority occurring in the Wauregan section of Plainfield.

In addition to the earthquakes that have occurred in Connecticut, the Region can feel the effects of earthquakes that happen outside the state. Most recently, on August 23, 2011, an earthquake that was centered in Virginia measured 5.8 on the Richter Scale. It was felt from Georgia to Canada, including by many in the Region. Despite, no damage was reported in the Region.

Hazard Probability

The conclusion by the USGS is that Connecticut is a region of minor seismic activity. The earthquakes that have occurred have been of low magnitude and intensity. Most people would not feel the shaking generated by an earthquake in Connecticut. While earthquakes have occurred outside the state, the impacts felt in Connecticut

Table 3.28: Connecticut Earthquakes. Source: USGS

RECENT EARTHQUAKES IN CONNECTICUT 1976 – 2018

Location	Magnitude	Depth	Date
Greenwich	0.8	2.4 km	12-Jan-16
Bristol	1.4	5 km	17-May-15
Plainfield	1.8	6.4 km	24-Feb-15
Plainfield	1.4	3.2 km	24-Feb-15
Plainfield	1.0	4.7 km	15-Jan-15
Plainfield	2.0	5.9 km	15-Jan-15
Plainfield	1.5	4.3 km	14-Jan-15
Plainfield	1.8	8.8 km	14-Jan-15
Plainfield	2.6	8.8 km	13-Jan-15
Plainfield (10)	0.6 - 3.3	1.7 - 4.6 km	12-Jan-15
Plainfield	2.3	4.6 km	8-Jan-15
Greenwich	1.5	2 km	20-Nov-14
Plainfield	0.8	4.2 km	9-Nov-14
Plainfield	1.5	4.4 km	9-Nov-14
Plainfield	1.5	5.3 km	14-Oct-14
Sterling	1.3	5 km	13-Oct-14
East Haddam	1.6	5 km	18-Aug-14
Deep River	1.7	4.5 km	14-Aug-14
Deep River	2.7	4.1 km	14-Aug-14
Stonington	2.0	5 km	29-Nov-13
Ledyard	2.0	6.3 km	29-Nov-13
Weston	1.4	12.6 km	4-Nov-12
Stamford	2.1	4 km	8-Sep-12
East Hartford	1.7	5 km	3-Jun-11
Clinton	2.3	2 km	11-Mar-08
Norwich	2.0	12 km	22-Aug-02
Greenwich	1.1	6 km	5-Mar-02
North Branford	1.8	2 km	3-Feb-01
Danbury	2.6	6 km	22-Aug-00
Groton	2.8	20 km	10-Mar-92
Stamford	3.0	10 km	28-Oct-91
Middletown	2.4	5 km	11-Sep-87
New Milford	3.0	7 km	26-Feb-83
Colchester	2.4	1 km	17-Jun-82
Colchester	3.0	2 km	17-Jun-82
Colchester	2.2	1 km	17-Jun-82
Madison	3.8	5 km	21-Oct-81
New Haven	3.0	0 km	25-Oct-80
East Haven	3.1	0 km	24-Oct-80
Middletown	2.2	0 km	24-Apr-76

from these events has also been minor. Based on this review of recent events, the likelihood of an earthquake of sufficient magnitude and intensity impacting the Region is low.

Climate change is not expected to affect the magnitude or frequency of earthquakes affecting the region.

Risk Assessment

Based on the historical record, the MetroCOG Region has a low risk for earthquake activity. However, it is not impossible that a significant event could occur and cause tremendous damage. While no earthquakes have been centered in Bridgeport, there have been historic earthquakes of estimated magnitude 5.0 and above in other parts of the state.

The State NHMP presents four "worst-case" scenarios for major earthquakes occurring in the state. These include a 6.4 magnitude earthquake in East Haddam, a 5.7 magnitude earthquake in Haddam, a 5.7 magnitude earthquake in Portland, and a 5.7 magnitude earthquake in Stamford. Each of these scenarios was modeled for each town in the Region using HAZUS-MH.

While these scenarios are unlikely, they would result in significant damage with the Stamford scenario causing the greatest loss in the region. As Table 3.29 shows, more than 4,800 buildings would be at least moderately damaged including 150 completely destroyed. Many essential facilities would lose functionality during the first day as shown in Table 3.30. For example, the HAZUS-MH model estimates that only 62% of available hospital beds would be available in Bridgeport immediately following the Stamford scenario earthquake.

The transportation system will also experience moderate damage in the earthquake however no facilities were completely damaged. Economic losses for transportation and utility systems are shown in Table 3.31.

The economic impact from the Stamford earthquake scenario would be devastating costing the region over 1.4 billion dollars in damage from building-related and lifeline-related losses. Table 3.32 summarizes the economic loss.

While a significant earthquake has never been centered in the Greater Bridgeport Region, the modeling suggests that a significant event in our developed and densely populated Region would have a serious impact.

Table 3.29: Hazus-MH building damage from earthquake
# of Buildings Damaged in Region

Scenario	None	Slight	Moderate	Extensive	Complete
East Haddam	83,802	8,767	2,542	375	40
Haddam	88,726	3,027	683	78	7
Portland	91,636	3,098	697	89	8
Stamford	76,268	13,300	4,841	968	152

Table 3.30: Hazus-MH essential facilities functionality
Essential Facilities Damage in Region (<50% functionality on day 1)

Facility	Total	East Haddam	Haddam	Portland	Stamford
EOC	2	0	0	0	0
Fire	16	0	0	0	1
Hospitals	3	0	0	0	0
Police	16	0	0	0	2
Schools	130	0	0	0	13

Table 3.31: Hazus-MH transportation and utility damage
Transportation and Utility Damage in Region (Millions)

Component	East Haddam	Haddam	Portland	Stamford
Highway Bridges	$69.46	$4.47	$4.45	$81.31
Railway Bridges, Facilities	$0.14	$0.05	$0.05	$0.28
Bus Facilities	$0.48	$0.20	$0.20	$0.81
Ferry Facilities	$0.07	$0.03	$0.03	$0.14
Port Facilities	$1.67	$0.64	$0.62	$3.30
Airport Facilities	$0.60	$0.25	$0.24	$0.84
Potable Water Systems	$1.65	$0.29	$0.30	$6.54
Wastewater Systems	$4.47	$0.84	$0.81	$15.72
Natural Gas Systems	$0.11	$0.04	$0.04	$0.17
Electrical Power Facilities	$3.46	$0.62	$0.60	$10.93
Communication Facilities	$0.02	$0.01	$0.01	$0.05

Table 3.32: Hazus-MH results for economic loss
Economic Loss in Region (in millions of dollars)

Town	East Haddam	Haddam	Portland	Stamford
Bridgeport	$270.08	$56.20	$56.32	$568.38
Easton	$11.37	$2.39	$2.56	$45.93
Fairfield	$122.80	$24.64	$24.94	$541.45
Monroe	$37.44	$9.66	$11.58	$50.29
Stratford	$125.42	$29.80	$29.27	$147.66
Trumbull	$73.53	$17.83	$19.28	$130.00
Total	**$640.64**	**$140.52**	**$143.95**	**$1,483.71**

Annualized loss estimates for earthquake damage were prepared for each community using HAZUS-MH as presented in Section 3.3.

3.11 Hazard Profile – Dam Failure

Setting

Dams are man-made or artificial barriers usually constructed across a stream channel to impound water. Various materials are used for dam construction such as timber, rock, concrete, earth, steel or a combination of these materials. However, in Connecticut, most dams are constructed of earth or combinations of earth and other materials. Spillways are commonly constructed of non-erosive materials such as concrete or rock. Spillway systems are typically provided along the dam to allow water to flow from the impounded area, and mechanisms are typically installed to control water levels of the impoundment.

The construction of dams began with the arrival of the first colonial settlers in the 1630s. Dams were essential for economic development and were used for manufacturing, water supply, mechanical power and for fire protection. In addition to the historic economic benefits, Connecticut's dams are also used for flood control, water supply, recreation and for mitigating the impact of increased runoff typically caused by land use changes associated with property development. Since 1878, the CTDEEP has exercised regulatory oversight of dams and reservoirs and regularly inspects dams. High hazard potential dams are inspected at a more frequent interval. Dam safety and inspection regulations are codified in state statutes.

The state classifies dams based on their hazard potential, that is, the damage that would likely occur if the structure failed. Five classes have been developed:

Class AA

Negligible hazard potential; no measurable damage to roadways, land and

structures. Economic loss would be negligible.

Class A

Low hazard potential; damage to agricultural land and unimproved roadways. Economic loss would be minimal.

Class BB

Moderate hazard potential; damage to normally unoccupied structures and low volume (less than 500 vehicles per day). Economic loss would be moderate.

Class B

Significant hazard potential; possible loss of life, minor damage to habitable structures, residences, and other critical infrastructure, damage to roadways that carry less than 1,500 vehicles per day, and impact on railroads. Economic loss would be significant.

Class C

High hazard potential; probable loss of life, major damage to habitable structures, residences, and other critical infrastructure, damage to main roadways that carry greater than 1,500 vehicles per day, and impact on railroads. Economic loss would be great.

The highest potential impact from a dam failure would result from Class B or Class C dams. The inundation of water released from a failure of these dams would result in loss of life and major damage to main roads and habitable structures.

There are 117 dams of varying size in the MetroCOG Region which are listed in Table 3.33. The majority of the dams are classified as having a negligible to low hazard potential – Class AA, A, or BB. Thirteen dams have been classified as Class C dams and two are Class B dams.

Table 3.33: Dams in Region. Source: CT DEEP

NUMBER OF DAMS BY CLASS
METROCOG REGION

Town	Total	Class A/AA	Class BB	Class B	Class C
Bridgeport	11	6	2	0	3
Easton	20	14	3	1	2
Fairfield	31	20	9	0	2
Monroe	16	14	1	0	1
Stratford	10	7	1	1	1
Trumbull	29	16	9	0	4
Region	117	77	25	2	13

The dams are scattered throughout the Region and the area of the impoundment ranges from small detention ponds to large public water supply reservoirs. Fairfield is the home of the most dams, including those impounding the Hemlock Reservoir and the Samp Mortar Reservoir. Both are classified as Class C dams. The second highest number of dams is found in the Town of Trumbull, with 29 dams. While most have low hazard potential, there are four Class C dams in the town. The Class C dams are located at and impound Canoe Brook Lake and Pinewood Lake, both private lakes. Twenty dams are located in Easton, including those impounding the Easton Lake Reservoir and Saugatuck Reservoir, and 16 dams are in Monroe. The most critical dam in Monroe is the Stevenson Dam that impounds the Housatonic River to create Lake Zoar and is used to generate electricity. Route 34, a main highway, is located along the top the Stevenson Dam. The fewest number of dams are located in Bridgeport, with 11 dams, and Stratford with 10 dams. Three of the dams in Bridgeport have high hazard potential, while one of the dams in Stratford poses a high risk. The Class C and Class B dams are listed in Table 3.34. Figure 3.23 shows the location of these dams.

Hazard Assessment

Dam failures can be triggered suddenly, with little or no warning, due to other natural disasters, such as, heavy rains, floods and earthquakes. Excessive floodwaters cause pressure and additional force to build behind dams, and, depending on its condition, a failure can occur. In addition, a chain reaction from the sudden release of waters can cause the next dam downstream to fail. Earthquakes cause a violent and rapid shaking of the ground, which can severely damage a dam, causing it to fail.

Historical Assessment

Fortunately, there have been few dam failures in Connecticut. The most recent severe dam failure incident in southern Connecticut occurred in 1982. During a period of heavy rain over the weekend of June 5th and 6th, 1982, flooding throughout the state resulted in 17 dam failures and severe damage to another 31 dams. The total cost from this event was approximately $70 million.

Only one significant dam failure event has

Table 3.34 High hazard dams in the Region. Source: CT DEEP

SIGNIFICANT & HIGH HAZARD POTENTIAL DAMS

Dam Name	Downstream Watercourse	Town	Class
Lake Forest Dam	Island Brook	Bridgeport	C
Bunnells Pond Dam	Pequonnock River	Bridgeport	C
Island Brook Lagoon Dam	Island Brook	Bridgeport	C
Popps Mountain Dike	Saugatuck River	Easton	C
Easton Reservoir Dam	Mill Brook	Easton	C
Hemlock Reservoir Dam	Cricker Brook	Fairfield	C
Samp Mortar Reservoir Dam	Mill River	Fairfield	C
Stevenson Dam	Housatonic River	Monroe	C
Beaver Dam Lake Dam	Pumpkin Ground Brook	Stratford	C
Canoe Brook Lake Dike	Horse Tavern Brook	Trumbull	C
Canoe Brook Lake Dam	Canoe Brook	Trumbull	C
Canoe Brook Lake East Dike		Trumbull	C
Pinewood Lake Dam	Booth Hill Brook	Trumbull	C
Aspetuck Reservoir Dam	Aspetuck River	Easton	B
Brewster Pond Dam	Long Brook	Stratford	B

occurred in the Region. According to the National Performance of Dams Program (NPDP), on July 29, 1905 a cloudburst produced 11.32 inches of rain in 17 hours. Four dams in the Pequonnock River watershed (Berkshire Mill Dam, Toucey Dam, Ward's Mill Dam, and Bunnell's Lower Reservoir Dam) were affected. The Berkshire Mill Dam was undermined. The Toucey Dam in the Long Hill section of Trumbull breached and contributed to the failure of the Ward's Mill Dam downstream. Reports to the NPDP suggest that the Ward's Mill Dam probably failed by sliding on ledge. The combined damage contributed to the collapse of the Bunnell's Lower Reservoir Dam (used for public water supply) downstream. The collapse at Bunnell's Dam was due in part from overflow caused by blockage of the spillway by debris. The resulting floodwaters damaged several bridges, impeded traffic, and damaged ships at the mouth of the river. According to contemporary reports, the tide was at ebb

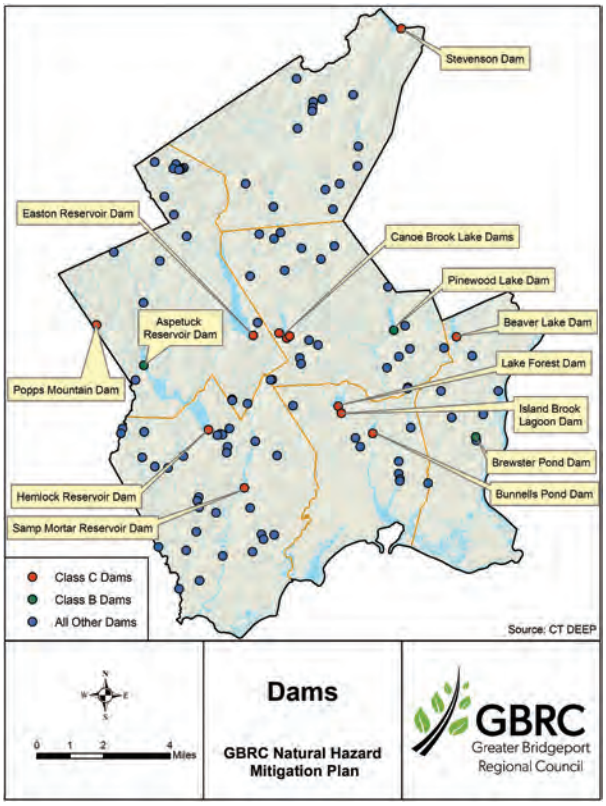


Figure 3.23: Dams in the Region. Source: CT DEEP

stage when the floodwave reached the mouth of the river which minimized damage to shipping. Total damages were estimated at $250,000, or $7.2 million in 2018 dollars.

Flooding from the September 25, 2018 storm washed out a small dam along Sasco Brook in Fairfield. A photo of the dam taken by Town staff is provided below.

Hazard Probability

Since the failure of a dam can occur without warning, there is no particular season that is more susceptible to dam failures than another. However, dams are at a greater risk of failure during heavy rain events as overtopping is a major cause of dam failure. To mitigate the potential hazards, the CTDEEP requires dams to be routinely inspected and those that have a higher hazard potential are inspected more frequently. Therefore, the likelihood of a dam failure impacting the Region is low.

CTDEEP and state regulations also require dams that are repaired or reconstructed to be designed to handle at least a 100-year rainfall event with at least one foot of freeboard. The dam safety statutes are codified in Section 22a-401 through 22a-411 inclusive of the Connecticut General

Minor Dam Washed Out along Sasco Brook.
Photo by Brian Carey, Town of Fairfield

Statutes. Sections 22a-409-1 and 22a-409-2 of the Regulations of Connecticut State Agencies, have been enacted which govern the registration, classification, and inspection of dams. Dams must be registered by the owner with CT DEEP, according to Connecticut Public Act 83-38.

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, CT 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 CT DEEP Commissioner is empowered by statute to remove or correct, at the expense of the owner, any unsafe structures which present a clear and present danger to public safety.

Important dam safety program changes occurred in Connecticut while the previous edition of this plan was being developed in 2013. Public Act No. 13-197, An Act Concerning the Dam Safety Program and Mosquito Control, passed in June 2013 and described new requirements for dams related to registration, maintenance, and emergency action plans (EAPs) moving forward. This act required owners of certain unregistered dams or similar structures to register them by October 1, 2015. The act generally shifted regularly scheduled inspection and reporting requirements from the CTDEEP to the owners of dams. The act also made owners responsible for supervising and inspecting construction work and established new reporting requirements for owners when the work is completed.

Effective October 1, 2013, the owner of any high or significant hazard dam (Classes B and C) was required to develop and implement an EAP after the Commissioner of DEEP adopts regulations. The EAP must be updated regularly, and copies must be filed with DEEP and the chief executive officer of any municipality that could potentially be affected in the event of an emergency. The new regulations were adopted in 2016 and subsequently established the requirements for EAPs, including (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.

Risk Assessment

As listed above, there are 13 Class C dams in the Region. These dams are considered to cause the greatest risk to life and property upon failure. Fortunately, the majority of dams in the region are well-maintained and the risk of failure is low. The overall risk of failure is likely to increase in the future due to the expected increased incidence of flooding due to the effects of climate change.

The following describes the land uses and hazards associated with each:

Bridgeport – Three Class C Dams

Bunnells Pond Dam

Impounds the Pequonnock River and creates an approximate 47-acre pond, located in Beardsley Park. The lake and dam are owned by the CT DEEP. Downstream of the dam is Glenwood Park, an active recreation area that includes tennis courts and ice skating facility. Farther downstream is the commercial area along US Route 1, as well as, densely populated residential neighborhoods. The dam was built in 1906 and is an earthen structure with a concrete spill-lay.

Lake Forest Dam

Impounds Island Brook and creates a privately owned lake with a surface area of about 66 acres.

The lake is surrounded by single family residential neighborhoods on relatively small lot sizes. Downstream is the Island Brook Lagoon, another impoundment of Island Brook that would be impacted by a failure of the Lake Forest Dam.

Island Brook Lagoon Dam

Impounds Island Brook and creates a small, privately owned lake, with a surface area of about five acres. It is surrounded by single family residential neighborhoods on relatively small lot sizes.

Easton – Two Class C Dams

Easton Lake Reservoir Dam

Impounds the Mill River to create the Easton Lake Reservoir, a public water supply reservoir. It is owned and maintained by the Aquarion Water Company. The dam is constructed of concrete and the reservoir has a surface area of about 488 acres. The area directly downstream of the reservoir is made up of sparsely developed residential land uses, consisting of single family homes on at least one-acre lots. Farther downstream, the residential patterns become denser but remain single family residential.

Popps Mountain Dam (Dike)

This dam is located on the Saugatuck Reservoir about 2,000 feet northeast of the main dam (Samuel P. Senior Reservoir Dam) that impounds the Saugatuck River to create the reservoir. The outflow from the dam drains primarily into the Town of Weston and undeveloped portions of Easton. The surface area of the Saugatuck Reservoir is about 827 acres. The dike is a concrete structure.

Fairfield – Two Class C Dams

Hemlock Reservoir Dam

Impounds the Cricker Brook to create the Hemlock Reservoir, a public water supply reservoir. It is owned and maintained by the Aquarion Water Company. The dam is constructed of concrete and the reservoir has a surface area of about 437 acres. The area directly downstream of the reservoir is low-to-medium dense residential development, consisting of single family homes on at least one-acre lots. Cricker Brook flows from the dam into Samp Mortar Reservoir. Farther downstream, the residential patterns become denser but remain single family residential.

Samp Mortar Reservoir Dam

Impounds Cricker Brook, entering on the west side, and the Mill River, entering from the north. The lake formed by the dam is owned and maintained by a private association. Residences line the banks of the Samp Mortar Reservoir, and land use downstream of the dam is moderately dense residential. The total surface area is about 35 acres.

Monroe – One Class C Dam

Stevenson Dam

Impounds the Housatonic River to create Lake Zoar. The concrete dam is owned and maintained by First Light Power Resources, and used for hydroelectric power generation. The area immediately downstream is largely undeveloped; although the Housatonic River is a very significant recreational resource, and numerous riverfront structures are present a short distance downstream from the dam in Derby and Shelton. Route 34, a main artery between New Haven and Newtown, is located on top of the dam.

Stratford – One Class C Dam:

Beaver Dam Lake Dam

Impounds the Pumpkin Ground Brook and creates Beaver Dam Lake, a private lake in the northwest corner of Stratford. It has a surface area of about 58 acres. The shoreline is sparsely developed and the large Roosevelt Forest is to the east of the lake. Downstream, land use patterns become medium density, single-family residential. The Trumbull Corporate Park lies downstream and just east of the dam.

Trumbull – Four Class C Dams

Canoe Brook Lake Dike

Impounds the Horse Tavern Brook and creates Canoe Brook Lake, a private lake in the northwest part of Trumbull. It has a surface area of about 64 acres. The lake and dike are owned and maintained by an association of property owners living on and near the lake. The shoreline is lined with homes on large lots and houses are setback from the edge of the water. The dike is located on the south edge of the lake and Canoe Brook Road is on top of the dike. Downstream, land use patterns are primarily medium density, single-family residential. Horse Tavern Brook flows into the land now occupied by the Westfield/Trumbull Shopping Park, about 1.2 miles downstream of the dike.

Canoe Brook Lake Dam

Impounds the Canoe Brook, entering Canoe Brook Lake (described above) on the west side. Land use on this side of the lake is more sparsely developed than downstream of the Canoe Brook Lake Dike along Horse Tavern Brook, although it is exclusively residential.

Canoe Brook Lake Dike, East Dike

This dike is located along the east side of Canoe Brook Lake (described above). Land use on this side of the lake consists of single-family residential homes on small-to-medium sized lots – one-half to one acre.

Pinewood Lake Dam

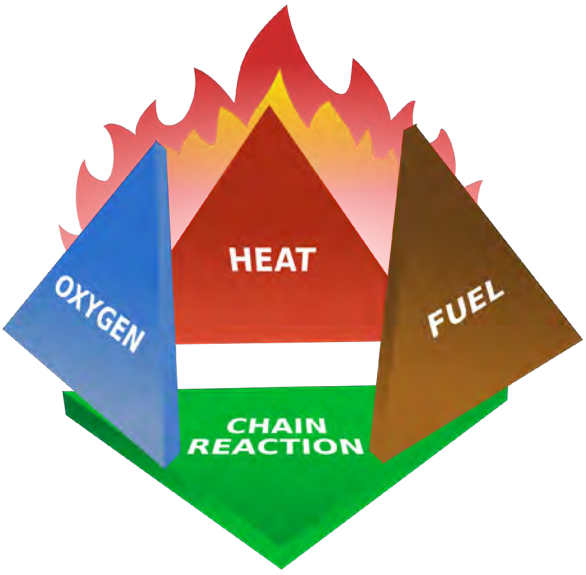
Impounds the Booth Hill Brook and creates Pinewood Lake, a private lake in the southeast part of Trumbull. It has a surface area of about 60 acres. The lake and dike are owned and maintained by an association of property owners living on and near the lake. The shoreline is lined with homes on large lots and houses are setback from the edge of the water. The dike is located on the south edge of the lake and West Lake Road runs along the top of the dike. Downstream, land use patterns are primarily medium density, single-family residential. Booth Hill Brook flows into Twin Brooks Park and joins the Pequonnock River.

3.12 Hazard Profile – Wildfires

Setting

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.

Wildfires typically occur in undeveloped rural or forested areas although smaller fires can also occur along highway medians. Wildfire damage is typically greatest at the wildland-urban interface where low-density suburban/rural developed areas border undeveloped wooded and shrubby areas. 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. Unlike the other hazards described in this Plan, the likelihood of damage due to wildfires in Connecticut typically decreases with increasing population density,



meaning that less developed communities such as Easton have a greater risk than heavily developed communities such as Bridgeport.

Hazard Assessment

Wildfires are also known as "wildland fires." Wildfires are any nonstructural 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.

According to the National Fire Protection Agency, fuel, heat, oxygen, and an uninhibited chain reaction (known as the fire tetrahedron) must be present in order to have any type of fire.

The CTDEEP Forestry Division 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 National Weather Service 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.

Historical Assessment

According to the CTDEEP 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.

In 1999, the State was faced with a busy wildfire year due to drought conditions. The State's 2014 NHMP Update notes that the worst year for wildland fires in the past decade was 2012 when 577 separate fire events occurred throughout the state. The 2016 drought also exacerbated wildland fires, with over 900 acres burned in the state during that year (Table 3.35).

Hazard Probability

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.

There are three fire seasons in Connecticut. The spring season runs from mid-March to mid-May. Prior to leaf-out, fuels such as grasses, dead leaves, branches, and twigs on the forest floor are heated and dried out by the sun. These fuels cause spring fires that tend to spread quickly although they tend to cause little long-term damage to the forest. The summer fire season lasts from mid-May through September and is largely dependent on precipitation, or lack thereof. Summer fires tend to spread less quickly than spring fires because they burn deeper into the ground. However, the burning of organic material in the soil makes summer fires more difficult to suppress. Summer fires are the most destructive to vegetation. Consequently, erosion usually follows summer forest fires. The fall fire season runs from October through the first snowfall. Fall fires can spread rapidly because of drying leaves that have fallen.

Fire 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 4,975 acres of land burned in Connecticut from 2002 through 2018 due to 2,931 nonprescribed wildfires, an average of 1.7 acres per fire and 293 acres per year (Table 3.35).

The CTDEEP Forestry Division estimated the average acreage burned per year statewide to be much higher (1,300 acres per year) in the 2014 Connecticut NHMP Update. In general, 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 180 fires per year from 2002 to 2017, or slightly more than one fire per Connecticut municipality per year), wildfires are a hazard communities must prepare for each year.

Based on the historic record, the average wildfire in Connecticut in a very dry year (1999) burned an average of 5 acres per fire while the average acres burned per fire has been 1.7 acres per year since 2002. These averages are also reasonable for the MetroCOG Region although it is expected that larger wildfires could occur, particularly in relatively undeveloped areas such as parts of Easton and Monroe.

Risk Assessment

The overall risk in the MetroCOG Region from wildfires is relatively low. The CTDEEP 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. Forest fires can cause not only long-term damage to vegetation and ecosystems but also damage to developments, especially as residential development has increased in woodland areas.

According to the 2010 USDA report *Wildland-Urban Interface of the Conterminous United States,* 65.6% of Connecticut lies in areas of wildland-urban interface. This area further includes 53.8% of all housing structures and 53.9% of the state's population. According to the mapping in this

Table 3.35: Wildland Fire Statistics for Connecitcut
Source: National Interagency Fire Center

Year	Number of Wildland Fires	Acres Burned	Number of Prescribed Burns	Acres Burned	Total Acres Burned
2018	52	40	0	52	40
2017	97	243	3	31	274
2016	268	778	3	152	930
2015	76	159	4	25	184
2014	28	69	4	34	103
2013	76	238	4	37	275
2012	180	417	4	42	459
2011	196	244	7	42	286
2010	93	262	6	52	314
2009	264	246	6	76	322
2008	330	893	6	68	961
2007	361	288	7	60	348
2006	322	419	6	56	475
2005	316	263	10	130	393
2004	74	94	12	185	279
2003	97	138	8	96	234
2002	101	184	13	106	290
Total	**2,931**	**4,975**	**103**	**1,192**	**6,167**

report, the coastal area of the MetroCOG region is generally considered outside of the wildland-urban interface and not prone to wildfires. The Town of Easton and Monroe as well as northern Fairfield and Stratford, and portions of Trumbull are located in the wildland-urban interface. These general risk areas were used to estimate vulnerable assets as presented in Tables 3.3 through 3.8.

Estimates of annualized loss have been determined based on data presented in the 2014 Connecticut Natural Hazard Mitigation Plan Update as presented in Table 3.9. The inverse of the population density of each town 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 2014 state plan). An estimated average cost of $2,000 per event was used to determine costs. This method generally allows for larger annualized 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 MetroCOG Region due to wildfires are relatively modest.

The State Water Plan (2018) climate models suggest increased summer temperatures and longer dry periods in the summer months. This suggests that climate change will contribute to lower summer groundwater levels and drier soil conditions that will make the region more susceptible to wildfires in the future.

3.13 Hazard Summary

NOTE: Hazards Summary presented on the next page.

HAZARDS SUMMARY

Hazard Type	Historical Extent	Probability of Future Occurence	Impacts	Vulnerable Areas
Hurricanes	Category 3 hurricane was strongest storm to strike Connecticut	• Tropical cyclone every 3.6 yrs • Cat 1 every 10-15 yrs • Cat 2 every 23-30 yrs • Cat 3 every 46-74 yrs	Loss of life, building damage, essential facility damage, debris, people requiring shelter, transportation disruption, loss of power, economic loss	Low-lying areas in or near flood zones vulnerable to inland flooding from rain; coastal low-lying areas vulnerable to coastal flooding and storm surge
Inland Flooding	The 1955 flood was estimated to be a 2% to 0.2% event for the region	Moderate to extreme flooding occurs at a fairly frequent rate. Based on historical record from 2000-2012 it suggests one such storm happens every year.	Loss of life, building damage, essential facility damage, debris, people requiring shelter, transportation disruption, economic loss, breach of dams	Low lying areas nears streams; especially those in the 1% and0.2% flood zones. Certain areas are more susceptible due to local conditions such as poor drainage.
Coastal Flooding	Category 3 hurricane was strongest storm to strike Connecticut creating largest storm surge	Based on historical record moderate to severe coastal flooding occurs once every three to four years	Loss of life, building damage, essential facility damage, debris, people requiring shelter, transportation disruption, economic loss	Low lying coastal areas especially those in FEMA 1% and 0.2% flood zones
Sea Level Rise	Relative sea level rise has been between 15-30 cm (~6-12 in) over last 100 years	IPCC reports 9-88cm (~3.5 to ~34.5 in) by 2100; CIRCA planning number of 0.5 m by 2050	More damage from coastal and inland flooding events	Low lying coastal areas especially those in FEMA 1% and 0.2% flood zones
Winter Storms	Recent storms have dropped up to 36 in of snow in the Region	Based on historical record severe winter storms occur once every 1.2 years in the Region	Transportation disruption, loss of power, moderate building damage, loss of life especially to at risk populations such (elderly/ disabled)	• Entire region • More rural areas where road clearing is more difficult and loss of power leads to loss of water
Summer Storms and Tornadoes	Most severe tornado in history was EF-2	Based on historic record tornadoes hit Region once every 15 years	Building damage, vehicular damage, debris, people needing shelter, power loss and downed trees, loss of life from lightning strikes and tornadoes	Entire region
Earthquakes	Magnitude 5 earthquakes have occurred historically in the State	Low probability of significant event	Loss of life, building damage, essential facility damage, debris, people requiring shelter, transportation disruption, economic loss, fires	Entire region
Dam Failure	Failure of a class C dam	Low probability but could occur during large rain events	Loss of life, building damage, essential facility damage, debris, people requiring shelter, transportation disruption, economic loss	Low lying areas downstream of dams
Wildfire	Undeveloped areas	Low probability for damaging fires	Building damage, debris, smoke, loss of life, people requiring shelter, economic loss	Structures near the urban-wildland interface

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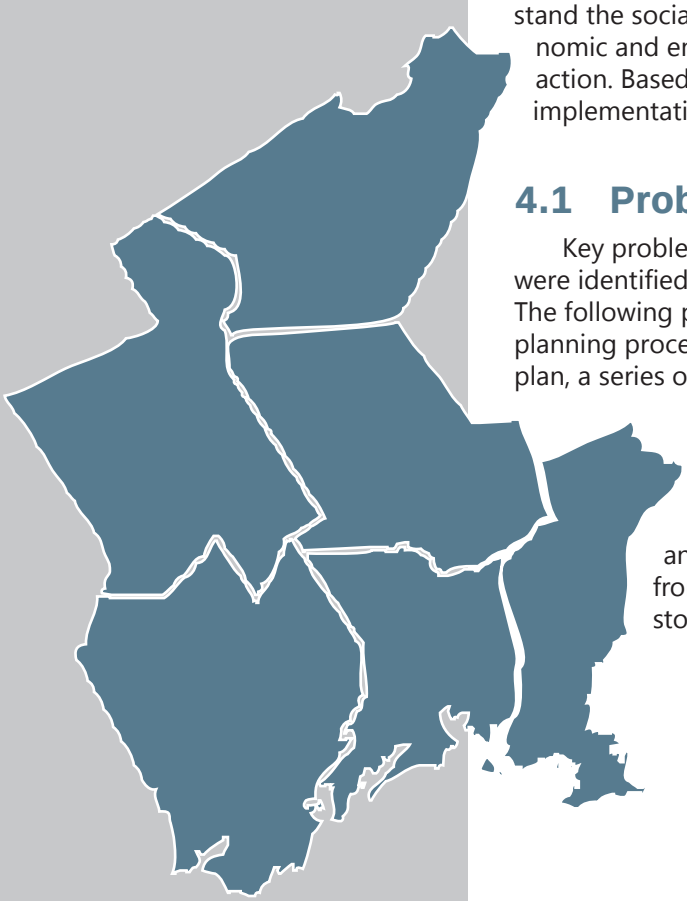
4 Mitigation Strategies

The previous section profiled hazards in the region and the impact, extent and probability of the hazard. Risks were assessed by data collection, research of past events, GIS and HAZUS-MH analyses and the planning process described in Section 2. The risk assessment was utilized to identify assets most vulnerable to specific hazards. As a result of these assessments, problem statements were developed to inform the formulation of goals and objectives and to determine mitigation actions.

The NHMP discusses mitigation actions at both the regional and local scale.

These recommended mitigation actions are a reflection of the risk and vulnerability assessments, problem statements and the Plan's goals and objectives. Regional mitigation actions address the challenges posed by hazards throughout the region, while local mitigation actions address the unique impacts of a hazard on a municipality or neighborhood. As this plan is an update to the 2014 NHMP, past mitigation actions were reviewed to determine whether they had been implemented, their effectiveness and their current applicability to the region or respective community. Those actions that are ongoing from the 2014 plans or that still must be implemented are included as mitigation actions for this update.

A cost benefit review tool, STAPLE+E was utilized to understand the social, technical, administrative, political, legal, economic and environmental costs and benefits of each mitigation action. Based on this review, actions were prioritized for future implementation.



4.1 Problem Statements

Key problem areas and critical issues for each municipality were identified through the risk and vulnerability assessments. The following problem statements were formed through the planning process and were utilized to develop a vision for the plan, a series of goals and objectives and mitigation actions.

City of Bridgeport

- Low lying neighborhoods and streets – Black Rock, Downtown, the East End, East Side and South End – are susceptible to coastal flooding from excessive storm surge from hurricanes, tropical storms, extratropical storms, and nor'easters.

- Vulnerable and at risk populations, including low income, minorities, persons with limited English proficiency, elderly and disabled persons disproportionately live in flood prone areas.
- Housing stock in areas at risk of coastal flooding from extreme weather is older and less able to withstand the forces of storm surges.
- Seaside Village, a housing cooperative, is at risk from severe flooding and has barriers to mitigation such as a complex combined sewer system and historic status.
- Several coastal features are vulnerable to damage from extreme weather, including Ash Creek, Seaside Park, Pleasure Beach and Johnson's Creek.
- Access to some parts of the City can be cut-off due to flooding, especially at underpasses of the Metro North New Haven Line and Interstate 95.
- Despite many years of planning and studies, flood risks remain present along confined urban watercourses such as Ox Brook, Island Brook, and the headwaters of Yellow Mill Channel.
- The City operates two wastewater treatment plants, both of which are located in flood hazard areas and flooding can cause overflows of waste water and pollution to enter Long Island Sound.
- Several sections of the City are served by combined sewer systems. These combined systems can be overwhelmed by excessive runoff from heavy rain events and cause overflows of wastewater from the sewage treatment plants.
- The City operates Reverse 9-1-1 and Everbridge systems to notify residents about approaching extreme weather or mandatory evacuation orders, but reaching those with limited English proficiency remains a challenge.
- Schools are used as emergency shelters. The schools are appropriate for short term shelter needs but are not appropriate for long term use as shelters, especially for people with medical needs.

When the prior edition of this plan was being developed in 2014, the City of Bridgeport and State of Connecticut were in the final stages of the design competition known as Rebuild by Design. The award for the City of Bridgeport was announced in 2014. The next year, the City and State of Connecticut participated in the National Disaster Resilience Competition, which also resulted in an award. As of 2019, the State of Connecticut is actively working toward implementation of the two awards, now known as "Resilient Bridgeport."

Resilient Bridgeport is a collaborative, integrative approach to coastal resiliency in the City. The project is funded by the United State Department of Housing & Urban Development through the Community Development Block Grant - Disaster Recovery (CDBG-DR) and National Disaster Recovery (CDBG-NDR) Programs. The funding is being administered by the Connecticut Department of Housing (DOH) and includes various other leveraged state and federal funds. Refer to the fact sheet on the next page for more information about the program. When executed, Resilient Bridgeport will provide flood protection to a large part of the City's South End.

Town of Easton

- A large proportion of Easton is forested and excessive damage and downing of limbs and trees occurs from severe winds. Downed trees cause power disruptions throughout the Town and restricts access to residential neighborhoods. Because of the development patterns in Easton, few alternate routes around downed trees exist, effectively isolating impacted areas.
- A water purification and filtration plant is located at the base of the Easton Lake Reservoir. The Region's public drinking water supply could potentially be severely limited if the plant is damaged during an extreme storm.

Town of Fairfield

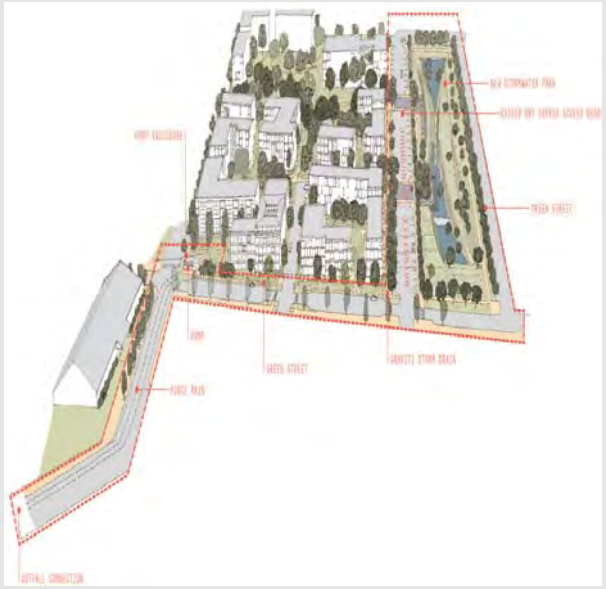
- Coastal flooding from excessive storm surge from hurricanes, tropical storms, extra-tropical storms, and nor'easters is a problem for areas of Fairfield south of US Route 1, especially the area just north of Fairfield Beach and Jennings Beach (and behind Fairfield Beach Club), which sits in a basin. Flood waters that over top the dunes or overflow from Ash Creek collect in the area as well. Sand deposited by the flood waters clogs storm drains, and water needs to be pumped.
- Coastal infrastructure, including roads, coastal shoreline protection elements, and water

NEW INITIATIVES

RESILIENT BRIDGEPORT

Above: Heavy street flooding in Bridgeport, CT Post

Below: Rebuild by Design project with stormwater park and elevated road for dry egress, Resilient Bridgeport



FOR MORE INFORMATION

Rebecca French, Ph.D.
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Connecticut Department of Housing
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ResilientBridgeport.com

WHAT IS THE INITIATIVE?

Resilient Bridgepoint is a collaborative, integrative approach to coastal resiliency in the City of Bridgeport. The project is funded by the Federal Department of Housing and Urban Development (HUD) Community Development Block Grant Disaster Recovery (CDBG-DR) and National Disaster Recovery (CDBG-NDR) programs, as part of the Connecticut Department of housing Sandy Recovery and National Disaster Resilience programs as well as leveraged state and federal funding.

Overall, the project provides a framework that can be implemented in the city, and that can also be used as a model by other areas in Bridgeport and other cities in the region.

In addition to the framework, a pilot project has been designed for the South End of Bridgeport. The project includes multiple elements:

- The Rebuild by Design project to provide stormwater management and dry egress for public housing in the South End
- Flood Risk Reduction on the east side of the South End consisting of a coastal flood defense system to reduce risk from acute storms; and a combination of green infrastructure, pump station, and stormwater management solutions to address chronic flooding
- A Resilience Center to educate and facilitate increased resiliency within the community

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

The City of Bridgeport and the other coastal municipalities in the MetroCOG region are heavily developed along the majority of the coastline. As a result, resiliency strategies are being considered and tailored to individual communities' issues and needs.

The Resilient Bridgeport project aims to serve as a multifaceted solution to flooding in the South End, as well as an example to surrounding communities on resiliency strategies that can be implemented. By addressing the flooding issues in the South End, future storm impacts can be reduced, and public space and private property can ultimately benefit from the runoff reduction strategies to be constructed.

MetroCOG communities, and others in the region, are facing increasing challenges as sea levels rise and storms become more intense. Projects such as this will hopefully provide long term relief to the community, and the to the diverse resources the city has to offer.

and sewer infrastructure are at risk of coastal flooding, coastal erosion, and sea level rise.
- The Pine Creek area is protected by a dike system, but recent events indicate a need to raise the height of the dikes.
- Fairfield's wastewater treatment plant is located in a flood hazard area. The berm that protects the facility from flooding needs to be raised. This project is underway.
- The northern part of Fairfield is forested and excessive damage and downing of limbs and trees occurs from high winds and heavy snow fall. Downed trees cause power disruptions throughout the area and restricts access to these residential neighborhoods. Because of the development patterns in this part of the Town, few alternate routes around downed trees exist, effectively isolating impacted areas.
- The severe storm of September 25, 2018 was a stark reminder that property owners are at risk of damaging riverine floods, especially along the Rooster River.
- Undersized culverts and low lying rail underpasses create chokepoints that cause isolated flooding in several areas. The most prominent is the culvert that carries Ash Creek under Interstate 95. The neighborhood north of this location experiences recurring flooding from even moderate intensity storms.
- The October and November 2018 storms caused surprising flood levels in Fairfield.

Town of Monroe

- The Town is susceptible to power disruptions from downed trees. Extensive tree coverage exists, especially in proximity of road rights-of-way. Damage and downing of limbs and trees occurs from high winds and heavy snow fall. Downed trees also restrict access to residential neighborhoods, effectively isolating impacted areas.
- Undersized culverts cause flooding at several locations, including along Route 25 in the vicinity of the West Branch of the Pequonnock River and the diversion to the Easton Lake Reservoir.
- Inland flooding occurs along the Pequonnock River behind Bart Shopping Plaza on Route 25 and behind Chuck's Corner on Route 25 near Purdy Hill Road.
- Alternate power generation at the high school needs to be addressed.

Town of Stratford

- Coastal flooding from excessive storm surge from hurricanes, tropical storms, extratropical storms, nor'easters, and heavy rain events during high tide is a problem for the South End neighborhood. This area also includes an industrial and commercial district located along Route 113. The adjacent Lordship area does not experience as much flooding from storms because it is a coastal upland with an elevation above base flood heights. However, the neighborhood can become isolated as access is cut-off by flood waters.
- Stratford's wastewater treatment plant is located in a flood hazard area. The berm that protects the facility from flooding has been sufficient, preventing the facility from being flooded. However, the berm needs to be raised to protect the plant against the newly calculated flood zone elevation and increased storm surges. The nearby animal shelter is also floodprone.
- A number of sewage pump stations are located in flood prone areas, and need to be protected.
- During thunderstorms and heavy rain events over a short period of time, inland flooding occurs in the South End, under railroad viaducts and along several smaller brooks and streams, especially in the Stratford Center area, Oronoque Village and along Bruce Brook and Raven Brook. These streams become overwhelmed by excessive runoff from heavy rain events. Several sections have been channelized and the structures exacerbate the flooding potential.
- Wind causes tree limbs to fall, block roads and cause power outages. The urban tree canopy of the Town is composed of many older trees and some species are not suitable for their locations.
- With limited options for addressing flooding from severe rain events, the Town is interested in siting green infrastructure. A study is needed to determine where it would be effective.

Town of Trumbull

- Inland flooding is a problem for areas of Trumbull along the Pequonnock River. Recurring problem areas include Trumbull Center

in the vicinity of Daniels Farm Road, the Twin Brooks Park area and west of Route 127 south of the Unity Park area.
- Trumbull does not operate its own wastewater treatment facility. Instead, sewage is collected by a sanitary sewer system that connects to the treatment plants located in Bridgeport. Because of the topography of Trumbull, pump stations are located throughout the Town. Many of these are located in flood hazard areas.
- There are three Class C dams located in Trumbull, and the failure of these structures would greatly impact residential neighborhoods downstream of the impoundments.
- Most streets throughout the Town are lined by mature trees that are susceptible to damage from high winds and heavy snow fall. Downed trees cause power disruptions throughout the Town and restricts access to some residential neighborhoods. The Town public works personnel can clear debris but must coordinate efforts with the utility company to ensure power to any downed lines has been deactivated.
- Undersized culverts create chokepoints that cause isolated flooding in several areas. Problem areas include: Daniels Farm Road over the Pequonnock River, Lake Avenue over the inlet to Canoe Brook Lake and Melrose Avenue over Island Brook.
- Like in Fairfield, the September 25, 2018 storm was a stark reminder that property owners are at risk of damaging riverine floods.
- The Town is planning to conduct a town wide Comprehensive Drainage and Flood Conveyance Study.

MetroCOG Region

Since the adoption of the 2014 NHMP Plan Update, MetroCOG has participated in a variety of regional resilience planning efforts. These efforts include:

- "Resilient Regional Framework for Coastal Resilience in Southern Connecticut" (2015-2017): The project was funded by the National Fish and Wildlife Foundation (NFWF) through a grant to the South Central Regional Council of Governments (SCRCOG). SCRCOG administered the grant and partnered with MetroCOG and The Nature Conservancy (TNC) to execute the project. The goal of the Regional Framework for Coastal Resilience was to foster collaboration among the ten participating municipalities (including Bridgeport, Fairfield, and Stratford in the MetroCOG Region) to identify and pursue green infrastructure and green coastal projects that would reduce risks to people and infrastructure. Through this collaboration, there was an assessment and advancement of opportunities to reduce risk from large-scale storm events, and increase the viability and resiliency of natural ecosystems along approximately thirty percent of Connecticut's coastline. Refer to the fact sheet on the next page for more information about the effort, as well as its outcomes.
- "Resiliency Planning for Historic & Cultural Resources" (2016-2018): Recognizing that historic and cultural resources are increasingly at risk to natural hazards and climate change, the State Historic Preservation Office (SHPO) conducted this planning initiative for the communities of Bridgeport, Fairfield and Stratford. 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. Refer to the Fact Sheet on the next page for more information about the effort, as well as its outcomes.

Statewide Efforts

In addition to MetroCOG's Regional efforts, the State of Connecticut and various state agencies have also advanced numerous hazard mitigation and resilience efforts since MetroCOG's 2014 NHMP Update. Fact sheets for five initiatives follow this page. Brief information is provided below:

- In 2014, the Connecticut State Colleges & Universities (CSCU) began a process to develop a Multi-Campus Hazard Mitigation Plan for each of the CSCU campuses. The purpose of the CSCU Multi-Campus Hazard Mitigation Plan is to institute a consistent hazard mitigation planning approach across

NEW INITIATIVES

REGIONAL FRAMEWORK FOR COASTAL RESILIENCE

Above: ArcGIS Online viewer, Regional Framework for Coastal Resilience
Below: Conceptual design for dune ridge in Fairfield

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WHAT IS THE INITIATIVE?

The Towns of Fairfield and Stratford and the City of Bridgeport participated in the "Regional Framework for Coastal Resilience in Southern Connecticut" in 2015-2017. The project was funded by the National Fish and Wildlife Foundation (NFWF) through a grant to the South Central Regional Council of Governments (SCRCOG). SCRCOG administered the grant and partnered with MetroCOG and The Nature Conservancy (TNC) to execute the project.

The goal of the Regional Framework for Coastal Resilience was to foster collaboration among the ten participating municipalities to identify and pursue green infrastructure and green coastal projects that would reduce risks to people and infrastructure, if implemented. Through this collaboration, there was an assessment and advancement of opportunities to reduce risk from large-scale storm events, and increase the viability and resiliency of natural ecosystems along approximately thirty percent of Connecticut's coastline.

The project began with a planning phase in 2015, continued through an engagement and design phase in 2016, and concluded with report and plan publication in 2017. The project web page can be found at https://scrcog.org/regional-planning/coastal-resilience/

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Approximately 120 individual coastal and non-coastal green infrastructure or gray-green resilience projects were identified in the three-town area of Fairfield, Bridgeport, and Stratford. Many of the projects were captured from the Greater Bridgeport Hazard Mitigation Plan Update (July 2014) and re-cast as potential green or green-gray projects.

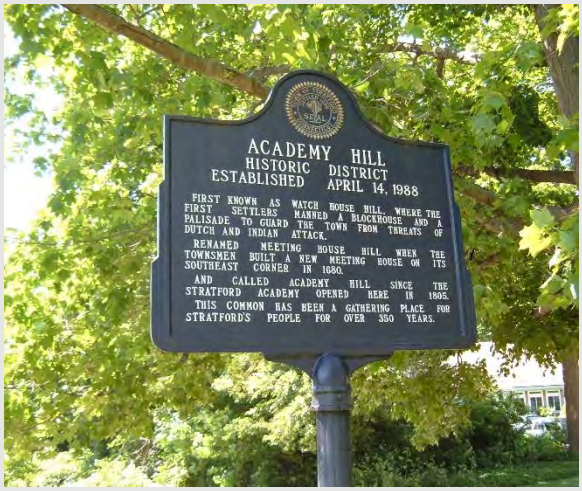
Some of these potential projects included beach nourishment, dune creation or restoration, incorporating living shorelines along the coast, using bioengineered coastal bank stabilization techniques, and constructing rain gardens in non-coastal areas. One conceptual design for each municipality was produced. Fairfield's design was a dune ridge creation (pictured to the left). Bridgeport's design was a living shoreline at Johnsons Creek. Stratford's design was a bioengineered coastal bank stabilization near Russian Beach in the Lordship area.

The Regional Framework for Coastal Resilience provided numerous potential projects that are closely aligned with the goals of hazard mitigation, and some of them were incorporated into the mitigation strategy of this plan.

NEW INITIATIVES

MITIGATION OF RISKS TO HISTORIC RESOURCES

Freeman House
Photo Weafer Design



Academy Hill Historic District
Photo Liz Davis

FOR MORE INFORMATION

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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

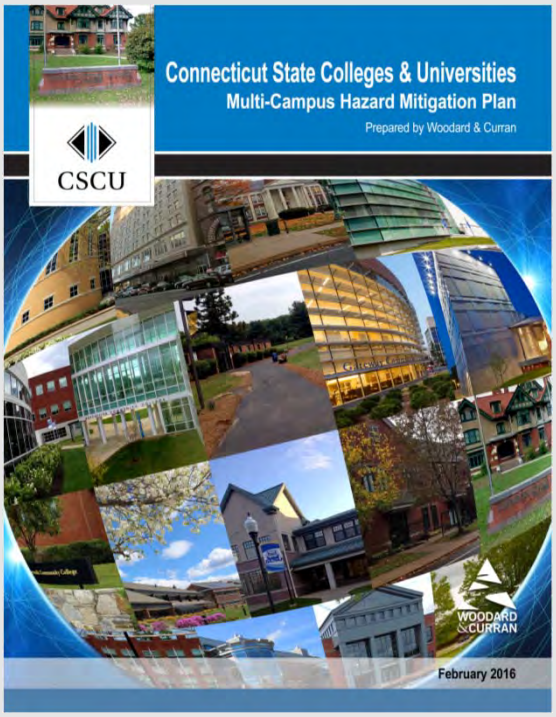
SHPO has produced three sets of resources that can be used to inform hazard mitigation planning:

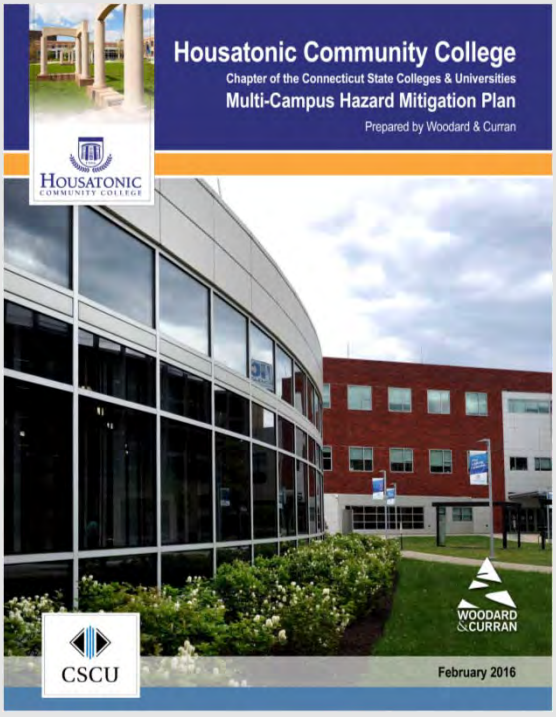
- Individual reports produced for coastal communities include detailed recommendations that are application in the Capitol Region.
- A best practices guide for planning techniques to make historic resources more resilient was completed in 2017 and will be made available in 2018.
- The State Historic Preservation Plan is being updated and will provide 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 as a mitigation action that each MetroCOG municipality should conduct a survey of potential historic resources in cooperation with SHPO.

NEW INITIATIVES

CONNNECTICUT 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 for each of the CSCU campuses to fulfill federal, state, and local hazard mitigation planning requirements. The purpose of the CSCU Multi-Campus Hazard Mitigation Plan 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 its susceptibility to many types of natural hazard events to its campuses, assets, and people involved in its operations. Major activities involved in the development of this plan consisted of 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.

Housatonic is a two-year public community college located at 900 Lafayette Boulevard in the City of Bridgeport. Housatonic currently serves an eleven-town area in southwestern Connecticut and offers 40 associates degrees in arts and sciences and 24 certificates through the departments of Humanities, Mathematics and Science, Behavioral and Social Sciences, Business and Computer Sciences, and Developmental Studies. Housatonic employs 198 full-time staff and faculty to serve an undergraduate population of 4,431 students.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

The Housatonic Community College (Housatonic) Chapter of the Multi-Campus Hazard Mitigation Plan addresses hazards, vulnerabilities, and mitigation actions specifically for the Housatonic campus. The campus is comprised of two buildings, Lafayette Hall and Beacon Hall that are both multipurpose and house academic, administrative, and instructional spaces. While the campus does not have residential buildings, commuters have easy access to Housatonic, which is located at the confluence of three major highways including Interstate 95 and Connecticut Routes 8 and 25. Distinctive to the campus is the Housatonic Museum of Art located on the first floor of Lafayette Hall, which contains an art collection valued at over $13 million. The public can view the 4,000 works of art in the collection free of charge. The museum at Housatonic is one of the largest art collections of any community college in the nation.

Mitigation actions recommended in the plan include the following:

- Increase emergency power generator capabilities on campus to cover essential services (e.g., IT, boilers, phone, laboratory refrigerators/freezers, alarms, and security cameras, repeaters).
- Evaluate & implement raising of critical infrastructure components that currently exist below flood zone elevations.
- Install green roofs to remove heat from roof surface and reduce stormwater runoff

NEW INITIATIVES

HELPING SMALL BUSINESSES MITIGATE IMPACTS OF NATURAL HAZARDS

Flooding in Downtown Fairfield
Photo Town of Fairfield

Ct.deep.gov

WHAT IS THE INITIATIVE?

In an effort to assist small business with reduction of property damage or loss due to natural hazards, CT DEEP has proposed strategies for towns to implement educational programs with recommendations for best management practices (BMPs) to prevent pollution from chemicals from getting out into the environment.

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. Damage during storm events result in property damage, loss of inventory, and environmental contamination and liabilities resulting from chemical releases into the environment.

The sample mitigation objectives for municipalities is to increase awareness by small businesses of any chemicals and toxic products they use, store and/or sell, and to use BMPs to improve safety. On a regional scale, the objectives are to improve chemical safety practices to prevent disruption of economic activity and protect the environment and public health.

Strategies for educational programs include providing information on municipal websites, social media, brochures and posters, or through workshops.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

The benefits of reducing damage to small businesses during a disaster are a reduction in property damage and losses, avoiding expensive cleanups, reducing liability and risk to public health, and a more rapid recovery and continued operations that result in less impacts to the municipality's economic base.

The municipalities of the MetroCOG Region can benefit from mitigation actions related to mitigating flood impacts to small businesses. DEEP has recommended that hazard mitigation plan strategic actions list the municipality as the lead agency, with assistance from CT DEEP, where DEEP would develop information for dissemination. Suggested action priority is on a medium scale, with a completion time frame of one year.

FOR MORE INFORMATION

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NEW INITIATIVES

LOW IMPACT DEVELOPMENT FOR RURAL RESILIENCY

Images: nrcs.usda.gov

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 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 be different than urban communities such as Fairfield (which developed a downtown green infrastructure plan). Municipalities in the MetroCOG Region such as Easton and Monroe can benefit from mitigation actions related to increasing resiliency through LID.

FOR MORE INFORMATION

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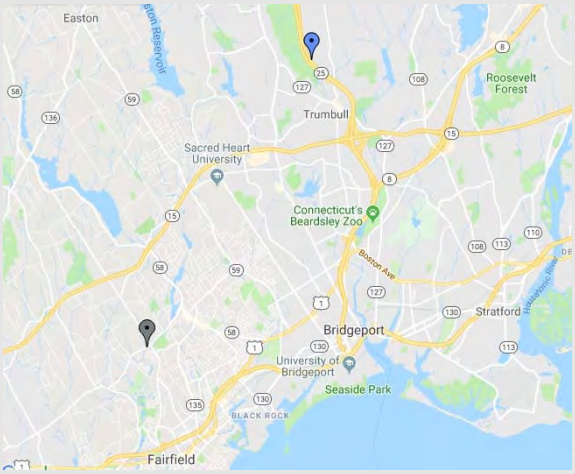
NEW INITIATIVES

"SUSTAINABLE CT"



Images courtesy of Sustainable CT

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Sustainable CT Mailing Address:
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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 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.

The town of Trumbull has registered for the Sustainable CT program, and the town of Fairfield has been Silver Certified.

NEW INITIATIVES

REVISED MUNICIPAL SEPARATE STORMWATER SYSTEM (MS4) GENERAL PERMIT

http://nemo.uconn.edu/ms4/index.htm

FOR MORE INFORMATION

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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. All municipalities in the MetroCOG 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 there 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.

all campuses and understand past and potential risks associated with natural hazard events. The Housatonic Community College campus is located in Bridgeport.

- In an effort to assist small business with reduction of property damage or loss due to natural hazards, CT DEEP has proposed strategies for towns to implement educational programs with recommendations for Best Management Practices (BMPs) to prevent pollution from chemicals from getting out into the environment.
- A joint "rural resiliency" initiative between CIRCA, Northwest Hills Council of Governments, and Northwest CT Conservation District resulted in development of a municipal-scale manual for a sustainable low impact development (LID) 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.
- Sustainable CT is a voluntary certification program to recognize resilient Connecticut municipalities. The program 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. MetroCOG worked closely with SustainableCT, housing an intern at our office in Bridgeport to assist member municipalities enrolling in the program. Currently, the Town of Fairfield and the Town of Trumbull are registered with SustainableCT, two of the 85 communities registered statewide. Fairfield, which has a Silver Certification Status in the program is one of five highest certified communities in the state. Trumbull is a participating community.
- 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 Connecticut 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. All municipalities in the MetroCOG region are required to comply. Some of the goals of the permit are well-aligned with hazard mitigation. Refer to the Fact Sheet for more information.

4.2 Vision, Goals & Objectives

The primary goal of the NHMP is to reduce the loss of life, personal injury and damage to property, infrastructure, natural, cultural and economic resources from natural disasters. This goal has remained consistent since the original 2006 NHMP.

The following vision statement was prepared by the Planning Committee and regional stakeholders in 2012-2013 to establish the goals, objectives and mitigation actions of the Plan. Goals represent the plan's long term vision for addressing the impact of and building resiliency to natural hazards throughout the Region.

Vision

"The communities of the MetroCOG Region recognize the need, in light of recent severe and extreme weather events, to increase resilience to the devastating effects of natural hazards and mitigate future impacts through adaptation of existing infrastructure, improved planning and assessment, expanded education and awareness, and proactive response to emergencies caused by natural hazards." This vision statement was deemed appropriate for the 2019 NHMP Update.

Goals

The individual goals and objectives of the NHMP cover six functional areas. Most were deemed appropriate for the plan update. A few additions were made during the public review of the 2019 draft plan. These are noted by an asterisk (*). One additional CRS related objective was also added as denoted by a pound sign (#).

Prevention

Goal

Continue pre-disaster mitigation planning that assesses impacts from natural hazards and identifies effective strategies to mitigate future events and increase hazard resiliency.

Objectives

1. Adopt and keep current the Natural Hazard Mitigation Plan.
2. Adopt and enforce nationally recognized building codes and design standards in high hazard areas.
3. Implement management practices and techniques that go beyond minimum requirements.
4. Integrate the natural hazard mitigation objectives and strategies detailed in the NHMP with local land use policies and zoning regulations.
5. Continue to participate and comply with guidelines and requirements of the National Flood Insurance Program (NFIP).
6. Improve storm water management planning and adopt policies to reduce runoff.
7. Implement "No Adverse Impact" policies.
8. Implement low impact development techniques and green infrastructure policies and design guidelines.

Property Protection

Goal

Protect buildings from the impacts of natural hazards and implement projects to safeguard against the impacts of natural hazards.

Objectives

1. Rebuild damaged buildings to meet minimum design standards so as to withstand the impacts of natural hazards.
2. Acquire repetitive loss properties, as deemed necessary.
3.* Ensure that code plus construction is considered to reduce wind damage risk during building elevation projects.

Structural and Infrastructure Projects

Goal:

Protect infrastructure from the impacts of natural hazards and implement projects (structural and infrastructure) to safeguard against the impacts of natural hazards.

Objectives

1. Rebuild damaged infrastructure and buildings to meet the minimum design standards to withstand the impacts of natural disasters.
2. Implement floodplain management techniques above and beyond minimum NFIP requirements.
3. Construct flood control measures.
4. Maintain drainage systems.
5. Increase the capacity of drainage systems, including the separation of combined sewer systems, utilization of low impact development techniques and construction of green infrastructure.
6.* Ensure that green, green/gray, and gray (hard) shoreline infrastructure are all utilized in the region as appropriate.

Natural Systems Protection

Goal

Protect and restore natural systems and features that mitigate the impact of natural hazards.

Objectives:

1. Prohibit removal of natural vegetation dunes and use of riprap along stream channels.
2. Restrict development in floodplains and sensitive coastal areas.
3. Protect and restore riverbanks, wetlands, salt marshes, and dunes.
4. Establish vegetative riparian buffers.
5. Preserve floodplains as open space and acquire floodplain lands for open space.
6. Restore and replenish beaches.
7. Implement tree trimming programs that maintain healthy and appropriate urban forest and tree canopy.

Education and Awareness

Goal

Educate residents, businesses and stakeholders throughout the region about natural hazards and increase the awareness of severe and extreme weather events.

Objectives

1. Inform residents of shelter locations and evacuation routes.
2. Encourage homeowners to purchase flood insurance.
3. Educate citizens about actions to take in the

event of extreme weather – before, during and after.
4. Educate residents on the importance of wetlands and the need for the protection and maintenance of wetlands.
5. Conduct outreach to educate and advise homeowners about risks to life, health and safety.
6. Hold workshops to facilitate dissemination of information on technical assistance programs.
7. Encourage residents and businesses to prepare for extreme weather and for actions to take when an event occurs.
8. Develop pamphlets on emergency procedures and management and make available at city and town halls, libraries and on municipal websites.
9.# Accomplish a robust education program in communities that have joined and participate in the FEMA Community Rating System (CRS).

Emergency Services Protection Actions

Goal

Improve upon and ensure the continuity of emergency services during severe and extreme weather events.

Objectives

1. Conduct planning studies on evacuation policies, sheltering needs and capacity, hydrology, "Make Safe" procedures, and natural features.
2. Protect critical facilities and infrastructure necessary for emergency response.

4.3 Development of Hazard Mitigation Strategies

Many mitigation success stories can be found in the MetroCOG Region. For example, the Town of Trumbull has partnered with homeowners to secure funding for property acquisitions, and the Town of Fairfield has partnered with homeowners to secure funding for building elevations. Refer to the fact sheet on the next page for more information about the acquisitions in Trumbull.

Bridgeport, Fairfield, and Stratford were highly successful is obtaining CDBG-DR funding associated with Hurricane Sandy. Some of these grants were used for planning while other were used for projects, yielding many successful mitigation projects or phases of projects. For example, the Town of Fairfield prepared a green infrastructure plan and concept design for the downtown area, which represents a key phase in a larger effort to install green infrastructure downtown. Other communities in the region may be interested in pursuing green infrastructure. Refer to the fact sheet below for more information.

The Town of Fairfield has been successful in working through the State's Microgrid Program to implement a local microgrid. Most of the other funded microgrids in Connecticut have been outside the MetroCOG Region, but Fairfield's success may inspire other towns to pursue similar projects. Refer to the fact sheet below for more information about the microgrid in Fairfield.

The numerous mitigation successes in the Region demonstrate a strong capacity for the MetroCOG communities to continue implementing mitigation projects.

While the mitigation actions in the original 2006 NHMP were developed in direct coordination with local officials, the mitigation actions in the 2014 Plan were developed through The Nature Conservancy's CRB process combined with a review of actions from the 2006 NHMP. Each community utilized the TNC Risk Matrix to understand the risks associated with natural hazards and to understand vulnerabilities and strengths. Through this matrix, participants developed and prioritized actions to address the impacts of natural hazards.

For the 2019 NHMP Update, MetroCOG and the Consultant regularly communicated with the Local Planning Teams, which consisted of municipal staff from areas such as Engineering, Planning & Zoning, Public Works/Facilities, Emergency Management & Public Safety and various other disciplines. In addition, MetroCOG provided each community and other stakeholders an opportunity to attend CRBs to provide an opportunity to continue the discussion regarding the identification of hazards, assessment of risks and the development of strategies to establish a more resilient Region.

Mitigation actions are considered at the regional and local levels. Regional actions are general in nature and can be regarded as best practices. Mitigation actions at the local level address the unique characteristics of a community or the concerns expressed by the community.

Each mitigation action falls into one of the following six categories:

MITIGATION SUCCESS STORY

PROPERTY ACQUISITIONS: TRUMBULL, CONNECTICUT

View of the parcel before acquisition
Photo by Town of Trumbull

View of vacant parcel
Photo by Town of Trumbull

FOR MORE INFORMATION

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WHAT IS IT?

When repeatedly experiencing and recovering from flood events, along with the ever-rising cost of flood insurance, becomes too much of a hassle, homeowners may decide that it's time to relocate.

The Town of Trumbull has periodically partnered with property owners to apply for FEMA mitigation funds and acquire properties that have experienced flood losses. The photograph to the left depicts the property at 206 Lake Avenue that was acquired using a PDM grant from FEMA. By acquiring properties at risk, the Town relieves the owners of a financial burden and enables them to move to a less hazard-prone area.

Following property acquisitions, Trumbull has converted the areas to open space. These areas are now a valuable aesthetic with the added benefits of improving wildlife habitat and creating areas where floodwaters can safely accumulate, decreasing flood risks elsewhere.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

If a property owner does decide it may be time to move, his or her town and state, as well as the federal government, may be able to help. Some local communities support property acquisition programs, and grants are available for application through the federal government. Property owners unable to sell their property on the market may be eligible for a property acquisition program or grant.

Acquisition and conversion to open space of flood prone properties aligns primarily with the Multi-Jurisdictional Hazard Mitigation Plan's Municipal Goal #4: Increase the use of natural, "green," or "soft" hazard mitigation measures, such as open space preservation and green infrastructure.

MITIGATION SUCCESS STORY

FAIRFIELD GREEN INFRASTRUCTURE

Street flooding in downtown Fairfield immediately downgradient from impervious surfaces

Concept design for rain garden in a parking area.

FOR MORE INFORMATION

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WHAT IS IT?

The Town of Fairfield is currently experiencing challenges relating to an excess of urban stormwater runoff coupled with a restrictive storm drainage system that is inadequate to handle the large volume of runoff generated by the town's impervious surfaces. Due to the high-density surface and subterranean infrastructure, it is impossible to fully condition the storm drainage system to handle the current and future stormwater volumes. Additionally, climate change projections indicate that future storms may be more intense, with greater rainfall totals in shorter amounts of time.

Green infrastructure (GI), sometimes used synonymously with “low impact development” (LID), is an important tool in addressing climate change. Consider the following:

- Reducing stormwater runoff reduces downstream flooding.
- GI reduces heat-island effects through reduction of heat emission from pavements, which can cool temperatures by 20-45 degrees.
- GI captures pollutants such as particulate matter and contaminants, providing improved water quality and significant public health benefits for communities.

REGIONAL SIGNIFICANCE AND LINK TO HAZARD MITIGATION

Many GI techniques can prevent stormwater from being generated, reduce total runoff volume, and/or can sequester stormwater runoff and allow it to infiltrate into the ground without entering a municipal stormwater system. This not only reduces flood threats but also reduces pollutant loading into water bodies and can help recharge groundwater aquifers. Rain gardens, bioretention swales, green roofs, porous pavement/pavers and other methods can be both functional and aesthetic additions to any community.

The Town of Fairfield executed a study of how GI can reduce runoff in the downtown area and developed a downtown green infrastructure conceptual plan. The Town intents to implement components of the conceptual plan over the next decade, which will lead to reduced generation of stormwater and help alleviate flooding in the downtown area.

MITIGATION SUCCESS STORY

MICROGRID: FAIRFIELD, CONNECTICUT

Fairfield ; photo by Daily Voice

Fairfield microgrid area; photo by Schneider Electric Blog

FOR MORE INFORMATION

Microgrid Program
CT Department of Energy and Environmental Protection
Bureau of Energy and Technology
(860) 827-2655
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WHAT IS IT?

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.

In 2015, the Town of Fairfield installed a 300-kilowatt microgrid, that, in the event of an emergency, will be capable of keeping multiple municipal resources in operation. These resources include the police and fire headquarters, emergency communications center, a cell phone tower, and the Operation Hope's Homeless Shelter. The natural gas and solar powered power source is located adjacent to the Fairfield Police Department.

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 commonly 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.

Developing microgrids that encompass critical facilities such as emergency response, shelter, and communications, can help make a community more resilient to natural disasters. Urgent needs of the community can be met and response and recovery efforts can move forward without delay while the regional grid is repaired.

Microgrid development aligns primarily with the Multi-Jurisdictional Hazard Mitigation Plan Municipal Goal #5: Improve the resilience of local and regional utilities and infrastructure using strategies including adaptation, hardening, and creating redundancies.

- Prevention: actions that will keep problems from getting worse
- Property Protection: actions that address individual buildings
- Public Education & Awareness: actions that will inform the public
- Natural Resource Protection: actions that will protect natural resources
- Emergency Services Protection: actions that will protect emergency services before, during and immediately after an occurrence
- Structural Projects: actions that will control the hazard

STAPLE+E

Throughout the planning process, a wide range of actions to mitigate and increase resiliency to the impacts of natural hazards were identified and discussed. Prioritizing each action will determine its effectiveness in reducing or preventing future impacts. The STAPLE+E method was used to prioritize the mitigation actions.

The STAPLE+E method evaluates the costs and benefits of a specific action against social, technical, administrative, political, legal, economic and environmental criteria. This method is commonly used by planners and public administrators. Based on this review, actions were prioritized for future implementation. The previous NHMP used a similar approach.

The STAPLE+E cost benefit review evaluates the following:

Social

1. Is the proposed strategy socially acceptable to the Region or municipality?
2. Are there equity issues involved that would mean that one segment of the Region or municipality is treated unfairly?

Technical

1. Will the proposed strategy work?
2. Will it create more problems than it will solve?

Administrative

1. Can the Region or municipality implement the strategy?
2. Is there someone to coordinate and lead the effort?

Political

1. Is the strategy politically acceptable?
2. Is there public support both to implement and maintain the project?

Legal

1. Is the Region or municipality authorized to implement the proposed strategy?
2. Is there a clear legal basis or precedent for this activity?

Economic

1. What are the costs and benefits of this strategy?
2. Does the cost seem reasonable for the size of the problem and the likely benefits?

Environmental

1. How will the strategy impact the environment?
2. Will the strategy need environmental regulatory approvals?

The benefit of each criteria was ranked as low (1), medium (2) or high (3). Costs were ranked as low (-1), medium (-2) or high (-3). Criteria received a 0 if there was no cost or benefit, or if the criteria were not applicable to the mitigation action.

The workshop risk matrices informed the overall STAPLE+E process, as actions identified through the risk matrices obviously had some community or stakeholder support. Typically, these actions received a high ranking for the administrative, social and/or political benefits. High administrative and technical rankings were given to actions that were underway or in the process of implementation, since the community demonstrates the capacity to implement the action.

The economic costs of actions were evaluated based on a monetary estimate. Minimal cost actions require little staff time or municipal resources and could possibly be implemented through volunteer assistance. Low cost actions were less than $100,000. Moderate cost actions were between $100,000 and $500,000 and high cost items were over $1,000,000.

The results of the STAPLE+E review will inform how actions are prioritized and implemented. Implementation will be discussed in Section 5 of the NHMP.

4.4 Regional Actions

Natural hazards are not governed by state, regional or local boundaries and typically impact a large geographic area. The following mitiga-

tion actions are general and address the regional scale and impact of natural hazards. These provide a basis for hazard mitigation in the region as well as a template for identifying specific mitigation projects.

Inland and Coastal Flooding:

Through the risk assessment, vulnerability assessment and discussions throughout the planning process, the communities of the MetroCOG Region were found to be most at risk from flooding, both inland and coastal. Common impacts of flooding include damage to personal property, buildings, and infrastructure, closure of roads, disruptions of critical services, and injuries to persons in flood prone areas. General mitigation actions include:

Prevention

1. Incorporate flood mitigation in local land use regulations.
2. Enforce flood management regulations.
3. Develop storm water management regulations and programs
4. Develop regional watershed councils to prepare watershed management plans.
5. Improve storm water management planning and adopt policies to reduce storm water runoff, such as, requiring development projects have "zero discharge."
6. Comply with the NFIP and maintain FEMA elevation certifications.
7. Implement floodplain management techniques above and beyond minimum NFIP requirements, including increasing "freeboard" heights, adopting "No Adverse Impact" policies, notifying repetitive loss property owners, and participating in the Community Rating System (CRS) program.
8. Conduct hydrologic and hydraulic studies to evaluate risks and flood mitigation strategies.

Property Protection

1. Adopt and enforce building codes and increase "freeboard" requirements.
2. Remove existing structures from flood-prone areas.
3. Flood-proof basements and other areas.
4. Encourage elevation of structures.

Structural

1. Limit the amount of impervious surface.
2. Prohibit filling in floodplain areas.
3. Increase capacity of storm water drainage systems and separate combined sewer systems.
4. Increase capacity of detention and retention ponds and basins.
5. Maintain drainage systems by clearing sediment, removing debris and routinely repairing and cleaning storm drains.
6. Elevate structures, roads, and bridges above base flood elevation.
7. Construct flood control measures, such as, berms and dikes, and use hardened material to prevent erosion.
8. Install bioengineered bank stabilization techniques.

Natural Systems Protection

1. Protect and restore natural flood mitigation features.
2. Protect and restore riverbanks, wetlands and dunes.
3. Use vegetative buffers.
4. Establish riparian buffers.
5. Preserve floodplains and wetlands as open space.
6. Acquire floodplain lands and wetlands for open space.
7. Establish a green infrastructure program that requires more trees to be planted or preserved, encourages the use of porous pavement, and planting of vegetative buffers.
8. Develop stream buffer ordinances.
9. Continue beach nourishment programs.
10. Limit or restrict development in floodplain areas.

Education and Awareness

1. Increase awareness of flood risk and safety.
2. Encourage homeowners to purchase flood insurance.
3. Educate citizens about safety during flood conditions.
4. Conduct outreach to educate and advise homeowners about risks to life, health and safety.
5. Hold workshops to facilitate dissemination of information on technical assistance programs.

Emergency Services

1. Flood proof critical facilities in vulnerable locations, such as wastewater treatment plants, EOCs, police and fire stations, and

emergency shelters.
2. Locate critical facilities, such as wastewater treatment plants, EOCs, police and fire stations, and emergency shelters outside flood-prone areas.

Sea Level Rise

Many of the mitigation actions that address the impact of coastal and inland flooding will also mitigate the impacts of sea level rise. Sea level rise causes land loss in low-lying coastal areas. Sea level rise also exacerbates erosion and flooding as new areas become vulnerable to storm surge, wave action, and tides.

Prevention

1. Map and assess vulnerability to sea level rise, including modeling of various "what if" scenarios. At a minimum, utilize the sea level rise projection prepared by CIRCA and adopted by Public Act 18-82.
2. Use GIS to map at-risk areas and structures.
3. Regulate and manage development in high risk areas and create a sea level rise overlay zone.
4. Prohibit reconstruction and redevelopment in areas susceptible to chronic flooding.

Property Protection

1. Protect buildings by acquiring structures in high risk areas and either demolish or relocate.
2. Raise buildings above potential sea levels.

Structural

1. Protect infrastructure by acquiring structures in high risk areas and either demolish or relocate.
2. Raise infrastructure above potential sea levels.
3. Limit the amount of impervious surface.

Natural Systems Protection

1. Preserve open space and wetlands in high risk areas.
2. Acquire open space in high risk areas.
3. Protect and restore natural buffers.
4. Implement dune restoration projects.
5. Promote conservation and management of open spaces and wetlands within sea level rise areas.

Education and Awareness

1. Increase awareness and educate the public about sea level rise.
2. Encourage homeowners to purchase flood insurance.

Emergency Services

1. Locate critical facilities, such as wastewater treatment plants, EOCs, police and fire stations, and emergency shelters outside areas vulnerable to sea level rise.

Severe Winter Weather

Severe winter storms may include snow, sleet, freezing rain, or a mixed precipitation, and are often accompanied by high winds. The damage from these storms includes downed trees, widespread power outages, road closures and limited access to critical facilities, and can result in injury and death.

Prevention

1. Adopt and enforce building codes.
2. Improve tree maintenance.

Infrastructure

1. Protect power lines and infrastructure.
2. Establish and follow standards and guidelines for tree pruning around power lines and routine inspection of hazardous trees.
3. Establish debris management and clearing capabilities.
4. Reduce the impacts to roads by planning for snow removal and debris clearing.
5. Maintain and improve snow clearing equipment.

Education and Awareness

1. Increase awareness and educate the public about proper tree maintenance.
2. Educate citizens about safety during winter storms and power outages.
3. Provide residents with the locations of warming centers and shelters during a power outage.

Emergency Services

1. Ensure adequate power to critical facilities such as EOCs, police and fire stations, and emergency shelters.
2. Improve communication and cooperation with local utilities, "Make Safe" crews and power restoration regarding downed trees and power lines.
3. Ensure emergency access to vulnerable populations and critical facilities.

Earthquakes:

Property damage from earthquakes is primarily caused by the failure and collapse of structures. The Region is not at high risk to earthquakes.

Severe Summer Weather:

Severe summer weather comes in the form of thunderstorms and tornadoes, and is accompanied by lightning, hail and high winds. These events pose a threat to lives, property, and vital utilities primarily from downed trees, limbs, power lines and flying debris. Although infrequent in the Region, a tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. The destruction caused by tornadoes ranges from light to catastrophic depending on the intensity, size, and duration of the storm.

Prevention

1. Adopt and enforce building codes.

Structural

1. Install lightning protection and grounding on communications infrastructure and critical facilities.
2. Install surge protection on critical electronic equipment.

Education and Awareness

1. Develop a lightning brochure for distribution at recreation facilities and parks.
2. Ensure the public is aware of emergency cooling centers during severe hot weather.

Emergency Services

1. Ensure adequate power to critical facilities such as EOCs, police and fire stations, and emergency shelters.
2. Improve communication and cooperation with local utilities regarding downed trees and power lines, "Make Safe" crews and power restoration.
3. Ensure emergency access to vulnerable populations and critical facilities.

Wildfires:

1. Pursue the extension of public water supply for fire protection into outlying areas.
2. Pursue the installation of dry hydrants in areas without adequate fire protection.
3. Ensure off-road emergency vehicles are available to access wildfires.
4. Provide educational information to homeowners and businesses within the wildland-urban interface.

All Hazards:

1. Secure and install backup generators that are adequate to meet the needs of critical facilities and evacuation locations, both short term and long term.
2. Expand the use of GIS to inform municipal staff, residents, businesses and regional stakeholders of potential natural hazards and strategies to mitigate, prepare and/or respond to the impacts of natural hazards.

National Flood Insurance Program

As described in Section 3, inland and coastal flooding has severely impacted communities throughout the MetroCOG Region. All communities in the MetroCOG Region participate in the National Flood Insurance Program (NFIP) as presented in Table 4.1.

Communities that participate in the NFIP must adopt a local flood damage prevention ordinance with established minimum building standards for

Table 4.1: NFIP Adoption

NFIP Status

City or Town	NFIP Entry Date	Effective FIRM	Total Policy Holders (as of 11/18)	Policy Holders in SFHA (as of 11/18)	Average Premium	Insurance In Force
Bridgeport	10/15/80	07/08/13	1,669	1,056	$1,056	$325,636,800
Easton	09/30/83	06/18/10	33	9	$764	$9,918,100
Fairfield	08/15/78	07/08/13	2,330	1,844	$1,610	$631,856,500
Monroe	04/17/85	06/18/10	50	16	$1,000	$13,324,500
Stratford	06/01/78	07/08/13	1,891	1,214	$1,421	$442,417,900
Trumbull	12/04/79	06/18/10	163	91	$1,081	$45,669,800

the floodplain. All new buildings and substantial improvements to existing buildings are required to be protected from damage by floods with a 1% annual chance of occurring (the 100-year flood). Any new floodplain development may not aggravate existing flood problems or increase damage to other properties.

All communities in the MetroCOG Region have adopted and continue to enforce floodplain management regulations that are consistent with those required by the NFIP. Continued compliance with NFIP standards, active participation in the NFIP and application to the Community Rating System will mitigate the financial impacts of future flood events.

Mitigation Actions for Repetitive Loss Properties

Due to multiple claims under the NFIP, Repetitive Loss Properties are costly to insure and strain FEMA resources. FEMA offers grant programs to assist communities and states in implementing actions that reduce or eliminate the long-term risk of flood damage to focus on repetitive loss properties. The primary objective of these programs is to eliminate or reduce the damage to property caused by repeated flooding. Funds are provided to implement various mitigation measures that will reduce future flooding losses. Possible mitigation actions include acquisition or relocation of severe repetitive loss properties and elevating existing structures.

4.5 Review of Prior Hazard Mitigation Actions

In the 2006 and 2014 NHMPs, local actions were recommended to mitigate the impacts of natural hazards and address the specific concerns of each respective community. The following narrative of mitigation strategies explains the overall concerns of each community during the 2014 NHMP Update. The mitigation strategy matrices in the 2014 NHMP were the result of the workshop's risk matrices, discussions with municipal staff, the concerns gathered through the public outreach process and the STAPLE+E review method.

City of Bridgeport

The primary natural hazards impacting Bridgeport include coastal flooding from tropical storms and hurricanes and inland flooding from heavy rain events. Inland flooding is worsened by the past channeling and/or burying of water courses. Addressing the impacts of coastal and inland flooding continue to be priorities in Bridgeport, as they were in the 2006 and 2014 NHMPs. NHMP recommendations expanded to include a diverse and very comprehensive set of strategies to address the impacts caused by a variety of natural hazards.

As detailed in the BGreen Plan, the City has placed a priority on proactively addressing rising sea levels and the impacts of climate change. While improvements to and expansion of infrastructure and structural solutions remained as priority actions, as in the previous NHMPs, green infrastructure, low impact development and comprehensive, region-wide watershed management were also recommended as strategies to mitigate the impacts of natural hazards. A number of strategies to protect/nourish beaches, such as at Seaside Park and shoreline neighborhoods were also recommended throughout the update process.

New priorities for infrastructure improvements were also identified as part of the update. While the 2006 NHMP identified specific sewer separation projects, recommendations in the 2014 NHMP were focused on finding opportunities for a coordinated approach to the overall sewer separation project by a number of City departments. This includes upgrading to a separated sanitary sewer system during road improvement projects. Continuing to secure funding for the various phases of ongoing projects and completing these projects remains a City priority. Integrating low impact development best management practices into these projects was emphasized throughout the update.

The 2014 NHMP placed greater emphasis on pre-disaster planning and effective public education. Public education, outreach and early warning to residents is crucial to insuring a resilient community. These strategies ensured that the public has the information to adequately prepare (and recover) in the event of a disaster. Assisting residents of high density public housing, vulnerable populations, the transit dependent and those with special needs before, during and after severe weather events was another City priority. The City of Bridgeport will continue to provide universal shelters, which provide facilities for people with special needs and accept pets.

Hazards caused by severe ice, wind, snow-

storms and heat also received attention from stakeholders in Bridgeport. During periods of severe heat, ensuring that vulnerable populations are aware of and have access to cooling centers is a crucial task. Developing a plan to address City operations protocols for varying levels of snowfall and securing additional equipment for snow removal are priorities to address events such as Winter Storm Nemo in 2013. Increasing the effectiveness of emergency communications – among City departments and to the public are priority strategies that can be utilized during a variety of natural hazard events.

Town of Easton

Easton is sparsely developed and a large proportion of the Town is preserved as either existing or former water company owned lands. As such, the impacts from natural hazards are somewhat limited. Most recommendations for Easton were oriented to infrastructure projects so as to mitigate the impacts of flooding. These recommendations, such as warning of residents in areas that may become isolated or blocked during severe weather remain as priorities to the Town. In the 2014 NHMP, the public drinking water supply and tree management received greater attention and increased in priority.

Easton is home to four reservoirs that are the primary source of public drinking water in the Region. A large filtration plant, located at the base of the Easton Lake Reservoir dam, was built several years ago to ensure clean and safe water. The Easton Emergency Management Director's primary concern is to ensure the plant remains operational during any hazard. Ensuring the public drinking water supply is a priority to the Town of Easton and the MetroCOG Region.

Damage to trees, and the resulting power outages from downed trees and from severe winds during thunderstorms, hurricanes, tropical storms, nor'easters and snow storms have also impacted the Town of Easton. Priority strategies to mitigate the impacts of these hazards include tree maintenance programs, education of residents on proper tree maintenance and coordination with utility tree trimming programs. During disasters, enhanced communications with utilities and access to emergency services (on roads blocked by downed trees, as well as snow) are necessary. Back-up and alternate power generation at key facilities received greater priority in the 2014 NHMP.

Town of Fairfield

In Fairfield, a lot more attention has been given to coastal areas since hurricanes Irene and Sandy hit the Town. Unprecedented coastal flood damage has renewed the focus on mitigating against future damage. A Coastal Resiliency Plan has been developed with the assistance of MetroCOG and The Nature Conservancy. Many residents have or are planning to have their homes elevated for storm protection and to lower flood insurance rates. Many neighborhoods are demanding better flood protection in the form of pump stations or dikes. The Town is also examining methods to harden its infrastructure and is assisting home owners to prevent future damage by elevating homes to achieve FEMA flood regulation compliance. Due to the impact of hurricanes, snow storms and weather related events, utility issues have also been on the forefront.

Town of Monroe

The 2006 NHMP included recommendations focused on mitigating the impacts of flooding through maintenance and infrastructure improvements. However, both the range of hazards to prepare for and the range of strategies expanded in the 2014 NHMP. This reflected a shift in priorities due to the impacts of heavy snow, ice and storms as well recognizing the role green infrastructure and natural features can play in mitigation.

Strategies to mitigate the impacts of snow, ice and wind included an expansion of the Town's tree maintenance program and improving communication with utilities. Warning residents who may become isolated by blocked roads and insuring adequate power generators at shelters were other recommendations made.

All properties in Monroe are served by on-site septic systems. Systems close to the Pequonnock River and the river's branches may fail due to heavy rains and subsequent flooding and cause an increase in pollutants entering the river. The recognition of the impact that a failing septic system may have on the quality of local waterways was a new concern of the Monroe community that was not reflected in the 2006 NHMP. The need to upgrade septic systems to sanitary sewers in certain areas was emphasized by workshop participants and in the Town's Plan of Conservation and Development.

Since 2006, the Town of Monroe has diversi-

fied how storm water management and flooding are approached. Infrastructure projects and regular maintenance remained as stormwater management and flood mitigation strategies. However, low impact development BMPs received greater focus in the 2014 NHMP. Zoning regulations have been revised to require improved landscaping and less pavement at developments. Riparian buffers along waterways and an emphasis on storm water retention and quality are further examples of the priority placed on the protection of natural features.

Town of Stratford

Recommendations made in the 2008 annex to the NHMP were primarily focused on flood mitigation through infrastructure improvements and regular maintenance of infrastructure. Due to more severe weather events since 2008, recommendations made in the 2014 NHMP Update emphasized the importance of pre-disaster planning and coordination, the utility of natural features for flood mitigation and the impact of hazards related to wind, ice and snow.

Greater understanding of the urban tree canopy, encouraging utilities to follow recommended arboriculture practices and a regular tree maintenance plan were new strategies in the 2014 NHMP to address pre-disaster planning and hazards not related to flooding – such as the impacts of wind, ice and snow. Insuring adequate power generators at shelters, encouraging restaurants and businesses to install backup generators and educating the public on preparing for severe weather are other recommendations that reflect planning and preparation as a community priority.

Like the coastal jurisdictions of Bridgeport and Fairfield, the impacts of hurricanes Irene and Sandy expanded and diversified the range of mitigation strategies that the Town of Stratford considered in the 2014 NHMP Update. Additional improvements to facilities and infrastructure so as to protect against flooding were identified – such as the waste water treatment plant and pump stations. These vulnerabilities led to the Town developing a coastal resilience plan in 2016. In 2014, the Town has placed a greater priority on low impact development techniques, ordinances to reduce storm water runoff, increased protection and maintenance of Stratford's beaches and enhancing the flood protection features of all natural areas (such as forests, marshes and open space). The Roosevelt Forest Management Plan is one such example of the Town's commitment to management and protection of its natural areas.

Town of Trumbull

Mitigating the impacts of inland flooding in certain areas of the Town of Trumbull, tree maintenance, coordinated power restoration and assisting residents during severe weather events are priorities in the Town of Trumbull. Recommendations in the 2006 NHMP were primarily oriented to infrastructure improvements so as to mitigate flooding. Like the other communities discussed in the NHMP, recommendations made by Trumbull stakeholders expanded in the 2014 NHMP to include a diverse set of measures to mitigate the impacts caused by a variety of natural hazards.

The Town's Plan of Conservation and Development promoted low impact development and green infrastructure approaches to protect natural resources as development occurs. Assessing the capacity of open space for flood storage, education to residents about green infrastructure solutions and wetland protection and the implementation of the Pequonnock River and Rooster River watershed-based plans were some of the recommendations that recognize the utility of natural features as a flood mitigation method. The importance of natural features was a new priority in the 2014 NHMP.

Inland flooding continues to be a concern for the Town of Trumbull. In addition to natural mitigation measures, improvements to infrastructure and structures is a Town priority as well. This priority has not changed since the 2006 NHMP. However, the number of recommendations regarding infrastructure and structural improvements increased in the 2014 NHMP.

A reliant and resilient electrical system was a key concern in Trumbull's POCD and increased in priority due to long term power outages after hurricanes Irene and Sandy and Winter Storm Alfred (in October of 2011). Tree lined streets play an important role in the Town's atmosphere and quality of life, but downed limbs and trees also brought power lines down and prevented access to many roads – further delaying power restoration. Balancing the importance of trees to the Town with a proactive maintenance plan for trees close to power lines is necessary for both these priorities to be realized.

In addition to tree maintenance, additional

recommendations were made to assist residents during long term power outages and for improved power restoration. Improved access to information about services for at-risk residents during disasters, adequate generators at shelters, charging stations and multiple avenues for communications with residents were some examples of recommendations in regards to community assistance. A variety of opportunities to restore power more quickly were identified, including town staff workforce availability, enhanced communication with utilities, periodically revisiting the critical locations for immediate power restoration and updated maps/GIS.

While downed trees and tree limbs knock out power, they also block roads and prevent residents from accessing emergency services. Snow and ice storms limit access to emergency services and emergency responders as well. Since Trumbull is served by hospitals in Bridgeport, this access is a regional priority. The importance of access to the regional services located in the City of Bridgeport became apparent during Winter Storm Nemo, as the amount of snow that needed to be cleared severely burdened public works crews throughout the region.

Summary of Prior Mitigation Actions

A summary of the previous mitigation strategies presented for each community in the 2014 NHMP is presented on the following pages. The tables include a description of each prior action, the status of the action in 2019, and, if necessary, a determination of whether the action required revisions for inclusion within the implementation strategies presented in Section 5.

ID	Description of Action	Status of Action in 2019	Revision for 2019-2024, if Applicable
	Prevention		
1	Consider enrolling and participating in FEMA's Community Rating System (CRS) program. Identify and integrate building codes, land use policies and zoning regulation modifications that minimize exposure of existing buildings, future development and critical infrastructure to natural hazards and extreme weather.	This action represents several specific actions but all are meant to support CRS participation. The City sent a CRS letter of interest to FEMA in June 2018. A new action is "Complete CAV and initial steps to enter into the CRS program."	Complete CAV and initial steps to enter into the CRS program.
2	Adopt stream dumping regulations.	This is already required by the City Code ("No person shall throw or deposit any solid waste in any stream, sewer or other body of water"). Regulation is not needed.	Not Applicable
3	Identify and integrate building code, land use policies and zoning regulation modification that minimize exposure of existing and future development and critical infrastructure and facilities.	The process states that this is already practice through the State Building Code. The building code narrative is not needed, but specificity about regulations is needed. Carry Forward with Revision. The Zoning Regulations (currently amended to July 2018) will be rewritten beginning in 2019, with anticipated adoption in 2021. LID and resilience standards will be added.	Revise Zoning Regulations to include low impact development (LID) and resilience standards.
4	Continue the policy of "Universal" shelters, "Universal" means specific needs and pets are allowed for.	Complete and ongoing	Not Applicable
5	Consider tapping into new or alternate sources of funding for resilience/hazard mitigation projects.	The City has achieved significant success in this matter, with projects ranging from a small grant from CIRCA ($60,000 for a living shoreline design) to several million dollars from Rebuild By Design and the NDRC competition. The City's focus is to now shift toward execution of the many grants. Future editions of the hazard mitigation plan may include actions similar to this.	Not Applicable
6	Consider adopting standards to require two or more feet of freeboard when developing or redeveloping structures in tidally influenced floodplains. Initiate longer-term opportunity to adapt the City to flooding through new building siting to elevations well above FEMA's 1% flood zones (i.e., 500-year standard).	Progress toward adopting freeboard has not been made, although the revised State Building Code requires one foot of freeboard. Carry Forward with Revision.	Freeboard of greater than one foot will be considered as part of the Zoning Regulation rewrite.
7	Investigate opportunities for floodplain easements on properties.	Carry Forward	Identify opportunities for floodplain easements on properties.
8	Encourage low impact development techniques and green infrastructure for new developments.	The City has made significant progress installing green infrastructure on public properties and along streets. Additional efforts are needed to encourage GI and LID on private properties. Carry Forward with revision.	LID will be included with the Zoning Regulation rewrite
9	Secure funding for and initiate an urban forest canopy study. A study was conducted in 2010 but needs to be updated.	Complete. In 2013, the City engaged the Spatial Analysis Laboratory (SAL) at the University of Vermont's Rubenstein School of the Environment and Natural Resources to carry out an assessment of the existing and potential tree canopy in Bridgeport. In 2014, a municipal tree maintenance workshop was held by GBRC and study report was published.	Not Applicable
10	Factor climate change impacts into all critical infrastructure improvement plans (i.e., bridges, bus route realignment).	Public Act 18-82 has addressed this, with new resiliency standards enumerated in State statute for State-funded projects and federally-funded projects passed through the State. This accounts for many of the infrastructure projects in Bridgeport.	Factor climate change impacts into City-funded critical infrastructure improvement plans by requiring that the standards similar to those of Public Act 18-82 be applied to City-funded projects. As a first step, produce guidance document by 2021.
11	Continue to implement the comprehensive urban forest management plan.	This action represents a capability. Subsequent to revised action #9 above, this action may be revised	Not Applicable
12	Continue to expand Energy Improvement Districts	Complete	Not Applicable
13	Continue to amend the storm water management manual as necessary.	Complete	Not Applicable
14	Conduct a study to assess and prioritize the highest risk locations across the City.	This is being accomplished through several efforts described in the plan and represented in these actions.	Not Applicable

ID	Description of Action	Status of Action in 2019	Revision for 2019-2024, if Applicable
15	Continue to enforce V-zone requirements in sections of coastal A zones located waterward of waterfront roadways. Applicable ordinances are amended as FIRM maps are revised.	Complete	Not Applicable
16	Pending funding, proceed with the Storm water Authority Feasibility Study. Consider incentives to reduce the amount of impervious surface in the City.	Progress has been impeded by lack of funding. Carry forward.	Pending funding, proceed with the Storm water Authority Feasibility Study. Consider incentives to reduce the amount of impervious surface in the City.
	Property Protection		
17	Encourage property owners to elevate electrical and heating systems above the base flood elevation.	Complete; additional efforts will be made in connection with substantial damage and substantial improvement determinations.	Not Applicable
18	Continue to flood-proof structures, especially in the Seaview Avenue/Lower East End neighborhoods.	Complete; additional efforts will be made in connection with substantial damage and substantial improvement determinations.	Not Applicable
19	Elevate houses as they are renovated or constructed in the Black Rock Area.	Complete; additional efforts will be made in connection with substantial damage and substantial improvement determinations.	Not Applicable
20	Encourage property owners to elevate structures above the base flood elevation.	Complete; additional efforts will be made in connection with substantial damage and substantial improvement determinations.	Not Applicable
	Structural		
21	Consider moving sediment to preserve the hydrologic function of Ash Creek.	Progress has been impeded by lack of funding. Carry forward.	Conduct study of Ash Creek sedimentation to determine if sediment removal will enhance flood capacity.
22	Expand the separation of sanitary and storm drainage sewers. Implement and install green infrastructure and building modifications to improve on-site storm water management, retention and infiltration.	Significant progress has been made in these areas, with GI installed on public property and along city roadways. The Zoning Regulations revision will help encourage the same on private properties. Other actions on this list are addressing the Zoning Regulations. A revised action here addresses city property and streets.	Pursue a target of 30 additional GI installations on City-owned land and along streets in the 2019-2024 planning timeframe. Select some locations from the Regional Framework for Coastal Resilience.
23	Improve the drainage and catch basin system.	This is an ongoing effort that is funded by the City.	Not Applicable
24	Improve ability of drinking water supply reservoirs to accommodate high intensity, short duration rain events.	With the implementation of the Streamflow Standards and Regulations in Connecticut, Aquarion Water Company will have fewer opportunities for this approach. Action must be deleted in favor of alternate means of flood mitigation downstream of reservoirs. Additionally, none of the Aquarion reservoirs are upstream of rivers that flow through the City.	Not Applicable
25	Minimize the impact of new development	Significant progress has been made in these areas, with GI installed on public property and along city roadways. The Zoning Regulations revision will help encourage the same on private properties. Other actions on this list are addressing the Zoning Regulations.	See above actions #3, 8, and 22
26	Expand the separation of sewer and surface runoff across more of the City's water/sewer infrastructure (i.e., CSO separation).	Progress has been made. Additional progress is desired.	Make additional progress with combined sewer separations and CSO abatement as outlined in plans developed in 2018.
27	Consider retreat from the Cedar Creek shoreline where vacant properties have little probability of expansive redevelopment.	Ultimately, the Rebuild By Design award did not address the Cedar Creek area. Lower West End resiliency planning with BEDCO and the WECDC was completed in 2019 to address the northwest bank of Cedar Creek.	Implement findings of the Lower West End resiliency planning to draw appropriate businesses to the northwest bank of Cedar Creek, such as water-dependent and floodable land uses.
28	Address the number of derelict structures in the City.	OPED and DPF are continuing to demolish or rehabilitate derelict structures, but additional progress is desired. Carry forward.	Continue to remove derelict structures in flood zones and other areas of high risk; and redevelop or convert to open space. The target for 2019-2024 is ten additional properties.
29	Continue to protect vital transportation infrastructure working with GBT, local, state and federal Agencies as well as providing safe and secure access to and from transit hubs as preparation for any future storm response and/or evacuation.	This is established practice and is updated as needed.	Not Applicable
30	Continue to implement the recommendations from the Pleasure Beach Master Plan. Phase I work is in construction. The City is seeking funding for Phase II and hopes to build in more resilience measure into plans.	Complete; additional efforts will be undertaken as part of the NDRC award execution. The project is known as "Resilient Bridgeport."	Complete the components of the "Resilient Bridgeport" project execution that are scheduled for 2019-2024.

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31	Implement recommendations made by the Seaside Park flood control study.	Complete; additional efforts will be undertaken as part of the NDRC award execution through "Resilient Bridgeport." Ultimately, the Rebuild by Design award did not address this area.	See action #30 above.
32	Initiate a waterfront recapture program and consider waterfront easements.	OPED implementing a zoning amendment requiring an easement along the waterfront so as to provide a waterfront pathway. Additional execution is desired.	Secure waterfront easements as available.
33	Improve drainage as part of road improvement projects.	Underway; this is now practice and a new action is not needed.	Not Applicable
34	Initiate strategically placed green infrastructure and roof leader and other building modification projects to improve on-site storm water runoff retention and infiltration. Continue working to find physical locations for 'green solutions' called for in the WPCA Long Term Control Plan (LTCP).	Significant progress has been made in these areas, with GI installed on public property and along city roadways. The Zoning Regulations revision will help encourage the same on private properties. Other actions on this list are addressing the Zoning Regulations and GI installations.	See above actions #3, 8, and 22
35	Protect beach at Seaside Park	This beach is re-nourished as needed. The action is not needed.	Not Applicable
36	Continue to clean catch basins annually.	This is an ongoing effort that is funded by the City.	Not Applicable
37	Continue the aggressive street sweeping program and cleaning streets prior to forecasted storms to keep storm grates clear and accommodate higher flows.	This is an ongoing effort that is funded by the City.	Not Applicable
38	Continue to frequently clean the racks at Bowe Street.	This is an ongoing effort that is funded by the City.	Not Applicable
39	Aggressively maintain culverts and remove debris from channels along Ash Creek/Rooster River.	This is an ongoing effort that is funded by the City.	Not Applicable
40	Use signage and large, visible staffs to indicate depths of water so that vehicles can avoid flooded viaducts when necessary.	This is an ongoing effort that is funded by the City.	Not Applicable
41	Aggressively maintain culverts and remove debris from channels along Johnson Creek, Pequonnock River, and Yellow Mill.	This is an ongoing effort that is funded by the City.	Not Applicable
42	Install an automated flood control gate system to measure flooding at viaducts. This system will insure timely police response to close the viaducts and prevent cars from getting stuck. The City has installed flood depth signage and posts to indicate the depth of water at critical locations to inform motorists to avoid flooded viaducts when necessary and has developed well-marked, color-coded evacuation routes for residents to follow.	Progress has been hindered by lack of funding and staff resources. The City wishes to make progress in this area and the action is carried forward with a revision to be more specific.	Pilot test an automated viaduct closure system for one viaduct.
43	Improve beach protection in the Black Rock Area.	These areas will be addressed as needed. Current beach conditions are considered appropriate.	Not Applicable
44	Proceed with creation of a storm water detention area at the north end of Roger's Park. The design phase of the project has been bonded. The project's scope and fee negotiation for design is anticipated to be complete by the end of 2013.	Complete	Not Applicable
45	Improve drainage when completing roadway projects in the future to address flooded viaducts.	This is an ongoing effort that is funded by the City.	Not Applicable
46	Continue the drainage maintenance program for inspections of private drainage facilities to be maintained and cleaned.	Ongoing; action not needed.	Not Applicable
47	Systematically replace culverts and bridges and upgrade drainage systems.	This is an ongoing effort that is funded by the City through the Capital Improvement Plan.	Not Applicable
48	Repair/replace the State Street Ext/Commerce Drive Bridge and upgrade the catch basins and drainage system.	Progress has been hindered by lack of funding. Carry forward.	Repair/replace the State Street Ext/Commerce Drive Bridge and upgrade the catch basins and drainage system.
49	Protect the Cedar Creek bank with bulkheads or other creative hard solutions.	Because the bank consists of privately-owned parcels, this must be accomplished during redevelopment or when existing owners approach the City with proposals.	Not Applicable

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50	Raise the height of two harbor breakwaters to protect the inner harbor, St. Mary's at Ash Creek and the Fayerweather lighthouse breakwater from the reach of higher waves and to reduce damage from wave action.	Progress has been impeded by lack of funding. This very costly project would need significant design and permitting efforts. The action is carried forward with a revision.	Conduct a feasibility study for increasing the heights of the breakwaters.
51	Implement physical enhancements of beach protection infrastructure, including breakwaters, groins, and hardscape along Seaside Park, in the Black Rock neighborhood and in the lower East Side, as necessary and appropriate.	Breakwaters are addressed by the City, whereas groins, walls, and bulkheads are addresses by property owners.	Not Applicable
52	Acquire additional land as needed for the creation of a detention area.	This action is in relation to Island Brook and Ox Brook. See revised action #53 below.	Not Applicable
53	Implement Flood Control Project to divert 400 cfs from Island Brook at Old Town Road to Ox Brook at Roger's Park. This flow is to be diverted back to Island Brook at Fairview Avenue through a large detention basin at Shriva Park. The final phase of the Ox Brook project will address this issue.	Progress has been hindered by lack of funding. Carry forward with the first phase.	Execute design of the flood mitigation project for Island Brook and Ox Brook.
54	In the Northeast section, continue with the Feasibility/Flood Control Study that takes the downstream constriction at the GE Property into consideration, and implement recommendations as appropriate.	Progress has been hindered by lack of funding. Carry forward with the first phase.	Execute design of the flood mitigation project for northeast Bridgeport.
55	Remove existing bridges at Feroleto Steel and Scofield Avenue and replace with new bridges that increases the base height of the structures and minimizes flood impacts.	Refer to Town of Fairfield. Action no longer addressed by Bridgeport.	Not Applicable
56	Build in extra flood storage at Island Brook, Bruce Brook and Rooster River/Ash Creek.	Progress has been made in some of these areas. The Town of Fairfield completed a study in 2019 to evaluate options for flood storage in the Rooster River watershed. Bridgeport has installed GIS citywide. Additional progress is desired for Island Brook and Ox Brook as noted above.	See action #53 for Island Brook/Ox Brook.
57	Replace or maintain the culverts along the Ox Brook to adequately handle the flow of water.	Progress has been hindered by lack of funding. Carry forward with the first phase.	See action #53 for Island Brook/Ox Brook.
58	Increase, and in some cases introduce, bank protection along the Yellow Mill Channel.	Progress has varied along the Yellow Mill Channel. Privately-owned sections have been addressed (i.e., at the Bass Pro Shop property). City-owned sections have been evaluated (i.e. in the Regional Framework for Coastal Resilience). Additional progress is desired.	Pursue funds for design of a demonstration project for green coastal bank protection opportunities along the Yellow Mill Channel.
59	Consider elevating Waterview Avenue, especially in connection with redevelopment projects.	The southern portion of the road was elevated for the Steel Point project. The northern section will not be elevated.	Not Applicable
60	Allow Barnum Boulevard to be submerged during a storm surge.	The currently plan for this road is to allow is to be submerged during coastal flood events that exceed the road elevation.	Not Applicable
61	Consider elevating the road and parking lots in the Cedar Creek area, especially in connection with redevelopment projects.	Recent planning efforts on both sides of Cedar Creek have been predicated on an assumption that roads will not be elevated. Property-specific options and limited use of flood protection systems will be considered on a case-by-case basis.	Not Applicable
62	Elevate low-lying roads, including the south end of Seaview Avenue, Waterview Avenue, Seabright Avenue and Gilman Street.	At the present time, the only roads contemplated for elevation are those identified as such in the "Resilient Bridgeport" project area. The City will continue to look for opportunities to elevate roads, but none are proposed at this time.	Not Applicable
63	Raise the electrical boxes at Seaside Park in areas vulnerable to flooding. Some of this has occurred following Super Storm Sandy.	Progress has been made but this is not yet complete. Carry forward.	Raise the remaining unmitigated electrical boxes at Seaside Park in areas vulnerable to flooding.

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64	Protect the banks along Cedar Creek and upstream of Black Rock Harbor with construction of a hurricane barrier, bulkheads and other hardscape and elevated streets and parking lots in vicinity of or adjacent to Cedar Creek.	Potential hurricane barrier locations for Cedar Creek were initially identified in the Rebuild By Design competition, but they are not part of the project at this time. Lower West End planning (completed in 2019) was predicated on an assumption that a hurricane barrier was unlikely to be feasible, and therefore the focus for this area is to attract businesses that can tolerate flooding and businesses that will address the bank of Cedar Creek.	See action #27 above.
65	Upgrade the Bridgeport Harbor Seawall.	Progress has been impeded by lack of funding. This very costly project would need significant design and permitting efforts. The action is carried forward with a revision.	Conduct a feasibility study for increasing the heights of the seawalls.
66	Upgrade improvements along Ash Creek/Rooster River from a 50-year storm to 100-year storm.	The approach for flood mitigation in the Rooster River/Ash Creek area has been more recently focused on reducing flood flows by identifying areas for flood storage (Town of Fairfield completed a study in 2019) and installing GI in Bridgeport. This action is not needed.	Not Applicable
67	Encourage the owner of the rail line to raise the grade of the railroad.	CTDOT owns this land and Metro North is the operator. Over the long-term, DOT involvement will be needed. An action is not needed for the five-year timeframe of this edition of the hazard mitigation plan.	Not Applicable
68	Replace the Charcoal Pond dam (private).	Because this dam is privately-owned, the City cannot make progress in this matter. CT DEEP involvement will address the dam.	Not Applicable
69	Realign Bruce Brook and soften the bends from Sage Street to Bowe Street.	The Town of Stratford is continuing to make progress with Bruce Brook. The Bruce Brook CLOMR at Barnum Avenue is still underway. Action will be carried forward with revision.	Continue to work with the Town of Stratford to complete the Bruce Brook improvements near Barnum Avenue.
70	Create dike and pumping system for low-lying areas along Ash Creek/Rooster River.	This action is no longer being pursued due to potential costs vs. benefits. Other flood mitigation efforts will be pursued if needed.	Not Applicable
71	Continue to monitor the replaced dam at Lake Forest.	Ongoing; action not needed.	Not Applicable
72	Install a hurricane barrier to connect Black Rock to Seaside Park to minimize storm surge and act as a flood control gate.	Potential hurricane barrier locations for Cedar Creek were initially identified in the Rebuild By Design competition, but they are not part of the project at this time. Lower West End planning (completed in 2019) was predicated on an assumption that a hurricane barrier was unlikely to be feasible, and therefore the focus for this area is to attract businesses that can tolerate flooding and businesses that will address the bank of Cedar Creek. Seaside Park improvements on the southeast side of Cedar Creek will continue to be made resilient to coastal flood events.	See action #27 above.
73	Reconstruct New Haven rail line bridges over city streets to prevent flooding.	Over the long-term, DOT involvement will be needed. As part of Barnum Station project, the City will be addressing drainage/flooding at Seaview Avenue. This project is in early design phases and the responsible department is OPED/PF.	Execute the design to address drainage and flooding at Seaview Avenue where it crosses the railroad line.
	Natural Systems Protection		
74	Preserve open space and wetlands in high risk areas.	Ongoing; action not needed.	Not Applicable
75	Utilize GIS to map open space, wetlands and ecologically valuable areas.	Ongoing; action not needed.	Not Applicable
76	Protect and restore natural buffers, natural systems on the watershed and full coastline scales	Progress has been slow but continues. The Regional Framework for Coastal Resilience identified potential coastal green infrastructure and living shoreline sites. Individual sites have been partly addressed (i.e. Johnson Creek design for a living shoreline). Additional progress is desired.	Pursue funds for design of a demonstration project for green coastal enhancement and restoration opportunities (similar to action #58 above).

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77	Acquire open space in high risk areas. Identify and seek further conservation through acquisition of marsh "Advancement Zones" and riparian corridor restoration projects throughout the City.	Progress has been impeded by lack of staff resources. Carry Forward with revisions, but defer the marsh advancement zone portion of the action to action #78 below.	Identify open space to acquire in high risk areas.
78	Implement the recommendations from the Pequonnock River Watershed Plan to improve water quality and alleviate flooding.	Progress has been impeded by lack of funding. Carry Forward with revision.	Select one recommendation from the Pequonnock River Watershed Plan to improve water quality and alleviate flooding, and secure funding.
79	Implement the recommendations from the Rooster River Watershed Plan to improve water quality and alleviate flooding.	Progress has been impeded by lack of funding. Carry Forward with revision.	Select one recommendation from the Rooster River Watershed Plan to improve water quality and alleviate flooding, and secure funding.
80	Plan for beach nourishment at Seaside Park.	This beach is re-nourished as needed. The action is not needed.	Not Applicable
81	Implement dune restoration projects.	Dune restoration projects will be identified as needed in future editions of the hazard mitigation plan.	Not Applicable
82	Promote conservation and management of open spaces and wetlands within sea level rise areas. Restore and protect natural systems in Bridgeport including replanting the Remington Woods riparian zone, Pleasure Beach and along Ash Creek.	Progress has been made in this area as described above. Several mitigation actions will address this.	See actions #58, 76, 77, and 80.
83	Identify parcels within the marsh advancement zone that could be acquired, including properties along Cedar Creek that have low potential for redevelopment.	Progress has been impeded by lack of staffing. Carry Forward with revision.	Identify parcels within potential marsh advancement zones that may be acquired, including properties along Cedar Creek that have low potential for redevelopment.
84	Introduce land forms to minimize vulnerability to storm surge in the South End community.	The South End neighborhood is being addressed by the NDRC funding and "Resilient Bridgeport" project.	Complete the components of the "Resilient Bridgeport" project execution that are scheduled for 2019-2024.
85	Mitigate erosion from flooding at Ash Creek.	Progress has been impeded by lack of staffing and funding. Carry Forward with revision.	Identify potential areas of erosion along Ash Creek that may require mitigation, and secure funding for feasibility studies.
	Education & Awareness		
86	Implement outreach programs to educate citizens regarding flood management ordinances, flood insurance programs, and other flood relevant issues, including creditable activities in the CRS program and GIS.	Progress has been hindered due to lack of staffing resources. If the City enters the CRS program, these actions may enhance the City's rating. Carry forward.	Implement outreach programs to educate citizens regarding flood management ordinances, flood insurance programs, and other flood relevant issues, including creditable activities in the CRS program and GIS.
87	Increase community awareness and preparedness through education and outreach via the religious community, public libraries and higher education and implement neighborhood specific emergency and communications plans.	Progress has been hindered due to lack of staffing resources. If the City enters the CRS program, these actions may enhance the City's rating. Carry forward.	Increase community awareness and preparedness through education and outreach via the religious community, public libraries and higher education and implement neighborhood specific emergency and communications plans.
88	Finalize specific neighborhood plans for emergency management and communications and implement plan provisions. Each plan should be translated into the top five languages spoken in the City of Bridgeport. The 2013 Clean Air Cool Planet fellow developed draft versions of Neighborhood Plans for the 3 coastal neighborhoods.	Progress has been hindered due to lack of staffing resources. If the City enters the CRS program, these actions may enhance the City's rating. Carry forward.	Finalize specific neighborhood plans for emergency management and communications and implement plan provisions. Each plan should be translated into the top five languages spoken in the City of Bridgeport.
89	Increase education and communications on response procedures for residents of high density public housing areas, especially those located in the coastal area.	Progress has been hindered due to lack of staffing resources. If the City enters the CRS program, these actions may enhance the City's rating. Carry forward.	Increase education and communications on response procedures for residents of high density public housing areas, especially those located in the coastal area.
90	Assess/augment local areas of the public refuge system across the City and ensure residents are aware of uses and procedures during emergencies.	Progress has been hindered due to lack of staffing resources. If the City enters the CRS program, these actions may enhance the City's rating. Carry forward.	Assess/augment local areas of the public refuge system across the City and ensure residents are aware of uses and procedures during emergencies.
91	Encourage homeowners to purchase flood insurance.	Progress has been hindered due to lack of staffing resources. If the City enters the CRS program, these actions may enhance the City's rating. Carry forward.	Encourage homeowners to purchase flood insurance.
92	Proactively reduce the disbursement of toxic substances from flooded homes and facilities.	Progress has been hindered due to lack of staffing resources. Carry forward with revision.	Help reduce the disbursement of toxic substances from flooded homes and facilities by conducting outreach regarding this topic.
93	Strengthen existing communication systems with new technology to ensure widespread and rapid alert and continue implementing a Reverse 9-1-1 system to alert residents in the case of impending floods	This is mostly complete and established practice.	Not Applicable

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	Emergency Services		
94	Continue to follow the State Debris Management Plans and FEMA Regulations regarding coordinated post-disaster clean-up and contamination remediation efforts.	This is established practice and is a City capability.	Not Applicable
95	In high density and public housing developments, address evacuation routes, communication, transportation needs and the age of basement utilities.	Progress has been hindered due to lack of staffing resources. Carry forward with revision.	In high density and public housing developments, post the evacuation routes, enhance communication, and evaluate additional transportation needs.
96	Additional snow removal equipment, such as back hoes and plows is needed for severe winter storms, such as Nemo.	Additional equipment is acquired as needed and in accordance with the City's capital planning.	Not Applicable
97	Reassess current capacity and needs of sheltering, cooling and medical network across City as well as adjoining municipalities in the Greater Bridgeport Region. The City has pre-identified mass care shelters, cooling/warming centers, and are discussing a regional approach to mass care sheltering.	The City has identified mass care shelters and cooling/warming centers, and is discussing a regional approach to mass care sheltering. Additional progress is desired.	Once during the timeframe of this plan update, assess capacities and needs of sheltering, cooling, and medical network across City as well as adjoining municipalities in the Greater Bridgeport Region.
98	Install a warning siren system in areas vulnerable to inland and coastal flooding to alert residents to evacuate.	Progress has been hindered by lack of funding. Carry forward.	Secure funding to install a warning siren system in areas vulnerable to inland and coastal flooding to alert residents to evacuate.
99	Continue to increase the effectiveness of the current emergency communication system and infrastructure with residents (i.e., communication trees) and commuters. Reassess effectiveness and shortfalls of emergency systems and infrastructure after major events.	This is established practice and is a City capability.	Not Applicable
100	Implement a system for the GPS tracking of trucks used for snow removal and cleanup.	Complete	Not Applicable
101	In coastal and low-lying areas, raise/repair bridges for evacuation routes, viaducts for pumping stations and back up generators.	These items have been scoped by the Public Facilities and Emergency Management departments to understand costs, prioritization and phasing. Coordination with state agencies may be necessary. Additional progress is desired for the bridges. Viaducts and generators are addressed elsewhere in this table.	Pursue funding to complete a feasibility study for raising bridges and their connecting roads in one specific pilot area.
102	Upgrade Emergency Operations Center equipment to include a complete camera board for Situational Awareness and display board for public facilities equipment tracking.	Progress has been hindered by lack of funding. Carry forward.	Secure funding to upgrade Emergency Operations Center equipment to include a complete camera board for situational awareness and display board for public facilities equipment tracking.
103	Update and integrate new technology across multiple platforms within the City, State and Federal storm response activities and provide additional training to staff.	Complete	Not Applicable
104	Install a camera system to more thoroughly understand storm surge and to enhance evacuation.	Progress has been hindered by lack of funding. Carry forward.	Secure funding to install a camera system to more thoroughly understand storm surge and to enhance evacuation.
105	Develop an annex to the All Hazards Emergency Operations Plan to specify police, fire and public facilities protocols for varying levels of snowfall. The City conducted a study of management operations following the 2013 Nemo Snowstorm and is working to increase mapping and emergency response protocols.	Complete	Not Applicable

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	Prevention		
1	Develop a tree management plan to prioritize actions and tree removal due to the white pine infestation.	Ongoing. Priority lists are maintained for trees. The more significant challenge is Emerald Ash Borer. Action can be removed in favor of #2 below.	Not Applicable
2	Implement a routine tree maintenance and inspection program and remove hazardous trees and branches.	Carry forward with revision. Priority lists are maintained for trees. The more significant challenge is Emerald Ash Borer.	Increase funding for the routine tree maintenance and inspection program and remove a greater number of hazardous trees and branches each year.
	Property Protection/Structural		
3	Improve the culverts under Morehouse Road that carry Morehouse Brook and Cricker Brook.	Both culvert replacements have been completed as of fall 2018.	Not Applicable
4	Consider elevating Morehouse Road in the vicinity of its crossing over Morehouse Brook at Morning Glory Drive	This has been considered and the Town does not believe it is necessary given the other work that has been conducted.	Not Applicable
5	Erect signs and install barricades at Silver Hill Road and at Wells Hill Road where they cross the Aspetuck River to prevent access during floods.	Ongoing capability.	Not Applicable
6	Erect signs and install barricades at Beers Road where it crosses the East Branch of Cricker Brook to prevent access during floods.	The culvert capacity has been doubled at this location and the action is no longer needed.	Not Applicable
7	Maintain the Emergency Telecom/Center Road area to keep clear of debris and vegetation.	Ongoing capability.	Not Applicable
8	Consider elevating Beers Road where it crosses the East Branch of Cricker Brook.	The culvert capacity has been doubled at this location and the action is no longer needed.	Not Applicable
	Public Education & Awareness		
9	Educate the dispersed elderly population on responses during disasters.	Ongoing capability. The Senior Center is used to distribute information and ensure that these efforts are reaching as many people as possible.	Not Applicable
	Emergency Services		
10	Improve warning of residents that would be isolated by flooding along Morehouse Brook at Pond Road	Complete. The Town utilizes a Reverse 911 system. This area was handled with direct outreach during the September 2018 flood event.	Not Applicable
11	Improve warning of residents that would be isolated by flooding along Morehouse Brook at Dogwood Drive	Complete. The Town utilizes a Reverse 911 system. This area was handled with direct outreach during the September 2018 flood event.	Not Applicable
12	Improve warning of residents that may become isolated by downed trees during an extreme weather event.	Complete. The Town utilizes a Reverse 911 system. Furthermore, this would be accomplished by direct outreach such as telephone calls.	Not Applicable

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	Prevention		
1	Enroll Fairfield in FEMA's Community Rating System (CRS) program to improve resilience and lower flood insurance premiums for residents and private entities in the National Flood Insurance Program.	Complete	Not Applicable
2	Develop a tree cutting and maintenance plan.	Complete	Not Applicable
3	Require underground utilities on new streets.	Complete	Not Applicable
4	Consider adopting standards to require two or more feet of freeboard when developing or redeveloping structures in tidally influenced floodplains.	One foot of freeboard is required per Zoning Regulations and is consistent with the State Building Code. Action can be retired.	Not Applicable
5	Integrate hazard mitigation plans and policies into town building codes, planning and zoning regulations, and the Town's Plan of Conservation and Development.	Complete. The POCD is being updated for adoption in 2020 and the Town follows the State Building Code, which was amended in 2018 with important flood hazard mitigation components.	Not Applicable
6	Develop a comprehensive protective infrastructure analysis of the Town's coast and waterways that incorporates natural infrastructure (salt marshes, beaches, dunes and floodplains) and existing engineered infrastructure.	Significant progress has been made including the Flood and Erosion Control Board's Flood Mitigation Plan, the Regional Framework for Coastal Resilience (resulting in a conceptual design for a dune ridge in the area south of Penfield Beach), and the Riverside Drive/Ash Creek flood protection system plan. In addition, the U.S. Army Corps of Engineers continues to evaluate flood protection for Fairfield. Future actions may include pursuing individual findings and conceptual designs.	Not Applicable
7	Reassess the viability and cost-benefit of direct future capital investment in the coastal floodplain as an immediate and longer-term, proactive risk reduction action.	As noted above for #6, significant progress has been made. The Town evaluates individual segments of green infrastructure and flood protection as funds and time allow.	Not Applicable
8	Consider expanding town-wide energy efficiency policies and building codes with the goal of substantially reducing Fairfield's carbon footprint.	The Clean Energy Task Force was established and meets on a monthly basis to identify and pursue actions.	Not Applicable
9	Increase design standards for tidal flood control structures and improve inspection and maintenance requirements to avoid failures during future coastal storm events.	The Town has proceeded with design of two tide gate system replacements, taking future conditions into consideration as well as manual and automatic controls to ensure that they remain operational.	Secure funds and proceed with construction of the Riverside Drive tide gate system.
10	Assess the current conditions and potential impact from catastrophic dam failure; assess previous inundation contingency plans.	Complete. Significant progress has been made subsequent to the State dam safety regulations of 2014-2015. Dam failure EAPs are available for all Class B and C dams, and these include detailed inundation mapping and procedures.	Ensure that dam failure EAPs are on file at the Town Hall and with the Emergency Management Department.
11	Develop a better debris management plan with designated lead for flood control structures before and after extreme events, particularly for the 28 town-owned and three state-owned tide gates in Fairfield.	Complete	Not Applicable
12	Modify and integrate building codes, land use policies, and zoning regulations to minimize the exposure to sea level rise, storm surge, and inland flooding of existing and future development, infrastructure, critical facilities, and natural resources.	Complete. The POCD is being updated for adoption in 2020 and the Town follows the State Building Code, which was amended in 2018 with important flood hazard mitigation components. Furthermore, Public Act 18-82 codified additional resilience measures for State-funded critical infrastructure and facilities.	Not Applicable
13	Assess the safety and viability of existing water and sewer infrastructure in the coastal flood zone.	Progress has been made. Most recently, the dike around the WWTP has been addressed. Water system infrastructure is owned by Aquarion Water Company and not addressed by the Town.	Not Applicable
14	Prepare an action plan to reduce the susceptibility of the low lying Fairfield Beach area to storm surges from Long Island Sound. Specifically the Plan should address the feasibility of installing a "hurricane barrier" and a storm water pump station.	Significant progress has been made including the Riverside Drive/Ash Creek flood protection system plan which addresses how storm surge affects this area; and the South Benson Road pumping station which has been designed and would pump stormwater and coastal waters from the area north of Fairfield Beach. Future phases will include securing funds for construction of the pumping station.	Break into two actions: (1) Advance the South Benson Road pumping station to final design and construction. (2) Pursue an executable phase of the Riverside Drive/Ash Creek flood protection system by focusing on design of a segment that affects only Town-owned land.

ID	Description of Action	Status of Action in 2019	Revision for 2019-2024, if Applicable
15	Reassess long-term viability of the wastewater treatment facility and determine the feasibility of hardening and flood proofing the existing structure versus siting a new facility in a lower risk area.	The reassessment has been completed and the Town elected to continue supporting the current location. The WWTP dike project is underway with completion in 2019. A microgrid has been proposed for the WWTP, animal shelter, and other municipal buildings in the vicinity.	Secure funds for a microgrid at the WWTP to include adjacent and nearby municipal buildings.
16	Reassess the capacity of existing flood control structures (berms/dikes, tide gates, culverts, dams, reservoirs) in light of accelerating rates of sea level rise and likelihood of more significant precipitation events.	Consideration of sea level rise and the former Federal Flood Risk Management Standard was a key component of the Riverside Drive/Ash Creek study and conceptual plan. The Town has the capability to use this approach on future evaluations.	Not Applicable
17	Factor sea level rise into all critical infrastructure, development plans, and public amenity improvements and consider planning for a worse-case scenario based on a 0.2% storm event or flood or a Category-3 Hurricane.	Public Act 18-82 has addressed this and codified considerations for State-funded critical actions and critical facilities. The Town can use the same approach for Town-funded projects. Even prior to Public Act 18-82, the Town considered sea level rise in the WWTP dike project and the Riverside Drive/Ash Creek study and plan.	Not Applicable
	Property Protection		
18	Strategically consider the acquisition of chronically flood prone and repetitive loss properties, as well as those properties that can assist in the implementation of flood drainage improvements to protect against storm surge or to allow flood waters to recede after a flood event.	Some progress has been made with potential property acquisitions using FEMA grants and private funds. Additional progress will likely be made as a result of CRS participation, which will require and enable annual outreach to properties in RL areas.	Not Applicable
19	Address equipment in library basements to prepare for when flooding occurs.	This project has been funded and is pending. Carry forward.	Address equipment in library basements to prepare for when flooding occurs.
20	Encourage home elevations for properties below the base flood elevation to comply with or exceed the standards of the National Flood Insurance Program.	Significant progress has been made. Over 50 home elevations were funded by HMGP, and numerous elevations have been pursued by property owners using their own funds. The Town has demonstrated capacity to administer these projects and the action does not need to be carried forward.	Not Applicable
21	Promote elevating private properties in the flood hazard zones to the required base flood elevations plus a 2-to-3 foot freeboard above the base levels.	The Town has adopted one foot of freeboard to be consistent with the State Building Code. FEMA-funded elevations will be performed with additional freeboard as required by the State. The intent of this action has been met.	Not Applicable
22	Ensure that the design criteria for future structures in the coastal floodplain include a determination of the probable factors of obsolescence during the structure's lifespan so that the design-service-life and value of a structure approximate the time when sea level rise or other factors would render the structure obsolete.	Progress has been made through several efforts. A policy discussion was included in the POCD Update. State-funded or assisted projects will be subject to Public Act 18-82 which codified standards for resilient critical activities and actions.	Not Applicable
	Structural		
23	Install flood protection and harden existing berms to protect critical municipal facilities, including the wastewater treatment plant and pump station.	Complete for the WWTP. Other berms in the area of the WWTP such as the Pine Creek dike system are being studied by the Army Corps of Engineers.	Not Applicable
24	Raise the berm around the wastewater treatment plant.	Complete	Not Applicable
25	Install storm water pump stations and upgrade storm systems to keep up with rising sea levels, especially in the area bounded by Old Post Road, Fairfield Beach Road, Reef Road and South Benson Road.	As noted above for #14, design of the South Benson Road pumping station has been completed. Additional progress is desired. Carry forward with revision.	Advance the South Benson Road pumping station to final design and construction.
26	Increase the height of the dike along Pine Creek by 2' to 3' to provide additional protection for several hundred homes, the sanitary sewer pump station, the municipal athletic complex, and Town roads. This project will also reduce potential flooding from a FEMA-defined 1% storm.	The Pine Creek dike system is being studied by the Army Corps of Engineers.	Coordinate with the Army Corps of Engineers to determine a feasible option for future improvements to the dike system.
27	Consider increasing beach nourishment.	The Town completed an assessment of five municipal beaches and conceptual design for developing engineered beaches.	Secure funds for beach nourishment in accordance with the engineered beach study and design.

ID	Description of Action	Status of Action in 2019	Revision for 2019-2024, if Applicable
28	Improve and elevate tide gates and dikes to keep up with rising sea levels.	As noted above for #9, the Town has proceeded with design of two tide gate system replacements, taking future conditions into consideration as well as manual and automatic controls to ensure that they remain operational. Regarding dikes, the Town plans to ensure that new flood protection systems (if constructed) will take sea level rise into account.	See #9: Secure funds and proceed with construction of the Riverside Drive tide gate system. See #26: Coordinate with the Army Corps of Engineers to determine a feasible option for future improvements to the dike system. See #14: Pursue an executable phase of the Riverside Drive/Ash Creek flood protection system by focusing on design of a segment that affects only Town-owned land.
29	Address the continued periodic tidal flooding of streets and properties in the coastal flood plain by making concerted efforts to design, construct, and maintain flood relief and drainage structures (e.g., dikes, tide gates, detention and natural marsh basins, storm sewers and natural channels) to ensure the discharge of flood waters during the receding tidal cycles immediately following the flood event.	This action is focused on ensuring that rapid draining of flooded areas will occur after flooding. Significant progress has been made relative to new tide gates and the South Benson Road pumping station as noted above. If additional projects are identified in the next five years, the Town will incorporate them into the next edition of this plan.	Refer to above carried forward and revised actions
30	Continue to maintain flood gates on the McLevy property.	This is an ongoing capability. The action can be removed.	Not Applicable
31	Continue to keep debris clear of drainage systems; plan for improvement/implementing routine management.	This is an ongoing capability. The action can be removed.	Not Applicable
32	Waterproof manhole covers.	Progress has been made and this action has been incorporated as a Public Works capability. The action can be removed.	Not Applicable
33	Continue to perform culvert maintenance and debris removal in the Rooster River, Ash Creek/Royal Avenue and Camden Street areas.	This is an ongoing capability. The action can be removed.	Not Applicable
34	Relocate the sanitary sewer transmission truck line from the flood prone Rooster River and Ash Creek corridor.	This project is underway. Carry forward for completion.	Relocate the sanitary sewer transmission truck lines from areas of significant flood risk.
35	Encourage green development and rehabilitation of existing impervious structures to reduce runoff generated in urbanized areas.	The Town has made significant progress through ongoing reviews of development proposals and completion of the Downtown Green Infrastructure Study and Conceptual Plan in 2018. Carry forward with revision to ensure progress resulting from the study and plan.	Secure funds for execution of a portion of the Downtown Green Infrastructure Study and Conceptual Plan.
36	Explore building modifications, use of pervious road materials and green infrastructure designs to improve on-site storm water retention and reduce storm water inflows into Fairfield's wastewater treatment system.	As noted immediately above, the Town has made significant progress through ongoing reviews of development proposals and completion of the Downtown Green Infrastructure Study and Conceptual Plan in 2018. Carry forward with revision to ensure progress resulting from the study and plan	Secure funds for execution of a portion of the Downtown Green Infrastructure Study and Conceptual Plan.
37	Prior to a storm, lower the volume of water in the wastewater treatment plant to increase capacity.	This is an ongoing capability. The action can be removed.	Not Applicable
38	Design culverts for a 50-year or 100-year storm in the Rooster River, Ash Creek/Royal Avenue and Camden Street areas.	Study and design has been completed for some areas. Carry forward with revision.	Allocate funds for replacements of culverts to alleviate flooding in the Rooster River, Royal Avenue, and Camden Street areas.
39	Consider improving the culvert at Merwins Lane.	Additional progress is desired. Carry forward.	Determine whether the culvert at Merwins Lane can be replaced to increase capacity.
40	Evaluate methods to increase storage or improve drainage to alleviate flooding downstream of the Fairchild Wheeler golf course.	A flood detention/storage study was completed in 2019 to augment previous studies in the Rooster River watershed. Carry forward with revision.	Identify the next steps to set aside land for detention/watershed storage in the Rooster River watershed.
41	Install on site detention, relay new storm lines, incorporate bioswales and/or rain gardens in developed areas to help reduce or redirect runoff that contributes to flooding. For example, in the Fairfield Center and Railroad parking lot.	As noted above for #35, the Town has made significant progress through ongoing reviews of development proposals and completion of the Downtown Green Infrastructure Study and Conceptual Plan in 2018. Carry forward with revision to ensure progress resulting from the study and plan.	Secure funds for execution of a portion of the Downtown Green Infrastructure Study and Conceptual Plan.
42	Continue to maintain/improve critical culverts and associated outlets/swales to remove debris, especially in advance of storms.	This is an ongoing capability. The action can be removed.	Not Applicable

ID	Description of Action	Status of Action in 2019	Revision for 2019-2024, if Applicable
43	Elevate Fairfield Beach Road as needed to keep up with rising sea levels.	Some progress has been made in the past, with two sections elevated, but significant buy-in from property owners will be needed for future efforts. The action will be carried forward with revision.	Conduct a feasibility study for elevating Fairfield Beach Road, including public outreach and incorporation of public input.
44	Extend the dike system along the shoreline from the Riverside Drive and Post Road area to Sasco Hill. Obtain easements to extend and complete the system in areas where it does not presently exist.	See #6 above. This action is essentially the same, but calls for a dike system rather than alternate approaches. Significant progress has been made including the Flood and Erosion Control Board's Flood Mitigation Plan, the Regional Framework for Coastal Resilience (resulting in a conceptual design for a dune ridge in the area south of Penfield Beach), and the Riverside Drive/Ash Creek flood protection system plan. In addition, the U.S. Army Corps of Engineers continues to evaluate flood protection for Fairfield. Future actions may include pursuing individual findings and conceptual designs.	Not Applicable
45	Extend the dike in Southport along Harbor Road in the AE flood zone.	Additional progress is desired. Carry forward.	Conduct a study to determine the feasibility of extending the dike in Southport along Harbor Road.
46	Improve the drainage system in the Downtown area, along Sanford and Reef Roads	The Town has determined that modifying the drainage systems on these roads may not be feasible. In lieu of modifying drainage systems, the Town will be pursuing green infrastructure in the downtown area that drains to these systems as noted above.	Not Applicable
47	Incorporate drainage improvements and best management practices to the Grasmere Brook watershed to reduce flooding.	?	?
48	Consider acquisition of properties where it is prudent and feasible to extend and construct the dike system.	This action cannot be achieved until the initial steps toward feasibility studies and designs are completed. Property acquisitions would be beyond the timeframe of this plan. The action should be removed in favor of the other actions listed above.	Not Applicable
49	Install pump stations to address flooding in the underpasses of New Haven rail line bridges.	This action will require ongoing coordination with the owner of the railroad. Carry forward with revision.	Determine the feasibility of installing pumping stations beneath the railroad underpasses to remove floodwaters.
50	Expand and repair flood gates along the Mill River.	?	?
51	Consider increasing the approved bulkhead elevation along Pine Creek to account for sea level rise.	Property owners along the bulkhead are opposed. The action can be removed.	Not Applicable
52	Consider elevating all roads within the AE and VE flood zones, including Fairfield Beach Road and surrounding neighborhoods.	Refer to #43 above. Some progress has been made in the past, but significant buy-in from property owners will be needed for future efforts. The action will be retired in favor of the action listed above for Fairfield Beach Road.	Not Applicable
53	Implement a dike system in the Rooster River, Holland Street, Ash Creek/Royal Avenue and Camden Street areas.	A flood protection system is not believed feasible due to the limited space available. Other options will be pursued here.	Not Applicable
54	Consider elevating Merwins Lane. This would require the abutting property owner's permission and permits.	This action is no longer desired as a method of addressing flood risk. The action can be dropped.	Not Applicable
55	Reconstruct New Haven rail line bridges over town streets to prevent flooding, including at North Pine Creek Road, Mill Plain Road, and Round Hill Road.	This action will require coordination with the owner of the railroad, Metro North, and Amtrak beyond the timeframe of this plan. Future editions of the plan will address this.	Not Applicable
56	Reconstruct and expand the culvert conveying Ash Creek and Rooster River under I-95 to reduce flooding in the Camden Street and Royal Avenue neighborhoods and to meet a 1% storm event. Include other local bridges on Rooster River in this project, so as to increase hydraulic capacity and reduce flooding.	A flood detention/storage study was completed in 2019 to augment previous studies in the Rooster River watershed. The Town plans to pursue these types of flood mitigation methods rather than upsizing the I-95 culverts.	Not Applicable

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57	Improve and install flood control outlet pipes and tide gates along Pine Creek and Ash Creek to increase the removal of flood waters.	Complete, although additional projects are planned as noted above.	Not Applicable
	Natural Systems Protection		
58	Incorporate improvements listed in the Rooster River Watershed based Plan.	Some progress has been made with actions listed in the watershed management plan. Revise for more specificity.	Select one action from the Rooster River Watershed Management Plan and secure funding for its execution. Focus on an action that has multiple hazard mitigation benefits.
59	Implement a comprehensive tree health, maintenance, and removal plan to reduce the number of downed trees and limbs during a storm event.	Complete	Not Applicable
60	Update the Town's Plan of Conservation and Development to include riparian corridor restoration as well as acquisitions of open space and marsh advancement zones for storm surge defense and floodwater storage.	The update is underway with a planned adoption in 2020. This is being incorporated.	Not Applicable
61	Protect and restore natural systems (salt marshes, beaches, dunes, floodplains/riparian areas, forested lands) on both watershed and full coastline scales, as well as diked and isolated wetlands to better withstand and absorb storm surges and flooding.	Significant progress has been made. For example, tidal wetlands along Reef Road were restored in 2017. The Town participated in the Regional Framework for Coastal Resilience (2015-2017) to identify specific green coastal infrastructure opportunities such as living shorelines and beach/dune creation and restoration. Additional progress is desired.	Conduct outreach and feasibility study for the conceptual dune ridge design that addresses the Penfield/Shoal Point area.
62	Renourish engineered beaches, Town and private beaches after storm events, including Fairfield Beach, Jennings Beach, Sasco Hill Beach and Southport Beach.	As noted above for #27, the Town completed an assessment of five municipal beaches and conceptual design for developing engineered beaches.	Secure funds for beach nourishment in accordance with the engineered beach study and design.
63	Restore upland storm water discharges in Pine Creek to their historical locations around the marsh and thereby utilize the large acre-foot-volume of storage capacity of the diked marshes with tide gates closed during storms to detain floodwaters during a high tide and heavy rain.	?	?
	Education & Awareness		
64	Train and equip neighborhood storm response teams (i.e., CERT), especially in neighborhoods that have in the past been cut off from emergency services by floodwaters or downed trees, as well as to assist lower-income populations.	Progress has been made and the CERT is active. Refer to https://www.fairfieldct.org/content/15561/12843/17868.aspx. Additional progress is desired. CRS participation will encourage progress with this action. Carry forward.	Train and equip neighborhood storm response teams (i.e., CERT), especially in neighborhoods that have in the past been cut off from emergency services by floodwaters or downed trees, as well as to assist lower-income populations.
65	Ensure that residents are aware of the location and operations of emergency shelters, warming/cooling centers, and charging stations and establish procedures for their use via routine notifications	This is an ongoing capability. The action can be removed.	Not Applicable
66	Communicate with residents about the importance of removing debris in marshes after storms.	This is an ongoing capability. The action can be removed.	Not Applicable
67	Develop tree planting guidelines.	Some progress has been made. Carry forward with revision.	Develop tree planting guidelines that are aligned with hazard mitigation goals.
68	Improve warning of residents that may become isolated by downed trees during an extreme weather event.	This is an ongoing capability. The action can be removed.	Not Applicable
69	Utilize GIS to inform responders and residents during a severe weather event, or in the event of an evacuation.	This is an ongoing capability. The action can be removed.	Not Applicable
70	Erect signs and install barricades on Merwins Lane to encourage residents to take alternate routes during flooding events.	Conducted on an as-needed basis.	Not Applicable
	Emergency Services		
71	Address road access by prioritizing snow clearing during storms, providing water pump-outs during flooding and identifying alternate routes to closed-off areas.	This is an ongoing capability. The action can be removed.	Not Applicable
72	Reassess needs and capacity for shelters, warming/cooling centers, and charging stations.	This is regularly conducted, and is an ongoing capability. The action can be removed.	Not Applicable
73	Continue use of pre-disaster communications (code red), social media and EOC communications.	This is an ongoing capability. The action can be removed.	Not Applicable

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74	Use vehicles (school buses, etc.) to transport vulnerable, senior and disabled populations to shelters.	The Town has an agreement with the Senior Center for bus transport, and acquired an Army transport truck for evacuations. The action is considered complete and can be removed.	Not Applicable
75	Protect/ flood-proof town services and data. Develop a plan for stockpiling food, water and gas in case of emergencies.	This is an ongoing capability. The action can be removed.	Not Applicable
76	Identify demographics so as to plan to prevent shut-ins during emergency events.	This is regularly conducted, and is an ongoing capability. The action can be removed.	Not Applicable
77	Clarify relationship with UI for downed power lines.	Significant progress has been made working with UI. This action can be removed.	Not Applicable
78	Identify vulnerable neighborhood egress chokepoints and identify alternate access routes to neighborhoods and facilities when those chokepoints are not passable; harden and flood proof these chokepoints as necessary to ensure they remain open.	The Town has identified these potential access problems and focuses on notifications and evacuations to address sections that cannot be kept open. Future projects include some road elevations as noted above (for Fairfield Beach Road). Turney Road is another possible corridor of interest. Elevating Turney Road was partly addressed during the public engagement associated with the Riverside Drive/Ash Creek flood protection study and conceptual plan.	Conduct a feasibility study for elevating Turney Road, including public outreach and incorporation of public input.
79	Reinstitute the Fairfield University and Sacred Heart University MOU with EOC.	Agreements are in place and this is an ongoing capability. The action can be removed.	Not Applicable
80	Build redundancies into EOC/EEC emergency communications systems and networks to ensure continuity of communications between town emergency services and residents. Utilize existing community networks (churches, etc.) as supplements to “technological” methods of communication.	This is an ongoing capability. The action can be removed.	Not Applicable
81	Provide and install generators to senior housing complexes and other complexes that serve vulnerable populations to allow them to shelter in place.	Progress has been hindered by lack of funding. Carry forward.	Provide and install generators to senior housing complexes and other complexes that serve vulnerable populations to allow them to shelter in place.
82	Provide adequate generators to evacuation facilities (Ludlowe High School, Warde High School and Ludlowe Middle School).	Complete	Not Applicable
83	Ensure Emergency Operation Plans of private dam facilities are adequate, including Aquarion Water Company facilities at Aspetuck Reservoir and Hemlock Reservoir.	The State's revisions to dam safety regulations in 2014 has resulted in new Emergency Action Plans (EAPs) for Class B and C dams. Complete.	Ensure that the current EAPs are filed with pertinent Town departments.
84	Enter into a mutual aid agreement with long term care facilities to share generators during an evacuation.	Complete	Not Applicable
85	Provide water/ice/showers for owners of private systems without power.	This is an ongoing capability. The action can be removed.	Not Applicable
86	Ensure the ability of cell phone towers to generate power; talk to cell companies about generation/ disaster recovery plans.	Significant progress has been made in tower coverage and redundancy.	Not Applicable
87	Consider alternate locations for ECC and EOC during weather events	Complete; Fairfield University is an alternate location.	Not Applicable
88	Expand the energy reliability of critical Town facilities, including the use of distributed generation and micro-grids. Relocate IT equipment out of municipal building basements in low lying areas.	Complete. A microgrid has been installed and IT equipment relocation is being executed. The microgrid can provide electricity for critical services at the Police and Fire Headquarters, the Emergency Communications Center, the nearby cell phone tower, and Operation Hope’s homeless shelter which is located behind Police Headquarters.	Not Applicable
89	Enhance flood protection at the DPW (immediate and surrounding areas) garage or consider feasibility of moving garage to an alternate location Study/explore how to evacuate water and relocate equipment prior to a threatening event.	Progress has been hindered by lack of funding. Carry forward.	Enhance flood protection at the DPW (immediate and surrounding areas) garage or consider feasibility of moving garage to an alternate location.
90	Conduct a study to identify the highest risk locations for prioritized mitigation and emergency response efforts before, during and/or after an extreme event during a variety of hazard scenarios.	The intent of this action has been met through numerous studies and plans conducted over the past five years. The Town continuously updates this information as needed, and the action can be removed,	Not Applicable

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	Prevention		
1	Explore building modifications, use of pervious road materials, and green infrastructure design to improve on-site storm water retention and reduce storm water runoff	The town encourages responsible stormwater management and includes elements of LID during review of individual projects. Compliance with the MS4 permit also leads to these efforts. However, with the POCD update in 2019-2020, the Town wishes to directly address LID and green infrastructure within a stormwater discussion or chapter.	During the update of the POCD, include a strong focus on stormwater management that sets policy for LID and green infrastructure, and encourages update of regulations to formalize the current practices of requiring onsite management of stormwater.
2	Establish a pre-storm drawdown process of Stepney Dam to increase storage capacity and prevent down stream flooding	Drawdowns and diversions by Aquarion have occurred on occasion, including prior to the September 25, 2018 flood event (at the direction of CT DEEP). The Town would like to formalize this process to ensure that it become standard practice and can be accomplished without intervention.	Work with Aquarion to ensure that informal practices of impoundment drawdown and water diversions are formalized in Aquarion operations plans.
3	Hold discussions with the Aquarion Water Company about the possibility of increasing the diversion of the Pequonnock River to the Easton Lake Reservoir in advance of a storm	Drawdowns and diversions by Aquarion have occurred on occasion, including prior to the September 25, 2018 flood event (at the direction of CT DEEP). The Town would like to formalize this process to ensure that it become standard practice and can be accomplished without intervention.	Work with Aquarion to ensure that informal practices of impoundment drawdown and water diversions are formalized in Aquarion operations plans.
4	Enforce rigorous storm water controls and encourage the installation of green infrastructure to reduce runoff generated at industrial and corporate parks, Strategies include on-site detention, bioswales and rain gardens	The town encourages responsible stormwater management and includes elements of LID during review of individual projects. Compliance with the MS4 permit also leads to these efforts. However, with the POCD update in 2019-2020, the Town wishes to directly address LID and green infrastructure within a stormwater discussion or chapter.	During the update of the POCD, include a strong focus on stormwater management that sets policy for LID and green infrastructure, and encourages update of regulations to formalize the current practices of requiring onsite management of stormwater.
5	Assess the impacts and location of septic systems impacted by flooding	The Health Department addresses this on an ongoing basis and the action can be dropped.	Not applicable
6	Conduct a town-wide hydrologic analysis of flooding/storm water impacts and water conveyance needs to minimize risk to people and infrastructure	A townwide hydrologic/drainage study has been in the Town's CIP for several years and has not been conducted due to budgetary constraints.	Conduct a townwide hydrologic analysis that addresses flooding, stormwater, and water conveyance needs to identify projects that can be implemented to reduce risks to infrastructure and people.
7	Improve coordination between the Monroe Department of Public Works crews and local utility crews to make safe areas with downed trees and allocate resources to priority locations.	This is an ongoing capability.	Not applicable
	Public Education & Awareness		
8	Encourage residents to take alternate routes during flooding events on Pepper Street	This is an ongoing capability.	Not applicable
9	Improve warning of residents that may become isolated by downed trees during an extreme weather event	Communications have improved with CodeRED, social media, and other platforms. This is an ongoing capability.	Not applicable
	Natural Resources Protection Actions		
10	Implement various strategies included in the Pequonnock River Initiative Watershed Management Plan, including increasing buffers, installing green infrastructure (rain gardens, bio-swales, storm water planters), and repairing stream channels.	The Town has made progress with this action. For example, a 319 grant was secured and used for a stream buffer enhancement project within the last five years. However, additional projects are desired outside the limited resources of the 319 program.	Implement one additional project identified in the watershed management plan, with a focus on flood risk reduction.
11	Continue and expand the proactive tree maintenance program by removing dead/diseased trees and branches and coordinate with the local utilities' tree trimming program	The program was expanded and the tree warden's budget was increased 25% between 2018 and 2019. The current level of effort is believed appropriate, although future expansions are not off the table.	Not applicable
	Emergency Services Protection Actions		
12	Upgrade the power supply at critical facilities with new generators, include the Town Garage, High School, Jockey Hollow and Chalk Hill School, all Town Shelters , the Emergency Operations Center, the Senior Center and senior housing facilities	The only remaining standby power need is the high school.	Acquire and install a generator for the high school that enables its use as a shelter.
13	Upgrade windows at the Emergency Operations Center, High School, and Shelters	All necessary upgrades are complete.	Not applicable
	Structural		
14	Incorporate additional power generation into the new Marian Heights facility under construction	This has been completed.	Not applicable

ID	Description of Action	Status of Action in 2019	Revision for 2019-2024, if Applicable
15	Upgrade the surge protection on the Town's computer server	This has been completed.	Not applicable
16	Replace and increase the size of culverts at key locations on Route 25 and Route 111, including the in vicinity of Chuck's Corner and Bart's Shopping Center	Culverts on Route 111 have been upgrades and culverts on Route 25 will be upgraded within the life span of this update.	Ensure that CT DOT completes the upgrades of culverts on Route 25.
17	Reconstruct and elevate a section of Route 25 in the vicinity of the West Pequonnock Reservoir	This project is part of DOT's ongoing Route 25 improvements.	Ensure that CT DOT completes the Route 25 drainage and flood risk reduction projects.
18	Replace or retrofit undersized culverts	As noted above, a townwide hydrologic/drainage study has been in the Town's CIP for several years and has not been conducted due to budgetary constraints. Once completed, additional culvert needs can be identified.	Conduct a townwide hydrologic analysis that addresses flooding, stormwater, and water conveyance needs to identify projects that can be implemented to reduce risks to infrastructure and people.
19	Install new culverts to address flooding on Main Street	This project is part of DOT's ongoing Route 25 improvements.	Ensure that CT DOT completes the Route 25 drainage and flood risk reduction projects.
20	Remove the Beaver Dam on Sammis Brook and replace with a constructed dam that has water level controls	A beaver dam is no longer a problem in this area. The Town wishes to re-evaluate conveyance between the two sides of the road, which could potentially address flood risk.	Prepare a hydraulic study of this section of the brook and determine if improvements are needed to reduce flood risk.
21	Replace and expand the culvert conveying the West Branch of the Pequonnock River under Pepper Street along Brook Street	As noted above, a townwide hydrologic/drainage study has been in the Town's CIP for several years and has not been conducted due to budgetary constraints. Once completed, additional culvert needs can be identified.	Conduct a townwide hydrologic analysis that addresses flooding, stormwater, and water conveyance needs to identify projects that can be implemented to reduce risks to infrastructure and people.
22	Consider elevating Pepper Street	This potential action should be deferred until studies are completed.	Not applicable
23	Improve the culverts conveying a low-gradient stream under Bart Road and along Verna Road and remove debris and blockages of the channel to maintain free flow	This area is characterized by wetlands and a low-gradient watercourse. Damage from flood has not occurred, as only backyards are affected. The action can be dropped.	Not applicable
24	Construct a proper channel for the swale of the tributary of the West Branch of the Pequonnock River in the backyards of residences along Pastor's Walk and Wiltan Drive	This area is characterized by wetlands and a low-gradient watercourse. Damage from flood has not occurred, as only backyards are affected. The action can be dropped.	Not applicable
25	Upgrade power lines and poles in the vicinity of Barn Hill and Webb Mountain	The need for this area was addressed through backfeed capabilities, and the action is no longer needed.	Not applicable
26	Remove debris and clear blockages of culverts at key river crossings throughout the Town, including the West Branch of the Pequonnock River at Route 25, Purdy Hill Road and Pepper Street, the Boys Halfway River at Cottage Street and the Far Mill River at Moose Hill Road	Ongoing MS4 compliance screening and work with CT DOT will reveal where these actions are needed. The action can be dropped from the update to this plan.	Not applicable

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	Prevention		
1	Integrate Low Impact Development techniques in the land use process, as well as in the new zoning regulations for the Transit Centered Development District in the vicinity of the Town Center.	Progress as been hindered by lack of staffing resources. This recommendation has been re-written because the previous one is too vague. The Town is looking into revising regulations to incorporate MS4 requirements while simultaneously addressing LID techniques. Carry forward with revision.	Develop comprehensive stormwater regulations that address both quality and quantity control measures including MS4 requirements and Low Impact Development (LID) techniques for transit oriented district at Town Center.
2	Flood audits on Masarik Avenue & Benton Street: after the permitting process has been completed, begin cleaning a downstream channel from Benton Street to Hathaway Drive.	This action item must be discontinued. Private property would be involved. It is not feasible for the Town to implement this action. However, see #40 below.	Not Applicable
3	Adopt ordinances that call for reductions in storm water runoff in new developments	See #1 above. Progress as been hindered by lack of staffing resources. The Town is looking into revising regulations to incorporate MS4 requirements while simultaneously addressing LID techniques. Carry forward with revision.	See #1: Develop comprehensive stormwater regulations that address both quality and quantity control measures including MS4 requirements and Low Impact Development (LID) techniques for transit oriented district at Town Center.
4	Evaluate ways to use the Stratford High School ball fields to increase protection of the Downtown.	Action should be discontinued. The Stratford High School was re-built recently. The Town will pursue other options for flood mitigation in this area.	Not Applicable
	Property Protection		
5	Develop a contingency plan and notification process to ensure buses are relocated prior to flooding events.	Complete; the Town revisits this plan on an ongoing basis. Action can be removed.	Not Applicable
6	Elevate structures in the Lordship area to meet or exceed FEMA requirements for Base Flood Elevation	Some progress has been made when projects trigger substantial damage or substantial improvement thresholds. Additional progress is desired. Carry forward with additional specificity.	Elevate private homes in Lordship area to meet or exceed FEMA requirements for Base Flood Elevation. Phase I to include homes on Washington Parkway. Pursue funding through Pre-disaster mitigation grants to elevate five homes on Washington Parkway.
7	Reassess existing and future risks to the South End and employment growth area identified in the Stratford Plan of Conservation and Development. The Plan should consider all costs of redeveloping land in vulnerable areas and consider less vulnerable areas; evaluate existing buildings and ensure new building are higher than unelevated existing ones; identify building codes that would reduce flood risk in at-risk locations.	Progress has been made. The new State Building Code effective 2018 incorporates freeboard for all flood zones. A coastal resiliency plan was developed in 2015-2016. Several action items were identified for implementation as part of this plan. Carry forward with revision that focuses on flood protection.	Pursue funding to mitigate existing and future risks to the South End and employment growth area identified in the Stratford Plan of Conservation and Development. Funds may be used to install flood control systems and/or elevate and extend seawalls where necessary.
8	Flood proof structures in the Lordship area where appropriate.	Structures in Lordship are mostly residential and will be elevated as noted above. Action can be removed.	Not Applicable
9	Flood proof structures and construct drainage improvements in the Town Center, as well as encourage Low Impact Development techniques to mitigate flooding in this area.	Floodproofing of structures is not practical because private properties are involved. The Town will be addressing overall drainage improvements as part of Complete Streets Phase I. LID will be addressed by regulations as noted above for #1.	Not Applicable
10	Relocate private contractor's equipment in flood zones to secure flood proofed location prior to events; Surf Avenue, Barnum Avenue, Bowe Avenue, Greenfield Avenue, Albright Avenue.	The Town encourages private property owners to take care of floodproofing of their properties. Limited budget available for addressing private properties otherwise. Action can be removed.	Not Applicable
11	Consider acquiring properties that have experienced repetitive loss from storms and flooding and maintain a list of properties with owner interest for future acquisition, and as NRCS funding becomes available.	The Town has not made progress in the area of property acquisitions. The Town's Coastal Resiliency Plan recommended various mitigation measures for properties severely impacted by flooding. These actions should be prioritized and properties that should be acquired should be identified.	Maintain a list of properties that have experienced repetitive loss from storms and flooding (with owner interest for future acquisition) and pursue open space funding as it becomes available. Acquire properties based on this list (this action calls for list development and applications for funding in the timeframe of this plan; acquisitions are deferred to future editions of this plan).
	Structural		
12	Proceed with roadway reconstruction on the Lordship Boulevard/State Route 113. The Connecticut Department of Transportation has initiated a project to elevate Route 113 in the vicinity of Sikorsky Airport.	Complete.	Not Applicable
13	Continue to clean catch basins on a regular basis.	This is a capability and the action can be removed.	Not Applicable

ID	Description of Action	Status of Action in 2019	Revision for 2019-2024, if Applicable
14	Address recurring flooding on Surf Avenue at the I-95 overpass.	The design of Surf Avenue culvert replacement project is on-going. Funding is needed for implementation. Carry forward with revision.	Pursue funding to design and initiate multiple culverts and channels on Surf Avenue at the I-95 overpass along with the flood wall to reduce chronic coastal flooding.
15	Complete the design phase and initiate construction to replace multiple culverts and channels at Barnum Avenue between Sage Avenue and Bowe Avenue to alleviate flooding of Barnum Avenue and West Avenue.	Significant progress has been made relative to design along this section of Bruce Brook. Carry forward with revision.	Pursue funding to design and initiate multiple culverts and channels at Barnum Avenue between Sage and Bowe Avenues.
16	Maintain the project to replace and enlarge the structured channel and culverts conveying Tanners Brook from the ball fields at Stratford High School, from Broadbridge Avenue and King Street and along the New Haven rail line.	Brook improvements are complete and the Stratford High School was rebuilt in 2018. Action can be removed. See #23 below for an additional action related to Tanners Brook.	Not Applicable
17	Develop a maintenance protocol with the US EPA to address flood mitigation strategies at the Raymark (Superfund) site. Work with the Raymark waste site at Ferry Creek and Lockwood Avenue to ensure planting and stabilization of land to prevent mobilization during events.	Progress has been made and the action can be removed. The Town and EPA are working together to address the site. If redevelopment occurs in the future, the Town will require the development to be resilient and compliant with flood damage prevention regulations and the State Building Code.	Not Applicable
18	Assess feasibility of elevating Main Street - from 5 1/2' to 7'.	Complete (see #12 above).	Not Applicable
19	Coordinate a full scale survey of Short Beach with the Army Corp of Engineers so that it may meet FEMA's definition of an engineered beach.	Survey was completed. Carry forward with revision.	Secure funding to build Short Beach to the elevations and grades of survey design recommendations conducted by US Army Corps of Engineers.
20	Increase protection around the wastewater treatment plant by raising the existing flood control berm.	The Town used a CDBG-DR grant to conduct a planning study of Town infrastructure and develop a Coastal Resiliency Plan. The plan recommended enhancements including this Mitigation Measure. A portion of funding is in place through CDBG grant for implementation. 40% match is needed to implement through federal or state grants. Carry forward with revision to focus on securing the funds.	Secure funding to implement flood protection measures around the wastewater treatment plant by raising the existing flood control berm.
21	In the South End neighborhood, evaluate installing twin 6' X 8' box culvert with regulating tide gate to allow tidal flushing while preventing tidal flooding up to elevation 9' on Lordship Boulevard.	The Town used a CDBG-DR grant to conduct a planning study of Town infrastructure and develop a Coastal Resiliency Plan. The plan recommended enhancements including this Mitigation Measure. Carry forward with revision to focus on securing the funds.	Secure funding to design and build twin 6' X 8' box culvert with regulating tide gate to allow tidal flushing while preventing tidal flooding along Lordship Boulevard.
22	Work with the local utility to harden utilities (bury lines); maintain contractor on call list; tree trimming and maintenance efforts; secure funding for tree removal.	Ongoing efforts are undertaken by the Tree Warden and Director of Public Works. An on-call contractor is also available. These efforts have addressed the intent of this action, and it can be removed.	Not Applicable
23	Continue with the project to increase the width of the channelized stream downstream of Broadbridge Avenue to reduce flooding at a condominium parking lot. The replacement and enlargement of the structured channel and natural channel that conveys Tanners Brook from Broadbridge Avenue South to King Street has been designed and is in the permitting phase. Funds have been allocated for construction.	The project to increase the width of channelized Tanners Brook downstream of Broadbridge Avenue is in permitting phase. CT DEEP and FEMA CLOMR application have been applied for. When approved, the Town will proceed with the balance of funding request to bid the project. Following the bid and fully funding the project, a contract will be awarded and the Town will oversee construction to fully implement the project. Additional progress is desired relative to other streams in the town that can potentially be daylighted. The action will be divided into two actions to carry forward.	1. Pursue funding to evaluate the feasibility of daylighting of streams and prioritize actions to reduce hazards. 2. Continue with the project to increase the width of the channelized stream downstream of Broadbridge Avenue to reduce flooding at a condominium parking lot. The replacement and enlargement of the structured channel and natural channel that conveys Tanners Brook from Broadbridge Avenue South to King Street has been designed and is in the permitting phase. Funds have been allocated for construction. Execute construction in the timeframe of this plan.
24	Complete the bridge project to elevate Broad Street over Ferry Creek.	This project is under preliminary design. The Town is currently proceeding with further study based on FEMA revisions to the Base Flood Elevation. Permitting and funding will be the next step in this design. Once completed, the Town will bid and oversee construction to fully implement the project.	Pursue funding to complete the bridge project to elevate Broad Street over Ferry Creek. Town currently pursuing funding through LOTCIP grant.

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25	Increase the capacity of the wastewater treatment system by reducing inflows, such as with flood proofed manhole covers.	Based on completion of assessment of its operations, the Town conducted a study to determine the areas where Inflow and Infiltration (I/I) can be reduced. In addition, the Coastal Resiliency Plan evaluated manholes and other infrastructure that needs to be protected during coastal flooding. Based on this evaluation, the Town applied for and received $700,000 of Clean Water Act grant funds. Carry forward with revision.	Reduce I/I through execution of projects utilizing the Clean Water Act grant funds.
26	Complete the design phase for a 36" relief pipe to Long Brook and proceed to construction.	Funding for this, which was obtained through a CDBG-DR grant, was de-commissioned recently. This project is currently being designed and will proceed to local permitting in the near future. The project should be implemented and constructed in less then two years.	Secure funding to design and build a 36" relief pipe to Long Brook and proceed to construction.
27	Complete the bridge project to elevate Broad Street over Ferry Creek.	Duplicate with #24 above	Duplicate with #24 above
28	Complete the West Broad railroad viaduct renovation project. Assess the feasibility of other locations in need (Bruce Avenue, King Street, East Main). Utilize green infrastructure to reduce drainage "upstream" from viaducts (catchment basins, swales, storm water gardens, etc...).	This project is approaching the construction phase. State funding in the amount of $ 6 million is in place. Carry forward to focus on execution. The green infrastructure component of this action will be addressed as explained in #1 above.	Execute the West Broad Street project to reduce drainage-related flooding and flooding associated with Tanners Brook.
29	Consider a quantitative study to determine which manhole covers within the existing or new flood zones to waterproof to prevent inundation of flood waters into the sanitary sewer system, and secure funding for this project.	See #25 above. This action is similar and the intent will be addressed with the CWA grant funds.	See #25 above.
30	Respond to future needs as appropriate at Oronoque Village.	The Health Department has reached out to Oronoque residents providing them with emergency preparedness information. In addition, staff have provided on-site instructions on how to enroll in the Stratford Electronic Notification System so they can be sure to receive timely emergency notifications. The Town needs additional equipment for providing emergency management services to Oronoque Village. However, limited funding has impeded this progress.	Secure funding to respond to future needs as appropriate at Oronoque Village. Specifically, acquire additional equipment to provided enhanced emergency management related to the development.
31	Flood proof critical buildings south of Stratford Avenue: raise equipment and generators, install projectile proof windows (municipal buildings, private residents, community buildings).	The Town used a CDBG-DR grant to conduct a planning study of Town infrastructure and develop a Coastal Resiliency Plan. The plan recommended enhancements including this Mitigation Measure. Carry forward with revision to focus on securing the funds.	Pursue funding to floodproof municipal buildings in the town by raising equipment and generators and installing projectile proof windows where necessary.
32	Complete the replacement of storm water culverts under Old Spring Road with new box culverts.	Permitting and design are underway. The Town is considering applying for local bridge program to pursue funding and implement. Carry forward with revision to focus on securing the funds.	Secure funds to replace the stormwater culverts under Old Spring Road with new box culverts.
33	The Town has selected a consultant to design a 7X3 culvert as part of the West Broad St roadway improvements. This will alleviate flooding at the West Broad St RR underpass at Tanner's Brook.	See #28 above	See #28 above
34	Proceed with increasing the size of the culvert at Reed St. to 500' of 12' X 4' box culvert.	Action can be removed. This is on a private property that was sold to another owner recently. Only this property floods on Reed Street and the property owner floodproofed it. No further work is needed at this time.	Not Applicable
35	An assessment of drainage system components through specific areas of Oronoque Village is underway. Continue to monitor improvements to drainage system completed by Association in 2004.	A stream improvement project was completed on Freeman Brook, which flows through this area. The action is no longer needed.	Not Applicable
36	Consider installing twin 6' X 8' box culverts on Lordship Boulevard with regulating tide gate to allow tidal movement while preventing flooding in the South End neighborhood.	Same as #21 above	Not Applicable
37	Consider replacing the storm water culverts under Quail Street with new box culverts. Due to the status of an adjacent Superfund site, the Town has been unable to proceed with this project.	The action can be discontinued. This location is Bruce Brook near Wooster Pond. No flood mitigation is required. The pond is believed to acts as a flood storage facility.	Not Applicable

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38	Conduct an investigation to examine the implications of various flooding scenarios on the wastewater treatment plant and identify appropriate and feasible responses, such as raising the berm.	Same as #20 above	Not Applicable
39	Assess approaches to maintain the functionality of the Birdseye boat docks and ramp under flooded conditions to ensure continued use during disasters.	Complete. In 2018, a consultant was hired to conduct an assessment of the Birdseye ramp to maintain functionality during storm events. No implementation has been undertaken yet although $14,000 was budgeted. EMS Department is currently seeking approval from DEEP and the Town Council. Carry forward with revision for next stage.	Pursue funding to implement the best approach to maintain the functionality of the Birdseye ramp under flooded conditions to ensure continued use during disasters.
40	Structural flood proofing on Massarik Avenue/Benton Street.	This action was recommended in the Coastal Resilience Plan. Progress has been impeded by lack of funding. Carry forward with revision.	Pursue funding to implement structural flood proofing on Massarik Avenue/Benton Street.
41	Evaluate a flood control structure at Stratford High School ball field on King St. to create 2.5 MG of flood storage for 1% storm event	This action can be discontinued in favor of the above descriptions of actions in the Tanners Brook watershed (i.e. #16 above).	Not Applicable
42	Consider bank erosion protection east of Diane Terrace.	Progress has been impeded by lack of funding. The Town will include in the CIP and prioritize this project and schedule the design, permitting and construction in the order of prioritized capital improvements.	Pursue funding to mitigate bank erosion at Diane Terrace and engage private properties on that street.
43	Maintain the Beaver and Brewster dam studies (inspection reports conducted by the State of Connecticut) and continue to identify mitigation actions to reduce loss. Assess current condition and impacts of catastrophic failure for all dams. Access previous inundation contingency plans for the Beaver Dam, Brewster Pond Dam, Pecks Mill Pond Dam, Cooks Pond Dam.	Beaver Dam and Cooks Pond Dam are privately owned sites, and Cooks Pond Dam does not exist now. An EAP exists for Brewster Dam. The Town's Conservation Administrator is updating the Brewster Dam study. The intent of this action has been met and it can be removed.	Not Applicable
44	Consider integrating the animal shelter into improvements at the wastewater treatment plant, such as by extending the protective berm around the shelter.	This action was recommended in the Coastal Resilience Plan. Progress has been impeded by lack of funding. Carry forward with revision.	Floodproof the animal shelter adjacent to the Wastewater Treatment Plant.
45	Strengthen and extend the Lordship Beach seawall.	Progress has been impeded by lack of funding. Carry forward with a revision to focus on a feasibility study,	Conduct a feasibility study to determine whether the Lordship seawall can be modified to increase its resilience to future storms.
46	Assess and scope the feasibility of hardening facilities associated with 2 pump stations; assess impact of temporary loss of multiple pump stations; consider alternative sites for relocation of vulnerable stations long term	The Town is currently addressing resiliency of pumping stations both in North End and South End. The Town Engineer has applied for funding provided by the WPCA; Clean Water Fund is being used for construction.	Secure funds for pumping station improvements to incorporate resiliency; and implement the improvements.
	Natural Systems Protection		
47	Protect and maintain Long Beach as an effective barrier beach.	The property is currently under a Conservation Restriction so that no future building can occur on the beach. The Town will continue to maintain Long Beach West as a natural and effective barrier beach.	Not Applicable
48	Implement a routine tree maintenance and inspection program and remove hazardous trees and branches.	This is a capability and the action can be removed.	Not Applicable
49	Protect and maintain Short Beach, including replenishing the beach (engineered beach) after a major event. Coordinate with federal agencies to conduct a cost/benefit analysis for Short Beach replenishment over time.	The Town executed a study in order to operate and maintain the beach as a "engineered beach" in relation to FEMA DAP 9580.8. In 2017, the beach was replenished with >520 cubic yards of sand. The sand was placed in accordance with engineered designs in order to ensure stability and maximum retention. The Town has an annual documented maintenance plan for the beach. The action can be discontinued.	Not Applicable
50	Assess the impacts on Long Beach/Pleasure Beach and adjoining National Wildlife refuge and built structures (roads, commercial/industrial, residential, airport) from breach of barrier island during future extreme weather events; cost/benefit analysis of beach restoration/replenishment over time.	This group of actions was addressed in the Coastal Resilience Plan and is addressed above within other actions.	Not Applicable
51	Renourish and replenish beaches and regenerate dunes after major events.	Progress has been made at Short Beach as noted above. Action has not been needed at other beaches.	Not Applicable

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52	Secure funding for and initiate the urban forest canopy study (an application for funding through an America the Beautiful grant was submitted in November 2013)	This project was completed by November 2014 and contributed to MetroCOG Tree Canopy Assessment.	Not Applicable
53	Assess the impacts of hazards on natural areas: Roosevelt Forest, Booth Memorial Park, Far Mill River, Wooster Park; identify ways to enhance defensive/protective features for additional flood protection longer-term.	Some progress was made via the Coastal Resilience Plan, but some of these areas are not coastal. Additional progress is desired but funding and staffing limitations have hindered progress. Carry forward with revisions and divide the action into separate studies.	Pursue funding to address the impacts of hazards on natural areas, focusing on individual studies for Roosevelt Forest, Booth Memorial Park, Far Mill River, and Wooster Park. The studies should identify ways to enhance defensive/protective features for additional flood protection in the long term.
54	Work with private land owners to understand the importance and benefits of maintaining and leaving vegetation in place to stabilize riverbanks	The Town is in the process of developing an educational program as part of Community Rating System (CRS) program that teaches residents and businesses about the importance of maintaining an adequate vegetative buffer to maintain stream channels and prevent erosion based on flooding. The program aims to educate the public through flyers and discussions at public events. Carry forward with revision.	Educate private land owners to understand the importance and benefits of maintaining and leaving vegetation in place to stabilize riverbanks
55	Consider a “Living Shoreline Plan” for the Stratford coastline.	Complete. The Town's Coastal Resilience Plan and its part of the Regional Framework for Coastal Resilience have together addressed the intent of this action and mapped out potential living shorelines.	Not Applicable
56	At Russian Beach, assess the ongoing and long-term impacts from hazards towards developing a sustainable course of action.	Partially complete. The Regional Framework for Coastal Resilience included a bioengineered bank stabilization design for Russian Beach. Landowner buy-in is needed. Additional steps will include final design and construction.	Secure landowner permissions and funding for design and execution of the bank stabilization project.
57	Work with local utilities to develop a replanting plan and maintenance plan for trees consistent with recommended arboriculture practices and that is supportive of the “right tree, right place” policy	Over the past five years the Town has attempted to work with utilities companies conducting right of way clearance and trimming of trees to support a replanting program in Town. The utility companies assert that they do not have the funding to support such a program. The Town applied for and was awarded an America the Beautiful grant by CT DEEP in 2016 to plant nearly 50 trees in public parks, schools, and open spaces in accordance with the "right tree right place" practice. The shade trees are now thriving and plans for future plantings are being developed. The Town has also encouraged residents to plant shade trees on their private property by offering a discount on tree purchases at a local garden exchange. Carry forward with revision for additional progress.	Develop a tree replanting plan and maintenance plan consistent with recommended arboriculture practices and that is supportive of the “right tree, right place” policy. The Town's Tree Warden will work to establish a regular tree planting program and obtain grants (as available) in support of the initiative. The Tree Warden will also develop an ordinance that mandates a tree replanting program/schedule in accordance with "right tree, right place" policy.
	Education and Awareness		
58	Highlight the Living Shoreline project on Stratford Point.	Over the past five years, the Town of Stratford Conservation Commission and the general public has been updated on the "Living Shoreline Project" via public meetings and outreach events at Stratford Point (i.e. Earth Day, Forest to Shore Day). Town residents, local students, and volunteers across the region have participated in planting saltmarsh cordgrass and coastal upland vegetation at the site, under the direction of Sacred Heart University and Audubon CT. Protective dunes on site have also been restored and stabilized through grant-funded projects overseen by Sacred Heart university. The Town will continue to work with Audubon CT and Sacred Heart University to educate the public on the importance of restoring coastlines via living shorelines methodologies. A specific mitigation action is not needed at this time.	Not Applicable
59	Utilize GIS for the purposes of notification, evacuation and awareness of the location of floodplains and mitigation projects.	Additional progress in this area is needed. Refer to #67 below for more information.	Refer to #67 below

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60	Focus public education on safety tips and reminders to individuals about how to prepare for cold weather, heat waves and severe weather events.	Participation in the CRS program will provide opportunities to make progress in this area. To raise public awareness on disaster preparedness and mitigation, and to maintain good standing with the program, a Program for Public Information (PPI) outlining the schedule and implementation of all outreach activities should be adopted by the Town. This PPI will serve as a guide in educating general public and local officials on all types of hazards.	Develop, adopt, and implement a PPI as part of the Town's participation in the CRS program.
61	Businesses in the Main Enterprise and Lordship Boulevard areas need to find solutions to minimize impacts to facilities and improve business continuity after major events; additional generators needed.	Participation in the CRS program will provide opportunities to make progress in this area. To raise public awareness on disaster preparedness and mitigation, and to maintain good standing with the program, a PPI outlining the schedule and implementation of all outreach activities should be adopted by the Town. This PPI will serve as a guide in educating general public and local officials on all types of hazards.	Develop, adopt, and implement a PPI as part of the Town's participation in the CRS program.
62	Implement outreach programs to educate citizens regarding Ordinances, Insurance, and other flood relevant issues.	Participation in the CRS program will provide opportunities to make progress in this area. To raise public awareness on disaster preparedness and mitigation, and to maintain good standing with the program, a PPI outlining the schedule and implementation of all outreach activities should be adopted by the Town. This PPI will serve as a guide in educating general public and local officials on all types of hazards.	Develop, adopt, and implement a PPI as part of the Town's participation in the CRS program.
63	Encourage restaurants throughout town to acquire and install backup generators to increase food preparation and ice availability.	Participation in the CRS program will provide opportunities to make progress in this area. To raise public awareness on disaster preparedness and mitigation, and to maintain good standing with the program, a PPI outlining the schedule and implementation of all outreach activities should be adopted by the Town. This PPI will serve as a guide in educating general public and local officials on all types of hazards.	Develop, adopt, and implement a PPI as part of the Town's participation in the CRS program.
64	Use signage and public information to make the public aware of evacuation routes and available shelters, especially those individuals living within hurricane storm surge evacuation zones.	This has largely been completed but participation in the CRS program will provide additional opportunities. To raise public awareness on disaster preparedness and mitigation, and to maintain good standing with the program, a Program for Public Information (PPI) outlining the schedule and implementation of all outreach activities should be adopted by the Town. This PPI will serve as a guide in educating general public and local officials on all types of hazards.	Develop, adopt, and implement a PPI as part of the Town's participation in the CRS program.
65	Continue use of QAlert (online) system for complaint tracking to maintain a database of calls received by the Town.	This is a capability and the action can be removed.	Not Applicable
	Emergency Services		
66	Continue to implement and operate the Stratford Electronic Notification System to alert residents and businesses in the case of impending storms and floods.	This is a capability and the action can be removed.	Not Applicable
67	Use of GIS to document evacuation plans.	The Town's EMS has plans to update the system. The Town will work with the Stratford Fire Department, Police Department, and MetroCOG to update the evacuation plans and make these routes available on the new Regional GIS system. The evacuation routes will be made available to the public on the Town's website.	Update the evacuation plans and make these routes available on the new Regional GIS system. The evacuation routes will also be made available to the public on the Town's website.
68	Improve coordination with utilities in response to disasters and increase “make safe” crews.	The Town is currently working with the Regional Homeland Emergency Preparedness Team to improve communications during storm events. This team will directly work with United Illuminating (UI) to streamline and improve the policy for administrating the use of "Make Safe" Crews. The action can be discontinued.	Not Applicable

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69	Provide adequate back-up power to Bunnell High School, Birdseye Municipal Complex, Flood Middle School, Stratford Housing Authority units and the Baldwin Senior Center.	The Town secured approximately $40,000 through the CIP and installed an emergency generator at Bunnell High School. Generators will be installed at other sites as additional funding is available.	Pursue funding to provide adequate back-up power to Birdseye Municipal Complex, Flood Middle School, Stratford Housing Authority units, and the Baldwin Senior Center; and to make improvements to the existing generator at Stratford Fire Station .
70	Update evacuation plans to factor lack of access to transportation routes during peak events (CAT-3). Integrate into notification of voluntary and mandatory evacuation orders.	Progress has been made in related areas. Fire, Police and Health coordinate to utilize the Stratford Electronic Notification System in a planned series of pre-event notifications warning people about the dangers of waiting too long to evacuate. For those not heeding voluntary or mandatory evacuations, the local National Guard unit may be called in to evacuate in the areas of highest risk. The Town currently has a multi-tiered approach to creating a communication flow with redisents. The Town's EMS works with CAO's office to disseminate messages through social media. The Town has plans to display digital signage with disaster preparedness and recovery messages at select locations in the town in the near future.	Pursue funding to update evacuation plans to factor lack of access to transportation routes during peak events such as a severe hurricane, and display them using digital signage at select locations. Integrate notification of voluntary and mandatory evacuation orders into these messages.
71	Prioritize use of evacuation sites/warming centers for storm events.	Complete	Not Applicable
72	Keep access to Birdseye Municipal Complex open as it is a critical sheltering facility	Discontinue action. EMS is working on alternative approaches. EMS staff are working on training town employees for sheltering people.	Not Applicable
73	Make Police Station more resilient during events	Components of this were completed two years ago using $170,000 from CIP funds.	Not Applicable
74	Clearly define roles of the Community Emergency Response Teams (CERT) to minimize response functions of emergency services.	Some progress has been made. The CERT team has been trained to provide support in sheltering and mass care activities. The Emergency Operation Plan has been updated to delineate the CERT functions. The Town's EMS Department has goals to re-focus on this program to determine usage, how to keep CERT members engaged, how to train and recruit CERT members, etc. Carry forward with revision.	Clearly define roles of the Community Emergency Response Teams (CERT) to optimize response functions of emergency services.
75	Address gas stations without generators by securing support and funding to provide generators to enable gas pumping.	This action is no longer believed necessary, as many gasoline service stations have upgraded standby power.	Not Applicable
76	Work with the Stratford Housing Authority to develop evacuation plans.	This is being addressed as parts of other actions that address evacuation routes and logistics such as #69 and #70 above.	Not Applicable
77	Improve warning of residents that may become isolated by downed trees during an extreme weather event.	Complete and ogling as part of the Town's notification systems.	Not Applicable

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	Prevention		
1	Participate in FEMA's Community Rating System (CRS) program.	Complete	Not Applicable; action removed
2	Improve the tree management plan.	The tree warden has an annual budget and the Town conducts some tree work. UI conducts tree maintenance which is also helpful. This action is not needed.	Not Applicable; action removed
3	Conduct a comprehensive assessment and study of all drainage easements in the Town to assess condition, map locations, prioritize and develop action plans for maintaining and upgrading as needed.	Progress has not been made, due to staff and budget constraints. Carry forward with revision.	Secure funds and develop a scope of work to study a portion of the Town's drainage easements and drainage network.
4	Modify regulations to provide incentives and/or credits for installation of green infrastructure for the on-site retention and control of storm water runoff.	Carry forward with revision. The Town encourages use of LID during development reviews. However, while the Town has made some progress, it does not have a policy in place or locations identified for additional green infrastructure, not are regulations in place to require such.	Replace with "Conduct a feasibility study to determine where green infrastructure can be installed" (#31 below) and "Prepare a draft of municipal regulations that can be used to require low impact development and green infrastructure."
5	Conduct a tree inventory and canopy assessment in Trumbull and identify locations for planting of trees. An application for an America the Beautiful grant to fund an unban tree canopy for the Greater Bridgeport Region has been submitted.	The study was completed.	Not Applicable; action removed
6	Conduct a drainage study at critical locations known to flood, including White Plains Road and Route 127 at the Town Center.	Progress was made on Horse Tavern Brook and Booth Hill Brook, and upgrades have resulted (i.e. Booth Hill Brook culvert replacement). Any remaining lack of progress is due to staff and budget constraints. Carry forward with revision.	"Secure funds and develop a scope of work to study one of the Town's watercourses and watersheds. Island Brook will be prioritized next."
7	Conduct hydrologic studies of water conveyance and obstacles for water courses throughout the Town, including Horse Tavern Brook, Island Brook and Booth Hill Brook, as well as in floodplains and at culverts and crossings.	Progress was made on Horse Tavern Brook and Booth Hill Brook, and upgrades have resulted (i.e. Booth Hill Brook culvert replacement). Any remaining lack of progress is due to staff and budget constraints. Carry forward with revision.	"Secure funds and develop a scope of work to study one of the Town's watercourses and watersheds. Island Brook will be prioritized next."
8	Utilize GIS to assess and identify the locations and extent of exposure from flooding for all structures within the SFHA.	This will occur in connection with CRS participation. The GIS capability already exists. Action can be removed.	Not Applicable; action removed
9	Review the Town's storm water management policy for green infrastructure projects.	Carry forward with revision. The Town encourages use of LID during development reviews. However, while the Town has made some progress, it does not have a policy in place or locations identified for additional green infrastructure, not are regulations in place to require such.	Replace with "Conduct a feasibility study to determine where green infrastructure can be installed" (#31 below) and "Prepare a draft of municipal regulations that can be used to require low impact development and green infrastructure."
10	Assess the flood storage capacity of existing open space as part of an upcoming inventory.	Progress has not been made, but this will be accomplished as hydrologic studies are completed.	"Secure funds and develop a scope of work to study one of the Town's watercourses and watersheds. Island Brook will be prioritized next."
11	Conduct a flood drainage study across the Long Hill drainage corridor.	Progress was made on Horse Tavern Brook and Booth Hill Brook, and upgrades have resulted (i.e. Booth Hill Brook culvert replacement). Any remaining lack of progress is due to staff and budget constraints. Carry forward with revision.	"Secure funds and develop a scope of work to study one of the Town's watercourses and watersheds. Island Brook will be prioritized next."
12	Review flood risks in areas north and west of the Route 25 and Route 111 intersection.	This will occur in connection with CRS participation. The GIS capability already exists. Action can be removed.	Not Applicable; action removed
13	Update Town drainage regulations for new development and redevelopment projects.	Subsequent to progress related to the actions regarding drainage (#3) and watercourses (#6, 7, 10, and 11), the Town will determine if regulation changes are needed.	Not Applicable; action removed
14	Improve drainage maintenance of vegetated swales.	Subsequent to progress related to the actions regarding drainage (#3) and watercourses (#6, 7, 10, and 11), the Town will determine if vegetated swale maintenance is needed.	Not Applicable; action removed
	Property Protection		
15	Consider elevating repetitive loss structures, structures in the floodplain, homes along the Pequonnock River and homes on Manor Drive and Larkspur Lane.	Carry forward with revision. The Town has encouraged property owners to elevate structures and requires this when substantial improvement limits are triggered.	Revise action to "Annually send a letter to property owners in RL areas to inform them of options for elevating or acquiring structures to reduce flood risk."

ID	Description of Action	Status of Action in 2019	Revision for 2019-2024, if Applicable
16	Determine base flood elevations for homes located in high flood hazard areas, including along Manor Drive and the Twin Brooks Park neighborhoods (Larkspur/Seneca).	Limited progress has been made, but this will be conducted as part of CRS participation. Carry forward.	"Provide 100 year floodplain locations on our GIS Website for residents."
17	Evaluate potential locations in the Island Brook Park/Island Brook area and Melrose (south of Island Brook) for detention and pursue property acquisition as needed.	Progress was made on Horse Tavern Brook and Booth Hill Brook, and upgrades have resulted (i.e. Booth Hill Brook culvert replacement). Any remaining lack of progress is due to staff and budget constraints. Carry forward with revision.	"Secure funds and develop a scope of work to study one of the Town's watercourses and watersheds. Island Brook will be prioritized next."
18	Acquire repetitive loss properties.	The Town has teamed with RL property owners to acquire and demolish several residential structures. Additional acquisitions will be considered depending on results of outreach conducted through CRS participation.	Revise action to "Annually send a letter to property owners in RL areas to inform them of options for elevating or acquiring structures to reduce flood risk" (see #15 above).
	Structural		
19	Upgrade snow removal and response equipment where needed.	Ongoing; this is standard practice and is one of the Town's capabilities.	Not Applicable; action removed
20	Implement the proposed floodplain management plan at Horse Tavern Brook, including the proposed detention ponds and basins.	Floodplain mapping in this area has been revised with a LOMR and the Town believes the appropriate risk is represented.	Not Applicable; action removed
21	Continue catch basin maintenance in the Pequonnock River watershed, along Pequonnock River tributaries and Pinewood Lake.	Ongoing; this is standard practice and is one of the Town's capabilities.	Not Applicable; action removed
22	Continue to maintain critical culverts and remove debris, especially in advance of storms.	Ongoing; this is standard practice and is one of the Town's capabilities.	Not Applicable; action removed
23	Flood-proof exposed pump stations in low-lying, floodprone areas	A master plan for pumping stations has been completed. The Town is currently rehabilitating and floodproofing the Beardsley pump station. Improvements were completed to the Reservoir Pump station to prevent flooding.	Design for other pumping stations is ongoing. Revise to demonstrate commitment to completing other pumping stations.
24	Continue to inspect and maintain existing dams in the Horse Tavern Brook area.	Significant progress has been made statewide relative to dam safety due to regulation changes in 2014-2015. Dams are inspected at the owner's cost as required by CT DEEP.	Not Applicable; action removed
25	Coordinate with the State to improve flood water conveyance at the culvert on Route 15.	This occurs as needed through typical DOT coordination.	Not Applicable; action removed
26	Continue to inspect and maintain existing dams and reexamine the safety and condition of Class A and B dams, including Canoe Brook Lake.	Significant progress has been made statewide relative to dam safety due to regulation changes in 2014-2015. Dams are inspected at the owner's cost as required by CT DEEP.	Not Applicable; action removed
27	Install back-up generation at sewage pump stations through the Town.	Complete	Not Applicable; action removed
28	Improve management of and conduct controlled drainage of Pinewood Lake prior to storm events to maximize retention capacity.	Progress has not been made, due to staff and budget constraints. A scope of work has been developed for this. Carry forward with revision.	Secure funds and complete study to determine how water level can be controlled to mitigate downstream flooding.
29	Complete storm sewer projects in the Pequonnock River and Pinewood Lake drainage basin.	Storm sewer projects in both Pequonnock & Pinewood drainage basins are ongoing. As the Town completes roadway improvements in these drainage basins areas, it makes stormwater system improvements. Because this is ongoing and in the capital improvement plan budgets, the action can be removed.	Not Applicable; action removed
30	Replace existing culverts conveying the Pequonnock River at Daniels Farm Road, in the Twin Brooks area and at the Merritt Parkway with higher capacity structures.	The Town has replaced many drainage pipes over the last five years and some of them were upgrades. These locations were not yet upgraded due to other replacement priorities that came up. The Merritt Parkway location cannot be modified with CT DOT taking the lead.	Replace with "Allocate funds and conduct design for enlarged conveyance at Daniels Farm Road/Pequonnock River and downstream in e Twin Brooks Park area"
31	Install green infrastructure, including bioswales, rain gardens, vegetative roofs and permeable pavement, to retain storm water runoff and promote infiltration.	Carry forward with revision. The Town encourages use of LID during development reviews. However, while the Town has made some progress, it does not have a policy in place or locations identified for additional green infrastructure.	Replace with “Conduct a feasibility study to determine where green infrastructure can be installed.”
32	Continue to ensure the culvert maintenance plan is updated and implemented, particularly in advance of a major rain event and specifically in the Twin Brooks area.	Ongoing; this is standard practice and is one of the Town's capabilities.	Not Applicable; action removed

ID	Description of Action	Status of Action in 2019	Revision for 2019-2024, if Applicable
33	Regrade the floodplain at the bend in the Pequonnock River at Route 127 to improve conveyance.	Progress has been impeded by lack of funding. The Town will determine if this is needed during the five-year plan timeframe.	Replace with "Determine if floodplain enhancement at the bend of the Pequonnock River near Route 127 is feasible and would be effective for flood mitigation, and secure funding if found to be cost effective."
34	Assess the condition of existing dams in Town, including at Canoe Brook Lake and Pinewood Lake, and install new drainage valves and other control devices necessary to draw down water levels in advance of approaching storms and limit the potential hazards to downstream properties.	Significant progress has been made statewide relative to dam safety due to regulation changes in 2014-2015. Action should be carried forward in light of this progress.	Replace with "Allocate funds and retain consultant to review dam safety files and EAPs for dams in Trumbull; and determine which dams may have the ability to be modified for flood mitigation capabilities."
35	Address road flooding by replacing high capacity flood control/conveyance structures at Twin Brooks and Trumbull Center.	Progress has been impeded by lack of funding. The Town will determine if this is needed during the five-year plan timeframe.	Replace with "Determine if bridge and culvert replacements at Twin Brooks and Trumbull Center will effectively reduce flooding, and secure funding if found to be cost effective."
	Natural Systems Protection		
36	Implement various strategies included in the Pequonnock River Initiative Watershed Management Plan, including increasing buffers, installing green infrastructure (rain gardens, bio-swales, storm water planters), and repairing stream channels.	Some progress has been made with actions recommended in the watershed management plan. However, additional progress is desired.	Replace with “Conduct a feasibility study to determine where green infrastructure can be installed” (see #31 above).
37	Implement a tree trimming and maintenance program, coordinated with utility companies, to remove diseased and hazardous trees and branches; and increase homeowner awareness and public outreach regarding the need to properly maintain trees.	The tree warden has an annual budget and the Town conducts some tree work. UI conducts tree maintenance which is also helpful. This action is not needed.	Not Applicable; action removed
38	Acquire land in flood prone and hazard areas for open space.	This action was geared toward converting acquired RL properties to open space. The Town has succeeded in acquiring and clearing a few properties. Going forward, this will be considered on a case-by-case basis in connection with CRS participation.	Not Applicable; action removed
	Public Education & Awareness		
39	Expand awareness of the benefits and opportunities of green infrastructure and pervious pavement.	Targeted outreach will be conducted as part of participation in CRS.	Carry forward as written.
40	Improve tree management through outreach and public education.	Carry forward	Same wording
41	Expand outreach to residents on the importance of wetlands and drainage swales for risk reduction from flooding. Look to increase the protection of additional floodplains.	Targeted outreach will be conducted as part of participation in CRS.	Carry forward as written.
42	Expand outreach efforts regarding how to prepare for extreme weather and what to do in the event of a natural disaster, including enhancing the Town’s website, preparing pamphlets to be available at Town Hall and the Trumbull Library and enhancing hazard-related mapping.	Targeted outreach will be conducted as part of participation in CRS.	Carry forward as written.
43	Improve access to information on services for at-risk populations during disasters.	Targeted outreach will be conducted as part of participation in CRS.	Carry forward as written.
44	Continue to update websites with information and maps to aid in preparedness and mitigation.	Complete	Not Applicable; action removed
45	Increase warning and notification of anticipated flood events to residents, especially those who live along the Pequonnock River and in the Manor Drive area.	Complete	Not Applicable; action removed
	Emergency Services Protection		
46	Improve the Town’s make safe plan for downed power lines and power outages. Improve communication and cooperation with local utilities.	Complete	Not Applicable; action removed
47	Continue to periodically revisit top 10 list of first power restoration sites and critical locations in the Town Center for immediate power restoration.	Ongoing; this is standard practice and is one of the Town's capabilities.	Not Applicable; action removed
48	Wire the Trumbull Library to serve as a recharging location for personal electronic devices.	Complete	Not Applicable; action removed
49	Improve access to and availability of information on services during an emergency.	Targeted outreach will be conducted as part of participation in CRS.	Carry forward as written.

ID	Description of Action	Status of Action in 2019	Revision for 2019-2024, if Applicable
50	Continue to operate CT ALERT system	Ongoing; this is standard practice and is one of the Town's capabilities.	Not Applicable; action removed
51	Improve coordination and communications during an extreme weather event.	Ongoing; this is standard practice and is one of the Town's capabilities.	Not Applicable; action removed
52	Continue to examine longer-term needs for power continuity and generator placement	Most facilities now have standby power, including the high school.	Not Applicable; action removed
53	Review workforce availability and increase disaster training as needed to ensure adequate and trained workforce for facilities during emergencies.	Ongoing; this is standard practice and is one of the Town's capabilities.	Not Applicable; action removed
54	Secure and install back-up generation equipment at critical and priority facilities, especially for adequate back-up power at Trumbull High School.	Most facilities now have standby power, including the high school.	Not Applicable; action removed
55	Secure support and funding to provide generators at gas stations to enable gas pumping.	Progress has been made by the owners of gasoline service stations. Action can be removed.	Not Applicable; action removed
56	Annual review of Region 1 Memorandum of Understanding and work to improve communications with the SHMO.	Ongoing; this is standard practice and is one of the Town's capabilities.	Not Applicable; action removed
57	Continue to explore opportunities to improve communications and coordination with the EMS Department.	Ongoing; this is standard practice and is one of the Town's capabilities.	Not Applicable; action removed
58	Evaluate the need for emergency access into and from the Trumbull Corporate Park and the Westfield/Trumbull Shopping Mall and construct access roads as deemed necessary.	Progress has been impeded by lack of staff resources for this type of evaluation. Carry forward with revision to focus on the evaluation, with construction deferred to a future hazard mitigation plan timeframe.	Evaluate the need for emergency access into and from the Trumbull Corporate Park and the Westfield/Trumbull Shopping Mall.

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5 Implementation

This section describes the process by which recommendations developed based on the discussions in the previous chapters will be implemented. The funding sources and planning mechanisms through which recommendations will be implemented are described. Plan monitoring and evaluation, public participation and the role that the Conservation Technical Advisory Committee (CTAC) and CRS program will play in these activities is explained.

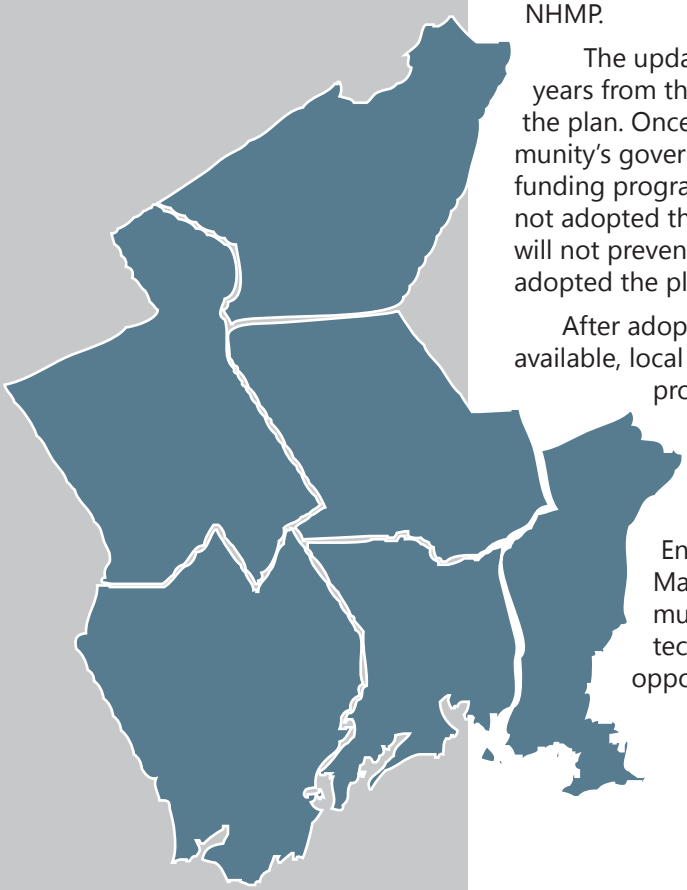
The strategies with which to implement mitigation recommendations are discussed at the local and regional scales. The mitigation action matrices from the previous section have been used as the framework to form an implementation plan for each community. A description of technical and financial resources concludes this section.

5.1 Adoption & Responsibilities for Implementation

MetroCOG will guide the updated NHMP through the FEMA approval process and will assist the governing bodies of member communities throughout the process of adopting the updated NHMP.

The updated NHMP will be considered current for five years from the date that the first MetroCOG community adopts the plan. Once the plan has been formally adopted by the community's governing body, the community is eligible for certain funding programs administered by FEMA. Communities that have not adopted the plan will not be eligible for these programs but will not prevent the eligibility of other communities that have adopted the plan.

After adoption by the community and as funding becomes available, local officials will be responsible for assigning the appropriate resources to implement mitigation actions. If and when recommendations from this NHMP are implemented, they will most likely be administered by the municipal departments that oversee these activities. These departments include Engineering, Public Works, Planning, and Emergency Management. MetroCOG will work with local communities to pursue mitigation actions by providing technical assistance to identify and pursue funding opportunities detailed later in this section.



5.2 Planning Mechanisms

Each community in the MetroCOG Region will integrate recommendations of the NHMP through existing planning mechanisms, such as Plans of Conservation and Development (Table 5.1), Zoning Regulations, Capital Improvement Plans, operating budgets and local programs or initiatives. By taking advantage of existing mechanisms, the recommendations of the NHMP are more likely to be successfully implemented.

Table 5.1: Status of Plans of Conservation and Development in the MetroCOG Region

Community	Date of Effective POCD	Is Hazard Mitigation Included?	Is POCD Update Underway?	Will Hazard Mitigation Be Included?
Bridgeport	2019	Yes	No	N/A
Easton	2018	Yes	No	N/A
Fairfield	2016	Yes	Yes	Yes
Monroe	2010	Yes	Yes	Yes
Stratford	2014	Yes	No	N/A
Trumbull	2014	Yes	No	N/A

As these hazard mitigation recommendations become institutional practices throughout the MetroCOG Region, new mechanisms to implement these actions are anticipated. New public-private partnerships, strengthened relationships with community organizations and local incentives will further realize the goals of the NHMP.

5.3 Progress Monitoring, Public Participation and Plan Maintenance

Each municipality has a local coordinator who will be responsible for a local annual review of the NHMP and will convene a meeting of public officials to discuss progress. At these local meetings, the status of local actions will be discussed, and new mitigation actions will be added if appropriate. Minutes from the local annual NHMP meetings will be provided to MetroCOG to track plan maintenance.

The Conservation Technical Advisory Committee (CTAC) of MetroCOG will monitor the regional progress of the NHMP implementation. Each MetroCOG municipality is formally represented on the CTAC with a member of the local Conservation Commission and a staff member with responsibilities related to conservation. Meetings of the CTAC are held quarterly and are open to the public. In addition to the appointed members, meeting attendees typically include local conservation organizations, residents, staff of the CTDEEP and other regional stakeholders. Throughout the process of developing the NHMP, the CTAC has provided guidance and will continue to monitor the implementation of mitigation actions post-adoption.

The agenda of each quarterly CTAC meeting will include an item regarding the NHMP. CTAC members will provide updates on the implementation of recommended NHMP mitigation actions in their respective communities. MetroCOG will keep track of these updates through the implementation matrix framework.

MetroCOG will annually report on the progress of implementing NHMP recommendations and will be responsible for coordinating an annual meeting with the CTAC to review the plan. In addition to CTAC members, participants in the review will include representatives of the departments listed in the implementation matrices including the local coordinators. Matters to be reviewed will include an assessment of the goals and objectives of the NHMP, a review of hazards or disasters that occurred during the preceding year, an evaluation of the mitigation activities that have been accomplished to date, a discussion of why implementation of mitigation activities may be behind schedule, and recommendations for new projects and revised activities. The maintenance schedule for the NHMP (post adoption) is presented in Table 5.2.

Continued public involvement will be sought regarding the monitoring, evaluation of and updating of the NHMP. Public input may be solicited through community meetings and input to web-based information gathering tools. Public comment on changes to the Plan may be sought through notifications posted to the websites of the MetroCOG, as well as through the websites and social media accounts of individual municipalities.

5.4 Community Rating System Program

FEMA's Community Rating System (CRS) is a voluntary program that offers discounts on flood insurance premiums to communities that undertake activities beyond minimum flood insurance standards. Activities include public outreach and

Table 5.2
Post-Adoption Plan Maintenance Schedule

2019-2020	2020-2021	2021-2022	2022-2023	2023-2024
MetroCOG staff will seek funding for regional projects and provide technical assistance to municipalities for local funding opportunities.	MetroCOG staff will seek funding for regional projects and provide technical assistance to municipalities for local funding opportunities.	MetroCOG staff will seek funding for regional projects and provide technical assistance to municipalities for local funding opportunities.	MetroCOG staff will seek funding for regional projects and provide technical assistance to municipalities for local funding opportunities.	MetroCOG staff will seek funding for regional projects and provide technical assistance to municipalities for local funding opportunities.
Municipalities will integrate NHMP recommendations into local plans, ordinances and budgets.	Municipalities will integrate NHMP recommendations into local plans, ordinances and budgets.	Municipalities will integrate NHMP recommendations into local plans, ordinances and budgets.	Municipalities will integrate NHMP recommendations into local plans, ordinances and budgets.	Municipalities will integrate NHMP recommendations into local plans, ordinances and budgets.
Quarterly meetings of the Conservation Technical Advisory Committee, hosted by the MetroCOG. Meeting agendas will include an item for municipalities to provide updates on the status of natural hazard mitigation actions.	Quarterly meetings of the Conservation Technical Advisory Committee, hosted by the MetroCOG. Meeting agendas will include an item for municipalities to provide updates on the status of natural hazard mitigation actions.	Quarterly meetings of the Conservation Technical Advisory Committee, hosted by the MetroCOG. Meeting agendas will include an item for municipalities to provide updates on the status of natural hazard mitigation actions.	Quarterly meetings of the Conservation Technical Advisory Committee, hosted by the MetroCOG. Meeting agendas will include an item for municipalities to provide updates on the status of natural hazard mitigation actions.	Quarterly meetings of the Conservation Technical Advisory Committee, hosted by the MetroCOG. Meeting agendas will include an item for municipalities to provide updates on the status of natural hazard mitigation actions. The CTAC will serve as a forum to discuss the status of the NHMP update.
Local coordinators will host a meeting with local staff to track progress on local mitigation actions and add new actions if appropriate. A summary of the meeting will be recorded to inform the next NHMP Update.	Local coordinators will host a meeting with local staff to track progress on local mitigation actions and add new actions if appropriate. A summary of the meeting will be recorded to inform the next NHMP Update.	Local coordinators will host a meeting with local staff to track progress on local mitigation actions and add new actions if appropriate. A summary of the meeting will be recorded to inform the next NHMP Update.	Local coordinators will host a meeting with local staff to track progress on local mitigation actions and add new actions if appropriate. A summary of the meeting will be recorded to inform the next NHMP Update.	Local coordinators will host a meeting with local staff to track progress on local mitigation actions and add new actions if appropriate. A summary of the meeting will be recorded to inform the next NHMP Update.
			MetroCOG will integrate NHMP recommendations into the Regional Plan of Conservation & Development. MetroCOG staff will work with municipalities to seek funding for the 2024 update of the NHMP.	MetroCOG, CTAC, municipalities and regional stakeholders submit the draft update of the NHMP to CT DEEP and FEMA. Ultimate adoption of NHMP by local legislative bodies.

information on flood protection, open space protection, storm water management and floodplain mitigation. Since the 2014 Plan Update, the Towns of Fairfield, Stratford and Trumbull have been admitted to the CRS Program. The City of Bridgeport submitted a Letter of Intent in 2018 and is the process of conducting the CRS application process. Due to the rigorous requirements of the CRS Program, the NHMP will be monitored, evaluated and updated as a CRS activity.

The CRS program requires that communities with ten or more repetitive loss properties (Category C communities) prepare a floodplain management plan that covers the repetitive loss areas. All coastal communities in the MetroCOG Region are Category C Repetitive Loss Communities. To enhance its CRS participation, the Town of Stratford plans to prepare a Repetitive Loss Area Analysis (RLAA) should grant funding be available.

Multi-jurisdictional Natural Hazard Mitigation Plans that are prepared in accordance with the CRS Floodplain Management Planning process qualify for floodplain management planning credit in the CRS Program. Each CRS community has been awarded approximately 200 points for adopting the NHMP. CRS Program requirements for the NHMP, post-adoption, are as follows:

- An annual evaluation report on progress towards plan implementation must be prepared at least once each year and submitted with the community's annual CRS recertification. The report must be submitted to the governing body, released to the media, and made available to the public.
- If a community receives credit as a result of participation in a multi-jurisdictional plan that includes action items for each community, the annual evaluation report must cover those action items. This can be done either by a multi-jurisdictional planning committee or through separate submittals by each community. However, a community will not receive credit if it did not participate in the meeting at which the annual report was prepared. Therefore, the submittal needs to show who participated in the preparation of the report.
- The community must update the plan at least every five years.

As public information activities are an important and required component of CRS, NHMP public participation requirements and recommendations of the NHMP regarding public education and awareness are being implemented through the CRS Program.

5.5 Mitigation Actions for Each Community

This 2019 NHMP Update includes mitigation actions for each community in the MetroCOG Region. New mitigation strategies were identified through a variety of meetings with local officials, the results of the 2019 CRB Workshops and the public participation process which included meetings, online surveys and reviews of the Plan. Other recommendations from the 2014 NHMP are carried forward as presented in Section 4.5. These actions are presented after Section 5.5, following the discussion of the top five priorities for each community presented below.

The STAPLE+E method was used to prioritize each action for each community. The STAPLE+E worksheet for each community is in Appendix H.

The STAPLE+E scores were reviewed to determine the top five priority actions for each community. It is important to note that other factors unrelated to the scores, such as availability of funding, may influence community priorities from 2019 through 2024. Nevertheless, the top five actions for each community represent a cross section of the primary concerns in each.

City of Bridgeport - Top Five Priorities

- #2 - Revise Zoning Regulations to include LID and resilience standards.
- #3 - Consider additional freeboard (> 1 foot) as part of the Zoning Regulation rewrite.
- #4 - Factor climate change impacts into City-funded critical infrastructure improvement plans by requiring that the standards similar to those of Public Act 18-82 be applied to City-funded projects. As a first step, produce guidance document by 2021.
- #11 - Identify open space to acquire in high risk areas.
- #44 - Carefully regulate the 60 Main Street and ferry terminal site redevelopments to ensure flood resiliency; these are key waterfront sites and the City has an opportunity for supporting innovative designs.

Four of the City's high priority actions are related to future regulation of development and redevelopment projects in the city, which is ap-

propriate given the densely-developed nature of the community and the regulations revision which is upcoming.

Town of Easton - Top Five Priorities

- #1 - Increase funding for the routine tree maintenance and inspection program and remove a greater number of hazardous trees and branches each year.
- #3 - Consider the pros and cons of incorporating LID in the upcoming regulations revision, and incorporate if found appropriate.
- #6 - Work with CTDEEP to complete a formal validation of the RL list (currently one property) and update the mitigation status of each listed property.
- #7 - Contact the owners of RL 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.
- #8 - Acquire a generator for the Senior Center to enhance its use as a heating and cooling center.

Two of the Town's actions are related to its rural, forested character which has contributed to loss of power due to damage to utilities from trees.

Town of Fairfield - Top Five Priorities

- #6 - Address equipment in library basements to prepare for when flooding occurs.
- #7 - Coordinate with the USACE to determine a feasible option for future improvements to the Pine Creek dike system.
- #10 - Secure funds for execution of a portion of the Downtown Green Infrastructure Study and Conceptual Plan.
- #24 - Enhance flood protection at the DPW (immediate and surrounding areas) garage or consider feasibility of moving garage to an alternate location.
- #32 - Develop a written plan for inspection of Town-owned bridges that may experience scour during flood events. The plan should set a time frame for inspections after floodwaters have receded.

The Town's high-priority actions cover a wide range of flood-related concerns from basement flooding to a dike system to green infrastructure to bridge scour. These actions reflect the diverse nature of flood risk in Fairfield.

Town of Monroe - Top Five Priorities

- #1 - During POCD update, include an appropriate focus on stormwater management that sets policy for LID and green infrastructure, and encourages update of regulations to formalize the current practices of requiring onsite management of stormwater.
- #2 - Work with Aquarion to ensure that informal practices of Stepney Dam impoundment drawdown is formalized in Aquarion operations plans.
- #4 - Conduct a town wide hydrologic analysis that addresses flooding, stormwater, and water conveyance needs to identify projects that can be implemented to reduce risks to infrastructure and people.
- #12 - Conduct outreach to local small businesses with the aim of preventing the accidental release and pollution from chemicals stored and used at their facilities during or following natural hazard events.
- #14 - Work with CTDEEP to complete a formal validation of the RL list (the sole listed RL property is not located in Monroe).

Monroe's concerns largely remain focused on flooding and drainage, and all of the high priority actions reflect this concern.

Town of Stratford - Top Five Priorities

- #3 - Pursue funding to mitigate existing and future risks to the South End and employment growth area identified in the Stratford Plan of Conservation and Development. Funds may be used to install flood control systems and/or elevate and extend seawalls where necessary.
- #5 - Pursue funding to design/build multiple culverts and channels on Surf Avenue at the Interstate 95 overpass along with the flood wall to reduce chronic coastal flooding.
- #8 - Secure funding to implement flood protection measures around the wastewater treatment plant by raising the existing flood control berm.
- #13 - Reduce inflow and infiltration through execution of projects utilizing the Clean Water Act grant funds.
- #17 - Pursue funding to floodproof municipal buildings in the town by raising equipment and generators and installing projectile-proof windows where necessary.

Similar to Fairfield, the Town of Stratford's

high-priority actions cover a wide range of flood-related concerns from structural projects to flood-proofing. These actions reflect the diverse nature of flood risk in Stratford.

Town of Trumbull - Top Five Priorities

- #2 - Prepare a draft of municipal regulations that can be used to require low impact development and green infrastructure.
- #7 - Provide FEMA Special Flood Hazard Area locations on the GIS Website.
- #16 - Expand awareness of the benefits and opportunities of green infrastructure and pervious pavement.
- #17 - Improve tree management through outreach and public education.
- #20 - Improve access to information on services for at-risk populations during disasters.

With suburban characteristics, the Town's priorities reflect an interest in LID, green infrastructure, and tree maintenance and management. These actions are meant to prevent flood risks and power outage risks from increasing.

5.6 Implementation Capabilities

Development patterns in the region have not significantly changed since the 2014 NHMP. FEMA's updated Digital Flood Insurance Rate Maps (DFIRMs) and the impacts of Hurricanes Sandy and Irene continue to affect communities throughout the Region. For many coastal communities, the Coastal V (Velocity) Zone widened to include structures that had previously been located in the A Zone (1% annual chance floodzone without wave action). Furthermore, the revised DFIRMs required communities to enforce local floodplain regulations for structures that were once located outside of the floodplain. Thus, recommendations from the previous NHMP regarding increased elevation standards and extending V Zone regulations to the A Zone have been implemented or partially realized by several communities since 2014.

The impacts of Hurricanes Irene and Sandy, as well as inland flooding, reinforce local awareness of the need to plan for and mitigate the potential impacts from flooding and high winds. While flooding had long-term devastating impacts on many properties along the coast, widespread power outages that lasted several days to a week or longer had severe impacts on residents, businesses and institutions throughout the Region. Improved tree maintenance programs, enhancing communication with utilities and prioritizing critical access roads for clearing of blockages from fallen tree limbs continue throughout the Region.

Each community has developed a number of capabilities relative to NHMP implementation as presented on the following pages.

MetroCOG

MetroCOG developed a regional website to inform residents, businesses, and regional stakeholders about natural hazards (http://www.ct-metro.org/projects/environment-sustainability-2/flood-protection/#.XNHr9RRKhpg). While primarily aimed at addressing flooding, the website also considers other hazards such as hurricanes, summer storms, tornadoes, winter storms, and earthquakes. The website details potential impacts and how residents and businesses should prepare for such events.

City of Bridgeport

The City of Bridgeport has demonstrated a commitment to implementing NHMP recommendations regarding regulations, infrastructure and public education and awareness. A storm water management manual was updated in 2008 and the Department of Public Facilities has the authority to amend the City's stormwater regulations. The CT-DEEP completed reconstruction of the Lake Forest dam in 2010. Over 200 seminars on flooding and public safety are provided to residents by the City of Bridgeport every year. A Reverse 911 system and the online Bridgeport 311 keeps residents and concerned citizens informed of issues and problems in the city.

Bridgeport has a universal shelter policy which helps to meet specific needs of attendees including allowing pets. Furthermore, the City has made significant progress installing green infrastructure on public property, completed an assessment of the existing and potential tree canopy in 2013, and has encouraged the elevation and/or floodproofing of homes and electrical systems. The City also continues to implement recommendations from the Pleasure Beach Master Plan, cleans catch basins, storm grates, and river channels regularly, and created a storm water detention area at the north end of Rogers Park (2013). New technology has also been established to track cleanup such as GPS

Proposed Mitigation Actions for Bridgeport, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
1	1	Complete CAV and initial steps to enter into the CRS program.	CF	PP, PR, PE, ES, NR	PF with assistance from OPED	The Engineering Department has been designated as the CRS coordinator (by letter to FEMA dated April 2018). The OPED staff will be brought into the process as needed, given the emphasis on reviewing building and development permits.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
2	3	Revise Zoning Regulations to include low impact development (LID) and resilience standards.	CF	PR	OPED	OPED has retained a consultant for assistance.	1/2019-6/2020	<$100,000	City capital funds to retain consultant
3	6	Consider freeboard of greater than one foot as part of the Zoning Regulation rewrite.	CF	PR	OPED	OPED has retained a consultant for assistance.	7/2019-6/2020	<$100,000	City capital funds to retain consultant
4	10	Factor climate change impacts into City-funded critical infrastructure improvement plans by requiring that the standards similar to those of Public Act 18-82 be applied to City-funded projects. As a first step, produce guidance document by 2021.	CF	PR, ST, PP	PF and OPED	PF and OPED will collaborate to develop this guidance, using the State's guidance related to Public Act 18-82.	1/2020-12/2020	<$100,000	Operating budget; existing staff to coordinate.
5	30	Complete the components of the "Resilient Bridgeport" project execution that are scheduled for 2019-2024.	CF	ST, PP	PF and OPED	The State is managing this project. The City will continue to coordinate and participate as needed.	7/2019-6/2024	>$1 Million	U.S. HUD, CT Department of Housing
6	26	Make additional progress with combined sewer separations and CSO abatement as outlined in plans developed in 2018.	CF	ST	PF and WPCA	PF to continue this effort.	7/2019-6/2024	>$1 Million	City capital funds and EPA CWA Funds
7	16	Pending funding, proceed with the Storm water Authority Feasibility Study. Consider incentives to reduce the amount of impervious surface in the City.	CF	PR	PF	PF will coordinate this project.	7/2020-6/2021	<$100,000	City capital funds to retain consultant
8	22	Pursue a target of 30 additional GI installations on City-owned land and along streets in the 2019-2024 planning timeframe. Select some locations from the Regional Framework for Coastal Resilience.	CF	ST, NR	PF and OPED	PF to continue this effort.	7/2019-6/2024	>$1 Million	City capital funds, grant funds, and in-kind services from non-profits such as The Nature Conservancy
9	7	Identify opportunities for floodplain easements on properties.	CF	NR	PF and OPED	PF and OPED will collaborate to identify these opportunities.	7/2019-6/2024	$100,000-$500,000	City capital funds to retain legal expertise
10	32	Secure waterfront easements as available.	CF	NR	PF and OPED	PF and OPED will collaborate to identify these opportunities.	7/2019-6/2024	$100,000-$500,000	City capital funds to retain legal expertise
11	77	Identify open space to acquire in high risk areas.	CF	NR	PF and OPED	PF and OPED will collaborate to identify these opportunities.	7/2019-6/2024	<$100,000	Operating budget; existing staff to coordinate (action is to identify only).
12	83	Identify parcels within potential marsh advancement zones that may be acquired, including properties along Cedar Creek that have low potential for redevelopment.	CF	NR	PF and OPED	PF and OPED will collaborate to identify these opportunities.	7/2019-6/2024	<$100,000	Operating budget; existing staff to coordinate (action is to identify only).
13	21	Conduct study of Ash Creek sedimentation to determine if sediment removal will enhance flood capacity.	CF	ST	PF	Public Facilities and engineering to work together and assess feasibility, using a consultant as needed.	7/2021-6/2022	<$100,000	City capital funds to retain consultant

Proposed Mitigation Actions for Bridgeport, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
14	85	Identify potential areas of erosion along Ash Creek that may require mitigation, and secure funding for feasibility studies.	CF	ST	PF	Public Facilities and engineering to work together and assess feasibility, using a consultant as needed.	7/2021-6/2022	<$100,000	City capital funds to retain consultant
15	27	Implement findings of the Lower West End resiliency planning to draw appropriate businesses to the northwest bank of Cedar Creek, such as water-dependent and floodable land uses.	CF	PP	OPED	OPED will work with the Bridgeport Economic Development Corporation (the agency that completed the planning study) to implement recommendations during the regulations revision process referenced above.	7/2019-6/2021	<$100,000	Operating budget; existing staff to coordinate.
16	28	Continue to remove derelict structures in flood zones and other areas of high risk; and redevelop or convert to open space. The target for 2019-2024 is ten additional properties.	CF	NR	PF and OPED	PF and OPED will collaborate to identify these opportunities.	7/2019-6/2024	>$1 Million	U.S. HUD, CT Department of Housing, FEMA HMA
17	48	Repair/replace the State Street Ext/Commerce Drive Bridge and upgrade the catch basins and drainage system.	CF	ST	PF	PF to lead this project.	7/2019-6/2024	>$1 Million	CT DOT and City capital funds
18	53	Execute design of the flood mitigation project for Island Brook and Ox Brook.	CF	ST	PF	PF to retain consultant or consultant team to complete this design.	7/2020-6/2022	$100,000-$500,000	City capital funds to retain consultants
19	54	Execute design of the flood mitigation project for northeast Bridgeport.	CF	ST	PF	PF to retain consultant or consultant team to complete this design.	7/2020-6/2022	$100,000-$500,000	City capital funds to retain consultants
20	58	Pursue funds for design of a demonstration project for green coastal bank protection opportunities along the Yellow Mill Channel.	CF	ST, NR	PF	PF to identify and secure funds. Potential funds are NOAA, NFWF, and CIRCA (state) grant programs.	7/2019-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
21	76	Pursue funds for design of a demonstration project for green coastal enhancement and restoration opportunities (similar to the action for Yellow Mill Channel, above).	CF	ST, NR	PF	PF to identify and secure funds. Potential funds are NOAA, NFWF, and CIRCA (state) grant programs.	7/2019-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
22	69	Continue to work with the Town of Stratford to complete the Bruce Brook improvements near Barnum Avenue.	CF	ST	PF	PF to collaborate as needed.	7/2019-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to work with Stratford).
23	73	Execute the design to address drainage and flooding at Seaview Avenue where it crosses the railroad line, potentially coinciding with the proposed Barnum RR Station.	CF	ST	PF	This item requires extensive coordination with CT DOT, MTA, and Metro North Rail. PF to retain consultant or consultant team to complete this design.	7/2021-6/2023	$100,000-$500,000	City capital funds to retain consultants
24	78	Select one recommendation from the Pequonnock River Watershed Plan to improve water quality and alleviate flooding, and secure funding.	CF	ST, NR	PF and OPED	PF and OPED to identify and secure funds. Potential funds are NOAA, NFWF, and EPA Section 319 (state) grant programs.	7/2020-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
25	79	Select one recommendation from the Rooster River Watershed Plan to improve water quality and alleviate flooding, and secure funding.	CF	ST, NR	PF and OPED	PF and OPED to identify and secure funds. Potential funds are NOAA, NFWF, and EPA Section 319 (state) grant programs.	7/2020-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
26	42	Pilot test an automated viaduct closure system for one viaduct.	CF	ES	PF and EMHS	EMHS to lead, but PF needed for coordination and design considerations.	7/2022-6/2024	$100,000-$500,000	City capital funds with potential DHS emergency preparedness funding
27	50	Conduct a feasibility study for increasing the heights of the breakwaters.	CF	ST	PF	PF to retain consultant or consultant team to complete this study.	7/2022-6/2024	$100,000-$500,000	City capital funds to retain consultants

Proposed Mitigation Actions for Bridgeport, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
28	63	Raise the remaining unmitigated electrical boxes at Seaside Park in areas vulnerable to flooding.	CF	PP	PF	PF to complete these efforts.	7/2020-6/2021	<$100,000	City capital funds
29	65	Conduct a feasibility study for increasing the heights of the seawalls.	CF	ST	PF	PF to retain consultant or consultant team to complete this study.	7/2021-6/2023	$100,000-$500,000	City capital funds to retain consultants
30	86	Implement outreach programs to educate citizens regarding flood management ordinances, flood insurance programs, and other flood relevant issues, including creditable activities in the CRS program and GIS.	CF	PE	PF and EMHS	Conduct in connection with CRS entry, if CRS entry timeframe allows. If CRS participation does not proceed as planned, complete the action as a standalone action.	7/2020-6/2024	<$100,000	Operating budget; existing staff to coordinate in connection with CRS
31	87	Increase community awareness and preparedness through education and outreach via the religious community, public libraries and higher education and implement neighborhood specific emergency and communications plans.	CF	PE	PF and EMHS	Conduct in connection with CRS entry, if CRS entry timeframe allows. If CRS participation does not proceed as planned, complete the action as a standalone action.	7/2020-6/2024	<$100,000	Operating budget; existing staff to coordinate in connection with CRS
32	88	Finalize specific neighborhood plans for emergency management and communications and implement plan provisions. Each plan should be translated into the top five languages spoken in the City of Bridgeport.	CF	ES	PF and EMHS	Conduct in connection with CRS entry, if CRS entry timeframe allows. If CRS participation does not proceed as planned, complete the action as a standalone action.	7/2020-6/2024	<$100,000	Operating budget; existing staff to coordinate
33	89	Increase education and communications on response procedures for residents of high density public housing areas, especially those located in the coastal area.	CF	PE	EMHS	EMHS to lead. Coordinate with action #34 below.	7/2020-6/2024	<$100,000	Operating budget; existing staff to coordinate
34	95	In high density and public housing developments, post the evacuation routes and evaluate additional transportation needs.	CF	ES	EMHS	EMHS to lead.	7/2020-6/2024	<$100,000	Operating budget; existing staff to coordinate
35	90	Assess/augment local areas of the public refuge system across the City and ensure residents are aware of uses and procedures during emergencies.	CF	ES	EMHS	EMHS to lead.	7/2020-6/2024	<$100,000	Operating budget; existing staff to coordinate
36	91	Encourage homeowners to purchase flood insurance.	CF	PP	PF and EMHS	Conduct in connection with CRS entry, if CRS entry timeframe allows. If CRS participation does not proceed as planned, complete the action as a standalone action.	7/2021-6/2024	<$100,000	Operating budget; existing staff to coordinate in connection with CRS
37	92	Help reduce the disbursement of toxic substances from flooded homes and facilities by conducting outreach regarding this topic.	CF	ES	PF and EMHS	Conduct in connection with CRS entry, if CRS entry timeframe allows. If CRS participation does not proceed as planned, complete the action as a standalone action.	7/2020-6/2024	<$100,000	Operating budget; existing staff to coordinate
38	97	Once during the timeframe of this plan update, assess capacities and needs of sheltering, cooling, and medical network across City as well as adjoining municipalities in the Greater Bridgeport Region.	CF	ES	EMHS	EMHS to lead.	7/2021-6/2023	$100,000-$500,000	City capital funds to retain consultants

Proposed Mitigation Actions for Bridgeport, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
39	98	Secure funding to install a warning siren system in areas vulnerable to inland and coastal flooding to alert residents to evacuate.	CF	ES	EMHS	EMHS to lead.	7/2021-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
40	101	Pursue funding to complete a feasibility study for raising bridges and their connecting roads in one specific pilot area.	CF	ST	PF	PF to retain consultant or consultant team to complete this study.	7/2022-6/2023	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
41	102	Secure funding to upgrade Emergency Operations Center equipment to include a complete camera board for situational awareness and display board for public facilities equipment tracking.	CF	ES	EMHS	EMHS to lead.	7/2021-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
42	104	Secure funding to install a camera system to more thoroughly understand storm surge and to enhance evacuation.	N	ES	EMHS	EMHS to lead.	7/2021-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
43	--	Closely monitor Marina Village reconstruction to ensure that the project is flood resilient.	N	PP	OPED	This is an ongoing project. The action is geared toward ensuring that the design and construction is resulting in a resilient housing complex.	7/2019-6/2023	<$100,000	Operating budget; existing staff to coordinate.
44	--	Carefully regulate the 60 Main Street and ferry terminal site redevelopments to ensure that the projects are flood resilient; these are key waterfront sites and the City has an opportunity for supporting innovative designs.	N	PP	OPED	These are anticipated high-visibility projects. The action is geared toward ensuring that the designs and construction are resulting in resilient development.	7/2019-6/2023	<$100,000	Operating budget; existing staff to coordinate.
45	--	Incorporate flood resiliency in the WWTP upgrades that occur in the near future.	N	PP	WPCA	WPCA to lead when project occurs.	7/2020-6/2024	>$1 Million	City capital funds and EPA CWA Funds
46	--	Complete permitting and design of Johnson Creek Living Shoreline demonstration project.	N	NR	PF	PF to pick up design from MetroCOG and continue.	7/2020-6/2021	<$100,000	City capital funds to retain consultant
47	--	Conduct outreach to local small businesses with the aim of preventing the accidental release and pollution from chemicals stored and used at their facilities during or following natural hazard events.	N	PE	EMHS	Coordinate directly with CT DEEP on this statewide initiative.	7/2020-6/2021	<$100,000	Operating budget; existing staff to coordinate.
48	--	Secure funding from SHPO to conduct a historic resources survey focusing on potential historic resources in coastal flood risk areas.	N	PP	OPED	Coordinate directly with CT SHPO on this statewide initiative.	7/2021-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
49	--	Work with CT DEEP to complete a formal validation of the RL list and update the mitigation status of each listed property.	N	PP	PF and OPED	Coordinate directly with CT DEEP. Conduct in connection with CRS entry, if CRS entry timeframe allows. If CRS participation does not proceed as planned, complete the action as a standalone action.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.

Proposed Mitigation Actions for Bridgeport, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
50	--	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.	N	PP	PF and OPED	Conduct in connection with CRS entry, if CRS entry timeframe allows. If CRS participation does not proceed as planned, complete the action as a standalone action.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.

Type of Action:

- PP = property protection
- PR = prevention
- NR = natural resources protection or restoration
- ST = structural projects
- ES = emergency services
- PE = public education

Proposed Mitigation Actions for Easton, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
1	2	Increase funding for the routine tree maintenance and inspection program and remove a greater number of hazardous trees and branches each year.	CF	PP	DPW	Work with Board of Selectmen and Finance to increase funding, with target for accomplishing this within two years.	7/2019-6/2021	<$100,000	Town budget
2	--	Consider the costs and benefits associated with registering in the Sustainable CT program, which includes some objectives aligned with hazard mitigation.	N	PR, NR, PE	Board of Selectmen	Reach out to neighboring towns such as Fairfield and Trumbull to seek advice about the program. Estimate staff and volunteer time to enter and remain in the program.	7/2020-6/2021	<$100,000	Operating budget; existing staff to coordinate.
3	--	Consider the pros and cons of incorporating low impact development (LID) in the upcoming regulations revision, and incorporate if found appropriate.	N	PR, NR	PZC	During the upcoming regulations revision process, review and consider the findings and recommendations of the rural LID guidance funded by CIRCA and published on the CIRCA web site.	7/2019-6/2022	<$100,000	Operating budget; existing staff to coordinate.
4	--	Secure funding from SHPO to conduct a historic resources survey focusing on potential historic resources in flood risk areas.	N	PP	PZC	Coordinate directly with CT SHPO on this statewide initiative.	7/2021-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
5	--	Complete bridge replacement projects funded by the LOTCIP program.	N	ST	DPW	Work with MetroCOG and CT DOT as needed to execute projects.	7/2019-6/2023	>$1 Million	LOTCIP
6	--	Work with CT DEEP to complete a formal validation of the RL list (currently one property) and update the mitigation status of each listed property.	N	PP	DPW	Contact the NFIP coordinator at CT DEEP to get started and obtain the appropriate forms.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
7	--	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.	N	PP	DPW	Contact the NFIP coordinator at CT DEEP to obtain the template for a letter.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
8	--	Acquire a generator for the Senior Center to enhance its use as a heating and cooling center.	N	ES	Board of Selectmen	Secure funding and assign project to appropriate staff to execute.	7/2021-6/2022	$100,000-$500,000	FEMA HMA, DHS emergency preparedness

Type of Action:

PP = property protection
PR = prevention
NR = natural resources protection or restoration
ST = structural projects
ES = emergency services
PE = public education

Proposed Mitigation Actions for Fairfield, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
1	9, 28	Secure funds and proceed with construction of the Riverside Drive tide gate system.	CF	ST	Conservation and Engineering	Conservation and DPW are collaborating on this project.	7/2019-6/2020	>$1 Million	Capital improvement funds
2	10, 83	Ensure that the current dam failure EAPs are filed with pertinent Town departments.	CF	ES	OEM	EMD to obtain copies and file them with departments such as DPW and Planning.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate (action is to obtain and distribute).
3	14, 25	Advance the South Benson Road pumping station to final design and construction.	CF	ST	DPW and Engineering	DPW/Engineering is coordinating this project.	7/2019-6/2022	>$1 Million	Capital improvement funds
4	14, 28	Pursue an executable phase of the Riverside Drive/Ash Creek flood protection system by focusing on design of a segment that affects only Town-owned land.	CF	ST	Conservation, Engineering, and FECB	Conservation and DPW collaborated on the Riverside Drive/Ash Creek project in 2016-2017 and should collaborate on the design phase.	7/2020-6/2022	$100,000-$500,000	Grant funds for design
5	15	Secure funds for a microgrid at the WWTP to include adjacent and nearby municipal buildings.	CF	PP, ES	WPCA	The Town has been successful with the State's microgrid program. Leverage this experience to pursue a microgrid at the WWTP and nearby buildings.	7/2019-6/2022	>$1 Million	State microgrid program
6	19	Address equipment in library basements to prepare for when flooding occurs.	CF	PP	Library/DPW	Continue this project to completion.	7/2019-6/2020	$100,000-$500,000	Capital improvement funds
7	26, 28	Coordinate with the Army Corps of Engineers to determine a feasible option for future improvements to the Pine Creek dike system.	CF	ST	FECB and Engineering	Although the Town's FECB has been discussing and promoting various means of improving the dike system, the Army Corps of Engineers is proceeding with a study of flood protection. The Town should try to participate more directly, either through CT DEEP or with the Corps.	7/2019-6/2022	<$100,000	Operating budget; existing staff to coordinate.
8	27, 62	Secure funds for beach nourishment in accordance with the engineered beach study and design.	CF	NR	Conservation and Engineering	The Town has conducted beach nourishment in the past and will utilize similar procedures going forward.	7/2020-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
9	34	Relocate the sanitary sewer transmission truck lines from areas of significant flood risk.	CF	ST	WPCA	This project is underway. Carry forward for completion.	7/2019-6/2022	>$1 Million	Capital improvement funds
10	35, 36, 41	Secure funds for execution of a portion of the Downtown Green Infrastructure Study and Conceptual Plan.	CF	ST, NR	Engineering	The Town applied for a grant from NFWF in 2018 but was not successful. Additional funding opportunities will be pursued.	7/2019-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
11	38	Allocate funds for replacements of culverts to alleviate flooding in the Rooster River, Royal Avenue, and Camden Street areas.	CF	ST	Engineering	Study and design has been completed for some areas. The Town will begin allocating funds through the CIP.	7/2022-6/2024	>$1 Million	Capital improvement funds

Proposed Mitigation Actions for Fairfield, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
12	39	Determine whether the culvert at Merwins Lane can be replaced to increase capacity.	CF	ST	Engineering	Due to neighbor opposition, the action should focus on determining whether the project is feasible, whether it can achieve the desired result, and whether issues with the neighbor can be resolved. If one of these is not favorable, this project should be retired from consideration.	7/2020-6/2021	<$100,000	Operating budget; existing staff to coordinate.
13	40	Identify the next steps to set aside land for detention/watershed storage in the Rooster River watershed.	CF	ST, NR	Engineering and DPW	A flood detention/storage study was completed in 2019 to augment previous studies in the Rooster River watershed. Utilize the momentum surrounding this issue to define the next steps to further explore feasibility.	7/2020-6/2021	<$100,000	Operating budget for existing staff and/or consultant
14	43	Conduct a feasibility study for elevating Fairfield Beach Road, including public outreach and incorporation of public input.	CF	ST, ES	Engineering, DPW, and OEM	Due to the dual needs of this project (engineering feasibility and public buy-in), a formal feasibility study will be conducted that directly incorporates public input.	7/2020-6/2021	$100,000-$500,000	Operating budget for existing staff and/or consultant
15	45	Conduct a study to determine the feasibility of extending the dike in Southport along Harbor Road.	CF	ST	FECB and Engineering	This feasibility study can proceed in a manner similar to the Ash Creek/Riverside Drive study and conceptual plan. Public input should be directly incorporated.	7/2021-6/2022	$100,000-$500,000	Operating budget for existing staff and/or consultant
16	49	Determine the feasibility of installing pumping stations beneath the railroad underpasses to remove floodwaters.	CF	ST	Engineering and DPW	Engineering should retain a consultant for this feasibility study if possible, but may be able to complete in-house if time permits.	7/2021-6/2022	$100,000-$500,000	Operating budget for existing staff and/or consultant
17	58	Select one action from the Rooster River Watershed Management Plan and secure funding for its execution. Focus on an action that has multiple hazard mitigation benefits.	CF	ST, NR	Conservation	Conservation to identify and secure funds. Potential funds are NOAA, NFWF, and EPA Section 319 (state) grant programs.	7/2020-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
18	61	Conduct outreach and feasibility study for the conceptual dune ridge design that addresses the Penfield/Shoal Point area.	CF	ST, NR	Conservation, Engineering, and FECB	Conservation to identify and secure funds, working with the FECB and Engineering. Potential funds are NOAA, NFWF, and CIRCA (state) grant programs.	7/2021-6/2022	$100,000-$500,000	Operating budget for existing staff and/or consultant
19	64	Train and equip neighborhood storm response teams (i.e., CERT), especially in neighborhoods that have in the past been cut off from emergency services by floodwaters or downed trees, as well as to assist lower-income populations.	CF	ES	OEM and CERT	The EMD and CERTs will collaborate to accomplish this action.	7/2019-6/2021	<$100,000	Operating budget; existing staff to coordinate.
20	67	Develop tree planting guidelines that are aligned with hazard mitigation goals.	CF	PP	DPW and Conservation	Conservation and DPW will team to develop guidelines.	7/2019-6/2021	<$100,000	Operating budget; existing staff to coordinate.

Proposed Mitigation Actions for Fairfield, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
21	78	Conduct a feasibility study for elevating Turney Road, including public outreach and incorporation of public input.	CF	ST, ES	Conservation, Engineering, FECB, and OEM	Because elevating Turney Road was partly addressed during the public engagement associated with the Riverside Drive/Ash Creek flood protection study and conceptual plan, this past effort should be used to initiate the study. Consultant services may be secured for further evaluating the feasibility and engaging the public. However, unlike the Riverside Drive/Ash Creek study, this action should directly involve emergency management personnel.	7/2022-6/2023	$100,000-$500,000	Operating budget for existing staff and/or consultant
22	81	Provide and install generators to senior housing complexes and other complexes that serve vulnerable populations to allow them to shelter in place.	CF	ES, PP	OEM and DPW	Assigned staff should begin securing funds early in the lifespan of the plan update.	7/2021-6/2024	>$1 Million	FEMA HMA, DHS preparedness grants
24	89	Enhance flood protection at the DPW (immediate and surrounding areas) garage or consider feasibility of moving garage to an alternate location.	CF	ST, PP	DPW	DPW will commence this action with a feasibility study that addresses flood protection vs. relocation.	7/2022-6/2023	$100,000-$500,000	Operating budget for existing staff and/or consultant
25	--	Conduct outreach to local small businesses with the aim of preventing the accidental release and pollution from chemicals stored and used at their facilities during or following natural hazard events.	N	PE	P&Z	Coordinate directly with CT DEEP on this statewide initiative.	7/2020-6/2021	<$100,000	Operating budget; existing staff to coordinate.
26	--	Secure funding from SHPO to conduct a historic resources survey focusing on potential historic resources in coastal flood risk areas.	N	PP	P&Z	Coordinate directly with CT SHPO on this statewide initiative.	7/2021-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
27	--	Work with CT DEEP to complete a formal validation of the RL list and update the mitigation status of each listed property.	N	PP	P&Z	Coordinate directly with CT DEEP. Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
28	--	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. Coordinate with CRS participation.	N	PP	P&Z	Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
29	--	Contact the owners of properties that experience frequent flooding (which may not be RL properties) to suggest options for mitigating flooding. This should be accomplished with a letter directly mailed to each property owner.	N	PP	P&Z	Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.

Proposed Mitigation Actions for Fairfield, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
30	--	Achieve additional objectives associated with the Sustainable CT program, focusing on those aligned with hazard mitigation.	N	PR, NR	Existing volunteer committee	Encourage the existing volunteer committee to achieve additional actions, with direction to focus on those aligned with hazard mitigation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
31	--	Work with USGS or NOAA to establish a tide gauge in Long Island Sound to provide real-time water level data. The nearest USGS gauge is in Stamford and the nearest NOAA gauge is in Bridgeport.	N	ES	Engineering and OEM	This action will require considerable coordination. Initial contacts should be made with NOAA and USGS, as both agencies host tide gauges in Long Island Sound.	7/2020-6/2022	<$100,000	Operating budget; existing staff to coordinate. Funding for execution will be addressed in future updates.
32	--	Develop a written plan for inspection of Town-owned bridges that may experience scour during flood events. The plan should set a timeframe for inspections after floodwaters have receded.	N	ST	DPW and Engineering	DPW and Engineering will collaborate on this action. Consultant services are not likely needed.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
33	--	Provide suggested "code plus" strategies to make structures more resilient to wind when applications are processed for elevating buildings.	N	PP	Building	The Building Department staff will commence this action in the next fiscal year and then make it common practice.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.

Type of Action:

PP = property protection
PR = prevention
NR = natural resources protection or restoration
ST = structural projects
ES = emergency services
PE = public education

Proposed Mitigation Actions for Monroe, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
1	1	During the update of the POCD, include an appropriate focus on stormwater management that sets policy for LID and green infrastructure, and encourages update of regulations to formalize the current practices of requiring onsite management of stormwater.	CF	PR, NR	PZ	The POCD Update will commence by mid-2019. The Town and consultant will work together to address LID and GI.	7/2019-6/2020	<$100,000	Town operating budget for staff resources plus allocation for consultant services during POCD update
2	2	Work with Aquarion to ensure that informal practices of Stepney Dam impoundment drawdown is formalized in Aquarion operations plans.	CF	ST, ES	ENG and EMD	This action has appeared in the hazard mitigation plan several times. During the timeframe of this update, the appropriate departments will make contact with Aquarion management to address and formalize this practice.	7/2020-6/2022	<$100,000	Town operating budget for staff resources
3	3	Work with Aquarion to ensure that informal practices of Pequonnock River water diversions are formalized in Aquarion operations plans.	CF	ST, ES	ENG and EMD	This action has appeared in the hazard mitigation plan several times. During the timeframe of this update, the appropriate departments will make contact with Aquarion management to address and formalize this practice.	7/2020-6/2022	<$100,000	Town operating budget for staff resources
4	6	Conduct a townwide hydrologic analysis that addresses flooding, stormwater, and water conveyance needs to identify projects that can be implemented to reduce risks to infrastructure and people.	CF	ST	ENG	A townwide hydrologic/drainage study has been in the Town's CIP for several years and has not been conducted due to budgetary constraints. The Engineering Department will work to secure the funding and execute this project.	7/2020-6/2022	$100,000-$500,000	Town capital funds combined with grant funds
5	10	Implement one additional project identified in the watershed management plan, with a focus on flood risk reduction.	CF	PR, NR	PW	The Town has made progress with this action. For example, a 319 grant was secured and used for a stream buffer enhancement project within the last five years. However, additional projects are desired outside the limited resources of the 319 program. The Town has experience in this matter and will apply for additional funds.	7/2021-6/2023	$100,000-$500,000	Town capital funds combined with Section 319 grant funds
6	12	Acquire and install a generator for the high school that enables its use as a shelter.	CF	ES, PP	PW	The Town will secure funds and prioritize this installation.	7/2021-6/2023	>$1 Million	FEMA HMA and DHS preparedness grants
7	16	Ensure that CT DOT completes the upgrades of culverts on Route 25.	CF	ST	ENG/CT DOT	Route 25 work is underway with completion scheduled for the timeframe of this plan update. The Town will continue to work with CT DOT.	7/2019-6/2023	>$1 Million	CT DOT
8	17	Ensure that CT DOT completes the Route 25 drainage and flood risk reduction projects.	CF	ST	ENG/CT DOT	Route 25 work is underway with completion scheduled for the timeframe of this plan update. The Town will continue to work with CT DOT.	7/2019-6/2023	>$1 Million	CT DOT
9	20	Prepare a hydraulic study of the part of Sammis Brook where a beaver dam has been a problem in the past, and determine if improvements are needed to reduce flood risk.	CF	ST	ENG	The necessary scope of this evaluation is believed understood. The Engineering Department will secure the appropriate funds and either complete internally, or retain a consultant for, the study.	7/2020-6/2021	<$100,000	Town capital funds combined with grant funds

Proposed Mitigation Actions for Monroe, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
10	--	Address (in the Subdivision Regulations) tree heights and appropriate street trees.	N	PP	PZ	Conduct simultaneous with the POCD Update noted above.	7/2019-6/2020	<$100,000	Town operating budget for staff resources plus allocation for consultant services during POCD update
11	--	Consider the costs and benefits associated with registering in the Sustainable CT program, which includes some objectives aligned with hazard mitigation.	N	PR, NR	PZ	Reach out to neighboring towns such as Fairfield and Trumbull to seek advice about the program. Estimate staff and volunteer time to enter and remain in the program.	7/2020-6/2021	<$100,000	Operating budget; existing staff to coordinate.
12	--	Conduct outreach to local small businesses with the aim of preventing the accidental release and pollution from chemicals stored and used at their facilities during or following natural hazard events.	N	PE	EMD	Coordinate directly with CT DEEP on this statewide initiative.	7/2020-6/2021	<$100,000	Operating budget; existing staff to coordinate.
13	--	Secure funding from SHPO to conduct a historic resources survey focusing on potential historic resources in flood risk areas.	N	PP	PZ	Coordinate directly with CT SHPO on this statewide initiative.	7/2021-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
14	--	Work with CT DEEP to complete a formal validation of the RL list (the sole listed RL property is not located in Monroe).	N	PP	ENG	Coordinate directly with CT DEEP to obtain the appropriate forms. Only one property is listed in Monroe.	7/2019-6/2020	Minimal	Operating budget; existing staff to coordinate.

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- NR = natural resources protection or restoration
- ST = structural projects
- ES = emergency services
- PE = public education

Proposed Mitigation Actions for Stratford, 2019-2024

Current ID (2019-2024)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
1	1, 3	Develop comprehensive stormwater regulations that address both quality and quantity control measures including MS4 requirements and Low Impact Development (LID) techniques for transit oriented district at Town Center.	CF	PR	Engineering and Planning	Develop regulations based on model stormwater ordinance that will be released by the State.	7/2020-6/2021	<$100,000	Operating budget; existing staff to coordinate.
2	6	Elevate private homes in Lordship area to meet or exceed FEMA requirements for Base Flood Elevation. Phase I to include homes on Washington Parkway. Pursue funding through Pre-disaster mitigation grants to elevate five homes on Washington Parkway.	CF	PP	Engineering and Planning	Over the next five years, pursue funding through Pre-disaster mitigation grants to elevate five homes on Washington Parkway.	7/2020-6/2024	>$1 Million	FEMA HMA
3	7	Pursue funding to mitigate existing and future risks to the South End and employment growth area identified in the Stratford Plan of Conservation and Development. Funds may be used to install flood control systems and/or elevate and extend seawalls where necessary.	CF	ST, PP	Engineering and Planning	Planning and Engineering will collaborate to pursue options for the South End, consistent with findings of the Coastal Resilience Plan.	7/2021-6/2024	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
4	11	Maintain a list of properties that have experienced repetitive loss from storms and flooding (with owner interest for future acquisition) and pursue open space funding as it becomes available. Acquire properties based on this list (this action calls for list development and applications for funding in the timeframe of this plan; acquisitions are deferred to future editions of this plan).	CF	NR	Engineering and Planning	The Town's Coastal Resiliency Plan recommended various mitigation measures for properties severely impacted by flooding. These actions should be prioritized and properties that should be acquired should be identified.	7/2020-6/2024	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
5	14	Pursue funding to design and initiate multiple culverts and channels on Surf Avenue at the I-95 overpass along with the flood wall to reduce chronic coastal flooding.	CF	ST	Engineering and PW	Currently, the design of Surf Avenue culvert replacement project is on-going. Funding is needed for implementation.	7/2020-6/2023	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
6	15	Pursue funding to design and initiate multiple culverts and channels at Barnum Avenue between Sage and Bowe Avenues.	CF	ST	Engineering and PW	Significant progress has been made relative to design along this section of Bruce Brook. Funding is needed for construction.	7/2020-6/2023	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
7	19	Secure funding to build Short Beach to the elevations and grades of survey design recommendations conducted by US Army Corps of Engineers.	CF	ST	Engineering and PW	Departments to collaborate on securing funding for this project.	7/2020-6/2023	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
8	20	Secure funding to implement flood protection measures around the wastewater treatment plant by raising the existing flood control berm.	CF	ST	Engineering and PW	A portion of funding is in place through CDBG grant for implementation. 40% match is needed to implement through federal or state grants.	7/2019-6/2021	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
9	21	Secure funding to design and build twin 6' X 8' box culvert with regulating tide gate to allow tidal flushing while preventing tidal flooding along Lordship Boulevard.	CF	ST	Engineering and PW	This action was recommended in the Coastal Resilience Plan. Funding is needed for design and construction.	7/2019-6/2021	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).

Proposed Mitigation Actions for Stratford, 2019-2024

Current ID (2019-2024)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
10	23	Pursue funding to evaluate the feasibility of daylighting of streams and prioritize actions to reduce hazards.	CF	ST, NR	Engineering and PW	This action came from a separation of previous strategies related to Tanners Brook. The section of Tanners Brook near Broadbridge Avenue is addressed below. The Town will leverage its experience with Tanners Brook to evaluate whether other streams can be partially restored by removing channelized sections.	7/2022-6/2024	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
11	23	Continue with the project to increase the width of the channelized stream downstream of Broadbridge Avenue to reduce flooding at a condominium parking lot. The replacement and enlargement of the structured channel and natural channel that conveys Tanners Brook from Broadbridge Avenue South to King Street has been designed and is in the permitting phase. Funds have been allocated for construction. Execute construction in the timeframe of this plan.	CF	ST	Engineering and PW	This project is in the permitting phase. CT DEEP permits and a FEMA CLOMR application have been applied for. When approved, the Town will proceed with the balance of funding requests and to bid the project. Following bid and fully funding the project, a contract will be awarded and the Town will oversee construction to fully implement the project.	7/2019-6/2024	>$1 Million	Capital improvement funds
12	24, 27	Pursue funding to complete the bridge project to elevate Broad Street over Ferry Creek. Town currently pursuing funding through LOTCIP grant.	CF	ST	Engineering and PW	This project is under preliminary design. The Town is currently proceeding with further study based on FEMA revisions to the Base Flood Elevation. Permitting and funding will be the next step in this design. Once completed, the town will bid and oversee construction to fully implement the project.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
13	25, 29	Reduce I/I through execution of projects utilizing the Clean Water Act grant funds.	CF	ST	Engineering and PW	Based on completion of assessment of its operations, the Town conducted a study to determine the areas where Inflow and Infiltration can be reduced. The Town applied for and availed $ 700,000 from State Clean Water Fund Grant Money.	7/2020-6/2023	>$1 Million	Clean Water Act funds.
14	26	Secure funding to design and build a 36” relief pipe to Long Brook and proceed to construction.	CF	ST	Engineering and PW	Funding for this, which was obtained through a CDBG-DR grant, was de-commissioned recently. This project is currently being designed and will proceed to local permitting in the near future. The project should be implemented and constructed in less then two years.	7/2022-6/2024	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
15	28, 33	Execute the West Broad Street project to reduce drainage-related flooding and flooding associated with Tanners Brook.	CF	ST	Engineering and PW	This project is currently getting ready to go into construction phase. State funding in the amount of $ 6 million is in place.	7/2019-6/2021	>$1 Million	State funding

Proposed Mitigation Actions for Stratford, 2019-2024

Current ID (2019-2024)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
16	30	Secure funding to respond to future needs as appropriate at Oronoque Village. Specifically, acquire additional equipment to provided enhanced emergency management related to the development.	CF	ES	Emergency Management	The Health Department has reached out to Oronoque residents providing them with emergency preparedness information. In addition, staff have provided on-site instructions on how to enroll in the Stratford Electronic Notification System so they can be sure to receive timely emergency notifications. The Town needs additional equipment for providing emergency management services to Oronoque Village.	7/2019-6/2021	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
17	31	Pursue funding to floodproof municipal buildings in the town by raising equipment and generators and installing projectile-proof windows where necessary.	CF	PP	PW	Staff will pursue funds from FEMA and other mitigation and preparedness grant programs.	7/2019-6/2021	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
18	32	Secure funds to replace the stormwater culverts under Old Spring Road with new box culverts.	CF	ST	Engineering and PW	Permitting and design are underway. Staff is considering applying for local bridge program to pursue funding and implement.	7/2019-6/2021	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
19	39	Implement the best approach to maintain the functionality of the Birdseye boat ramp under flooded conditions to ensure continued use during disasters.	CF	ES	PW and Emergency Management	In 2018, a consultant was hired to do assessment of the Birdseye ramp to maintain functionality during events. No implementation has been undertaken yet although $14,000 was budgeted. EMS Department is currently seeking approval from DEEP and the Town Council.	7/2019-6/2021	>$1 Million	Capital improvement funds
20	40	Pursue funding to implement structural flood proofing on Massarik Avenue/Benton Street.	CF	PP	Engineering and Planning	Staff will pursue funds from FEMA and other mitigation and preparedness grant programs.	7/2020-6/2021	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
21	42	Mitigate bank erosion at Diane Terrace and engage private properties on that street.	CF	ST	Engineering and PW	The Town will include in CIP and prioritize this project and schedule the design, permitting and construction in the order of prioritized capital improvements	7/2020-6/2022	>$1 Million	Capital improvement funds
22	44	Secure funds to floodproof the animal shelter adjacent to the Wastewater Treatment Plant.	CF	PP	Engineering and PW	Staff will pursue funds from FEMA and other mitigation and preparedness grant programs.	7/2020-6/2021	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
23	45	Conduct a feasibility study to determine whether the Lordship seawall can be modified to increase its resilience to future storms.	CF	ST	Engineering and PW	Staff will pursue funds from municipal budgets and other mitigation and resiliency grant programs, and then conduct the study in-house or retain consultants.	7/2020-6/2021	$100,000-$500,000	Combination of municipal and other funds (NOAA, CIRCA, etc.)

Proposed Mitigation Actions for Stratford, 2019-2024

Current ID (2019-2024)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
24	46	Secure funds for pumping station improvements to incorporate resiliency; and implement the improvements.	CF	ST	Engineering and PW	Town Engineer is currently applying for funding provided by WPCA; Clean Water Fund is being used for construction. Town is currently addressing resiliency of pumping stations both in North End and South End. These will be shovel ready in 2019.	7/2019-6/2021	>$1 Million	Clean Water Act funds.
25	53	Pursue funding to address the impacts of hazards on natural areas, focusing on individual studies for Roosevelt Forest, Booth Memorial Park, Far Mill River, and Wooster Park. The studies should identify ways to enhance defensive/protective features for additional flood protection in the long term.	CF	NR	Engineering and Conservation	Staff will pursue funds from municipal budgets and other mitigation and resiliency grant programs, and then conduct the study in-house or retain consultants.	7/2020-6/2021	$100,000-$500,000	Combination of municipal and other funds (NOAA, CIRCA, etc.)
26	54	Educate private land owners to understand the importance and benefits of maintaining and leaving vegetation in place to stabilize riverbanks	CF	PE	Conservation	The Town is in the process of developing an educational program as part of CRS program that teaches residents and businesses about the importance of maintaining an adequate vegetative buffer to maintain stream channels and prevent erosion based on flooding. The program aims to educate the public through flyers and discussions at public events.	7/2019-6/2021	<$100,000	Operating budget; existing staff to coordinate.
27	56	Secure landowner permissions and funding for design and execution of the bank stabilization project at Russian Beach.	CF	ST, NR	Engineering and Conservation	Staff will pursue funds from mitigation and resiliency grant programs, and engage legal counsel for landowner coordination.	7/2020-6/2021	$100,000-$500,000	Operating budget; existing staff and legal counsel to coordinate.
28	57	Develop a tree replanting plan and maintenance plan consistent with recommended arboriculture practices and that is supportive of the “right tree, right place” policy. The Town's Tree Warden will work to establish a regular tree planting program and obtain grants (as available) in support of the initiative. The Tree Warden will also develop an ordinance that mandates a tree replanting program/schedule in accordance with "right tree, right place" policy.	CF	PP	PW	The Town's Tree Warden will work to establish a regular tree planting program and obtain grants (as available) in support of the initiative. The Tree Warden will also develop an ordinance that mandates a tree replanting program/schedule in accordance with "right tree, right place" policy.	7/2019-6/2021	<$100,000	Operating budget; existing staff to coordinate.
29	60-64	Develop, adopt, and implement a PPI as part of the Town's participation in the CRS program.	CF	PE	Planning	The Town of Stratford is now officially a CRS community. It received a preliminary rating of Class 8 from FEMA. To raise public awareness on disaster preparedness and mitigation, and to maintain good standing with the program, a Program for Public Information (PPI) outlining the schedule and implementation of all outreach activities should be adopted by the Town. This PPI will serve as a guide in educating general public and local officials on all types of hazards.	7/2019-6/2021	<$100,000	Operating budget; existing staff to coordinate.

Proposed Mitigation Actions for Stratford, 2019-2024

Current ID (2019-2024)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
30	59, 67	Update the evacuation plans and make these routes available on the new Regional GIS system. The evacuation routes will also be made available to the public on the Town's website.	CF	ES	Emergency Management	The Town's EMS has plans to update the system. The Town will work with the Stratford Fire Department, Police Department, and MetroCOG to update the evacuation plans and make these routes available on the new Regional GIS system. The evacuation routes will be made available to the public on the Town's website.	7/2019-6/2020	$100,000-$500,000	Operating budget; existing staff to coordinate.
31	69	Pursue funding to provide adequate back-up power to Birdseye Municipal Complex, Flood Middle School, Stratford Housing Authority units, and the Baldwin Senior Center; and to make improvements to the existing generator at Stratford Fire Station .	CF	ES, PP	PW	The Town secured approximately $40,000 through CIP and installed an emergency generator at Bunnell High School. Generators will be installed at other sites as additional funding is available.	7/2020-6/2022	>$1 Million	FEMA HMA and preparedness grant programs
32	70	Pursue funding to update evacuation plans to factor lack of access to transportation routes during peak events such as a severe hurricane, and display them using digital signage at select locations. Integrate notification of voluntary and mandatory evacuation orders into these messages.	CF	ES, PE	Emergency Management	Fire, Police and Health will coordinate to utilize the Stratford Electronic Notification System in a planned series of pre-event notifications warning people about the dangers of waiting too long to evacuate. For those not heeding voluntary or mandatory, the local National Guard unit may be called in to evacuate in the areas of highest risk. The Town currently has a multi-tiered approach to creating a communication flow with residents. The Town's EMS works with CAO's office to disseminate messages through social media. The Town has plans to display digital signage with disaster preparedness and recovery messages at select locations in the town in the near future.	7/2019-6/2020	$100,000-$500,000	Operating budget; existing staff to coordinate.
33	74	Clearly define roles of the Community Emergency Response Teams (CERT) to optimize response functions of emergency services.	CF	ES	Emergency Management	The CERT team has been trained to provide support in sheltering and mass care activities. The Emergency Operation Plan has been updated to delineate their function. The Town's EMS Department has goals to re-focus on this program to determine usage, how to keep CERT members engaged, how to train and recruit CERT members, etc.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
34	--	The Town's EMS has identified the need to rehabilitate the dispatch center which has outdated technology and equipment. Pursue funding to rehabilitate the dispatch center with new technology and furniture, and conduct evaluation to improve the data center.	N	ES	Emergency Management	The Town's EMS has identified the need to rehabilitate the dispatch center which has outdated technology and equipment.	7/2019-6/2021	$100,000-$500,000	Operating budget; existing staff to coordinate.

Proposed Mitigation Actions for Stratford, 2019-2024

Current ID (2019-2024)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
35	--	Conduct outreach to local small businesses with the aim of preventing the accidental release and pollution from chemicals stored and used at their facilities during or following natural hazard events.	N	PE	Planning and Emergency Management	Coordinate directly with CT DEEP on this statewide initiative.	7/2020-6/2021	<$100,000	Operating budget; existing staff to coordinate.
36	--	Secure funding from SHPO to conduct a historic resources survey focusing on potential historic resources in coastal flood risk areas.	N	PP	Planning	Coordinate directly with CT SHPO on this statewide initiative.	7/2021-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).
37	--	Work with CT DEEP to complete a formal validation of the RL list and update the mitigation status of each listed property.	N	PP	Planning	Coordinate directly with CT DEEP. Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
38	--	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. Coordinate with CRS participation.	N	PP	Planning	Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
39	--	Prepare a Repetitive Loss Area Analysis (RLAA) in support of the Town's CRS program including education and outreach to homeowners.	N	PP	Planning	This study will prioritize flood mitigation activities to reduce impacts to the 77 repetitive loss properties and neighboring properties in the RLAs. The study will set priorities using a systematic approach for evaluating the feasibility of FEMA-approved flood mitigation activities including a benefit/cost analysis of feasible activities. The results of this study will enable to Town to then pursue additional funding based on the highest priorities outlined in the study.	7/2020-6/2021	$100,000	Grant funds.

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Proposed Mitigation Actions for Trumbull, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
1	4, 9, 31, 36	Conduct a feasibility study to determine where green infrastructure can be installed.	CF	PR, NR	P&Z and PW	The Town encourages use of LID during development reviews. However, while the Town has made some progress, it does not have a policy in place or locations identified for additional green infrastructure, nor are regulations in place to require such. A feasibility study will help the Town understand where effective GI can be installed.	7/2020-6/2021	$100,000-$500,000	Grant funding from Section 319, CIRCA, or other
2	4, 9	Prepare a draft of municipal regulations that can be used to require low impact development and green infrastructure.	CF	PR, NR	P&Z and PW	Review and consider the findings and recommendations of the rural LID guidance funded by CIRCA and published on the CIRCA web site. Potential regulations can be taken from this guidance.	7/2020-6/2022	<$100,000	Operating budget; existing staff to coordinate.
3	3	Secure funds and develop a scope of work to study a portion of the Town's drainage easements and drainage network.	CF	ST	PW	The Town intends to secure funds and retain consultant services for this study.	7/2021-6/2022	$100,000-$500,000	Capital budget combined with operating budgets and grant funds such as STEAP or other
4	6, 7, 10, 11, 17	Secure funds and develop a scope of work to study one of the Town's watercourses and watersheds. Island Brook will be prioritized next.	CF	ST	PW	The Town intends to secure funds and retain consultant services for this study.	7/2021-6/2022	$100,000-$500,000	Capital budget combined with operating budgets and grant funds such as STEAP or other
5	15, 18	Annually send a letter to property owners in RL areas to inform them of options for elevating or acquiring structures to reduce flood risk.	CF	PP	PW	Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
6	16	Provide 100 year flood plain locations on the GIS Website for residents.	CF	PE	P&Z	Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
7	23	Floodproof remaining sewer pumping stations in accordance with master plan, as designs are completed.	CF	PP	PW	A master plan for pumping stations has been completed. The Town is currently rehabilitating and floodproofing the Beardsley pump station. Improvements were completed to the Reservoir Pump station to prevent flooding. The Town will continue with remaining pumping stations.	7/2019-6/2023	>$1,000,000	Operating sewer budget and CWA funds as appropriate.
8	28	Secure funds and complete study to determine how water level in Pinewood Lake can be controlled to mitigate downstream flooding.	CF	ST	PW	The Town intends to secure funds and retain consultant services for this study.	7/2021-6/2022	$100,000-$500,000	Capital budget combined with operating budgets and grant funds such as STEAP or other
9	35	Determine if bridge and culvert replacements at Twin Brooks and Trumbull Center will effectively reduce flooding, and secure funding if found to be cost effective.	CF	ST	PW	This action may be possible to complete internally without outside services, as the need is to make a determination and then secure funding (if appropriate).	7/2022-6/2023	<$100,000	Operating budget; existing staff to coordinate (action is mainly to secure funding).
10	30	Allocate funds and conduct design for enlarged conveyance at Daniels Farm Road/Pequonnock River and downstream in the Twin Brooks Park area.	CF	ST	PW	The Town intends to secure funds and retain consultant services for this study.	7/2021-6/2022	$100,000-$500,000	Capital budget combined with operating budgets and grant funds such as STEAP or other (funds are for design stage).

Proposed Mitigation Actions for Trumbull, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
11	33	Determine if floodplain enhancement at the bend of the Pequonnock River near Route 127 is feasible and would be effective for flood mitigation, and secure funding if found to be cost effective.	CF	ST	PW	The Town intends to secure funds and retain consultant services for this study.	7/2022-6/2023	$100,000-$500,000	Capital budget combined with operating budgets and grant funds such as STEAP or other (funds are for design stage).
12	34	Allocate funds and retain consultant to review dam safety files and EAPs for dams in Trumbull; and determine which dams may have the ability to be modified for flood mitigation capabilities.	CF	ST	PW	The Town intends to secure funds and retain consultant services for this study. The Town may be able to couple this effort with action #10 above (Pinewood Lake).	7/2021-6/2022	$100,000-$500,000	Capital budget combined with operating budgets and grant funds such as STEAP or other.
13	39	Expand awareness of the benefits and opportunities of green infrastructure and pervious pavement.	CF	PE	P&Z and PW	Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
14	40	Improve tree management through outreach and public education.	CF	PE	P&Z and PW	Although tree limb maintenance is not related to CRS participation, the Town may be able to leverage CRS-related efforts to conduct this outreach.		<$100,000	Operating budget; existing staff to coordinate.
15	41	Expand outreach to residents on the importance of wetlands and drainage swales for risk reduction from flooding. Look to increase the protection of additional floodplains.	CF	PE	P&Z and PW	Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
16	42	Expand outreach efforts regarding how to prepare for extreme weather and what to do in the event of a natural disaster, including enhancing the Town's website, preparing pamphlets to be available at Town Hall and the Trumbull Library and enhancing hazard-related mapping.	CF	PE	OEM	Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
17	43	Improve access to information on services for at-risk populations during disasters.	CF	PE	OEM	Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
18	49	Improve access to and availability of information on services during an emergency.	CF	PE, ES	OEM	Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
19	58	Evaluate the need for emergency access into and from the Trumbull Corporate Park and the Westfield/Trumbull Shopping Mall.	CF	ES	OEM	OEM to conduct.	7/2021-6/2022	<$100,000	Operating budget; existing staff to coordinate.
20	--	Conduct outreach to local small businesses with the aim of preventing the accidental release and pollution from chemicals stored and used at their facilities during or following natural hazard events.	N	PE	OEM	Coordinate directly with CT DEEP on this statewide initiative.	7/2020-6/2021	<$100,000	Operating budget; existing staff to coordinate.
21	--	Secure funding from SHPO to conduct a historic resources survey focusing on potential historic resources in flood risk areas.	N	PP	P&Z	Coordinate directly with CT SHPO on this statewide initiative.	7/2021-6/2022	<$100,000	Operating budget; existing staff to coordinate (action is to secure funds only).

Proposed Mitigation Actions for Trumbull, 2019-2024

Current ID (2019-2014)	Former ID (2014-2019)	Action for 2019-2024	Carried Forward or New Action?	Type of Action	Responsible Department	Process for Implementation	Timeframe	Cost	Funding
22	--	Work with CT DEEP to complete a formal validation of the RL list and update the mitigation status of each listed property.	N	PP	PW	Coordinate directly with CT DEEP. Conduct in connection with CRS participation.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.
23	--	Take steps to become certified in the Sustainable CT program, focusing on actions that achieve hazard mitigation benefits.	N	PR, NR	P&Z	Existing coordinator to work on this.	7/2019-6/2020	<$100,000	Operating budget; existing staff to coordinate.

Type of Action:

PP = property protection
PR = prevention
NR = natural resources protection or restoration
ST = structural projects
ES = emergency services
PE = public education

tracking of snow removal vehicles. The City has also completed an All-Hazards Emergency Operations Plan Annex for winter storms. Furthermore, City Hall, the Police Department, and the Senior Center are served by a new microgrid.

Lastly, the City has begun implementing the first phase of the Ox Brook flood control project, which is rehabilitating the dam at Elton Rogers Park. The project is currently in the final stages of design and permitting, with construction planned for late 2019 or early 2020. The City has also been addressing stormwater issues through changes to the stormwater regulations and through the WPCA's efforts to implement items required by the MS4 permit. These include efforts to disconnect directly connected impervious areas from collection systems, and installation of bioswales to remove roadway runoff from the sewer system.

Town of Easton

The Town of Easton continues to ensure the safety of residents by erecting barricades at roads vulnerable to flooding during heavy rain events and by warning residents that may become isolated by flooded roads or downed trees. Tree management and maintenance plans, as well as structural projects to mitigate the impact of flooding on state and local roads are new recommendations.

The Town of Easton has recently completed culvert replacements to address previously flood-prone culverts on Morehouse Brook and Cricker Brook (2018), and has established a Reverse 911 system that, combined with direct outreach, was effective at warning residents of flooded areas during the September 2018 storm.

Town of Fairfield

The Town of Fairfield's coastline was severely impacted by coastal flooding and storm surge from both Hurricanes Irene and Sandy. The Town adopted FEMA's new DFIRMs in 2013, and many property owners in the coastal floodplain have elevated their homes.

Since the 2014 NHMP Update, the Town of Fairfield has made significant strides in implementing actions related to hazard mitigation. The Town has enrolled in the CRS Program, developed tree health, cutting and maintenance plans, and requires any new streets to utilize underground utilities. Other initiatives have included:

- The Town has also completed the Riverside Drive/Ash Creek Flood Protection and Coastal Resiliency Study and has developed conceptual plans for green infrastructure projects throughout Fairfield Center.
- Design of the South Benson Road Pump Station has been completed with the Town seeking funds for implementation.
- The berm protecting the Wastewater Treatment Facility has also been hardened and regular maintenance to the Town's culvert and drainage system continues.
- The Town was successful in installing a microgrid to provide electricity to critical facilities such as Police & Fire Headquarters, the Emergency Operations Center, a nearby cell tower and homeless shelter. Generators have also been installed at evacuation facilities around Town.
- Finally, since the destruction caused by Superstorm Sandy, approximately 50 home elevations have occurred using FEMA Hazard Mitigation Grant Program (HMGP) funds or other federal funding sources. Approximately 50 more homes were elevated using solely private funds, and approximately 200 homes were torn down and rebuilt to flood-compliant standards.

Town of Monroe

The Town of Monroe continues proactive maintenance of culverts and keeping debris out of streams. In addition, the Town continues to encourage residents to use alternate routes in areas prone to flooding during flood events via public service announcements, notices, and postings on the Town web site.

The Town of Monroe continues to improve coordination between the Department of Public Works and local "Make Safe" utility crews before, during and after a high wind or storm event. This coordination ensures that resources are allocated to priority locations, downed trees and limbs are cleared from roads and the ultimate restoration of power to homes and businesses. Communication with residents who may become isolated because of downed tree limbs is another ongoing activity in the Town.

The Town of Monroe has also installed generators at the Town Garage, Jockey Hollow Middle School, all town shelters, the EOC, the Senior Center, and Fairway Acres (the Town's senior hous-

ing complex). Furthermore, the windows at the EOC, Masuk High School, and shelters have been upgraded to be storm resistant.

Finally, the Connecticut Department of Transportation is replacing Bridge 02220 and Bridge 02219 on Route 25 (Main Street). The project involves the replacement of two box culverts, installation of new drainage and a water main, and associated road repairs and paving.

Town of Stratford

Since the 2014 NHMP Update, the Town of Stratford has implemented a number of recommendations. Improvements to the storm drainage system were made in the Main Street/Stratford Center viaduct and Massarik Avenue/Benton Street locations. The King Street culvert (to Main Street) has been upgraded to increase hydraulic capacity. Since 2014, the Connecticut Department of Transportation completed a project to elevate Route 113 in the vicinity of Sikorsky Airport. The Everbridge electronic notification system was implemented to replace the Citywatch Reverse 911 system. In addition to the recommendations from the 2014 NHMP Update, some manhole covers have been waterproofed and a backup generator has been secured for the Stratford Housing Authority offices and community center.

More recently, the Town of Stratford has enlarged the Tanners Brook channel to mitigate flooding downstream of Stratford High School. Numerous studies have been completed presenting recommendations that, if funding is secured, will mitigate damage from natural hazards. The Town also completed a Coastal Resilience Plan, and entered into the CRS program in 2019.

Town of Trumbull

The Town of Trumbull continues to provide timely information, notifications and warnings to residents through a reverse 911 system and regular website updates. Long term needs for power continuity and generator upgrades continue to be assessed. Improvements to communication and coordination with Region 1, local utility crews and the EMS Department are ongoing.

More recently, the Town of Trumbull has joined FEMA's CRS Program, replaced several floodprone culverts, and installed generators at sewage pump stations throughout town.

5.7 Technical & 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 the NHMP. This list is not inclusive of all resources and should be updated periodically.

Federal Resources

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. Each MetroCOG 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 (FIMA): FIMA 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. 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. 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:

- **Flood Map Modernization:** maintains and updates NFIP maps.
- **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 (HMGP):** a process for states and communities to identify policies, activities, and tools that can reduce or eliminate long-term risk to life and property from a hazard event.

FEMA programs administered by the **Risk Reduction Division** include:

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

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

- **The 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. This includes the **Public Assistance Grant Program (PA)**, which provides 75% grants for mitigation projects to protect eligible damaged public and private nonprofit facilities from future damage. "Minimization" grants at 100% are available through the **Individuals and Family Grant Program**. The **Hazard Mitigation Grant Program** and the **Fire Management Assistance Grant Program** are also administered by this division.
- **Emergency Management Performance Grants (EMPG) Program:** The Fiscal Year (FY) 2019 Emergency Management Performance Grants (EMPG) Program provides resources to assist state, local, tribal, and territorial governments in preparing for all hazards, as authorized by the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121 et seq.). The FY 2013 EMPG Program plays an important role in the implementation of the National Preparedness System (NPS) by supporting the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal (NPG) of a secure and resilient Nation. Delivering core capabilities requires the combined effort of the whole community, rather than the exclusive effort of any single organization or level of government. The FY 2019 EMPG's allowable costs support efforts to build and sustain core capabilities across the prevention, protection, mitigation, response, and recovery mission areas.

Title VI of the Stafford Act authorizes FEMA to make grants for the purpose of providing a system of emergency preparedness for the protection of life and property in the United States from hazards, and to vest responsibility for emergency preparedness jointly in the Federal government and the states and their political subdivisions. The Federal government, through the EMPG Program, provides necessary direction, coordination, guidance, and necessary assistance, as authorized in this title so that a comprehensive emergency preparedness system exists for all hazards.

FEMA is also offering High Hazard Potential Dams Rehabilitation Grants in 2019. These grants provide up to $1.25 million for technical, planning, design, and construction assistance to non-Federal governmental organizations or nonprofit organiza-

tions for the rehabilitation of eligible high hazard dams.

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 (SBA assistance is triggered by a FEMA declaration, however.) SBA can provide additional low-interest funds (up to 20% above what an eligible applicant would "normally" qualify for) to install mitigation measures. They can also loan the cost of bringing a damaged property up to state or local code requirements. These loans can be used in combination with the new "mitigation insurance" under the NFIP or in lieu of that coverage.

Environmental Protection Agency - Region I

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

Grants for restoration and repair and educational activities, including:

Capitalization Grants for State Revolving Funds: Low interest loans to governments to repair, replace, or relocate wastewater treatment plants damaged in floods. The grants do not apply to drinking water or other utilities.

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

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 (CDBG) to communities with populations greater than 50,000, who may contact HUD directly regarding CDBG. 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 "404" Hazard Mitigation Grant Program. Funds can also be applied toward "blighted" conditions, which is often the post-flood condition. A separate set of funds exists for conditions that create an "imminent threat." The funds have been used in the past to replace (and redesign) bridges where flood damage eliminates police and fire access to the other side of the waterway. Funds are also available for smaller municipalities through the state-administered CDBG program participated in by the State of Connecticut.

U.S. Army Corps of Engineers

New England District
696 Virginia Road
Concord, MA 01742-2751
(978) 318-8520

The Corps provides 100% funding for floodplain management planning and technical assistance to states and local governments under several flood control acts and the Floodplain Management Services Program (FPMS).

U.S. Department of Commerce

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

The National Weather Service 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. Department of the Interior

National Park Service

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

The National Park Service provides 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 and Wildlife Service

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

The U.S. Fish and Wildlife Service provides technical and financial assistance to restore wetlands and riparian habitats through the North American Wetland Conservation and Partners for Fish and Wildlife programs.

U.S. Department of Agriculture

Natural Resources Conservation Service (formerly SCS)
Connecticut State Office
344 Merrow Road, Suite A
Tolland, CT 06084-3917
(860) 871-4011

The Natural Resources Conservation Service 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.

State Resources

Connecticut Department of Economic and Community Development (DECD)

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

The Connecticut Department of Economic and Community Development administers HUD's State CDBG Program, 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 Energy & Environmental Protection

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

The Connecticut DEEP provides technical assistance to subapplicants for planning efforts and hazard mitigation assistance projects. The department includes several divisions with various functions related to hazard mitigation:

Bureau of Water Protection and Land Reuse, Inland Water Resources Division: This division is generally responsible for flood hazard mitigation in Connecticut, including administration of the National Flood Insurance Program.

National Flood Insurance Program State Coordinator: Provides flood insurance and floodplain management technical assistance, floodplain management ordinance review, substantial damage/improvement requirements, community assistance visit, and other general flood hazard mitigation planning including the delineation of floodways.

Flood & Erosion Control Board Program: Provides assistance to municipalities with active Flood and Erosion Control Boards to solve flooding, beach erosion, and dam repair problems. The program has the power 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 on a noncompetitive basis.

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.

Dam Safety Program: 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.

Clean Water Fund: Funding and grants under the Clean Water Act involving sewage treatment plant construction and upgrades, combined sewer overflow remediation, nutrient removal and nonpoint source pollution control projects that protect Long Island Sound, collection system improvements, water pollution control and river restoration.

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.

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

Department of Emergency Services and Public Protection

25 Sigourney Street, 6th Floor
Hartford, CT 06106-5042
(860) 256-0800
http://www.ct.gov/demhs/

The Department of Emergency Services and Public Protection (DESPP) houses the Division of Emergency Management and Homeland Security (DEMHS). DEMHS includes emergency preparedness, response and recovery, mitigation and an extensive training program. DESPP/DEMHS is the state point of contact for most FEMA grant and assistance programs.

State Hazard Mitigation Officer: The State Hazard Mitigation Officer (SHMO) is responsible for hazard mitigation planning and policy, oversight of administration of the Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, and Pre-Disaster Mitigation Program. The Officer also has the responsibility of making certain that the State Natural Hazard Mitigation Plan is updated every five years.

Connecticut Department of Administrative Services

1111 Country Club Road
Middletown, CT 06457
(860) 685-8190
http://www.ct.gov/das/

Office of the 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 Transportation

2800 Berlin Turnpike
Newington, CT 06131-7546
(860) 594-2000
http://www.ct.gov/dot/

The Department of Transportation (CT DOT) administers the federal surface transportation bill, Fixing America's Surface Transportation Act (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. CT DOT is also involved in traffic improvements and bridge repairs that could be mitigation related.

Private and Other Resources

Association of State Dam Safety Officials (ASDSO)

450 Old Vine Street
Lexington, KY 40507
(859) 257-5140
http://www.damsafety.org

ASDSO is a nonprofit organization of state and federal dam safety regulators, dam owners/operators, dam designers, manufacturers/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.

The Association of State Floodplain Managers (ASFPM)

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

ASFPM is a professional association with a membership of over 6,000 that provides education to assist state and local governments with the NFIP, CRS, and flood mitigation. ASFPM 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 (CAFM)

P.O. Box 270213
West Hartford, CT 06127
ContactCAFM@gmail.com
http://ctfloods.org

CAFM is a professional association of private consultants and local floodplain managers that provides training and outreach regarding flood management techniques. CAFM is the local state chapter of ASFPM.

Insurance Institute for Business & Home Safety (IBHS)

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

IBHS 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 (MCEER)

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, MCEER'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.

The National Association of Flood & Storm water Management Agencies (NAFSMA)

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

NAFSMA is an organization of public agencies 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 (NEMA)

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

NEMA 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 on hazards 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 ASFPM for floodplain management publications.