Western Connecticut Council of Governments
Multi-Jurisdiction Hazard Mitigation Plan Update
2021 – 2026

Municipal Annex
for
Danbury

155 Deer Hill Avenue
Danbury, CT
August 2021

Prepared for:
WESTERN CONNECTICUT
COUNCIL OF GOVERNMENTS
1 Riverside Road
Sandy Hook, CT 06482
475-323-2060
www.westcog.org

MMI #3101-22

Prepared by:
MILONE & MACBROOM, INC.
99 Realty Drive
Cheshire, Connecticut 06410
(203) 271-1773
www.mminc.com

MILONE & MACBROOM
ENGINEERING | PLANNING | LANDSCAPE ARCHITECTURE | ENVIRONMENTAL SCIENCE

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 Purpose of Annex

The purpose of this Hazard Mitigation Plan (HMP) annex is to provide a community-specific hazard risk assessment, capability analysis, and evaluation and prioritization of hazard mitigation measures and projects. Background information and the regional effects of pertinent natural hazards are discussed in the main body of the Western Connecticut Council of Governments (WestCOG) Multi-Jurisdictional Hazard Mitigation Plan. This annex is designed to supplement the information presented in the Multi-Jurisdictional HMP with more specific detail for the City of Danbury and is not to be considered a standalone document.

The primary goal of this HMP, including this Municipal Annex, is to identify natural hazard risks and mitigation opportunities in order to reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources. This includes the reduction of public and private damage costs. Limiting losses of and damage to life and property will also reduce the social, emotional, and economic disruption associated with a natural disaster.

2.0 COMMUNITY PROFILE

2.1 Geography

2.1.1 Physical Setting

The City of Danbury is located in northern Fairfield County along the New York state border. Danbury is bordered (clockwise) by the Connecticut municipalities of New Fairfield to the north, Brookfield and Bethel to the east, and to the south by Redding and Ridgefield. It is bordered to the west by the municipality of Southeast in Putnam County, New York. Refer to Figure 2-1 for a map showing the regional location of Danbury.

Danbury is located in the Western Highlands of Connecticut. The topography of the City is characterized by higher elevations away from the lower-elevation City center. These high-elevation areas drain into the Still River corridor, which flows generally west to east across Danbury. Peaks in the western part of the City reach elevations nearing over 1,000 feet above sea level while the majority of the urban core lies at elevations between 300 and 500 feet above sea level. In addition to the many ponds, lakes, and reservoirs throughout the City, an arm of Lake Candlewood extends from the New Fairfield border approximately 2.5 miles into Danbury. The varying terrain of Danbury makes the City vulnerable to an array of natural hazards.

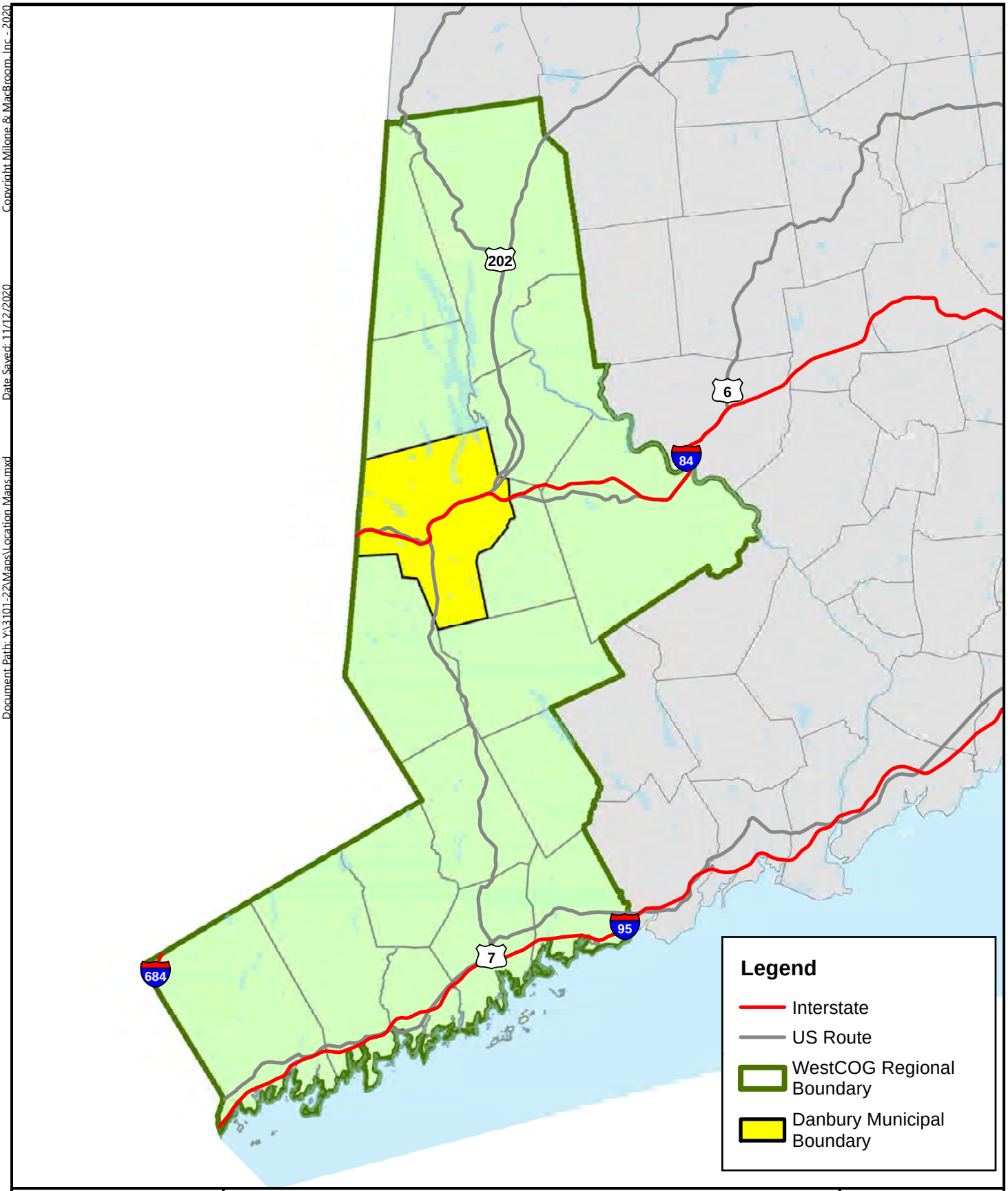
The Center for Land Use Education and Research (CLEAR) has developed a land cover dataset derived from 2016 satellite imagery to depict statewide land cover. The land cover by percent of total land can be found in Table 2-1. According to this data, about 45 percent of the City is forested, and one-third of the City's approximate 43.93 square miles is developed.

Table 2-1: Land Cover by Area

Land Cover	Area (acres)	Percent of City
Deciduous Forest	9,482.1	33.72%
Developed	3,339.7	11.88%
Turf & Grass	506.4	1.80%
Water	281.2	1.00%
Coniferous Forest	10,374.4	36.90%
Forested Wetland	1,210.7	4.31%
Other Grasses	1,682.5	5.98%
Agricultural Field	104.5	0.37%
Barren	930.7	3.31%
Non-Forested Wetland	0.0	0.00%
Utility (Forest)	149.5	0.53%
Tidal Wetland	56.2	0.20%
Total	**28,118**	**100%**

Date Saved: 11/12/2020

Document Path: Y:\3101-22\Maps\Location Maps.mxd



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

Regional Location of Danbury

WestCOG Hazard Mitigation Plan
City of Danbury

N

0 40,000 80,000
Feet

SCALE	1 " = 82,167 '
DATE	11/12/2020
PROJ. NO.	3101-22

FIG. 2-1

2.1.2 Land Use

Danbury is an urban municipality characterized by high population density, limited agricultural uses, significant industrial areas, and extensive commercial development. The majority of the higher density development is along the Interstate 84 and Still River corridor, which runs west to east across the City.

In general, lower-density residential uses are located in the hills away from the urban core, which consists of the central business district and higher-density residential areas. Light industry is scattered throughout the City primarily near the Interstate 84 and Route 7 corridors. The highest density industry is zoned in the eastern section of the City near northern Bethel. The southern and northwestern portions of Danbury are predominantly forested. Consistent with City zoning, the highest density development is along the Interstate 84 corridor running east to west across the City center.

2.1.3 Climate and Climate Change

Current Climate Conditions

Over the course of the year, the temperature in Danbury typically varies from 18°F to 82°F and is rarely below 2°F or above 89°F. The warm season lasts from May to September, with an average daily high temperature above 72°F. The hottest day of the year is July 20, with an average high of 82°F and low of 63°F. The cold season lasts from December to March, with an average daily high temperature below 44°F. The coldest day of the year is January 29, with an average low of 18°F and high of 35°F.

Rain falls throughout the year in Danbury. The most rain falls during the 31 days centered around June 4, with an average total accumulation of 3.9 inches. The least rain falls around January 29, with an average total accumulation of 1.7 inches.

The snowy period of the year lasts for 5.4 months, from October 31 to April 13, with a sliding 31-day liquid-equivalent snowfall of at least 0.1 inches. The most snow falls during the 31 days centered around January 26, with an average total liquid-equivalent accumulation of 1.1 inches.

Climate data was sourced from Weather Spark based on analysis of the years 1980 to 2016.

Climate Change

Climate change projections for Connecticut were sourced from the 2019 Connecticut Physical Climate Science Assessment Report, which was developed by the University of Connecticut (UConn) Atmospheric Sciences Group, commissioned by the Connecticut Institute for Resilience and Climate Adaptation (CIRCA) with funding from the Department of Energy and Environmental Protection (DEEP). All projections are based on the IPCC high CO_2 emission scenario (RCP8.5).

Temperature

Annual temperatures have been increasing throughout Connecticut and is projected to continue to do so in the future. By mid-century, average annual temperature is projected to increase by 5°F. Seasonal average temperatures are also expected to rise, with the greatest increase (6°F) experienced in summer (June to August). The number of nights over which temperature remains

above 68°F will quadruple from 10 days per year to more than 40 days, and the number of extremely hot days will increase from above 4 a year to 48 per year.

Precipitation

Rainfall data in "Technical Paper No. 40" by the U.S. Weather Bureau (now the National Weather Service) (Hershfield, 1961) dates from the years 1938 through 1958. According to these data, the 24-hour rainfall amount for a 50% annual-chance storm in Fairfield County is 3.3 inches.

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

The NOAA Atlas 14, released on September 30, 2015 puts the 24-hour rainfall amount for a 50% annual-chance annual storm in Danbury at 3.55 inches.

The Northeast Regional Climate Center (NRCC) has partnered with the Natural Resources Conservation Service (NRCS) to provide a consistent, current regional analysis of rainfall extremes (http://precip.eas.cornell.edu/). In 2020 this dataset listed the 24-hour rainfall amount for a 50% annual-chance storm in Danbury as 3.40 inches.

These precipitation amounts, and more details, are summarized in Table 2-2, below.

Table 2-2: 24-Hour Rainfall Amounts by Annual-Chance Occurrence

Source	24-Hour Rainfall Amount (inches) by Annual-Chance Occurrence		
	50%	4%	1%
Technical Paper No. 40	3.3	5.7	7.2
NOAA Atlas 14	3.55	6.77	8.68
NRCC	3.40	6.39	9.06

Annual precipitation has been increasing statewide and is projected to continue to increase. By mid-century, annual precipitation is projected to increase by 8.5%, with the greatest increase (13.4%) occurring in the winter months. Extreme precipitation events are projected to increase in both frequency and magnitude. Based on this increase and the precipitation figures above, by 2050 Danbury can expect the 24-hour rainfall amount for a 50% annual-chance storm to be around 3.7 to 3.8 inches or greater.

Impervious surfaces and infrastructure in the City have increased over time as well, leading to increasing runoff and peak discharge values.

Despite overall increases in precipitation, drought risk is projected to increase, especially during summer, due to changing precipitation patterns and projected increases in potential evapotranspiration (plants taking up more water in hotter temperatures and longer growing seasons).

2.1.4 Drainage Basins and Hydrology

Danbury is divided among 12 subregional watersheds as shown in Table 2-3. The majority of the drainage basins drain into the Still River and then to the Housatonic River, but certain areas drain

into New York state, Lake Candlewood (and then eventually to the Housatonic River), or to the Saugatuck River. All of the water that passes through Danbury eventually empties into Long Island Sound.

The majority of these drainage basins have FEMA-defined Special Flood Hazard Areas (SFHA) along the primary watercourses. Such areas consist of 1-percent-annual-chance floodplains without elevations, 1-percent-annual-chance floodplains with elevations, and 0.2-percent-annual-chance floodplains. Refer to Section 3.1 for more detail regarding SFHAs.

Table 2-3: Subregional Drainage Basins

Drainage Basin	Overall Subregional Area (square miles)	Area of City (square miles)	Percent of City
Still River	31.36	16.57	37.7%
Kohanza Brook (Boggs Pond Brook)	6.54	6.53	14.9%
Padanaram Brook	7.27	5.78	13.2%
Saugatuck River	48.55	4.46	10.2%
Lake Candlewood	27.69	3.63	8.2%
Sympaug Brook	7.25	2.34	5.3%
Miry Brook	5.03	1.62	3.7%
Limekiln Brook	8.77	1.04	2.4%
East Branch Croton River	75.13	0.95	2.2%
Corner Pond Brook	4.92	0.60	1.4%
Ball Pond Brook	7.58	0.21	0.4%
East Swamp Brook	5.11	0.20	0.4%
Total	**N/A**	**43.93**	**100.0%**

Source: Connecticut Department of Environmental Protection GIS Data

Still River

The Still River originates near the New York state boundary in western Danbury, flows eastward beneath Interstate 84 into Lake Kenosia, then past the Danbury Fair Mall. From the Danbury Fair Mall, it flows northeast to downtown Danbury where it enters the Army Corps of Engineers Flood Protection Project (FPP), which protects the City center. The river flows east within the FPP through downtown Danbury until it reaches the end of the FPP. The river then continues generally north through a well-developed commercial and industrial area before joining Limekiln Brook, flowing back under Interstate 84 and Route 7, into Brookfield, and eventually to the Housatonic River.

Overall, the Still River directly drains 16.57 square miles of the City of Danbury (37.5 percent of the City's land area) and drains 34.08 square miles in Danbury overall (78 percent of the City's land area) when the river's upstream subregional watersheds are included.

Miry Brook

Miry Brook originates in northern Ridgefield and enters Danbury near Miry Brook Road. The brook turns northeast, flowing past Wooster School into a diversion area on the boundary of the Danbury Municipal Airport. Part of the flow continues north along the original streambed to join the Still River at Danbury Fair Mall. The remainder is directed along the airport boundary into flood storage retention ponds adjacent to the Danbury Fair Mall. This water eventually rejoins Miry Brook just south of its confluence with the Still River.

Overall, Miry Brook directly drains 1.62 square miles of the City of Danbury (3.7 percent of the City's land area) and drains 5.03 square miles overall.

Padanaram Brook

Padanaram Brook originates in a swamp north of Ball Pond Road (Route 39) in northern Danbury. The brook flows southeast along Padanaram Road (at one point impounded by the Padanaram Reservoir) until it enters a 700-foot-long FPP before passing beneath Padanaram Road, after which it enters a 740-foot culvert beneath a shopping plaza. After exiting the culvert, the brook flows south, beneath Interstate 84 and past Wooster Cemetery, after which it is joined by Kohanza Brook, turns south into downtown Danbury, and joins the Still River.

Padanaram Brook directly drains 5.78 square miles of the City of Danbury (9.2 percent of the City's land area) and drains 7.27 square miles overall. Including upstream subregional areas and Kohanza Brook (described below), Padanaram Brook drains a total of 13.81 square miles.

Kohanza Brook (Boggs Pond Brook)

Kohanza Brook originates at Upper Kohanza Reservoir, flowing south into Lower Kohanza Reservoir, then the Ridgewood Country Club. Boggs Pond Brook originates in Boggs Pond in northwestern Danbury and flows east into West Lake Reservoir, Rogers Pond, and Mercers Pond (passing Turtle Pond) until it joins Kohanza Brook in the Ridgewood Country Club. Kohanza Brook continues east, crossing Interstate 84 through a 960-foot culvert before turning southeast to join Padanaram Brook. Overall, Kohanza Brook directly drains 6.53 square miles of the City of Danbury (14.9 percent of the City's land area) and drains 6.54 square miles overall.

Sympaug Brook

Sympaug Brook originates at Sympaug Lake in southwestern Bethel and flows north to enter Danbury near South Street (Route 53). It continues north through a commercial and industrial area and beneath Great Pasture Road and Shelter Rock Road before reaching the Still River. The brook drains 7.25 square miles overall, 2.34 within Danbury (5.3% of the land area).

Limekiln Brook

Limekiln Brook originates in Newtown, Connecticut, and flows northwest, joining East Swamp Brook at the Danbury boundary, just east of the former City landfill. Limekiln Brook receives inflow from the City's sewage treatment plant. The brook continues north to its confluence with the Still River. Newtown Road is the only crossing that Limekiln Brook passes in Danbury. The brook drains 1.04 square miles of Danbury (2.4% of the land area) and drains 13.88 square miles overall.

East Swamp Brook

East Swamp Brook originates in southeastern Bethel, flows northwest, and enters Danbury at Shelter Rock Road. The brook continues north and joins Limekiln Brook just southeast of the former City landfill. The brook drains 0.20 square miles of the City (0.4% of the land area) and 5.11 square miles overall.

Lake Candlewood

Lake Candlewood is the country's first pump-storage reservoir and, at 5,400 acres, is the largest lake in Connecticut. The reservoir was constructed to support power generation at the Rocky River power station in New Milford. Since 1926, water has been diverted from the Housatonic River and pumped uphill into the lake. During low-flow conditions on the Housatonic River, water is released from Lake Candlewood to run the generation turbines, and hence, this water is returned to the Housatonic River.

The Lake Candlewood watershed comprises 8.2 percent of Danbury's land area. Kellners Pond, Doyles Pond, and several intermittent streams outlet into the lake. The lake is impounded in Danbury by the Lake Candlewood Dam near the Danbury Candlewood Park, and is impounded by several dams lying in other municipalities as well.

Ball Pond Brook

Ball Pond Brook flows southeast through New Fairfield, joined by an intermittent stream that may be locally known as Deep Hollow Brook on the way to its confluence with Lake Candlewood. Deep Hollow Brook drains the small part of the watershed that lies within the City of Danbury. The Ball Pond Brook watershed drains 0.21 square miles (0.4 percent) of Danbury's land area and 7.58 square miles overall.

East Branch Croton River/Corner Pond Brook

1.55 square miles (2.6%) of Danbury drain west into the East Branch Croton River, including the area of Corner Pond Brook. The East Branch Croton River drains to reservoirs that contribute to New York City's water supply.

Saugatuck River

The Saugatuck River originates in a large swamp in southern Danbury between Route 7 and Starrs Plain Road. The River flows southeast toward Redding. After leaving Danbury, it continues south to its confluence with Long Island Sound. The Saugatuck River drains a total of 48.55 square miles of southwestern Connecticut and drains 4.46 square miles (10.2 percent) of Danbury, primarily in the southern hills of the City.

2.2 Society, Culture, and Governments

2.2.1 Population and Demographic Setting

Danbury had a population of 80,893 in 2010 according to the U.S. Census, with an overall population density exceeding 1,800 persons per square mile. According to the 2018 American Community Survey five-year estimates, Danbury's population between 2013 and 2018 was approximately 84,573. The Connecticut State Data Center predicts that population in Danbury will continue to increase in the future, with the population in 2040 projected to be 94,602.

Most residents of Danbury live near the urban core, particularly in the vicinity of Main Street, West Street, White Street, and Franklin Street. Danbury has significant populations of people who are linguistically isolated, elderly, and/or disabled and therefore have special needs during emergencies. In addition to the residents with special needs spread throughout the City, there are facilities with higher concentrations of such residents. These include Danbury Hospital, several health care and convalescent centers, and a variety of assisted living facilities. These facilities are included in the City's list of critical facilities (Section 0).

Elderly, linguistically isolated, and disabled populations have numerous implications for hazard mitigation as they may require special assistance or different means of notification before and during natural hazards.

One important aspect of natural hazard mitigation planning is to identify a community's demographic trends in relation to natural hazards. The Center for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI) is used to identify vulnerable populations in Danbury. The SVI uses census data to identify populations within the City that may be more vulnerable to natural hazards. As a result of this analysis, the City is identified to have a certain level of overall social vulnerability with a rank of 0 to 1; 1 being the most vulnerable and 0 being the least.

To determine social vulnerability, the CDC incorporates 15 factors into the overall SVI calculation under four categories, or themes: socioeconomic status, household composition and disability, minority status and language, and housing type and transportation. Figure 2-2 represents the breakdown of the SVI process. These themes and their ranking are based on census statistics. By evaluating these factors and determining a level of social vulnerability, a community can identify specific needs for before, during, and after an event. Such needs may include sheltering capacity, evacuation routes, or to decide how many emergency personnel may be required to respond after an event.

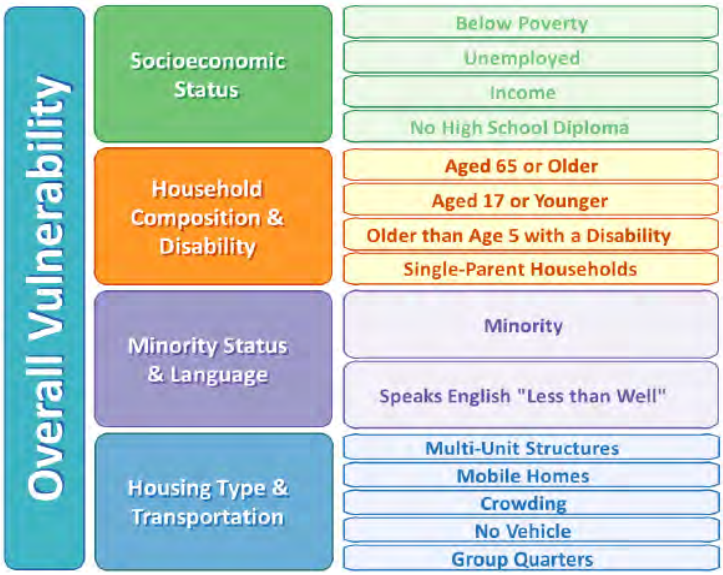


Figure 2-2: The CDC SVI Index Factors. Graphic: svi.cdc.com

The City of Danbury is considered to have a moderate to high level of vulnerability, and in relation to the SVI ranking, is the most vulnerable community in the WestCOG region. The most vulnerable social aspect in the City being minority populations and those that do not speak English well. In addition, there are socioeconomic concerns, as well as high density housing

populations and transportation disparities. These vulnerable populations are concentrated in the central, more urbanized tracts, with rankings slightly lowering throughout the surrounding, suburban tracts. It is important to note that four of the fifteen tracts in the City are considered highly vulnerable, with one tract ranking 0.94 on the SVI scale. Appendix D explores the SVI for Danbury in more depth, including maps showing overall vulnerability, and theme vulnerability.

2.2.2 Development Trends

In 1800, Danbury had a population of 3,180. By 1900, the City's population had increased almost six-fold to 19,474. Continued expansion led to a 1950 population of 30,337. While in 1950 Danbury was a compact, aging single-industry small town, by 1990 Danbury was a cosmopolitan small City with a diverse and highly sophisticated economy. Suburban development had spread across large areas of the City with the exception of the southern and western fringes. The population of Danbury reached 74,848 in 2000, an increase of 14 percent over the 1990 population. Danbury had the largest estimated population increase in the state for the years 2000 through 2009, and the results of the year 2010 census confirmed the strong growth. The official count for 2010 was 80,893, representing an 8.1 percent increase over the 2000 population. The Connecticut State Data Center's 2017 projections (www.ctdata.org/demographics) predicted continued population growth in Danbury over the next 30 years and estimated that the City would grow to 94,602 people by 2040.

Major employers in Danbury are listed in Table 2-4. Danbury continues to have a diversified economy as shown by the top five employers in the City.

Table 2-4: Major Employers in Danbury

Rank	Employer	Service
1	Danbury Hospital	Comprehensive medical services
2	Boehringer Ingelheim	Pharmaceuticals
3	Western Connecticut State University	Educational institution
4	IQVIA Holdings	Health information technology
5	Collins Aerospace	Aerospace and defense

Source: CERC (2014)

Only 28 percent of the remaining developable land in Danbury was undeveloped in 2008. The Candlewood Valley Regional Land Trust (which has taken over the Land Trust of Danbury) currently protects over 270 acres (primarily in the southern part of the City), and an additional 1,381 acres of land have been designated by the City for parks and other recreational use. Other lands are protected by the City as part of water supply watersheds.

Residential growth has remained strong overall, and the City continues to be among the fastest-growing municipalities in the state. According to the Connecticut Department of Economic and Community Development, 3,073 housing units were added to the community's housing stock between 2000 and 2009. The City had the greatest number of new building permits per year in Fairfield County for the years 2002 through 2006 inclusive and had the greatest net gain in the number of housing units in Fairfield County for the years 2002, 2004, 2005, and 2006. From 1996 to 2005, 3,652 new homes were permitted in Danbury (365 per year) while from 2006 to 2015, 2,761 homes (276 per year) were permitted. In 2017, 155 new homes were permitted (CERC). This

is a clear drop in the rate of home development yet still reflects strong continued growth in the City.

As in the past, there remains new or potential development on the western side ("West Side") of the City. Recently completed, ongoing, or proposed developments in this area of Danbury includes, but is not limited, to the following as noted below.

- "The Reserve," "Crown Point," and "Abbey Woods" developments on former Union Carbide land on the western edge of the City that will combine to have more than 2,000 units when fully built out. The Crown Point and Abbey Woods developments have been completed, but construction within The Reserve is still in process. Within The Reserve, more than 100 new residential units have been completed or are under construction since the last HMP including Rivington Mews, Rivington Ridge, the Enclave, the Village, and the Woodlands developments. Two buildings containing non-residential space for neighborhood retail and service uses, as noted in The Reserve Master Plan, have also been approved although these buildings are not yet under construction.
- The former Matrix Corporate Center, now known as "The Summit at Danbury," recently obtained a rezoning to the Planned Neighborhood Development designation and Master Plan approval and is in process of obtaining final site plan approvals. Approvals will represent an ambitious top-to-bottom renovation of the approximately 1.2 million square foot existing office building and site into a multi-use property combining office, residential, and industrial uses. This project is underway.
- Since the last HPM, Western Connecticut State University built a $97 million fine arts building on its "West Side" campus.
- Dynamix Energy recently received site plan approval for construction of two 125-megawatt natural gas generation facilities with 62,264 SF in two separate buildings located on land at the Danbury-Ridgefield municipal boundary line.
- Conversion of the former Novo Labs building on Turner Road to a manufacturing facility for Belimo Aircontrols Inc.
- Construction of 70 townhouse residential units in 2014 at the corner of Turner Road and Saw Mill Road, known as Mayfair Square.
- Redevelopment of an outdated office building at 40 Old Ridgebury Road to medical offices and a parking garage.
- Two new free-standing restaurants were approved on the Danbury Fair Mall site in the parking area between the mall's internal ring road and Backus Avenue.

Other notable development heading east into Danbury include:

- Phase II of Brookview Commons located at 333 Main Street, the former News Times site, approved for 149 one- to two-bedroom multi-family units with ground level commercial space. This development includes a new vehicular bridge over the Padanaram Brook, near the convergence with the Still River, to join its Phase 1 site located on Crosby Street. A detailed flood analysis was performed as part of the project.
- Redevelopment of the former Mallory Hat Factory site on Rose Hill Avenue for transitional housing, as defined in the Danbury Zoning Regulations. This City-owned brownfield property adjacent to the Still River was cleaned up pursuant to a grant issued by the State's Brownfield

Remediation Program. A detailed flood analysis was performed prior to issuance of any floodplain permits. Clean-up has been completed and the site has been transferred to a non-profit organization.

- The Kennedy Avenue Bridge Plate reconstruction project is slated to begin in 2021. This project will replace the bridge plate over the culvert of the Still River within the Kennedy Avenue right-of-way and on adjacent City property. It is funded, in part, through the State bridge program.
- The Connecticut Institute for Communities constructed a medical office building at 120 Main Street which was Phase 1 of a multi-phase project that also includes 79 one- and two-bedroom units, 24 of which are designated elderly housing. The housing portion of the development has not yet been constructed.
- Keystone at Wooster Heights, an assisted-living facility, is nearing completion on Wooster Heights Road just east of Route 7.
- A freestanding restaurant was approved on Newtown Road on land previously occupied by a restaurant.
- Amazon retrofitted an existing warehouse structure on Old Sherman Turnpike into a state-of-the-art distribution center.

Numerous other, smaller developments are underway around the City.

As noted below in section 2.4.1, Danbury has completed study of transit-oriented development (TOD) opportunities centered around the passenger rail station and overlapping with the downtown area. Much of the above listed development is within the TOD study area and supports transit.

With so much development and redevelopment underway, the City of Danbury regulates development carefully to avoid increasing risks in areas of natural hazard risks. In fact, redevelopment pressures have provided the City with opportunities to directly address risks, as mentioned above in the bullets for Phase II of Brookview Commons and the former Mallory Hat Factory. Over time, Danbury anticipates that its vulnerabilities will decrease, even with the proximity of the Still River and its tributaries to many downtown redevelopment projects.

2.2.3 Governmental Structure

The City is governed by a Mayor-City Council form of government. Legislative responsibilities are the responsibility of the City Council whereas the Mayor serves as the chief executive and is the presiding officer of the City Council. The City Council consists of 21 members, two from each of the City's seven wards and seven at-large. The council enacts ordinances and resolutions by a simple majority vote. If the Mayor does not approve the ordinance within 5 days (similar to a veto), the City Council may revote on it; if it passes with two-thirds majority, then the resolution becomes effective without the Mayor's approval.

In addition to the Mayor and City Council, there are boards, commissions, and committees providing input and direction to City administrators while City departments provide municipal services and day-to-day administration. Many of these commissions and departments play a role in hazard mitigation, including the Office of Emergency Management, the Engineering Division, the Fire Department, the Planning and Zoning Department, the Health Department, the Planning

Commission, the Environmental Impact Commission, the Building Official, and the Police Department.

The Fire Department is the primary responder to emergency situations caused by natural hazards while the Police Department and Public Works Department provide traffic control, investigation assistance, cleanup, and repair support. Complaints related to City maintenance issues are routed to the Public Works Department and are investigated and remediated as necessary.

2.2.4 Historic and Cultural Resources

Historic and cultural resources include districts, sites, buildings, structures, and objects that are significant in history, architecture, archaeology, engineering, and culture (National Trust for Historic Preservation). In its 2014-2017 Strategic Plan, the Connecticut Trust for Historic Preservation explains that protection of these resources grows economies, enhances community character, and highlights our cultural heritage. FEMA report 386-6, *Integrating Historic Property and Cultural Resource Considerations Into Hazard Mitigation Planning*, published in 2005, states that the loss of irreplaceable historic and cultural resources, including buildings, artwork, monuments, heirlooms, and documents, can be particularly painful because "residents rely on their presence after a disaster to reinforce connections with neighbors and the larger community, and to seek comfort in the aftermath of a disaster." Consideration of these resources in this HMP is critical.

Historic preservation planning allows for the protection of historic properties and cultural resources before they are threatened with demolition or alteration.
Hazard mitigation planning allows for the protection of life and property from damage caused by natural and manmade hazards. Integrating these two planning processes will help to ensure the future growth of safe and sustainable historic communities.
- FEMA Report 386-6, May 2005

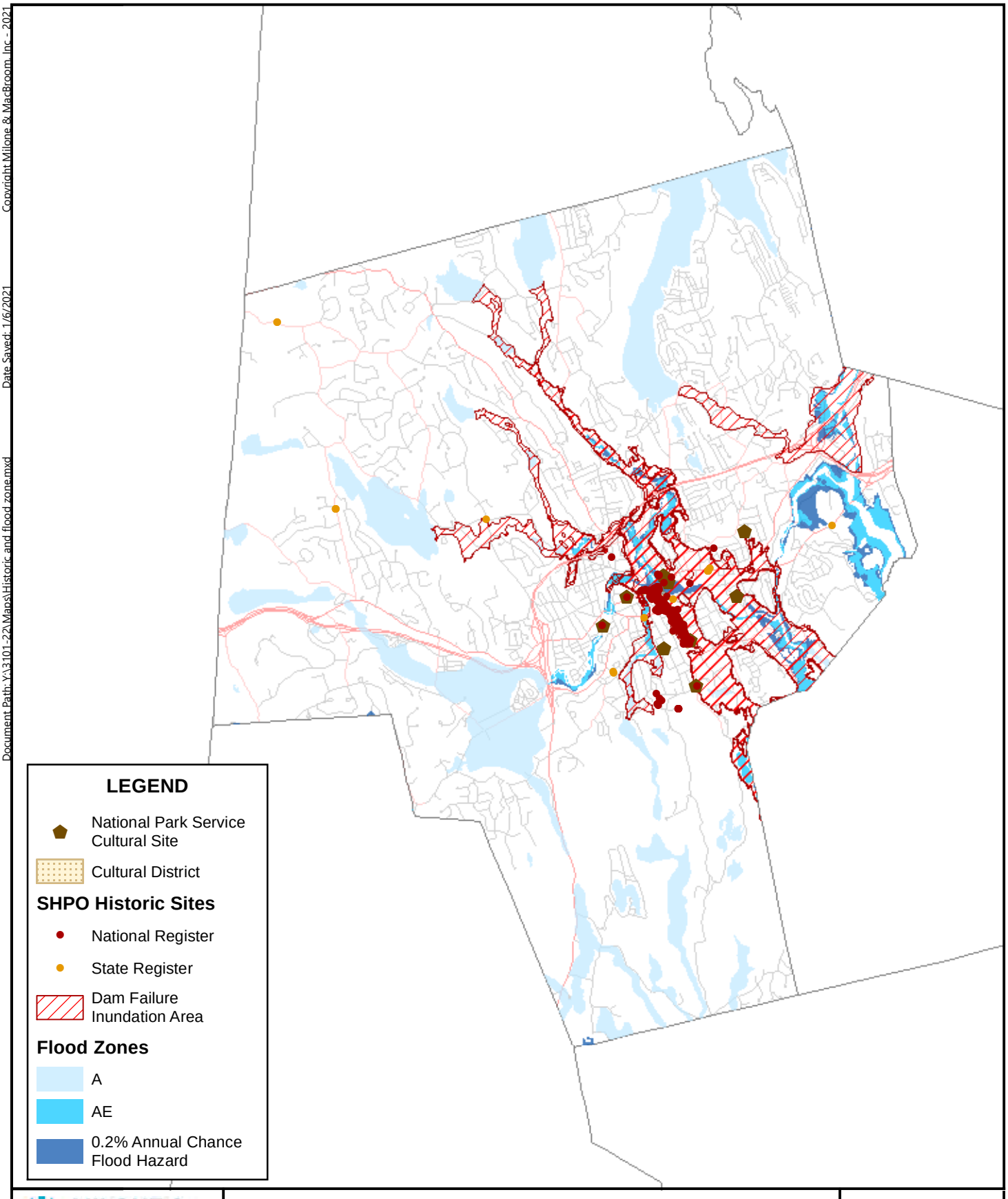
The importance of historic resources to Danbury is written into the City's 2013 *Plan of Conservation and Development*. In the Plan, the Danbury Museum and Historical Society point to the following buildings that are listed on the National Historic Register:

- Ball and Roller Bearing Company - 20-22 Maple Avenue
- Hearthstone Castle - 18 Brushy Hill Road
- Charles Ives House - 7 Mountainville Avenue
- Locust Avenue School - Locust Avenue
- Main Street Historic District - Boughton, Elm, Ives, Keeler, Main, West, and White St.
- Meeker's Hardware - 86-90 White Street
- New Haven RR, Danbury Turntable - 120 White Street
- Octagon House - 21 Spring Street
- Rider House (at Danbury Museum) - 43 Main Street
- Robinson Fur Cutting Company - Oil Mill Road
- Tarrywile - Southern Boulevard and Mountain Road
- Union Station - White Street and Patriot Drive

Other historic and cultural resources in Danbury may be listed on state or local registers. See Figure 2-3 for a map of historic resources in the community.

Date Saved: 1/6/2021

Document Path: Y:\3101-22\Maps\Historic and flood zone.mxd



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

Historic Resources with Flood Zones and Dam Failure Inundation Areas

WestCOG Hazard Mitigation Plan
City of Danbury

NPS: Cultural Resources CT DEEP: DFA FEMA: DFRIM & Q3

N

0 3,500 7,000
Feet

SCALE	1 " = 7,319 '
DATE	1/6/2021
PROJ. NO.	3101-22

FIG. 2-3

Analysis of the State Historic Preservation Office (SHPO) database of historic resources shows that some of these resources are exposed to natural hazards, as shown in **Error! Not a valid bookmark self-reference.**.

Table 2-5: Number of Historic Assets Exposed to Different Hazards in Danbury

Hazard	Count
Dam Failure	2
Earthquake	126
Flooding	-
1% Annual	0
0.2% Annual	2
Hurricane/Tropical Storm	126
Thunderstorm	126
Tornado	126
Winter Storm	126
Wildfire	92

Historic buildings and structures may be particularly susceptible to natural hazards because they were built prior to the establishment of more recent construction standards. Additionally, some of the structural integrity of these resources may have been degraded over the decades or centuries since their original construction. Structural retrofits and hazard mitigation methods may be challenging or restricted in cases where alteration of a resource will also diminish its cultural or historical aesthetic and value. Finally, miscommunications or lack of knowledge may lead to historic resources being damaged during the disaster recovery process.

It will be important for Danbury to take steps to incorporate historical and cultural preservation into its future planning processes. Steps to take will include the following:

- Inventory and survey historic and cultural resources
- Implement appropriate mitigation measures for those resources
- Take steps to move portable resources, such as artwork or documents, to safe locations prior to the occurrence of a hazard, if possible
- Consider these resources in emergency operations plans to prevent accidental damages during recovery efforts

2.3 Infrastructure

2.3.1 Transportation

State and federal roads are the major transportation arteries into and out of the City and include Interstate 84, Route 6, Route 7, Route 37, Route 39, Route 53, and Route 202.

Public transportation is available to move residents and visitors. The Metro North Railroad to Norwalk has a stop in Danbury, and HART buses serve the City.

2.3.2 Utilities

Electricity and natural gas services in Danbury are provided by Eversource.

According to geoISP (geoISP.com), access to Broadband Internet is available to most residents in Danbury. There are 2 DSL Providers (AT&T and MegaPath), 2 Cable Internet providers (Xfinity and CSC Holdings), and 3 Fiber Internet providers (Fibertech Networks, LLC, Level(3) Communications, and Connecticut Education Network). There are also 4 Mobile Broadband (cellular) providers with service available in Danbury.

The Danbury Public Utilities Division of the Public Works Department operates and maintains the majority of City's water utility infrastructure, including water supply impoundments. A number of other community water system service areas and exclusive service areas are scattered throughout the City, including the Lake Waubeeka Association system and a handful of small Aquarion systems. Transient Non-Community Public Water Systems are also located throughout the City.

The Danbury Public Utilities Division also operates and maintains the City's sanitary sewer infrastructure, including overseeing the contract operation of the City's Water Pollution Control Plant (WPCP) in accordance with the Wastewater Treatment Facility Service Agreement between the City of Danbury and Veolia Water North America. The WPCP, (also known as the John Oliver Memorial Sewer Plant), provides wastewater and septage treatment for Danbury, Bethel, Brookfield, Ridgefield, and Newtown, and also accepts septage from New Fairfield, Redding, and Bridgewater, and some out-of-region towns.

2.4 Planning and Regulatory Capabilities

2.4.1 Review of Existing Local Plans

The City maintains several planning documents that guide development. In addition to planning and zoning, subdivision, and wetlands regulations, the City has a Plan of Conservation and Development and Aquifer Protection Area regulations. All of these regulations were reviewed in the development of this Plan. WestCOG published a "Western Connecticut Comprehensive Economic Development Strategy (CEDS)" in 2013 and updated in 2017 that was reviewed for this Plan. In addition to providing guidance and regulations for development, the local and regional development plans also discuss potential infrastructure improvements that would support City and regional growth. These improvements include expansion of water service, expansion of sewer service, and transportation improvements.

Regulations, codes, and ordinances that apply to hazard mitigation include the following:

- ***Regulations of the Environmental Impact Commission***. The purpose of the 1992 inland wetlands and watercourses regulations is to protect the citizens of the City of Danbury by making provisions for the protection, preservation, maintenance, and use of inland wetlands and watercourses, including deterring and inhibiting the danger of flood and pollution. City policy gives the Danbury Environmental Impact Commission (EIC) authority to enforce these regulations and all provisions of the Inland Wetlands and Watercourses act, and to issue or deny permits for all regulated activities within wetlands and watercourses.

- ***Plan of Conservation and Development.*** This document, amended in 2013, is the City's vision statement for future development. It is updated every 10 years. The Danbury Planning and Zoning Department enacts programs to execute each of these actions.

- ***Stormwater Management:*** Danbury maintains a *Stormwater Management Plan*, last updated in 2017. This document has been updated to comply with the requirements of the US EPA 2017 updated *General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems* (MS4 General Permit).

- ***Economic Development Plan:*** Danbury is included within the Western Connecticut Economic Development Plan of 2017, developed by WestCOG. The plan aligns with the COG's other efforts to promote climate sustainability and resiliency in the region. Danbury also completed the *Downtown Danbury Transit-Oriented Development Study* in January 2019. This document lays out a strategy to capitalize on the City's downtown spaces and multi-modal transit connections to focus development in the City's urban core.

- ***Emergency Operations Plan (EOP):*** Danbury's EOP is reviewed annually and updated as needed. Dam failure Emergency Action Plans (EAPs) for dams with failure inundation zones that may impact Brookfield, and for which EAPs are available, are on file locally.

- ***Watershed Management Plan:*** Watershed Management Plans have been developed for the Saugatuck-Aspetuck River Watershed and the Still River Watershed. The Saugatuck River Watershed Based Plan was developed by the former South Western Regional Planning Agency (SWRPA) in 2012, while the Still River Watershed Management Plan was developed by the Housatonic valley Association with support from the Still River Partners in 2019. These plans are focused on water quality, but can help the community mitigate inland flood risks by incorporating watershed management best practices into its planning efforts.

- ***Zoning Regulations***. The 1994 *City of Danbury Zoning Regulations*, as amended through 2020, have been "enacted to protect the health, safety, general welfare, convenience, and property values in the City; lessen congestion in the streets; secure safety from fire, panic, flood, and other dangers; provide adequate light and air; prevent the overcrowding of land; avoid undue concentrations of population; and facilitate adequate provision for transportation, water, sewerage, schools, parks, and other public requirements

- ***Subdivision Regulations.*** Effective in 1958 and last amended in 2019, this document establishes the provisions required for the minimum acceptable standards of street construction, to regulate the layout and development of lots and streets, to prevent degradation of potable water sources, to control erosion and siltation, to preserve adequate and convenient open spaces, and to retain the natural features of the land.

- ***Building Code:*** Danbury enforces the Connecticut State Building Code locally.

- ***Inland Wetlands and Watercourses Regulations:*** Most recently updated in January 2019.

- ***Capital Improvement Plan.*** The Danbury Department of Planning and Zoning prepares the City's Capital Improvements Plan annually, and always includes many capital projects that are pertinent to hazard mitigation.

2.5 Emergency Services, Critical Facilities, Sheltering, and Evacuation

The City considers its police, fire, governmental, and major transportation arteries to be its most important critical facilities since these are needed to ensure that emergencies are addressed while day-to-day management of Danbury continues. In terms of natural hazard planning, educational institutions and churches are also included as critical facilities as these can be used as shelters or neighborhood supply distribution centers. Health care facilities are also considered critical facilities, as these often house populations that would require special assistance during an emergency. The City also considers various infrastructure and facilities (such as electrical substations and the airport) to be critical facilities as well as companies and businesses storing hazardous materials.

The Fire Department maintains a list of essential facilities by type within the City. This list includes:

- **Educational Facilities:** 29 private and public institutions, including administrative facilities
- **Fire Department:** A Fire Headquarters, 16 engine companies, and a training facility
- Hazardous Materials Reporters: 33 facilities
- **Health Care Facilities:** Nine facilities, including Danbury Hospital
- **Infrastructure:** 14 facilities, including the airport, Danbury Fair Mall, Public Works, Police Department, electrical substations, Housatonic Area Regional Transit (HART) buses, and City Hall
- **Worship:** 41 religious facilities of various denominations

A selection of critical facilities pertinent to natural hazard mitigation planning are presented in the table below and discussed in more detail in the following subsections.

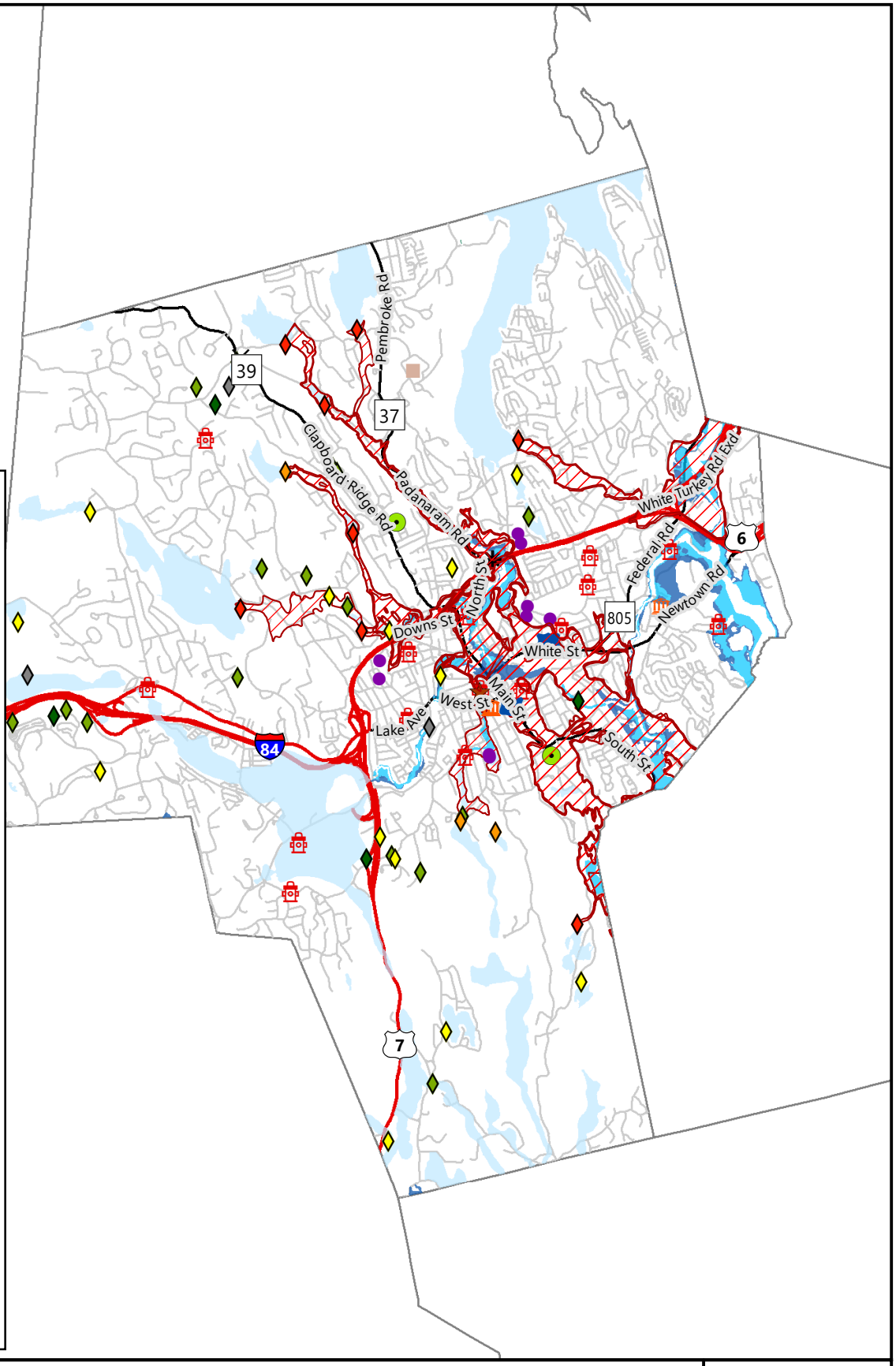
Facility	Address or Location	Type	Emergency Power	Shelter	In 1% Floodplain
Danbury Health and Housing Department	155 Deer Hill Ave	EOC	x		
Danbury Fire Department - Headquarters	19 New Street	Backup EOC	x		x
Padanarum Hose Company 3 Incorporated	17 North Street	Fire	x		x
Independent Volunteer Hose Company 4	37 Hoyt Street	Fire			
Wooster Volunteer Hose Company 5	7 Coalpit Hill Road	Fire			
Citizens Volunteer Hose Company 6	65 Jefferson Avenue	Fire			
Water Witch Volunteer Hose Company 7	37 Locust Avenue	Fire			
Phoenix Volunteer Hose Company 8	14 Well Avenue	Fire	x		
Beckerley Volunteer Hose Company 9	69 Liberty Street	Fire			
Germantown Volunteer Hose Company 10	36 Germantown Rd	Fire			
Mill Plain Volunteer Fire Company 12	54 Mill Plain Road	Fire			
Miry Brook Volunteer Fire Company 13	51 Miry Brook Road	Fire			
Danbury Fire Department Engine 23	210 Osborne Street	Fire	x		
Danbury Fire Department Engine 24	36 Eagle Road	Fire	x		

Facility	Address or Location	Type	Emergency Power	Shelter	In 1% Floodplain
Danbury Fire Department Engine 25 ***Volunteer Engine Company 14***	171 South King St	Fire	x		
Danbury Fire Department Engine 26	75 Kenosia Avenue	Fire	x		
Beaver Brook Volunteer Fire Company Incorporated	57 Beaver Brook Rd	Fire			
Danbury Fire Training Facility	23 Plumtrees Road	Fire			
Danbury Public Works Complex, Wastewater Treatment Plant (WWTP), and Landfill	53 Newtown Rd	Public Works	x		
Danbury Hospital (Danbury Health Care Affiliates Inc)	24 Hospital Avenue	Hospital	x		
Pope John Paul Health Care	33 Lincoln Avenue	Care Facility			
Danbury Assisted Living, LLC.	8 Glen Hill Rd	Care Facility			
Maplewood At Danbury Alsa, LLC	22 Hospital Ave	Care Facility			
Saint John Paul Ii Center	33 Lincoln Ave	Care Facility			
Hancock Hall	31 Staples St	Care Facility			
Glen Hill Center	1 Glen Hill Rd	Care Facility			
Filosa, For Nursing And Rehabilitation	13 Hakim St	Care Facility			
Western Rehabilitation Care Center	107 Osborne St	Care Facility			
Western Connecticut State College Police	181 White Street	Police			
Danbury Police Department	375 Main Street	Police / PSAP		x	
Danbury Ambulance Service Incorporated	14 Walnut Street	Emergency			
All Star Energy LLC	133 Padanaram Rd	Utility			
Federal Correctional Institution - Danbury	33 Pembroke Road	Prison			
Danbury High School	43 Clapboard Ridge Rd	Shelter	x	x	
Danbury War Memorial	1 Memorial Dr	Shelter	x	x	

Critical Facilities are mapped in Figure 2-4.

Date Saved: 7/29/2021

Document Path: Y:\3101-22\Maps\Historic and flood zone.mxd



LEGEND

Dams

- Unclassified
- AA
- A
- BB
- B
- C
- Dam Failure Inundation Area
- Ambulance
- Care Facility
- Municipal
- EOC
- Fire
- Police
- Prison
- Shelter
- Utility
- Dam Failure Inundation Area

Flood Zones

- A
- AE
- 0.2% Annual Chance Flood Hazard

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

Critical Facilities with Flood Zones and Dam Failure Inundation Areas

WestCOG Hazard Mitigation Plan

City of Danbury

NPS: Cultural Resources CT DEEP: DFA FEMA: DFRIM & Q3

N

0 3,500 7,000
Feet

SCALE 1 " = 7,319 '

DATE 7/29/2021

3101-22
PROJ. NO.

FIG. 2-4

2.5.1 Shelters

Emergency shelters are an important subset of critical facilities as they are needed in many emergency situations. The City has designated one American Red Cross emergency shelter, the War Memorial (see inset photo on next page) located at 140 South Street. This multiple-purpose facility includes monuments and plaques honoring those who served in America's wars, hosts community events, and is operated as a fitness center. The facility has a generator and can shelter approximately 400 people.

This building has been designated as a public shelter facility by meeting specific American Red Cross guidelines. The War Memorial Staff, the Police and Fire Department, and volunteers staff the shelter. Amenities and operating costs of the designated shelters including expenses for food, cooking equipment, emergency power services, bedding, etc., are the responsibilities of the community and generally are not paid for by the American Red Cross.

Other potential shelters are included on the Fire Department's list of critical facilities. The first option for the City is to utilize its public educational institutions for additional sheltering space. If necessary, the City will contact private educational facilities and places of worship.

In case of a sustained power outage, it is anticipated that 10 percent to 20 percent of the population (8,000 to 16,000 people) would relocate although not all of those relocating would necessarily utilize the shelter facilities. The City utilizes its facilities on a temporary basis to provide shelter until hazards such as hurricanes diminish. Regionally located mass care facilities operated and paid for by the American Red Cross may also be available during recovery operations when additional sheltering services are necessary.

2.5.2 Emergency Response Facilities

Emergency Operations

The Office of Emergency Management coordinates emergency preparedness activities in the City of Danbury. The office develops plans, protocols, and procedures that assure the safety of Danbury's citizens. In 2020, the City engaged Western Connecticut Health Network Affiliates in a multi-year performance based contractual service to provide specific mutually agreed upon deliverables to enhance all hazard emergency management activities. It also provides training for emergency response personnel, supports state and local emergency response exercises, and provides technical assistance to state and local emergency response agencies and public officials. Its goal is to provide citizens with the highest level of emergency preparedness before, during, and after disasters or emergencies.

The City's EOC is currently located in the basement of City Hall. This facility has video conferencing ability with 10 municipalities within the region plus many other towns and hospitals within Region 5 of Connecticut's DEMHS emergency service regions. It includes a Ham

Operations room that has the ability to communicate worldwide, a full kitchen, locker room with decontamination showers, and a backup well water system. City Hall has a generator that can power the entire building. The City utilizes a program known as "Connect CTY" to direct geographically specific emergency notification telephone calls into affected areas. A comprehensive analysis of the current space and technology supporting the EOC was underway at the time this HMP was being developed.

The City has an Emergency Operations Plan (EOP) that guides its response to emergencies arising from both natural and anthropogenic hazards. A full review of the EOP was underway at the time this HMP was being developed, including reformatting the plan to be consistent with the best practice of Emergency Support Functions (ESFs) organizational structure. An annex to this plan is a "Commodities Distribution Plan" through which during emergencies such as the aftermath of a major hurricane the City would utilize the Danbury Fair Mall parking lot as a local or regional supply distribution center. This facility would open once any floodwaters associated with the Still River receded to the point where vehicles could freely access the mall parking lot. If operated as a regional distribution center, the municipalities of Danbury, Brookfield, Redding, Ridgefield, New Fairfield, and Bethel could be served.

Emergency Dispatch Center

The City's Public Safety Answering Point (PSAP) 9-1-1 Emergency Dispatch Center operates out of the Danbury Police Department Headquarters at 373 Main Street. In 2013, the PSAP answered over 44,000 calls, which resulted in 3,938 fire and service responses and an additional 4,771 "first responder" responses. In 2014, the City converted to a new Computer Aided Dispatch system called Nexgen, which improved emergency response capabilities significantly.

Of note is the large increase in the percentage of 9-1-1 calls made from cell phones rather than land lines. According to a consumer guide posted by the Federal Communications Commission (FCC) (https://www.fcc.gov/consumers/guides/911-wireless-services), "Since wireless phones are mobile, they are not associated with one fixed location or address. While the location of the cell site closest to the 911 caller may provide a general indication of the caller's location, that information is not always specific enough for rescue personnel to deliver assistance to the caller quickly."

Fire Response

The Danbury Fire Department is the City's all-hazard emergency response agency. Its headquarters is located at 19 New Street (inset photo), which is located within the SFHA of Blind Brook. Emergency calls can include fires, hazardous materials leaks, medical calls, major water main breaks, flooding, noxious odors, alarms, fallen trees, airport crashes, motor vehicle accidents, and to people trapped on roofs or in confined spaces. In total, the Fire Department boasts 120 career fire fighters spread between five fire stations with five engine companies, two vehicle rescue companies, an

aerial truck company, and a command vehicle. The department also includes 136 volunteers at 12 volunteer companies. The department is a keystone in the state's Regional Response Plan; a number of the state's resources are housed in Danbury, and Danbury firefighters respond with those resources to regional or state emergencies. The department also provides staffing to operate and support a hazardous material response vehicle, foam trailer, a mass decontamination trailer, and a mass casualty trailer.

The Fire Headquarters is located within the 1-percent-annual-chance floodplain of Blind Brook. Since the adoption of the original HMP, the driveway of the firehouse has been regraded to direct water away from the building, but other flood protection actions have not been taken.

Most of Danbury's firefighting facilities have emergency generators, many of which have been updated or installed new in the last five years. Engine 26 on Kenosia Avenue has a relatively new generator, though it is more than five years old. Volunteer Engine Company 14 (attached to the Engine 25 building on South King Street) had a new generator installed in 2019.

The Padanarum Hose Company 3, located on North Street, is currently undergoing relocation. As it is currently located within a SFHA, relocation may reduce its exposure to flood risk.

Police Response

The Danbury Police Department operates out of 373 Main Street. The City's 9-1-1 call center is also housed in this building. In addition, the Candlewood Lake Authority has a small seasonal police force that is overseen by the DEEP, but it provides security more than emergency services. With the Public Works Department, the Police Department also responds to natural hazard emergencies to provide traffic control, investigation, and cleanup and repair.

Emergency Medical Services Response

The City's Emergency Medical Services are provided through partnerships between Danbury Emergency Medical Services, the City of Danbury Fire Department, Danbury Hospital, and Western Connecticut Health Network. The program is operated as a single tiered advanced life support system that mobilizes a paramedic for each and every emergency medical service request in the City.

2.5.3 Health Care

The central health care facility in the City is Danbury Hospital, located at the intersection of Locust Avenue (Route 202) and Hospital Avenue. The facility is a 371-bed regional medical center and university teaching hospital associated with Yale University, the University of Connecticut, and the University of Vermont. Danbury Hospital has a relatively new Emergency Department with increased capacity, a helipad, and a 6400-MW cogeneration plant for power and heat.

One of three Connecticut State Field Hospitals, set up during state emergencies, is located at Lions Club Park between Danbury Hospital and Broadview Middle School. The Field Hospital is run by the State of Connecticut's Department of Health. The State Field Hospital has been used as a backup in the past when Danbury Hospital had capacity limitations or service interruptions. A generator and gas mains are available to support the Field Hospital site.

2.5.4 Evacuation and Emergency Access

Interstate 84, Route 6, Route 7, Route 37, Route 39, Route 53, and Route 202 are the major evacuation routes.

Public transportation is available to move residents into and out of the City. The Metro North Railroad to Norwalk could be utilized to transport people and supplies during emergencies, and supplies could be shipped along the Housatonic Railroad Company tracks as well. HART buses are also available to transport people; they have been used in this manner to bring residents to the War Memorial shelter during a serious heat advisory. In addition, City school buses and vans may be available for transportation during emergency situations.

Some of the former lakefront communities around Lake Candlewood have poor access for emergency vehicles. Many of the dead-end roads are long, narrow, and private, with some steep grades and turns that can impede access for emergency equipment. The private roads in Marjorie Manor are also difficult to access. The City utilizes a variety of smaller equipment to provide emergency services to these areas. New public and private roads are regulated by the City through the subdivision process such that emergency access is not an issue for new developments.

Emergency services can also be cut off by fallen trees or washed out culverts during certain emergencies. The City's Forestry Division (part of the Public Works Department) performs tree and shrub removal and trimming on City-owned lands and rights-of-way. During emergencies and following storms, the Forestry Division responds to calls related to downed trees.

WestCOG does not have a regional/emergency evacuation plan and instead relies on the emergency operations plans of its member towns as well as the complementary regional emergency plan developed by DEMHS Region 5. Danbury's Office of Emergency Management, Public Works Director, City Engineer, and Traffic Engineers participated in the Region 5 Interstate-84 Traffic Diversion Study. This plan, titled "Traffic Diversion Plan for I-84 and Routes 7 and 8" (developed by the consulting firm Wilbur Smith Associates) was completed in 2011. It addresses how best to handle traffic if Interstate-84 is shut down due to an accident of other related issues. This will be an important document for guiding emergency situations since the interstate could be damaged during a severe natural hazard event.

The member communities of the HVCEO ratified a Regional Mutual Aid Agreement for emergency response activities within the Housatonic Valley region on June 10, 2010. This agreement remains effective despite the incorporation of HVCEO into WestCOG and provides a more formalized approach to providing mutual aid during a major regional emergency. The member communities of HVCEO had previously ratified a Regional Public Health Mutual Aid Agreement for response to bioterrorism and other forms of public health emergencies in 2006.

2.5.5 Summary of Policies and Programs

Danbury's existing capabilities include: the coordination and development of emergency plans and protocols by the Office of Emergency Management (OEM); the training and technical assistance programs of the OEM; the City's application of the Connect CTY emergency notification system; its preparation of an Emergency-Operations and commodities-distribution plan; the

development of a traffic diversion plan; the establishment of a regional mutual aid agreement; the tree-maintenance program carried out by its DPW Forestry Division; and its established policies designating the Fire Department as the primary responder to natural hazards, the Police and Public Works Departments as the providers of traffic control, investigation assistance, cleanup, and repair support, and the DPW as the department responsible for responding to City maintenance complaints. Other City authorities, policies, programs, and resources will be discussed in the following sections of the Plan.

2.5.6 Improvements to General Municipal Capabilities

Danbury is consistently working to improve its emergency communication capabilities. Establishment of a new communication and dispatch center in Danbury has contributed to this effort.

Danbury has been working to improve the resilience of its IT systems, creating network backups and fireproof data storage systems. The City is working to enable some services to be completed through cloud-based programs, allowing for operations to occur even if City Hall is inaccessible due to a disaster.

The City recently completed a $53.5 million Danbury High School Addition and Renovations with Safety Improvements project.

The City has completed installation of new replacement emergency generators at the Harvest Hill and Frandon Drive Wastewater Pump Stations. The City has also updated emergency power capabilities at numerous fire department facilities.

The City of Danbury purchased a service boat to add marine response capabilities for all emergency services. The new City of Danbury Service Boat is a 32-foot Silver Ships Explorer series landing craft style boat. It was designed with the three City of Danbury emergency services divisions in mind. Those needs would include rescue of victims on the lake in all weather conditions with ample room on the foredeck to care for the most seriously injured. Fire suppression for marina's, marine craft and had to reach residential properties with a 1,000 GPM pump and monitor. Along with dive support capabilities and evidence recovery capabilities. The boat was designed to serve the community for the next 30 years.

3.0 HAZARD ASSESSMENT

3.1 FLOODING (COASTAL, INLAND, AND ICE JAMS)

3.1.1 Setting

In general, the potential for flooding is widespread across Danbury, with the majority of major flooding occurring along established SFHAs. The areas impacted by overflow of river systems are generally limited to river corridors and floodplains. Indirect flooding that occurs outside floodplains and localized nuisance flooding along tributaries are also common problems in the City. This type of flooding occurs particularly along roadways as a result of inadequate drainage and other factors. The frequency of flooding in Danbury is considered likely for any given year, with flood damage potentially having significant effects during extreme events.

The majority of the watercourses and water bodies in Danbury are mapped as Zone A while most of the Still River, Blind Brook, the lower reach of Kohanza Brook, Padanaram Brook, Sympaug Brook, and Limekiln Brook are mapped as Zone AE. Refer to Figure 2-4 for the areas of Danbury susceptible to flooding based on FEMA flood zones.

3.1.2 Capabilities

The City of Danbury has in place a number of measures to prevent flood damage. These include vulnerability and hazard monitoring programs; structural flood control channel improvements; and regulations, codes, and ordinances preventing encroachment and development near floodways.

Participation in the NFIP

The City has consistently participated in the NFIP since May 2, 1977. SFHAs in Danbury are delineated on a Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS). The original FIS and FIRMs for flooding sources in the City are based on work completed in March 1976 and originally published in May 1977, with revisions in April 1982. Both the FIRM and the FIS were updated as part of the Fairfield County FIS during the countywide Map Mod program. The updates were published on June 18, 2010. The most recent FIRM and FIS updates for Fairfield County were published on October 16, 2013, but the panels relevant to Danbury were not included in that update. The City intends to continue participating in the NFIP.

The NFIP administrator for the City oversees the enforcement of NFIP regulations. The City Zoning Regulations were most recently revised to account for the recent updates to the FIS and FIRMs for Fairfield County published in June 2010. The degree of flood protection established by the variety of regulations in the City meets the minimum reasonable for regulatory purposes under the NFIP. One foot of freeboard is required for new construction and substantial improvement within the 1% annual-chance flood zone.

The City's Planning Commission and Zoning Commission policies are to use the 1-percent-annual-chance flood boundaries from the FIRM delineated by FEMA to determine floodplain areas. Site plan standards require that all proposals be consistent with the need to minimize flood damage, that public facilities and utilities be located and constructed to minimize flood damage, and that adequate drainage is provided. The placement of fill within a floodplain requires compensation through removal of an equal volume of material within that floodplain.

The Environmental Impact Commission reviews new developments and existing land uses on and near wetlands and watercourses.

A USACE study in 2012 developed base flood elevations for certain parts of Danbury, and City policy is that those elevations are used for planning purposes. Many of the flood zones in Danbury are A zones, which have floodplain borders but no elevation information.

Bridge Inspection and Maintenance Program

Since 2010, it has been City policy to have the Department of Public Works or the Office of Emergency Management inspect the following scour-critical bridges during storm events to field check potential scour damages:

- **The West Street bridge** at the Still River (critical river flow is caused by a 10-year frequency storm event – 1.8 inches in 1 hour or 5.0 inches of rainfall in 24 hours)
- **The Crosby Street bridge** over Padanaram Brook (critical river flow is caused by a 25-year frequency storm event – 2.1 inches in 1 hour or 5.7 inches of rainfall in 24 hours)
- **The Eagle Road bridge** over the Still River (critical river flow is caused by a 10-year frequency storm event)

Annual Budget

The following flood-hazard-mitigation objectives have been highlighted in the 2019-2020 adopted budget as being of high importance to the City:

- Rehabilitation or reconstruction of the Triangle Street Bridge
- Rehabilitation or reconstruction of the Crosby Street Connector Bridge over the Still River
- Rehabilitation or reconstruction of the Kennedy Avenue Bridge
- Rehabilitation or reconstruction of the Middle River Road Bridge over an unnamed brook
- Initiation of Waste Water Treatment Plan Improvements
- Repair and installation of stormwater drainage systems to correct known icing and flooding conditions, as well as to replace aging infrastructure

Other capital improvement projects expected in the coming years include:

- Rehabilitation or reconstruction of the Kenosia Avenue Bridge over Mill Plain Swamp
- Old East Ditch Drainage Improvements Phase II
- Blind Brook Channel Improvements Phase II
- Chestnut Street and Wildman Street Drainage Improvements

Still River Flood Control System

Three major structural flood control channel improvements have been completed since the floods of 1955. Descriptions of these projects follow based on the 2010 Fairfield County FIS. No new projects were reported in the 2013 countywide FIS update.

1. The USACE constructed an improved concrete-walled channel and improved trapezoidal channel as part of the Central Flood Urban Renewal Project. This project covers the Still River from the vicinity of Rose Street downstream to the railroad yard and confines the 1-percent-

annual-chance flood flow. The 0.2-percent-annual-chance flood will overflow the conduits and flood the parking lots bordered by Crosby and Elm Streets.

2. The USACE constructed a local protection project consisting of approximately 3,625 feet of concrete conduit and 2,695 feet of enlarged and realigned Still River riprapped trapezoidal channel from the vicinity of the railroad yards to a point downstream of Triangle Street. The project required rebuilding four railroad bridges, constructing two highway bridges, and removing a privately owned bridge.

3. The State of Connecticut constructed a riprapped trapezoidal channel along the Still River from downstream of Triangle Street to Cross Street. This project lowers flood elevations and reduces the potential damages along the Still River and its tributary Sympaug Brook. A design discharge of 2,800 cubic feet per second (cfs) was used for the section between Padanaram Brook and Sympaug Brook while a design discharge of 3,300 cfs was used between the Cross Street bridge and Sympaug Brook.

Danbury Airport Flood Control System

Danbury Airport has had a history of flooding problems since its founding in 1928. The majority of the airport is built on top of fill material. A drainage study of the Danbury Airport was performed by Edwards and Kelsey, Inc. in 1987. The study noted that the major drainage channels traversing generally north across the airport property, namely Miry Brook in the west and Kissen Brook in the east, were flat and subject to heavy siltation. The study found that the majority of the channel on Kissen Brook and most of the channel along Miry Brook flooded during the 5-year flood event. Refer to Figure 3-1 for an overview of Danbury Airport.

Figure 3-1: Danbury Municipal Airport 2010 USGS Aerial.
from http://Bing.com/maps/

The 1987 study presented recommendations for channel improvements that would convey the 5-year, 2-hour rainfall event without flooding. Twin 30-inch reinforced concrete pipes now run beneath the runway. The various channel improvements and culvert replacements necessary to accomplish this goal were estimated to cost approximately $1.6 million (1987 USD). The improvements were constructed in 1991. An additional $3.4 million in drainage improvements were performed later, including isolating storm sewer and sanitary sewer lines, reducing the length of one runway, and replacing the north-south runway with pervious material to restore some flood storage capacity at the site. While the airport still floods during heavy rainfall events (and severe events such as Tropical Storm Floyd), the improvements have reduced the overall frequency of flooding at the airport.

Regulations, Codes, and Ordinances

Regulations, codes, and ordinances that apply to flood hazard mitigation in conjunction with and in addition to NFIP regulations include the following:

- ***Regulations of the Environmental Impact Commission***
  - Section 2 defines "Regulated Activities" covered by the regulations, which among other activities includes any construction or other development activity that causes the discharge of stormwater to increase the downstream peak flow of the receiving watercourse using the 25-year storm as a reference standard.
  - Section 4.1 (b) states that no residential homes will be permitted "as of right" in wetlands and watercourses after 1987.
  - Section 6.1 states that no person may conduct or maintain a regulated activity without obtaining a permit. Section 7 outlines the permit application requirements.

- ***Plan of Conservation and Development.***
  - Section 1-A-3 (page IV.13) recommends that "to protect environmentally sensitive areas, [the City should] restrict development in [State] Conservation areas to primarily very low and rural density single family homes and traditional neighborhood and rural uses."
  - Section 1-C-6 (page IV.14) states that the Zoning Regulations should "retain or enact environmental regulations and programs to protect environmentally sensitive areas, including public water supply watersheds, wetlands, floodplains, aquifers, steep hillsides, and extensive woodlands.
  - Section 2-B-2 (page IV.19) states that the City should "acquire abandoned residential properties [in the Urban Core District], as feasible, for subsequent resale and rehabilitation." This recommendation could be applied to floodprone properties.
  - Section 2-B-4 (page IV.20) states that the City should "continue to assist in the development and implementation of neighborhood plans for the Elm/Beaver, Rowan Street, and Blind Brook neighborhoods."
  - Section 2-D-4 (page IV.20) states that the City should "undertake drainage improvements to prevent periodic flooding by Blind Brook and [within] the East Ditch [drainage system]." These are important structural projects that are in the capital budget for the years 2019-2020 (for Blind Brook) and already begun (for East Ditch).
  - Section 3-B-3 (page IV.23) states that the City should "construct stormwater management structures to provide water quality enhancement of runoff discharged into Lake Kenosia,

particularly from the Mill Plain Road sub-watershed." Such structures could be designed in coordination with a system to attenuate peak flows.
- Section 3-D-2 (page IV.24) states that the City should "extend sanitary sewer service to the Jensen Trailer Park." Such service would reduce septic system damage and failures in the area during flooding events.
- Section 5-B-3 (page IV.30) states that the City should determine "the percentage of land for each new development that should be devoted to stormwater renovation and consider adoption into the appropriate land use regulation."
- Section 5-B-6 (page IV.30) states that the City should "expand the Blind Brook flood control and drainage study to other floodprone areas of the City."
- Section 5-B-8 (page IV.30) states that the City should "maintain the Still River Greenway."
- Section 8-B-3 (page IV.39) states that the City should "consider acquisition of land along Padanaram Brook."

❑ ***Zoning Regulations***
- Danbury's floodplain regulations were last updated in 2010.
- Section 7.A discusses floodplain zones and allowed activities in such zones in the City of Danbury.
- Section 7.A.1 states that "a permit shall be required for all proposed construction and other development, including the placement of mobile manufactured homes, which occurs in all floodplain zones."
- Section 7.A.2 specifically defines the 1-percent-annual-chance SFHAs set forth in the June 2010 Fairfield County FIS and FIRM as the regulatory floodplain.
- Section 7.A.4 notes that the requirements of Section 7.A take precedence over all other local ordinances, regulations, or codes.
- Section 7.A.8 defines floodways and notes that "encroachments, including fill, new construction, substantial improvements, and other developments, shall be prohibited unless certification (with supporting technical data) by a registered professional engineer licensed in the State of Connecticut is provided demonstrating, through hydrologic and hydraulic analyses performed in accordance with accepted engineering practice, that encroachments shall not result in any (0.00 feet) increase in flood levels during occurrence of the base flood discharge."
- Section 10.A.2 designates the Zoning Enforcement Officer as the authority to enforce the Zoning Regulations.

❑ ***Subdivision Regulations***
- Chapter 2-B-4 (page 2) requires a Stormwater Management Plan for any application proposing one or more acres of impervious coverage. Chapter 4-E-3 (page 14) states that such plan should "adequately control the runoff generated for a 25-year storm" for the entire upstream drainage area, whether inside or outside the subdivision. It also notes that "stormwater retention or detention systems may be required when it is found that such systems would alleviate downstream flooding as a result of such subdivision. Chapter 5-B outlines drainage specifications.
- Chapter 3-B-2 (page 3) requires any subdivision application containing land regulated as an inland wetland or watercourse as defined by the *Regulations of the Environmental Impact Commission* to review the application.

- Chapter 4-A-2.1 (page 7) outlines lands "of such character requiring additional precautions for development," including SFHAs; land containing slopes of 20 percent or greater; wetlands, watercourses, marshes, bogs, and swamps as defined by the Environmental Impact Commission; natural or man-made drainage ways; and land containing areas of soil types with severe or very severe limitations for on-site septic systems. Such lands "require appropriate safeguards to protect the health and safety of future occupants within the subdivision and existing residents of the community."
- Chapter 4-A-2.2 (page 7) outlines regulations for development in SFHAs, including the following:
    1. That proposals need to be consistent with the need to minimize flood damage within the floodprone area
    2. All public utilities and facilities must be elevated or constructed to minimize infiltration of floodwaters and discharges from the sewer systems into floodwaters.
    3. Adequate drainage is provided so as to reduce exposure to flood hazards.
    4. Full floodplain data including base flood elevation data is provided.
    5. The subdivision of land within the boundaries of the SFHA preserves the floodway for a 1-percent-annual-chance flood.
- Chapter 4-F (page 14) specifically summarizes the flood protection measures presented previously and notes that subdivision proposals and other proposed development, including manufactured home parks or subdivisions, must meet all requirements for flood protection.

Danbury has programs in place to execute each of these regulations. The intent of these regulations is to promote the public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas of the City of Danbury by the establishment of standards designed to do the following:

- Protect human life and public health.
- Minimize expenditure of money for costly flood control projects.
- Minimize the need for rescue and relief efforts associated with flooding.
- Minimize prolonged business interruptions.
- Minimize damage to public facilities; utilities such as water and gas mains, electric, telephone, and sewer lines; and streets and bridges located in floodplains.
- Maintain a stable tax base by providing for the sound use and development of floodprone areas in such a manner as to minimize flood blight areas.
- Ensure that purchasers of property are notified of special flood hazards.
- Ensure the continued eligibility of owners of property in Danbury for participation in the NFIP.

Operational Capabilities

The City Department of Public Works (DPW) is in charge of the maintenance of the City's drainage systems and performs clearing of bridges and culverts and other maintenance as needed. Drainage complaints are routed to the DPW and recorded via the "Q-Alert" system. The City uses these reports to identify potential problems and plan for maintenance and upgrades. The City receives regular weather updates through DEMHS Region 5 email alerts as well as watches and warnings through the National Weather Service.

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

The Office of Emergency Management and the Fire Department are responsible for monitoring local flood warnings. The City of Danbury can access the National Weather Service website at http://www.weather.gov/ to obtain the latest flood watches and warnings before and during precipitation events.

Summary

In summary, the City primarily attempts to mitigate flood damage and flood hazards by restricting building activities in areas of flood risk. This policy is carried out through both the Planning and Zoning (P&Z) and the Environmental Impact Commissions (EIC). All watercourses are to be encroached minimally or not at all to maintain the existing flood-carrying capacity. These regulations rely primarily on the FEMA-defined 1-percent-annual-chance flood elevations or USACE-determined base flood elevations.

Other City policies relevant to flood mitigation include: requiring developers to secure a permit from the EIC; requiring a number of flood mitigation design features to be included in site plans, requiring an equal volume of earth to be removed from a site to compensate for fill placed on a site within a flood zone.

The City also has a variety of programs and structural projects in place or earmarked that are pertinent for hazard mitigation purposes. These were discussed above and include: the multi-year capital improvement program that includes drainage and stream crossing upgrades; DPW bridge inspection and maintenance; DPW bridge and culvert debris monitoring and clearing; the Q-Alert drainage complaint recording and review program to identify and prioritize problem locations; and the variety of programs instituted to execute POCD recommendations and City regulations. The City also consistently performs upgrades to flood mitigation infrastructure and seeks grants for further structural projects.

Actions Completed and New Capabilities

Danbury has completed many capital-improvement projects in the last five years that contribute to flood hazard mitigation efforts, including:

- Rehabilitation of the Crosby Street Bridge over Padanaram Brook
- Removal of Vegetation, Dredging, and Wall Repair in the Still River
- Rehabilitation of the Reservoir Street Bridge
- Rehabilitation of the Franklin Street Extension Bridge over Mercers Pond Brook
- Rehabilitation of the Mountainville Avenue Bridge
- West Street Drainage Improvements at Railroad Crossing
- Rehabilitation of the Jefferson Avenue Bridge over Blind Brook
- Rogers Park Area Storm Drainage Improvements
- Rehabilitation of the Shelter Rock Road Bridge over Sympaug Brook
- Rehabilitation of the Miry Brook Road Bridge near Harwood Drive

Tree clearing and dredging is performed along 3,000 feet of designed channel within the Still River flood control system as need, as encouraged by the USACE.

The Waterworks, Inc. office on Backus Avenue completed a minor expansion within the Miry Brook floodplain, near a wetland, and used permeable pavers for the project. This is an example of City staff encouraging the use of low-impact development techniques in the floodplain.

3.1.3 Vulnerabilities and Risk Assessment

This section summarizes areas at risk of flooding within the City. A more detailed discussion of flood risks, including maps depicting specific locations of concern, in included in Appendix C. A map of flood zones in Danbury is included as Figure 2-4.

Flooding can impact a variety of river corridors and cause severe damages in the City. Flooding due to poor drainage and other factors is also a persistent hazard in the City and can cause minor infrastructure damage, expedite maintenance, and create nuisance flooding of yards and basements.

Danbury staff report that there have been no major flood events in Danbury since adoption of the previous HMP in 2016.

Vulnerability Analysis of Private Property

According to the 2010 FEMA FIRM, a total of 3,653 acres of land in Danbury are located within the 1-percent-annual-chance flood boundary, and a total of 3,964 acres of land are located within the 0.2-percent-annual-chance flood boundary (which includes areas within the 1-percent-annual-chance flood boundary). A total of 28 Letters of Map Change have been issued since the adoption of the 2010 flood map. Based on correspondence with the State of Connecticut NFIP Coordinator at the Connecticut DEEP, a total of 29 repetitive loss properties (RLPs), two of which are severe repetitive loss (SRL), are located in the City. Of this total, 22 of the properties are residential.

The RL properties are located along Blind Brook, Kohanza Brook, Padanaram Brook, the Saugatuck River, and the Still River. Sixteen of the structures are located within the 1-percent-annual-chance floodplain, four are mapped in the 0.2-percent-annual-chance floodplain, and nine are located in areas marked as "C" or "X" - zones of minimal flood hazard.

Many structures in Danbury are located within the 0.2-percent-annual-chance floodplain, the 1-percent-annual-chance floodplain, and the 1-percent-annual-chance floodway delineated by FEMA. The software platform *ArcGIS* was utilized to determine the number and value of properties located within the various floodplains within the City as discussed below.

The City provided GIS data to MMI in order to analyze potential hazards to the City. This data included parcel boundaries with address information, an associated assessment database, and structure boundaries. This data allowed specific parcels susceptible to flooding to be positively identified throughout the City.

There are over 1,530 parcels in Danbury with at least a portion of the property located within a mapped floodplain. The *ArcGIS* software was used to determine the number of structures within the various floodplains, with the following caveats:

- If a parcel did not have a structure in the floodplain, it was excluded from further analysis. Therefore, parcels with obvious structures within the floodplain were included. Small outbuildings (tool sheds, garages) were not included unless they were approximately similar in size to the main building. Larger outbuildings were included since these are often associated with commercial properties in the City and store significant inventories.
- 2004 leaf-off aerial photography from the Connecticut DEEP and 2008-2009 leaf-on aerial photography from Microsoft Virtual Earth were utilized to confirm structure boundaries.
- The analysis uses valuation data from 2007, which are likely inflated over 2016 market values. There was no way to easily separate land value from structure value in the database. Based on a limited survey of properties within the Vision Appraisal Database for Danbury, land assessments range from approximately 34 percent to 75 percent of the overall property value, with a mean around 50 percent.
- Condominium values are the sum of individual unit appraisals. If only part of a complex could be affected, then the overall value is conservatively high.
- The analysis does not include streets that are the only access to an area where a flood would isolate residents.
- Water utility buildings constructed in floodplains were excluded as these buildings are floodproofed.
- No accounting was made for local flood protection projects not already in Digital Flood Insurance Rate Map (DFIRM) mapping.

The result of the analysis is relatively straightforward and provides useful numbers for planning purposes. Out of the more than 1,530 parcels located within defined floodplains in the City of Danbury:

- 538 parcels have structures located within 0.2-percent-annual-chance floodplains. These parcels are appraised at $1,357,501,000. Assuming that the land value is 50 percent of the parcel valuation, these buildings appraise at approximately $678,750,500. This value includes structures in the 1-percent-annual-chance floodplains and floodways.
- 373 parcels have structures located within 1-percent-annual-chance floodplains. These parcels are appraised at $1,121,984,000. Assuming that the land value is 50 percent of the parcel valuation, these buildings appraise at approximately $560,992,000. This value includes structures within floodways.
- 36 parcels have structures located within floodways. These parcels are appraised at $125,308,400. Assuming that the land value is 50 percent of the parcel valuation, these buildings appraise at approximately $62,654,200.

Thus, if a 1-percent-annual-chance flood occurred that caused an average of 10 percent damage to structures in the mapped 1-percent-annual-chance floodplain and floodway, a conservative damage estimate could total approximately $56 million to private property. This value is likely slightly elevated due to the 2007 appraisals that occurred prior to the recent economic downturn, the inclusion of full condominium data when only a portion of the development is at risk of

flooding, and the fact that the delineated floodplain may not be correlated precisely to local topography (thus including more areas than actually at risk).

Vulnerability Analysis of Critical Facilities

The list of critical facilities provided by the City was used with the parcel data to accurately locate each critical facility throughout the City. A total of 17 critical facilities were found to lie within the 1-percent-annual-chance floodplains of a variety of watercourses in the City. Table 3-1 lists these critical facilities with the exception of hazardous materials reporters (six) and religious buildings (two). The facilities are described in more detail below.

Table 3-1: Critical Facilities Located Within the 1-Percent-Annual-Chance Floodplain[1]

Name or Type	Address	Flooding Source
Fire Engine Company 6	65 Jefferson Avenue	Blind Brook
Pope John Paul Health Care	33 Lincoln Avenue	Blind Brook
Fire Headquarters	19 New Street	Blind Brook
Fire Engine Company 3	17 North Street	Kohanza Brook
Danbury Fire Training Facility	23 Plumtrees Road	Limekiln Brook
Danbury Municipal Airport	Wibling Road	Miry Brook and Kissen Brook
Fire Engine Company 26	75 Kenosia Avenue	Miry Brook
Danbury Fair Mall	7 Backus Avenue	Miry Brook and Still River
Fire Engine Company 24	36 Eagle Road	Still River

[1] *A total of 17 critical facilities have part of their structures within the mapped 1% annual-chance floodplain. This table does not include hazardous materials reporters (six) or religious buildings (two).*

Fire Engine Company 6 is a Volunteer Fire Department station located on Jefferson Avenue. As shown in the inset photo (right), the property is completely within the 1-percent-annual-chance floodplain (without elevations defined) of Blind Brook. The mapped 1-percent-annual-chance floodplain is the area in teal. While this building is not known to have experienced serious flooding damage, the potential exists that this facility could be flooded by a severe flood event.

Fire Engine Company 6 on Jefferson Avenue.
2008 Aerial Photo from Microsoft.

The southeast wing of the Pope John Paul Healthcare Center is located within the 1-percent-annual-chance floodplain of Blind Brook (without elevations defined). This floodplain is due to backwater flooding caused by the constriction in flow at the West Wooster Street culvert. This facility has reportedly experienced minor flooding in the past. A photo of this area is shown at right.

The Fire Department Headquarters is partially located within the 1-percent-annual-chance floodplain of Blind Brook (see inset photo on next page). The mapped 1-percent-annual-chance floodplain is the blue area. The brook is culverted beneath New Street and daylights near the southeast corner of the property. The culvert is reportedly in poor condition. When the flow in the brook is excessive, it overtops New Street and can flood the building. This occurred during Tropical Storm Floyd in 1999 when 5 inches of water was flowing through the main hallway of the building. The 9-1-1 call center in this building is being relocated in the near future to the new Police Station on Main Street (this new building does not lay within the 1-percent-annual-chance floodplain).

Fire Department Headquarters on New Street.
2008 Aerial Photo from Microsoft.

Fire Engine Company 3 is a Danbury Volunteer Fire Department building located on North Street. As shown in the inset photo at right, the property is completely within the 1-percent-annual-chance floodplain (with elevations defined) of Kohanza Brook. While this building is known to have only experienced minor flooding damage, the potential exists that this facility could be damaged by a severe flood event.

Fire Engine Company 3 on North Street.
2008 Aerial Photo from Microsoft.

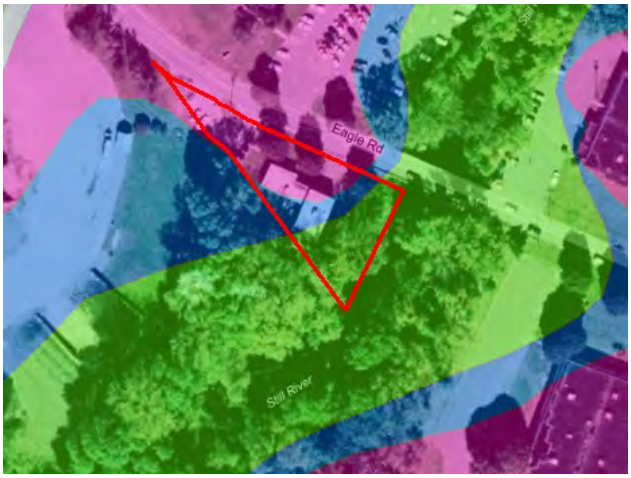
The Danbury Fire Training Facility is located on Plumtrees Road near the former City landfill. Portions of the area are within 1-percent-annual-chance floodplains associated with Limekiln Brook. However, no significant infrastructure at this location is believed to be affected by flooding. If the Fire Department chooses to expand this facility to take on a more regional nature in the future (as suggested by various planning documents), careful consideration should be given to nearby floodplains.

The Danbury Municipal Airport and its fire station, Fire Engine Company 26, were constructed in the 1-percent-annual-chance floodplain of Miry Brook. The airport is expected to partially flood during minor events (greater than 5-year return frequency) and completely flood during serious flood events. Various improvements have been performed at the airport to reduce the vulnerability of the facility to flooding.

Pope John Paul Healthcare Center on Lincoln Avenue. 2008 Aerial Photo from Microsoft.

While the Danbury Fair Mall is located within the 1-percent-annual-chance floodplain of the Still River and Miry Brook, the mall structure was designed such that the doors are above the 1-percent-annual-chance flood elevation. As such, the parking lot and a portion of the lowest level of the parking garage will be flooded, but the interior of the mall will not be flooded during a 1-percent-annual-chance flood event. The mall parking lot will be inaccessible from Backus Road due to the flooding, thus requiring a mall closure similar to that which occurred during Tropical Storm Floyd in 1999. The mall is considered a critical facility because after natural disasters it is utilized as an important regional commodity distribution site.

Finally, Fire Engine Company 24 is a Danbury Fire Department building located on Eagle Road. As shown by the inset photo at right, the property is completely within the 0.2-percent-annual-chance floodplain of the Still River (purple area), with portions of the building within the mapped 1-percent-annual-chance floodplain (with elevations defined) and the floodway (green area) of the Still River. While this building has not experienced flooding damage in the past, the potential exists that this facility would be flooded by a severe flood event in the future.



Fire Engine Company 24 on Eagle Road.
2008 Aerial Photo from Microsoft.

While each of these facilities is susceptible to the 1-percent-annual-chance flood, they may also be susceptible to floods of lesser magnitude.

In addition to these facilities, the City's transportation network is at risk of flooding. As shown in the historic record, the Metro North railroad running from Norwalk to Danbury has been damaged by flooding (or simply flooded) during several storm events, forcing service shutdowns. Severe storms such as Tropical Storm Floyd have the potential to close many City roads, resulting in Interstate 84 being the only means to cross the City. This is particularly a concern given that Danbury's emergency personnel are regional responders, and flooding can make it difficult for ambulances to access Danbury Hospital due to a variety of detours from road closures.

Vulnerability Analysis of Areas Along Watercourses

The primary waterway in the City is the Still River. The remaining waterways in Danbury are mostly small streams and brooks significant for water supply and conservation purposes but which are not significant recreational resources. Lake Candlewood and a variety of smaller lakes and ponds are significant recreational resources. Floodplains with and without elevations are delineated for the majority of the floodprone brooks in the City, and the majority of the brooks in the City have issues with flooding. Specific areas susceptible to flooding are identifiable by the FEMA defined SFHAs, and additional areas susceptible to flooding were identified by City personnel and observed by MMI staff during past field inspections.

There are many roads, and in particular dead-end roads, in Danbury that pass over a watercourse, such as access roads to condominiums or other private properties. It is believed that the majority of the culverts under these roads were designed using rainfall data published in "Technical Paper No. 40", and may therefore be undersized given increasing precipitation magnitudes observed in recent years (see Section 2.1.3).

City personnel are concerned about the effects that development in neighboring municipalities has had and will continue to have on flooding conditions within Danbury. Specifically, there is concern that new floodplain development downstream in Brookfield and New Milford is causing

increased runoff and exacerbating flood stages along the entire Still River corridor, including Danbury.

The following subsections highlight flooding potential along the various watercourses in Danbury, beginning with the Still River. The Still River is divided into three sections in Danbury – the Upper Still River above Segar Street, the Middle Still River from Segar Street to Cross Street, and the Lower Still River to the Brookfield municipal boundary.

Upper Still River Area

Jensen's Mobile Home Park on Lake Kenosia continues to be a repeated flooding area. The mobile homes nearest the lake are only 1 to 2 feet above the normal water elevation of the lake. This park is historically flooded several times each year, with larger events resulting in necessary evacuations although few significant storms or flood events have occurred since adoption of the initial HMP. Past utility improvements at the park have included electrical facilities being raised to mitigate flooding damage. There is an effort underway to tie the park into the municipal sewage system, which will remove the problem of septic overflow due to high groundwater. As an age-restricted (55+) park, this area also has a high concentration of elderly persons who need additional assistance during an emergency.

According to City personnel, Mill Plain swamp floods often although limited damages result due to the undeveloped nature of the area. Restrictions in the Still River channel near Segar Street cause it to back up through Mill Plain Swamp behind the Danbury Fair Mall and then into Lake Kenosia. The problems are exacerbated by inflow from Miry Brook and Kissen Brook and by the small, antiquated bridge on Kenosia Avenue that overtops during the 10-year flood event. When enough rainfall backs up, Jensen's Mobile Home Park floods, with floodwaters closing down Kenosia Avenue.

Residents at Kenosia Commons Mobile Home Park at 46 Kenosia Avenue now have a need for flood insurance because of the recent FIRM update. More than half of the park is mapped within the 1-percent-annual-chance floodplain.

Miry Brook and Airport Area

One of the most frequently flooded areas in the City is in the vicinity of the airport. Miry Brook, an unnamed stream, and Kissen Brook all drain through the airport to their eventual confluences with the Still River. The airport and the on-site Fire Department (Engine Company 26) are in the combined 1-percent-annual-chance floodplain of Miry Brook and Kissen Brook along with a large commercial area that includes restaurants, stores, and the parking lot of the Danbury Fair Mall. During Tropical Storm Floyd, the majority of the airport and its runways were inundated as was the entire mall parking lot and many of the surrounding stores.

As noted previously, the airport is built primarily on fill material, which has reduced overall floodplain storage capacity, and in the past, improvements have been performed to allow the drainage system to pass the 5-year, 2-hour rainfall event without overtopping. These improvements also serve to retain some water at the site in order to reduce peak flows downstream (particularly at West Street). As noted in Section 2.4, the TP-40 rainfall values have been superseded with more recent rainfall data that suggest that storm sizes are increasing.

Thus, even with the improvements in the early 1990s, it is likely that the airport and the surrounding area will be flooded more frequently in the future than they were in the past.

Additional improvements have been constructed at the mall to provide additional flood storage capacity. A series of retention ponds line the access roads leading into the mall adjacent to both Miry Brook and Kissen Brook. Flap gates allow each pond to fill with water but close to prevent drainage during a flood event. These improvements buffer the natural capacity of Mill Plain Swamp to store floodwaters.

Exacerbating the problem at the airport and the mall is the fact that outflow from Lake Waubeeka in southern Danbury was diverted north into the City after the floods of 1955. This diversion was performed because Lake Waubeeka is used for contact recreation, and the upper Saugatuck River drains to reservoirs used for public water supply; in-water recreation is contrary to the Public Health Code. As such, more water is directed into the airport now than when it was first built in the late 1920s. The outflow from Lake Waubeeka manifests along Route 7 as Kissen Brook and drains the eastern side of the airport through a system of open channels and closed culverts.

Middle Still River Area

Downstream of Segar Street, a sand and gravel processing site and a few houses on Belmont Lane are the only buildings in the 1-percent-annual-chance floodplain until the vicinity of Oil Mill Road. The River Woods Condominium complex has units within the 1-percent-annual-chance floodplain; however, the access bridge over the Still River is designed to pass the 1-percent-annual-chance flood event with 2 feet of freeboard. As such, this complex should not get isolated from the rest of the City during a 1-percent-annual-chance flood although parts of the complex may flood. Beyond this bridge, the Still River channel is incised and does not have a delineated floodplain until it nears West Street.

The intersection of West Street and Benedict Avenue is where the railroad bridge passes over West Street. A combination of factors at this location results in frequent flooding. First, West Street drops in elevation to pass under the railroad bridge, creating a road surface that is near the water elevation of the Still River and a depression that collects rainwater. When the Still River is high, the storm drains beneath the railroad bridge cannot discharge water to the river, and a pool forms. The sharp "S-curve" in the Still River provides tangential velocity to aid the river in running overbank. The City sets up barricades in this area to close the road several times per year during heavy rain events.

Flooding in the railroad underpass area is exacerbated by sedimentation, which is caused by the pooling described above. Danbury has performed dredging at this site in the past.

Downstream of West Street, a pair of factories (with multiple employers) is located within the 1-percent-annual-chance floodplain. The Still River then proceeds to enter the three major flood control projects erected after the floods of 1955. The 1-percent-annual-chance flood is completely contained within these protection projects although the 0.2-percent-annual-chance flood will inundate a significant area near the railroad yard. These culvert systems continue to need attention and maintenance.

Municipal staff have identified the area of Lower Main Street, New Street behind the Fire Department, and Blind Brook as continuing to be frequently flooded.

Few other areas within the middle section of the Still River are vulnerable to overbank flooding except the confluence with Sympaug Brook, which is discussed in that section.

Blind Brook Area

Flood damage is generally limited immediately downstream of Tarrywile Lake although significant flood damage occurred during Tropical Storm Floyd. City employees point to Blind Brook Park, between East Pearl Street and West Wooster Street, as a location that experiences frequent flooding. Upstream of West Wooster Street, Fire Engine Company 6 and the Pope John Paul Health Center are located in the 1-percent-annual-chance floodplain associated with Blind Brook. Repeated flood damages occur downstream of West Wooster Street. According to City personnel, flooding occurs within this part of the Blind Brook corridor three or four times per year. One of the most common areas for flooding is the East Pearl Street and William Street neighborhood. Flooding in this area is due primarily to channel encroachments reducing flow capacity.

Downstream of George Street, Blind Brook is directed into an underground culvert that extends north past New Street to daylight at the Fire Headquarters. This underground culvert reportedly passes beneath several houses and commercial structures. City personnel have noted in the past that the entire culvert system needs repairs and have described the section of culvert beneath New Street as "failing."

The culvert continues to be channelized by an open-topped concrete culvert down to the access road leading to the City homeless shelter. This section of channel continually narrows, which has caused damage to the adjacent concrete. The Pentecostal Church in this area has reportedly experienced flooding damage. The brook then enters a short underground culvert that empties into the underground channel of the upstream Still River protection project.

Several studies of the corridor have occurred to attempt to quantify the frequency and magnitude of flooding. The USACE (2000) has studied the stream and determined that its rate of flow is too low to qualify for federal funding through USACE grants. The USACE noted that outflow from the two upstream dams on Tarrywile Lake and Parks Pond peaks well after the lower watershed has its peak flows. As such, water from these ponds is not a major contributor to peak flows in the lower section of the brook, and the USACE recommended further study on a detention basin upstream of Jefferson Avenue and culvert improvements downstream of West Wooster Street.

A study was performed by Roald Haestad, Inc. for the City of Danbury in 2003 to investigate the improvements recommended by the USACE. The report noted that the current culverts within the Blind Brook study reach have the capacity to discharge a 2-year to 5-year return frequency flood while the Elm Street culvert can discharge an approximate 10-year flood. The report noted that the proposed detention above Jefferson Avenue would result in significant discharge reductions for all flood frequencies (1-percent-annual-chance was lowest frequency studied) at Jefferson Avenue and West Wooster Street but that discharge reductions were less noticeable at West Street (only for 25-year flood and above) and at Elm Street (only for 50-year storm and above).

Thus, the upstream detention improvements would have limited impact on higher frequency floods but would mitigate peak flows for the lower frequency, higher discharge events.

Boggs Pond Brook and Kohanza Brook Area

Infrequent flooding occurs in the upper reaches of Boggs Pond Brook above the West Lake Reservoir. This area does not have any floodplains defined; these are first delineated on Kohanza Brook upstream of Kohanza Street at Ridgewood Country Club. The golf course does not have any structures (other than cart path bridges) that are in the floodplain. Downstream of Kohanza Street, the 1-percent-annual-chance floodplain is confined to the channel of the brook such that there are few flooding problems until after Kohanza Brook passes into a culvert beneath Interstate 84.

When Kohanza Brook is high, the drainage systems on Main Street can back up and cause pooling near Interstate 84. During severe storms, this can essentially close one lane of traffic as observed during Tropical Storm Nicole in 2010. Downstream of Main Street, the brook daylights in a commercial area between Thorpe Street Extension and Patch Street that experienced severe flooding damage during Tropical Storm Floyd. This area has occasional flooding problems, with two RLPs and Fire Engine Company #3 located within the 1-percent-annual-chance floodplain. Due to the nearby confluence of Kohanza Brook with Padanaram Brook, this area can be affected by flooding from either source.

Padanaram Brook Area

The upper basin of Padanaram Brook is impounded by various reservoirs, which provide a measure of flood mitigation except during extreme events when the reservoirs are full. The major flooding issues along the corridor begin at the beginning of the mapped floodplain.

The stream corridor is narrow and steep through the reach, culminating in a culvert beneath the Danbury Shopping Center. Flooding in this area is exacerbated by the influx of water from Penny & Ericson Brook into the underground culvert. Just southeast of this area, floodwaters back up near the terminus of Walnut Street due to the constriction in flow caused by the Interstate 84 culvert.

Flooding damages are usually relatively minor along Rowan Street although there are several apartment complexes and homes within the 1-percent-annual-chance floodplain in this area. As previously noted, the confluence of Kohanza Brook (in the vicinity of North Street, Barnum Court, and Patch Street) is a repeated flooding area. Flooding during Tropical Storm Floyd was so severe that evacuations were necessary.

Padanaram Brook continues southeast toward its confluence with the Still River. A new Police Department building was completed in 2009 near East Franklin Street; the rear parking lot of this building is located within the 1-percent-annual-chance floodplain of the brook. This building currently contains the civilian-operated dispatch center for Police, Fire, and Emergency Medical Services, previously located in the Fire Engine Company 6 building within the 1-percent-annual-chance floodplain of Blind Brook. This represents a removal of that critical facility from a hazardous area although the parking lot of the current location is within the 1-percent-annual-chance floodplain of Padanaram Brook as noted above.

Sympaug Brook Area

While the Sympaug Brook Area has a defined floodway and 1-percent-annual-chance floodplain, there are relatively few areas prone to flood damage in this part of the City. A factory on Great Pasture Road and six industrial properties on Shelter Rock Road are the only structures within the 1-percent-annual-chance floodplain. Similar to Limekiln Brook, much of the flooding in this area occurs due to high flows on the Still River creating backwater conditions.

Lower Still River Area

Downstream of Cross Street, the Still River enters a major industrial and commercial area of the City. Many properties in this area have experienced flood damage. When flooding occurs, it is exacerbated by the many meanders of the Still River in the area, particularly near the confluence of Limekiln Brook and Federal Road. Historically, floodwaters in this area have been deep and widespread; during Tropical Storm Floyd, several feet of flooding was reported in many buildings, and floods up to 3 feet deep have occurred several times on Finance Drive.

The Still River Alliance believes that most of the flooding along the Still River will continue to be concentrated in the area near the confluence with Limekiln Brook as it acts as a floodplain bottleneck. Flooded properties are mainly commercial and industrial in this area although roads are flooded as well. The Eagle Road area used to be a farm prior to its development, and the Finance Drive area is constructed on fill. Both of these factors suggest that an overall loss in floodplain storage has occurred in this area.

City personnel say they have observed increasing flooding in this area in past years. Increasing development within and around the floodplain downstream in the town of Brookfield may be contributing to the problem by increasing runoff and backwatering. Danbury may attempt to get more information about downstream projects to determine what effect they are having on upstream flooding.

Limekiln Brook Area

Limekiln Brook enters Danbury just east of the former City landfill and receives inflow from the City's WPCF. While the Danbury WPCF performs tertiary treatment, it does rely on Limekiln Brook and the Still River for waste assimilation.

The most common area for flooding along Limekiln Brook in Danbury is at Newtown Road (Route 6). According to the Still River Alliance, during severe rain events a minor constriction at the Interstate 84 culvert creates backwater flooding conditions along the Still River and along the lower section of Limekiln Brook.

Saugatuck River Area

Route 7 South near the Redding town line experiences occasional flooding issues from the Saugatuck River.

Vulnerability of Other Areas

The City has a variety of areas that are subject to flooding away from defined watercourses. Many of these areas flood due to clogged or undersized drainage systems or the complete lack of a drainage system. City personnel described flash flood events, some occurring in areas with no history of flooding, lasting around an hour following brief heavy rainstorms. In particular, 1 inch of rain falling on West Street over 20 minutes requires flood rescues on West Street, Tamarack Avenue, and other areas. Generally, such minor flood events can cause stranded residents to require rescue as well as causing damage to roads and ponding of nearby yards, basement flooding, and other damages. These events can usually be repaired by the DPW through cleaning, curb repair, and asphalt patching. More extreme events can require complete infrastructure replacement. As noted in Section 2.1.3, these damage events are expected to become more frequent in the future as the intensity and magnitude of rainfall events continues to increase.

Several areas were mentioned by City personnel as having repeated flooding of this type. Main Street, Tamarack Avenue, Stevens Street, the North Street Shopping Center, and Osborne Street were specifically highlighted during the Plan update meeting. Other locations were noted during development of the initial Plan, including West Redding Road and Old Lantern Road (affected by flooding of adjacent swamps) and private roads near Lake Candlewood (Cornell Road, Old Neversink Road, and Forty Acre Mountain Road). These roads lack or have insufficient drainage systems. Similar to the other flooding areas, it is likely that these areas will experience more frequent and intensive flooding events in the future. The City recognizes a need to respond to very short duration (lasting less than 1 hour) emergencies during summer storms.

East Ditch

The East Ditch is an antiquated drainage system that was designed in the late 19th century to route sewage, horse manure, and stormwater to the Still River. The general route is from the intersection of Elmwood Place and Main Street to Park Place, then to Liberty Street, and finally beneath the railroad tracks to the Still River.

The main issue is that the entire culvert system is undersized. One specific problem with the system is that several 18-inch-diameter pipes and a 24-inch-diameter pipe flow into one 18-inch pipe, which leads to backups during heavy rain events. The intersection of Wooster Street, Main Street, and Park Place regularly floods during storm events (approximately five times per year) requiring barricades to protect traffic. Nearby houses have their entire basements fill with water.

Neighbors have kept records and pictures of the flooding since the 1980s. As described in newspaper articles, neighbors feel that the 1999 Harrison Square Development (52 Main Street) and the 1982 Danbury Commons Development (51 Main Street) exacerbated the frequency and magnitude of flooding in the area. The 1982 development reportedly was built in a wooded area locally known as "the old swamp" that retained water during heavy rain events. City records note that both developments were approved with detention systems to mitigate downstream flooding. According to the City Engineering Division, these detention systems may not have been properly maintained and therefore may not be functioning as designed.

Various studies have been conducted with the goal of increasing system capacity. Improvements to the system were designed by Roald Haestad, Inc. in 2002 that included upgrading the existing trunk line to piping ranging in size from 36 inches near Main Street to 54 inches downstream of State Street and installing a 5-foot by 10-foot box culvert from downstream of State Street to Liberty Street, along Liberty Street, and beneath the railroad tracks to the Still River. The cost estimate for this work is several million dollars, and much time has been spent securing the necessary property easements to perform the work.

Phase I of the project was completed prior to development of the City's initial HMP. The City installed approximately 370 feet of 5-foot-high by 10-foot-wide box culvert from the Still River to a point just north of Pahquioque Avenue. A section of 54-inch reinforced concrete pipe (RCP) was also installed. Funding for Phase II was listed in the 2011/2012 adopted budget for implementation in fiscal year 2012/2013. In the 2012/2013 adopted budget, it was expected to be completed over 3 years from 2013/2014 through 2015/2016. The project was not mentioned at all in the budget for 2012/2013 and was listed as an unfunded capital project in the budgets of 2013/2014 and 2014/2015. It was included in the adopted budget of 2015/2016 as "deferred" past 2021. This phase of the project will install an additional 355 linear feet of 5-foot-high by 10-foot-wide box culvert along Liberty Street. Additional phases are planned to complete the work upstream of Liberty Street but have yet to be designed. City personnel say that the City has been unable to secure the funds necessary for the project.

Vulnerability Due to Projected Sea Level Change

In accordance with Public Act 13-179, Section 6 (effective 10/1/2013), the sea level change scenarios published in the NOAA Technical Report OAR CPO-1 were considered in development of this Plan. According to that report, the worst-case scenario for sea level rise by 2100 is a global average increase of 6.6 feet above the 1992 mean sea level. In the coastal Connecticut area, sea level has risen between 0 and 2 feet per century since 1854. The entire City of Danbury is above 6.6 feet of elevation and does not include any tidally influenced watercourses. Therefore, this community is unlikely to be affected by sea level rise through 2100.

3.2 DAM FAILURE

3.2.1 Setting

Dam failures can be triggered suddenly, with little or no warning, and often from other natural disasters such as floods and earthquakes. Dam failures often occur during flooding when the dam breaks under the additional force of floodwaters. In addition, a dam failure can cause a chain reaction where the sudden release of floodwaters causes the next dam downstream to fail. While flooding from a dam failure generally has a moderate geographic extent, the effects are potentially catastrophic. Fortunately, a major dam failure is considered very unlikely in any given year.

3.2.2 Capabilities

The Dam Safety Section of the DEEP Inland Water Resources Division is charged with the responsibility for administration and enforcement of Connecticut's dam safety laws. The dam safety statutes are codified in Section 22a-401 through 22a-411 inclusive of the Connecticut General Statutes. Dams must be inventoried by the owner with the DEEP according to Connecticut Public Act 83-38. Dam Inspection Regulations require that nearly 700 dams in Connecticut be inspected annually. The DEEP currently prioritizes inspections of those dams that pose the greatest potential threat to downstream persons and properties. Dams found to be unsafe under the inspection program must be repaired by the owner.

All dams regulated by DEEP must be designed to pass the 1%-annual-chance rainfall event with 1 foot of freeboard, a factor of safety against overtopping. **Significant and high hazard dams** are required to meet an even greater design standard.

Section 5.1 (a) of Danbury's *Inland Wetlands and Watercourses Regulations* notes that the state regulates the construction or modification of any dam. Connecticut Public Act No. 13-197, *An Act Concerning the Dam Safety Program and Mosquito Control,* requires the owner of any high or significant hazard dam (Classes B and C) to develop and implement an emergency action plan (EAP). The EAP shall be updated every 2 years, and copies shall be filed with DEEP and the chief executive officer of any municipality that would potentially be affected in the event of an emergency

The City of Danbury maintains EAPs for each of its Class C dams. EAPs include threshold elevations which, when reached by impoundment waters, initiate response activities (such as alerting the state or the public). Monitoring is performed by the Public Works Department.

FirstLight, the owner of the Lake Candlewood Dams, has prepared an "Emergency Action Plan" for each of its dams and dikes. Mercer's Pond Dam is privately owned, and it is unknown if the owner maintains such a plan. Eureka Lake Dam is owned by the Town of Bethel. Based on correspondence between the City Engineering Department and the Bethel Town Engineer, the Town of Bethel does not believe it has an EOP for Eureka Lake Dam.

The City of Danbury has established a Flood and Erosion Control Board as noted in the Code of Ordinances section 2-184; the board consists of the City Council.

More information regarding the Flood and Erosion Control Board program can be found at **http://www.ct.gov/dep/lib/dep/water_inland/flood_mgmt/fecb_program.pdf.**

The City-owned water supply dams are inspected every two years in compliance with state requirements. These include Margerie Lake Dam and Dike, East Lake Dam, Padanaram Dam, Upper and Lower Kohanza Dams, West Lake Dam, and Boggs Pond Dam. The City has routinely retained private contractors to perform the inspections and prepare a summary report. The last summary report immediately available for review was for the October 2009 inspections. All dams were reported to be in good condition, and only minor repairs were necessary. These dams have all been inspected within the last 2 years.

According to its *Emergency Operations Plan*, Tarrywile Lake Dam is to be checked weekly and inspected quarterly by Danbury public works staff as well as receive a formal annual inspection. The *Emergency Operations Plan* was most recently updated in June 2011. The inspection schedule for Parks Pond Dam was not immediately available, but it is assumed it is inspected annually as repairs were recently completed to the structure, and a new *Emergency Operations Plan* was finished in 2011.

The City of Danbury uses Connect CTY for emergency notification. The current emergency notification system is under review to determine, among other things, its overall effectiveness in reaching the citizens of Danbury. The dam failure inundation mapping discussed in the next section can be used to help streamline the geographic contact areas if the failure of a major dam is imminent.

Actions Completed and New Capabilities

Danbury has recently completed repairs to the Tarrywile Parks Pond Dam.

Overall, Danbury's capability to mitigate for dam failure and prevent loss of life and property has improved in recent years as the result of the recent statewide legislative actions described above. Over the next few years, it is anticipated that dam safety programs will continue to strengthen in Connecticut.

Summary

Programs enacted in Danbury to mitigation dam failure include participation in the Statewide Dam Safety Program, staying up to date on the evolution of any EAPs and Dam Failure Analyses for high hazard dams in the City, making copies of those documents available at City Hall for public viewing, and including dam failure areas into the Connect CTY emergency notification system.

Danbury's capabilities to mitigate for dam failure and prevent loss of life and property have increased since the previous HMP was adopted, mainly as a result of recent rehabilitation work on dam structures.

3.2.3 Vulnerabilities and Risk Assessment

This section summarizes dam failure hazards within the City. A more detailed discussion of flood risks, including maps depicting specific dam failure inundation areas, in included in Appendix C. Dams and dam failure inundation areas in Danbury are shown on Figure 2-4.

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

- *Class AA*: negligible hazard potential
- *Class A*: low hazard potential
- *Class BB*: moderate hazard potential
- *Class B*: significant hazard potential
- *Class C*: high potential hazard

As of 1996, there were 36 Connecticut DEEP-inventoried dams within the City. The list of Class B and C dams was updated by the DEEP in 2007, and DEEP provided an updated list of all inventoried dams in the City to the Engineering Department in March 2010. Research in the DEEP files by MMI revealed two additional dams, for a total of 47 dams inventoried in the City. The most recent data on dam classifications from the DEEP is from 2020. Dam classifications include four Class AA, 16 Class A, 13 Class BB, three Class B, eight Class C, and three that are unclassified. DEEP-inventoried dams in Danbury are listed in Table 3-2.

Table 3-2: Dams Inventoried by the DEEP in the City of Danbury

#	Name	Location	Class	Owner
3401	Upper Kohanza Lake Dam	Saddle Rock Road	C[4]	Danbury
3402	Margerie Lake Reservoir Dam	Peck Road	C	Danbury
3403	Lower Kohanza Lake Dam	Kohanza Street	C	Danbury
3404	Lake Candlewood Dam / Rocky River Danbury Dike	Hayestown Road	C	Business
3405	East Lake Reservoir Dam	East Lake Road	C	Danbury
3406	Padanaram Reservoir Dam	Padanaram Road	C	Danbury
3407	Rose Hill Avenue Pond Dam	Rose Hill Rd/Beaver St	BB	Private
3408	Mercers Pond Dam	Franklin Street Extension	C	Business
3409	Waubeeka Lake Dam	Lake Waubeeka	BB	Association
3410	Lake Wackawana Dam	Lakeside Road	BB	Business
3411	Eureka Lake Dam	Long Ridge Road	C	Bethel
3412	Mountain Pond Dam	Long Ridge Road	BB	Bethel
3413	Rogers Pond Dam	Franklin Street Extension	BB	Private
3414	West Lake Reservoir Dam	Middle River Road	C	Danbury
3415	Tarrywile Lake Dam	Tarrywile Lake Road	B	Danbury
3416	Lees Pond Dam #1	Wooster Heights Road	BB	Business
3417	Saugatuck River Dam	Route 7 South	BB	Business
3418	Old Oil Mill Pond Dam	Lake Avenue	*Breached*	Business
3419	Small Pond Dam	Driftway Road	A	WCSU
3420	Farringtons Pond Dam	Joes Hill Avenue	BB	Business
3421	Sterns Pond Dam	King Street	A	Private
3422	Boggs Pond Reservoir Dam	Timbercrest Drive	BB	Danbury
3423	Dickens Pond Dam	Boyce Rd/Middle River Rd	A	Private
3424	Turtle Pond Dam	Franklin Street Extension	A	Private

#	Name	Location	Class	Owner
3425	Clapboard Ridge Pond Dam #1	Clapboard Ridge Road	A	Private
3426	Clapboard Ridge Pond Dam #2	Clapboard Ridge Road	A	Private
3427	Borderline Pond Dam	Clapboard Ridge Road	A	Danbury
3428	Kellners Pond Dam	Apple Blossom Lane	A	Private
3429	Doyles Pond Dam	East Hayestown Road	BB[2]	Danbury
3430	Lees Pond Dam #2	Wooster Heights Road	A	Business
3431	Robinson Pond Dam	Wooster Heights Road	A	Business
3432	[unnamed dam]	Tarrywile Lake Road	A	Private
3433	Starrs Plain Road Pond Dam	Route 7 South	A	Private
3434	Natural Pond (No dam)	[not mapped]	*Delisted*	[not listed]
3435	Natural Pond (No dam)	[not mapped]	*Delisted*	[not listed]
3436	Sanford Pond Dam (No dam)	Mill Plain Road	-	[not listed]
3437	Lake Kenosia (No dam)	Kenosia Avenue	*Delisted*	[not listed]
3438	Parks Pond Dam #2	Terre Haute Road	B	Danbury
3439	Ridgewood Country Club Dam	Franklin Street Extension	BB	Business
3440	Nabby Road Detention Pond #1	Nabby Road	*Delisted*	[not listed]
3441	Nabby Road Detention Pond #2	Nabby Road	*Delisted*	[not listed]
3442	Kovacs Pond Dam	[not mapped]	*Delisted*	Business
3443	Brancato Dam	Chambers Road	AA[3]	Private
3444	Lees Pond Detention Basin Dam	[not mapped]	BB	CT DOT
3445	King Street Diversion Dam	Clapboard Ridge Road	-	Danbury
3446	Ross Dam	[not mapped]	*Delisted*	Business
3447	Woodland Hills Detention Pond	[not mapped]	*Delisted*	Association
3448	[unknown]	N/A	*Delisted*	N/A
3449	Reserve Detention Basin L Dam	[not mapped]	BB	Business
3450[1]	Detention Basin C Dam	[not mapped]	A	Private
3451[1]	Detention Basin E Dam	[not mapped]	A	Private
3452[1]	Sugar Hollow & Miry Brook Roads Dam	[not mapped]	AA	[not listed]
3453[1]	Willow Lake Dam	Willow Lake Road	A	[not listed]
3454[1]	Detention Basin B Dam	[not mapped]	AA	Private
3455[1]	Reserve Detention Basin Dam (Warrington Round)	Off Warrington Round	A	[not listed]
3456[1]	Still River Fdr Levee	[not mapped]	AA	[not listed]

[1]Added to DEEP files since 2016
[2]Identified as class A in 2016
[3]No class assigned in 2016
[4]Class upgraded since 2016 from Class B to Class C

The City of Danbury also owns the Margerie Lake North Dam (CT DEEP number 9119) located in New Fairfield. Failure of this class C dam would impact the town of New Fairfield and is the responsibility of the City of Danbury but does not directly affect public safety in Danbury. Therefore, it is not discussed in this Plan.

This section primarily discusses the possible effects of failure of high hazard (Class C) dams. Failure of a Class C dam has a high potential for loss of life and extensive property and infrastructure damage. As shown above, the City of Danbury owns a total of 12 dams. There are eight Class C dams in the City, with five of them owned by Danbury. There is also one Class C dam upstream of Danbury in (and owned by) the Town of Bethel, known as the Chestnut Ridge Reservoir Dam, that drains to Sympaug Brook.

According to City personnel, the City-owned dams throughout are generally in good condition. The condition of the many minor, privately owned dams throughout the City is not known. The following section primarily discusses known vulnerable areas located downstream of Class C dams.

Dam failure analyses have been prepared for many of the dams owned by the City. In addition, FirstLight has prepared a failure analysis for the Danbury Dikes on Lake Candlewood, whose failure could impact the City. The inundation limits portrayed on each of these dam failure analysis maps represent a highly unlikely, worst-case scenario (1,000-year) flood event and should be used for emergency action planning only. As such, they are appropriate for use in the Connect CTY emergency call database. These analyses should not be interpreted to imply that the dams evaluated are not stable, that the routine operation of the dams presents a safety concern to the public, or that any particular structure downstream of the dam is at imminent risk of being affected by a dam failure.

Lake Candlewood – Danbury Dike (FirstLight)

The Danbury Dike forms the closure for the southern end of Lake Candlewood. The dike consists of two earth-fill sections (the Main Dike and the Wing Dike) divided by a rock outcrop. The overall length of the dike is about 1,000 feet with a crest elevation of 440 feet National Geodetic Vertical Datum (NGVD). Electronic monitors have been installed in the weirs downstream of the Main Dike and the Wing Dike (and at other FirstLight dams and dikes on the lake) that trigger audio and visual alarms in the event of a leak at either dike. This information is continually relayed to the Rocky River Plant in New Milford, which is staffed 24 hours a day, 7 days a week. Thus, FirstLight has the capability to immediately become aware of any potential problems at its dams and dikes on Lake Candlewood.

The Danbury Dike is inspected weekly by FirstLight personnel, annually by the Federal Energy Regulatory Commission (FERC), and every 5 years by a FERC-approved independent consultant. The Danbury Dike is believed to be in good to excellent condition.

A Dam Breach Analysis was prepared for the Danbury Dike in 1999. A breach model was prepared using the National Weather Service's *DAMBREAK* program, with the model extending from the Danbury dike downstream to the Shepaug Dam on the Housatonic River. Two analyses were performed, one under "sunny day" low flow conditions and another during the 1-percent-annual-chance flood on the Still River and the Housatonic River. It was assumed that the breach would form within 30 minutes, and models found that outflow from the breach would continue for several days under both scenarios. Inundation would reach the Shepaug Dam in 4 hours under the 1-percent-annual-chance flood scenario and 5 hours under the "sunny day" scenario.

The City estimates that there are several hundred buildings within the dam failure inundation area of the Danbury Dike. Three critical facilities (Great Plain School and two hazardous materials reporters) would also be affected.

Outflow from the worst-case scenario breach would cause peak flood depths relatively quickly in Danbury. Peak flood depths would be over 20 feet and overtop (and possibly wash out) Interstate

84. The closing of Route 7 and Interstate 84 at Exit 7 in Danbury would be necessary, and regional coordination would be necessary to reroute traffic and provide emergency services to affected areas. Fortunately, given the continuous monitoring of the dike by FirstLight staff, it is unlikely that a dam breach would take the City completely by surprise.

Chestnut Hill Reservoir Dam (Town of Bethel)

The Chestnut Hill (Ridge) Reservoir Dam is an earth fill dam with a separate dike originally constructed in 1910. It is owned by the Town of Bethel and used to impound a reservoir for water supply. It is believed that the dam is in good condition.

No dam failure analysis was immediately available at the Connecticut DEEP regarding this dam. It is unknown if one had ever been developed. Should the dam fail, it is likely that a significant portion of the Sympaug Brook corridor would be flooded in Bethel and Danbury.

East Lake and Padanaram Reservoir Dams (City of Danbury)

An *Emergency Operations Plan* for the East Lake and Padanaram Reservoir Dams was prepared in 1996 by Roald Haestad, Inc. for the City. According to the plan, East Lake Dam is an earth fill embankment about 500 feet long with a maximum height of about 36 feet. The spillway at East Lake Dam is capable of safely discharging the probable maximum flood (PMF), which has a return period of once in 1,000 years.

Padanaram Reservoir Dam is an earth embankment with a stone masonry faced downstream slope that is approximately 325 feet long and 25 feet high. The spillway at Padanaram Reservoir Dam is capable of safely discharging one-half the PMF without overtopping the earth embankment. This flood has a return frequency of 0.2 percent annual chances.

The *Emergency Operations Plan* contains information relative to the peak discharges and maximum water surface elevations from a failure of the two dams with water levels at the PMF elevation. Thus, the analysis is based on a worst-case scenario, a once in 1,000 years event.

The PMF itself would cause widespread death, property damage, and infrastructure damage in Danbury and Bethel. A complete failure during the PMF would cause significant inundation along the Padanaram Brook corridor, moderate additional inundation in the City center south to Rogers Park, and relatively minor additional inundation in the Sympaug Brook corridor upstream into Bethel. Under the worst-case PMF and dam failure scenario, water levels would reach more than 30 feet above the streambed in some areas. Over 125 roads in Danbury and 46 roads in Bethel would be affected as well as 33 critical facilities.

The areas most susceptible to flooding from dam failure alone are those in the Padanaram Brook corridor. Three feet to 14 feet of flooding is expected along the corridor from failure of the dams alone while areas downstream along the Still River and along the Sympaug Brook corridor would only experience relatively minor flooding.

Eureka Lake Dam (Town of Bethel)

The City of Danbury Engineering Department contacted the Town of Bethel in September 2010 regarding the Eureka Lake Dam. The Bethel Town Engineer noted that evacuation plans are not in

the current Town EOP and that no EOP or Dam Failure Analysis appeared to be available for the Eureka Lake Dam. The Town Engineer noted that a Phase II Dam Inspection Report was completed by Lenard and Dilaj Engineering in 1980 for the Eureka Lake Dam, which outlined four houses in Danbury and four houses in Bethel that would be inundated if the dam were to fail. The most likely areas to be impacted by the failure of this dam in Danbury would be Reservoir Road, Martino Road, Long Ridge Road, Mountainville Road, the Rogers Park area, and the Sympaug Brook corridor.

Margerie Lake Reservoir Dam and Dike (City of Danbury)

Margerie Lake Reservoir Dam is a compacted earth fill embankment about 760 feet long with a maximum height of 28 feet. It is located at the south end of the reservoir in the City. The spillway is reportedly capable of passing the PMF with the water level 1.4 feet below the top of the dam. A compacted earth fill embankment dike is located at the northern end of the reservoir in New Fairfield. The dike is about 1,110 feet long with a maximum height of 16 feet. There is no spillway or low-level outlets at the dike. Both structures were reportedly originally built in the 1930s.

A *Dam Failure Analysis* was prepared for the Margerie Lake Reservoir Dam and Dike in 1996 by Roald Haestad, Inc. The analysis was prepared using the National Weather Service's *DAMBREAK* program. This document contains information relative to the peak discharges and maximum water surface elevations from a failure of the dam or dike with water levels at the PMF elevation. Thus, the analysis is based on a worst-case scenario event.

Similar to the East Lake scenario, the PMF would cause widespread death, property damage, and infrastructure damage in Danbury and Bethel. A complete failure during the PMF would cause significant inundation along the Padanaram Brook corridor, moderate additional inundation in the City center south to Rogers Park, and relatively minor additional inundation in the Sympaug Brook corridor upstream into Bethel. Under the worst-case PMF and dam failure scenario, water levels would reach more than 30 feet above the streambed in some areas. Over 125 roads in Danbury and 46 roads in Bethel would be affected as well as 33 critical facilities.

The areas most susceptible to flooding from dam failure alone are those in the Padanaram Brook corridor. Four feet to 14 feet of flooding is expected along the corridor from failure of the dams alone while areas downstream along the Still River and along the Sympaug Brook corridor would only experience relatively minor flooding.

Recall that Margerie Reservoir is impounded by a dike at its northern end in the town of New Fairfield. According to the Dam Failure Analysis, failure of the Margerie Lake Dike would cause relatively minor flooding (up to 1 foot) along Ball Pond Brook near the town center of New Fairfield. Damages from the dam failure would be practically indistinguishable from those caused by the PMF. For this reason and the fact that a failure of the dike would not cause a natural hazard within the City, a detailed analysis of the dike failure is not presented herein.

Mercers Pond Dam (Private)

Mercers Pond Dam is an earth embankment approximately 400 feet long and 17 feet high, with 250 linear feet of granite blocks lining the downstream face. The privately owned dam is located

along Boggs Pond Brook upstream of Ridgewood Country Club. The condition of the dam is unknown.

No dam failure analysis was immediately available at the Connecticut DEEP regarding this dam. It is unknown if one had ever been developed. Should the dam fail, it is likely that a significant portion of lower Boggs Pond Brook, lower Kohanza Brook, lower Padanaram Brook, and the Still River corridor would be flooded in Danbury.

Tarrywile Lake Dam (City of Danbury)

An *Emergency Operations Plan* for the Tarrywile Lake Dam was prepared in 2011 by Roald Haestad, Inc. for the City. According to the plan, Tarrywile Lake Dam consists of an upstream concrete wall with downstream earthen embankments. The dam is about 197 feet long with a maximum height of about 14 feet. The spillway of the dam is capable of safely discharging one-half the PMF (1,170 cfs) with 1 foot of freeboard.

The *Emergency Operations Plan* contains information relative to the peak discharges and maximum water surface elevations from a failure of the two dams with water levels at the PMF elevation. Thus, the analysis is based on a worst-case scenario event.

The PMF itself would cause significant death, property damage, and infrastructure damage in the Blind Brook corridor of Danbury. A complete failure during the PMF would cause significant inundation upstream of Jefferson Avenue and relatively minor additional inundation downstream of Jefferson Avenue to the Still River.

Under the worst-case PMF and dam failure scenario, water levels would reach up to 16 feet above the streambed in some areas. Approximately 30 roads and 10 critical facilities would be affected. The effects of the PMF along Blind Brook are not expected to significantly impact flows in the Still River.

The areas most susceptible to flooding from dam failure alone are those in the Blind Brook corridor above Jefferson Avenue. Two to 6 feet of flooding is expected along the corridor from failure of the dams alone while areas downstream would only experience relatively minor flooding from dam failure.

Upper and Lower Kohanza Lakes Reservoir Dams (City of Danbury)

A *Dam Failure Analysis* for the Upper and Lower Kohanza Lakes Dams was prepared in 1992 by Roald Haestad, Inc. for the City. According to the analysis, Upper Kohanza Lake Dam is a compact earth fill embankment about 600 feet long with a maximum height of 33 feet above the streambed that was originally constructed in 1865. It was immediately rebuilt following the 1869 failure. The spillway at the Upper Kohanza Lake Dam is capable of safely discharging one-half the PMF without utilizing the emergency spillway and can pass the PMF utilizing the emergency spillway.

Lower Kohanza Lake Dam is a 450-foot-long earth embankment with a maximum height of 28 feet above the streambed. The dam was originally constructed in 1866 and breached in 1869 as a result of the failure of the upper dam. The Lower Kohanza Lake Dam was immediately

reconstructed following the breach. The spillway is capable of safely discharging the PMF with the water level at the top of the dam.

The *Dam Failure Analysis* contains information relative to the peak discharges and maximum water surface elevations from a failure of the two dams with water levels at the PMF elevation. Thus, the analysis is based on a worst-case scenario event.

The PMF itself would cause widespread death, property damage, and infrastructure damage in Danbury. A complete dam failure during the PMF would cause significant inundation along the Kohanza Brook and lower Padanaram Brook corridors. Under the worst-case PMF and dam failure scenario, water levels would be approximately 4 feet above grade downtown, 6 feet above grade at the Ridgewood Country Club, and approximately 13 feet above normal pool levels at Lower Kohanza Lake and at Zinn Road (downstream of Cross Section 5). Approximately 30 streets and 10 critical facilities would be affected

The areas most susceptible to flooding from dam failure alone are those in the Kohanza Brook corridor. Five to 11 feet of flooding is expected along the corridor from failure of the dams alone while areas downstream of Ridgewood Country Club along Kohanza Brook will have approximately 6 feet of rise due to dam failure. The lower sections of Kohanza Brook and Padanaram Brook are expected to only experience 2 to 3 feet of rise due to dam failure although backwater conditions along Padanaram Brook will cause impacts upstream past Interstate 84.

West Lake Reservoir Dam (City of Danbury)

A *Dam Failure Analysis* for the West Lake Reservoir Dam was prepared in 1992 by Roald Haestad, Inc. for the City. According to the analysis, West Lake Reservoir Dam consists of a compacted earth fill embankment originally constructed in 1907. The dam is about 850 feet long with a maximum height of about 45 feet above the streambed. The spillway of the dam is capable of safely discharging the PMF with 4 feet of freeboard.

The *Dam Failure Analysis* contains information relative to the peak discharges and maximum water surface elevations from a failure of the dam with water levels at the top of dam, which is 4 feet higher than the PMF elevation. Thus, the analysis is based on a worst-case scenario event. A breach model was prepared using the National Weather Service's *DAMBREAK* program

The PMF itself would cause widespread death, property damage, and infrastructure damage in Danbury. A complete failure during the PMF would cause significant inundation along the Boggs Pond Brook, lower Kohanza Brook, and lower Padanaram Brook corridors.

Under the worst-case PMF and dam failure scenario, water levels would overtop all downstream roads with depths ranging from 12 to 25 feet and inundate many houses. Downtown Danbury would experience flood depths ranging from 1 to 21 feet. Some of the floodwaters would bypass the Still River corridor and cause over 20 feet of flooding in the Sympaug Brook corridor as well. Over 100 streets and 28 critical facilities would be affected.
The areas most susceptible to flooding from dam failure alone are those in the Boggs Pond Brook and lower Kohanza Brook corridor. Five to 19 feet of flooding is expected along the corridor from failure of the dams alone while areas along the lower Padanaram Brook corridor are expected to

experience 4 to 5 feet of flooding from dam failure, with backwater conditions on the brook extending past Interstate 84 upstream.

The Still River corridor is expected to have flood heights ranging from 2 to 4 feet from dam failure alone. Similar flood heights are expected upstream along the Sympaug Brook corridor. The lower Still River is expected to be able to contain the increased flows due to dam failure downstream of Newtown Road.

3.3 HURRICANES AND TROPICAL STORMS

3.3.1 Setting

Several types of hazards may be associated with tropical storms and hurricanes including heavy or tornado winds, heavy rains, and flooding. While only some of the areas of Danbury are susceptible to flooding damage caused by hurricanes, wind damage can occur anywhere in the City. A hurricane striking Danbury is considered a possible event each year and could cause critical damage to the City and its infrastructure.

Inland Connecticut is vulnerable to hurricanes despite moderate hurricane occurrences when compared with other areas within the Atlantic Tropical Cyclone basin. Since hurricanes tend to weaken within 12 hours of landfall, inland areas are relatively less susceptible to hurricane wind damages than coastal areas in Connecticut; however, the heaviest rainfall often occurs inland. Therefore, inland areas are vulnerable to riverine and urban flooding during a hurricane.

3.3.2 Capabilities

Existing mitigation measures appropriate for flooding are discussed in Section 3.1.2. These include the ordinances, codes, and regulations that have been enacted to minimize flood damage. In addition, various structures exist to protect certain areas, including dams, local flood protection projects, and riprap.

Wind loading requirements are addressed through the State Building Code. The current code was updated and effective as of October 1, 2018. The code specifies the design wind speed for construction in all the Connecticut municipalities. Effective October 1, 2018 the ultimate design wind speed or the City of Danbury is 110 mph for a Category 1 event, 120 mph for a category 2, and 125 mph for a Category 3, 4 or 5 hurricane event. Danbury has adopted the Connecticut Building Code as its building code.

Eversource Energy, the local electric utility, provides tree maintenance near its power lines. City personnel indicate that Eversource's utility maintenance and outage recovery has been adequate since it took over from CL&P although they cited an incident of delayed power recovery following a March 2016 event that downed trees and power lines.

The City has a tree warden (in the Forestry Division of the DPW) who encourages residents to cut trees that can be dangerous to power lines. The Forestry Division is also responsible for maintenance along City roads and advises private associations regarding potentially hazardous trees on private roads. Thus, landowners and community associations are primarily responsible for conducting tree maintenance on private property. In addition, all utilities in new subdivisions must be located underground whenever possible in order to mitigate storm-related damages.

During emergencies, the City currently has a designated emergency shelter available at the War Memorial. The City has additional facilities available that could be converted to shelter space if the need arose. As hurricanes generally pass an area within a day's time, additional shelters can be set up after the storm as needed for long-term evacuees. The War Memorial is specifically designed to resist the effects of wind.

One approach the City takes to prepare for potential power outages is to make sure emergency generators are staged in locations where they may be needed.

The City relies on radio, television, area newspapers, and the internet to spread information on the location and availability of shelters. It is understood that several of these information sources can be cut off due to power failure, so emergency personnel can also pass this information on manually. Prior to severe storm events, the City ensures that warning/notification systems and communication equipment are working properly and prepares for the possible evacuation of impacted areas.

Actions Completed and New Capabilities

Danbury has improved roofs at Mill Ridge Primary School and the Old Quarry Nature Center, mitigating risks from wind events, as well as snow events. The Forestry Department has an aggressive program to remove dangerous trees and limbs in City rights-of-way.

Summary

Municipal policies related to tropical storm mitigation in Danbury include the following: the most up-to-date Connecticut State Building Code is implemented in the City; landowners are responsible for maintaining trees on their properties; utilities must be placed underground in new developments. Relevant programs include: Eversource's tree maintenance program near power lines; Danbury's Tree Warden program; and ensuring that emergency communication systems are operational prior to forecasted storm events. The tree warden program includes designating a City Tree Warden within the DPW Forestry division, noting and encouraging residents to cut dangerous trees on their properties, and cutting dangerous trees on public roads and rights-of-way.

Danbury primarily mitigates tropical storm hazards by warning residents prior to storm events and managing trees and limbs to limit power outages. Communication and tree management capabilities are strong in Danbury and have not increased significantly since the initial HMP.

3.3.3 Vulnerabilities and Risk Assessment

Connecticut is located in FEMA Zone II regarding maximum expected wind speed. The maximum expected wind speed for a 3-second gust is 160 mph. This wind speed could occur as a result of either a hurricane or a tornado in western Connecticut and southeastern New York. The American Society of Civil Engineers recommends that new buildings be designed to withstand this peak 3-second gust.

Debris such as signs, roofing material, and small items left outside become flying missiles in hurricanes. Extensive damage to trees, towers, aboveground and underground utility lines (from uprooted trees or failed infrastructure), and fallen poles cause considerable disruption for residents. Streets may be flooded or blocked by fallen branches, poles, or trees, preventing egress. Downed power lines from heavy winds can also start fires during hurricanes with limited rainfall. In general, as the residents and businesses of the State of Connecticut become more dependent on the internet and mobile communications, the impact of hurricanes on commerce will continue to increase. A major hurricane has the potential of causing complete disruption of power and communications for up to several weeks, rendering electronic devices and those that

rely on utility towers and lines inoperative. According to the Connecticut DEEP, this is a significant risk that cannot be quantitatively estimated.

Danbury staff have noted that many vulnerable residents, including those reliant on electricity-dependent medical equipment, are home during storms; such individuals are particularly vulnerable to power outages.

3.4 SUMMER STORMS AND TORNADOES

3.4.1 Setting

Heavy wind (including tornadoes and downbursts), lightning, heavy rain, hail, and flash floods are the primary hazards associated with summer storms. Flooding caused by heavy rainfall was covered in Section 3.1 of this plan and will not be discussed in detail here.

Summer storms and tornadoes have the potential to affect any area within the City of Danbury. These types of storms and the hazards that result (flash flooding, wind, hail, and lightning) tend to have limited geographic extent, so it is possible for a summer storm to harm one area within the City without harming another.

Based on the historical record, it is considered highly likely that a summer storm that includes lightning will impact the City of Danbury each year, although lightning strikes tend to have a limited effect. Strong winds and hail are considered likely to occur during such storms but also generally have limited effects. A tornado is considered a possible event in Fairfield County each year that could cause significant damage to a small area.

3.4.2 Capabilities

Warning is the primary method of existing mitigation for tornadoes and thunderstorm-related hazards. The NOAA National Weather Service issues watches and warnings when severe weather is likely to develop or has developed, respectively.

Although tornadoes pose a threat to all areas of the state, their occurrence is not considered frequent enough to justify the construction of tornado shelters. Instead, the state has provided NOAA weather radios to all public schools as well as many local governments for use in public buildings. The general public continues to rely on mass media for knowledge of weather warnings. Warning time for tornadoes is very short due to the nature of these types of events, so predisaster response time can be limited. However, the NOAA weather radios provide immediate notification of all types of weather warnings in addition to tornadoes, making them very popular with communities.

Aside from warnings, several other methods of mitigation for wind damage are employed in Danbury as explained in Section 3.3.2. In addition, the Connecticut State Building Code includes guidelines for the proper grounding of buildings and electrical boxes.

Municipal responsibilities relative to summer storm and tornado mitigation and preparedness include the following:

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

Actions Completed and New Capabilities

Danbury's capabilities to mitigate for summer storms and tornadoes have not changed significantly since the previous HMP was adopted. Its wind mitigation capabilities are considered to be sufficient at this time.

Summary

Capabilities center around communication, firefighting, and restoration of power after power lines are downed. Programs and policies include: ensuring communication systems are operational prior to forecast storms; broadcasting storm warning information; disseminating tornado safety information and evacuation procedures; designating tornado-resistant public shelters; periodic testing of tornado response plans; putting emergency personnel on standby at tornado "watch" stage; a strong tree maintenance program; and requiring that buildings meet the Connecticut State Building Code. All of these are strong in Danbury. The City will continue to evaluate whether capabilities need to be strengthened in the future.

3.4.3 Vulnerabilities and Risk Assessment

Tornadoes are most likely to occur in Connecticut in June, July, and August of each year.

The City of Danbury is at a moderate to low risk for tornadoes. Climate change is expected to increase the frequency and intensity of thunderstorms, in turn increasing the risk and occurrence of associated tornadoes.

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

In general, thunderstorms and hailstorms in Connecticut are more frequent in the western and northern parts of the state and less frequent in the southern and eastern parts. Fairfield County experiences an average of 7.5 severe, damaging thunderstorms per year. Although lightning is usually associated with thunderstorms, it can occur on almost any day. The likelihood of lightning strikes in the Danbury area is very high during any given thunderstorm although no one area of the City is at higher risk of lightning strikes. The risk of at least one hailstorm occurring in Danbury is considered moderate in any given year.

Most thunderstorm damage is caused by straight-line winds exceeding 100 mph. Straight-line winds occur as the first gust of a thunderstorm or from a downburst from a thunderstorm and have no associated rotation. The risk of downbursts occurring during such storms and damaging the City is believed to be low for any given year. All areas of the City are particularly susceptible to damage from high winds although more building damage is expected in the City center while more tree damage is expected in the less densely populated areas in the southern and western parts of the City.

Secondary damage from falling branches and trees is more common than direct wind damage to structures. Heavy winds can take down trees near power lines, leading to the start and spread of fires. City personnel note that strong thunderstorms will cause power lines to fall all over the City

and noted that a thunderstorm in summer 2010 downed 35 trees in 42 minutes. Most downed power lines in Danbury are detected quickly, and any associated fires are quickly extinguished. Such fires can be extremely dangerous during the summer months during dry and drought conditions. However, it is important to have adequate water supply for fire protection to ensure this level of safety is maintained.

There are no critical facilities believed to be more susceptible to summer storm damage than any other, with the exception of the War Memorial. Some critical facilities are more susceptible than others to flooding damage due to summer storms. Facilities susceptible to flooding damage were discussed in Section 3.1.3.

Summary

In summary, the entire City of Danbury is at relatively equal risk for experiencing damage from summer storms and tornadoes. Based on the historic record, very few summer storms or tornadoes have resulted in costly damages to the City. Most damages are relatively site specific and occur to private property (and therefore are paid for by private insurance). For municipal property, the City budget for tree removal and minor repairs is generally adequate to handle summer storm damage. Given the limited historic record for damaging tornado events, the City believed an estimate of 7 million dollars to be reasonable in 2011 for an EF1 tornado striking the City center, with less damage for a tornado striking the outskirts of the City, with a greater damage amount to be expected should an EF2 or stronger tornado strike.

3.5 WINTER STORMS AND NOR'EASTERS

3.5.1 Setting

Winter events and the hazards that result (wind, snow, and ice) have a widespread geographic extent and have the potential to affect any area of the City of Danbury. Due to its variable elevation, Danbury can have higher amounts of snow in the outskirts of the City than in the City center. In general, winter storms are considered highly likely to occur each year (although major storms are less frequent), and the hazards that result (winds, snow, and blizzard conditions) can potentially have a significant effect over a large area of the City. Most winter weather events occur between December and March.

The NCDC receives data from the Danbury Weather Station regarding snowfall. Mean annual snowfall is 43.6 inches per year, with a minimum of 11.6 inches and a maximum of 82.1 inches recorded over 29 complete years of data. The maximum 1-day, 2-day, and 3-day snowfall events recorded at this station each total 24.0 inches over 63 years of data.

3.5.2 Capabilities

Existing programs applicable to winter storms are those related to preparing plows, sand, and salt trucks; tree trimming to protect power lines; and other associated snow removal and response preparations.

The City uses the average snow removal cost of the last seven winters for its annual snow removal budget. In extreme years, such as the winter of 2010-2011, this budget can be quickly eclipsed and must be supplemented from other budget sources.

The City primarily uses City staff for plowing operations. The City has 30 defined plow routes and utilizes plow trucks to clear and treat all City-owned roadways, properties, and sidewalks. Priority is given to plowing egresses to critical facilities. The Connecticut DOT plows all state roads and Interstate 84. Homeowners, private associations, and businesses are responsible for plowing their own driveways and roads. In some places, Danbury has been plowing private roads (for various reasons), an act which causes confusion with nearby residents who believe that the City should also pay for or perform additional roadway maintenance.

Before a winter weather event, the City ensures that all warning/notification and communications systems are ready and ensures that appropriate equipment and supplies, especially snow removal equipment, are in place and in good working order. The City also prepares for the possible evacuation and sheltering of some populations that could be impacted by the upcoming storm (especially the elderly and special needs persons). During emergencies, a plow vehicle can be dispatched ahead of an emergency vehicle. In addition, if critical employees (such as certain hospital staff) cannot get to or home from work, an emergency vehicle can be dispatched to deliver those personnel.

Actions Completed and New Capabilities

The Park Maintenance department clears snow and ice from public schools and public buildings as needed.

In 2019 the Town performed a GPS study of roads in order to prioritize plowing routes, increase efficiency and efficacy of plowing efforts, and help plan evacuation routes.

Summary

In summary, policies relevant to winter storm mitigation include: assigning a snow removal budget based on the average cost of the previous 7 years; primarily using Town staff for plowing operations; clearing of state, Town, and private roads are the responsibility of the state, Town, and private communities respectively. Relevant programs include: ensuring communication systems, equipment and supplies, evacuation routes and shelters are all prepared prior to forecast storm events; dispatching plows ahead of emergency vehicles or to transport critical employees.

Danbury's capabilities to mitigate for winter storms have not changed significantly since the initial HMP was adopted. Capabilities center on education, snow removal planning, communication, and restoration of power after power lines are downed. All of these are strong in Danbury. The City will continue to evaluate whether capabilities need to be strengthened in the future. Such strengthening will likely focus on plow-route prioritization.

3.5.3 Vulnerabilities and Risk Assessment

According to the 2019 Connecticut *Natural Hazard Mitigation Plan Update*, Connecticut residents can expect at least two or more severe winter weather events per season, including heavy snowstorms, potential blizzards, nor'easters, and potential ice storms. Recent climate change studies predict a shorter winter season for Connecticut (as much as 2 weeks) and less snow-covered days with a decreased overall snowpack. These models also predict that fewer more intense precipitation events will occur with more precipitation falling as rain rather than snow. This trend suggests that future snowfalls will consist of heavier (denser) snow, and the potential for ice storms will increase. Such changes will have a large impact on how the state and its communities manage future winter storms and the impact such storms have on the residents, roads, and utilities in the state.

The amount of snowfall and freezing precipitation in Danbury is elevation-dependent during storms. As the population of Danbury increases and more areas (particularly in the higher elevations such as the northwestern corner of the City) are developed, the vulnerability of Danbury residents to the effects of winter storms will increase.

The structures and utilities in the City are vulnerable to a variety of winter storm damage. Tree limbs and some building structures may not be suited to withstand high wind and snow loads. Ice can damage or collapse power lines, render steep gradients impassable for motorists, undermine foundations, and cause "flood" damage from freezing water pipes in basements. Drifting snow can occur after large storms, but the effects are generally mitigated through municipal plowing efforts.

Heavy winter precipitation can also lead to roof collapse. Between January 12, 2011 and February 17, 2011, 76 locations in Connecticut experienced roof or building collapses and damage due to buildup of frozen precipitation. A garage on West Street in Danbury was one of the structures damaged that winter.

Icing causes difficult driving conditions throughout the hillier sections of the City, but City personnel note that there are few unusual areas or particular "trouble spots" for icing. Such areas include the Shelter Rock area, the Wooster Heights area, South King Street near the King Street Intermediate School, West Redding Road, Brushy Hill Road, Middle River Road, Franklin Street Extension, and Boyce Road. The Q-Alert system reported icing occurring along Birch Road during winter 2007 due to the lack of a drainage system and reported icing along Farm Street in 2008.

Ice jams are not typically a problem along the rivers in Danbury. According to the 2010 Connecticut Natural Hazard Mitigation Plan Update, Limekiln Brook in the town of Bethel was the ninth most susceptible river to ice jams in Connecticut. It is possible that a severe ice jam along this brook could cause flooding downstream in the City of Danbury. However, City personnel cannot recall any flooding occurring along Limekiln Brook due to an upstream ice jam.

The elderly population in Danbury, in particular, is susceptible to the impacts created by winter storms due to resource needs (heat, electricity loss, safe access to food, etc.). It is possible that a few thousand of the population impacted by a severe winter storm could consist of the elderly, a few thousand could consist of linguistically isolated households, and several thousand could be disabled. While the elderly population is spread throughout the City, the majority of the linguistically isolated and disabled populations are in the census blocks near the City's urban core. It is important for Danbury's emergency personnel to continue to be prepared to assist these special populations during emergencies such as winter storms.

No critical facilities are believed to be more susceptible to winter storm damage than any other, with the exception of the War Memorial. Some critical facilities are more susceptible than others to flooding damage due to winter storms. Such facilities susceptible to flooding damage were discussed in Section 3.1.3.

Summary

The entire City is at relatively equal risk for experiencing damage from winter storms although some areas (such as icing trouble spots and neighborhoods with a high concentration of flat roofs) are more susceptible. Based on the historic record, it is difficult to determine if any winter storms have resulted in costly damages to the City as damage estimates for severe storms are generally spread over an entire county. Many damages are relatively site specific and occur to private property (and therefore are paid for by private insurance) while repairs for power outages are often widespread and difficult to quantify to any one municipality. For municipal property, the City budget for tree removal and minor repairs is generally adequate to handle winter storm damage although the plowing budget is often depleted. In particular, the heavy snowfalls associated with the winter of 2010-2011 drained the City's plowing budget and raised a high level of awareness of the danger that heavy snow poses to roofs.

3.6 WILDFIRES AND DROUGHT

3.6.1 Setting

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

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

It is at this interface that the most damage to buildings and infrastructure occurs. An isolated wildland fire may not be a threat, but the combined effect of having residences, businesses, and lifelines near a wildland area causes increased risk to life and property. Thus, a fire that might have been allowed to burn itself out with a minimum of firefighting or containment in the past is now fought to prevent fire damage to surrounding homes and commercial areas as well as smoke threats to health and safety in these areas.

The most common causes of wildfires are arson, lightning strikes, and fires started from downed trees hitting electrical lines. Thus, wildfires have the potential to occur anywhere and at any time in both undeveloped and lightly developed areas. Wildfires are more common in rural areas than in developed areas as most fires in populated areas are quickly noticed and contained. The likelihood of a severe wildfire developing is lessened by the vast network of water features in the state, which create natural breaks likely to stop the spread of a fire. During long periods of drought, these natural features may dry up, increasing the vulnerability of the state to wildfires.

According to the Connecticut DEEP, the actual forest fire risk in Connecticut is low due to several factors. First, the overall incidence of forest fires is very low (an average of 215 fires per year occurred in Connecticut from 2002 to 2010, which is a rate slightly higher than one per municipality per year). Secondly, as the wildfire/forest fire prone areas become fragmented due to development, the local fire departments have increased access to those neighborhoods for firefighting equipment. Third, the problematic interface areas such as driveways too narrow to permit emergency vehicles are site specific. Finally, trained firefighters at the local and state level are readily available to fight fires in the state, and intermunicipal cooperation in such instances is common.

Traditionally, the highest forest fire danger in Connecticut occurs in the spring from mid-March to mid-May. The Fire Department reports that wildfires are rare in Danbury, occurring once or twice every 4 to 5 years. Hazards associated with wildfires include property damage and loss of habitat. Wildfires are considered a likely event each year, but when one occurs, it is generally contained to a small range with limited damage to nonforested areas.

In the drought year of 1999, the average wildfire burned 5 acres in comparison to the two most extreme wildfires recorded since 1986 that burned 300 acres each. Given the availability of

firefighting water in the City including the use of nearby water bodies and longstanding mutual aid assurances the Danbury Fire Department has with neighboring communities, it is believed that this average value for a drought year and the extreme value are applicable to the City as well. Indeed, City personnel report that wildfires occur in Danbury only once or twice every 4 to 5 years and typically only burn approximately 1 to 10 acres at a time.

In addition, Danbury, and Fairfield County overall, has experienced drought challenges over recent years. The U.S. Drought Monitor (USDM), which has been monitoring nationwide drought conditions since 2000, estimates that over the past two decades Connecticut experienced its longest drought of 46 weeks beginning June 21, 2016 and lasting until May 2, 2017. It was also estimated that the most intense period of this extended drought occurred the week of November 15, 2016, where approximately 44.5% of Connecticut lands were impacted. Figure 3-2: USDM Drought Time Series for Fairfield County depicts the various drought conditions in Fairfield County since 2000, where the warmer colors represent more advanced drought stages.

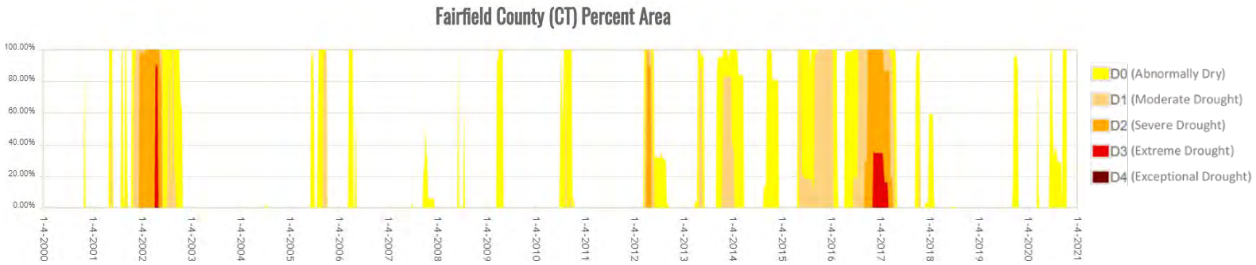


Figure 3-2: USDM Drought Time Series for Fairfield County

The 2019 Connecticut Natural Hazard Mitigation Plan assumes that the State of Connecticut has a medium probably of future drought events. This assumption is based on climate change projections anticipating hotter and wetter conditions in the near future. Climate forecasts often suggest that while precipitation may increase, the overall pattern will generally be higher intensity storms, with longer than average dry periods between events. The State Plan also identifies that Fairfield County accounts for roughly 7.34% of the state's total number of farms, with a market value of over $34 million in product sold from these farms.

3.6.2 Capabilities

Existing mitigation for wildland fire control is typically focused on Fire Department training and maintaining an adequate supply of equipment. Firefighters in Danbury are focused on training for structural fires and maintain a secondary focus on wildland fires.

Regulations regarding fire protection are outlined in the *Zoning Regulations* and the *Subdivision Regulations*, and recommendations are outlined in the *Plan of Conservation and Development*:

- ***Code of Ordinances, Section 8-30 (Ordinance 616, 6-2-04)*** covers regulations governing outdoor fires. It includes provisions requiring permission to light outdoor fires, establishing time periods when outdoor fires are permitted and requiring that fires may not be left unattended.

- ***Zoning Regulations, Section 10.D.10, page 10-14*** states that "All projects for which a site plan is required shall provide for adequate fire protection, including provisions for accessibility to and through the site and to structures thereon for fire and emergency vehicles. If the site is to be served by the municipal water system, a professional engineer, licensed and registered in the State of Connecticut, or a fire suppression technician shall submit written certification or verification that adequate fire flow pressure and quantity can be delivered to the site. If the site is not to be served by the municipal water system, alternate plans for fire suppression shall be submitted for review and approval. All site plans and related supplemental fire protection information shall be referred to the Fire Chief or his/her designee for review and approval."

- ***Subdivision Regulations, Chapter 4, Section A-2, pages 6 and 7*** state that "All land to be subdivided shall be of such character that it can be used for building purposes without danger to health and safety, especially with respect to water supply, sewage disposal, flood and erosion control hazards, traffic and pedestrian safety and accessibility to emergency services. Every lot within the subdivision shall contain sufficient area of suitable terrain to accommodate essential service and emergency vehicles, septic systems and reserve areas including required setbacks and separation among buildings for the purposes of fire safety."

- ***Subdivision Regulations, Chapter 4, Section B-1, page 9*** states "Streets shall be arranged to provide for continuation between adjacent properties where such continuation is necessary for the convenient movement of traffic, effective fire and police protection, efficient provision of utilities, or where such continuation is in accordance with the Danbury Plan of Conservation and Development."
    - Subsection 4-B-1.1 also discourages the use of privately owned roads in individual lot subdivisions.
    - Section 4-B-6 notes that cul-de-sac and loop streets with only one point of ingress and egress from a public street are permitted whenever a through street is impossible because of adjacent property or because a through street would do significant damage to environmentally sensitive areas.

- ***Plan of Conservation and Development.*** This 2013 document notes the following:
    - Section 4-G-2 (page 28) recommends that the City "extend sewer and water service to areas of the City identified for future urban development." This would enhance fire protection in these areas.
    - Section 9-A (page 41) states that the City should "expand the Fire Training Center into a regional facility,"
    - Section 9-C are recommendations for a variety of municipal water system upgrades, including replacement of water mains, lines, and interconnections, the construction "of storage tanks at Bear Mountain" and "upgrading water pumps as needed." All these activities will enhance fire protection in outlying areas of the City.

In accordance with the above regulations, developments are reviewed for emergency access and fire response during the planning stages, so such issues are addressed. A variety of measures can

be introduced to ensure that adequate levels of emergency services can be provided, such as the inclusion of sprinkler systems (including in residential buildings) or aboveground storage tanks. The City does not have an ordinance specifically requiring a source of fire protection water, such as cisterns or dry wells, when municipal water service is not available for residential or commercial building developments. The Fire Department would like the City to adopt an ordinance that would address this gap for new developments.

The City of Danbury has an Insurance Services Office (ISO) rating of 4-9 relative to its fire protection, water main and hydrant, and 9-1-1 communication services. The lower the ISO rating on a scale of 1 to 10, the lower the insurance rates typically are for an area. The "4" rating is for areas served by the municipal water system while the "9" rating is for outlying areas (these areas have limited or no water supplies such that the Fire Department is typically limited to using tanker truck water). Unlike wildfires on the west coast of the United States where the fires are allowed to burn toward development and then stopped, the Danbury Fire Department goes to the fires whenever possible. This proactive approach is believed to be effective for controlling wildfires.

The Fire Department has some water storage capability in its tanker trucks and storage tanks but primarily relies on the use of the municipal water system to fight fires throughout the City whenever possible. The Danbury Fire Department has been proactive in reducing the number of areas with poor access to firefighting water by recommending main extensions to the municipal water system and encouraging the installation of water storage tanks throughout the City by the Public Utilities Department. Since adoption of the initial HMP, Danbury has significantly expanded its municipal water system. The Fire Department and Public Utilities Department agree that the number of areas without access to municipal firefighting water has been adequately reduced, and pursuit of additional water sources (such as dry hydrants) where adequate supplies do not exist does not need to be a priority.

As a regional responder, the Danbury Fire Department has a variety of equipment for accessing remote locations with firefighting water. The City also has mutual aid agreements with all of its neighbors. Finally, the DEEP Forestry Division uses rainfall data from a variety of sources to compile forest fire probability forecasts. This allows the DEEP and the City of Danbury to monitor the drier areas of the state to be prepared for forest fire conditions.

Actions Completed and New Capabilities

The Danbury Fire Department has refurbished two Fire Pumpers, and is has begun the second phase of a radio infrastructure buildout, which will improve emergency communication capabilities.

Summary

In summary, Danbury programs that mitigate wildfire hazards include: continual expansion of the municipal water system to provide firefighting water supplies to areas currently underserved; intermunicipal firefighting coordination; public outreach and education about fire safety and outdoor burning; patrolling public spaces to monitor campfires; participation in the Connecticut Open Burning program; and execution of relevant recommendations in the Plan of Conservation and Development.

Policies include requiring fire ponds with dry hydrants and water tanks to be installed at new subdivisions, requiring sprinklers be installed in new buildings, requiring that roads are constructed to allow firefighting vehicles access at new subdivisions, and proactively going to fires when possible rather than letting them burn. Additional policies are outlined in the municipal code of ordinances, zoning regulations, and subdivision regulations, as described in the previous section.

3.6.3 Vulnerabilities and Risk Assessment

The City of Danbury is generally considered a low-risk area for damaging or extensive wildfires but at a high risk for small brush fires. Wildfires are of particular concern in outlying areas without public water service and other areas with poor access for fire-fighting equipment. Figure 3-3 presents the wildfire risk areas for the City of Danbury.

The City of Danbury understands that there are weaknesses in its firefighting capability, particularly in outlying areas away from the municipal water system. There are many areas of the City where roads are narrow and one way, particularly near Lake Candlewood. This hinders emergency access to fight fires. The Fire Chief noted that a house fire in this area completely engulfed the home before the Fire Department could get a tanker truck to the home. Fire trucks often need to drive into such areas in line, with the last truck in being the first one to back out as there is no place to turn around. In other places, fire trucks simply can't get to the houses that are up narrow dirt roads and driveways.

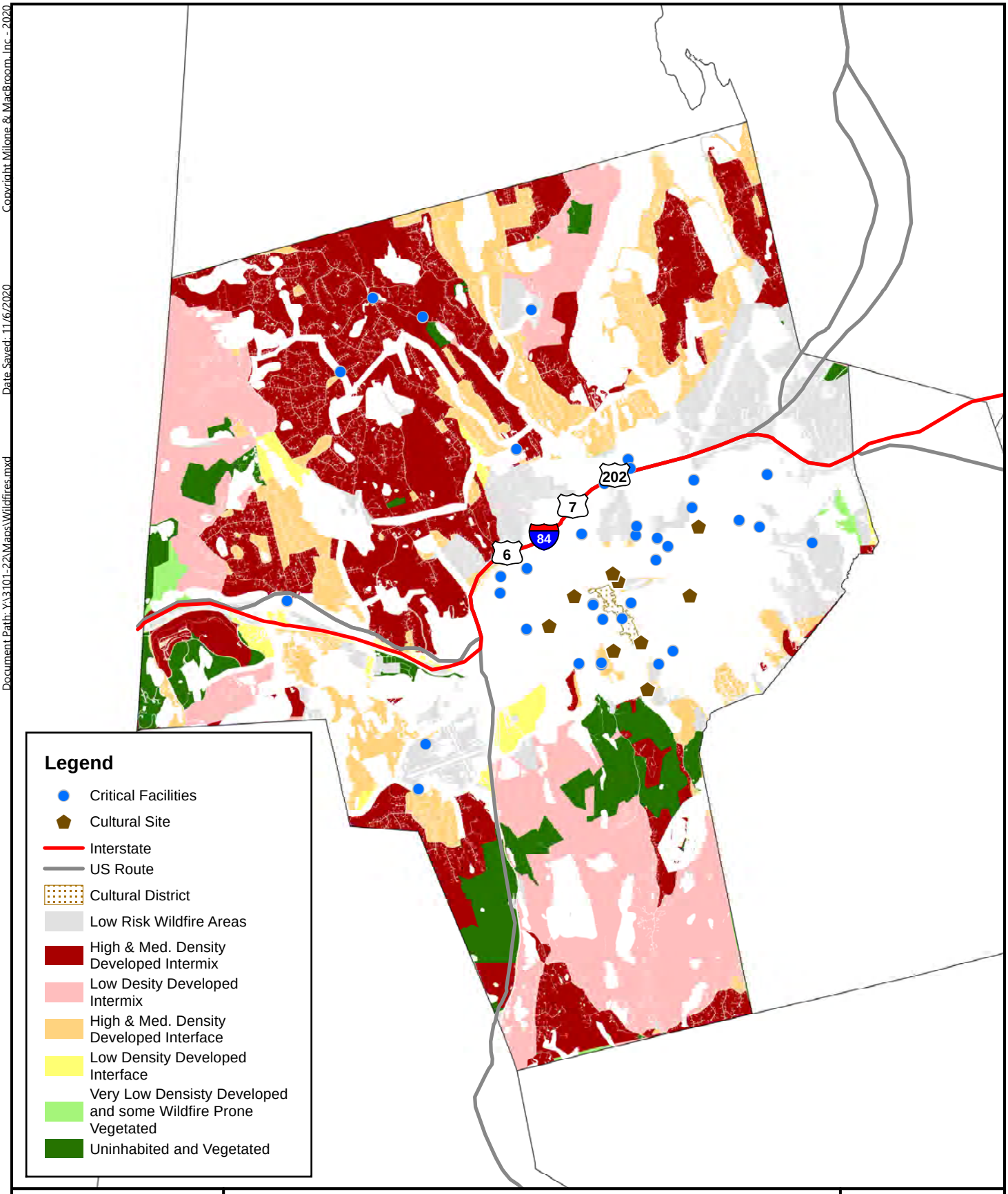
There are limited public camping areas in the City, so there are few fires caused by out-of-control campfires. The only state park in town is the Wooster State Forest along Route 7 in southern Danbury. City personnel report that the larger private tracts of forest do not tend to attract children or have repeated problems with arson.

Areas noted by City personnel as being the most susceptible to wildfires include the Bear Mountain area and the Federal Correctional Institution area just west of Lake Candlewood, the land trust lands in the southern part of the City near Long Ridge Road, and the northwest hills where there is no public water service or dry hydrants. The Fire Department noted that the hydrants near the correctional facility are marginal for fire protection purposes. In the remaining areas, the City relies on its tanker trucks for water supply.

It is possible that over a thousand of the population impacted by a wildfire could consist of the elderly, several hundred could consist of linguistically isolated households, and over a thousand with disabilities could reside near wildfire impact areas. Thus, it is important for the Danbury Fire Department to continue to be prepared to assist these special populations during emergencies, including wildfire.

Date Saved: 11/6/2020

Document Path: Y:\3101-22\Maps\Wildfires.mxd



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

Wildland-Urban Interface: Wildfire Risk Areas

WestCOG Hazard Mitigation Plan

City of Danbury

NPS: Cultural Resources

Wildland-Urban Interface:USFA

N

0 3,000 6,000

Feet

SCALE	1 " = 6,956 '
DATE	11/13/2020
PROJ. NO.	3101-22

FIG. 3-2

3.7 EARTHQUAKES AND LANDSLIDES

3.7.1 Setting

The entire City of Danbury is susceptible to earthquake damage. However, even though earthquake damage has the potential to occur anywhere both in the City and in the northeastern United States, the effects may be felt differently in some areas based on the type of geology. In general, earthquakes are considered a hazard that may possibly occur but that may cause significant effects to a large area of the City.

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

Areas of steep slopes can collapse during an earthquake, creating landslides. Seismic activity can also break utility lines such as water mains, electric and telephone lines, and stormwater management systems. Damage to utility lines can lead to fires, especially in electric and gas mains. Dam failure can also pose a significant threat to developed areas during an earthquake. For this Plan, dam failure has been addressed separately in Section 0.

3.7.2 Capabilities

The Connecticut Building Codes include design criteria for buildings specific to each municipality as adopted by the Building Officials and Code Administrators (BOCA). These include the seismic coefficients for building design in the City of Danbury. The City has adopted these codes for new construction, and they are enforced by the Building Official.

Due to the infrequent nature of damaging earthquakes, land use policies in the City of Danbury do not directly address earthquake hazards. However, various documents do indirectly discuss areas susceptible to earthquake damage and regulations that help to minimize potential earthquake damage:

- ***Plan of Conservation and Development.*** The 2013 plan states the following:
  - Section I-A-3 (page IV.11) recommends that "to protect environmentally sensitive areas, [the City should] restrict development in [State] Conservation areas to primarily very low and rural density single family homes and traditional neighborhood and rural uses."
  - Section I-C-6 (page IV.12) states that the Zoning Regulations should "retain or enact environmental regulations and programs to protect environmentally sensitive areas, including public water supply watersheds, wetlands, floodplains, aquifers, steep hillsides, and extensive woodlands."
  - Section 5-B-4 (page IV.30) recommends that the City "require stabilization and re-vegetation after grading and enact other regulations governing steep slopes to prevent increases of silt and chemicals into surface water reservoirs."
  - Sections 5-C-1 to 5-C-3 (page IV.30) states that the City should "review the zoning of land on steep slopes to determine if development should be limited to protect hillsides," "require an overlay zoning district to protect hillsides and ridgelines," and "require an

erosion and sedimentation control permit for single family lots that are not part of an approved subdivision plan where such lots are located on steep slopes or ridgelines."

- ***Subdivision Regulations***. The 2008 regulations state the following:
  - Section 2.1 states that land that contains slopes of 20% or greater warrants special attention and evaluation in the review process, and requires appropriate safeguards to protect the health and safety of the community.
  - Section 6.2 states that development on steep slopes should be avoided to the greatest extent possible, and that the City reserves the right to impose more stringent regulations on a site to maintain the stability of the banks and ensure safety under the proposed conditions.

- ***Zoning Regulations***. The Zoning Regulations, last amended in 2020 state the following:
  - Section 8A is a thorough discussion of the erosion and sedimentation controls required for various projects, including excavation.

Actions Completed and New Capabilities

Earthquake mitigation capabilities have not significantly changed in Danbury since the initial HMP and are deemed to be sufficient given the low risk of a hazardous event.

Summary

City policy continues to require adherence to Connecticut Building Codes. The City will continue to evaluate whether capabilities need to be strengthened in the future.

3.7.3 Vulnerabilities and Risk Assessment

Several areas in Danbury are underlain by sand and gravel, particularly within the Still River corridor, the Saugatuck River basin, and in the vicinity of Limekiln Brook. Structures in these areas are at increased risk from earthquakes due to amplification of seismic energy and/or collapse. The best mitigation for future development in areas of sandy material may be application of the most stringent building codes or possibly the prohibition of new construction. However, many of these areas occur in floodplains associated with the various streams and rivers in Danbury, so they are already regulated. The areas that are not at increased risk during an earthquake due to unstable soils are the areas underlain by glacial till.

A series of earthquake probability maps were generated using the 2009 interactive web-based mapping tools hosted by the USGS. These maps were used to determine the probability of an earthquake of greater than magnitude 5.0 or greater than magnitude 6.0 damaging the City of Danbury. Results are presented in Table 3-3 below.

Table 3-3: Probability of a Damaging Earthquake in the Vicinity of Danbury

Time Frame (Years)	Probability of the Occurrence of an Earthquake Event > Magnitude 5.0	Probability of the Occurrence of an Earthquake Event > Magnitude 6.0
50	2% to 3%	< 1%
100	4% to 6%	1% to 2%
250	10% to 12%	2% to 3%
350	12% to 15%	3% to 4%

Based on the historic record and the probability maps generated from the USGS database, it is likely that Danbury will continue to experience minor earthquakes (magnitude less than 3.0) in the future. While the risk of an earthquake affecting Danbury is relatively low over the short term, long-term probabilities suggest that a damaging earthquake (magnitude greater than 5.0) could occur within the vicinity of Danbury.

Despite the low probability of occurrence, earthquake damage presents a potentially significant hazard to the City. Infrastructure such as water treatment plants, sewer pumping stations, and water storage tanks, could be affected by an earthquake. Should a damaging earthquake occur in Connecticut, it is possible that some Danbury medical personnel will be needed in other parts of the state that are harder hit by the earthquake and that Danbury Hospital will receive patients from other areas.

Landslides are also a concern in Danbury, primarily in areas with steeper slopes, especially those undercut by roads or other infrastructure.

4.0 MITIGATION STRATEGIES AND ACTIONS

4.1 Goals and Objectives

Municipal goals and objectives have been made consistent regionally and are presented in the Multi-Jurisdictional Plan document.

4.2 Status of Mitigation Strategies and Actions from Previous HMP

The table below lists the mitigation actions developed in the previous HMP and the status of each. Actions to be carried forward are noted as such. Actions that have been institutionalized as capabilities are not carried forward.

#	Action	Responsible Party	Status	Notes
1	Add pages to City website dedicated to citizen education and preparation for natural hazard events	OEM	Carry Forward	This action has not yet been completed. *Carry forward*
2	Upgrade emergency communications as necessary to better facilitate emergency response and coordination with neighboring towns	OEM, Fire Dept.	Completed	This action has been completed. City has ongoing work to increase transmission and reception abilities around the City. They have also improved their communication system with surrounding towns through mutual aid agreements, which work very well. A new communication and dispatch center has been established in City, further improving both its emergency response capabilities and its ability to coordinate with neighboring communities.
3	Assess the interim POCD update for appropriate changes to egress regulations. If inadequate, prepare to make changes to next POCD update.	PC, DPZ	Drop	POCD has not been changed since adoption of the previous HMP; the next scheduled update is 2023. City looks at site egress as part of the site plan review process for permitting. This action is not considered necessary.

#	Action	Responsible Party	Status	Notes
4	Ensure that both specific actions and general recommendations presented in this Plan Update are considered during the POCD update process, which will be completed after the end of this document's planning horizon.	PZC	Carry Forward	POCD has not been changed since adoption of the previous HMP; the next scheduled update is 2023 This action is carried forward.
5	Pursue funding to place utilities underground in existing developments	OEM	Carry Forward (with Revisions)	Subdivision regulations require that new utilities be buried underground, but the City has not succeeded in securing funding for burial of existing utilities. The City continues to be interested in placing existing utilities underground. This action is carried forward
6	Require floodplain permits to be reviewed by both the Fire Department and OEM for potential problems and any comments addressed before permit issuance	PC, DPZ	Capability	Through the site plan review process, all applications are reviewed by the appropriate city departments, including the Department of Planning and Zoning. Outside technical experts are hired for more complicated projects as necessary to ensure compliance with regulations. The Planning Commission ultimately issues floodplain permits.
7	Expand definition of "substantial improvement" in the floodplain zoning ordinance to include work performed of two or three years, instead of just one	PC, DPZ	Drop	Floodplain regulations were updated in 2010, and the City decided to keep the definition of substantial improvement to be cumulative over a single year. The City does not observe a consistent problem with properties completing major improvements in a manner to avoid having to be brought into code; this action is not considered necessary.
8	Add a freeboard requirement to the floodplain zoning ordinance	PC	Completed	City requires one foot of freeboard.

#	Action	Responsible Party	Status	Notes
9	Perform flood studies to determine base flood elevations for unnumbered A zones	PC, DPZ	Carry Forward	City has not succeeded in completing this action. One specific area of concern is the Starrs Plain and West Redding Road area, as well as areas of the Upper still River (Kenosia Avenue, Mill Plain Swamp, area around the Danbury Fair Mall). Carry Forward.
10	Select a City employee to participate in events sponsored by the CT Association of Flood Managers throughout the year.	OEM DPZ	Capability	The DPZ has a designated floodplain manager who participates in trainings and educational programs.
11	Pursue property acquisitions of floodprone properties in the floodplain of Blind Brook. Utilize the land acquired along Blind Brook to expand Blind Brook Park or to provide additional floodplain storage.	Mayor	Carry Forward	Blind Brook continues to be a problem area with localized flooding. The area has many multi-family houses, with no vacant land and flooding occurring in backyards and basements. There are repetitive loss properties in that area. City has not succeeded in pursuing acquisitions in this area. Carry Forward.
12	Perform floodplain elevation studies in the vicinity of repetitive loss properties mapped in the 500-year floodplain	DPW	Capability	The DPW regularly evaluates RLP flood risks. This is a capability.
13	Perform a study of the lower Kohanza Brook / Padanaram Brook area to make recommendations regarding resizing area bridges	DPW	Carry Forward	Project has not yet been completed due to limited funding. Carry Forward.
14	Complete the dredging project for the Still River West Street Railroad Underpass	DPW	Carry Forward	Project has not yet been completed due to limited funding. Carry Forward.

#	Action	Responsible Party	Status	Notes
15	Pursue property acquisitions along the Still River near Eagle Road and Newtown Road: specifically target structure within floodway.	Mayor	Carry Forward with Revisions	City has not succeeded in pursuing acquisitions in this area. It is possible that planned improvements to I-84 will increase bridge sizes and help convey water downstream more quickly, reducing flood peaks in this area. Carry Forward with Revisions.
16	Pursue a replacement building for Fire Engine Company 3 on North Street outside of the 100-year floodplain and relocate the department	Mayor / Fire Dept.	Completed	*This project is approaching completion as part of a general volunteer fire department consolidation project. The department has already moved out of the building but the relocation process is not yet complete and negotiations are ongoing. Existing building is located right on Kohanza Brook just upstream of the confluence with Padanaram Brook, and will most likely be demolished after relocation is completed. The building is currently being used during the COVID-19 pandemic for the career Fire Department to accommodate social distancing needs.*
17	Pursue funding for floodproofing measures at Fire Engine Company 3	Mayor	Drop	This building will be demolished after relocation is completed; floodproofing will therefore not be necessary.
18	Perform a study to determine if the 100-year floodplain is properly mapped in the vicinity of Fire Engine Company 24 on Eagle Road.	DPW	Drop	Town believes FEMA-mapping is sufficient.
19	Evaluate cost of enrolling in the Community Rating System and calculate the benefit to residents	Mayor / PZC	Carry Forward with Revisions	*City worked with WestCOG to explore CRS participation, but found the administrative requirements to be beyond the capabilities of the City. Danbury is interested in participating if it can get assistance with administration, perhaps by WestCOG.* *Carry forward with revisions.*
20	Ensure that the new bridges at Crosby Street is sized based on NRCC rainfall return periods	DPW	Drop	*Bridge replacement has been completed. Bridge was appropriately sized.*

#	Action	Responsible Party	Status	Notes
21	Complete the scheduled removal of vegetation, dredging, and river wall repair along the Still River protection projects to ensure proper protection levels	DPW	Capability	This is an ongoing capability.
22	Construct the Chestnut Street and Wildman Street drainage improvements	DPW	Carry Forward	Project has not yet been completed due to limited funding. Carry Forward.
23	Construct the proposed Phase II East Ditch drainage improvements	DPW	Carry Forward	Project has not yet been completed due to limited funding. Carry Forward.
24	Construct the proposed Blind Brook channel improvements (channel widening and detention basin)	DPW	Carry Forward	Project has not yet been completed due to limited funding. Carry Forward.
25	Incorporate NRCC rainfall return periods into ongoing bridge studies	DPW	Carry Forward	Project has not yet been completed due to limited funding. Carry Forward.
26	Develop a hydrologic and hydraulic model of the Still River watershed using NRCC rainfall data as a way for the City to prioritize mitigation activities, determine the potential impacts of developments, and prioritize culvert and bridge upgrades and installation of retention and detention basins	DPW	Carry Forward	Project has not yet been completed due to limited funding. Carry Forward.

#	Action	Responsible Party	Status	Notes
27	Implement options to reduce flooding from adjacent swamps on West Redding Road and Old Lantern Road	DPW	Carry Forward	Project has not yet been completed due to limited funding. Carry Forward.
28	Encourage the use of wind-mitigation structural techniques in new structures to protect new buildings to a greater level than the required standard	DPZ / ZEO	Drop	This action is not considered necessary; wind-load requirements are built into new state building code.
29	Require wind-mitigation structural techniques in new municipal critical facilities	ZC	Drop	This action is not considered necessary; wind-load requirements are built into new state building code.
30	Collaborate with the Stormwise project, participate in education, management, and research efforts, and implement the Stormwise framework on forests adjacent to key roads.	DPW	Drop	Town has increased its tree maintenance capabilities. This specific action is no longer necessary.
31	Determine whether development of a microgrid is feasible within the City to maintain power at certain facilities or areas during regional outages.	DPW	Drop	Town does not believe a microgrid is feasible or necessary at this time.
32	Post the snow plowing routes in municipal buildings each winter	OEM *DPW*	Drop	City does not believe this action will provide benefits that reduce losses from winter storms.

#	Action	Responsible Party	Status	Notes
33	Perform a GPS study of roads in order to prioritize plowing routes, increase efficiency and efficacy of plowing efforts, and help plan evacuation routes	DPW	Completed	Action was completed in 2019.
34	Ensure that municipal departments and critical facilities (e.g. WWTF) have adequate backup equipment (e.g. generators) in case damage occurs	DPW	Completed	The City has significantly improved its emergency generator capabilities over recent years. This action is considered complete.
35	Include dam failure areas in the Connect CTY emergency contact database	OEM	Drop	City uses its 3-1-1 system to send out calls about weather and other hazards to residents. It has EAPs on file for all dams, and public alerts are part of the emergency procedures. Residents in dam failure areas are notified as part of the broader alerts.
36	Develop an ordinance standardizing fire protection requirements for new developments	ZC / Fire Dept.	Drop	City has regulations and a review process for new development which includes fire protection requirements and fire department review. Ordinance is not believed to be necessary.
37	Perform prescribed burning on municipal land when and where appropriate	Fire Dept.	Drop	City does not believe prescribed burning is necessary.

4.3 Prioritization of Strategies and Actions

The STAPLEE method, described in the Multi-Jurisdictional document, was used to score mitigation activities. The STAPLEE matrix in Appendix A provides the total scores. Actions have been further prioritized based on implementation cost, project urgency, and municipal and public input. The strategies below are presented in priority order, with qualitative priority levels listed for each.

4.4 Mitigation Strategies and Actions Implementation Table

The City proposed to initiate several new mitigation actions for the upcoming five years. Additionally, a number of actions from the previous planning period are being carried forward or replaced with revised actions. These are listed below.

New mitigation strategies and actions include:

- Complete installation of replacement generators at Backus Avenue, Fourth Street, Delay Street and Southfield Sewer Pump Stations.
- Install an early warning lightning detection system encompassing all major park venues. The system will ensure advance warning of impending severe weather and notify officials when it is safe to resume play
- Continue radio infrastructure build out including microwave transmitter/receivers

The full suite of hazard mitigation actions to be carried forward in this plan are presented below.

Action DBY-01	
Ensure that both specific actions and general recommendations presented in this Plan Update are directly included in the POCD update, which will be completed by 2023.	
Lead	PC
Cost	$0 - $25,000
Funding	Operating Budget
Timeframe	2021
Priority	High

Action DBY-02	
Provide information on the City website about CT DEEP training and information around small business chemical management for hazard resilience.	
Lead	EM, City Council
Cost	$0 - $25,000
Funding	Operating Budget, CT DEEP
Timeframe	2021
Priority	High

Action DBY-03	
Use the CT Toxics Users and Climate Resilience Map to identify toxic users located in hazard zones within your community. Contact those users to inform them about the CT DEEP small business chemical management initiative.	
Lead	EM, City Council
Cost	$0 - $25,000
Funding	Operating Budget, CT DEEP
Timeframe	2021
Priority	High

Action DBY-04	
Host a CT DEEP presentation for municipal staff and local businesses about business chemical management for hazard resilience.	
Lead	EM, City Council
Cost	$0 - $25,000
Funding	Operating Budget, CT DEEP
Timeframe	2021
Priority	High

Action DBY-05	
Register as a Sustainable CT community and make progress with the hazard mitigation goals associated with registration.	
Lead	City Council
Cost	$0 - $25,000
Funding	Operating Budget
Timeframe	2021
Priority	High

Action DBY-06	
Collaborate with CIRCA on the "Resilient Connecticut" project	
Lead	City Council
Cost	$0 - $25,000
Funding	Operating Budget
Timeframe	2022
Priority	Med

Action DBY-07	
Coordinate with CT SHPO to conduct outreach to owners of historic properties to educate them on methods of retrofitting historic properties to be more hazard-resilient while maintaining historic character.	
Lead	DPZ
Cost	$0 - $25,000
Funding	Operating Budget
Timeframe	2022
Priority	Med

Action DBY-08	
Coordinate with CT SHPO to seek funding to conduct historic resource surveys, focusing on areas within natural hazard risk zones (flood zones, wildfire hazard zones, steep slopes) to identify historic resources at risk and support the preparation of resiliency plans across the state.	
Lead	DPZ
Cost	$25,000 - $50,000
Funding	CT SHPO
Timeframe	2024
Priority	Med

Action DBY-09	
Develop a hydrologic and hydraulic model of the Still River watershed using NRCC rainfall data as a way for the City to prioritize mitigation activities, determine the potential impacts of developments, and prioritize culvert and bridge upgrades and installation of retention and detention basins	
Lead	DPW
Cost	$50,000 - $100,000
Funding	Capital Improvement Plan, CT DEEP, Other Grant
Timeframe	2024
Priority	Med

Action DBY-10	
Secure permanent on-call contracts with contractors (who are compliant with FEMA criteria for storm recovery and accounting, to enable later reimbursements) to assist with recovery following storms (in particular related to power restoration and debris clearing).	
Lead	OEM, DPW
Cost	$50,000 - $100,000
Funding	Operating Budget
Timeframe	2024
Priority	Med

Action DBY-11	
Construct the proposed Blind Brook channel improvements (channel widening and detention basin)	
Lead	DPW
Cost	More than $1 million
Funding	Capital Improvement Plan, FEMA Grant, Other Grant
Timeframe	2025
Priority	Med

Action DBY-12	
Implement options to reduce flooding from adjacent swamps on West Redding Road and Old Lantern Road	
Lead	DPW
Cost	$100,000 - $500,000
Funding	Capital Improvement Plan, FEMA Grant, Other Grant
Timeframe	2025
Priority	Med

Action DBY-13	
Add pages to City website dedicated to citizen education and preparation for natural hazard events.	
Lead	OEM
Cost	$0 - $25,000
Funding	Operating Budget
Timeframe	2022
Priority	Low

Action DBY-14	
Work with WestCOG to pursue enrolling in the Community Rating System	
Lead	Mayor
Cost	$50,000 - $100,000
Funding	Capital Improvement Plan, FEMA Grant
Timeframe	2025
Priority	Low

Action DBY-15	
Seek funding to perform flood studies in the Sugar Hollow area, along West Redding Road, to determine base flood elevations for unnumbered A zones	
Lead	DPW
Cost	$50,000 - $100,000
Funding	Grant
Timeframe	2025
Priority	Low

Action DBY-16	
Conduct a study of improvements and alternatives for reducing flooding in the Blind Brook corridor	
Lead	DPW
Cost	$50,000 - $100,000
Funding	Operating Budget, Grant
Timeframe	2025
Priority	Low

Action DBY-17	
Monitor the State's I-84 improvement project to identify impacts and opportunities related to flood risk.	
Lead	DPW
Cost	$50,000 - $100,000
Funding	Operating Budget, Grant
Timeframe	2025
Priority	Low

Action DBY-18	
Install an early warning lightning detection system encompassing all major park venues. The system will ensure advance warning of impending severe weather and notify officials when it is safe to resume play	
Lead	OEM / Recreation
Cost	$100,000 - $500,000
Funding	Capital Improvement Plan, Other Grant
Timeframe	2026
Priority	Low

Action DBY-19	
Construct the Chestnut Street and Wildman Street drainage improvements	
Lead	DPW
Cost	More than $500,000
Funding	Capital Improvement Plan, FEMA Grant, Other Grant
Timeframe	2026
Priority	Low

Action DBY-20	
Construct the proposed Phase II East Ditch drainage improvements	
Lead	DPW
Cost	More than $1 million
Funding	Capital Improvement Plan, FEMA Grant, Other Grant
Timeframe	2026
Priority	Low

Action DBY-21	
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.	
Lead	EM, City Council
Cost	$0 - $25,000
Funding	Operating Budget, FEMA Grant
Timeframe	2023
Priority	Low

Action DBY-22	
Perform a study of the lower Kohanza Brook / Padanaram Brook area to make recommendations regarding resizing area bridges	
Lead	DPW
Cost	$25,000 - $50,000
Funding	FEMA Grant, Other Grant
Timeframe	2023
Priority	Low

Action DBY-23	
Incorporate NRCC rainfall return periods into ongoing bridge studies	
Lead	DPW
Cost	$0 - $25,000
Funding	Operating Budget
Timeframe	2023
Priority	Low

Action DBY-24	
Work with CT DEEP to validate and/or correct the RL list and update the mitigation status of each listed property.	
Lead	DPZ
Cost	$25,000 - $50,000
Funding	FEMA Grant
Timeframe	2024
Priority	Low

Action DBY-25	
Annually conduct an emergency operations exercise for a local terrorism, sabotage, or mass casualty event.	
Lead	EMD
Cost	$25,000 - $50,000
Funding	Operating Budget
Timeframe	2024
Priority	Low

Action DBY-26	
Pursue funding to place utilities underground in existing developments; target at least two for the 5-year lifespan of this plan update.	
Lead	OEM / PZC
Cost	More than $1 million
Funding	Capital Improvement Plan, Other Grant
Timeframe	2026
Priority	Low

Action DBY-27	
Complete the dredging project for the Still River West Street Railroad Underpass	
Lead	DPW
Cost	$100,000 - $500,000
Funding	Capital Improvement Plan, FEMA Grant, Other Grant
Timeframe	2026
Priority	Low

Action DBY-28	
Continue radio infrastructure build out including microwave transmitter/receivers	
Lead	OEM
Cost	$100,000 - $500,000
Funding	Capital Improvement Plan, Other Grant
Timeframe	2026
Priority	Low

APPENDIX A

Appendix A: STAPLEE Matrix

#	Action Description	Regional Theme	Lead Department	Cost Estimate	Potential Funding Sources	Timeframe for Completion	Weighted STAPLEE Criteria														Total STAPLEE Score
							Benefits							Costs							
							Social	Technical (x2)	Administrative	Political	Legal	Economic (x2)	Environmental	Social	Technical (x2)	Administrative	Political	Legal	Economic (x2)	Environmental	
DBY-01	Ensure that both specific actions and general recommendations presented in this Plan Update are directly included in the POCD update, which will be completed by 2023.	Integrate with other Planning	PC	$0 - $25,000	Operating Budget	2021	1	1	1	1	1	1	1	0	0	0	0	0	0	0	9
DBY-02	Provide information on the City website about CT DEEP training and information around small business chemical management for hazard resilience.	CT DEEP Small Business Chem	EM, City Council	$0 - $25,000	Operating Budget, CT DEEP	2021	1	1	1	0	1	1	1	0	0	0	0	0	0	0	8
DBY-03	Use the CT Toxics Users and Climate Resilience Map to identify toxic users located in hazard zones within your community. Contact those users to inform them about the CT DEEP small business chemical management initiative.	CT DEEP Small Business Chem	EM, City Council	$0 - $25,000	Operating Budget, CT DEEP	2021	1	1	1	0	1	1	1	0	0	0	0	0	0	0	8
DBY-04	Host a CT DEEP presentation for municipal staff and local businesses about business chemical management for hazard resilience.	CT DEEP Small Business Chem	EM, City Council	$0 - $25,000	Operating Budget, CT DEEP	2021	1	1	1	0	1	1	1	0	0	0	0	0	0	0	8
DBY-05	Register as a Sustainable CT community and make progress with the hazard mitigation goals associated with registration.	Sustainable CT	City Council	$0 - $25,000	Operating Budget	2021	1	1	1	1	0	1	1	0	0	0	0	0	0	0	8
DBY-06	Collaborate with CIRCA on the "Resilient Connecticut" project	ResilientCT	City Council	$0 - $25,000	Operating Budget	2022	1	1	1	0	0	1	1	0	0	0	0	0	0	0	7
DBY-07	Coordinate with CT SHPO to conduct outreach to owners of historic properties to educate them on methods of retrofitting historic properties to be more hazard-resilient while maintaining historic character.	SHPO	DPZ	$0 - $25,000	Operating Budget	2022	1	1	1	1	0	1	0	0	0	0	0	0	0	0	7
DBY-08	Coordinate with CT SHPO to seek funding to conduct historic resource surveys, focusing on areas within natural hazard risk zones (flood zones, wildfire hazard zones, steep slopes) to identify historic resources at risk and support the preparation of resiliency plans across the state.	SHPO	DPZ	$25,000 - $50,000	CT SHPO	2024	1	1	1	1	0	1	0	0	0	0	0	0	0	0	7
DBY-09	Develop a hydrologic and hydraulic model of the Still River watershed using NRCC rainfall data as a way for the City to prioritize mitigation activities, determine the potential impacts of developments, and prioritize culvert and bridge upgrades and installation of retention and detention basins	NRCC	DPW	$50,000 - $100,000	Capital Improvement Plan, CT DEEP, Other Grant	2024	0	1	1	0	1	1	1	0	0	0	0	0	0	0	7
DBY-10	Secure permanent on-call contracts with contractors (who are compliant with FEMA criteria for storm recovery and accounting, to enable later reimbursements) to assist with recovery following storms (in particular related to power restoration and debris clearing).	Tree Management	OEM, DPW	$50,000 - $100,000	Operating Budget	2024	0	1	1	1	1	1	0	0	0	0	0	0	0	0	7
DBY-11	Construct the proposed Blind Brook channel improvements (channel widening and detention basin)	Drainage	DPW	More than $1 million	Capital Improvement Plan, FEMA Grant, Other Grant	2025	0	1	1	0	1	1	1	0	0	0	0	0	0	0	7
DBY-12	Implement options to reduce flooding from adjacent swamps on West Redding Road and Old Lantern Road	Drainage	DPW	$100,000 - $500,000	Capital Improvement Plan, FEMA Grant, Other Grant	2025	0	1	1	0	1	1	1	0	0	0	0	0	0	0	7
DBY-13	Add pages to City website dedicated to citizen education and preparation for natural hazard events.	Outreach and Education	OEM	$0 - $25,000	Operating Budget	2022	1	0	1	1	0	1	1	0	0	0	0	0	0	0	6
DBY-14	Work with WestCOG to pursue enrolling in the Community Rating System	CRS	Mayor	$50,000 - $100,000	Capital Improvement Plan, FEMA Grant	2025	1	1	0	1	1	1	0	0	0	-1	0	0	0	0	6
DBY-15	Seek funding to perform flood studies in the Sugar Hollow area, along West Redding Road, to determine base flood elevations for unnumbered A zones	Flood Study	DPW	$50,000 - $100,000	Grant	2025	1	1	1	1	1	1	0	0	-1	0	0	0	0	0	6
DBY-16	Conduct a study of improvements and alternatives for reducing flooding in the Blind Brook corridor	Flood Study	DPW	$50,000 - $100,000	Operating Budget, Grant	2025	1	1	1	1	1	1	0	0	-1	0	0	0	0	0	6
DBY-17	Monitor the State's I-84 improvement project to identify impacts and opportunities related to flood risk.	Flood Study	DPW	$50,000 - $100,000	Operating Budget, Grant	2025	1	1	1	1	1	1	0	0	-1	0	0	0	0	0	6

#	Action Description	Regional Theme	Lead Department	Cost Estimate	Potential Funding Sources	Timeframe for Completion	Weighted STAPLEE Criteria														Total STAPLEE Score
							Benefits							Costs							
							Social	Technical (x2)	Administrative	Political	Legal	Economic (x2)	Environmental	Social	Technical (x2)	Administrative	Political	Legal	Economic (x2)	Environmental	
DBY-18	Install an early warning lightning detection system encompassing all major park venues. The system will ensure advance warning of impending severe weather and notify officials when it is safe to resume play	Emergency Response	OEM / Recreation	$100,000 - $500,000	Capital Improvement Plan, Other Grant	2026	1	1	1	0	1	1	0	0	0	-1	0	0	0	0	6
DBY-19	Construct the Chestnut Street and Wildman Street drainage improvements	Drainage	DPW	More than $500,000	Capital Improvement Plan, FEMA Grant, Other Grant	2026	0	1	1	0	1	1	0	0	0	0	0	0	0	0	6
DBY-20	Construct the proposed Phase II East Ditch drainage improvements	Drainage	DPW	More than $1 million	Capital Improvement Plan, FEMA Grant, Other Grant	2026	0	1	1	0	1	1	0	0	0	0	0	0	0	0	6
DBY-21	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.	RLPs	EM, City Council	$0 - $25,000	Operating Budget, FEMA Grant	2023	0	1	1	0	1	1	0	0	0	-1	0	0	0	0	5
DBY-22	Perform a study of the lower Kohanza Brook / Padanaram Brook area to make recommendations regarding resizing area bridges	Flood Study	DPW	$25,000 - $50,000	FEMA Grant, Other Grant	2023	0	0	1	0	1	1	1	0	0	0	0	0	0	0	5
DBY-23	Incorporate NRCC rainfall return periods into ongoing bridge studies	Drainage	DPW	$0 - $25,000	Operating Budget	2023	0	0	1	0	1	1	1	0	0	0	0	0	0	0	5
DBY-24	Work with CT DEEP to validate and/or correct the RL list and update the mitigation status of each listed property.	RLPs	DPZ	$25,000 - $50,000	FEMA Grant	2024	0	0	1	0	1	1	0	0	0	0	0	0	0	0	4
DBY-25	Annually conduct an emergency operations exercise for a local terrorism, sabotage, or mass casualty event.	Terrorism & Mass Casualty	EMD	$25,000 - $50,000	Operating Budget	2024	1	1	1	1	1	0	0	0	0	-1	0	0	0	0	5
DBY-26	Pursue funding to place utilities underground in existing developments; target at least two for the 5-year lifespan of this plan update.	Energy Resiliency & Backup Power	OEM / PZC	More than $1 million	Capital Improvement Plan, Other Grant	2026	1	1	1	1	1	1	0	0	-1	-1	0	0	0	0	5
DBY-27	Complete the dredging project for the Still River West Street Railroad Underpass	Drainage	DPW	$100,000 - $500,000	Capital Improvement Plan, FEMA Grant, Other Grant	2026	0	1	1	0	0	1	0	0	0	0	0	0	0	-1	4
DBY-28	Continue radio infrastructure build out including microwave transmitter/receivers	Emergency Response	OEM	$100,000 - $500,000	Capital Improvement Plan, Other Grant	2026	0	1	1	0	0	0	0	0	0	0	0	0	0	0	3

APPENDIX B

Appendix B: Detailed Soil and Geological Setting

In terms of soil types, approximately 51 percent of Danbury contains Hollis-Chatfield-Rock outcrop complex; Paxton and Montauk fine sandy loams; Udorthents-Urban land complex; Charlton Chatfield complex (very rocky); and Ridgebury, Leicester, and Whitman soils (Table 1). Approximately 15 percent of the remaining soils are influenced by urban land uses with the remaining soils consisting of various sandy loams, silt loams, wetland soils, and rock outcrops. The following soil descriptions are taken in part from the official series descriptions from the United States Department of Agriculture (USDA) website.

TABLE 1: Soil Classifications

Soil Type	Area (acres)	Percentage of City
Hollis-Chatfield-Rock outcrop complex	4,188	14.9%
Paxton and Montauk fine sandy loams	3,836	13.6%
Udorthents-Urban land complex	2,607	9.3%
Charlton-Chatfield complex, very rocky	2,146	7.6%
Ridgebury, Leicester, and Whitman soils	1,680	6.0%
Paxton-Urban land complex	1,663	5.9%
Canton and Charlton soils	1,628	5.8%
Water	1,574	5.6%
Various Soil-Urban land complexes	1,479	5.3%
Urban land	1,208	4.3%
Various sandy loams	1,204	4.3%
Woodbridge fine sandy loam	1,202	4.2%
Various other loams	1,137	4.0%
Other soils	1,031	3.7%
Urban land-various soil complexes	636	2.3%
Other urban soils	467	1.7%
Other soil complexes	432	1.5%
Total	28,118	100%

Source: 2007 Soil Survey Geographic (SSURGO) database for the State of Connecticut

- Hollis-Chatfield-Rock outcrop complex soils are characterized as being 35 percent Hollis soils, 30 percent Chatfield soils, 15 percent rock outcrop, and 20 percent minor components.
    - Hollis soils are well drained or somewhat excessively drained, gently sloping to steep soils that are very shallow or shallow over crystalline bedrock, including schist or gneiss. Their permeability is moderate or moderately rapid.
    - Chatfield soils are moderately deep, well drained, and somewhat excessively drained soils formed in till. They are nearly level through very steep and occur on convex bedrock-controlled glaciated upland landscapes.
    - Rock outcrops are mapped in areas where exposed bedrock occupies more than 50 percent of the surface. Most of the exposed rock is schist, gneiss, and granite. Slopes are gentle to hilly or steep.
- The Paxton and Montauk fine sandy loams consist of the following:

- The Paxton series is characterized by well-drained loamy soils formed in lodgement till. The soils are very deep to bedrock and moderately deep to a densic contact. They are nearly level to steep soils occurring on till plains, hills, and drumlins. Slope ranges from 0 to 45 percent. Saturated hydraulic conductivity is moderately high or high in the surface layer and low to moderately high in the substratum.

- The Montauk series is characterized by well-drained soils formed in lodgement of flow till derived primarily from granitic materials. The soils are very deep to bedrock and moderately deep to a densic contact. The soils are typically on upland till plans and moraines. Slope ranges from 0 to 35 percent. Saturated hydraulic conductivity is moderately high to high in the mineral soil and lower in the substratum.

- The Udorthents-Urban land complex consists of the following:

  - Udorthents is a soil type characterized by the original soil having been disturbed by human activity, most commonly development. These soils are characterized by cut or borrow areas, filled areas, or some combination of both. Soil permeability varies depending on source, compaction, and use.

  - Urban land soils are those that have been disturbed and paved or built upon. These soils are typically no longer capable of supporting woodlands.

- The Charlton-Chatfield complex consists of moderately deep to deep, well-drained, and somewhat excessively drained soils formed in glacial till. They are very nearly level to very steep soils on glaciated plains, hills, and ridges. The soil is often stony or very stony. Slope ranges from 3 to 45 percent. Crystalline bedrock is at depths of 20 to 40 inches. Saturated hydraulic conductivity is moderately high to high in the mineral soil.

- Ridgebury, Leicester, and Whitman Soils are generally poorly drained and derived from granite, gneiss, and schist although formation varies among the three series:

  - The Ridgebury series consists of very deep, somewhat poorly and poorly drained soils formed in till derived mainly from granite, gneiss, and schist. They are nearly level to gently sloping soils in low areas in uplands.
  - The Leicester series consists of very deep, poorly drained loamy soils formed in friable till. They are nearly level or gently sloping soils in drainageways and low-lying positions on hills.
  - The Whitman series consists of very deep, very poorly drained soils formed in lodgement till derived mainly from granite, gneiss, and schist. These soils are nearly level or gently sloping soils in depressions and drainageways on uplands.

APPENDIX C

Detailed Drainage Basin, Hydrology, and Flood Assessment

1.0 DETAILED DRAINAGE BASIN AND HYDROLOGY ASSESSMENT

Danbury is divided among 12 subregional watersheds as shown in Table 1. The majority of the drainage basins drain into the Still River and then to the Housatonic River, but certain areas drain into New York state, Lake Candlewood (and then eventually to the Housatonic River), or to the Saugatuck River. All of the water that passes through Danbury eventually empties into Long Island Sound.

The majority of these drainage basins have FEMA-defined Special Flood Hazard Areas (SFHA) along the primary watercourses. Such areas consist of 1-percent-annual-chance floodplains without elevations, 1-percent-annual-chance floodplains with elevations, and 0.2-percent-annual-chance floodplains. Refer to Section 3 for more detail regarding SFHAs.

Table 1: Subregional Drainage Basins

Drainage Basin	Overall Subregional Area (square miles)	Area of City (square miles)	Percent of City
Still River	31.36	16.57	37.7%
Kohanza Brook (Boggs Pond Brook)	6.54	6.53	14.9%
Padanaram Brook	7.27	5.78	13.2%
Saugatuck River	48.55	4.46	10.2%
Lake Candlewood	27.69	3.63	8.2%
Sympaug Brook	7.25	2.34	5.3%
Miry Brook	5.03	1.62	3.7%
Limekiln Brook	8.77	1.04	2.4%
East Branch Croton River	75.13	0.95	2.2%
Corner Pond Brook	4.92	0.60	1.4%
Ball Pond Brook	7.58	0.21	0.4%
East Swamp Brook	5.11	0.20	0.4%
Total	**N/A**	**43.93**	**100.0%**

Source: Connecticut Department of Environmental Protection GIS Data

1.1 Still River

The Still River originates at the outlet of Sanfords Pond south of Joes Hill Road near the New York state boundary in western Danbury. Sanfords Pond is fed by the confluence of the outlet of Farringtons Pond (off Joes Hill Road) and the Sawmill River (off Sawmill Road). The river flows east through an undefined channel north of the Housatonic Railroad Company tracks, forming a channel as it passes under Old Mill Plain Road. The Still River then flows southeast beneath Mill Plain Road and Interstate 84 into Lake Kenosia and then continues through Mill Plain Swamp to the Danbury Fair Mall where it is joined by major stream Miry Brook and the minor streams of Kissen Brook and Lees Pond Brook. One-percent-annual-chance floodplains without elevations have been defined by FEMA up to this point along the Still River as well as for Miry Brook and Kissen Brook.

The Still River flows east from the Danbury Fair Mall beneath Route 7 and then turns northeast toward the city center. FEMA has defined a floodway, a 1-percent-annual-chance floodplain with elevations, and a 0.2-percent-annual-chance floodplain for the Still River downstream of Route 7.

The river is impounded off Beaver Street by the Rose Hill Avenue Pond Dam, a Class B dam. The river then flows north beneath the Housatonic Railroad Company tracks and immediately into a 600-foot-long culvert beneath a factory, Rose Hill Avenue, and a vacant lot. After the culvert daylights, the river turns sharply to the southeast just south of Franklin Street and then turns northeast to enter a short (175-foot-long) culvert running parallel to the railroad tracks. After the culvert, the river turns southeast to pass beneath the railroad tracks and Rose Street and enter downtown Danbury.

Just upstream of Kennedy Avenue, the Still River enters a culvert beneath Kennedy Avenue and Main Street (a conveyance of approximately 260 feet). The Still River is joined by flow from the minor stream Parks Pond Brook (which is locally known as Blind Brook and designated as such in this plan) within the culvert and is joined by the confluence of the major stream Padanaram Brook approximately 400 feet downstream of the culvert. This section of the Still River is the upstream limit of the Army Corps of Engineers Flood Protection Project (FPP), which was constructed following the 1955 floods and protects the city center to the 1-percent-annual-chance flood level.

After the confluence of Padanaram Brook, the Still River flows generally east within the FPP through an industrial area of Danbury. The FPP protects to a greater than 0.2-percent-annual-chance flood level beginning near Chestnut Street. The Still River turns south to pass below Chestnut Street and a section of railroad tracks and reaches the end of the FPP approximately 650 feet downstream of the culvert.

The Still River turns southeast to flow beneath Casper Street and turns east to flow beneath Triangle Street. It then passes beneath a set of railroad tracks and turns sharply northeast near Cross Street where it is joined by the major stream Sympaug Brook. The river then continues generally north through a well-developed commercial and industrial area before turning southeast near Corporate Drive to its confluence with the major stream Limekiln Brook. The Still River then flows generally north and receives flow from the minor stream Beaver Brook before passing beneath Route 7, into Brookfield, and eventually to the Housatonic River.

Overall, the Still River directly drains 16.57 square miles of the city of Danbury (37.5 percent of the city's land area) and drains 34.08 square miles in Danbury overall (78 percent of the city's land area) when the river's upstream subregional watersheds are included.

1.2 Miry Brook

Miry Brook originates at the outlet of a swamp south of Shadow Lake Road near the Ridgebury section of northern Ridgefield. The brook generally flows east through Ridgefield and is joined by three unnamed tributaries before entering Danbury near Pine Mountain Road. After passing beneath Pine Mountain Road, the brook turns generally north to flow beneath Miry Brook Road and then northeast near Wooster School. The brook has the upper limit of its 1-percent-annual-chance floodplain defined (without elevations) at Wooster School.

Miry Brook continues northeast near Wooster School, passes beneath a one-way private access to the school, and then turns east to flow beneath Backus Avenue into a small impoundment. The outlet from this impoundment drains east into the Danbury Municipal Airport. Miry Brook is joined by an unnamed tributary from the south as it flows northeast along the boundary of the airport and then reaches a diversion area. Part of the flow continues along the original streambed to the north toward Backus Avenue while the remainder of the flow is directed northeast along the airport boundary toward Kenosia Avenue Extension. The flow in the original streambed flows north beneath Backus Avenue and then northeast beneath Kenosia Avenue and into the vicinity of the Danbury Fair Mall.

Drainage and streamflow at the airport have been significantly altered to mitigate flooding/

The flow that is diverted along the boundary of the airport flows under Kenosia Avenue Extension and then turns north near the north end of runway #17 to pass under Backus Avenue. After passing under Backus Avenue, the flow enters a channelized section near the west entrance of the mall that allows water to pass into the adjacent retention ponds for flood storage. The flap gates allow water to enter but prevent the water from leaving the ponds through the same inlet, thus providing retention of stormwater and floodwater. The remaining discharge intersects the normal channel of Miry Brook at the northwest end of the channelized section, and the reunited brook flows northeast to its confluence with the Still River on the north side of the mall.

Overall, Miry Brook directly drains 1.62 square miles of the city of Danbury (3.7 percent of the city's land area) and drains 5.03 square miles overall.

1.3 Padanaram Brook

Padanaram Brook originates at the outlet of a swamp northeast of the intersection of Ball Pond Road (Route 39) and Padanaram Road in northern Danbury. The swamp is formed after the confluence of two unnamed tributaries just upstream of Route 39. The brook flows southeast along Padanaram Road into the Padanaram Reservoir where it is joined by the outflow from East Lake Brook from New Fairfield and the East Lake Reservoir. Padanaram Reservoir is impounded by a Class C dam.

After exiting Padanaram Reservoir, Padanaram Brook continues to flow southeast along Padanaram Road. It is joined by the outflow from Margerie Lake Reservoir (also impounded by a Class C Dam) and is joined by an unnamed tributary before reaching the upper limit of its defined floodplain near the intersection of Padanaram Road (Route 37) and the west end of Jeanette Road . The flood delineation includes a floodway, a 1-percent-annual-chance floodplain with defined elevations, and a 0.2-percent-annual-chance floodplain. The brook continues to the southeast along Padanaram Road and enters a private, 700-foot-long FPP from 30 to 18 Padanaram Road. After passing east beneath Padanaram Road, the brook enters a 740-foot culvert beneath the Rite Aid plaza at the intersection of Padanaram Road and Hayestown Road. The brook is joined within the culvert by the minor stream Penny & Ericson Brook.

After exiting the culvert, the brook flows generally southward and beneath Interstate 84 where it is joined by the outflow of a pond in Wooster Cemetery. The brook then flows south and

southwest, eventually passing beneath Balmforth Avenue and Maple Avenue where it is joined by the major stream Kohanza Brook. Padanaram Brook then turns south into downtown Danbury where it reaches its confluence with the Still River.

Padanaram Brook directly drains 5.78 square miles of the city of Danbury (9.2 percent of the city's land area) and drains 7.27 square miles overall. Including upstream subregional areas and Kohanza Brook (described below), Padanaram Brook drains a total of 13.81 square miles.

1.4 Kohanza Brook (Boggs Pond Brook)[1]

Kohanza Brook originates as the outflow from Upper Kohanza Reservoir, which is impounded by a Class B dam. The brook flows generally southeast beneath Zinn Road to enter Lower Kohanza Reservoir, which is impounded by a Class C dam. Outflow from the reservoir continues southeast into Ridgewood Country Club and eventually into the Ridgewood Country Club Pond.

Boggs Pond Brook originates in Boggs Pond, an impoundment located south of Round Mountain in northwestern Danbury. Boggs Pond is impounded by Boggs Pond Dam, a Class BB dam. The brook flows east from Boggs Pond into West Lake Reservoir, which is impounded by a Class C dam. Both impoundments have a 1-percent-annual-chance floodplain without elevations delineated. Water that passes out of West Lake Reservoir winds generally east through Danbury to Rogers Pond where it is joined by an unnamed tributary from the north. Rogers Pond is impounded by a privately owned Class BB dam. The outflow from Rogers Pond is joined by the outflow from Turtle Pond Dam (a privately owned Class A dam) before passing into Mercers Pond. Mercers Pond is impounded by a privately owned Class C dam and has a 1-percent-annual-chance floodplain without elevations defined.

The outflow from Mercers Pond flows east into Ridgewood Country Club where it is impounded by the Ridgewood Country Club Pond Dam (a privately owned Class BB dam). The confluence of Boggs Pond Brook with Kohanza Brook also occurs in this pond.

Downstream of the pond, the brook passes beneath the entrance road to the Ridgewood Country Club and is joined by an unnamed stream from the south. The brook also enters the upper limits of its FEMA floodplain delineation (1-percent-annual-chance floodplain with elevations and 0.2-percent-annual-chance floodplain). Kohanza Brook continues northeast beneath Kohanza Street and turns sharply to the south, entering a steeply banked area where no floodplains are defined.

As Kohanza Brook continues northeast along Interstate 84, it enters a 960-foot-long culvert beneath the Exit 5 interchange that daylights downstream of the Interstate 84 east on ramp north of Tooley Lane. The 1-percent-annual-chance floodplain and a floodway are again defined downstream of Interstate 84, and the brook appears fairly channelized as it flows southeast to its intersection with Padanaram Brook. Overall, Kohanza Brook directly drains 6.53 square miles of the city of Danbury (14.9 percent of the city's land area) and drains 6.54 square miles overall.

[1] The Connecticut DEEP recognizes the subregional drainage basin as being Boggs Pond Brook, but this name does not appear on the USGS topographic maps. FEMA recognizes the lower reach of the brook as being Kohanza Brook, so the subregional drainage basin may be more appropriately named as Kohanza Brook. Both streams are described herein.

1.5 Sympaug Brook

Sympaug Brook originates at the outlet of Sympaug Lake in southwestern Bethel. The brook flows north toward Danbury, receiving inflow from the minor streams Signor Pond Brook, Chestnut Brook, Bethel Reservoir Brook, and two unnamed tributaries before entering the city of Danbury near South Street (Route 53). Bethel Reservoir Brook is formed at the outlet of Eureka Lake in Danbury and flows northeast into Bethel, where it is fed by the minor stream Braunies Brook and two unnamed tributaries. One of the unnamed tributaries flows from the Rogers Park area of Danbury. Some of these areas have associated floodplains such as Rogers Park Pond and Jerome Park Reservoir, Eureka Lake (locally known as Eureka Reservoir), Mountain Pond (1-percent-annual-chance floodplain), and Bethel Reservoir Brook (floodway and 1-percent-annual-chance floodplain with elevations).

Once the brook enters Danbury, it flows generally north through a commercial and industrial area and beneath Great Pasture Road and Shelter Rock Road before reaching its confluence with the Still River. These are the only two crossings of the main channel of the brook in the city. Sympaug Brook has a floodway, 1-percent-annual-chance floodplain with elevations, and a 0.2-percent-annual-chance floodplain defined in this area. The brook directly drains 2.34 square miles of the city of Danbury (5.3 percent of the city's land area) and drains 7.25 square miles overall.

1.6 Limekiln Brook

Limekiln Brook originates on a hillside east of Poverty Hollow Road in Newtown, Connecticut. The brook flows generally northwest toward Danbury, receiving inflow from several unnamed tributaries and minor streams including East Fork Brook and Dibbles Brook before being joined by the major stream East Swamp Brook at the Danbury corporate boundary. Limekiln Brook enters Danbury just east of the former City landfill and receives inflow from the City's sewage treatment plant. As it flows to the north, it receives inflow from the minor stream Stony Hill Brook before passing beneath Newtown Road and reaching its confluence with the Still River. Newtown Road is the only crossing that Limekiln Brook passes in Danbury.

The brook has a floodway, 1-percent-annual-chance floodplain with elevations, and a 0.2-percent-annual-chance floodplain defined throughout its reach in Danbury. The brook directly drains 1.04 square miles of the city of Danbury (2.4 percent of the city's land area) and drains 13.88 square miles overall including the subregional area of East Swamp Brook (5.11 square miles).

1.7 East Swamp Brook

East Swamp Brook originates on a hillside south of Katrina Circle in southeastern Bethel. The brook flows generally northwest toward Danbury, receiving inflow from several unnamed tributaries and the minor stream Wolf Pit Brook before entering Danbury at Shelter Rock Road. The brook continues to flow north into Danbury and joins Limekiln Brook just southeast of the former City landfill. Thus, Shelter Rock Road is the only crossing of the brook in the city of Danbury.

The brook has a floodway, 1-percent-annual-chance floodplain with elevations, and a 0.2-percent-annual-chance floodplain defined throughout its reach in Danbury. The brook directly

drains 0.20 square miles of the city of Danbury (0.4 percent of the city's land area) and drains 5.11 square miles overall.

1.8 Lake Candlewood

Lake Candlewood is the country's first pump-storage reservoir and, at 5,400 acres, is the largest lake in Connecticut. The reservoir was constructed to support power generation at the Rocky River power station in New Milford. Since 1926, water has been diverted from the Housatonic River and pumped uphill into the lake. During low-flow conditions on the Housatonic River, water is released from Lake Candlewood to run the generation turbines, and hence, this water is returned to the Housatonic River.

The Lake Candlewood watershed comprises 8.2 percent of the city's land area. In Danbury, Kellners Pond, Doyles Pond, and several intermittent streams outlet into the lake. Larger tributaries to the lake include Sawmill Brook and Glen Brook in Sherman and Ball Pond Brook in New Fairfield. The lake is impounded in Danbury by the Lake Candlewood Dam, a Class C dam near the Danbury Candlewood Park off Hayestown Road, and is impounded by several dams lying in other municipalities as well. There is a delineated 1-percent-annual-chance floodplain surrounding the lake without elevations defined.

1.9 Ball Pond Brook

Ball Pond Brook originates at Ball Pond in southwestern New Fairfield and flows southeast through New Fairfield. The brook is joined by the minor streams Short Woods Brook, Bates Brook, and an intermittent stream that may be locally known as Deep Hollow Brook on the way to its confluence with Lake Candlewood. Deep Hollow Brook drains the small part of the watershed that lies within the city of Danbury. The Ball Pond Brook watershed drains 0.21 square miles (0.4 percent) of Danbury's land area and 7.58 square miles overall.

1.10 East Branch Croton River/Corner Pond Brook

The East Branch Croton River is a major river in New York State that drains to the Croton River, a major water body that drains to reservoirs that supply 10 percent of New York City's water supply. The subregional watershed is very large (75.13 square miles) with only a small fraction (2.2 percent) lying within the city of Danbury. In total, 1.55 square miles (2.6 percent) of the city of Danbury drain west into the East Branch Croton River, including the area of Corner Pond Brook.

While the Connecticut DEEP considers Corner Pond Brook to be a subregional drainage area, most of the area within the basin actually drains through Putnam Lake. The Corner Pond Brook drainage area has its headwaters in Corner Pond in the northwest corner of the city. The pond has a 1-percent-annual-chance floodplain without elevations defined. The brook drains through swamplands generally west into New Fairfield and then continues into New York State and eventually into the East Branch Croton River. Neither stream has any road crossings within Danbury.

1.11 Saugatuck River

According to the USGS 1997 topographic map (Bethel Quadrangle), the Saugatuck River originates as the outflow from Sugar Hollow Pond (Jackson Lake) just east of Sugar Hollow Road

(Route 7) and Wooster Mountain State Park in southern Danbury. The Connecticut DEEP GIS data suggests that the Saugatuck River instead originates as the outflow from Wataba Lake in Ridgefield. The two streams in question combine in a large swamp in southern Danbury that is located between Sugar Hollow Road (Route 7) and Starrs Plain Road.

The Saugatuck River next flows southeast toward Redding generally parallel to West Redding Road and has a 1-percent-annual-chance floodplain defined without elevations. After leaving Danbury, the river continues generally south to its confluence with Long Island Sound. Overall, the Saugatuck River drains a total of 48.55 square miles of southwestern Connecticut and drains 4.46 square miles (10.2 percent) of Danbury, primarily in the southern hills of the city.

2.0 HISTORIC RECORD OF FLOODING IN DANBURY

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

According to the 2010 FEMA FIS, at least 26 major storms occurred in the Housatonic River basin since 1693. The notable historical floods in the early 20th century occurred in March 1936, September 1938, January 1949, August 1955, October 1955, and September 1960. In terms of damage to the city, the most severe of these was damage associated with the flood of October 1955, which had a return period of 80 years. This flood was the result of high intensity rainfall falling on saturated ground.

The year 1955 was a devastating year for flooding in Connecticut. Connie was a declining tropical storm when it hit Connecticut in August 1955, producing heavy rainfall of 4 to 6 inches across the state. The saturated soil conditions exacerbated the flooding caused by Tropical Storm Diane 5 days later, the wettest tropical cyclone on record for the northeast. The storm produced 14 inches of rain in a 30-hour period, causing destructive flooding conditions along nearly every major river system in the state. The Mad and Still Rivers in Winsted and the Naugatuck, Farmington, and Quinebaug Rivers in northeastern Connecticut caused the most damage.

When heavy rains caused the floods of October 1955, damage was generally lower since there was limited time to rebuild following the August storms. Serious flooding was reported along the Still River in downtown Danbury, leading to the creation of three separate flood protection projects along the Still River (Section 3.5). The August and October floodwaters resulted in over 100 deaths, left 86,000 unemployed, and caused an estimated $500 million in damages (1955 United States Dollars, or USD) in Connecticut. To put this damage value in perspective, consider that the total property taxes levied by all Connecticut municipalities in 1954 amounted to $194.1 million.

In general, minor flooding problems are widespread throughout Danbury. Extreme events along defined floodplains often result in damage to insured structures. The most common damage is to infrastructure and occurs due to flash flooding. The most extreme damage occurs to homes and businesses along the Still River corridor resulting from extreme rainfall events. Appendix C contains a compilation of photos collected by the City for various flooding events since 1999.

According to the NCDC Storm Events Database, since 1993 there have been 52 flooding events and 30 flash flood episodes in Litchfield County (the county north of Fairfield county), 20 flooding and 60 flash flooding episodes in Fairfield County, and 25 flooding and 21 flash flooding events in Dutchess County, New York (the county on the west side of Fairfield county). The following are descriptions of more recent examples of floods in and around the city as described in the NCDC Storm Events Database and based on correspondence with municipal officials. Note that flooding

was not necessarily limited to the described areas, and also note that flooding related to Tropical Storm Floyd in 1999 is provided its own subsection of this Plan (Section 3.3.1) and is not discussed immediately below. Information on disaster declarations was taken from articles within FEMA's Connecticut Disaster History database.

- June 12, 1994: Torrential thunderstorms caused 4.15 inches of rainfall, which led to severe flooding along Blind Brook on West Wooster Street, Spruce Street, William Street, and East Pearl Street. Approximately 40 people (approximately nine families) were evacuated by rowboat and sheltered for the night. Over 1 foot of water was reported on the first floor of a duplex at the corner of Spruce and William Streets while the remaining houses mainly suffered basement flooding. The remnants of a concrete garage floor had fallen into the streambed on William Street, clogging the channel. Six inches of flooding was also reported throughout Jensen's Mobile Home Park.

- October 21, 1996: A rainstorm brought 5.35 inches of rain to Danbury. Blind Brook overtopped the East Pearl Street culvert and flooded that road and William Street. Debris caught in the culvert caused the flooding, and damage to the culvert was reported.

- September 16, 2002: A rainstorm caused flooding on Main Street and Park Place in the East Ditch area. Appendix C contains photos of the flooding.

- September 8, 2004: The remnants of Hurricane Frances produced torrential rainfall across western Connecticut, with total rainfall amounts ranging from 1 to 6 inches. The rainfall produced flash flooding of many roads in Fairfield County.

- March 28 - April 2, 2005: Spring rainstorms produced heavy rain and urban flooding across the region, with the second storm also producing heavy winds that downed trees rooted in saturated ground. A total of 5.3 inches of rainfall was recorded in New Fairfield from the two events. A total of 22 feet of riverbank behind Wallin's Cap City at 115 Federal Road eroded during the storms, wiping out a bank stabilization project previously funded and performed by the NRCS.

- July 18, 2005: Flash flooding in Danbury trapped several motorists in their cars as the water quickly rose. Metro North service was stopped due to high floodwaters.

- October 2005: Although the consistent rainfall of October 7-15, 2005 caused flooding and dam failures in most of Connecticut (most severely in northern Connecticut), the precipitation intensity and duration was such that only moderate flooding occurred in Danbury. A total of 7.15 inches of rain was reported in neighboring New Fairfield from October 8 to October 9, with an additional 7.50 inches reported from October 11 to October 14. Urban flooding of low-lying and poor drainage areas occurred throughout the region.

- April 15-27, 2007: A combination of storms caused widespread flooding across New York and Connecticut. The Metro North railroad line from Danbury to Norwalk suffered track washouts in three locations and was out of service for a day. Jensen's Mobile Home Park was evacuated due to severe flooding. Flooding along the Still River in Danbury was estimated as

being between the 10-year and 50-year recurrence interval. The City estimated the total flood damage at $7 million. Fairfield County was declared a disaster area, and statewide there were 1,450 registrations for aid totaling $1,489,916 for housing assistance and $62,874 for other needs assistance. According to the "Q-Alert" system, flooding was reported at the intersection of Old Brookfield Road and Federal Road on April 16, 2007, preventing the residents of the Lexington Mews, Lexington Court, and Good Shepard Hill Summit View condominiums from leaving or entering. Many parts of Route 7 were reported closed from Danbury to New Milford. On the morning of April 17, Route 7 was reported open for Danbury area residents.

- June 14, 2008: Thunderstorms resulted in several people being stranded in their cars due to flash flooding in Danbury. The intersection of White Street and Meadow Street as well as West Street under the railroad overpass were under water. The intersection of Hospital Avenue and Osborne Street was under about 3 feet of water.

- September 6, 2008: The remnants of Tropical Storm Hanna produced rainfall amounts of 5 to 6 inches in Danbury. The storm caused approximately $32,000 in damages in Fairfield County, and flash flooding caused one death. Many roads in Danbury were beneath 1 to 3 feet of water, including the roads near Western Connecticut State University on White Street.

- August 21, 2009: Thunderstorms caused a flash flood resulting in 3 feet of standing water on White Street at the intersection of Meadow Street. Six to 8 inches of standing water also accumulated on roads near the Bethel town line.

- March 13, 2010: A nor'easter dropped 3 inches of rain and brought high winds to Connecticut. Areas of Jensen's Mobile Home Park in Danbury had 2 feet of flooding, and two people were killed by falling trees in southern Fairfield County. The Danbury to Norwalk Metro-North line had scattered service interruptions.

- March 30, 2010: A 2-day storm ending March 30, 2010 produced 4.5 inches of rain resulting in a disaster declaration for Fairfield County. FEMA estimated the overall damage to the city of Danbury to be approximately 7 million dollars. This storm was the fourth time that sections of Jensen's Mobile Home Park flooded in March 2010 alone. Saturated grounds caused a 70-foot-tall tree to fall on a house on Great Plains Road in Danbury, West Street was closed due to flooding for several days, and the entire gazebo behind the Marriott hotel was under water on Eagle Road. Statewide, there were 3,681 registrations for aid, totaling $4,383,365 for housing assistance and $244,276 for other needs assistance as well as 3,438 Small Business Administration loan applications with $2,659,200 in assistance approved. Repeated severe spring storms occurred through May 17, 2010.

- July 13, 2010: A flash flood occurred in Danbury following heavy rain and thunderstorms. Two inches of rain fell within a half-hour, with daily totals recording higher than 3 inches. Vehicles became stuck in high water on Main Street near Elmwood Park, and Beaver Brook Road and Commerce Drive were under a few feet of water.

March 7, 2011 flooding of Blind Brook on Williams Street. Picture taken looking south toward East Pearl Street and Blind Brook Park.

- March 7, 2011: Heavy spring rains produced up to 4.6 inches of rain throughout the Danbury area, well above the monthly average of 4.12 inches as reported by the Connecticut Weather Center in Danbury. The Fire Department received 95 calls related to water flooding basements, flowing through houses, and closing streets. Metro North service was suspended until March 21 due to floodwaters eroding the berm beneath a 150-foot section of track in Bethel. The Still River flooded Newtown Road near Walmart and Commerce Park up to 3 feet in some areas, and the section of Federal Road near Stew Leonards was also reported as flooded. Kenosia Avenue was overtopped deep enough to stall cars. The City's Water Pollution Control Facility (WPCF) went into bypass mode as it was unable to treat all the stormwater. Main Street near Elmwood Park, Mountainville Road, Reservoir Street, West Wooster Street, Williams Street, and Beaver Brook Road were still closed on March 8. The West Street and Backus Avenue bridges, as well as parts of Rogers Park, were also closed. Pictures associated with this flooding are included in Appendix C.

- August 28. 2011: Tropical Storm Irene moved northward over western Connecticut and eastern New York. Rainfall amounts averaged 5 to 10 inches in Litchfield County concentrated in a 12-hour period. Numerous roads were closed due to flooding. This event will be discussed more in the Tropical Cyclone section.

- September 2, 2013: Scattered thunderstorms dropped between 2 and 2½ inches of rain in a short period, causing flash flooding in Fairfield County. Damages were seen in the town of West Redding.

- January 9, 2014: A coastal storm passing to the southeast of the region caused strong winds and heavy rain. Isolated flooding occurred around Southern Connecticut, including an episode in neighboring Bethel that forced closure of an intersection.

In addition to the above events, the City's "Q-Alert" complaint database was reviewed for potential damages related to natural hazards. Complaints are addressed by the City when the cause of the problem is within the City's jurisdiction. Many of the complaints received were due to heavy rainfall causing potholes or deteriorating the road surface or for drainage clogs that caused flooding of nearby yards. A selection of complaints that were received by the City from 2006 through 2010 are listed here:

- Heavy rains in early summer 2006 deteriorated the road surface of Spruce Trail and Pine Trail in the upper section of Margerie Manor, and Pleasant Drive. These are private roads, with Pleasant Drive being a mix of public and private.
- Dirt, rocks, and debris reportedly slide into Driftway Road from Hall Passway after moderate to heavy rainstorms, causing a hazardous condition for both motor vehicles and pedestrians.
- Heavy rains in early August 2006 caused a manhole to collapse on Sheridan Street. This area was patched and later repaired.
- The April 2007 storms caused several minor problems throughout the city as follows:
    - The 24-inch concrete pipe running under Old Lantern Road was reported as practically full (80 percent) of sand and debris. As a result, the storm resulted in yard flooding of nearby properties. The pipe was reported as being "cleaned out several years ago" but refilled. The pipe clogged again in March 2008 and December 2009.
    - Potholes and flooding were reported on Bragdon Avenue.
    - The culvert at Hawthorne Cove was reported as collapsed.
    - A drainage easement on Birch Road filled with sand and debris, causing nearby yard flooding.
    - Curbing and the side of the road were washed away on Aunt Hack Road near Canterbury Court.
    - A variety of drainage issues were reported on Padanaram Road.
- In late July 2007, the entrance to Pembroke Road off Route 37 needed to be repaved as a result of severe flood/water damage.
- Collection of debris in a storm sewer caused a pothole on Ford Lane in late August 2007.
- Heavy rain in March 2008 caused gullying and erosion on private property on Old Stadley Road. The curbing behind the house was too low to handle the water flow that came down the hill.
- A log was reported jammed in a catch basin where a small brook passed beneath Parkwood Terrace in May 2008.
- The September 6, 2008 heavy rainstorm damaged the sidewalk in front of #9, #11, and #13 East Pearl Street.
- Heavy roadway flooding of Caye Road occurred due to a drainage clog and buildup of debris downstream. The problem occurred during winter 2007-2008 and again in October and December 2008.
- In April 2009, roadway flooding and yard flooding were reported on Hamilton Drive. The problems were due to a recently installed private drainage system.
- Lakeview Drive has no drainage system, and the heavy rains in March 2010 caused a washout of the road and severe erosion of a private access to nine houses.

2.1 Tropical Storm Floyd

On September 16, 1999, torrential record rainfall preceding the remnants of Tropical Storm Floyd caused widespread urban, small stream, and river flooding in Connecticut. Fairfield, Litchfield, and Hartford Counties were declared disaster areas (FEMA-1302-DR-CT). Initial cost estimates for damages to the public sector alone were estimated by the Connecticut Office of Emergency Management to be $1.3 million for Fairfield County, $204,254 for Hartford County, and $53,000 for Litchfield County. Serious widespread flooding of low-lying and poor drainage areas resulted in the closure of many roads and basement flooding across Fairfield, New Haven, and Middlesex Counties.

As with many inland towns in Connecticut, flooding associated with Tropical Storm Floyd represents the storm of record in Danbury. Total rainfall amounts measured nearly 11 inches in nearby New Fairfield as reported by the NCDC and were reported by the Connecticut DEEP as being 11.13 inches in Danbury, well above the 1-percent-annual-chance rainfall return frequencies presented in the National Weather Service's "Technical Paper No. 40." Flood elevation analysis indicated that the flooding along a large portion of the Still River was greater than the 1-percent-annual-chance flood level, and a 2001 study by the United States Army Corps of Engineers (USACE) noted that the upper Still River basin received a 300-year flood event.

The *Danbury News-Times* and the Danbury Engineering Department have archived much information regarding Floyd. The storm generated more than 300 calls for help from flooded homes, closed hundreds of businesses (including the entire Danbury Fair Mall), submerged dozens of cars, washed away sections of city roads, and turned the vicinity of the airport into a large pond. Over 300 homes, two car dealerships, an elderly apartment complex, Jensen's Lakeview Mobile Home Park (an age-restricted [55+] living community), several roads, and a bridge were damaged in the city. A total of 16 mobile homes in Jensen's Mobile Home Park were destroyed. The total of Public Assistance damages from the storm was $2.2 million dollars.

Several city streets were reported as being inundated with as much as 4 feet of water. During the storm, the majority of the secondary roads in Danbury were flooded or impassable such that only Interstate 84 remained open to effectively connect both ends of the city. Blind Brook flooded the City's Fire Headquarters on New Street with 5 inches of water, forcing officials to reroute 9-1-1 emergency calls. Fortunately, most areas of the city did not lose electrical service. The War Memorial was activated as the emergency shelter for evacuees, with approximately 110 people spending at least one night.

The following is a list of areas affected by flooding during Floyd, organized by stream:

Beaver Brook
Roadway washouts were reported on Hawley Road. Upstream, the bridge was damaged on Tamanny Trail, and washouts were reported on Purchase Street and Tabor Street. The upstream damages required a major repair project.

Bethel Reservoir Brook (Tributary)
The outlet stream from Rogers Park Pond flowing south to Bethel Reservoir Brook caused a washout of the bridge at the south end of Memorial Drive.

Blind Brook

Blind Brook experienced flooding throughout its entire reach in Danbury. The outflow from Tarrywile Lake overtopped the western section of Tarrywile Lake Road and caused 1 to 4 feet of flooding down Southern Boulevard to the eastern section of Tarrywile Lake Road. Downstream, Jefferson Avenue was overtopped by 6 inches, and Lincoln Avenue was overtopped by 1 foot. The pond upstream of West Wooster Street overtopped the road by 3.5 feet, causing major damage to the culvert beneath the street.

As Blind Brook proceeded into its culverted section, the flooding damage intensified. A wide area in the vicinity of Spruce Street, East Pearl Street, and William Street was flooded with as much as 4 feet of water. The culvert carrying Blind Brook beneath East Pearl Street was completely damaged and replaced following the storm. Up to 1.5 feet of flooding was reported at George Street, the intersection of William Street, and West Street; Montgomery Street had 1 to 2 feet of flooding; and up to 2.5 feet of water overtopped New Street with 5 inches of water flowing through the Fire Headquarters. Downstream, the homeless shelter had 1.5 feet of flooding, and Elm Street reportedly suffered minor damages.

Boggs Pond Brook and Kohanza Brook

While damages upstream of Ridgewood Country Club were minor, damages intensified as Kohanza Brook approached its confluence with Padanaram Brook. High-velocity flow caused erosion of the stream bottom at a bend in the stream off Parker Street, exposing a sewer line. The area was repaired with riprap. Downstream of Interstate 84, the bridge over the brook on Thorpe Street Extension was damaged and required major repairs. Deep floodwaters described as having "rapids"-like velocity stranded residents and stalled cars at the height of the storm. City officials evacuated the entire street. Barnum Court was also evacuated as it flooded to a depth just over 5 feet, causing damage to the street and private property.

East Ditch Flooding

Relatively shallow (less than 2 feet) flooding was widespread throughout East Ditch. Wooster Street, Main Street, Park Place, State Street, Center Street, Keeler Street, and Liberty Street were all reported as having various degrees of roadway and basement flooding.

East Lake Brook

East Lake Road had over 1,000 linear feet of damage due to flow in East Lake Brook and an overwhelmed drainage system.

Miry Brook and Kissen Brook

Flooding in the Miry Brook corridor was widespread. The private road leading through Wooster School between Miry Brook Road and Ye Olde Road experienced several washouts. Drainage clogs were reported on Kissen Brook near Old Sugar Hollow Road, which caused Miry Brook Road to be overtopped and exacerbated airport flooding. The majority of the airport was flooded, and Runway 17 at the airport was closed due to flooding and experienced minor damage.

A large section of Backus Avenue stretching west from Route 7 almost to Miry Brook Road was closed with a variety of washouts and other street damage reported. Flooding along Kissen Brook at the east end caused the intersection of Backus Avenue and Sugar Hollow Road to be closed.

The section of road from Kenosia Avenue to the mall entrance was closed due to flooding on Miry Brook. A drainage clog backed up Miry Brook near the United States Post Office (23 Backus Avenue) west of Kenosia Avenue. Water from Mill Plain Swamp (the large swamp at the confluence of Miry Brook and the Still River) flooded the mall parking lot and the first level of the parking garage.

Padanaram Brook

Three main areas were affected by flooding along Padanaram Brook. Near the reservoirs, over 2,000 linear feet of roadway damage was reported on Padanaram Road. Silt washed into Padanaram Reservoir and had to be removed. Margerie Reservoir Brook, a short tributary to Padanaram Brook, caused washouts on Capitola Road and undermined the culvert carrying it under Padanaram Road before its confluence with Padanaram Brook. Downstream near Interstate 84, volunteer firefighters had to use a rowboat to rescue nine people trapped in flooded houses on Oakland Avenue Extension. The rescue effort was impeded by strong currents. Concurrently with flooding damages along the lowest reach of Kohanza Brook, the lower section of Padanaram Brook was affected by flooding. City officials evacuated Patch Street due to flooding, with the roadway and bridge experiencing damage.

Saugatuck River

Washouts were reported on West Redding Road due to flooding in the Saugatuck River and its tributaries.

Still River

Flood damages were widespread throughout the Still River corridor. Near the upstream end of the river, a variety of roadway washouts and damages were reported on small tributary streams passing beneath Joes Hill Road. Jensen's Mobile Home Park was particularly affected. A large portion of the trailer park was flooded by Lake Kenosia in the upper Still River watershed, with strong currents flowing through the park and water entering the first floor of many trailers. A total of 18 trailers were completely destroyed. Homes from 46 to 82 Greenlawn Avenue experienced the most serious flooding. Forty people were evacuated by rowboat, and the majority of the remainder of the park was evacuated.

Downstream of Lake Kenosia, Kenosia Avenue was overtopped by the river for several days, closing the road between Mill Plain Road and Boulevard Drive during this time. The flood damage caused several areas of the road to wash out. Firefighters rescued a city man by rowboat after his car went off the road into nearby floodwaters. Flooding was also reported on Precision Road because of pooling of water in Mill Plain Swamp due to the bridge constriction at Segar Street, and an unnamed tributary to the Still River caused flooding on Lake Avenue west of Route 7.

Flooding was reported on Oil Mill Road, where it impacted the River Woods condominium complex and a house. To the north, West Street was closed at the railroad bridge for several days. The velocity of the floodwaters slowed along Beaver Street, causing deep floodwaters on Rose Hill Avenue and Rose Street at the Mallory Hat Factory. The elevated flood stages on the Still River combined with the influx of floodwaters on Blind Brook to back water up through the catch basins to flood Elm Street.

The local protection projects protected the city center area from flooding associated with the Still River. Downstream of the protection projects, the unprotected commercial and industrial areas experienced deep flooding and extensive damages. Widespread flooding occurred on Newtown Road, with floodwaters rising more than 9 feet in some areas. Scores of nearby businesses were flooded, including the Holiday Inn and many stores in the Berkshire Shopping Center. The Holiday Inn evacuated all 140 guests. Other flooded businesses included several restaurants, a movie theatre, Commerce Park, and a bank.

The flooding caused washouts on Beaver Brook Road and roadway damage on Broad Street near Old Newtown Road. The floodwaters overtopped the Old Newtown Road bridge, damaging an ongoing bridge reconstruction project. Businesses on August Drive were decimated by more than 6 feet of water. One business reported that $750,000 in inventory was lost.

Further downstream, the Still River caused widespread damage at its bend near Federal Road. Low-lying areas were completely submerged and parts of the road closed. Two hundred used cars in the parking lot of Greentree Toyota had water above the tires, with 4 million dollars in damages reported on the lot. Bob Sharp Motors next door had 4 feet of water in its building. Flooded buildings included many businesses, an assisted living facility, and the Still River Corporate Park. Water reached the bottom of the loading dock at Stew Leonards. The intersection with Nabby Road was closed. Several motorists had to be rescued from stalled cars in waist-deep water.

Sympaug Brook

Roadway damage was reported along Shelter Rock Road at various stream crossings, particularly at Sympaug Brook and the unnamed tributary to Limekiln Brook.

In addition to the above areas, the City compiled a list of miscellaneous drainage problems and damages caused by Tropical Storm Floyd that were not associated with major river or stream corridors. These include drainage clogs or failures, and flooding due to ponding or insufficient drainage. The areas that required repair are listed in Table 2.

The City Engineering Department compiled a list of private homes reported as being flooded on September 19, 1999 due to the storm. These homes are listed in Table 3 although additional houses were added later to the final count.

A few positive outcomes were noted as a result of the flood. The heavy rain completely refilled the city's reservoirs, which were down to 60 percent capacity during the 1999 summer dry season. Also, the city's flood control system along the Still River worked as designed, moving large quantities of water away from the center of the city with minimal flooding.

TABLE 2:
List of Miscellaneous Drainage Problems and Damages Caused by Tropical Storm Floyd
(as reported to the City by September 19, 1999)

Location of Drainage Clog		Location of Ponding/Poor Drainage Flooding
Aunt Hack at Autumn Drive		Amity Lane (washouts)
Birch Road #13 (lost retaining wall)		Brushy Hill Road (washouts)
Moran Avenue at #4-6		East Pembroke Road (washouts in several locations)
Oakland Avenue Extension		Franklin Street Extension (driveway washout)
Mountainville Road at Reservoir Road inlet		Lake Avenue near Westville Avenue and Morris Street (washouts)
Blind Brook (several locations)		Nabby Road (basement flooding from hillside)
Starrs Plain Road at Route 7 end		Old Ball Pond Road (private road, washouts)
Starrs Plain Road at Redding end crossing		Park Avenue School
Hillandale Road at #19, #63, #65, and #78		Pleasant Drive (washouts, private road)
King Street (drainage clog)		Reynolds Road (washouts)
Cherokee Drive (failure caused hole in road)		Rockwood Lane (washouts)
Beaver Brook Road (off) at Route 7 cross culvert		South King Street (washouts)
Rockwood Lane (catch basin)		Stacey Road (washouts)
Beaver Brook Road at Board of Education cross culvert		Ventura Drive (washouts)
Beaver Brook Road at railroad cross culvert		Ward Drive South (washout at #30)
Patch Street (debris in stream)		Westwood Drive (washouts on lower 300 linear feet)
Meadow Street/White Street (railroad culvert)		Wilkes Road (washouts)
Middle River Road (double cross culvert)		
Ta'Agan Point Road		
Middle River Road at #201		
Bergh Street at #7		

TABLE 3
Summary of Homes Flooded by Tropical Storm Floyd
(as reported to the City by September 19, 1999)

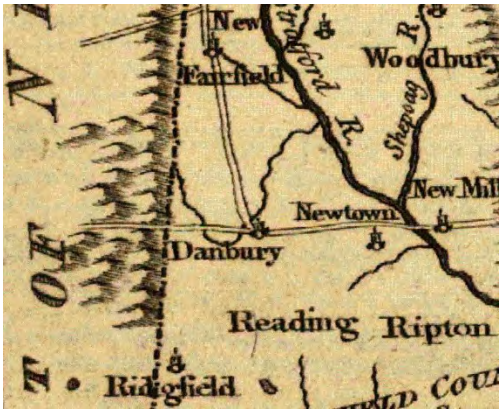
Count	Flooding Source
47	Nonriverine
~ 10	East Ditch
8	Padanaram Brook
5	Still River
4	Kohanza Brook
2	Kissen and Miry Brooks
1	Blind Brook
77	Total

3.0 DEVELOPMENTAL HISTORY OF DANBURY

3.1 Early Settlement

Danbury was first settled in 1685 by colonists from the area of what is now Norwalk and Stamford. Early settlers were attracted to the mild terrain and the fertile, well-watered soils of the upper Still River valley. The settlers originally called the town "Swampfield" but the name was changed to Danbury in 1687 based on the origin point of many of its settlers (Danbury, Essex in England). The original settlement took place on one street just south of and near the Still River, flanked to the east and west by the two low ridges of Town Hill and Deer Hill.

As additional settlers arrived, the decreasing availability of land in the older settlements led to the settlement of upland areas. Rough paths and trails soon led outward in several directions from the central town street. By 1710, Danbury was no longer an isolated frontier community for Connecticut had granted additional charters for settlements in New Milford, Newtown, and Ridgefield. A mill had been erected on the Still River, and the original village expanded northward to include houses, a meeting house, shops, and taverns.



Portion of "A map of Connecticut and Rhode Island, with Long Island Sound" by Thompson (1776). Available

The town's population grew rapidly as large families were common. By 1756, there were 1,527 people living in Danbury, and this number increased to 2,526 by 1774. Virtually the entire population was engaged in some form of agriculture for every family had a farm for basic sustenance. However, numerous trades and individual person enterprises sprang into existence to serve local needs.

Danbury lay at the intersection of an east-west route connecting central Connecticut with the Westchester County-Hudson Valley area (inset photo at left) and a north-south route from Litchfield County to Long Island Sound. When the American Revolution began in 1775, these routes became strategically important because of the British occupation of New York City and control of Long Island Sound commerce. Thus, Danbury became an important military supply depot for the revolutionary forces. In April 1777, the British burned and looted the city and destroyed the supplies. The central motto on the seal of the City is Latin for "We have restored," a reference to the destruction caused by the Loyalist troops.

3.2 Industrial Boom of the 19th Century

Despite the casualties and economic losses of war, Danbury's population increased to 2,747 in 1782. Danbury's wartime experience in producing and shipping large quantities of merchandise energized its entrepreneurs and led to a postwar boom in commerce and manufacturing. In 1780, the first hat factory in Danbury was established, employing three workers and making 18 hats per week. By 1800, Danbury led the country in fur hat production, and its factories were exporting 20,000 hats per year.

Danbury had 24 hat shops in operation in 1836 in addition to approximately 100 dwellings and numerous other buildings, nine mercantile stores, a printing office, two churches, a courthouse, and an academy. Hat-making surpassed total employment in all other manufacturing trades. The small shops and factories were largely concentrated along the banks of the Still River at the northern end of the central village. The concentration of homes and businesses along Main Street and the surrounding neighborhoods resulted in a community with interests distinct from the surrounding rural town, and borough privileges were granted by the state in 1822. The Borough of Danbury was able to tax for and provide various facilities including improved streets, sidewalks, fire protection, and water supply.

Image of 1911 postcard entitled "Hat Factory in Danbury, Conn." Building reads "Hayes, Von Gal Co. Inc. Hat Manufacturers Agencies Everywhere". Public domain image hosted in Wikimedia Commons.

As Danbury is not situated on a major navigable waterway, transportation improvements were necessary to maintain levels of commerce. Several turnpike roads were built with Danbury at the hub. Annual passenger trips from Danbury to New York City are estimated at 10,000 in 1835, and 7,000 tons of freight were hauled from the region. In 1852, the Danbury and Norwalk railroad was completed, effectively linking Danbury to the outside world.

In 1850, the population of Danbury reached 5,964, a large majority of which were concentrated in the borough, and Danbury was growing much faster than surrounding towns. The southeastern section of Danbury seceded to form the Town of Bethel in 1855, but despite the loss of approximately 1,500 persons, the population of Danbury increased to 7,234 by 1860.

The 1850s marked a time of significant industrial changes in the borough. The introduction of a hat-making machine in 1849 revolutionized the hat industry in Danbury, which formerly consisted only of highly skilled hand laborers. The railway facilitated access to raw materials and made coal available to power the new industrial machinery. Larger shops and factories replaced smaller operations, which had numbered approximately 120 in 1850. The new factories were concentrated along the banks of the Still River from West Street to East Liberty Street.

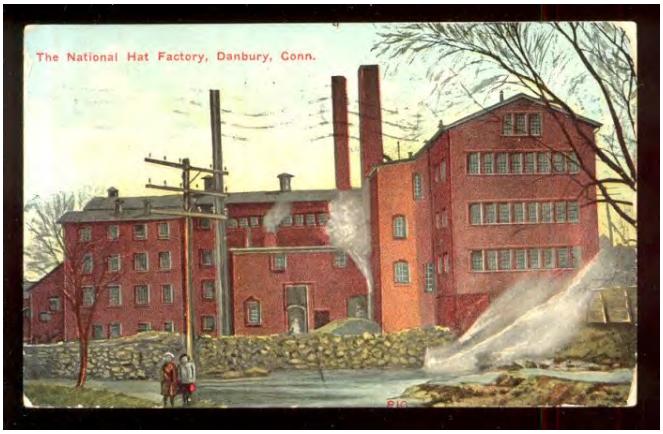


Image of 1912 postcard entitled "The National Hat Factory, Danbury, Conn." Public domain image hosted in Wikimedia Commons.

The growing national market for hats supported a booming hat industry throughout the latter half of the 19th century. The borough expanded rapidly during this time, with town population increasing to 11,666 by 1880 and 19,473 in 1890. In 1889, the borough was reincorporated as the City of Danbury. Over a thousand buildings were constructed in the 1880s as factory capacity increased, new businesses were developed to support the industry, and dozens of new residential streets were built. City improvements included fine Victorian homes; several hotels, banks, and churches; a horse-car street railway; water supply reservoirs on Padanaram Brook and at East Lake; Main Street paved with stone blocks; a fire alarm system; centralization of Danbury Hospital; the first electric lines; and a telephone exchange. In addition, the New York and New England Railroad was completed as an east-west rail line through the town in 1881, connecting Waterbury and central Connecticut with Poughkeepsie and central New York State. Hat making (inset photos) reached its peak in the 1890s and early 20th century. In 1904, for example, 24 percent of the hats purchased in the entire United States were made in Danbury.

Image of 1907 postcard entitled "Main Street, East from White Street, Danbury, Conn." Public domain image hosted in Wikimedia Commons.

Population remained static from 1890 to 1900. The industrial area of the city continued to be concentrated along the Still River although now the river was used primarily as a conduit for waste. Hat factories discharged acids, dyes, mercury, and fur waste into the Still River, creating a polluted stream. In addition, the City installed sewers to deliver waste to the Still River. A settling pond for sewage treatment was installed in the early 1890s on Triangle Street, but it was destroyed in the flood of 1894. In 1895, the City purchased 200 acres along Beaver Brook and constructed a sewage filtration plant, a pioneering effort considered at that time to be a model for a small city.

3.3 Early 20th Century

At the turn of the 20th century, the city remained a compactly developed community centered about the commercial and public buildings of Main, West, and White Streets (inset photos) and the factories along the Still River. Fully developed residential neighborhoods extended out to include North Street, Locust Avenue, White Street, South Street, Pleasant Street, and Highland Avenue. Prior to World War I, virtually all growth was confined to the central area of the town while the surrounding area remained rural and agricultural. With the arrival of railroads, subsistence farming declined and was replaced by market-oriented agriculture producing dairy products, poultry, fruit, and produce. Marginal farmland was abandoned, and larger farms prospered.

Other growth prior to World War I included several neighborhood public schools. A high school, parochial school, and the Danbury Normal School (precursor to Western Connecticut State University) were constructed from 1890 to 1910. In addition, the first permanent Danbury Hospital structure was built in 1890 on Locust Avenue, and additional water supply reservoirs were constructed on Kohanza Brook and at West Lake. However, the hat industry began its slow decline during this period due to labor strife, competition from other areas, and a general economic slowdown. The industry revived briefly with government orders during World War I and with strong civilian demand in the 1920s but entered its final period of decline during the Great Depression of the 1930s.

Image of 1907 postcard entitled "Main Street, East from White Street, Danbury, Conn." Public domain image hosted in Wikimedia Commons.

Danbury's role as the center of commerce and industry in the region led to prioritization for improvement of its surrounding highways (namely U.S. Routes 6, 7, and 202, see inset photo) in the years 1916 to 1930. Various state routes were also installed during this era, radiating outward from central Danbury and strengthening its position as a regional trading center; these roads included present-day Routes 37, 39, 53, 58, and 133. Population, which had declined slightly during the years just prior to World War I, resumed an increase as Danbury maintained jobs and became more of a regional trading center. The year 1929 saw the City's adoption of a zoning code, the first in the region.

The central business district developed a regional clientele during this period, and workers were able to commute from outside Danbury reliably for the first time. Various new businesses such as movie theatres, specialty stores, and automobile dealers opened in the central area. Traffic congestion became a problem where the main routes converged. While some institutional and other new buildings, notably a new Danbury High School in 1927, were erected, overall there was relatively little change in the city's core between the two World Wars.

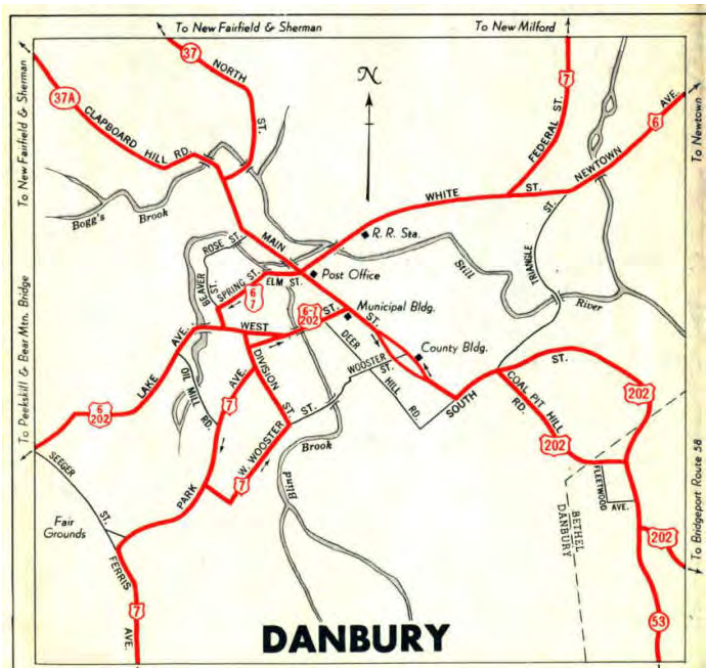


Image of major roads in Danbury prior to the interstate highway era. Image courtesy of HVCEO.

With the paving of local roads and streets and a rapid escalation in automobile ownership during the 1920s, growth began for the first time outside of the city core.

New residential streets were added at the western and northern peripheries of the city, with some areas just beyond city boundaries being accessible to water and sewer. By 1920, electric and telephone lines extended throughout both the city and the town. Rural neighborhood schools closed, farming declined, and city people established country homes. Wooster School, a private preparatory school, was established in 1926 on a 150-acre farm in the Miry Brook section, and other farms became the country estates of wealthy persons.

Roadsides along the principal highways attracted small traffic-oriented commercial ventures, especially along Route 6 and Route 7. Gasoline filling stations, tourist cabins, refreshment stands, repair garages, antique shops, souvenir and produce stands, and billboards were erected. In 1928, a group of local aviation enthusiasts purchased a 60-acre tract known as "Tucker's Field" and leased the property to the Town of Danbury for an airport. With the advent of World War II, federal funds were available, and the Town bought out the corporation of private owners, forming the Municipal Airport.

The most far-reaching development of the 1920s was the creation of Lake Candlewood. By 1928, the Connecticut Light & Power Company had acquired, by purchase and condemnation, approximately 5,500 acres in Danbury, New Milford, Brookfield, New Fairfield, and Sherman for a pumped storage hydroelectric reservoir to serve a generating plant in New Milford. The reservoir was filled with water by late 1929, and Connecticut's largest lake came into existence.

Speculators and land developers rushed to buy lakefront properties, and a number of summer cottage communities began to be built almost immediately. Building lots were small, and cottages were seasonal, with several hundred units being built by 1940. Above the western shore of the lake, a 350-acre tract of former hilltop farmland became the site of a new federal prison constructed from 1938 to 1940. The Danbury Federal Correctional Institution was designed to accommodate 600 inmates but has housed nearly 1,000 at various times.

Building construction in Danbury slowed in the 1930s with the exception of the seasonal cottages. Population increased only slightly, and unemployment was an issue. Even though development was beginning to occur outside the city core, it remained concentrated along the principal highways. Agriculture continued to play a major role in outer Danbury, with 259 agricultural businesses occupying 56 percent of the combined city and town area in 1935. As World War II approached, idle factories began to receive government orders for defense materials, and new firms launched in abandoned mill buildings to make parts for the booming war economy. By the end of the war, industrial diversification was well advanced, with the number of workers employed in industry other than hat making exceeding hat makers for the first time in over a century in 1949.

Intersection of Main and White Streets, downtown Danbury, 1948. Image hosted by Connecticut History Online (http://www.cthistoryonline.org).

3.4 Post World War II Population Boom

In 1950, the densely built-up area of Danbury was still largely limited to the city and its immediate environs. A major housing boom occurred following World War II, and extensive subdivision of land began in many areas of rural Danbury. Population reached 30,337 in 1950 and increased 67 percent over the next 2 decades to 50,781 in 1970. The flood of October 1955 led to a major flood control project along the Still River and redevelopment along Main and White Streets. Downtown traffic congestion reached its peak before I-84 was constructed north of downtown in 1959. The construction of the interstate highway greatly expedited access to other urban centers and to Danbury's industrial areas; however, the I-84 section through Danbury also carried Routes 7 and 202, creating lengthy traffic bottlenecks. The state turned this area into a six-lane highway by the late 1980s to alleviate traffic congestion. Growth also spurred public

policy changes as Danbury's two governments were consolidated under the current Mayor-Council system on January 1, 1965.

The population of Danbury more than doubled between 1950 and 1990 when the census count indicated 65,585 inhabitants. Most of this residential growth consisted of single-family dwellings outside of the area served by water and sewer at the end of World War II. More gradual growth occurred in portions of the central area as new low-rise apartments were constructed and old single-family houses were converted to two- or three-family use. Several medium density condominium and apartment projects were also built in outlying areas such as Mill Plain and Nabby Road. In addition, extensive conversions of seasonal lakefront cottages to year-round residences took place, and new permanent homes were built on small lots originally intended for seasonal cottages.

The rapid increase in Danbury's population led to a major school reconstruction program. Three new elementary schools and a new high school were completed in 1965. Two additional elementary schools and a second junior high school were built by 1972. In addition, Western Connecticut State University was formed in the late 1970s and since that time (into the present day) has been developing a 300-acre tract between Mill Plain Road and West Lake Reservoir. The more recent developments have been for a performing arts center, business school, dormitory, and sports complex. Other new public buildings were necessary to provide City services: A new City Hall, police station, a new library, and several fire stations were built along with a new state courthouse in the 1970s and 1980s.

The boom in residential growth reflected not only the outward expansion of the New York metropolitan area and the accessibility of Danbury along major highways but also a significant change in Danbury's economy. The diversification of the city's industrial base during World War II allowed the city to survive the final decline of the hatting industry from 1945 to 1970. While the hatting industry declined from 5,500 to 500 jobs during this period, the economy grew by 10,000 nonhatting jobs. More than 60 new industries located in Danbury during this time including major firms such as Preferred Utilities, Consolidated Controls, Republic Foil, Sperry Products, Connor Engineering, Viking Wire, Heli-Coil, Davis & Geck, Eagle Pencil, Branson Sonic Power, and National Semi-Conductor. Products included precision ball bearings, surgical instruments, gun sight equipment, cosmetic containers, oil burners, and clothing.

Growth also led to public policy changes. As planning and zoning modernized, consideration of limiting natural features became more formalized in local land use regulations. Zoning regulations were adopted in the Town of Danbury in 1960, and the 1929 City Zoning Regulations were updated in 1963. The comprehensive set of zoning regulations in use today was enacted in 1971. In 1973, Connecticut's wetlands protection law was passed, which defined 12 percent of land in Danbury as wetlands.

This significantly reduced development potential in the city although development continued on available land. In addition, sewer studies in this period led to significant expansion of the sewer system in the city.

The boom in light industrial development occurred in the 1970s, with an additional 40 new companies taking up residence in Danbury by 1974. The majority of the new jobs in the 1970s and later were in the high-technology and administrative categories. By 1980, the majority of the people working in the 10 largest firms were "white collar" employees. Corporate offices, high technology industry, and research firms dominated economic development through 1990. New firms included Perkin-Elmer (known for its work in developing the Hubble Space Telescope) and which later became Hughes Optical; Unimation; Atomic Energy Research Corporation; Duracell Products; Boehringer-Ingelheim Pharmaceuticals; Barden Corporation; and the corporate headquarters of Ethan Allen, Grolier, and Union Carbide. Hat making ceased entirely in the 1980s, and the principal products in 1990 now included specialized machines, heat and power units, helicopters, flight refueling apparatus, screw thread inserts, leather goods, electronic robots, air conditioning equipment, and computers.

The new industries were located in low-density industrial and corporate office parks in the previously undeveloped sections of Shelter Rock, Beaver Brook-Eagle Road, Old Sherman Turnpike, Sugar Hollow-Miry Brook, and Mill Plain-Old Ridgebury sections of the city. While industry took up 200 acres of land in 1950, industrial and corporate office use had grown over fourfold to 941 acres in 1990.

Commercial growth occurred concurrently with residential, office, and industrial growth. The scattered roadside commercial development that began in the 1920s outside of the central business district became more aggressive in new, large shopping centers along major routes leaving the city center, and many smaller commercial enterprises were locating along arterial streets as well. By 1980, retail, service, offices, automotive, wholesale, and general businesses lined the frontages of Mill Plain Road to Old Ridgebury Road, Newtown Road to the Bethel town boundary, and Federal Road to the Brookfield town boundary.

The largest commercial development in Danbury's history occurred in the 1980s with the construction of the Danbury Fair Mall. The 70-acre enclosed shopping mall is located on the 142-acre former fairgrounds site and includes three major department stores, a multitude of smaller retail outlets, and parking for thousands of vehicles. An interchange with the Route 7 expressway was constructed directly to the mall's parking lot.

APPENDIX D

Appendix D: Danbury Social Vulnerability Index

City of Danbury
Climate Vulnerability Assessment
A Component of Sustainable CT Action 5.4

The City of Danbury, for this Climate Vulnerability Assessment (CVA) is considered an urban inland community, resulting in various climate change vulnerabilities. Inland flooding, extreme heat and winter storms may impact the community the most as many issues have been identified.

Hazards

Inland Flooding

With FEMA flood zones along a few streams in Danbury, such as the Still River and Kohanza Brook, there is continuously concern for riverine flooding. Danbury has several streams running through the City, presenting the possibility for small or larger scale flooding during heavy rain events, posing a flood risk to adjacent properties. With precipitation expected to increase due to climate change, in addition to highly impervious areas, flooding events may occur more frequently.

Winter Storms

Danbury is comprised of urban and suburban areas that can be impacted by winter storms in various ways. Suburban communities are often impacted by strong winter storms by way of power outages from downed trees, accessibility issues, and icing concerns. While the urban areas can also be impacted by these results, urban areas are also often prone to localized flooding from poor drainage and impervious surfaces, along with snow removal challenges during heavy snow events. Anticipated shifts in winter precipitation may bring more freezing rain events, which can result in an increase of downed trees and iced roads during a winter storm event, or increased flooding in poorly drained or impervious areas. Downed trees can result in power outages across the city and cause a lack of emergency access and egress.

Drought and Extreme Temperatures

About half of the City is serviced by public water supply which is concentrated around the central areas of the city along Interstate 84 and Route 7, the more developed areas in Danbury. The more suburban areas surrounding the developed area is likely serviced by a private well. Therefore, impacts to water supply may be an issue to the City as temperatures rise in the near future, resulting in isolated issues with water scarcity for private well owners. Also, with historic impacts to public water supply availability during droughts, and temperatures expected to rise, the challenge of maintaining adequate supply during these times may also increase for public systems.

In addition to water scarcity, increased temperatures can also increase the urban heat island effect throughout the urban, highly impervious areas. This increase in heat island can have impacts on both water quality and human health.

When considering these impacts from climate change, the primary vulnerabilities for the City of Stamford include:

- Municipal infrastructure and neighborhoods
- Riverine flooding
- Water scarcity & urban heat island effect

Secondary Impacts

Economic Impacts

With vulnerable homes and infrastructure, the City faces an economic challenge of mitigating or relocating city-owned facilities and assisting residents with mitigation efforts. There is also a potential economic impact to local businesses during inland and coastal flooding events.

Private property owners who rely on private drinking water wells may also be impacted economically during droughts or periods of extreme heat. With increasing heat, typically comes increased water demand. This demand would be placed upon local aquifers, potentially resulting in the need for new well construction, or deepening of an existing well.

The many impacts of climate change can result in economic impacts to many citizens, business owners, and municipal budgets as the impacts can be felt on a City level, down to building level.

Social Impacts

To identify social impacts to the City, the Center for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI) was used to identify any vulnerable populations within the City. This index was developed to supplement a community's natural hazard preparation actions. To evaluate social vulnerability, the CDC incorporates 15 factors (Fig. 1) into the overall calculation under the categories, or themes, of: socioeconomic status, household composition and disability, minority status and language, and housing type and transportation. These themes and their ranking are based on census statistics. By evaluating these factors and determining a level of social vulnerability, a community can identify specific needs for before, during, and after an event. Such needs may include sheltering capacity, evacuation routes, or to decide how many emergency personnel may be required to respond after an event.

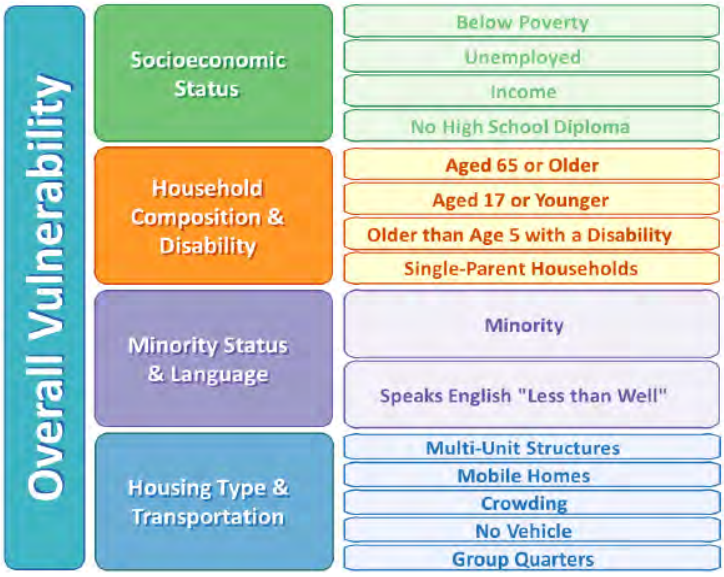


Figure 1: The CDC SVI Index Factors. Graphic: svi.cdc.com

Each municipalities' census tracts were ranked for overall vulnerability, and theme vulnerability, in comparison to other Connecticut municipalities. This rank, 0 to 1, is based on the percentile rank among all tracts within the State of Connecticut. A value closer to 0 indicates a lower vulnerability, while a value closer to

1 indicates a higher vulnerability. Table 1 presents the overall vulnerability and theme rankings for Danbury.

Table 1: Danbury SVI Factor Rankings

	Overall SVI	Socioeconomic	Household Composition & Disability	Minority Status & Language	Housing Type & Transportation
DANBURY	.62	.62	.32	.75	.62

The City of Danbury is considered to have a moderate to high level of vulnerability, and in relation to the SVI ranking, is the most vulnerable community in the WestCOG region. The most vulnerable social aspect in the City being minority populations and those that do not speak English well. In addition, there are socioeconomic concerns, as well as high density housing populations and transportation disparities. These vulnerable populations are concentrated in the central, more urbanized tracts, with rankings slightly lowering throughout the surrounding, suburban tracts. It is important to note that four of the fifteen tracts in the city are considered highly vulnerable, with one tract ranking 0.94 on the SVI scale.

These populations may be vulnerable to impacts from drought and extreme heat, and inland or coastal flooding events based on the geographic concentrations.

Public Health Considerations

Of the primary vulnerabilities identified, drought and flooding can potentially have public health repercussions. During hot summer months, or drought, if private wells were to be impacted, certain populations may find themselves without adequate drinking water supply, resulting in health problems. Also, when considering the environmental shifts occurring during drought periods, drinking water contamination may become an issue as aquifers become stressed due to excessive pumping.

Urban heat islands can also impact human health and water quality. Increased precipitation, in conjunction with high imperviousness, can move pollutants found on these surfaces into nearby water bodies. These water bodies may ultimately flow into drinking water supply or be used for recreation. Also, increased temperatures coincide with reduced air quality. Poor air quality can result in respiratory health concerns for those living in these effected areas.

Inland flooding, or poor drainage flooding, also presents the concern of pollution into nearby water bodies as these commercialized and impervious areas drain, they collect pollutants and excess sediment. Depending upon the drainage areas, this runoff can have environmental impacts in associated ecosystems, or public health impacts if water bodies are used for recreational activities.

Vulnerable Populations

The SVI identified the presence of certain populations within the City that may be more vulnerable to climate change hazards. In addition to the SVI, the Connecticut Department of Public Health (DPH)[1] has identified at least three assisted living facilities and eight convalescent homes in Danbury.

[1] https://www.elicense.ct.gov/Lookup/LicenseLookup.aspx