

**HAZARD MITIGATION PLAN UPDATE
ANNEX FOR THE CITY OF NORWICH**

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

DECEMBER 2017

ADOPTED

MMI #3570-09



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1.0 INTRODUCTION

1.1 Purpose of Annex

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

The primary goal of this hazard mitigation plan annex is to identify risk to natural hazards and potential mitigation measures for such natural hazards in order to **reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources**. This includes the reduction of public and private damage costs. Limiting losses of and damage to life and property will also reduce the social, emotional, and economic disruption associated with a natural disaster.

1.2 Setting

The City of Norwich is an urban community in the north-central region of New London County that was founded in 1659. The community has since grown to a population of 36,117 as of the 2000 census. Additional growth over the next decade brought the total population of the City to 40,493 as of the 2010 census. The City is approximately 29 square miles in area and consists of several villages including Taftville, Norwichtown, Occum, Greenville, and Thamesville. The City is bordered by Bozrah to the west, Franklin to the northwest, Sprague to the north, Lisbon to the northeast, Preston to the east and southeast, and Montville to the south.

Norwich is located at the focus of several major transportation corridors. Major roads and bus lines allow access to Norwich and include Interstate 395, Route 2, Route 12, Route 32, Route 82, Route 97, Route 169, and Route 642. Rail lines that travel through the City include the Providence/Worcester line and the New England Central line. The rail lines allow residents and goods to travel from Norwich to New London and other communities throughout southeastern Connecticut and the eastern seaboard.

Major waterways include the Yantic River (which drains from Bozrah and Franklin), the Shetucket River (which drains from Sprague and forms the eastern boundary of the City), and the Thames River. The Thames River, a major navigable estuary in southeastern Connecticut, is formed by the confluence of the Yantic and Shetucket Rivers and drains to Long Island Sound.

1.3 Plan Development

The 2017 HMP and its annexes were developed through a series of meetings and the completion of written questionnaires, personal interviews, and workshops as described in the Multi-

Jurisdictional HMP update. Since that time, the HMP has been available in local governmental offices and available to emergency personnel. Residents were encouraged to contact the Emergency Management Director with any concerns regarding emergency response or potential projects related to natural hazard damage.

Based on the existing plan, existing information, and hazards that have occurred since 2017, SCCOG determined that the following data collection program would be sufficient to collect data to update the Multi-Jurisdictional plan and each annex.

- ❑ A survey soliciting public input was hosted at www.surveymonkey.com/r/SCCOGHazard from October 17, 2016 through March 17, 2017. Topics addressed by the survey included the types of natural hazards that concern participants, the assets, infrastructure, and government services they feel are most at risk, and the types of mitigation measures they support. The survey link was publicized along with the public meetings in *The Day*, *The Norwich Bulletin*, and local *Patch* websites, and at all public meetings.
- ❑ The SCCOG issued a press release on November 4th, 2016 announcing two public information meetings on the multi-jurisdictional HMP update. This press release was published in the *Norwich Bulletin* and *The Day*, as well as in relevant local "Patch" news websites. This notice was also posted on the SCCOG Facebook page and website. The public information meetings were held on November 28 and December 1, 2016, at the Town of Groton Library and the SCCOG office, respectively.
- ❑ A data collection meeting was held with the on November 30, 2016 to discuss the scope and process for updating the plan and to collect information. The Emergency Management Director coordinated the local planning team which included the City Planner and the Director of Public Works. The meeting focused on reviewing each section of the existing natural hazard mitigation plan and annex, critical facilities, and various types of hazards that have affected the City and that should be addressed in the update.
- ❑ The draft that is sent for State review will be posted on the City website (<http://www.norwichct.org/>) as well as the SCCOG website (<http://www.seccog.org>) for public review and comment. In addition, a hard copy will be made available in the SCCOG office in Norwich. A press release will announce the availability of the HMP for review. This will provide residents, business owners, and other stakeholders throughout the SCCOG region the opportunity to review and comment on a relatively complete draft with all annexes. Comments received from the public will be incorporated into the final draft where applicable following State and Federal comments.

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

1.4 Progress Monitoring

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

The HMP will be on file with the Emergency Management Director and at the Planning & Neighborhood Services Department to assist in guiding growth decisions. See Section 2.5 for recommendations related to integrating the findings of this HMP into other City planning documents. The City will encourage residents to contact the Emergency Management Director with concerns related to natural hazards or emergency response via the City's website. Such announcements will also state that the HMP is available for public review at the Planning & Neighborhood Services Department as well as available on the City's and the SCCOG's website.

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

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

2.0 COMMUNITY PROFILE

2.1 Physical Setting

The City of Norwich is located in the north-central section of the SCCOG. Elevations range from approximately mean sea level along the Thames River and Fishers Island Sound to just over 500 on Plain Hill in the northwestern section of the city. The southeastern area of the city near the confluence of the Yantic and Shetucket Rivers is the most densely developed area, while outlying areas, particularly in the northwestern portion of the city, are relatively rural. As noted in the 2002 *Plan of Conservation and Development*, many areas have rough topography, resulting in an urban community that is irregular and fragmented with a sometimes eccentric, twisting and occasionally steep street pattern.

Geology is important to the occurrence and relative effects of natural hazards such as earthquakes. Thus, it is important to understand the geologic setting and variation of bedrock and surficial formations in lands underlying the City of Norwich.

The City of Norwich lays above five bedrock formations which trend southwest to northeast across the area. The majority of the city is underlain by the Tatnic Hill formation, while areas located to the west of Interstate 395 are underlain by the Fly Pond member of the Tatnic Hill formation, the Yantic member of the Tatnic Hill formation, the Hebron gneiss, and the Canterbury gneiss. Each of these formations consists primarily of gneiss and schist which are relatively hard metamorphic rocks.

There are three bedrock faults mapped within or near the City of Norwich boundary. The Honey Hill Fault, a thrust fault that is Devonian or Ordovician in origin, parallels the City's southern boundary with Montville. An unnamed fault runs southeast from the vicinity of Mohegan Park to intersect with the Honey Hill Fault in Preston near Happyland. A third unnamed fault runs southeast from Baltic into Preston, approximately paralleling a portion of the City's boundary with Sprague.

The City's different surficial geologic formations include glacial till and stratified drift. Refer to the Multi-Jurisdictional HMP for a generalized view of surficial materials. The majority of the City is underlain by glacial till. Areas adjacent to the Shetucket River, the Yantic River, Trading Cove Brook, and Byron Brook have fairly extensive areas underlain by sand and gravel or floodplain alluvium. Till contains an unsorted mixture of clay, silt, sand, gravel, and boulders deposited by glaciers as a ground moraine. The amount of stratified drift present is important as areas of stratified materials are generally coincident with floodplains. These materials were deposited at lower elevations by glacial streams, and these valleys were later inherited by the larger of our present-day streams and rivers. However, the smaller glacial till watercourses can also cause flooding. The amount of stratified drift also has bearing on the relative intensity of earthquakes and the likelihood of soil subsidence in areas of fill.

2.2 Land Use and Development Trends

Norwich was an important colonial seaport in the 17th century and one of Connecticut's largest cities in the 18th and 19th centuries. Shipbuilding and associated industries grew in the area near the head of the Thames River, spurring the development of homes and a broad economic base. The introduction of rail lines in the 19th century further spurred industrial development particularly in the vicinity of Yantic, including textile mills. Residences were constructed to house the workers to these industries, and fine homes were built on hillsides overlooking the commercial and industrial areas. The City made a concerted effort to develop hydropower and other utilities (water, sewer) to provide service to the residents and businesses of the city. In 1904, the City purchased a commercial utility and formed Norwich Public Utilities to provide water, sewer, natural gas, and electricity service.

The 20th century saw a decline of industry in Norwich as many larger industries moved south, the primary railroad line between Boston and New York was relocated through New London, and the nation became less reliant on shipping goods via water. As more goods began to be shipped via trucks, Norwich lost the competitive advantage of its location on the Thames. In addition, Interstate 95 bypassed Norwich such that vehicular traffic between New York and Boston also did not need to pass through the city.

According to the 2002 *Plan of Conservation and Development* for the City, 75% of the community is either developed or committed to a specific use, while 25% is considered vacant. Approximately 55% of the developed land in the city is considered residential, with 12% considered to be open space or recreation, 5% to be retail or commercial, 3% to be industrial, and the remainder to be associated with utilities, institutional, or other public use. Mohegan Park, a primarily forested area that includes hiking and biking trails, picnic areas, a beach, and playgrounds is the City's largest park. The 2002 Plan noted that over 4,000 acres of land could be developed in the city.

The "2006 Land Cover by Area" data developed by the University of Connecticut Center for Land Use Education and Research (CLEAR) showed approximately 48% of City covered by deciduous or coniferous forest and forested, non-forested, and tidal wetlands. 18% of the City was used for turf and grass, other grasses, and agricultural field. Only 33% was "developed."

SCCOG data on land use collected in 2011 indicates that approximately 54% of City land is developed, 13% has been dedicated to open space, and 32% remains hypothetically open to development. Much of this change may be due to differences in land use designation between the UConn CLEAR program and SCCOG. For example, very low density residential is considered developed land by SCCOG, despite the fact that a large portion of each parcel may be open space.

According to the 2011 SCCOG data, 24% of the developed area is low and very low density residential land, while 37% is medium and high density residential. 18% is transportation, communications, or utility usage. The remaining approximately 21% of the developed area consists of industrial, commercial, and institutional uses.

Today, Norwich is primarily a service center rather than an industrial hub. Casino and tourism employment is one of the top employment sectors for city residents. Commercial corridors with restaurants and shops are located along Route 32, Route 82, and other State roads in the city, as well as in downtown areas. Commercial development such as Dodd Stadium, which is home to the Connecticut Tigers Baseball team and the Norwich Municipal Ice-Skating Rink, has continued to help Norwich's economy. Dodd Stadium draws visitors from all around the southeastern Connecticut area.

Current industrial areas are located along the Yantic River, the Shetucket River, and the Thames River. The 450-acre Norwich Industrial Park has allowed for many businesses to operate in Norwich including Computer Sciences Corporation, Foxwoods Resort Casino Training Center, Frito-Lay, and the Connecticut Tigers at Dodd Stadium. Other sizeable enterprises include Bob's Discount Furniture distribution center, Phelps Dodge Industries / Freeport-McMoran Copper Products, and the Mashantucket Pequot Tribal Nation's Spa at Norwich Inn.

According to the 2002 *Plan of Conservation and Development*, approximately 47% of all housing units in the City are renter-occupied. Many were built during the housing boom of the 1970's and 1980s, but most housing structures pre-date these decades and as such do not meet current or even recent building codes. The low percentage of owner occupancy can lead to increased susceptibility to natural hazards, as owners are not present on a daily basis to secure their properties.

In the time since the last HMP was written in 2012, development has continued at a slow but steady pace. Recent developments include:

- ❑ Subdivisions off Hanson Road
- ❑ An apartment and condominium complex in Taftville near the Shetucket River is mostly complete. There have been some permitting issues centered around the impacts that tree removal on the property is having on runoff, erosion, and landslide hazards. There is also a disagreement about the need for a retaining wall on the property.
- ❑ Historic Ponemah Mills on the Shetucket River at the Shetucket Falls Dam is undergoing redevelopment into residential use. This property is in the Special Flood Hazard Area.
- ❑ Businesses are being constructed on Boswell Avenue. Properties in this area often experience floods, and therefore this development is a concern for the City. A Dollar General is being built here, and will have a large detention basin for stormwater management.

2.3 Drainage Basins and Hydrology

The Thames River is a long tidal estuary in Connecticut. It flows south from Norwich approximately 15 miles, to New London and Groton, which flank its mouth at the Long Island Sound. All land in the city eventually drains to the Thames River, although approximately two-thirds of the City drains to the Shetucket or Yantic Rivers first. Additional sub-regional watersheds are associated with Beaver Brook (which drains to the Shetucket River in Sprague), Poquetanuck Brook (which drains to the Thames River in Montville), Trading Cove Brook (which drains to the Thames River in Norwich), and Susquetonscut Brook which drains to the Yantic

River. Other notable bodies of water found throughout Norwich include Bog Meadow Reservoir, Wilcox Pond, Spaulding Pond, Eely Pond, Great Plain Brook, Ford Brook, Bobbin Mill Brook, and Goldmine Brook.

The headwater streams of the Shetucket River are heavily flood controlled such that widespread flooding is no longer an issue along this watercourse. Three significant dams are located on Shetucket River in Norwich at Occum, Taftville, and Greenville, but they do not offer any flood abatement capacities.

The Yantic River is not flood controlled, and flooding due to severe weather is a frequent issue particularly in the Yantic and Norwichtown sections of the city. City officials indicate that upstream "releases" along the Yantic River occasionally cause flooding in Norwich. It is unclear whether the releases originate in Bozrah, Colchester, Lebanon, or Salem.

2.4 Governmental Structure

The City of Norwich is governed by a Council/Mayor/Manager government. The Mayor presides over the City Council and with the Council appoints a City Manager who serves as the chief executive officer of the City and is directly responsible for the administration of all departments, agencies, and offices. Together, Mayor and the City Council review and approve all City business.

The City of Norwich has several departments that provide municipal services. Departments pertinent to natural hazard mitigation include the Emergency Management, Finance, Fire, Planning & Neighborhood Services, Police, Public Utilities, and Public Works Departments. In addition, there are several boards and commissions that can take an active role in hazard mitigation, including the Commission on the City Plan, Harbor Management Commission; the Board of Public Utilities Commissions; the Public Works & Capital Improvements Committee; the Public Safety Committee; the Inland Wetlands, Watercourses, and Conservation Commission; and the Zoning Board of Appeals. The general roles of most of these departments and commissions are common to most municipalities in SCCOG and were described in Section 2.8 of the Multi-Jurisdictional HMP. More specific information for the departments and commissions of the City of Norwich is noted below:

- ❑ The Board of Public Utilities Commissioners reviews and provides recommendations for expansion of public utilities such as water, sewer, and electricity and approves rate increases by Norwich Public Utilities.
- ❑ The Commission on the City Plan is the planning authority for the City and reviews and approves new site plans. The City Council is the zoning authority of the City. The Planning & Neighborhood Services Department oversees orderly and appropriate use and development of residential, commercial, and industrial land and the conservation of natural resources. They assist the Commission on the City Plan by reviewing a wide range of land use applications, zoning regulation amendments, planning and development projects, and grant opportunities to ensure that development and growth in the City is consistent with existing land use, environmental policy, and the objectives of the *Plan of Conservation and*

Development. They administer the City's Zoning Regulations and Inland Wetlands and Watercourses Regulations, enforce building codes, perform planning studies, and provide technical assistance to developers.

- ❑ The Emergency Management Department strives to protect life and property from natural and man-made disasters through meaningful public information and education programs as well as Emergency Preparedness (planning, mitigation, response, and recovery). The department oversees emergency response in the City during natural and man-made disasters. The Emergency Management website (<http://www.cityofnorwich.org> – Click on "Emergency Management") provides information for residents about natural hazard preparedness, terrorism, sheltering, and joining the statewide Reverse 9-1-1- system. This department also oversees the Community Emergency Response Team (CERT) that provides support to the City's first responders and to the City's shelters.
- ❑ The Finance Department is responsible for accounting and financial reporting, budgeting, information technology, payroll, purchasing and accounts payable, and tax collection. Coordination with the Finance Department is essential to constructing successful mitigation projects.
- ❑ The City of Norwich Fire Services consists of two career (full-time) stations and five volunteer stations. The Norwich Fire Department has 59 career firefighters and administrative staff and responds to approximately 2,200 fire and emergency-related calls each year with an average response time of two minutes. The volunteer system is comprised of the Taftville, Yantic, Occum, East Great Plain, and Laurel Hill volunteer fire departments. They also participate in more than 200 prevention and public education events each year and have fire prevention tips for all seasons on their website. They provide fire suppression, fire prevention, rescue, and hazardous materials response services to the City.
- ❑ The Harbor Management Commission provides guidance for economic growth and enhanced public enjoyment of the City's tidal waterfront including the lower sections of the Shetucket and Yantic Rivers and the Thames River. It maintains the City's Harbor Management Plan and recently released a vision plan for future waterfront development, as well as assigning mooring locations.
- ❑ The Inland Wetlands, Watercourses, and Conservation Commission is the Inland Wetlands Regulatory Agency for the City of Norwich and reviews plans for compliance with said regulations and maintains the City's inland wetlands map.
- ❑ Norwich Public Utilities provides electricity, potable water, natural gas, and sewer service to the City of Norwich and the surrounding region. They maintain and test fire hydrants utilized by the Fire Department.
- ❑ The Police Department provides preventative planning for public safety, enforcement of laws, administration of police personnel, traffic authority, and issuance and recording of permits for vendors, auctioneers, and firearms. There are 82 paid members. During a hazard event, they provide situation containment and control services.

- ❑ The Public Safety Committee reviews all public safety matters in the City and recommends expenditures to the City Council for repairing or purchasing equipment.
- ❑ The Public Works & Capital Improvement Committee reviews and recommends capital improvements in the City.
- ❑ The Public Works Department includes the Engineering and Administration Division, Streets and Parks Division, Building Maintenance Division, Fleet Maintenance Division, and daily operation of the Transfer Station. They provide services including safe, efficient and well-maintained infrastructure of roads, bridges, snow removal and deicing on roads; tree and tree limb removal in rights-of-way; and maintain and upgrades storm drainage systems to prevent flooding caused by rainfall.
- ❑ The Zoning Board of Appeals reviews projects that were denied by the City Council or were cited by the Planning & Development Department, and those that require variances.

In addition to the departments described above, the City of Norwich has several other departments similar to surrounding municipalities, including Human Resources, attorneys, etc. The roles of City departments have not changed since the time of the previous HMP. Thus, the City of Norwich is technically, financially, and legally capable of implementing mitigation projects for natural hazards. As discussed in the next section and the historic record throughout this annex, the City of Norwich is densely developed in certain areas but practically rural in outlying areas, presenting a range of vulnerability to certain types of natural hazards.

2.5 Review of Existing Plans and Regulations

The City has several Plans and regulations that suggest or create policies related to natural hazard mitigation. These policies and regulations are outlined in the Emergency Operations Plan, *Plan of Conservation and Development*, *Harbor Management Plan* and Ordinance, *A Waterfront Vision for the City of Norwich*, Zoning Regulations, and Inland Wetland Regulations. The Zoning Regulations were recently updated to incorporate new NFIP requirements that match suggestions provided in the previous HMP.

Emergency Operations Plan

The City has an Emergency Operations Plan (EOP) that is updated by the Emergency Management Director and certified by the City Manager annually. This document provides general procedures to be instituted by the City Manager and/or designee, Emergency Management Department, Police Department, and Fire Department in case of an emergency. Emergencies can include but are not limited to natural hazard events such as hurricanes and nor'easters as noted in the Severe Weather Annex of the EOP. The EOP is directly related to providing emergency services prior to, during, and following a natural hazard event.

Plan of Conservation and Development (2013)

The Norwich POCD seeks to be a statement of policies, goals and standards for the physical and economic development of the City and recommends the most desirable uses types and population densities in various parts of the municipality. The 2002 edition of the POCD predated the 2005 edition of the HMP, but it included many strategies pertinent to natural hazard mitigation. Recommendation strategies from the 2002 POCD were noted as being a high or low priority, and were as follows:

High Priority

- ❑ Identify steep slopes with additional natural resource potential, such as those associated with scenic view sheds or those within proximity to surface water bodies, and prioritize them for conservation efforts.
- ❑ Continue the strict enforcement of floodplain regulations to minimize potential flood hazards and property damage during flood events.
- ❑ Continue to support linear park and trail systems along Norwich's major rivers, including a possible expansion of the Norwich Heritage Riverfront Walkway.
- ❑ Seek out additional funding for open space acquisition from Federal/State programs & encourage the private donation of open space.
- ❑ Improve public access to coastal areas and expand river walkways.
- ❑ Explore opportunities to market water service regionally while preserving capacity to meet Norwich demands.
- ❑ Continue to implement comprehensive plans to maintain and upgrade water service infrastructure.

Low Priority

- ❑ Identify rock outcrops with additional natural resource potential, such as those located atop ridgelines or those located along rivers, and prioritize them for conservation efforts.
- ❑ Consider additional regulations and design standards for the development of properties with slopes greater than 15%.
- ❑ Explore means to remove existing structures from the floodplain and relocate associated residents and businesses.
- ❑ Investigate means to remove outdated industrial-age dams on the major rivers.
- ❑ Continue to regulate development within and adjacent to inland wetlands.
- ❑ Ensure the City has a system in place for periodic cleaning of storm sewers and drainage systems.
- ❑ Establish a municipal land acquisition fund to expand existing public land holdings or to purchase other significant natural areas.
- ❑ Coordinate with Norwich Public Utilities to provide full access to all emergency surface water supplies.
- ❑ Provide leadership in developing a regional approach to the development of new water supplies and existing resources.

The Norwich POCD was most recently updated in 2013. The update includes the following new

actions aligned with hazard mitigation:

- ❑ Strive to preserve natural resources such as wetlands, watercourses, steep slopes, 100 year flood zones, and NDDDB identified areas.
- ❑ Protect coastal resources from the effects of seas level rise through the aid of federal programs for coastal management.

Therefore, the 2002 and 2013 editions of the Norwich POCD are considered consistent with the current goals and actions of the hazard mitigation plan. The next update to the POCD (scheduled for 2023, beyond the life of the current hazard mitigation plan) will continue to incorporate the elements of the hazard mitigation plan.

Harbor Management Plan

The Harbor Management Plan of the City of Norwich, as enacted under City Ordinance 1229, authorizes the Harbor Master to carry out harbor management directives and enforce all provisions of the Plan, including collecting fees for mooring permits and assigning mooring locations; standardizing mooring tackle requirements; and enforcing wake and speed, waterskiing, motor, noise, and refuse regulations. In particular, this ordinance allows the City to have a list of persons who currently have boats moored such that removal or emergency response can be coordinated. The Harbor Management Plan was updated in 2012, and was undergoing additional updates as of 2017.

Zoning Regulations

The Zoning Regulations of the City of Norwich were last updated on November 2, 2015. They include a variety of preventative regulations pertinent to mitigating natural hazards. These regulations are applied during the permitting process for new construction and during substantial improvement of existing structures.

Chapter 3.4 discusses floodplain and floodway zoning in the City. The City has adopted the FIS and FIRM released by FEMA in July 2011 and utilizes areas on the FIRM denoted as Zone A, Zone AE, and floodway as its regulatory flood hazard map. In particular:

- ❑ Chapter 3.4.3.3 notes that any structure partially located within a floodplain or is considered to be entirely within the floodplain and must comply with the more restrictive building standards.
- ❑ Chapter 3.4.4.1 authorizes the Zoning Enforcement Officer to verify the floodplain and floodway boundary using the elevations provided in the New London County FIS. Chapter 14.3.2 authorizes the Zoning Enforcement Officer to investigate floodway data from other sources for Zone A floodplains and to request flood data for watercourses not mapped by FEMA.
- ❑ Chapter 3.4.5 notes prohibited uses within the floodplain and floodway, and specifies that floodway encroachments must certify that there will be no net increase in flood levels

during the base flood discharge, no residential buildings will be permitted in floodways, and new construction or substantial improvements cannot be located entirely or partially over water unless the structure is a water dependent use.

- ❑ Chapter 3.4.6 assigns permitted uses within the floodplain and floodway that require a permit from the Zoning Enforcement officer, and authorizes that officer to request erosion and sediment control plans and any other information necessary to comply with the Zoning Regulations.
- ❑ Chapter 3.4.7 notes uses requiring a special permit in floodplains and the floodway. Such permits are issued by the Commission on the City Plan. These include dams, paving, excavation, and new structures. In particular, all new construction or substantial improvement of residential structures, including manufactured or mobile homes, shall have the lowest floor (including the basement) elevated 1.5 feet above the base flood elevation with utilities also located to prevent water from entering or accumulating during flooding.
 - All new construction or substantial improvement of non-residential structures must also meet this requirement. Non-residential structures must also be floodproofed to 1.5 feet above the base flood elevation with walls capable of resisting hydrostatic and hydrodynamic loads and the effects of buoyancy.
 - This section also requires that the water holding capacity of the floodplain (except in tidally-influenced areas) not be reduced and authorizes the City to require storage compensation.
 - This section currently requires that residential structures repaired as a result of substantial damage be elevated to or above the base flood elevation.
- ❑ Section 3.4.8 notes that variances may be granted by the Zoning Board of Appeals.

The City of Norwich found that this most recent 2015 update to the Zoning Regulations had inadvertently led to noncompliance with FEMA requirements. The City Council, which is Norwich's zoning authority, amended both ZR Section 3.4 and the "Flood Related Terms" in in the Definitions Section. These amended regulations became effective on June 1, 2017.

Code of Ordinances

Chapter 19-23 of Norwich's Code of Ordinances presents the City's Subdivision Regulations and notes that all public utilities and facilities, such as sewer, gas, electrical, and water systems, must be located and constructed to minimize or eliminate flood damage. Chapter 19-23 also requires that applicants submit a coastal site plan if the activity is located within the Coastal Area Management Boundary of the City. The coastal site plan requirements are codified in Chapter 17.1.5. This area is located within 1,000 feet of the Thames River and the lower sections of the Yantic and Shetucket Rivers as defined by the Connecticut DEEP. It authorizes the commission to consider impacts to coastal resources from the proposed development.

Inland Wetland and Watercourses Regulations

The Inland Wetlands and Watercourses Regulations in the City of Norwich were last amended on June 1, 2010. The regulations require a permit for certain regulated activities which take place within 100 feet of a wetland or watercourse. These regulations build on the preventative flood mitigation provided by the Zoning regulations by preventing fill and sedimentation that could lead to increased flood stages.

2.6 Critical Facilities, Sheltering Capacity, and Evacuation

The City of Norwich considers several facilities to be critical to ensure that emergencies are addressed while day-to-day management of the City continues. In addition, locations with populations that may be at additional risk during an emergency are also considered to be critical. Critical facilities are presented on figures throughout this annex and summarized in Table 2-1.

As shown on Table 2-1, only three critical facilities (the Yantic Fire Station, the water pollution control facility, and the Stanton Elementary School) are located within the 1% annual chance floodplain, and no critical facilities are located within potential hurricane surge zones. These facilities are described in more detail below.

Fire Departments

The City has seven fire stations; five are volunteer companies while two house career fire fighters. Many of the fire stations are historic. In particular, the Yantic Fire Engine Company No. 1 was established in 1847, and the Greeneville Fire Station was established in 1896. These buildings have been recently renovated and the City is continuing to explore ways to mitigate flooding in the vicinity of the Yantic Fire Engine Company. The seven fire departments provide excellent fire and rescue response to the City, and have pump trucks, brush trucks, and boats to provide fire response and rescue services.

The City believes that the Yantic Fire Station qualifies for a grant that would fund relocation of that Fire Department. The building is historic, limiting on-site mitigation options. The City will continue to explore possible actions to address the vulnerability of this facility.

SCCOG completed an assessment of critical facilities in the region in 2017, fulfilling an action listed in the 2012 edition of the multi-jurisdiction hazard mitigation plan. Two fire stations (Yantic and Occum) and the Norwich Public Works facility were included in the assessment. The assessment determined that all three faced current flood risks and would experience increasing flood risks. Recommendations are incorporated into the list of actions in Chapter 11 of this annex and summarized in the table below.

Facility	Address	Short-Term (0-20 years)	Long-Term (>20 years)
Yantic FD	151 Yantic Rd	Eliminate basement	Relocate facility
Occum FD	44 Taftville Occum Rd	Eliminate basement	Relocate facility
Public Works	50 Clinton Ave	Dry floodproof the utility room	Wet floodproof all remaining lower areas

Municipal Facilities

Norwich Public Utilities (NPU) provides electric, water, sewer, and natural gas service to the City and the surrounding area. The City's Emergency Operations Center (EOC) operates out of NPU's headquarters, while the City's backup EOC is located at the Norwich Fire department Headquarters station located at 10 North Thames Street. Both facilities have generators for emergency power. The City's water pollution control facility on Hollyhock Island (at the mouth of the Yantic River) is located within the 1% annual chance floodplain, and several of the city's water and sewer pumping stations may also be located in the floodplain. The Rose City Senior Center is one of the City's backup shelters and is not susceptible to flooding. Public Works facilities are not located within the 1% annual chance floodplain although the headquarters is located within the 0.2% annual chance floodplain.

Literature is an important means of conveying and educating the public. Located in the main lobby of City Hall are several pamphlets describing emergency checklists, home emergency plans, wildfires, evacuation routes, etc. In addition, this information is sent to all new homeowners in the City.

**TABLE 2-1
Critical Facilities**

Facility	Address or Location	Emergency Power?	Shelter?	In 1% Annual Chance Floodplain?	In Surge Zones?
Emergency Services					
Fire Department Headquarters - Station 1	10 North Thames Street	✓			
Greenville Fire Department - Station 2	446 North Main Street	✓			
East Great Plain Volunteer Fire Department	488 New London Turnpike	✓			
Laurel Hill Volunteer Fire Company	509 Laurel Hill Road	✓			
Occum Volunteer Fire Department	44 Taftville-Occum Road	✓		✓	
Taftville Fire Company No. 2 (Volunteer)	134 Providence Street	✓			
Yantic Fire Engine Company No. 1 (Volunteer)	151 Yantic Road	✓		✓	
Police Department	70 Thames Street	✓			
Municipal Facilities					
City Hall / backup EOC / Public Works*	100 Broadway	✓			
Norwich Public Utilities / EOC	173 North Main Street	✓			
Rose City Senior Center	8 Mahan Drive	✓	✓		
Public Works Headquarters	50 Clinton Avenue	✓			

**TABLE 2-1
Critical Facilities**

Facility	Address or Location	Emergency Power?	Shelter?	In 1% Annual Chance Floodplain?	In Surge Zones?
Public Works - Fleet Management	Asylum Street				
Water Pollution Control Facility	Falls Avenue	✓		✓	
Health Care Facilities & Senior Living					
Backus Hospital	326 Washington Street	✓			
Norwich Public Schools					
Samuel Huntington Elementary	80 West Town Street				
Thomas W. Mahan Elementary	94 Salem Turnpike				
John M. Moriarty Elementary	20 Lawler Lane	✓	✓		
John B. Stanton Elementary	386 New London Turnpike			✓	
Uncas Elementary	280 Elizabeth Street Extension	✓	✓		
Veterans Memorial Elementary	80 Crouch Avenue				
Wequonnoc Elementary	155 Providence Street				
Kelly Middle	25 Mahan Drive	✓	✓		
Teachers' Memorial Middle	15 Teachers Drive	✓	✓		
Deborah Tennant-Zinewich - Special Education	30 Case Street				
Hickory Street (Special Education)	201 Hickory Street				
Alternate Public Schools					
Integrated Day Charter School	68 Thermos Avenue				
Norwich Technical High School	7 Mahan Drive				
Private Schools					
Wildwood Christian School	35 Wawecus Hill Road				
Montessori Day	218 Dudley Street				
Norwich Free Academy	305 Broadway				

*Building & Maintenance

Health Care Facilities

The William W. Backus Hospital is partially located within the 0.2% annual chance floodplain of the Yantic River. This facility provides emergency, advanced outpatient, and inpatient services to the City of Norwich and the surrounding region. The hospital also posts emergency response procedures for natural hazards on its website. Residents can also travel to Windham Hospital in Willimantic for care.

Norwich includes many small commercial health care, senior living, and assisted living facilities throughout the city. For example, the West Side Walk-In Medical Center is available for minor health problems. These commercial entities have their own Emergency Operations Plans.

Norwich houses populations of people who are elderly and/or possess disabilities. Not surprisingly, the more populated areas include a higher percentage of individuals who may

require special assistance or different means of notification before and during natural hazards. The City does not keep a list of elderly or disabled residents who may need additional help in case of an emergency simply because the City has too great a population to maintain an accurate list.

Schools

The City of Norwich has a large public-school system that encompasses seven elementary schools, two middle schools, and two special education facilities. These facilities are considered to be critical facilities because they house a large student population that may not be prepared for emergencies to the extent of an adult. Students may choose to attend either Norwich Free Academy, a semi-public high school that is publically endowed by local municipalities and also funded by private sponsors which accepts students from around the world, or the Norwich Technical High School, one of seven Connecticut regional technical high schools. Norwich Free Academy is also home to the Slater Memorial Museum which attracts many visitors to Norwich. The Integrated Independent Day School offers alternative public pre-secondary education to Norwich Residents.

Several private schools are also located in the City. For example, the Wildwood Christian School and the Montessori Day School both offer pre-secondary education. The Integrated Day Charter School educates pre-K to 8th graders. Similar to the public schools, the City considers these to be critical facilities due to the ages of the children attending.

The City of Norwich also offers GED programs for adults, and boasts the Three Rivers Community College. However, these adult education facilities are not considered to be critical facilities since they cater to adult students.

Shelters

The City of Norwich has four primary shelters for residents and can activate an additional 10 shelters in case of a regional emergency. Each primary shelter has a backup generator and is staffed by the American Red Cross. The primary shelters are listed in Table 2-2. Additional sheltering space would be needed if Groton evacuated due to a hurricane, coastal flooding, or an accident at the Millstone Nuclear Facility in Waterford. Under that scenario, the City has agreements in place to provide short-term shelter to approximately 33,000 people. Of the additional shelters, three are certified by the American Red Cross.

**TABLE 2-2
Primary Shelters**

Facility	Address or Location	Short-Term Capacity	Long-Term Capacity
Kelly Middle School*	25 Mahan Drive	2,000	1,774
John M. Moriarty Elementary	20 Lawler Lane	900	775
Uncas Elementary School	280 Elizabeth Street Extension	1,000	599
Teachers' Memorial Middle	15 Teachers Drive	2,000	1,774
Total		5,900	4,922

*Shelter for disabled and special needs residents

Communications

The City has a robust communication system. All departments can communicate via portable radios on separate UHF and VHF communications frequencies as well as by cell phone and email. The City is also part of the Statewide CT Alerts "Everbridge" Reverse 9-1-1 system to provide emergency notification and response to areas affected by a natural hazard. Residents can communicate issues either by directly calling municipal departments or by utilizing a web tool located on the homepage of the City's website.

The Office of Emergency Management visits several civic groups each year to educate them on the threats that face the community, how to prepare, and how to relocate if necessary.

Evacuation Routes

The Emergency Management Director has a three-phase coastal evacuation plan on file that can be activated because of an emergency at the Millstone Nuclear Power Plant in Waterford, a coastal flooding emergency, or a hurricane. The evacuation map includes evacuation routes connected to the shelters in the City. If the City of Norwich needed to evacuate, residents would utilize Interstate 395, Route 2, Route 12, Route 32, Route 82, Route 97, or Route 169 to leave the City.

Additional Groups

In addition to City offices, The American Red Cross and the Salvation Army help provide shelter and vital services during disasters and participate in public education activities.

3.0 INLAND FLOODING

3.1 Setting / Historic Record

Flooding is the primary natural hazard that impacts the City each year as documented in the previous HMP. While riverine flooding is of primary concern, nuisance flooding and poor drainage are also issues at several locations in the City. Flooding is typically caused by heavy rainstorms, but can also be caused by relatively light rains falling on frozen ground, ice jams, or dam failures (as discussed in Section 10). A major concern to City officials and residents of Norwich is flooding along the Yantic River, a watercourse that is not protected by upstream flood protection projects as exist along the Shetucket River.

The maximum flood of record in Norwich occurred in September 1938 as a result of a major hurricane moving through New England. Refer to the Multi-Jurisdictional HMP for a description of this hurricane. If this flood were to reoccur at the present time, it would approximate a 0.3% annual chance flood. During this flood, high water marks of eight feet (8') were recorded at the corner of Bath and Franklin Streets north of the confluence of the Shetucket and Thames Rivers, and marks of five feet five inches (5'5") were recorded above the railroad track to Laurel Hill at the Shetucket River. The USGS gaging station on the Yantic River recorded an approximately 1% annual chance flood.

A selection of flood events that have impacted the City of Norwich since 1990, as listed in the Yantic River Natural Hazard Mitigation Plan (2000), by the NCD, and from accounts by City officials are listed below:

- ❑ January 1994: An ice jam followed by a quick thaw caused minor flooding at numerous locations along the Yantic River.
- ❑ March 1998: Flood height on the Yantic River measured at slightly more than 11 feet (a 10% annual chance flood).
- ❑ October 28, 2006: Flash flooding closed side roads adjacent to Interstate 395.
- ❑ March 2, 2007: Widespread flash flooding occurred due to heavy rainfall. Several roads were closed in Yantic.
- ❑ April 16, 2007: A nor'easter produced heavy rainfall that led to flooding along the Yantic River.
- ❑ February 13, 2008: Heavy rainfall fell on top of two to three inches of snow, causing several businesses on West Town Street to have three to five feet of water in their basements. The Yantic River crested nearly seven inches above flood stage.
- ❑ March 8, 2008: A heavy rain event totaling 4.81 inches caused businesses along Boswell Avenue to accumulate several inches of water resulting in minor property damage.

- ❑ December 12, 2008: Widespread rainfall produced up to 4.5 inches of rain in Norwich, causing major flooding along the Yantic River. The Yantic River crested at 11.82 feet and impacted Yantic and Norwichtown with many businesses forced to close due to flooding. Flooding from poor drainage also impacted Greeneville. In the East Great Plain area, floodwaters washed out the culvert beneath Montville Road that conveys Trading Cove Brook.
- ❑ July 2, 2009: Several roads in Norwichtown were flooded due to heavy rain, including a low-lying underpass beneath a railroad bridge on Wawecus Street that was closed for much of the day. Mediterranean Lane was also closed due to flooding. Fire crews were dispatched to assist residents with pumping water out of their basements in areas that typically experience flooding such as Bliss Place off Washington Street.
- ❑ March 2010 floods: Two heavy rainfall events occurred producing significant flooding in the region. The City experienced more flooded basements than it ever experienced previously, including in areas that never had an issue with flooding. Route 82 had a significant flood near the entrance to KFC and Staples, and over 9,000 sandbags were deployed to protect buildings across the City. Crouch Avenue experienced slumping hillsides due to the sustained heavy rainfall. Sections of West Town Street, New London Turnpike, Wawecus Street, and Mohegan Park Road were closed, as was the "Canada Bridge" on Sherman Street over the Yantic River. The Yantic Fire Engine Company No. 1 sustained flood damage. One employee parking lot was closed at Backus Hospital. Water rescues were performed on Interstate 395 in Norwich. The NCDC listed an estimated \$280,000 in property damage to homes and businesses occurred.
- ❑ On March 30, 2014, a wave of low pressure tracked northeast along a stationary frontal boundary from the Tennessee River Valley to the Mid-Atlantic Coast and into the Atlantic Ocean. Several inches of rain fell across Southern Connecticut resulting in flooding on the Yantic River. Anywhere from two to five inches of rain fell across southern New England. The Yantic River at Yantic exceeded its flood stage of 9.0 feet at 7:00 AM, crested at 10.10 feet at 10:00 AM and fell back within its banks at 5:45 PM. Numerous roads in Norwich were under two feet of water as a result. West Town Street under Interstate 395 was closed. A swift-water rescue had to be performed to extract someone from a car.

3.2 Existing Capabilities

The City attempts to mitigate inland flood damage and flood hazards by utilizing a wide range of measures including restricting activities in floodprone areas, replacing bridges and culverts, promoting flood insurance, acquiring floodprone structures, maintaining drainage systems, through education and outreach, and by utilizing warning systems. Many mitigation measures are common to all hazards and therefore were listed in Section 2.6. Additional mitigation measures have been put in place by the State and Federal government upstream of Norwich that helps to reduce flooding downstream, including several protection projects.

Flood Control Structural Projects

As noted in Section 3.4.4 of the Multi-Jurisdictional HMP, several significant flood control projects have been constructed by the USACE upstream of Norwich on the Shetucket and Quinebaug Rivers. These flood protection projects were completed in the 1950's and 1960's and greatly reduce the incidence and severity of flooding in Norwich. The USACE also deepened and widened a 700-foot section of the lower portion of the Shetucket River in 1958-1959, significantly improving the flood conveyance of the river downstream of Greenville Dam. In addition, two small reservoirs were constructed by the Soil Conservation Service (now the Natural Resources Conservation Service) in 1963 and 1964 on Spaulding Pond Brook to provide moderate control of upland runoff.

A flood prevention plan written by the Soil Conservation Service and the U.S. Department of Agriculture and sponsored by the Connecticut DEP in 1970 recommended the construction of two flood control dams upstream of Norwich in the Town of Lebanon. These dams would have reduced flooding potential along the Yantic River. However, strong opposition within the Town of Lebanon prevented this plan from being implemented.

Bridge Replacements, Drainage, and Maintenance

The Department of Public Works cleans and inspects catch basins and culverts at least annually or more often if problems are noted. When flooding occurs, the Public Works department or the Fire Department would handle the complaints depending on the location. For example, public works would inspect bridges and culverts and erect barricades to close roads, while the Fire Department responds to calls requesting help for flooded basements. The City uses a message system on its webpage and fields phone calls related to drainage complaints. Drainage complaints are reviewed by the Public Works Director. No formal logs are kept unless a project results.

A project to rehabilitate Canada Bridge (also known as the Sherman Street Bridge) is in the design phase. When completed, the bridge will be 1.5 feet higher than its current configuration. The project will also raise a section of Asylum Street 1.5 to two feet.

Regulations, Codes, and Ordinances

The City of Norwich has planning and zoning tools in place that incorporate floodplain management. The City of Norwich has included floodplain regulations in its zoning ordinance since January 1991, recently revised them in November 2015, and is currently working on another revision in order to bring them into compliance with FEMA requirements, as noted in Section 2.5. The City utilizes the 1% annual chance floodplain as defined by FEMA to regulate floodplain and floodway activities and requires 100 percent compensatory storage for any encroachment in the floodplain. The City also requires freeboard of 18 inches for new construction or substantial renovations, a greater amount of freeboard than the 12 inches recommended in some communities.

The City's zoning regulations allow for the Commission on the City Plan to require additional mitigation to reduce potential flooding. For example, the Norwich Commission on the City Plan required the Norwichtown Mall to erect a four-foot high concrete floodproofing reinforcement abutting the entire perimeter of its exterior walls. As part of this project, the State rebuilt the streambank on both sides of the Yantic River with rip-rap where the Yantic River crosses through the Norwichtown Mall property

Regulations covering development in inland wetland areas have been in existence since July 1974 and enforced by the City's Inland Wetlands, Watercourses and Conservation Commission. The City Council has also adopted a map prepared by the Inland Wetlands Watercourses and Conservation Commission which regulates building in wetland areas. With regard to stormwater drainage, the City Department of Public Works pursues a policy of zero percent increase in stormwater runoff when reviewing major development projects within the watershed, but this policy is not written.

Changes to the State's MS4 requirements will affect local stormwater runoff regulations. They require retaining water on site in order to improve downstream water quality. The City will monitor application of these new requirements to determine the effects they have on flood risk. City officials are reviewing limitations on impermeable surfaces in the local Zoning Regulations as part of the MS4 update.

Acquisitions, Elevations, and Property Protection

The City of Norwich has long accepted State and Federal assistance to remove floodprone properties from the floodplain. FEMA helped the City acquire one commercial property and three residential properties across the street from the Public Works Headquarters following the floods of 1982. These properties, and the former Pleasant Street mall property, are now all open space.

The State of Connecticut acquired and demolished twelve residences within the Yantic River's flood zone prior to the 2005 edition of the HMP. Part of the acquisition occurred at the intersection of Clinton Avenue and Wawecus Street. This area of vacant land will remain as open space for the City of Norwich.

The City has acquired the old Nutmeg Industries headquarters in the years subsequent to the 2012 edition of the HMP. The Company has relocated to a new building outside the flood zone.

While acquisition, especially commercial acquisitions, has historically been a high priority for the City, in recent years the City has had to change course. Officials report that the City owns many empty structures that it has acquired over the years, and is at capacity with regards to maintenance and monitoring. Until these properties are demolished or sold, the City is not interested in performing additional acquisitions. However, the City will pursue acquisitions of commercial floodprone properties if the acquisition project includes conversion to open space, and if funding is available. The City also supports acquisitions performed by land conservancies and similar organizations.

Norwich has 2,000 flood-protection sandbags that are filled and ready for deployment in case of emergency. They have an additional 20,000 bags that are empty. An REPT grant was used to purchase an automated sand-bagger that can rapidly fill bags as needed. These bags are deployed prior flood events to protect non-residential structures. The Emergency Manager maintains a call list of organizations that can be contacted for volunteer assistance with emergency flood response activities. This list was recently used to recruit volunteers to help direct traffic during a parade. Similar activities could be helpful during road flooding.

Flood Watches and Warnings

The Emergency Management Director, Fire Department, and Police Department access weather reports through the National Weather Service, and utilize Reverse 9-1-1 to telephone warnings into affected areas when flooding is imminent. The City also carries out public information and education programs about flood dangers and mitigation measures during non-emergency conditions.

The City has a specific warning procedure for Norwich Commons. Weather alerts sent to the Emergency Manager are forwarded to store owners. Deployable floodgates have been installed at many of these properties and this warning allows store owners to deploy them. The City also provides sandbags to supplement the floodgates.

The City has compiled a list of addresses of structures within the Special Flood Hazard Area. They are able to use this information to send out warnings and alerts. The City has also begun tracking repair costs for these properties to help determine long-term damage costs from flooding.

Summary

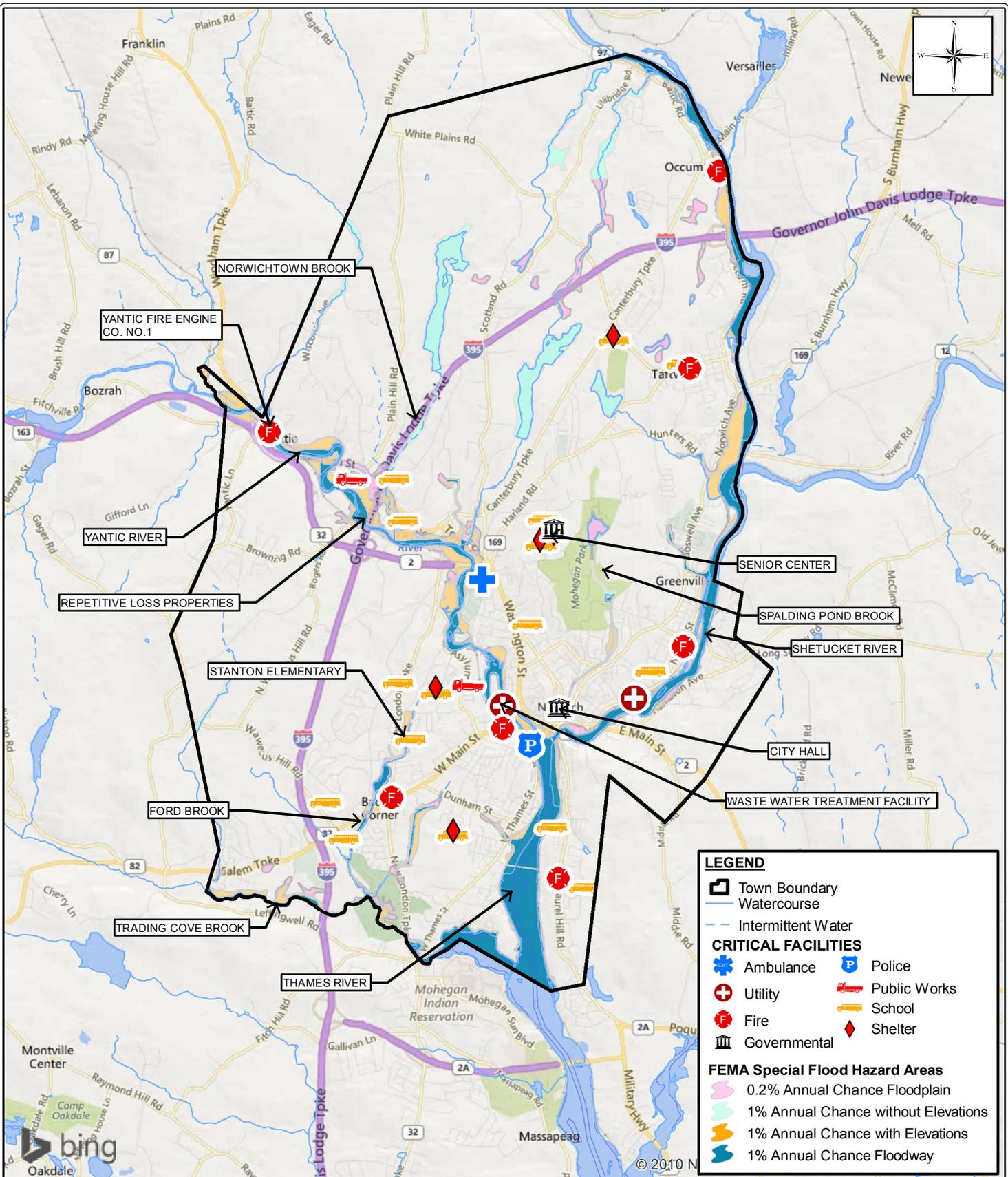
In general, municipal capabilities to mitigate flood damage have increased since the 2012 edition of the hazard mitigation plan was adopted.

3.3 Vulnerabilities and Risk Assessment

This section discusses specific areas at risk to inland flooding within the City. Areas at risk from coastal flooding are discussed in Section 4 of this annex. Inland flooding due to overbank flooding along the Yantic River is the most common type of flooding experienced by the City, although nuisance flooding in basements is also extremely common.

3.3.1 Vulnerability Analysis of Areas along Watercourses

Major inland watercourses and water bodies in Norwich have the 1% annual chance floodplain defined by FEMA. The majority of watercourses do not present flooding hazards to residents, buildings, or roadways. However, some watercourses do present recurring flooding issues. Impacts to structures are discussed in Section 3.3.2 and Section 3.3.3 below. This section discusses roadways and other floodprone areas along the major watercourses and water bodies in the city. Refer to Figure 3-1 for the location of the 1% annual chance floodplain in the City.



LEGEND

- Town Boundary
- Watercourse
- Intermittent Water

CRITICAL FACILITIES

- Ambulance
- Police
- Utility
- Fire
- Governmental
- Public Works
- School
- Shelter

FEMA Special Flood Hazard Areas

- 0.2% Annual Chance Floodplain
- 1% Annual Chance without Elevations
- 1% Annual Chance with Elevations
- 1% Annual Chance Floodway

MILONE & MACBROOM
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 www.miloneandmacbroom.com

FEMA SPECIAL FLOOD HAZARD AREAS

**SCCOG HAZARD MITIGATION UPDATE
 CITY OF NORWICH ANNEX**

NORWICH, CONNECTICUT

SOURCE: NATIONAL FLOOD HAZARD LAYER, FEMA, 2017

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

DRAWING NAME:

FIG. 3-1

**TABLE 3-1
Roadways Flooded by Nearby Watercourses in the City of Norwich**

Watercourse or Water Body	Road	Crossing
Yantic River	New London Turnpike	Bridge over Yantic River
	Sherman Street	Bridge over Yantic River with utilities beneath
	West Main Street	Two bridges over Yantic River at Hollyhock Island
Bobbin Mill Brook	Town Street	Culvert beneath road and commercial parking lot
	East Town Street	Culvert
	Scotland Road	Culvert near pond outlet
Spaulding Pond Brook	Main Street (Route 32)	Underground culvert system from downstream of Hickory Street and beneath each street and along most of Chestnut Street. The culvert daylight at the Shetucket River downstream of Main Street
	Bath Street	
	Willow Street	
	Chestnut Avenue	
	Lake Street	
	Broad Street	
	Hickory Street	Underground culvert system from outlet of Spaulding Pond to above Hickory Street
	East Baltic Street	
Ford Brook	New London Turnpike	Culvert
	Stanton Elementary School driveway	Underground culvert beneath school parking lot
	Newton Street	Culvert
Great Plain Brook	Village Court	Underground culvert from beneath Three Rivers Community College parking lot to Norwich Golf Course. Lower section near New London Turnpike and Village Court in 0.2% annual chance floodplain
	New London Turnpike	
	Melrose Park Road	
Tributary to Shetucket River from Mediterranean Lane	Boswell Avenue (Route 12)	Culvert – Road has flooded three or four times over past decade by Hess Station

Flooding is a concern for many roadways throughout Norwich. Flooding may inhibit emergency response times as well as damage roads and guardrails, undermine power lines, scour bridges, and wash out culverts.

Many areas in Norwich have extensive underground culvert systems. Several flooding sources in Norwich are associated with culverts of insufficient capacity to convey water during major storms. As a result, water backs up and occasionally floods the road near these culverts. Several of these culvert systems are decades old and may be undersized for the increased frequency and magnitude of rainfall over historical averages that Connecticut has been

experienced recently. Table 3-1 presents roadways in Norwich that have experienced recurring flooding issues.

The 2011 FIRM for New London County maps a floodway through the downtown area of Norwich. The Norwich City Planner and Emergency Management Director note that there is an underground culvert in that area that pipes water through the system, and claim that it was not accounted for in the FEMA mapping. Those officials have presented this site, as well as two other sites (including a development on West Town Street near Interstate 395, along the Yantic River), to FEMA for reassessment.

Poor drainage flooding is also an issue in several areas. The City reports that Mohegan Park road has issues with poor drainage in its low-lying areas, as does the bottom of Case Street, Bozrah Avenue, Shays Lane, Leffingwell / Sachem Plains, Montville Road, Glenwood Avenue, Smith Avenue, Wilderness Road, Mediterranean Lane, Boswell Avenue, and Saint Regis Avenue.

The "Canada Bridge" on Sherman Street passes over the Yantic River. This bridge has an issue with silt buildup and during periods of high water it is affected by the backwater of a downstream dam. The City wishes to remove the silt buildup but is deterred by the magnitude of the State and Federal permitting involved. Removing the downstream dam would also eliminate the threat to the bridge and the exposed utilities that hang beneath it by greatly lowering the water surface elevation beneath the bridge during flooding events. The City is moving forward with plans to elevate the bridge.

The New England Central rail line parallels the Yantic and Thames Rivers on its path through Norwich. Although portions of the line are within the flood zone, the rail bed is elevated in many places and creates a dike effect that isolates flood waters from inland areas.

Ice Jams are an issue upstream of Norwich in Baltic on the Shetucket River. This is partially due to the backwater effect of the Occum Dam located approximately two miles downstream of Baltic in Norwich. Ice Jams have also historically been an issue along the Yantic River, but are less frequent. Typically, ice jams do not cause flooding that affects structures.

3.3.2 Vulnerability Analysis of Private Properties

While most structures affected by flooding in the City are located along the Yantic River, there are several watercourses and water bodies in the City that have adjacent structures located within the 1% annual chance floodplain (mapped as Zone AE). The majority of these structures are residential. Table 3-2 presents the approximate number of structures located within the 1% annual chance floodplain based on the current DFIRM and 2007-2009 aerial mapping available from Microsoft. No structures appear to be located within the Zone A flood zone in Norwich.

Ponemah Mills, previously an empty industrial building, is being refurbished and made into residential apartments and condominiums. This will result in the creation of a new hazard as the building is vulnerable to flooding, but had previously not had tenants.

Note also that the Shetucket River and Spaulding Pond Brook have a significant number of structures located within the 1% annual chance floodplain. However, flood control activities (Section 3.2) located upstream of Norwich in the headwater streams of the Shetucket River and in the headwaters of Spaulding Pond Brook have greatly reduced the frequency and magnitude of flooding along these watercourses. Norwichtown Brook is impounded by the Bog Meadow Reservoir in its headwaters. While this impoundment is for water supply and not flood control, it also reduces the frequency and magnitude of flooding downstream.

**TABLE 3-2
Number of Structures within the 1% Annual Chance Floodplain**

Watercourse or Water Body	Number of Structures within Zone AE	Number of Structures within the Floodway
Ford Brook	9	4
Great Plain Brook	11	9
Hunter Brook	2	3
Norwichtown Brook	28	6
Shetucket River	82	12
Spaulding Pond Brook	16	29
Thames River	5	15
Trading Cove	0	5
Trading Cove Brook	7	4
Tributary to Shetucket River from Saint Joseph's Cemetery	0	13
Tributary to Thames River from Albert Street	1	2
Tributary to Yantic River from Mediterranean Lane	4	4
Yantic River	106	12
Total (389)	271	118

There are several areas of commercial and industrial properties along the Yantic River that have been identified as being located within the 1% annual chance floodplain and are considered to be susceptible to damage.

- West Town Street – A gas pipeline facility owned by the Algonquin Transmission Company
- Clinton Avenue – A mix of commercial buildings and an old industrial building
- Yantic Road – A tavern and several commercial buildings near the Yantic Fire Engine Company No. 1
- Pleasant Street & Sturtevant Street – Shop-Rite Plaza
- Connecticut Avenue – Plas-Pack Industries, Inc. experiences flooding, as does an electrical substation nearby.
- Rollins Road – Electrical substations
- Wawecus Street - Phelps-Dodge Industrial Plant – flooding of the access driveway restricts vehicular access to the facility. Freeport McMoRan is also flooded by the Yantic River.

- ❑ The Dollar General being constructed on Boswell Avenue will be located outside of the floodway after it was noted by City officials that the initial plan placed it within that high hazard zone. Nevertheless, the building is still in a SFHA and at risk to flooding.
- ❑ The newly refurbished office space known as "Foundry 66" in the downtown area is at risk to flooding.

Since the previous HMP, Nutmeg Industries has moved out of its property located along the Yantic River and relocated to a new headquarters building at 1 Ohio Avenue, which is outside of the floodprone area. The City has acquired the old building utilizing funds provided by the HMGP.

As of 2012, repetitive flood insurance claims had been filed at 19 properties in the City of Norwich over the preceding twenty-five years. These repeat claims demonstrate the serious nature of the flood hazards in the City of Norwich, particularly along the Yantic River. Six of the repetitive loss properties had been mitigated through buyouts. The remaining repetitive loss properties were located along the Yantic River (11), Great Plain Brook (1), and Norwichtown Brook (1). As of 2017, 21 repetitive loss properties are listed in Norwich, representing an increase of two. One of these is located along Ford Brook, while the other is of an undetermined location. In general, the repetitive loss list for Norwich had some inconsistencies and potential errors in both 2012 and 2017 – more than any other SCCOG jurisdiction – and could benefit from efforts to permanently correct errors.

The City of Norwich has no formalized program currently in place to identify the location or the number of structures that are susceptible to flooding. Such information would be valuable in directing hazard mitigation efforts to locations with the greatest risk. City planners should use the recently released DFIRM to identify the approximately 389 structures in the City that are located in the 1% annual chance floodplain. This could provide a list of addresses to inspect following a storm event and allow for the City to track building permits for repairs following a natural hazard. This information, in turn, would provide supporting data for future grant applications.

3.3.3 Vulnerability Analysis of Critical Facilities

As noted in Section 2.6, the only critical facilities located within a 1% annual chance floodplain are the waste water treatment facility on the Thames River, the Yantic Fire Engine Company No. 1, the Occum Fire Department, and John B. Stanton Elementary School. The waste water treatment facility and the elementary school do not typically experience flooding. The risk of inland flooding to these facilities is therefore considered to be low. The Yantic Fire Engine Company No. 1 is frequently flooded and the Fire Department moves equipment out of this building when major floods are forecast. The City is continuing to explore ways to mitigate flooding in this area. The Occum Fire Department is partly in the SFHA along the Shetucket River and has not flooded as often as the Yantic Fire Department.

The City's Department of Public Works offices and garage are located in the 0.2% annual chance floodplain of the Yantic River on the periphery of the 1% annual chance floodplain. This facility is located on the north side of Clinton Avenue and is susceptible to flood damage. The City

stores sandbags at this facility which they deploy to protect the structure when major floods are forecast.

SCCOG completed an assessment of critical facilities in the region in 2017, fulfilling an action listed in the 2012 edition of the multi-jurisdiction hazard mitigation plan. The two at-risk fire stations (Yantic and Occum) and the Norwich Public Works facility were included in the assessment. The assessment determined that all three faced current flood risks and would experience increasing flood risks. Recommendations are incorporated into the list of actions in Chapter 11 of this annex and summarized in the table below.

Facility	Address	Short-Term (0-20 years)	Long-Term (>20 years)
Yantic FD	151 Yantic Rd	Eliminate basement	Relocate facility
Occum FD	44 Taftville Occum Rd	Eliminate basement	Relocate facility
Public Works	50 Clinton Ave	Dry floodproof the utility room	Wet floodproof all remaining lower areas

3.4 Potential Mitigation Strategies and Actions

General potential mitigation measures that can be taken to reduce the effects of inland flooding were discussed in Section 3.7 and in Section 11.2.2 of the Multi-Jurisdictional HMP. General recommendations pertinent to all natural hazards that could affect the City are listed in Section 11 of this annex along with general and specific measures pertinent to reducing inland flooding in the City of Norwich under the categories of prevention, property protection, emergency services, public education and awareness, natural resource protection, and structural projects.

4.0 COASTAL FLOODING & SHORELINE CHANGE

4.1 Setting / Historic Record

Despite being located well-inland from the Connecticut shoreline, the City of Norwich has coastal resource areas that are tidally influenced. The coastal area of the City of Norwich consists of nearly 14 miles of riverfront associated with the Thames River, the lower section of the Yantic River upstream to Uncas Leap, and the lower section of the Shetucket River Greenville Dam. The shoreline of the City of Norwich contains developed shorefront along these rivers, with estuarine embayments (defined as a protected coastal water body with a direct connection to Fishers Island Sound) located at the confluence of the Shetucket River and the Yantic River, upstream of Hollyhock Island on the Yantic River, and just downstream of Greenville Dam on the Shetucket River. The coastal resources found in Connecticut and described by DEEP are listed in the Multi-Jurisdictional HMP.

Homes, businesses, and industry are located in close proximity to the shorefront along the coastal area. However, the City's location at the headwaters of the Thames River places many properties at higher elevations than low-lying areas adjacent to Long Island Sound. As such, the City does not typically experience coastal flooding, and only a few areas are at risk of coastal storm surge from hurricanes.

While coastal flooding is relatively infrequent in the City, hurricanes and tropical storms have the potential to induce coastal flooding and storm surge that can impact structures. No coastal flooding or storm surge events have occurred since the time of the previous HMP. However, the City is concerned with the potential long-term effects of sea level rise and its potential to exacerbate coastal flooding conditions in the future.

4.2 Existing Capabilities

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

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

The new Norwich Intermodal Transportation Center, constructed in 2010-2011 on an island at the mouth of the Yantic River, is a good example of recent construction abiding by flood damage

prevention regulations. The lower levels of the transportation center may be flooded by coastal storm surges.

As noted in Section 2.5, the City of Norwich has *A Waterfront Vision for the City of Norwich* which includes increasing public access and walkways near the riverfronts. This plan suggests that non-water dependent uses will be moved away from the shoreline and replaced with land uses more appropriate for the floodplain in the future.

The shoreline of Norwich contains many coastal flood control structures. Small, private bulkheads can be found in many of the commercially and industrially developed coastal neighborhoods. Larger structures such as the Trading Cove Dike and the Long Rock Dike are also located on the Thames River and provide a modicum of shoreline protection.

Like many communities, the City lacks existing policies and mitigation measures that are specifically designed to address sea level rise. Although the City of Norwich does not currently have a specific plan to address sea level rise, important pieces are in place in the form of the codes and regulations cited in this HMP that have been enacted to minimize storm, erosion, and flood damage to structures, such as requiring that new buildings located in the floodplain have 18 inches of freeboard above the base flood elevation.

Summary

Municipal capabilities to mitigate coastal flood damage have not changed since the 2012 edition of the HMP. In the coming years, the City plans to re-assess its risks to coastal and tidally-influenced flooding from the Thames River, and will modify its capabilities as needed.

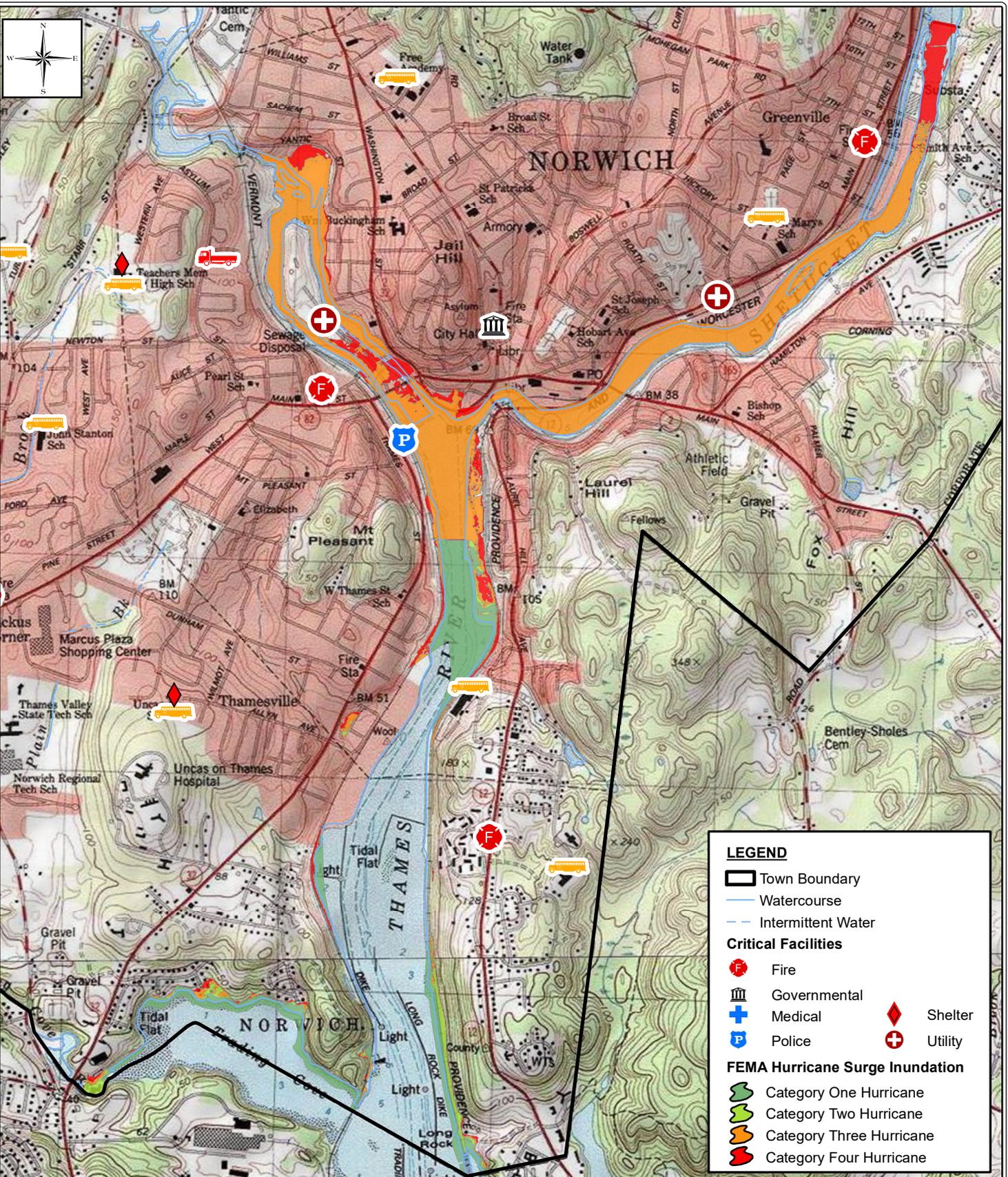
4.3 Vulnerabilities and Risk Assessment

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

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

4.3.1 Vulnerability Analysis of Areas Along Coastal Waters

As noted in Section 3.3, the low-lying shoreline areas of the city along the Yantic, Shetucket, and Thames River are subject to periodic inland flooding. The area potentially flooded by storm surge is not as extensive as the 1% annual chance floodplain. In general, the coastal area affected by storm surge is limited to areas immediately within and adjacent to the rivers. Due to the similarity of the areas, it may be difficult for City officials to judge whether an area is being affected by inland flooding or coastal storm surge during a particularly heavy rainfall associated with a hurricane or nor'easter.



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POTENTIAL HURRICANE STORM SURGE

**SCCOG HAZARD MITIGATION UPDATE
 CITY OF NORWICH ANNEX**

NORWICH, CONNECTICUT

SOURCE: HURRICANE SURGE INUNDATION LAYER; CTDEEP, 2012

DATE: JULY 26, 2017

SCALE: 1"=2,000'

PROJ. NO.: 3570-09

DESIGNED SB	DRAWN PS	CHECKED DM
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DRAWING NAME:

FIG. 4-1

Based on the 2008 FEMA mapping, the Shetucket River will only be affected by storm surge from a Category Three or Category Four Hurricane. A Category Three hurricane would produce storm surge within the channel up to 8th Street, although only one structure in the vicinity of Route 2 would be affected. A Category Four hurricane would produce storm surge up to the Greeneville Dam, and industries in the vicinity of 8th Street may be affected.

Similar to the Shetucket River, areas along the lower section of the Yantic River are also only affected by storm surge from a Category Three or Category Four hurricane. A business on Yantic Street and homes on Watercress Avenue and Sturtevant Avenue could potentially be impacted by storm surge. While the waste water treatment facility on Hollyhock Island may only be affected by storm surge from a Category Four Hurricane, the remainder of the island is at risk of storm surge from a Category Three hurricane. Several commercial structures, including the American Wharf marina and the new Norwich Intermodal Transportation Center would be affected. Business and parking garages on Chelsea Harbor Drive and Market Street would also be affected by storm surge from a Category Three hurricane.

Areas adjacent to the Thames River would also be affected by storm surge. On the west side of the Thames, condominiums near South Thames Street would be affected by storm surge from Category Three and Category Four hurricanes, as would homes in the vicinity of South Street and Rose Street. Two homes in Trading Cove would also be affected by storm surge from a Category Two Hurricane, with additional homes being affected from larger storms. Railroads on both the west side and the east side of the Thames River may also be affected by storm surge. On the east side of the Thames, only an industrial area known as New Wharf would be affected by storm surge from a Category Three or Category Four Hurricane.

In general, it is assumed that as sea level rises, the frequency and magnitude of coastal flooding in the City will increase, with structures and roadways closest to existing sea level being affected more quickly. Areas adjacent to Trading Cove are likely to be affected first.

Coastal erosion is generally not an issue in the City of Norwich since the majority of the shorefront is almost fully developed (particularly along the industrial areas). Two dikes also protect the shoreline of the Thames River in the southern portion of Norwich. However, as sea level rises, the effectiveness of these structures could be undermined such that erosion will be able to occur landward of the walls necessitating expansion of the structures.

4.3.2 Vulnerability Analysis of Private Properties

The coastal areas of the City of Norwich have properties that are inhabited year-round. This intensifies risk to life and property in coastal areas. Waterfront properties are very susceptible to damage from storm surge although FEMA has not established any coastal velocity zones in Norwich. Shoreline erosion is a relatively minor concern for private property owners at this point in time since coastal flooding is very infrequent.

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

The City of Norwich has no formalized program currently in place to identify the location or the number of structures that are susceptible to flooding. Such information would be valuable in directing hazard mitigation efforts to locations with the greatest risk. City planners should use the recently released FEMA storm surge mapping to identify the structures in the City that are at risk for storm surge. This could provide a list of areas to inspect following a storm event and allow for the City to track building permits from repairs following a natural hazard. This information, in turn, would provide supporting data for future grant applications.

4.3.3 Vulnerability Analysis of Critical Facilities

As shown on Figure 4-1, the only critical facility located within potential storm surge areas is the City's waste water treatment facility on the Yantic River. No additional facilities are located in hurricane storm surge zones as shown on Figure 4-1.

4.4 Potential Mitigation Strategies and Actions

General potential mitigation measures that can be taken to reduce the effects of coastal flooding were discussed in Section 4.7 and in Section 11.2.2 of the Multi-Jurisdictional HMP. General recommendations pertinent to all natural hazards that could affect the City are listed in Section 11 of this annex along with general and specific measures pertinent to reducing coastal flooding in the City of Norwich under the categories of prevention and structural projects.

5.0 HURRICANES AND TROPICAL STORMS

5.1 Setting / Historic Record

Several types of hazards may be associated with tropical storms and hurricanes including heavy or tornado winds, heavy rains, and flooding. Flooding and storm surge hazards are discussed in Section 3 and Section 4 of this annex. Wind hazards are widespread and can affect any part of the City. However, some buildings in the City are more susceptible to wind damage than others.

The last major hurricane or tropical storm wind event to affect the City prior to the 2012 edition of the HMP was associated with Hurricane Irene in August 2011. While trees fell throughout the City, power outages lasted up to a week in outlying rural areas since tree density was greater in these areas. Some areas in the southern portion of the City did not lose power at all.

In 2012, Hurricane Sandy, a hybrid storm with both tropical and extra-tropical characteristics, brought high winds and coastal flooding to southern New England. Record breaking high tides and wave action was combined with sustained winds of 40 to 60 mph and wind gusts of 80 to 90 mph. Widespread significant statewide power outages of 667,598 lasted up to 8 days. City officials describe the impact of this Storm on Norwich as minimal. Nevertheless, the City of Norwich received nearly \$800,000 in disaster relief from FEMA to cover the cost of damages from the storm.

5.2 Existing Capabilities

Wind loading requirements are addressed through the state building code. The Connecticut State Building Code was most recently adopted with an effective date of October 1, 2016. The code specifies the design wind speed for construction in all the Connecticut municipalities. The ultimate design wind speed for Norwich ranges from 125 to 145 miles per hour depending on the building use (for example, hospitals must be designed to the higher wind speed). Note that changes in design wind speed figures since the previous HMP are largely the result of a shift from "nominal" to "ultimate" wind speeds, for compatibility purposes; see the Connecticut Building Code or the American Society of Civil Engineers website for more information. Norwich has adopted the Connecticut Building Code as its building code. The City has on file a report summarizing the ability of operational municipal buildings to withstand wind loading; this does not include abandoned buildings acquired by the City but which are vacant. The three primary shelters of the City are rated to withstand winds from a Category 3 Hurricane.

Parts of trees (limbs) or entire tall and older trees may fall during heavy wind events, potentially damaging structures, utility lines, and vehicles. Utility lines are located underground in only a few areas of the City. The City has two tree wardens within the Public Works Department; both can post notification and schedule tree removal. The Public Works staff also monitors trees as part of their normal rounds and includes a budget for minor tree maintenance. The City has its own bucket truck and tree crew, but will also hire outside contractors for larger jobs; the City

has a standing contract with Linden Tree for tree maintenance and removal. Norwich staff describe their tree maintenance program as very robust.

After a storm, debris is brought to the City transfer station for disposal and reuse.

The City of Norwich receives utility service from Norwich Public Utilities and Algonquin Gas. Norwich Public Utilities provides electricity, potable water, natural gas, and sewer service to the City and the surrounding region. Norwich Public Utilities and Algonquin Gas perform trimming near their utilities and hire contractors for larger jobs. Coordination between the City and Norwich Public Utilities is very strong; in fact, the current Emergency Operations Center is located at the Norwich Public Utilities Administrative and Operations Center Building.

Warning is one of the best ways to prevent damage from hurricanes and tropical storms, as these storms often are tracked well in advance of reaching Connecticut. The City can access National Weather Service forecasts via the internet as well as listen to local media outlets (television, radio) to receive information about the relative strength of the approaching storm. This information allows the City to activate its EOP and encourage residents to take protective or evacuation measures if appropriate. NOAA weather radios are located in a number of locations with large populations, including every school, Dodd Stadium, and the Norwich Marina. Norwich staff note that these radios are often stolen and regularly need to be replaced.

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. The statewide CT "Everbridge" Reverse 9-1-1 system can be utilized to warn residents of an impending evacuation. The City works with local marinas to ensure personal watercraft are removed in a timely manner prior to severe wind events.

Although hurricanes that have impacted Norwich have historically passed in a day's time, additional shelters could be outfitted following a storm with the assistance of the American Red Cross on an as-needed basis for long-term evacuees. In the case of an extended power outage, residents would be directed to one of the five primary shelters in the City to stay or for showering and charging services.

Summary

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

5.3 Vulnerabilities and Risk Assessment

The entire City is vulnerable to hurricane and tropical storm wind damage and from any tornadoes (Section 6) accompanying the storm, as well as inland flooding (Section 3) and potentially coastal flooding and storm surge (Section 4). Of particular concern are the blockage

of roads and the damage to the electrical power supply from falling trees and tree limbs. The City had relatively extensive outages in some areas because of tree damage to utility lines.

Direct wind damage to newer buildings from hurricane or tropical storm-level winds is rare in the City since the new buildings were constructed to meet or exceed current building codes. Many buildings in the City were built in the 1970s and 1980s and do not meet current building codes. Older buildings in the City and mobile homes are particularly susceptible to roof and window damage from high wind events, particularly in the many historic districts in the city. This risk will be reduced with time as these buildings are remodeled or replaced with buildings that meet current codes.

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

5.4 Potential Mitigation Strategies and Actions

General potential mitigation measures that can be taken to reduce the effects of wind damage from hurricanes and tropical storms were discussed in Section 5.7 and in Section 11.2.3 of the Multi-Jurisdictional HMP. General recommendations pertinent to all natural hazards that could affect the City are listed in Section 11 of this annex along with general and specific measures pertinent to reducing wind damage to the City of Norwich under the categories of prevention, property protection, emergency services, and public education and awareness.

6.0 SUMMER STORMS AND TORNADOES

6.1 Setting / Historic Record

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

A selection of summer storm damage in the City of Norwich as reported to the NCDC is presented below:

- ❑ April 12, 2008: An isolated severe thunderstorm produced penny-sized hail in Norwichtown.
- ❑ July 2, 2008: A severe thunderstorm produced quarter to half-dollar (up to 1.25-inch) hail along Dunham Street, with nickel-sized hail being reported in Norwichtown and penny-sized hail throughout the City. A roof was reported as being blown off of a roof in Norwichtown, resulting in \$100,000 in damages.
- ❑ July 23, 2008: A severe thunderstorm downed a few trees on Dunham Street. A contractor at the Norwich Housing Authority was struck or nearly directly struck by lightning, suffering minor injuries.
- ❑ May 12, 2009: A severe thunderstorm produced nickel-sized hail in Norwich.
- ❑ May 4, 2010: Scattered severe thunderstorms produced strong gusts that downed large branches in Norwich.
- ❑ May 8, 2010: Lightning struck a transformer, causing 5,000 people to lose power in the City.
- ❑ On July 25, 2013, the combination of a moist airmass and a wave of low pressure tracking north along a cold front just to the east of Long Island resulted in scattered showers and thunderstorms across Southeast Connecticut. The redevelopment of these showers and storms over the same area led to a period of persistent heavy rain, which resulted in flash flooding. The City of Norwich was hit the hardest with total accumulation estimates of 5 to 8 inches.

6.2 Existing Capabilities

Warning is the most viable and therefore the primary method of existing mitigation for tornadoes and thunderstorm-related hazards. The NOAA National Weather Service issues watches and warnings when severe weather is likely to develop or has developed, respectively. The City can access National Weather Service forecasts via the internet as well as listen to local media outlets (television, radio) to receive information about the relative strength of the

approaching storm. This information allows the City to activate its EOP and encourage residents to take protective measures if appropriate.

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

Summary

In general, municipal capabilities to mitigate thunderstorm and tornado damage have not increased significantly since the 2012 edition of the hazard mitigation plan was adopted.

6.3 Vulnerabilities and Risk Assessment

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

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

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

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

6.4 Potential Mitigation Strategies and Actions

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

7.0 WINTER STORMS AND NOR'EASTERS

7.1 Setting / Historic Record

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

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

- ❑ The winter of 2010 – 2011 produced significant snowfall in Norwich. The City had to shovel the roofs of several municipal buildings. City Hall had minor damage to its gutters, and two vacant schools (Buckingham School and Greeneville School) sustained roof damage. The schools were set to be torn down and have since been removed. One business had to replace its roof after it was damaged, and the City compiled several reports to private roofs being damaged during snow removal. For example, a snowblower hit a gas line on one roof.
- ❑ Winter Storm Alfred in late October 2011 caused significant tree damage and additional power outages for several days in outlying areas. Trees which were able to withstand the heavy winds of Irene were not able to withstand both wind and snow load during Storm Alfred.
- ❑ 2013 featured exceptional snow events that severely taxed snow removal abilities of towns in the region. The blizzard of 2013 in early February dumped one to two feet of snow on the region. Another snowstorm struck the region in mid-March 2013 dumping upwards of one to two feet of snow in some parts of the county.
- ❑ In January 2015, the City received 36 inches of snow in a single day.

7.2 Existing Capabilities

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

Information for protecting City residents during cold weather, and for mitigating icing and insulating pipes at residences, is provided to the public through the City's Human Services department, as well as United Way and TBCCA.

As it is almost guaranteed that winter storms will occur annually in Connecticut, it is important to locally budget fiscal resources toward snow management. Snow is the most common natural

hazard requiring additional overtime effort from City staff, as parking lots and roadways need constant maintenance during storms. The Public Works Department oversees snow removal in the City. Salt and sand is stored at the Public Works facility. The City has established plowing routes that prioritize access to and from critical facilities. The Connecticut Department of Transportation (DOT) plows State roads. As two Connecticut DOT facilities are located in Norwich (District 2 Headquarters on Route 82 and a satellite garage in Occum), winter plowing of State roads in the city is generally timely. During snow events, the Public Works Department will send a plow out with emergency response vehicles on their ways to difficult-to-access areas. Parking bans implemented during such events are effective at helping keep roads clear.

The Connecticut Building Code specifies that a pressure of 30 pounds per square foot be used as the base "ground snow load" for computing snow loading for roofs. The City monitors and shovels the roofs of municipal buildings, and most residents and businesses also shoveled or plowed their roofs. The City has a priority program for snow removal from roofs: The Police Headquarters are cleared first, followed by the Fire Department, then City Hall, then other facilities.

Summary

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

7.3 Vulnerabilities and Risk Assessment

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

This section focuses on those effects commonly associated with winter storms, including those from blizzards, ice storms, heavy snow, freezing rain, and extreme cold. Warning and education can prevent most injuries from winter storms. Most deaths from winter storms are indirectly related to the storm, such as from traffic accidents on icy roads and hypothermia from prolonged exposure to cold. Damage to trees and tree limbs and the resultant downing of utility cables are a common effect of these types of events. Secondary effects can include loss of power and heat.

The majority of City buildings were constructed relatively recently and therefore not particularly susceptible to damage from heavy snow. While some City buildings could be susceptible to heavy snow loads, they will be cleared quickly if safety is a concern. Many buildings in the City have flat roofs which are more susceptible to damage from heavy snow than sloped roofs.

The Reid and Hughes Building is a large multi-story building in the downtown area. This building has a flat roof that is deteriorated. The City is in discussions with the Historic Commission to demolish the building, but in the meantime, it still stands and is a serious hazard, as a large

snow event could collapse the roof and potentially lead to damage in the area surrounding the building.

Icing is not an issue anywhere in the City. In general, there are few steep slopes such that extra sanding and salting of the roadways in necessary locations alleviates any trouble spots.

7.4 Potential Mitigation Strategies and Actions

General recommendations pertinent to all natural hazards that could affect the City are listed in Section 11 of this annex. Potential mitigation measures for flooding caused by nor'easters include those appropriate for flooding that were discussed in Section 3.7 of the Multi-Jurisdictional HMP and Section 11 of this annex. General potential mitigation measures that can be taken to reduce the effects of wind damage were discussed in Section 5.7 and in Section 11.2.3 of the Multi-Jurisdictional HMP. However, winter storm mitigation measures must also address blizzards, snow, and ice hazards. General and specific measures pertinent to reducing damage from winter storms in the City of Norwich under the categories of prevention, property protection, emergency services, and public education and awareness are presented in Section 11.

8.0 EARTHQUAKES

8.1 Setting / Historic Record

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

8.2 Existing Capabilities

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

City Departments have adequate backup supplies and facilities for continued functionality following an earthquake.

Due to the infrequent nature of damaging earthquakes, City land use policies do not directly address earthquake hazards. Earthquakes are indirectly addressed through policies preventing residential development in areas prone to collapse such as below steep slopes or areas prone to liquefaction. However, the potential for an earthquake and emergency response procedures is addressed in the City's EOP.

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

8.3 Vulnerabilities and Risk Assessment

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

Three bedrock fault lines exist within or nearby the City of Norwich. Unlike seismic activity in California, earthquakes in Connecticut are not associated with specific known active faults. However, bedrock in Connecticut and New England in general is typically formed from relatively hard metamorphic rock that is highly capable of transmitting seismic energy over great distances. For example, the relatively strong earthquake that occurred recently in Virginia was felt in Connecticut because the energy was transmitted over a great distance through such hard bedrock.

The built environment in the City primarily includes some more recent construction that is seismically designed. However, most buildings were built in the 1970s and 1980s or before and therefore are not built to current building codes. In addition, many buildings are renter-occupied and therefore may not be fully maintained, thereby increasing the risk of damage from an earthquake. Thus, it is believed that most buildings would be at least moderately damaged by a significant earthquake. Those City residents who live or work in older, non-reinforced masonry buildings are at the highest risk for experiencing earthquake damage.

Areas of steep slopes can collapse during an earthquake, creating landslides. The City has many areas of steep slopes and bluffs particularly overlooking the Thames River. Thus, landslides are a concern in the City.

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

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

8.4 Potential Mitigation Strategies and Actions

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

9.0 WILDFIRES

9.1 Setting / Historic Record

Wildfires are considered to be highly destructive, uncontrollable fires. The most common causes of wildfires are arson, lightning strikes, and fires started from downed trees hitting electrical lines. Thus, wildfires have the potential to occur anywhere and at any time in both undeveloped and lightly developed areas of the City. Structural fires in higher density areas of the City are not directly addressed herein. No wildfires have occurred in the City since the last HMP.

9.2 Existing Capabilities

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

Existing mitigation for wildland fire control is typically focused on building codes, public education, Fire Department training, and maintaining an adequate supply of equipment. The City's EOP recommends a 30 to 50 foot cleared radius be maintained around homes and buildings to prevent wildfires.

The Fire Department goes to fires as quickly as possible in the City. Norwich Public Utilities provides fire protection water. Fire pumps are tested weekly and are considered to provide excellent pressure. Each hydrant is banded such that the Fire Department knows how much pressure is available. The City also has several dry hydrants in outlying areas that are not connected to public water service. Water service that will assist with firefighting was extended to Ponemah Mills as part of the renovation of that property.

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

Summary

In general, municipal capabilities to mitigate wildfire damage have remained consistent since the 2012 edition of the hazard mitigation plan was adopted.

9.3 Vulnerabilities and Risk Assessment

The City has three areas that are concerns for wildfires due to difficult access. Each is located in the northern portion of the city. These are the undeveloped watershed lands surrounding Bog Meadow Reservoir, undeveloped lands between Barbers Road and Cold Brook, and undeveloped areas along Byron Brook east of Scotland Road. There are no developed roads in these areas and access roads are few; where they do exist, they are typically one-way. The City must utilize off-road equipment to fight fires in these areas; thus, the risk of wildfire in these areas is considered moderate.

The risk for wildlife in the remainder of the City is considered low for most areas for several reasons. First, the City has widespread development such that there are few outlying areas where a wildfire could advance undetected. As such, there have been no major fires in recent history. Secondly, nearly all developed areas of the City have public water service provided by Norwich Public Utilities. This public water service provides sufficient water volume and pressure to fight nearly any fire. Outlying areas have dry hydrants that provide additional fire fighting water. Third, the Thames River, the Yantic River, and the Shetucket River are near most developed areas if additional firefighting water was necessary. Fourth, there are few notable dead ends or one-way roads that are difficult to access in the City, and emergency vehicles can typically turn around in private driveways on these roads. Finally, the City has agreements with its neighbors to provide assistance in case of an emergency. Thus, if a wildfire did occur, it would likely be contained to within only a few acres.

9.4 Potential Mitigation Strategies and Actions

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

10.0 DAM FAILURE

10.1 Setting / Historic Record

Dam failures can be triggered suddenly with little or no warning and often in connection with natural disasters such as floods and earthquakes. Dam failures can occur during flooding when the dam breaks under the additional force of floodwaters. In addition, a dam failure can cause a chain reaction where the sudden release of floodwaters causes the next dam downstream to fail. While flooding from a dam failure generally has a limited geographic extent, the effects are potentially catastrophic depending on the downstream population. A dam failure affecting the City of Norwich is considered a possible event each year with potentially critical effects. No dam failures affected the City since the time of the last HMP.

The 1955 floods washed out dams on the Shetucket River, causing damage in Norwich. However, the best-known example of a dam failure impacting the City of Norwich occurred several years later. A dam failure occurred on March 6, 1963 on Spaulding Pond Brook. This failure occurred during a moderate storm on the Spaulding Pond Dam, 400 feet above the center of the City of Norwich. Thousands of gallons of water poured into the city, leaving six dead and causing \$6 million in property damage.

10.2 Existing Capabilities

The Connecticut DEEP administers the Dam Safety Section and designates a classification to each state-registered dam based on its potential hazard as detailed in the regional plan. As noted in the Multi-Jurisdictional HMP, the City of Norwich is home to five Class C (high hazard) dams and three Class B (significant hazard) dams. In addition, there are three dams located upstream of Norwich whose failure could potentially lead to flooding within the City. These dams are listed on Table 10-1.

TABLE 10-1
High and Significant Hazard Dams Within and Upstream of the City of Norwich

Dam	Hazard Class	Location	Owner	River System
Bog Meadow Reservoir Dam	B	Norwich	Norwich Public Utilities	Norwichtown Brook
Deep River Reservoir Dam	C	Colchester	Norwich Public Utilities	Yantic River
Fairview Reservoir Dam	C	Norwich	Norwich Public Utilities	Bobbin Mill Brk / Yantic River
Fitchville Pond Dam	C	Bozrah	Private (Commercial)	Yantic River
Greeneville Dam	C	Norwich	Norwich Public Utilities	Shetucket River
Scotland Dam	C	Windham	Private (Commercial)	Shetucket River
Spaulding Pond Dam Site #1	C	Norwich	City of Norwich	Spaulding Pond Brook
Spaulding Pond Site #2 Dam	C	Norwich	City of Norwich	Spaulding Pond Brook
Taftville Dam #4 (Taftville Pond)	C	Norwich	Private (Commercial)	Shetucket River
Taftville Reservoir #1	B	Norwich	Norwich Public Utilities	Hunter Brook
Taftville Reservoir #3	B	Norwich	Norwich Public Utilities	Unnamed Tributary to Shetucket River

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

Norwich Public Utilities maintains an EAP for each its dams, as does the City of Norwich. All eight EAPs maintained by Norwich Public Utilities were updated in 2015 to incorporate changes in the State's dam safety regulations and the new requirements for failure analysis and inundation mapping.

Two of the private dams listed in Table 10-1 are each hydropower dams and have EAPs, and the Fitchville Pond Dam in Bozrah was formerly used to provide power to mills in Yantic but is no longer active. An EAP does exist for the dam. Recently completed "Rehabilitation Assessment" reports for the two Spaulding Pond Dams are also available to the Norwich Emergency Management Director to supplement the EAPs for those dams.

The City has included dam failure inundation areas within its Everbridge reverse 9-1-1 contact database, allowing it to alert residents in case there is a risk of failure.

While the existence of dams is usually stable, changes do occur. A privately-owned significant hazard (Class B) dam in Bozrah on the Yantic River, the Gilman Dam, was removed in 2006 to 2007. A Class B dam in southeastern Norwich, the Cradnall Property Dam, was downgraded by the Connecticut DEEP to no longer being a significant hazard dam sometime before 2007.

The City owns the Upper Falls Dam on the Yantic River. This former hydropower dam is located downstream of the Sherman Street bridge. The City wishes to remove this dam as part of a Sherman Street bridge project since backwater conditions from this dam exacerbate flooding at the Sherman Street bridge. This project has not yet been completed, but the City continues to be interested in at least investigating the impacts that removal would have.

The City of Norwich and Norwich Public Utilities have together conducted a number of emergency drills using the EAPs on file.

Summary

In general, municipal capabilities to mitigate dam failure damage have increased sharply since the 2012 edition of the hazard mitigation plan was adopted. In addition, changes in the State's regulation of dams have increased Statewide capabilities.

10.3 Vulnerabilities and Risk Assessment

The potential impacts related to the failure of Class C and Class B dams within and upstream of Norwich are described below. Where information was available, the descriptions below are based on information available at the Connecticut DEEP Dam Safety Section. For dams without a formal dam failure analysis, a qualitative assessment was prepared for this HMP. Refer to Figure 10-1 for a location map showing the dams and potential dam failure inundation areas (where available).

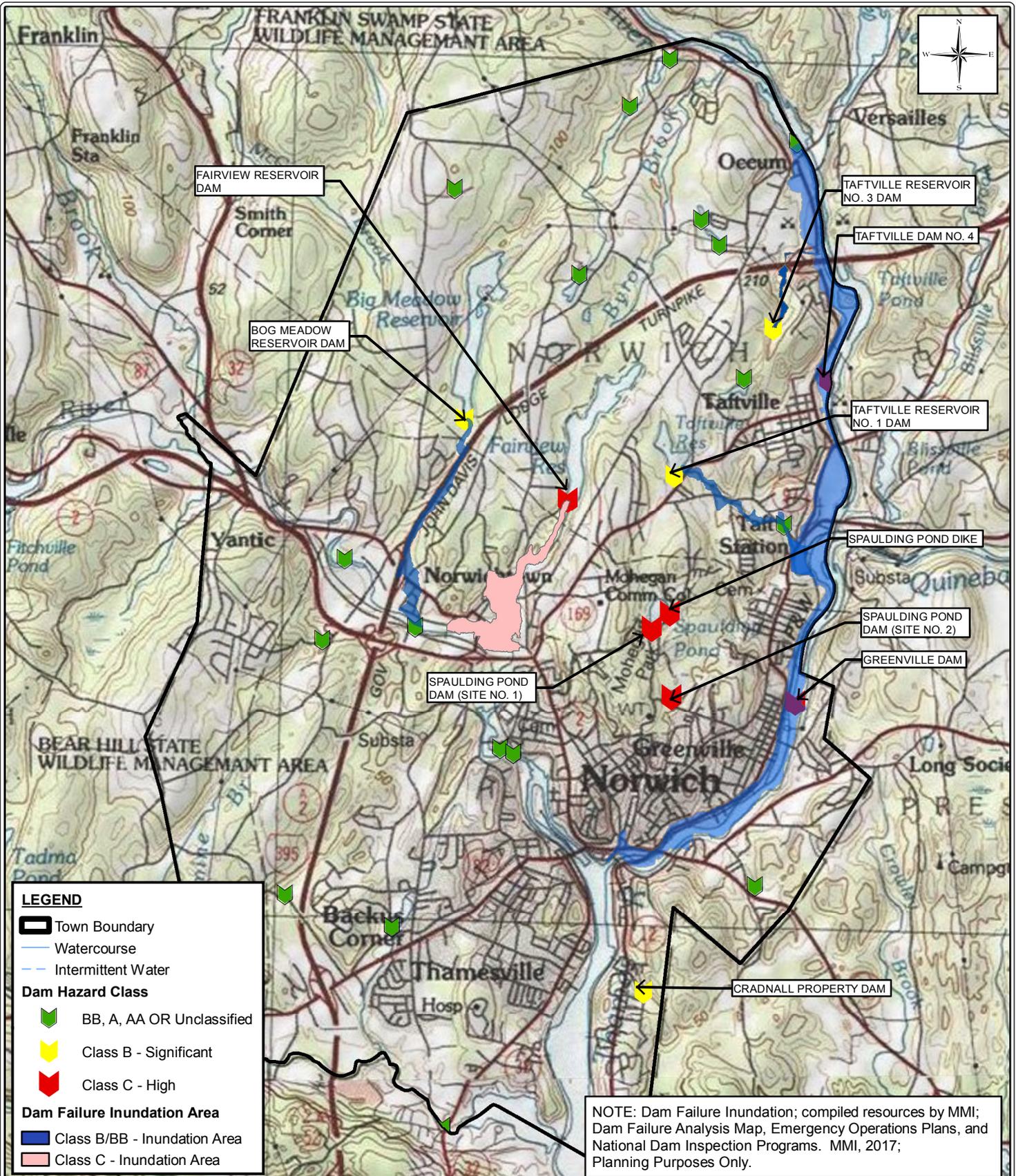
Bog Meadow Reservoir Dam – Bog Meadow Reservoir has a Class B dam that impounds the headwaters of Norwichtown Brook. The reservoir was formerly used for water supply but is inactive. This dam is owned and maintained by Norwich Public Utilities. An EOP was prepared for the dam in 2009 and an EAP was developed in 2015 in accordance with the new dam safety regulations.

The potential dam failure inundation area of the Bog Meadow Reservoir Dam was originally prepared by Lenard & Dilaj Engineers sometime in the late 1970s. The potential inundation area includes both residential and commercial areas as well as Interstate 395. No structures would be affected until floodwaters reached the vicinity of West Town Street, at which point many commercial and industrial buildings would be affected on West Town Street, Case Street, Clinton Avenue, Wawecus Street, Pleasant Street, and Sturtevant Street. The Public Works Headquarters would also be impacted on Clinton Avenue. Residences on West Town Street, Lee Avenue, Sholes Avenue, Woodrow Avenue, Everett Avenue, Sturtevant Street, and Pleasant Street would also be impacted. The inundation area ends at the Yantic River under the assumption that the increase in stage would not reach the level of the 1% annual chance flood.

Deep River Reservoir Dam – Deep River Reservoir has a Class C dam that impounds Deep River in Colchester. The reservoir is used for potable water supply. This dam is owned and maintained by Norwich Public Utilities. An EOP was prepared for the dam in 2009 and an EAP was developed in 2015 in accordance with the new dam safety regulations.

The potential dam failure inundation area of the Deep River Reservoir Dam was originally prepared by Lenard & Dilaj Engineers sometime in the late 1970s. The potential inundation area includes primarily residential areas and a few roadways. No structures would be affected until floodwaters reached the vicinity of Reservoir Road in Lebanon, at which point the Deep River Water Treatment Plant owned and operated by Norwich Public Utilities would be inundated as would 10 nearby structures that appear predominantly residential.

Floodwaters would then likely overtop Route 2 and proceed to the Yantic River where it would inundate an area wider than the 1% annual chance flood event. An alcohol and drug treatment facility on Camp Moween Road would be inundated, as would a residence on Camp Moween Road and a residence on Norwich Avenue. Those two roads may also overtop. Downstream of Camp Moween Road, three additional homes on Norwich Avenue would be affected before floodwaters subside within the 1% annual chance floodplain of the Yantic River and eventually the Yantic River channel.



LEGEND

- Town Boundary
- Watercourse
- Intermittent Water

Dam Hazard Class

- BB, A, AA OR Unclassified
- Class B - Significant
- Class C - High

Dam Failure Inundation Area

- Class B/BB - Inundation Area
- Class C - Inundation Area

NOTE: Dam Failure Inundation; compiled resources by MMI; Dam Failure Analysis Map, Emergency Operations Plans, and National Dam Inspection Programs. MMI, 2017; Planning Purposes Only.

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HIGH & SIGNIFICANT HAZARD DAMS

**SCCOG HAZARD MITIGATION UPDATE
 CITY OF NORWICH ANNEX**

NORWICH, CONNECTICUT

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

DATE: JULY 26, 2017		
SCALE: 1"=5,000'		
PROJ. NO.: 3570-09		
DESIGNED SB	DRAWN PS	CHECKED DM
DRAWING NAME:		

FIG. 10-1

Fairview Reservoir Dam – Fairview Reservoir has a Class C dam located approximately two miles north of the center of the City of Norwich that impounds the headwaters of Bobbin Mill Brook. The reservoir was formerly used for potable water supply but is currently inactive. Norwich Public Utilities owns and maintains the dam. An EOP with an associated dam failure inundation area was prepared for the dam in 2009 and an EAP was developed in 2015 in accordance with the new dam safety regulations.

The potential dam failure inundation area generally follows the channel of Bobbin Mill Brook to its confluence with the Yantic River. The inactive treatment works located immediately downstream of the dam would be affected by a dam failure almost immediately. Six homes on Scotland Road one on Huntington Lane, and one on East Town Street would be affected next. East Town Street and Town Street would both be overtopped, with several commercial buildings on Town Street being inundated along with three homes on Butts Lane. The mapped inundation area ends at Route 2, although it is likely that the lower section of the Yantic River would swell with floodwaters.

Fitchville Pond Dam – Fitchville Pond has a Class C dam that is an impoundment of the Yantic River. The impoundment was formerly used to provide power to mills in Yantic. The dam is privately owned. Today the impoundment is used for recreation and is heavily silted in such that the dam does not impound a significant amount of water. While a dam failure inundation area for this impoundment is not believed to exist, the 0.2% annual chance floodplain of the Yantic River between the dam and Yantic would provide a suitable interim dam failure inundation area.

Greeneville Dam – Greeneville Dam is a Class C dam located on the Shetucket River and owned by the City of Norwich Dept. of Public Utilities. The dam was constructed in 1888 and is a timber crib structure used for hydroelectric power generation. Failure of this dam would likely result in an inundation area similar to the 1% annual chance flood event for areas downstream along the Shetucket River from the dam to the Thames River. This would cause the inundation of several industries nearby 8th Street. An EAP was developed in 2015 in accordance with the new dam safety regulations.

Scotland Dam – The Scotland Dam is a Class C dam located on the Shetucket River near the Windham, Scotland, and Franklin boundary that is privately owned and used for hydroelectric power generation. Failure of this dam would likely result in an inundation area similar to the 0.2% annual chance flood event for areas downstream along the Shetucket River from the dam to Occum Pond, with lesser impacts downstream in Norwich. This would cause the inundation of several industries nearby 8th Street. Thus, a dam failure could result in the flooding of homes and businesses along Route 97 in Norwich. See the Sprague Annex for the location of this dam.

Spaulding Pond Dam (Site #1 & Site #2) – The two Spaulding Pond Dams are both Class C dams located in Mohegan Park that are impoundments of Spaulding Pond Brook. The upper dam (Site #1) is owned by the City of Norwich and the impoundment is used for recreation. This dam failed in 1963 as noted in Section 10.1. The lower dam (Site #2) was constructed by the Natural Resources Conservation Service in the 1960s for flood control purposes (see Section 3.2). The

lower impoundment is much smaller than the upper impoundment so the inundation level and the amount of damage would likely be less for a failure of this dam than for the upper dam.

Failure of the upper dam would inundate a major parking area in Mohegan Park, Mohegan Park Road, and likely washout Spaulding Pond Dam (Site #2) downstream above Mohegan Park Road, combining floodwaters from both impoundments. Floodwaters would then continue downstream, overtopping Mohegan Park Road, inundating a condominium complex, and impacting several homes and apartment buildings in the vicinity of East Baltic Street. Homes in the vicinity of Hickory Street, Brook Street, Baltic Street, and Broad Street would also be affected. Commercial buildings on Lake Street, Pond Street, Franklin Street, Chestnut Avenue, Chestnut Street, Willow Street, Bath Street, Main Street, and City Landing would also likely experience floodwaters. The Thames River would likely absorb the floodwaters without further inundation.

A "Rehabilitation Assessment" was recently completed for the two Spaulding Pond Dams. These reports are available to the Norwich Emergency Management Director to supplement the EAPs for those dams.

Taftville Dam #4 – Taftville Dam #4 is a Class C dam located on the Shetucket River and privately owned. The dam impounds water for hydroelectric power generation. Failure of this dam would likely result in an inundation area similar to the 1% annual chance flood event for areas downstream along the Shetucket River from the dam to the Thames River. This would cause the inundation of several industries in Taftville as well as downstream nearby 8th Street.

Taftville Reservoir #1 Dam – Taftville Reservoir #1 has a Class B dam that impounds the headwaters of Hunter Brook. The reservoir was formerly used for water supply but is currently inactive. The area around the impoundment is currently used for recreation. The dam is owned and maintained by Norwich Public Utilities and the City of Norwich. An EOP for the dam was prepared in 2009 and an EAP was developed in 2015 in accordance with the new dam safety regulations.

Currently, the water level in the inactive reservoir is typically maintained six or seven feet below normal pool level. However, failure of the dam at full pool elevation could cause immediate flooding of nine homes on Route 169, as well as one home of Tetreault Avenue, one home on Oakland Drive, and approximately 40 homes and commercial structures on Hunters Road. The Hunters Pond Dam, a Class A dam located on Hunters Road just upstream of Route 12, could also breach. Approximately 20 additional residential structures located on Route 12 / Route 97, Prentice Street, and Bolduc Lane would also be inundated. The Shetucket River is expected to absorb the floodwaters without additional downstream flooding.

Taftville Reservoir #3 Dam – Taftville Reservoir #3 has a Class B dam that impounds an unnamed tributary to the Shetucket River. The dam impounds less than one acre and ultimately the dam will be fully breached and drained. According to the EOP prepared for the dam in 2009, the dam is remotely located and is accessible only by a 15-minute walk. Dam failure inundation mapping prepared by Milone & MacBroom, Inc. in conjunction with the EOP shows that the potential inundation area stretches downstream to Interstate 395 and does not intersect any

structures. Thus, the hazard classification of the dam may not be accurate. An EAP was developed in 2015 in accordance with the new dam safety regulations.

10.4 Potential Mitigation Strategies and Actions

The City of Norwich is generally a low-risk area for dam failure since the majority of dams are well-maintained with active EOPs. Potential mitigation measures for dam failure include a combination of prevention, education, and emergency planning, as well as dam removal projects as presented in Section 11.

11.0 MITIGATION STRATEGIES AND ACTIONS

11.1 Status of Mitigation Strategies and Actions

The previous edition of the SCCOG Multi-Jurisdictional HMP and City of Norwich annex listed a suite of hazard mitigation actions applicable both locally and region-wide. These actions, along with commentary regarding the status of each, are listed in the tables in this section. Additionally, new actions were developed in the process of developing this HMP update. These are listed at the end of each hazard section below.

11.1.1 Actions Applicable to All Hazards

Action	Status	Notes
Regional Coordination		
Continue to promote inter-jurisdictional coordination efforts for emergency response	<i>Capability</i>	<i>Completed through mutual-aid agreements, agreements and SCCOG regional hazard management initiatives.</i>
Continue to promote local and regional planning exercises that increase readiness to respond to disasters	<i>Capability / Carry Forward</i>	<i>Change to "Improve participation in..." Exercises are run, but there is not enough attendance for them to be useful</i>
Continue to evaluate communication capabilities and pursue upgrades to communication and ensure redundant equipment is available	<i>Carry Forward</i>	<i>Capabilities have been evaluated, but upgrades have not been implemented, for the most part, due to budget constraints. A backup EOC has been set up in the City Hall office of the Emergency Manager</i>
Continue to promote regional transportation planning through SCCOG	<i>Capability</i>	<i>This action is the responsibility of, and is being performed by, SCCOG. This action is redefined as a regional capability.</i>
Work with the SCCOG to perform a regional study of the vulnerability of critical facilities to natural hazard damage	<i>Capability</i>	<i>This action is the responsibility of, and was performed by, SCCOG in 2017. Three facilities in Norwich were included in the study. Recommendations from the study are incorporated into this HMP.</i>
Work with the SCCOG to develop regional evacuation scenarios that include but build upon the Millstone evacuation plan	<i>Capability</i>	<i>This is a regional capability</i>
Local Emergency Response & Public Information		
Continue to review and update the City EOP at least once annually	<i>Capability</i>	<i>This is a living document and is updated as needed.</i>
Continue to implement comprehensive plans to maintain and upgrade water service infrastructure	<i>Capability</i>	<i>This falls under the authority of Norwich Public Utilities</i>
Continue to maintain emergency response training and equipment and upgrade equipment when possible	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Encourage City officials to attend FEMA-sponsored training seminars at EMI	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Continue to evaluate emergency shelters, update supplies, and check communication equipment	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Continue to promote dissemination of public information regarding natural hazard effects into Government buildings, with additions	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Utilize the Reverse 9-1-1 system to telephone warnings into affected areas, and add DFIRM floodplain areas to the database	<i>Capability</i>	<i>City utilizes the Everbridge system</i>

Action	Status	Notes
Prevention		
Develop a checklist for land development applicants that cross-references the specific regulations and codes related to disaster resilience	<i>Delisted</i>	<i>This need is addressed through the permitting process and the Building Official.</i>
Integrate additional elements of this HMP into the Plan of Conservation and Development during the next update	<i>Capability</i>	<i>Norwich has incorporated elements of the previous HMP into the POCD (the 2002 POCD was already consistent with hazard mitigation, as well)</i>
Continue reviewing building plans to ensure proper access for emergency vehicles	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Require the underground installation of utilities for all new development and pursue opportunities to put existing lines underground	<i>Delisted</i>	<i>The City does not feel this is cost-effective, despite having higher resilience. They expect this would cost about \$300-\$400 thousand. They prefer to focus on aggressive tree trimming and above-ground utility maintenance.</i>
Continue to enforce the appropriate building code for new building projects	<i>Capability</i>	
Encourage residents to install and maintain lightning rods on their structures	<i>Delisted</i>	<i>City feels this is the responsibility of Individual Home Insurance Companies</i>
Natural Resource Protection & Open Space		
Identify rock outcrops and steep slopes with additional natural resource potential and prioritize for conservation efforts	<i>Carry Forward</i>	<i>This has not yet been completed due to a lack of continuity in staffing. The new City Planner intends to pursue this action.</i>
Continue to support linear park and trail systems in the 1% annual chance floodplain, and expand the Heritage Riverfront Walkway	<i>Carry Forward</i>	<i>The expansion of the Heritage Riverfront Walkway is underway. It includes Yantic Falls.</i>
Seek additional funding for open space from Federal/State programs and encourage private donations	<i>Delisted</i>	<i>City is not interested in purchasing more properties with structures, but will consider acquiring open space if funding is made available.</i>
Improve public access to coastal areas and expand river walkways	<i>Carry Forward</i>	<i>See Heritage Riverfront Walkway Action above.</i>
Consider additional regulations and design standards for development of properties with slopes greater than 15%	<i>Carry Forward</i>	<i>This has not yet been completed due to a lack of continuity in Town staffing. The new City Planner intends to pursue this action.</i>

New actions that the City wishes to implement moving forward, developed during this Plan update, include:

- Improve Norwich staff participation in local and regional planning exercises that increase readiness to respond to disasters.
- Implement necessary upgrades to communication capabilities, specifically the city radio communications system
- From the SCCOG Critical Facilities Assessment:
 - o Yantic Fire Department – Eliminate basement while beginning to identify funding and land to relocate the facility.
 - o Occum Fire Department – Eliminate basement while beginning to identify funding and land to relocate the facility.
 - o Public Works – Dry floodproof the utility room.

11.1.2 Actions Applicable to Inland and Coastal Flooding

Action	Status	Notes
Prevention		
Continue to regulate new development activities within SFHAs to the greatest extent possible within Town land use regulations	<i>Carry Forward</i>	<i>This is effectively a capability, but listed here as "carry forward" until the Zoning Regulations have been revised to be compliant with FEMA requirements.</i>
Consider requiring new buildings in floodprone areas to be protected to the highest recorded flood level regardless of SFHA	<i>Delisted</i>	<i>Municipal staff feel this action is unreasonable and unaffordable, and that the public would not buy into it. Plus, Norwich already requires freeboard.</i>
Require developers to demonstrate whether detention or retention of stormwater is the best option for reducing peak flows downstream	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Review local Zoning Regulations and evaluate incorporating further limitations on impermeable surfaces in floodprone areas	<i>Capability</i>	<i>This is being required under updated MS4 guidelines</i>
Conduct an annual inspection of floodprone areas that are publically accessible. Recommend drainage improvements as appropriate. Work with State and Federal agencies to ensure that flood protection regulations reflect current standards regarding sea level rise	<i>Capability</i>	<i>Catch basins and drainage systems are regularly checked. Improvements are made as needed.</i>
Compile a list of addresses of structures within the 1% annual chance floodplain and storm surge areas, and track repair costs	<i>Carry Forward</i>	<i>A list of addresses of structures within the SFHA was compiled. Repair costs are beginning to be tracked Carry forward until municipal staff feel it has been completed.</i>
Property Protection		
Incorporate information on the availability of flood insurance into all hazard-related public education workshops	<i>Carry Forward</i>	<i>Flood insurance information is provided, but education and distribution of this information could be improved.</i>
Make available FEMA-provided flood insurance brochures and encourage residents to purchase insurance if they are in a SFHA	<i>Carry Forward</i>	<i>Flood insurance information is provided, but education and distribution of this information could be improved.</i>
Provide technical assistance to owners of non-residential structures regarding floodproofing techniques	<i>Delisted</i>	<i>The city directs non-residential structure owners to consult with an engineer. Providing technical assistance is not a capability of Municipal personnel.</i>
Pursue acquisition of floodprone residential properties - RLPs should be prioritized - and convert to open space	<i>Delisted/ Modify/ Carry Forward</i>	<i>Norwich already owns many properties, and cannot afford to acquire more. They are, generally, attempting to "shed" properties, rather than acquire more. The City is interested in replacing this action with the following: "Convert previously residential structures owned by the City into open space, prioritizing those that are floodprone." "Use grant funding to acquire floodprone private residential properties that pose significant health and safety risks from owners that approach the City."</i>
Pursue acquisition of Nutmeg Company, Inc. and other commercial floodprone properties and convert to open space	<i>Complete</i>	<i>Nutmeg Company Inc. has relocated, and previous property has been acquired by the City. City wishes to carry forward "pursue acquisition of commercial floodprone properties and convert to open space, if funding is available."</i>

Action	Status	Notes
Encourage residents to submit flood insurance claims following damage events	<i>Capability</i>	<i>City facilitates flood insurance claims and provides guidance, but does not feel it is appropriate to actively encourage submittal of claims.</i>
Acquire grant funding to floodproof the Yantic Fire Engine Co. No. 1 building and complete floodproofing project	<i>Carry Forward/ Modify</i>	<i>Historic Building, so floodproofing measures cannot be applied. Relocating the department and abandoning the building is possible, but City does not wish to give it up. The SCCOG Critical Facilities assessment recommended elimination of the basement in the short term and relocation of the fire station function in the long term. Refer to Page 11-2 above.</i>
<u>Emergency Services</u>		
Investigate locations and labor involvement for the pre-event stockpiling of sand bags for use in floodprone areas	<i>Capability</i>	<i>4,000 bags are pre-filled and ready to go. 20,000 bags are empty and ready to be filled. REPT grant used to purchase an automated sand bagger that can rapidly fill bags as needed.</i>
Pursue mutual aid agreements with non-profits to provide volunteer labor for filling sand bags and other response activities	<i>Capability</i>	<i>Emergency Manager maintains a call list of organizations that can be contacted for assistance. This list was recently used to recruit volunteers to help direct traffic during a parade.</i>
Implement a roadway-specific warning system to alert motorists to flooding dangers	<i>Delisted</i>	<i>Town has physical barriers and the ability to send warnings to specific areas using the Everbridge system. These systems are deemed sufficient, and this action unnecessary.</i>
<u>Public Education and Awareness</u>		
Conduct a "Flood Fair" so that interested parties can familiarize themselves with flood mitigation	<i>Delisted</i>	<i>City has many public education programs that address all hazards. A Flood Fair is not deemed necessary.</i>
Visit schools and educate children about the risks of flooding and how to prepare	<i>Delisted</i>	<i>FEMA provides some educational material for children, such as coloring books. There are also many other public education programs run by the City, including training videos on the City website. This action is not deemed necessary.</i>
Annually distribute a brochure outlining the risks of floodprone areas, mitigation strategies, and contacts	<i>Carry Forward</i>	<i>City is interested in distributing a brochure, but does not want to commit to an annual brochure.</i>
Encourage builders, developers, and architects to become familiar with NFIP land use and building standards at annual workshops	<i>Capability</i>	<i>City does not hold annual workshops. Completes this action on a case-by-case basis as developers, etc., approach City about new construction.</i>
<u>Natural Resource Protection</u>		
Pursue the acquisition of additional open space in SFHAs	<i>Carry Forward</i>	<i>City actively creates open space on properties already acquired. City is not interested in acquiring new properties at this point in time. Carry forward as "Pursue the creation of additional open space on City-owned properties, prioritizing those within SFHAs."</i>
Continue to aggressively pursue wetlands protection and incorporate performance standards into subdivision reviews	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
<u>Structural Projects</u>		
Encourage the use of floodplain storage and other flood control methods in new developments and at existing properties where appropriate	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Continue to evaluate culvert sizing as time and funding allows in order to prioritize replacements	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>

Action	Status	Notes
Utilize the recently available extreme rainfall data to determine existing culvert sizing and encourage upgrades where undersized	Capability	<i>This is a capability and can be removed from the list of actions.</i>
Continue to perform catch basin and culvert surveys to prioritize upgrades and perform maintenance and cleaning	Capability	<i>This is a capability and can be removed from the list of actions.</i>
Investigate funding and feasibility of mitigating frequent drainage problems	Capability	<i>This is a capability and can be removed from the list of actions.</i>
Consider removing the silt buildup from the vicinity of the Canada Bridge on Sherman Street	Carry Forward	<i>This is part of the Canada Bridge replacement project. Carry Forward to completion.</i>
Upgrade stormwater collection and discharge systems to keep up with rising sea level	Capability	<i>This is a capability and can be removed from the list of actions.</i>

New actions that the City wishes to implement moving forward, developed during this Plan update, include:

- Work with CT DEEP and FEMA to eliminate errors in the list of repetitive loss properties.
- Convert previously residential structures owned by the City into open space, prioritizing those that are floodprone.
- Pursue the creation of additional open space on City-owned properties, prioritizing those within SFHAs.
- Use grant funding to acquire floodprone private residential properties that pose significant health and safety risks from owners that approach the City.
- Pursue acquisition of commercial floodprone properties and convert to open space, if funding is available.
- Assist NPU with completion of their sewer separation project.

11.1.3 Actions Applicable to Wind Damage from Hurricanes, Tropical Storms, Summer Storms, Tornados, and Winter Storms

Action	Status	Notes
Prevention		
Work with the State to locate NOAA weather radios in commercial buildings with large populations and educate managers to use them	Capability	<i>One radio is located in every school and other locations with large populations (Dodd Stadium, Norwich Marina). Theft issue - radios keep having to be replaced</i>
Work with City marinas to ensure that personal watercraft can be removed in a timely manner or removed to sea prior to severe winds	Capability	<i>Marina is receptive, and does a good job of this</i>
Work with SCCOG to develop a regional marina management plan addressing wind damage, and encourage local marinas to develop plans	Capability	<i>Will work with SCCOG when approached</i>
Property Protection		
Promote the use of functional shutters for older buildings in the City, and investigate funding sources	Delisted	<i>Loss of windows from wind has not been an issue in the City. Historical Society would not want shutters installed on historic structures (loss of historic character).</i>
Make information on wind-resistant construction techniques available to all building permit applicants	Carry Forward	<i>Information distribution could be improved. This information is likely readily available.</i>

Action	Status	Notes
Encourage commercial building owners to develop emergency response plans and identify mitigation opportunities	<i>Capability</i>	<i>City encourages on a case by case basis</i>
<u>Emergency Services</u>		
Identify a location for a brush-disposal operation for dealing with debris following wind storms and determine potential reuse	<i>Capability</i>	<i>The City Transfer Station has been designated.</i>
Consider surveying all City-owned buildings, particularly historic buildings to determine their ability to withstand wind loading	<i>Capability</i>	<i>City has a report summarizing this information for all operational city buildings. Does not include city-acquired abandoned buildings.</i>
Develop agreements with landowners and companies to chop/chip to ensure backup plans are in place for debris removal	<i>Delisted</i>	<i>City does not feel this is necessary</i>
Prioritize wind-related retrofitting for the City's shelters over other critical facilities.	<i>Complete</i>	<i>The three primary shelters of the City have been assessed and rated to withstand a Category 3 Hurricane.</i>
<u>Public Education and Awareness</u>		
Visit schools and educate children about the risks of wind events and how to prepare for them	<i>Capability</i>	<i>Emergency Manager does this when he performs his all-hazard educational programs</i>
Conduct an annual workshop so that interested parties can familiarize themselves with wind mitigation	<i>Delisted</i>	<i>City does not have capacity for this, addresses on a case by case basis.</i>
Work with local homeowners associations and community groups to provide education regarding wise landscaping and proper tree planting	<i>Delisted</i>	<i>City does not believe this is a necessary action.</i>

11.1.4 Actions Applicable to Other Damage from Winter Storms

Action	Status	Notes
Consider conducting a study to identify buildings vulnerable to roof damage or collapse from heavy snow in the city	<i>Delisted</i>	<i>City employees know which buildings are vulnerable. Study is not necessary.</i>
Consider drafting a written plan for inspecting and prioritizing the removal of snow from City-owned structures	<i>Capability</i>	<i>City has a priority program for snow removal and clearance. Starts with Police, then Fire, then City Hall, etc.</i>
Continue making funding available to the Public Works Department each year for clearing snow from roads and parking lots	<i>Capability</i>	
Provide information for protecting City residents during cold weather and for mitigating icing and insulating pipes at residences	<i>Capability</i>	<i>Human Services has information. United Way and TBCCA, which run the home heating fuel program, also provide information.</i>
Consider posting the snow plowing routes in local government buildings and on the City's website	<i>Delisted</i>	<i>Not useful because routes will change for each storm.</i>
Continue to identify areas that are difficult to access during winter storm events and develop contingency plans to access such areas	<i>Capability</i>	<i>Plow goes out with emergency vehicles. Parking bans help keep roads clear.</i>

11.1.5 Actions Applicable to Earthquakes

Action	Status	Notes
Ensure that City departments have adequate backup	<i>Capability</i>	<i>This is a capability and can be removed from the list of</i>

supplies and facilities for continued functionality following an earthquake		<i>actions.</i>
Consider preventing residential development in areas prone to collapse such as below steep slopes or areas prone to liquefaction	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>

11.1.6 Actions Applicable to Wildfires

Action	Status	Notes
Continue to evaluate fire flows, available water supply, and areas at risk of wildfire in the City	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Extend public water supply & fire protection to future areas identified as being particularly at-risk	<i>Complete/ Delisted</i>	<i>The City does not feel this is a necessary action given existing water supply and dry hydrant availability. Water is extended to new development (and redevelopment, as in the case of Ponemah Mills)</i>
Pursue other sources of firefighting water where adequate supplies do not exist, such as through the installation of dry hydrants	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Continue to support public outreach programs to increase awareness of forest fire danger, equipment usage, and protecting homes	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Ensure provisions of City regulations regarding fire protection facilities and infrastructure are being enforced	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Continue to evaluate fire flows, available water supply, and areas at risk of wildfire in the City	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>

11.1.7 Actions Applicable to Dam Failure

Action	Status	Notes
Continue to maintain City-owned and NPU dams in good to excellent condition	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Include dam failure inundation areas in the Reverse 9-1-1 contact database	<i>Complete</i>	<i>This has been completed.</i>
Work with CT DEEP to ensure that the owners of high hazard dams have current EOPs and keep local copies	<i>Capability</i>	<i>This is a capability and can be removed from the list of actions.</i>
Provide assistance to the owners of lesser ranked dams regarding resources available for inspections and maintenance	<i>Capability</i>	<i>Performed on a case-by-case basis.</i>
Remove the Upper Falls dam on the Yantic River to eliminate backwater flooding at Sherman Street	<i>Carry Forward</i>	<i>Carry forward as "investigate feasibility of removal of..." It's not clear that it would be worthwhile.</i>
Encourage NPU to remove Taftville Reservoir #3 dam	<i>Complete</i>	<i>Norwich Public Utilities retained a consultant to evaluate the pros and cons of removing the dam. At this time, no action is proposed.</i>
Investigate means to remove other outdated industrial-age dams on major rivers	<i>Delisted</i>	<i>Upper Falls is the only one they are aware of; action not needed.</i>

New actions that the City wishes to implement moving forward, developed during this Plan update, include:

- Investigate feasibility and utility of removing the dam downstream of the Canada Bridge.

11.2 Prioritization of Specific Actions

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

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Action or Strategy #	Table 11-1: Mitigation Actions and Strategies for Norwich 2016 - 2021	Status	Responsible Department ¹	Fiscal Year					Cost	Potential Funding Sources ²	Weighted STAPLEE Criteria ³													Total STAPLEE Score	Priority for Community				
				7/2018-6/2019	7/2019-6/2020	7/2020-6/2021	7/2021-6/2022	7/2022-6/2023			Benefits							Costs											
											Social	Technical (x2)	Administrative	Political	Legal	Economic (x2)	Environmental	STAPLEE Subtotal	Social	Technical (x2)	Administrative	Political	Legal			Economic (x2)	Environmental	STAPLEE Subtotal	
1	Identify rock outcrops and steep slopes with additional natural resource potential and prioritize for conservation efforts	Carried Forward	PL		x				Low	OB	1	1	1	1	1	0	1	7.0	0	0	0	0	0	0	0	0.0	7.0	High	
2	Continue to support linear park and trail systems in the 1% annual chance floodplain, and expand the Heritage Riverfront Walkway	Carried Forward	PL	x	x	x	x	x	Moderate	OB	1	1	1	1	1	0.5	1	8.0	0	0	0	0	0	0	-0.5	0	-1.0	7.0	High
3	Consider additional regulations and design standards for development of properties with slopes greater than 15%	Carried Forward	PL			x			Minimal	OB	0.5	1	1	1	1	0	1	6.5	0	0	0	0	0	0	0	0.0	6.5	Medium	
4	Improve Norwich staff participation in local and regional planning exercises that increase readiness to respond to disasters.	New	EM	x	x	x	x	x	Low	OB	1	1	1	1	1	0	0	6.0	0	0	0	0	0	0	0	0.0	6.0	Medium	
5	Implement necessary upgrades to communication capabilities, specifically the city radio communications system	New	EM			x			Moderate	CIB, EOC	1	1	1	1	1	0.5	0	7.0	0	0	0	0	0	0	-0.5	0	-1.0	6.0	Medium
6	Eliminate basement of Yantic Fire Engine Co. No. 1 building	New	EM				x		High	CIB, HMA	0.5	1	1	1	1	1	0.5	8.0	0	0	0	0	0	0	-1	0	-2.0	6.0	Medium
7	Eliminate basement of Occum Fire Department building	New	EM				x		High	CIB, HMA	0.5	1	1	1	1	0.5	0.5	7.0	0	0	0	0	0	0	-1	0	-2.0	5.0	Low
8	Dry floodproof the utility room at Public Works	New	DPW		x				Moderate	CIB	1	1	1	1	1	0.5	0.5	7.5	0	0	0	0	0	0	-0.5	0	-1.0	6.5	Medium
9	Continue to regulate new development activities within SFHAs to the greatest extent possible within Town land use regulations	Carried Forward	PL	x	x	x	x	x	Minimal	OB	1	1	1	1	1	1	0.5	8.5	0	0	0	0	0	0	0	0.0	8.5	High	
10	Compile a list of addresses of structures within the 1% annual chance floodplain and storm surge areas, and track repair costs	Carried Forward	PL	x					Low	OB	1	1	1	1	1	0	0	6.0	0	0	0	0	0	0	0	0.0	6.0	Medium	
11	Incorporate information on the availability of flood insurance into all hazard-related public education workshops	Carried Forward	PL			x			Minimal	OB	1	1	1	1	1	1	0	8.0	0	0	0	0	0	0	0	0.0	8.0	High	
12	Make available FEMA-provided flood insurance brochures and encourage residents to purchase insurance if they are in a SFHA	Carried Forward	EM	x					Low	OB	1	1	1	1	1	0.5	0	7.0	0	0	0	0	0	0	0	0.0	7.0	High	
13	Distribute a brochure outlining the risks of floodprone areas, mitigation strategies, and contacts	Carried Forward	EM		x				Low	OB	1	1	1	1	1	0.5	0	7.0	0	0	0	0	0	0	0	0.0	7.0	High	
14	Consider removing the silt buildup from the vicinity of the Canada Bridge on Sherman Street	Carried Forward	DPW	x					Minimal	CIB	0.5	1	1	1	1	0.5	1	7.5	0	0	0	0	0	0	0	0.0	7.5	High	
15	Work with Connecticut DEEP and FEMA to eliminate errors in the list of repetitive loss properties	New	PL	x					Low	OB	1	1	1	1	1	0	0	6.0	0	0	0	0	0	0	0	0.0	6.0	Medium	
16	Convert previously residential structures owned by the City into open space, prioritizing those that are floodprone.	New	PL				x		Mod. each, High overall	CIB	1	1	1	1	1	0.5	1	8.0	0	0	0	0	0	0	-1	0	-2.0	6.0	Medium
17	Pursue the creation of additional open space on City-owned properties, prioritizing those within SFHAs.	New	PL					x	High	CIB	1	1	1	1	1	0.5	1	8.0	0	0	0	0	0	0	-1	0	-2.0	6.0	Medium
18	Use grant funding to acquire floodprone private residential properties that pose significant health and safety risks from owners that approach the City.	New	PL	x	x	x	x	x	High	CIB, HMA	0.5	1	1	1	1	1	0.5	8.0	0	0	0	0	0	0	-1	0	-2.0	6.0	Medium
19	Pursue acquisition of commercial floodprone properties and convert to open space, if funding is available.	New	PL	x	x	x	x	x	High	CIB, HMA	1	1	1	1	1	1	1	9.0	0	0	0	0	0	0	-1	0	-2.0	7.0	High
20	Assist NPU with completion of their sewer separation project.	New	DPW	x	x				Low	OB	1	1	1	1	1	0	1	7.0	0	0	0	0	0	0	0	0.0	7.0	High	
21	Make information on wind-resistant construction techniques available to all building permit applicants	Carried Forward	BO	x	x	x	x	x	Low	OB	1	1	1	1	1	0.5	0	7.0	0	0	0	0	0	0	0	0.0	7.0	High	
22	Investigate feasibility of removing the Upper Falls dam on the Yantic River to eliminate backwater flooding at Sherman Street	Carried Forward	DPW			x			Moderate	OB	0.5	1	1	1	1	0	0	5.5	0	0	0	0	0	0	-0.5	0	-1.0	4.5	Low
23	Investigate feasibility and utility of removing the dam downstream of the Canada Bridge.	New	DPW				x		Moderate	OB	0.5	1	1	1	1	0	0	5.5	0	0	0	0	0	0	-0.5	0	-1.0	4.5	Low

¹Notes
BO = Building Official
DPW = Department of Public Works & Engineering
EM = Emergency Management
PL = Planning Department

²Notes
CIB = Capital Improvement Budget
EOC = EOC Grants
HMA = FEMA Grant Programs
OB = Operating Budget

³Notes
Beneficial or favorable ranking = 1
Neutral or Not Applicable ranking = 0
Unfavorable ranking = -1

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

APPENDIX A

ADOPTION RESOLUTION

CERTIFICATE OF ADOPTION
CITY OF NORWICH CITY COUNCIL

A RESOLUTION ADOPTING THE HAZARD MITIGATION PLAN UPDATE, 2017

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

WHEREAS, the Norwich City Council approved the previous version of the Plan in 2012; and

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

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

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedures for the City of Norwich; and

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

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

RESOLVED by the City Council:

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

Adopted this _____ day of _____, 201_ by the City Council of Norwich, Connecticut

Mayor

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the City of Norwich this _____ day of _____, 201_.

City Clerk

