
TOWN OF BOZRAH ANNEX DOCUMENT

Southeastern Connecticut Council of Governments
Multi-Jurisdictional Hazard Mitigation and Climate Adaptation Plan Update

March 2023



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1. Introduction

1.1. Purpose of Annex

The planning process for the multi-jurisdiction hazard mitigation plan update commenced in April 2022 and ended in December 2022, spanning a period of nine months. The planning process included 24 jurisdictions (22 municipalities and two tribal governments) with two participating together (Griswold and Jewett City) for a net total of 23 local planning teams represented. For this 4th edition of the plan, SCCOG elected to link the planning process to a parallel planning process administered by the Connecticut Institute for Resilience and Climate Adaptation (CIRCA) that is known as “Resilient Connecticut 2.0” (stylized as *Resilient Connecticut*). The *Resilient Connecticut* program is described on CIRCA’s web site at <https://resilientconnecticut.uconn.edu/> and the expansion of the program into southeastern Connecticut is described at <https://circa.uconn.edu/2022/02/23/resilient-connecticut-expands-statewide/>.

The linkage of the two planning processes was advantageous for the following reasons:

- Incorporation of climate change into the hazard mitigation plan update
- Increased interest from the local communities, especially for those interested in developing climate adaptation strategies.
- Direct incorporation of climate change vulnerability products developed by CIRCA including the Climate Change Vulnerability Index (CCVI) for flood and extreme heat vulnerabilities.
- Direct incorporation of combined sea level rise and coastal flood inundation simulations from CIRCA
- Positioning of the SCCOG jurisdictions for new funding sources in Connecticut such as the new Department of Energy and Environmental Protection (DEEP) Climate Resilience Fund (DCRF)
- Consistency with the Governor’s Council for Climate Change (GC3) outcomes from the 2020-2021 planning process
- Positioning of the actions for incorporation on the State’s “resilience project pipeline” per Executive Order (EO) 21-3 issued at the end of 2021.

The planning process commenced for the local communities on April 20, 2022, with a presentation to the SCCOG Board. During this presentation, the consultant and CIRCA described the planning process and the approach for incorporating the *Resilient Connecticut* program into the hazard mitigation plan update, and notified the chief elected officials that invitations to local planning meetings would follow at the end of April. Local planning team meetings commenced on May 23, 2022 and ended on July 8, 2022. Workshops with local coordinators were conducted in July and September 2022, and supplemental meetings with water utilities in the region and specific stakeholders continued through November 2022.

The purpose of this HMP annex is to provide an update to the 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 hazards on the Town of Bozrah. Background information and the regional effects of pertinent hazards are discussed in the main body of the Multi-Jurisdictional Hazard Mitigation and Climate Adaptation Plan. Thus, this annex is designed to

supplement the information presented in the Multi-Jurisdictional HMCAP with more specific detail for Bozrah and is not to be considered a standalone document.

1.2. Hazard Mitigation and Climate Adaptation Goals

The primary goal of the previous hazard mitigation plans adopted in 2013 and 2018 was to identify risks to hazards and potential mitigation measures for such hazards in order to **reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources**. This included the reduction of public and private damage costs. Limiting losses of and damage to life and property was also meant to reduce the social, emotional, and economic disruption associated with a natural disaster.

Coinciding with the incorporation of climate adaptation and the alignment of this HMCAP with the *Resilient Connecticut* planning process administered by CIRCA, five new goals were developed for this HMCAP:

- Ensure that critical facilities are resilient, with special attention to shelters and cooling centers.
- Address risks associated with extreme heat events, especially as they interact with other hazards.
- Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.
- Reduce losses from other hazards.
- Invest in resilient corridors to ensure that people and services are accessible during floods and that development along corridors is resilient over the long term.

2. Community Profile

2.1. Physical Setting

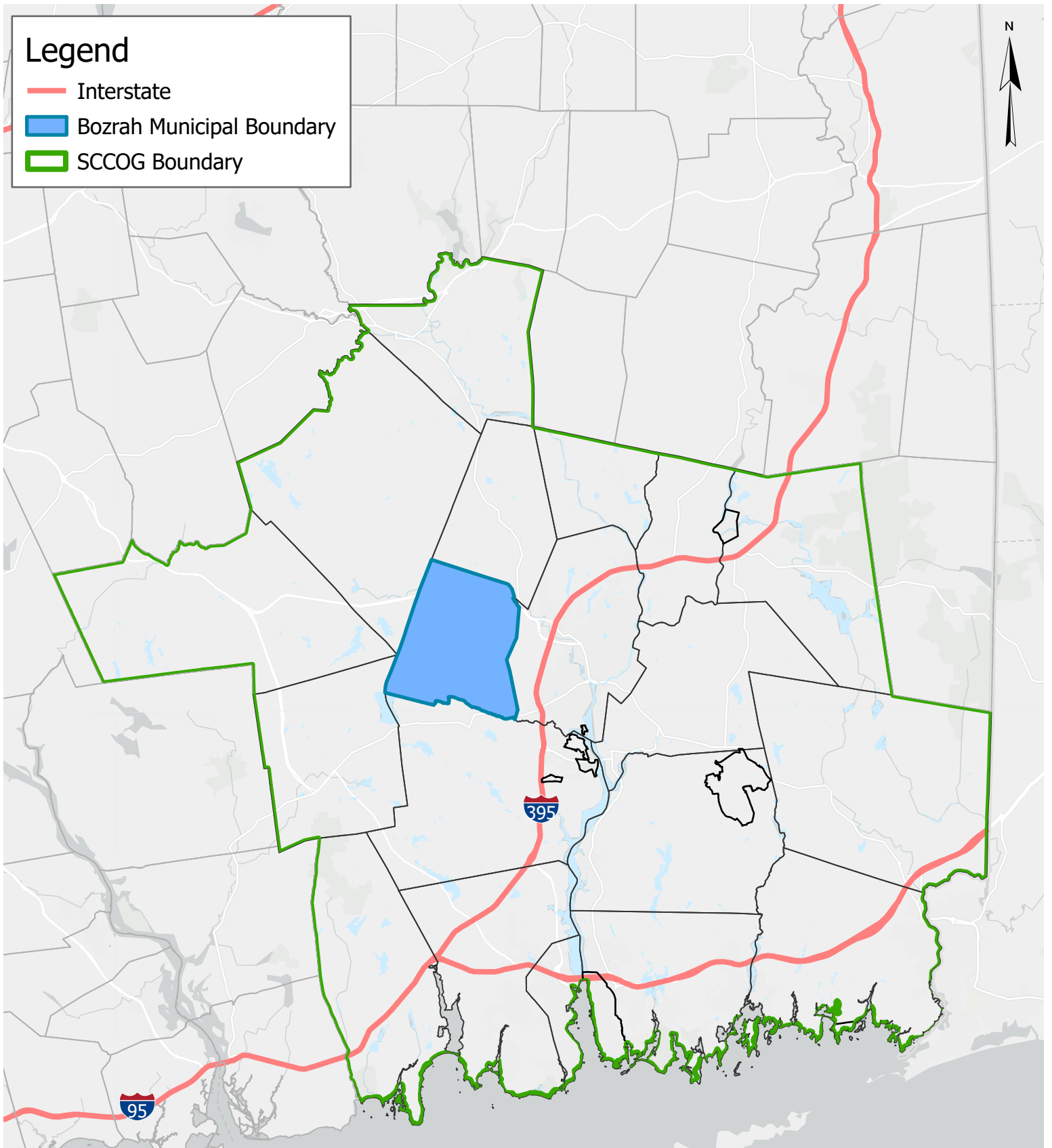
Bozrah is located in the northwestern corner of the SCCOG planning area. Elevations range from approximately 540 at the top of Scott Hill Road near the town line with Lebanon to approximately 110 feet near the Franklin/Norwich town line and the Central Vermont Railroad. The most densely populated area of town surrounds the Yantic River, Gardiner Brook in the vicinity of Fitchville Pond at the intersection of Routes 2 and 163, while outlying areas are rural. The town is mostly undeveloped with many hills and forestland.

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 Bozrah. Bozrah lies above seven bedrock formations which largely trend northeast to southwest across the town. Two faults that are oriented east-west near the town line with Montville pinch the formations into east-west and v-orientations in the south-southeastern section of town. The majority of the town is underlain by the Hebron Gneiss formation. The Hebron Gneiss formation consists of dark-grey schist and greenish grey fine to medium-grained calc-silicate gneiss, while the remaining six formations are comprised of gneiss, gabbro, and schist.

The Town's surficial geologic formations include glacial till and stratified drift. Refer to the Multi-Jurisdictional HMCAP for a generalized view of surficial materials. Till contains an unsorted mixture of clay, silt, sand, gravel, and boulders deposited by glaciers as a ground moraine. Areas adjacent to the Austin Brook, Mineral Spring Brook, Bentley Brook, the Yantic River, and Gardiner Brook have fairly extensive areas underlain by sand, sand and gravel, fines, alluvial sediment, or gravel. 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.

Legend

- Interstate
- Bozrah Municipal Boundary
- SCCOG Boundary

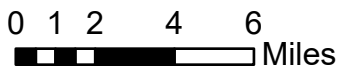


Regional Location of Bozrah

SCCOG Hazard Mitigation and Climate Adaptation Plan

Town of Bozrah

Date: 7/22/2022



Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

2.2. Drainage Basins and Hydrology

As previously stated, the Yantic River and Gardiner Brook are the primary watercourses in Bozrah. Their orientations are described in Section 1.2. Major tributaries include Austin Brook, Bentley Brook, and Trading Cove Brook (which forms the southern town line). Besides the Yantic River, there are approximately 15 named water bodies and many unnamed small tributaries in Bozrah.

There are a total of five subregional watershed basins in Bozrah. The subregional basins are Gardner Brook, Pease Brook, Susquetonscut Brook, Trading Cove Brook, and the Yantic River. The Yantic River, Gardner Brook and Trading Cove Brook dominate almost all of town. The Gardner Brook basin covers approximately 38% of town, while the Yantic River basin covers approximately 36% of town and the Trading Cove Brook basin comprises approximately 25% of Bozrah. The Pease Brook basin accounts for approximately 2% of town land, while the Susquetonscut Brook basin accounts for less than 1% of land area.

The extreme northwest corner drains to the Pease Brook drainage basin and the extreme northeast corner drains to the Susquetonscut Brook drainage basin, while the Yantic River basin stretches from the northern town line south to the Gardner Brook basin and southeast to the Trading Brook Cove basin.

The two dams with the most significant dam classifications are the Fitchville Pond Dam (Class C), and the Gardner Lake Dam (Class B).¹ According to the 1996 "Connecticut Dams" shapefile available from the Connecticut DEEP, additional dams in the Gardiner Brook basin include two unclassified and one Class A dam and in the Trading Cove Brook basin two Class A and one Class BB dam located on tributaries.

2.3. Land Use

According to the 2016 1-meter resolution land cover developed by the NOAA Office of Coastal Management, Bozrah is predominantly comprised of mixed forest, with approximately 72.42% of the town classified as such. The second largest land cover type is developed open space, which covers about 5.30%, and next is developed impervious which is about 4.04% of land cover. All land covers and their percent coverage can be found in Table 2-1.

Table 2-1 Town of Bozrah Land Cover

Land Cover Type (2016)	% Coverage
Barren Land	0.71
Cultivated Crops	2.42
Developed, Impervious	4.04
Developed, Open Space	5.30
Grassland/Herbaceous	3.87
Mixed Forest	72.42
Open Water	1.84
Palustrine Aquatic Bed	0.10
Palustrine Emergent Wetland	0.64
Palustrine Forested Wetland	3.09

¹ CT Registered Dam Query from September 2, 2022

Palustrine Scrub/Shrub Wetland	0.19
Pasture Hay	4.01
Scrub/Shrub	1.36

2.4. Population, Demographics, and Development Trends

Bozrah has been a rural community subsisting on agriculture and small businesses since it was incorporated in 1786. Population growth was very limited until the 1960s. Following the completion of Interstate 95 in 1956, the town began to attract residents working in nearby communities and wanting to live in a rural area. Residential and commercial development further increased with the completion of Interstate 395 and the highway portion of Route 2.

As of the 2020 Decennial Census, the population for the town is 2,429, which equates to 122 people per square mile. The 2020 American Community Survey 5-year estimates identified the annual median income for Bozrah to be \$90,750, with 30.4% of the population holding a bachelor’s degree or higher, and an unemployment rate of 3.4%.

In recent years, the Town has experienced some infill development in the Fitchville and Gilman Villages, though nothing too extensive. Currently, there are discussions surrounding new development in the vicinity of the Mid City Steel Plant on Stockhouse Road. While nothing specific has been approved, there is potential in this commercialized area. In addition to the steel plant area, major development typically occurs in the southeast corner of Bozrah around Route 32 and Stockhouse Road; as of October 2022 no major redevelopments have been proposed.

Overall, new development and redevelopment in Bozrah is not increasing risks to natural hazards. Redevelopment throughout the community offers significant opportunities for flood mitigation to be incorporated into buildings and stormwater management to be addressed on-site; and new development is constructed per the flood damage prevention, wind loading, and snow loading requirements in the State Building Code.

2.5. Governmental Structure

Bozrah is governed by a Town Meeting and Board of Selectmen form of government. The authority of town officials is granted by Connecticut General Statutes. The Town Meeting is the legislative body of the town and the Board of Selectmen is responsible for the administration of town policies. The First Selectman is the chief elected official and is responsible for the day-to-day administration of Bozrah. The First Selectman also acts as the Chief of Police (Police services are provided by Quinebaug Valley Dispatch in Killingly), and the Public Works Director.

The Town of Bozrah has boards and commissions that can take an active role in hazard mitigation, including the Inland Wetlands Commission, the Planning and Zoning Commission, the Zoning Board of Appeals, and the Board of Selectmen. Departments and commissions common to all municipalities in SCCOG were described in Section 2.9 of the Multi-Jurisdictional HMP. More specific information for the departments and commissions of the Town of Bozrah is noted below:

- The Building Official reviews plans for new development and inspects the work to ensure it meets current building codes.

- The Bozrah Volunteer Fire Company provides fire suppression, fire prevention, rescue, and hazardous materials response services to the town.
- The Inland Wetlands Commission is the Inland Wetlands Regulatory Agency for the Town of Bozrah and reviews plans for compliance with said regulations and maintains the town's inland wetlands map.
- The Planning & Zoning Commission reviews land use applications, zoning regulation amendments, planning and development projects, and grant opportunities to ensure that development and growth in the town is consistent with existing land use, environmental policy, and the objectives of the *Plan of Conservation and Development*. They are assisted by the Zoning Enforcement Officer. When planning services are needed, they are contracted through SCCOG.
- The Public Works Department consists of the First Selectman and a small staff. The department provides services including maintaining safe, efficient and well-maintained infrastructure of roads and bridges, snow removal and deicing on roads, hazardous trees and tree limb removal in right-of-ways, and maintaining and upgrading storm drainage systems to prevent flooding caused by rainfall.
- The Zoning Board of Appeals reviews projects that were denied by the Planning & Zoning Commission or were cited by the Zoning Enforcement Officer, as well as those that require variances.

The roles of Town departments have not changed since the time of the previous HMP. Thus, the Town of Bozrah is technically, financially, and legally capable of implementing mitigation projects for hazards to the extent that funding is available.

2.6. Review of Existing Plans and Regulations

Bozrah has different plans and regulations that suggest or create policies related to hazard mitigation. These policies and regulations are outlined in the Emergency Operations Plan (2016), *Plan of Conservation and Development* (2015), Zoning Regulations, and Inland Wetland Regulations. The Zoning Regulations were recently updated to incorporate new NFIP requirements.

Emergency Operations Plan

The town has an Emergency Operations Plan (EOP) that is reviewed and certified by the First Selectman annually. In 2016 the document was updated to match the new Statewide template.

This document provides general procedures to be instituted by the First Selectman and/or designee and the Fire Department in case of an emergency. Emergencies can include but are not limited to hazard events such as hurricanes and nor'easters. The EOP is directly related to providing emergency services prior to, during, and following a hazard event.

Plan of Conservation and Development (2015)

The updated *Plan of Conservation and Development* was adopted with an effective date of April 1, 2015 with contributions from local boards and commissions, citizens, and citizen groups. The Plan does not directly address the potential impacts of natural hazards, but does note areas that cannot be built upon

due to natural features such as steep slopes (those exceeding 15%) that restrict development. POCD goals and recommendations that may serve to encourage hazard mitigation include:

- Conduct special study for Gilman and Salem turnpike to create development scheme with particular attention to wetlands, floodplains, steep slopes, and watercourses.
- Review regulations to support agricultural services.
- Promote a coordinated conservation program for sensitive natural resources.

The purpose of the Plan is to balance growth with maintaining the rural quality of life that citizens within the town embrace. Intensive development is encouraged in only the Fitchville, Gilman, and Salem Turnpike sections of town. Preservation of agricultural land is a major focus of the document.

The POCD is considered somewhat inconsistent with the current goals and actions of the hazard mitigation plan. Although it notes that development should pay attention to wetlands, floodplains, steep slopes, and watercourses, it does not directly address several of the hazards such as winter storm hazards, flood hazards, earthquake hazards, and wind hazards. The next update to the POCD (scheduled for 2025 outside the life of the current hazard mitigation plan) should incorporate additional elements of hazard mitigation planning.

Zoning and Subdivision Regulations

The Zoning Regulations of the Town of Bozrah, Connecticut were last updated in 2022, with most recent hazard related revisions in 2011. The Bozrah Planning and Zoning Commission updated the Zoning Section 10.8 Special Flood Hazard Area (SFHA) Requirements, and the Subdivision regulations Section 5.3.9 and 5.7.3 on June 1, 2011. These changes reflect required changes associated with the DFIRM.

Inland Wetland and Watercourses Regulations

The Inland Wetlands and Watercourses Regulations in the Town of Bozrah require a permit for certain regulated activities that take place near or in a wetland or watercourse or that may impact 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.

2.7. Critical Facilities, Sheltering Capacity, and Evacuation

The Town of Bozrah has 12 critical facilities including three shelters, and two facilities that could serve as a cooling center during extreme heat events. All town facilities are identified in Table 2-2.

Table 2-2 Town of Bozrah Critical Facilities

Facility	Address or Location	Emergency Power	Shelter	Cooling Center	In SFHA
<i>Emergency Services</i>					
Bozrah Volunteer Fire Company/EOC	239 Fitchville Road	✓	✓		

Municipal					
Fields Memorial School (ARC shelter)	8 Bozrah Street	✓	✓		
Highway Department Garage	231 Fitchville Road	✓			
Town Hall	1 River Road			✓	
Senior Center	59 Bozrah Street			✓	
Stockhouse Road Organization	81 Stockhouse Road				
Other Infrastructure / Facilities					
Bozrah Moose Lodge 950 (alternate shelter)	115 Fitchville Road		✓		
Fitchville Residential Care Home	187 Fitchville Road				
Reliance House Substance Abuse Rehabilitation Home	36 Houghton Road				
Home for people with disabilities	Caroline Road				
Chicken Farms	Townwide				
Utilities					
Norwich Public Utilities Potable Water Facilities	Townwide				✓

Bozrah Volunteer Fire Company

Bozrah has one volunteer fire company on Fitchville Road that responds to fires and accidents. The fire station is also the town's EOC and is outfitted with standby power supply via a generator. A new generator was installed here in 2014.

The Fire Company has a variety of equipment including an ambulance, a rescue pumper, a 65 foot rescue ladder, a special equipment rescue truck, a 300 gallon forestry truck, a traffic control pick-up truck, an Emergency Medical Service (EMS) SUV, and a 2,750 gallon tanker. The Fire Company is the primary agency involved with hazard mitigation through emergency services and public education.

Shelters

The main shelter in Bozrah is Fields Memorial School. The facility is staffed by the American Red Cross as needed and has a generator. The Bozrah First Selectman reported in December 2016 that the emergency generator safety switch had been replaced at this site since the 2012 edition of the HMP.

Bozrah Moose Lodge 950 is a backup shelter. The second floor of the Fire Company, which was the primary shelter in the past, is now considered to be a second backup shelter. As stated earlier, the Fire Company has an emergency power supply.

In the event of an extreme heat event or heat wave, the town has identified the Senior Center and Town Hall as cooling centers.

Communications

The town's communication capability is adequate for most circumstances. Emergency communications are good except during long power outages. Since the previous HMP, Bozrah switched from the Colchester-based KX dispatch to the Quinebaug Valley Dispatch (QVEC dispatch) based in Killingly. This is a larger operation and has improved the town's capability to respond to emergency situations.

Communication with Bozrah Light & Power (BL&P), a fully-owned subsidiary of Groton Utilities, was efficient following Tropical Storm Irene and Winter Storm Alfred in 2011. Power was lost for two days following Tropical Storm Irene, but was restored quickly as a result of the efficient communication between BL&P, the Fire Company, and Public Works. There were no reported challenges associated with more recent events.

The town is migrating emergency alert communications to the “TextMyGov” system. This system allows the municipality to send alerts to residents, and allows residents to connect with the town such as reporting outages or flooded roadways.

Additional Facilities

The town's Highway garage is located next to the Fire Company and is considered a critical facility.

The Fitchville Residential Care Home is a state-supported assisted care facility located on Fitchville Road and is also designated a Bozrah critical facility. Reliance House, located at 36 Haughton Road next to the temporary Town Hall is considered a critical facility as it is a substance abuse rehabilitation home that requires response from the Fire Company and is a significant draw on town resources. A home for people with disabilities is located on Caroline Road and is considered a critical facility.

Lastly, water facilities (including the Norwich Public Utilities transmission pipeline) that are located throughout town, and chicken farms (the largest group of taxpayers) with multiple locations are considered critical facilities. These farms are considered critical due to their size and need for a potentially large emergency response. In January 2023, a large egg farm in town (Hallandale Farms) required more than 100 firefighters from the town and the region to extinguish a large fire. Although this fire was not attributed to a natural hazard, the incident underscores the significant challenges posed by incidents that threaten large egg and livestock facilities. In the event of severe storm or extreme heat wave, large farm operations such as this one may require additional resources.

Evacuation Routes

Bozrah's EOP describes the town's evacuation plans. The Evacuation Coordinator is responsible for maintaining up-to-date evacuation route maps which depict designated primary and alternate evacuation routes.

The highest capacity egress routes from Bozrah include Fitchville Road (Route 608) which runs parallel with Route 2 across northern Bozrah. Both roadways stretch from Lebanon at the west to Norwich at the east. Stretching west to east near the town line with Montville, South Road extends from Salem at the west to Route 82 in the southeastern corner town. At the South Road/Route 82 intersection, Route 82 extends to the east into Norwich. The main north-south egress route in Bozrah is that extends from the Montville town line to Route 608 is Route 163. From there, the most logical and highest capacity roadway to the town's border with Franklin to the north is Brush Hill Road.

2.8. Repetitive Loss Properties

A repetitive loss (RL) property is defined as any insurable building that has had two or more claims exceeding \$1,000 that were paid by the National Flood Insurance Program (NFIP) within a ten-year period. As of June 2022, there are no RL properties in the Town of Bozrah.

2.9. Exposure to Climate-Affected Natural Hazards

Properties, people, historic resources, and critical facilities in the town are exposed to natural hazards affected by climate change (i.e., severe storms, coastal flooding, droughts) as well as hazards that are not affected by climate change (i.e., earthquakes). As an initial screening of exposure to hazards, areas of risk have been overlaid onto parcel and point data in a GIS to understand the maximum potential exposure to hazards. The results of this analysis are found in Table 2-3.

Table 2-3 Town of Bozrah Exposure Analysis

Hazard	At-Risk Parcels		At-Risk Facilities		At-Risk Historic Assets	
	Value	Number	Value	Number	Value	Number
Hurricane/Tropical Storm	\$199,070,380	1,338	\$2,007,140	5	\$14,883,470	47
Severe Thunderstorm	\$199,070,380	1,338	\$2,007,140	5	\$14,883,470	47
Severe Winter Storm	\$199,070,380	1,338	\$2,007,140	5	\$14,883,470	47
Tornado	\$199,070,380	1,338	\$2,007,140	5	\$14,883,470	47
Drought	\$147,094,840	938	\$644,420	1	-	-
Flood						
1% Annual Chance	\$32,900,430	177	\$306,040	1	\$2,719,790	20
0.2% Annual Chance	\$51,197,020	300	\$306,040	1	\$3,001,920	21
Earthquakes	\$199,070,380	1,338	\$2,007,140	5	\$14,883,470	47
Wildfire	\$106,258,700	638	\$644,420	1	-	-

2.10. Community Climate Change Challenges

As is with all of the SCCOG communities, the Town of Bozrah has several concerns regarding climate change challenges. Most communities in the region are typically most concerned with the impacts of increased flooding and extreme heat events, however, there are often concerns about other climate driven hazards. The following summary sheet identifies the top flooding, heat, and other climate change concerns for the town, along with the hazard mitigation and climate adaptation actions that will work to address these concerns.

Climate Change Summary Sheet for Town of Bozrah

What are the Town's Top Climate Change Concerns?

Flooding: The Yantic River flows through the town and poses risk to Stockhouse Road. Trading Cove Brook in the southeastern corner of the town is also a concern. The Town is concerned with dam conditions throughout Bozrah.

Extreme Heat: The Town has increasing concerns about the effects of extreme heat events on chicken and other agricultural and livestock operations. Avian flu and other health-related cascading impacts of extreme heat events.

Others: The Town wishes to address remaining needs related to critical facilities that are needed to help address impacts of climate change.

Which Hazard Mitigation and Climate Adaptation Actions Will Address Climate Change Concerns?

Flooding: Partner with CT DEEP's Dam Safety team to deliver a unified message to dam owners that inspections and risk communication are necessary. Target year 1 for working with DEEP and year 2 for the messaging to dam owners.

Extreme Heat: Partner with chicken farms and other facilities to develop reliable, drought-resilience water supplies and standby power that is capable of operating cooling equipment.

Others: Pursue American Red Cross certification to make Fields Memorial School the primary shelter and a cooling center, and additional certifications for the back-up shelters which include both Bozrah Moose Lodge 950 (alternate shelter) and the Volunteer Fire Company.

3. Extreme and Severe Storms

3.1. Climate Change Impacts

Climate change projections indicate varying changes in the frequency and intensity of severe storms and their relative hazards like precipitation and wind. It is expected that as global mean temperatures continue to rise, storms like hurricanes, tropical storms, and severe thunderstorms, may become more frequent and more intense. The degree to which these events might change, and the confidence levels in the models, vary by event type.

Hurricanes and tropical storms are likely to be accompanied by higher wind speeds and an overall increase in intensity. Warm water and air temperatures are essentially the fuel source for the storm, therefore warmer temperatures mean an increase in fuel which can produce more intense winds and high precipitation levels.

While the future behavior of tornado and high wind events is a little more challenging to predict in comparison to hurricanes, it has been noted that the number of days of tornadic activity has decreased in recent decades, though the number of tornadoes in a single day has increased.² There is a similar lack in confidence when projecting severe thunderstorm and wind events. Because these events are short-lived and relatively small-scale, monitoring and modeling are more challenging. Overall, however, future climate conditions are likely to become more conducive to the development of such events, therefore increasing the potential for occurrence.

Severe winter storm events, similar to hurricanes, are expected to become more intense under future climate conditions, however they are expected to become less frequent. These storms will continue to be capable of producing large amounts of precipitation, though in future decades this precipitation will consist of less snow and more wintry mix or rain.

These changes in storms could equate to an increase in risk throughout town or for specific populations, more severe storm damages and impacts, or an increase in flooding occurrences.

3.2. Hurricanes and Tropical Storms

3.2.1 Setting and Recent Occurrences

Several types of hazards may be associated with tropical storms and hurricanes including heavy winds, heavy rains, and flooding. Flooding hazards are discussed in Section 5.2 of this annex. Wind hazards are widespread and can affect any part of the town. However, some buildings in the town are more susceptible to wind damage than others.

Tropical Storm Irene impacted the region in August 2011. Sections of trees fell throughout the town and the region causing power outages lasted over a week in some parts of the region. The Town learned that communication between the Town and its power utility at the time, Connecticut Light & Power (CL&P), needed to greatly improve in order to efficiently and effectively clear roadways throughout town in the future.

² <https://nca2018.globalchange.gov/chapter/2/>

In 2012, Superstorm 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. Emergency managers recommended mandatory evacuations of 362,000 people that lived in low lying areas. Widespread significant statewide power outages of 667,598 lasted up to 8 days.

On August 2, 2020 Tropical Storm Isaias swept through the State bringing severe winds which resulted in the highest number of outage events Connecticut has ever experienced. With over 620,000 outages reported by Eversource alone, the state's largest electric supplier, residents across the SCCOG region were without power, cable, and internet for extended periods of time. While this storm did not generate typical amounts of rainfall experienced during a tropical storm event, the wind damage exceeded expectations bringing down trees and power lines across the state.

In 2021, there were four tropical storm events that passed through, or within 50 miles of, the state. Some of these events, which are described in more detail below, resulted in flooding along several brooks and stream crossings, including roadway washouts. During Hurricane Ida, the Town reported that the areas that "are known to flood" did so during this heavy precipitation tropical event. Power outages during these events, and other severe storms, were still a challenge for the town.

The 2021 events included Elsa, Fred, Henri, and Ida.

- July 9, 2021 (T.S. Elsa) – Elsa made landfall as a tropical storm in Florida and traveled along the eastern seaboard. It passed through Southeastern New England bringing high winds and rainfall. Gusts were reported over 40 mph, and residents throughout the region and state were left without power.
- August 19, 2021 (Extratropical Storm Fred) – This tropical event passed north of the state bringing heavy rain to some areas in Connecticut; there was a reported 5.14 inches in West Hartford. Fred also produced an EF-0 tornado in Windham County.
- August 22, 2021 (T.D. Henri) – Hurricane Henri made landfall in Rhode Island as a tropical storm and then traveled northwest across the State of Connecticut. While the impacts for Henri were projected to be more severe than they actually were, the storm did result in heavy rainfall and thousands of power outages.
- September 1, 2021 (Extratropical Storm Ida) – Though Hurricane Ida made landfall in Louisiana as a category 1, the storm moved south of Long Island as an extratropical storm and is reported to be costliest storm even since Hurricane Sandy a decade earlier. Ida caused major flooding across Connecticut and the Southeastern Region. For the first time, a statewide flash flood warning was issued. Several communities in the state, including the City of Norwich, warned residents to have minimal contact with surface waters due to the discharge of untreated sewage. There were reports of 7 to 8 inches of rainfall in the Southeastern Region, and as high as 8.58 inches in Uncasville.

3.2.2 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 Bozrah ranges from 120 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. Bozrah has adopted the Connecticut Building Code as its building code.

The Town does not have a specific requirement that utilities be located underground in new developments; however the relatively new roadway intended to spur commercial and industrial development, Rachel Drive, has underground utilities.

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 couple areas of the town.

Since the previous HMP, the Town has appointed a tree warden. In early 2022 the tree warden undertook a town-wide tree tagging project to catch up on tree trimming throughout town and to address those impacted by the Emerald Ash Borer.

The town department of public works has a small budget for in-house maintenance work, including tree trimming and removal. There is also a separate budget available for tree maintenance related to specific events or situations. This latter budget can be used to contract out work to private companies. For example, if there is a tree that is higher, or if a situation is more complex, than what the town's equipment can handle, the town utilizes the services of a contractor. The Town DPW is equipped with a bucket truck that is used for tree removal.

The Bozrah DPW is responsible for debris collection and disposal following a storm. The Volunteer Fire Department will also help to clear roads after an event. The town has designated an official debris disposal site.

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

Residents can sign up to receive warnings from the statewide CT Alert "Everbridge" Emergency Notification System to receive critical information and the town will have the ability to send area specific alerts. Although hurricanes that have impacted Bozrah have historically passed in a day's time, additional regional shelters could be outfitted following a storm with the assistance of the American Red Cross on an as-needed basis for long-term evacuees.

Summary

In general, municipal capabilities to mitigate hurricane damage have not increased significantly since the 2017 edition of the hazard mitigation plan was adopted. This is likely because the Town increased its

capabilities sharply between the 2005 and 2012 plan adoptions, in response to the winds of Tropical Storm Irene in 2011.

3.2.3 Vulnerabilities and Risk Assessment

The entire town is vulnerable to hurricane and tropical storm wind damage and from any tornadoes (Section 3.3) accompanying the storm, as well as inland flooding (Section 5.2). Of particular concern are the blockage of roads and the damage to the electrical power supply from falling trees and tree limbs. There was a town-wide two day power outage following due to tree damage to utility lines following Hurricane Irene in 2011.

Many of the structures built in town do not meet current building codes and are particularly susceptible to roof and window damage during high wind events. Those newer structures put in place since the 1990s are less vulnerable to damage from hurricanes and/or tropical storms. This risk to structures will be reduced with time as these buildings are remodeled or replaced with buildings that meet current codes. The Town is currently working on upgrading municipal buildings as funding allows. For example, the Town Hall has been rehabilitated and renovated to meet all current building codes.

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

3.2.4 Hazard Losses

There were no reported hurricane or tropical storm related losses for the Town of Bozrah from NOAA since 2017 or the FEMA PA program within the past decade.

There were reported losses from Hurricane Ida for three property owners in the amount of \$11,759. These funds were received by the property owners under the FEMA Individual Assistance (IA) program.

FEMA HAZUS-MH 6.0 was used to develop losses associated with seven probabilistic hurricane scenarios from the 10 year to 1,000 year return period. Losses include economic loss, building damages, debris, and sheltering needs. Table 3-1 through Table 3-3 presents hurricane related damages for the Town of Bozrah. Additional HAZUS-generated losses for the town and region can be found in the Multi-Jurisdictional document.

Downscaled tropical storm losses based on the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document.

Table 3-1 HAZUS-MH Hurricane Related Economic Impacts

Bozrah	Return Period	Residential	Commercial	Industrial	Others	Total
	10-year	\$14,450	\$0	\$0	\$0	\$14,450
	20-year	\$305,110	\$46,950	\$2,050	\$4,360	\$358,470
	50-year	\$1,848,850	\$618,970	\$28,030	\$63,590	\$2,559,440
	100-year	\$3,718,680	\$2,099,290	\$109,690	\$465,160	\$6,392,820
	200-year	\$6,757,650	\$5,217,990	\$299,030	\$1,036,260	\$13,310,930

	500-year	\$13,899,050	\$12,825,090	\$753,370	\$1,703,110	\$29,180,620
	1,000-year	\$21,071,640	\$20,400,680	\$1,183,850	\$2,374,060	\$45,030,230

Table 3-2 HAZUS-MH Hurricane Related Building Damage

Bozrah	Return Period	Minor	Moderate	Severe	Destruction	Total
	10-year	1	0	0	0	1
	20-year	3	0	0	0	3
	50-year	40	4	0	0	44
	100-year	104	14	1	0	119
	200-year	182	34	4	1	221
	500-year	275	75	13	3	366
	1,000-year	323	109	23	7	462

Table 3-3 HAZUS-MH Hurricane Related Debris Generation and Sheltering Needs

Bozrah	Return Period	Debris Generated (Tons)	Households Displaced	Individuals Seeking Temporary Shelter
	10-year	4	0	0
	20-year	40	0	0
	50-year	643	0	0
	100-year	1,060	0	0
	200-year	1,783	0	0
	500-year	3,434	0	0
	1,000-year	4,797	5	1

3.3. Tornadoes and High Wind Events

3.3.1 Setting and Recent Occurrences

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

- On September 6, 2017, a cold front triggered severe storms in county and caused tree damage in multiple communities in the region. Neighboring Colchester reported trees and wires down, and the Groton-New London Airport measured sustained winds at 44 mph and gusts of 56 mph.
- On April 13, 2020, a low pressure system resulted in high winds throughout New London County
- On November 13, 2021, a tornado touched down in Pawcatuck, and another in Plainfield. There were reports of uplifted trampolines, downed trees and powerlines, and an uplifted metal shed. This same storm also caused damage in other surrounding communities.

3.3.2 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 town can access National Weather Service forecasts via the internet as well as listen to local media outlets (television, radio) to receive information about the relative strength of the approaching storm. This information allows the town to activate its EOP and encourage residents to take protective measures if appropriate.

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

Summary

In general, municipal capabilities to mitigate thunderstorm and tornado damage have not increased significantly since the 2017 edition of the hazard mitigation plan was adopted, with the exception of changes in the tree warden position.

3.3.3 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 town are equally likely to experience the effects of summer storms. The density of damage is expected to be greater near the more densely populated area of the town.

Most thunderstorm damage is caused by straight-line winds exceeding 100 mph. Experience has generally shown that wind in excess of 50 miles per hour (mph) will cause significant tree damage during the summer season as the effects of wind on trees is exacerbated when the trees are in full leaf. The damage to buildings and overhead utilities due to downed trees has historically been the biggest problem associated with wind storms. Heavy winds can take down trees near power lines, leading to the start and spread of fires. Such fires can be extremely dangerous during the summer months during dry and drought conditions. Fortunately, most fires are quickly extinguished due to the town's strong fire response and coordination with Connecticut DEEP fire fighters. Lightning and hail are generally associated with severe thunderstorms and can produce damaging effects. All areas of the town are equally susceptible to damage from lightning and hail, although lightning damage is typically mitigated by warnings and proper grounding of buildings and equipment. Hail is primarily mitigated by warning,

although vehicles and watercraft can often not be secured prior to the relatively sudden onset of a hailstorm.

Lightning and hail are considered likely events each year, but typically cause limited damage in the town. Older buildings are most susceptible to lightning and hail damage since many were constructed prior to current building codes, and many campgrounds offer little structural protection from the elements.

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

3.3.3.1 Hazard Losses

There have been no reported losses attributed to tornadoes or high wind events for the Town of Bozrah from Public Assistance or NCEI. NOAA has reported \$200,000 in strong wind damages for northern New London County since 2017. Downscaled losses based on the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document.

3.4. Severe Winter Storms

3.4.1 Setting and Recent Occurrences

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

The winter storms of 2010-2011 had a significant effect on the town, producing significant snowfall in Bozrah. However, roof damage was not observed. Concern for the school resulted in an inspection by the town's engineer. The town eventually cleared the roof because more snow was in forecast. Winter Storm Alfred in late October 2011 caused only minor tree damage and no loss of power in town.

Winter storms and nor'easters have affected the town since the last HMP as reported to the NCEI and reported by town officials. The year 2013 featured exceptional snow events that severely taxed snow removal abilities of towns in the region. The blizzard of 2013 in early February dumped 1-2 feet of snow on the region. Another heavy snowstorm in March 2013 dumped 1-2 feet of snow in the region. The town received over \$15,000 in federal reimbursement for costs related to storm cleanup.

A heavy storm came through the region on February 9, 2017, bringing blizzard conditions and heavy snowfall. Nearby Colchester report 14.5 inches of snow, and 13 inches were reported along the coast in Groton.

A late winter storm on March 12, 2018, resulted in 23 inches of snowfall in Oakdale, with reports of one to two feet in other parts of Northern New London County. The southern part of the region experienced 10 to 18 inches of snow, and strong wind gusts. There were also reports of downed trees throughout the region as a result of this storm.

On January 28, 2022, the region was hit with a heavy snowstorm and blizzard like conditions. Parts of the region reported up to 22 inches of snowfall, and gusts up to 65 mph. There were also several hours of less than ¼ mile visibility. Snow drifts were also reported to be a challenge, with some areas experiencing drifts up to three and a half feet deep.

3.4.2 Existing Capabilities

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

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

The Public Works Department oversees snow removal in the town. The Connecticut Department of Transportation (DOT) plows the State roadways, while the town plows approximately 36 miles of roads by employing four trucks and five crews. The town regularly maintains and upgrades its plow fleet; two new used plow-trucks and one new Mason-style dump-truck were purchased and delivered to the town in December of 2016.

The First Selectman is responsible for conducting reconnaissance work prior to dispatching plow crews. The First Selectman is also responsible to advise the superintendent of schools whether a delay or closure is necessary. Public Works Department crews are usually plowing by 4 a.m. and a high priority is given to school bus routes that include steep hills.

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 town monitors and shovels the roofs of municipal buildings when snow loads accumulate, and many residents and businesses shovel or plow their roofs.

Summary

In general, municipal capabilities to mitigate snowstorm damage have increased slightly since the 2017 edition of the hazard mitigation plan was adopted. This is because the Town continues to experience heavy snow each winter.

3.4.3 Vulnerabilities and Risk Assessment

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

Warning and education can prevent most injuries from winter storms. Most deaths from winter storms are indirectly related to the storm, such as from traffic accidents on icy roads and hypothermia from

prolonged exposure to cold. Damage to trees and tree limbs and the resultant downing of utility cables are a common effect of these types of events. Secondary effects can include loss of power and heat.

As a result of a significant change in elevation in town with elevations ranging from approximately 110 feet to approximately 540 feet, town officials report that microclimates exist in Bozrah. According to the First Selectman there are three or four in town and they present area-specific problems in town. Snowfall amounts can vary significantly in Bozrah dependent on elevation.

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

3.4.3.1 Hazard Losses

There have been no winter storm related losses in the past five years for the Town of Bozrah from NOAA or the FEMA PA program. The most recent documented winter loss can be attributed to the January 2015 winter storm event where the town received \$15,236 in FEMA PA funds for \$20,315 in project costs. Downscaled losses based on the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document.

4. Sea Level Rise

4.1. Climate Change Impacts

Sea levels are rising at an increased rate across the globe. These rising waters are attributed to melting glaciers and ice sheets, as well as thermal expansion from warming ocean waters. Global sea level rise takes into account the major causes of rise, and the averages of rise around the world. Local sea level rise estimates considers the global changes, in addition to what is happening more locally such as changes in currents or land subsidence.

The University of Connecticut, Connecticut Institute for Resilience and Climate Adaptation (CIRCA) has, in accordance with state statute, developed local sea level rise projections for communities to use as a planning threshold (Figure 4-1). CIRCA recommends that communities plan for 0.5 meter (1.64 feet) of sea level rise above 2001 levels by 2050. CIRCA intends to revisit this estimate and update the planning thresholds in the lifespan of this plan (2023-2028).

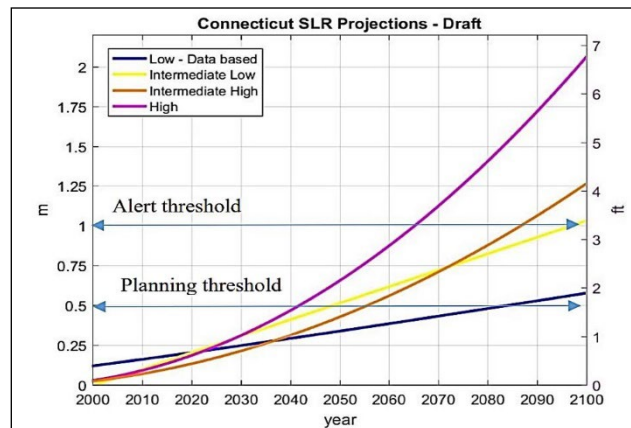


Figure 4-1 Four Localized Sea Level Rise Scenarios for Connecticut

Even though sea level rise occurs over a longer time period than other hazards, coastal communities are becoming increasingly concerned with the cascading impacts. Increased sea levels can cause a greater geographic reach for coastal flooding events, an increase in frequency or extent of “sunny day” flooding, an increase in storm surge extent, and saltwater inundation along the shoreline. All of these impacts can damage properties, deteriorate infrastructure, cause access and egress challenges, and exacerbate coastal erosion processes.

4.2. Coastal Flooding

4.2.1 Setting and Recent Occurrences

Bozrah is not located along the coastline nor is it located in a potential hurricane surge zone. As such, no coastal flooding or storm surge has affected the town since the last HMP. Therefore, the town is not considered to be affected by coastal flooding and storm surge.

4.2.2 Existing Capabilities

Due to the town not being on the coast, it does not have and/or need regulations to restrict development due to coastal flooding hazards.

4.2.3 Vulnerabilities and Risk Assessment

No areas of the town are vulnerable to coastal flooding or storm surge.

4.2.3.1 Hazard Losses

There are no reported losses for the Town of Bozrah related to coastal flooding.

4.3. Shoreline Change

4.3.1 Setting and Recent Occurrences

Bozrah is not located along the coastline, as such, no coastal erosion has impacted the town since the last HMP. Therefore, the town is not considered to be affected by coastal flooding and storm surge

4.3.2 Existing Capabilities

Due to the town not being on the coast, it does not have and/or need regulations to restrict development due to coastal flooding hazards.

4.3.3 Vulnerabilities and Risk Assessment

No areas of the town are vulnerable to coastal flooding or storm surge.

4.3.3.1 *Hazard Losses*

There are no reported losses for the Town of Bozrah related to shoreline change.

5. Changing Precipitation

5.1. Climate Change Impacts

Across the United States, annual precipitation has increased in the past century, however, this change *is* dependent upon the region. Here in the northeast, precipitation totals and intensity are believed to have increased, and are projected to continue to increase during spring and winter months. However, climate change has also been linked to a reduction in snow cover extent, and an earlier spring melt. Winter precipitation may also change from snow to a wintry mix or rainfall due to warmer temperatures; so while precipitation may increase it may not necessarily be an increase in snow.

Changes in precipitation can also shift the frequency and severity of droughts. As the climate warms, surface soil moisture is likely to decrease as evaporation rates rise. This decrease in soil moisture, and potentially longer periods of time between intense precipitation events, could potentially mean longer and stronger droughts.

These changes in precipitation can have various types of impacts. With an increase in intense precipitation, flooding events may become more frequent, damages to crops may occur, and spring flood trends may shift with less snow and more rain. Droughts on the other hand can also cause damage to crops, stress livestock and agricultural operations, and also reduce drinking water supplies or private wells.

5.2. Riverine and Pluvial Floods

5.2.1 Setting and Recent Occurrences

Flooding is the primary hazard that impacts the town each year as documented in the previous edition of this plan. While riverine flooding along watercourses is a concern, shallow nuisance flooding and poor drainage have also caused flooding at several locations in the town. Flooding is typically caused by heavy rainstorms, but can also be caused by relatively light rains falling on frozen ground. Flooding of roadways is more common than damage to structures during pluvial and riverine floods.

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

- The Yantic River rose to the level of Stockhouse Road in the northeast section of town, but did not submerge or cross the road. Businesses in this area are located at high points and therefore did not flood. This section of Stockhouse Road is part of a SFHA.
- Low-lying sections of Route 163 historically experience nuisance flooding due to poor drainage. This happens at the intersection of Caroline Road. This area is adjacent to Gardner Brook which flows from Gardner Lake to the Yantic River in this area.
- During the March 2010 storms, the area of Old Salem Turnpike near the Norwich city line experienced backed up water which accumulated three to four feet of water in basements in homes with walk-out basements. This was the result of an insufficient culvert capacity. In this area, small streams from Wawecus Hill flow southerly to this area.

More recently, the September 2018 severe storms (described below) and the summer of 2021 tropical events caused flooding in town. Though reports were not as extensive as those from 2010, the areas that typically experience flooding along the Yantic River did flood during the 2018 and 2021 storm events.

The September 2018 rain event caused severe flooding throughout the state, with several communities in the SCCOG region receiving FEMA funding for the event. Neighboring Norwich received 4.85 inches of rainfall and Lebanon had a reported 6.79 inches.

Storm Ida, which produced several inches of rain across the state, caused flooding in many SCCOG communities. Norwich Public Utilities recorded 6.34 inches of rainfall and Groton-New London Airport recorded 2.05 inches.

After the severe flashy drought of summer 2022, a severe rainstorm event on September 5-6, 2022, caused flooding throughout southeastern Connecticut. Lebanon experienced road closures and washouts, while Norwich Public Utilities observed 5.85 inches of rainfall. There were flood and flash flood warnings throughout the region and across the state. Neighboring Rhode Island reported 11 inches of rainfall in some communities.

5.2.2 Existing Capabilities

The town attempts to mitigate inland flood damage and flood hazards by utilizing a wide range of measures including restricting activities in areas of flood risk, replacing and upsizing bridges and culverts, promoting flood insurance, maintaining drainage systems, advancing education and outreach, and by utilizing warning systems. Many mitigation measures are common to all hazards and are listed in Section 8. No structural flood control projects are located within or upstream of Bozrah, although the existing dams provide a small amount of flood mitigation.

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 First Selectman (as Public Works Director) or the Fire Department typically handles complaints from residents. 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. Drainage complaints are directed to the First Selectman.

The Town has an active program for replacing / resizing road culverts and has a yearly line item in the budget for this purpose. The First Selectman explained in the December 2016 meeting that old culverts are being replaced with modern risers, rather than the older cinderblock systems. Additionally, as issues arise, old corrugated metal pipes are replaced with PVC pipes.

According to Town staff, the following bridges have been completely rebuilt in the last five to ten years:

- Bozrah Street Extension over Gardner Brook (completed 2006)
- Stanton Road over Yantic River (completed September 2012)
- Bashon Hill Road over Austin Brook
- Gager Road over Gardner Brook (completed 2012)
- Bishop Road over Pearsons Brook

Additionally, ongoing drainage improvement are being implemented on Wahconah Drive.

Regulations, Codes, and Ordinances

Bozrah has planning and zoning tools in place that incorporate floodplain management. The town also has subdivision regulations that require adequate drainage be provided to reduce exposure to flood hazards. Regulations covering development in and/or near inland wetland areas also exist.

The Connecticut DEEP has updated its municipal stormwater (MS4) regulation guidelines. Compliance with these new guidelines (required by the state) is expected to improve stormwater runoff management and mitigate flooding.

Acquisitions, Elevations, and Property Protection

Bozrah has not performed acquisitions or elevations of floodprone property. Property protection has focused instead on preventive measures and maintaining and upgrading drainage systems.

Flood Watches and Warnings

The First Selectman and the Fire Department access weather reports through the National Weather Service and local media. The town is working to implement the “TextMyGov” system to allow for communication and emergency alert to residents.

National Flood Insurance Program

The Town of Bozrah participates in the National Flood Insurance Program (NFIP) and has been a member community since September 30, 1981. Currently, as of August 31, 2022, the Town of Bozrah has three active flood insurance policies in town that have a total coverage of \$630,000.

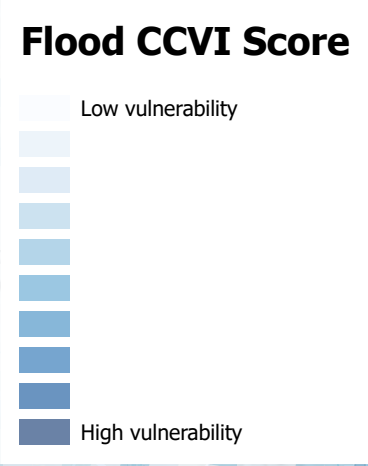
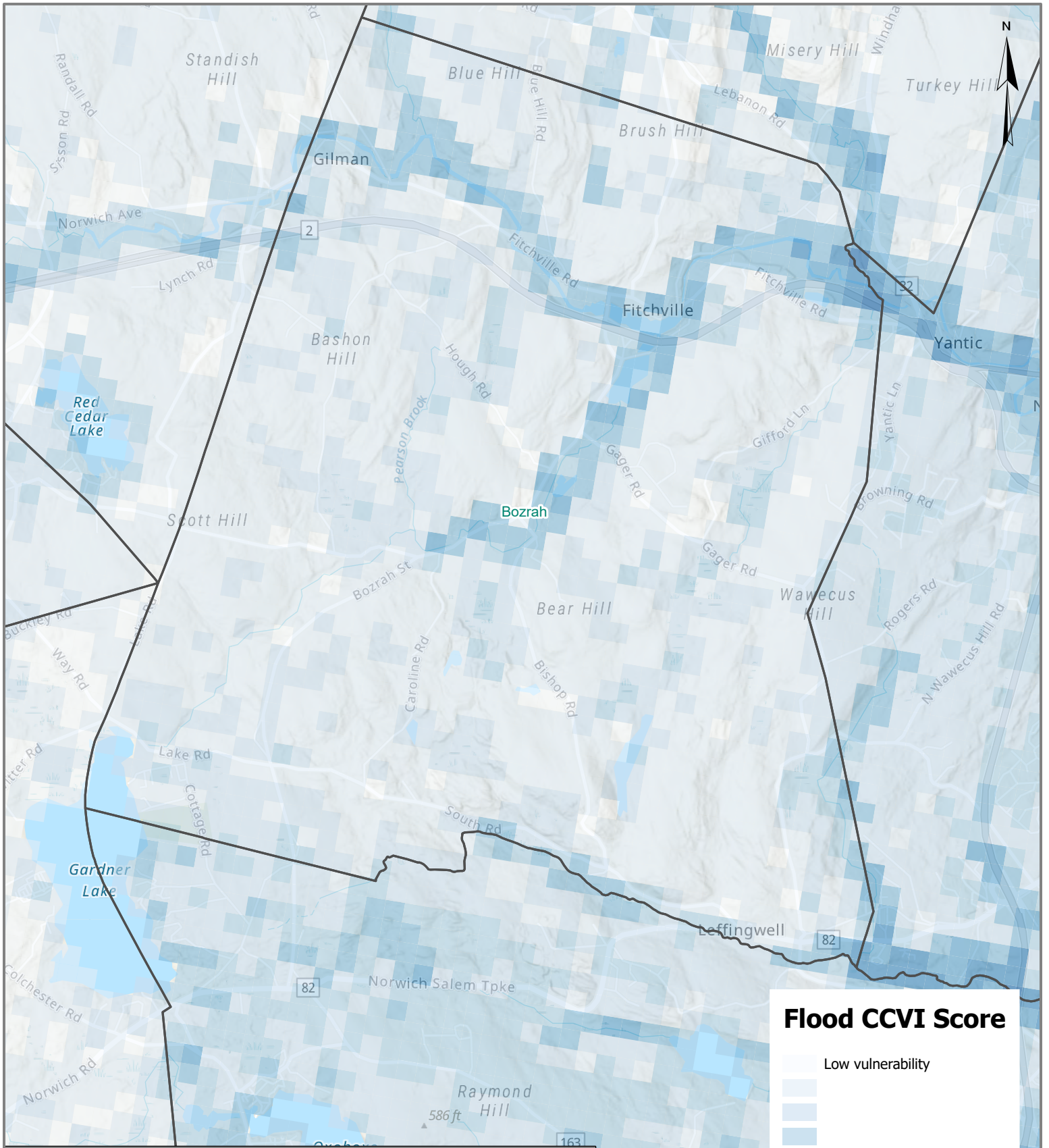
Summary

In general, municipal capabilities to mitigate flood damage have not increased significantly since the 2017 edition of the hazard mitigation plan was adopted. This is likely because the Town increased its capabilities sharply between the 2005 and 2012 plan adoptions, in response to the flooding of 2010.

5.2.3 Vulnerabilities and Risk Assessment

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

UConn CIRCA has developed a tool to aid in understanding flood vulnerability for communities across the state. This tool, known as the Climate Change Vulnerability Index (CCVI), is comprised of dozens of factors that contribute to a community’s flood sensitivity, exposure, adaptive capacity, and ultimately the overall flood vulnerability. The CCVI has been used as a tool to characterize flood vulnerability for the town. The distribution of flood vulnerability throughout the community can be seen in Figure 5-1. The CCVI demonstrates that flood vulnerability in Bozrah ranges from low to moderate. Most of the vulnerability score is due to the Yantic River.



Flood CCVI Score

SCCOG Hazard Mitigation and Climate Adaptation Plan

Town of Bozrah

1/17/2023

0 0.2 0.3 0.7 1 Miles

Esri, NASA, NGA, USGS, FEMA, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS,

Vulnerabilities Along Watercourses

Two major inland watercourses in Bozrah have SFHAs defined by FEMA. These are the Yantic River and Gardner Brook which both are mapped as Zone AE, indicating that flood elevations are available. Additional mapped floodplains are Zone A. As previously discussed, there are a few areas of town that flooding is hazardous to residents, buildings, or roadways. Those areas are discussed in Section 3.1. Refer to Figure 5-2 for the location of SFHAs within Bozrah.

Major transportation routes in Bozrah include Fitchville Road (Route 608), Route 2, South Road / Route 82, and Route 163 / Brush Hill Road. In addition to the stretch of Route 163 described in Section 5.2.1 above, the DFIRM mapping suggests that these routes can be affected by extreme flooding. The DFIRM mapping shows FEMA flood zones stretching across at least one section of each route of egress listed above. According to town officials, likely the most problematic area of flooding associated with transportation through town is the section of Route 163 described in Section 5.2.1.

Vulnerability Analysis of Private Properties

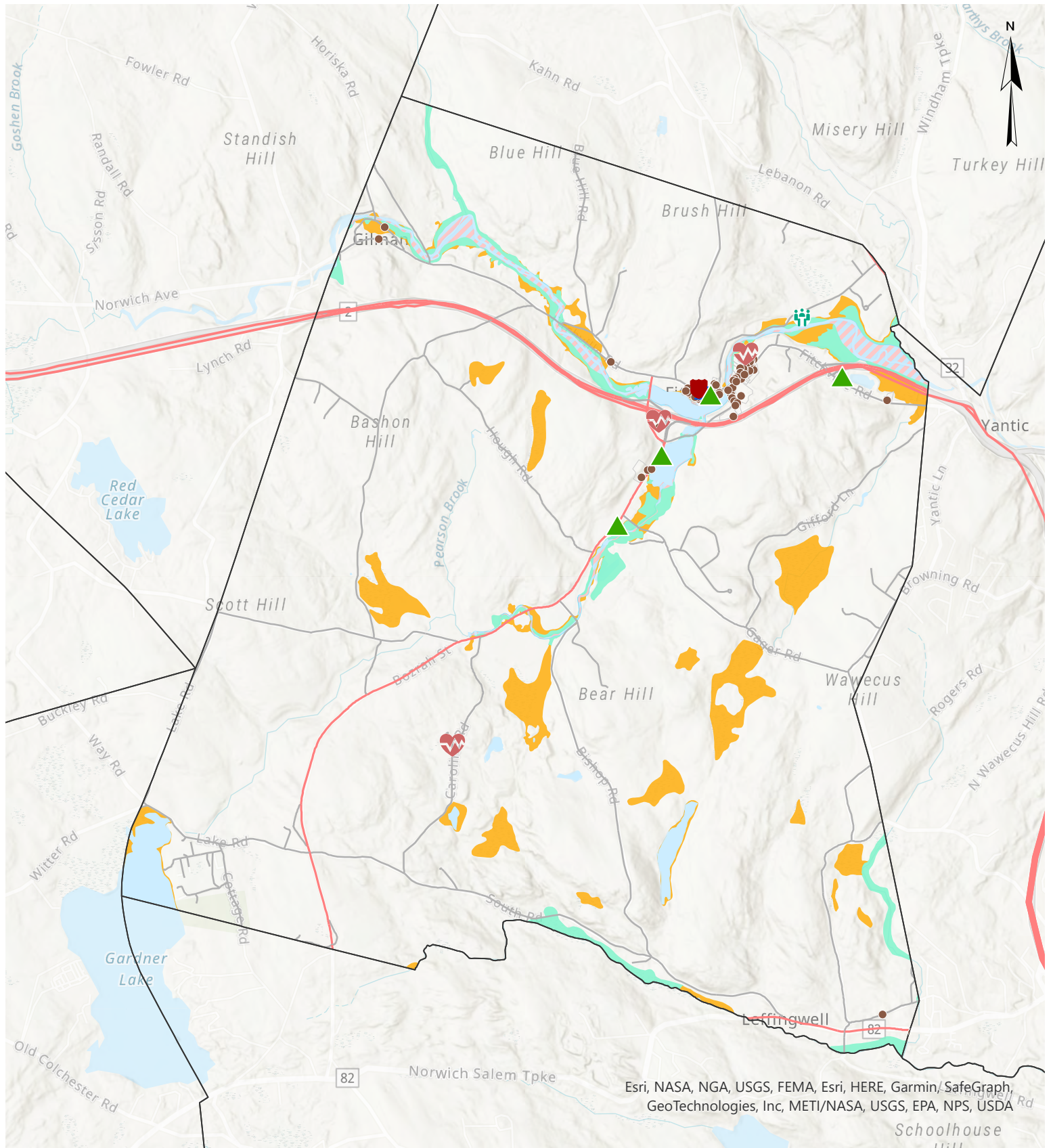
Most structures in the floodplain are located along the Yantic River with the majority of structures being residential and only a few commercial. Three structures appear to be located within the Zone A floodplain (the SFHA floodplain without flood elevations defined), while the remaining ten appear to be located either within Zone AE or the floodway in Zone AE.

Town personnel indicate that structures typically do not get flooded via overbanking, but structures in the Old Salem Turnpike area described in Section 5.2.1 experienced basement flooding during the flood event of March 2010. The Town believes that a culvert replacement on Old Salem Turnpike would help to mitigate the basement flooding, but it would be an expensive project and the Town does not currently have the funding to perform the replacement.

As shown in the table of the Multi-Jurisdictional HMP, there are no repetitive loss properties in town. Such properties are those which have received two or more claim payments of more than \$1,000 from the NFIP with any rolling 10-year period for the home or business. Largely, flooding of private properties is an issue related to insufficient drainage systems.

Vulnerability Analysis of Critical Facilities

As noted in Section 2.7, only components of the Norwich Public Utilities potable water system in Bozrah are located within an SFHA flood zone. With respect to critical facilities, there are no serious concerns to the town in conjunction with flooding.

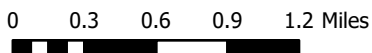


Critical Facilities and Historic Resources with Flood Zones










SCCOG Hazard Mitigation and Climate Adaptation Plan

Town of Bozrah

Date: 8/1/2022



Legend

-  Historic Resources
-  Community Support
-  Emergency Services
-  Municipal
-  Shelter or Cooling Center
-  Care and Medical Facility
-  1% Annual Chance Flood Hazard Area
-  .2% Annual Chance Flood Hazard Area
-  Floodway

5.2.3.1 Hazard Losses

According to NFIP statistics, as of June 30, 2022, the Town of Bozrah has had a total of six flood related losses, with a total of \$6,296 paid towards the claims. There have been no other flood related damages reported by NOAA or FEMA PA funds in the past five years. FEMA HAZUS-MH 6.0 was used to determine losses for various flood scenarios. Table 5-1 presents the residential, commercial, industrial, and other building related direct and business interruption losses. More HAZUS-generated loss estimates for riverine floods and downscaled flood losses based on the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document.

Table 5-1 HAZUS-MH Flood Related Economic Losses

Bozrah	2022 Results				
	RES	COM	IND	OTHER	TOTAL
Direct					
Building	\$5,570,000	\$4,350,000	\$670,000	\$330,000	\$10,920,000
Contents	\$3,430,000	\$15,080,000	\$1,020,000	\$2,220,000	\$21,750,000
Inventory	\$0	\$3,120,000	\$150,000	\$20,000	\$3,290,000
Subtotal	\$9,000,000	\$22,550,000	\$1,840,000	\$2,570,000	\$35,960,000
Business Interruption					
Income	\$780,000	\$6,520,000	\$30,000	\$750,000	\$8,080,000
Relocation	\$1,380,000	\$3,020,000	\$30,000	\$530,000	\$4,960,000
Rental Income	\$1,430,000	\$1,960,000	\$0	\$50,000	\$3,440,000
Wage	\$1,850,000	\$10,810,000	\$60,000	\$11,790,000	\$24,510,000
Subtotal	\$5,440,000	\$22,310,000	\$120,000	\$13,120,000	\$40,990,000
Total	\$14,440,000	\$44,860,000	\$1,960,000	\$15,690,000	\$76,950,000

5.3. Drought

5.3.1 Setting and Recent Occurrences

A drought can occur during any season when there is a long, abnormally dry period of time. These events are naturally occurring during periods of limited precipitation. The effects of drought may vary throughout Town, with some being impacted more than others. For example, agricultural operations in Bozrah may feel the impacts more acutely than the average homeowner or business owner due to higher water needs.

In recent years, droughts have become flashier and more frequent throughout the region. During recent events, there have been reports in the region of wells going dry on residential and farming properties. Some of the more severe and impactful events include:

- **2016** – A statewide drought that lasted almost two years and peaked in 2016, resulted in water conservation efforts throughout the southeastern part of the region, elevated fire risks in some areas, and was noted as the 11th driest spring on record.

- **2020** – From June to December, New London County experienced a moderate to severe drought, with the county being declared a Stage 3 by the Connecticut Interagency Drought Work Group.
- **2022** – During the development of this plan, the region was in an ongoing drought, with severe drought conditions in August 2022. New London County was declared a Stage 3 drought emergency on August 18.

5.3.2 Existing Capabilities

The Town of Bozrah, like many other communities, does not have specific regulations that are geared toward drought mitigation. The Zoning Regulations have been developed with one purpose being to protect existing and potential drinking water sources.

In addition, the town does have certain provisions that promote the use of public water over private wells. In Zoning Regulations Section 5.7 the provision of public water nullifies the building area requirement. While this requirement is in place to allow adequate space on a property for a drinking water well, the nullification of a buildable area requirement may incentivize a homeowner to connect to public, therefore having a potentially more reliable and redundant source of drinking water during a drought. Also, in order for development to qualify for Village District use, they must connect to Norwich Public Utilities water supply, again becoming more resilient during drought.

5.3.3 Vulnerabilities and Risk Assessment

The entire Town of Bozrah is vulnerable to drought, however there is particular concern regarding the poultry farms in Town. These are large, extensive operations that rely on wells for water supply. There is a concern that during an extended drought event there could be an impact on the these, and other livestock, operations.

In addition to the farming operations, a majority of the town relies on private wells for their residential or commercial drinking water. These wells could also be impacted during a drought, limiting residential water supplies.

5.3.3.1 Hazard Losses

There have been no reported drought losses from NOAA or the FEMA PA statistics in recent years, however, the United States Department of Agriculture (USDA) does provide emergency relief funds for agricultural operations in the wake of natural disasters. Since 2017 no farm has received USDA funding for a drought related emergency, however, \$1,062 was distributed in the past decade for drought related losses.

5.4. Dam Failure

5.4.1 Setting and Recent Occurrences

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 Bozrah is considered a possible event each year with potentially critical effects. No dam failures have affected the town since the time of the last HMP.

5.4.2 Existing Capabilities

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

The 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, Bozrah is home to one Class C (high hazard) dam and one Class B (significant hazard) dam. These dams, and others in town, are listed in Table 5-2. No Class B or Class C dams are located upstream of Bozrah whose failure could potentially lead to flooding within the town.

Table 5-2 Dams Registered with DEEP in the Town of Bozrah

CT Dam#	Dam Name	Dam Class	Owner Type
1304	BISHOP POND DAM	A	Private
1306	HIBBARD POND DAM	A	Private
1307	SCHALLER POND DAM	A	Private
1308	DUBINSKI POND DAM	A	Private
1311	TAYLOR POND DAM	AA	Private
1305	GARDNER LAKE DAM	B	State Owned
1303	TADMA POND DAM	BB	Institution
1302	FITCHVILLE POND DAM	C	Private Corporation

Owners of high and significant hazard dams are required to maintain Emergency Action Plans (EAPs), updated every two years, for such dams. The Town of Bozrah does not own any dams. An out-of-date EOP for the Fitchville Pond Dam and an inundation map for the Gardner Lake Dam were available in the files at the CT DEEP. The town should work with the DEEP and dam owners to ensure that EOPs remain current and on file. For specific information on both dams, see Section 5.4.3 below.

Norwich Public Utilities completed a dam breach analysis and inundation mapping of the Class C Deep Reservoir dam (located upstream on the Colchester/Lebanon town line) in 2015. The inundation mapping extends to the Lebanon/Bozrah town line. While a breach of the dam would be expected to cause flooding along the Yantic River, the flood elevation in Bozrah would be less than 1.5 feet higher than the normal water surface elevation of the river at the time of the breach. Therefore, Deep River Reservoir is not addressed in detail in this chapter.

Summary

In general, municipal capabilities to mitigate dam failure damage have not increased significantly since the 2017 edition of the hazard mitigation plan was adopted. However, changes in the State's regulation of dams have increased Statewide capabilities sharply.

5.4.3 Vulnerabilities and Risk Assessment

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

- Fitchville Pond Dam – Fitchville Pond is a Class C dam located at the northeast end of Fitchville Pond that forms an impoundment of the Yantic River. The structure is located 500 feet south of the Route 163/Route 2 intersection. According to the 1979 USACE Inspection Report, the dam is a stone masonry/concrete gravity structure constructed in 1871 for recreation and process water for the Palmer Brothers Company mill complex. The original dam was a masonry-timber structure with earthen embankments. It was modified in 1914, when a concrete overflow spillway was constructed and outlet gates and adjacent walls were reconstructed. The dam has a height of 27 feet and length of 200 feet. The 108-foot spillway is an uncontrolled ogee overflow located in the right two-thirds of the dam. Three manually operated sluice gates comprise the outlet works which discharges flows to a wasteway at the left abutment. A nine-foot diameter corrugated metal penstock which led to the mill complex has been blocked.

The pond has a width of 1,800 feet, a length of 7,200 feet, and a surface area of 487 acres. The drainage area to the lake is approximately 68.5 square miles, and the impoundment capacity is 759 acre-feet. Water flowing over the spillway passes beneath the Fitchville Road (State Route 608) bridge located over the Yantic River. Although the USACE standards describe the structure as small, it is a significant hazard dam. The test flood outflow is one-half the PMF (30,000 cfs), which would overtop the structure by 11 feet. The spillway capacity is only enough for 24% of the test flood outflow. Estimated water depth at failure (9,620 cfs) is 17 feet at the dam and 12 feet at a location 10,000 feet downstream of the dam. Failure of the structure could cause damage due to high velocity, impact from debris and flooding to homes, commercial properties, roadways (specifically Route 2), and utilities (telephone and power lines at Route 2). Immediately below the dam, the 30-inch water supply line for the City of Norwich crosses the river on its own bridge support.

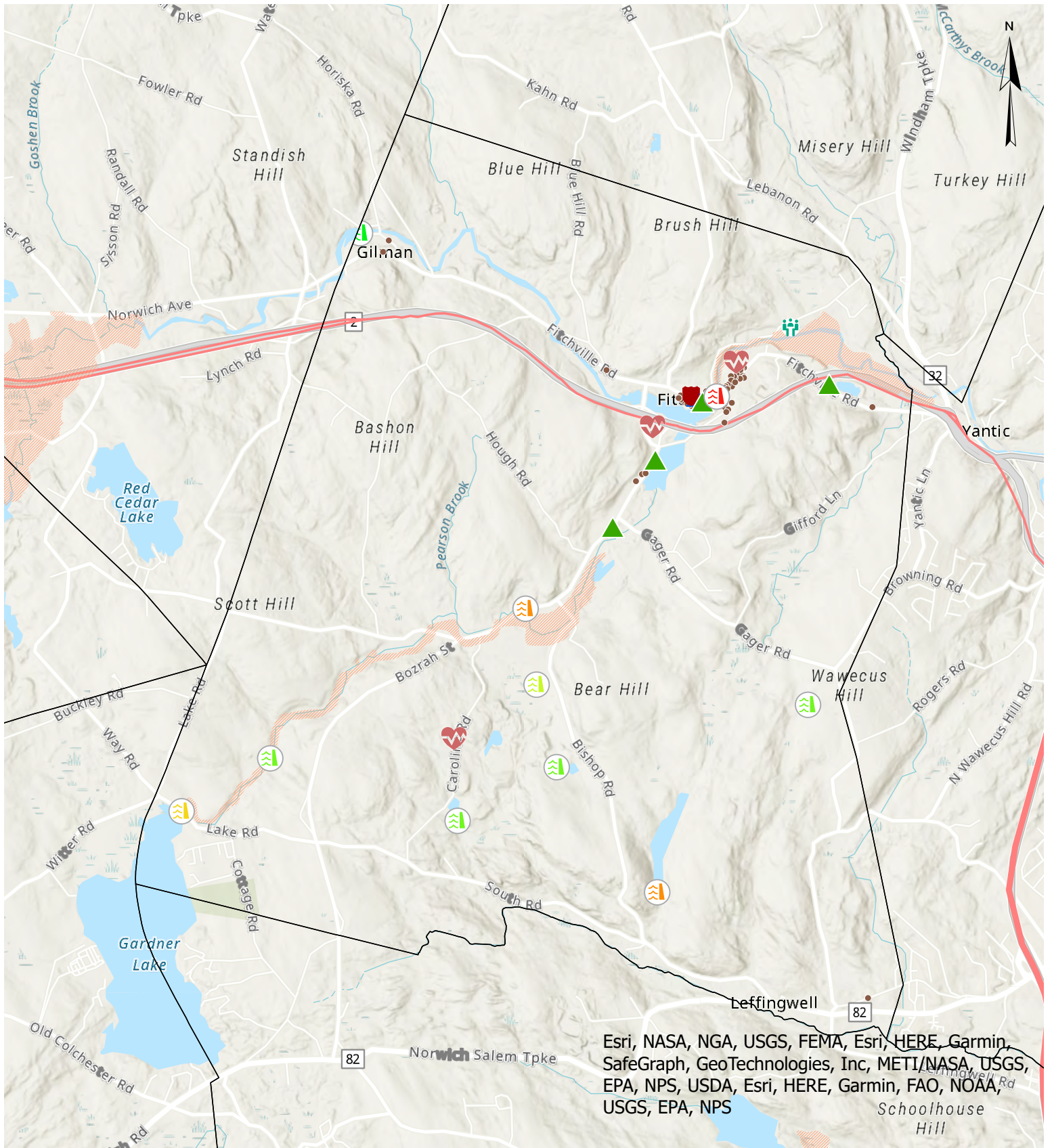
An inspection by the state in May 1963 noted that the structure was unsafe, and repairs were completed in 1964. A July 1972 inspection by Buck & Buck Engineers noted leakage at the penstock inlet to the mill, and repairs were completed in April 1973. In April 1974, the existing penstock was sealed and the downstream stone retaining wall on the south side was repaired. In 1978, the state reconstructed the highway bridge below the dam. The 1979 USACE inspection noted that the structure was in fair condition and recommended repairs and further study. In August 1990 a report was issued by Cummings & Lafayette which investigated the dam and repairs to the structure. The report included a dam failure analysis and map of inundation should the structure fail. This map was based on the one-half PMF and notes that the spillway

would be overtopped by 9.8 feet and Route 2 would be overtopped by 5.7 feet. The report identified several problem areas leading to a rating of poor condition. As of July 2002, the CT DEEP was reviewing plans that included installation of shotcrete and a proposed gatehouse, along with continued discussions on the transfer of ownership. θ

- Gardner Lake Dam – Gardner Lake Dam is a Class B dam located at the northern end of Gardner Lake, at the southwest corner of the town, approximately 4.9 miles upstream of Gardner Brook confluence with the Yantic River. The dam is owned by the CT DEEP. The drainage area to the lake is approximately 5.63 square miles, and the lake itself has a maximum storage capacity of 3,270 acre-feet. The lake is 9,400 feet in length and has a surface area of 521 acres. The structure is a low spillage-low surcharge dam used to impound a recreational lake. According to the 1979 USACE Inspection Report, the dam is an earthen embankment structure with a shallow concrete wall that extends across the full length of the upstream face. The structure is classified as intermediate in size and a significant hazard. The top of the dam is approximately 9.6 feet above the streambed of Gardner Brook. The top of the dam is approximately 168 feet long along the upstream edge of the crest and ranges in width from 72 feet to 154 feet. Lake Road passes over the crest near the downstream face of the dam. The structure includes two concrete spillways: a service spillway located at the left abutment having a length of 11.5 feet, and an auxiliary spillway and outlet structure at the right abutment having a length of 12 feet. The outlet is controlled by a three-foot square sluice gate.

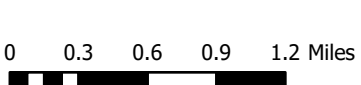
Failure of the structure may result in economic loss and a few lives. The PMF is 9,200 cfs and the test flood is one-half the PMF. The 1979 Phase I noted that a breach failure would release water down Gardner Brook to the Yantic River. Lake Road would be severed between the dam and Scott Hill Road (approximately two miles). Downstream of Scott Hill Road, it is not anticipated that there would be structure or property damage. Scott Hill Road itself would be flooded and one house on the east side would be damaged.

Reconstruction work was completed in 1969. The 1979 inspection noted that there was no evidence of seepage or slides. Emergency repairs were completed in 1983. Repair work on a void at the intersection of the two upstream concrete training walls was completed in February 1990. The gate stem and gate were repaired in 2006. Weed control operations and the associated drawdown were completed in October 2007. The Gardner Lake State Boat Launch area was also repaired in fall 2007.



Esri, NASA, NGA, USGS, FEMA, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS

Dams and Dam Failure Inundation Areas
 Southeastern Connecticut Council of Governments
 Town of Bozrah
 Date: 2/23/2023



Legend

Dams

- Unknown/Unclassified
- A
- AA
- B
- BB
- C

- Historic Resources
- Community Support
- Emergency Services
- Municipal
- Shelter or Cooling Center
- Care and Medical Facility
- Dam Failure Inundation Area

5.4.3.1 Hazard Losses

There are no reported losses for the Town of Bozrah related to dam failure. Downscaled losses from the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document.

6. Rising Temperatures

6.1. Climate Change Impacts

On average, the annual temperature across the U.S. has increased by 1.8 degrees Fahrenheit when looking at the entire period of record (1895-2016). Accelerated warming patterns between 1979 and 2016 have been observed with satellite and surface data, and paleoclimate records show that some of the recent decades have been the warmest in the past 1,500 years.³

In general, periods of freeze and frost have decreased, therefore lengthening the period of time between the first winter freeze and spring thaw, since the early 1900's. These warming temperatures impact snowfall and accumulation, alter seasonal patterns, and can disrupt certain natural processes. In addition, warming temperatures can act as fuel for other natural hazards such as wildfires, droughts, hurricanes and severe storms, and also play a role in changing precipitation patterns.

In addition to exacerbating some natural hazards, extreme heat waves are becoming more frequent, which can also have a serious impact on public health. In recent years, the region has experience numerous heat waves, with several consecutive days of extremely hot temperatures and high heat indexes. Infrastructure can also be at risk during heat waves as some components, such as roadways or bridges, have not been designed to withstand ongoing, extreme temperatures.

6.2. Extreme Heat

6.2.1 Setting and Recent Occurrences

An extreme heat event can occur at any time during the warmer months, and can be defined as temperatures that hover 10 degrees or more above the average high temperature for the region. These events typically last for a prolonged period of time and is accompanied by high humidity. A heat wave, typically lasts three or more days with temperatures over 90 degrees for those days.

Since 2012, 480 days over 85 degrees have been recorded at the Norwich Public Utilities weather stations, 165 of which were over 90 degree. During the summer of 2022, 45 days over 85 degrees were recorded, 21 of which were at least 90 degrees. A majority of these high temperature days occurred in July and August, with some of these extreme temperatures occurring outside summer months in May and October. Table 6-1 presents the daily maximum temperatures recorded at the Groton New London Airport and Norwich Public Utilities weather stations. Those values that are bold are days above 90 degrees.

Table 6-1 Daily Maximum Temperatures from May to September Since 2017

	May		June		July		August		September	
	GNL	NPU	GNL	NPU	GNL	NPU	GNL	NPU	GNL	NPU
2017	85	93	89	94	88	92	87	89	86	89
2018	80	91	87	90	89	101	91	94	90	92
2019	83	85	88	91	94	96	88	91	87	84
2020	75	81	82	91	92	96	89	92	87	87
2021	88	87	86	96	86	94	88	96	82	85
2022	93	92	85	92	91	96	91	94	94	85

³ <https://nca201758.globalchange.gov/chapter/2/>

6.2.2 Existing Capabilities

The Town of Bozrah has identified two cooling centers in town that can provide heat respite for residents; the Town Hall and the Senior Center. The Senior Center also has minor food prepping capabilities in the event this was needed.

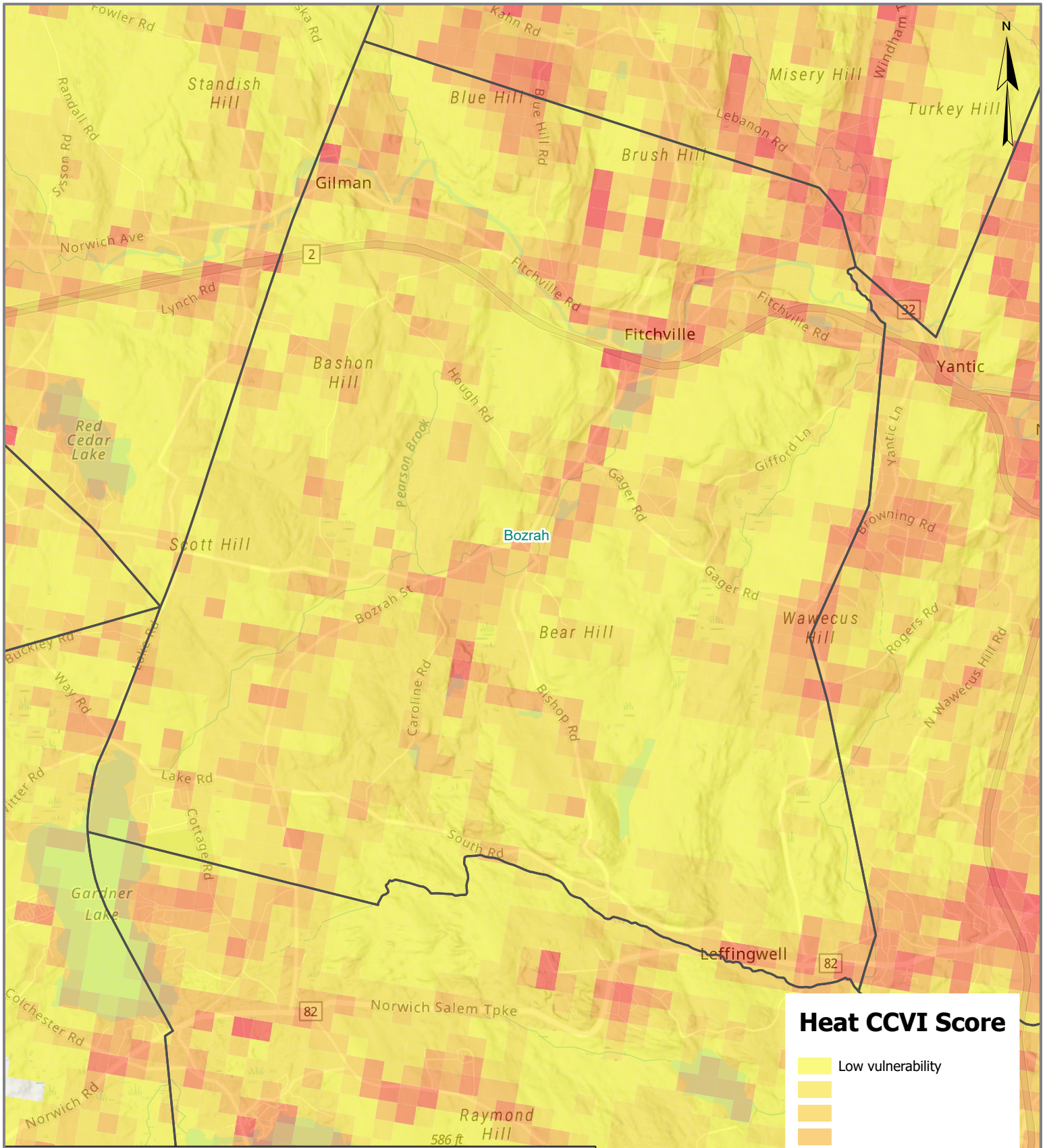
6.2.3 Vulnerabilities and Risk Assessment

While the entire town is at risk of an extreme heat event, vulnerability can widely vary based on age, health, or the type of property owned in Bozrah. The elderly populations in town are more vulnerable to extreme heat events, particularly when in home cooling is not available. Also, those with certain health conditions may also be more vulnerable to the health factors associated with extreme temperatures.

It has also been noted that there is a large presence of poultry operations in town, and these may be more vulnerable to during extended periods of heat, or drought. As temperatures rise, flocks may become more stressed, which then increases the demand for cooling and water, stressing power sources and private wells.

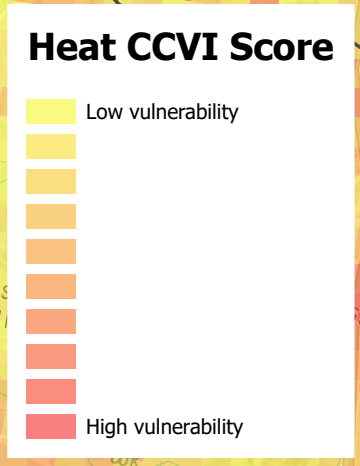
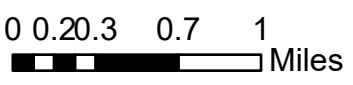
UConn CIRCA has developed a tool to aid in understanding extreme heat vulnerability for communities across the state. This tool, known as the Climate Change Vulnerability Index (CCVI), is comprised of dozens of factors that contribute to a community's heat sensitivity, exposure, adaptive capacity, and ultimately the overall heat vulnerability. The CCVI has been used as a tool to characterize heat vulnerability for Bozrah. The distribution of heat vulnerability throughout the community can be seen in Figure 6-1.

Heat exposure is relatively low across most of Bozrah, with a few pockets of higher exposure north of Fitchville Road due to clusters of buildings and impervious surfaces. Heat sensitivity follows a similar spatial pattern, with the addition of a higher sensitivity area along South Road near the border with Montville. Bozrah has abundant vegetation and two potential cooling centers, resulting in relatively strong adaptive capacity. Therefore, the overall heat vulnerability for Bozrah ranges from low to medium depending on location.



Heat CCVI Score

SCCOG Hazard Mitigation and Climate Adaptation Plan
 Town of Bozrah
 12/9/2022



Esri, NASA, NGA, USGS, FEMA, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS,

6.2.3.1 Hazard Losses

There are no reported losses for the Town of Bozrah related to extreme temperatures. Future editions of this plan will revisit this topic.

6.3. Wildfires

6.3.1 Setting and Recent Occurrences

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

According to the First Selectman, no specific areas of wildfire risk or vulnerability are known. Small fires occasionally occur during dry spring weather, but no large-scale fires have historically affected the town. As noted previously, a significant fire at Hallandale Farms in January 2023 necessitated significant attention and regional response, but this was not a wildfire.

6.3.2 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 town can access this information over the internet. The town also receives "Red Flag" warnings via local media outlets.

Existing mitigation for wildland fire control is typically focused on building codes, public education, Fire Department training, and maintaining an adequate supply of equipment. The Fire Company has a variety of equipment including a 300 gallon forestry truck. The Fire Department also has mutual aid agreements with surrounding communities.

The Fire Department goes to fires as quickly as possible in the town. Fire protection water can be obtained through fire hydrants located in sections of town served by Norwich Public Utilities, mostly in the Town Center.

Most of the town lacks hydrants, and a series of water sources (surface water fire suppression sources) are located throughout town. In areas located far from the dry hydrant, water is drafted from the various streams, ponds, and rivers in the town. When fighting a fire in such an area, the town has a 300 gallon forestry tanker truck that continuously moves to and from the nearest hydrant, or other water source, to maintain a constant water supply. This "gator" or "quad" style vehicle is very versatile and nimble in off-road environments.

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." 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.

Between the Bozrah Fire Department's tanker truck and several mutual aid agreements with neighboring towns, Bozrah believes their services are fully capable. The amount of fire protection afforded by the dry hydrants and nearby streams is considered to be adequate for the development level of Bozrah. The Volunteer Fire Company will continue to evaluate the level of risk and the need for additional hydrants as development continues in the future. The company also regularly maintains and upgrades its equipment; it recently replaced an old pickup truck with an upgraded one.

Summary

In general, municipal capabilities to mitigate wildfire damage have not increased since the 2017 edition because the wildfire risk profile has not changed since 2017.

6.3.3 Vulnerabilities and Risk Assessment

Forests and inaccessible tracks of land are at the highest risk for wildfires. However, according to the First Selectman, there are no specific areas of wildfire risk or vulnerability in Bozrah. Refer to Figure 3-6 in the Multi-Jurisdictional HMCAP for a general depiction of wildfire risk areas region wide.

6.3.3.1 Hazard Losses

There are no reported losses for the Town of Bozrah related to wildfires. Downscaled losses from the 2019 Connecticut Natural Hazard Mitigation Plan using WUI acreage are developed in the Multi-Jurisdictional document.

7. Earthquakes

7.1. Climate Change Impacts

Earthquakes are not a climate related hazard, therefore there are no expected impacts as a result of climate change. There are however secondary impacts that could be a concern and amplify the damages of an earthquake. The deterioration of infrastructure from extreme heat or salt water as a result of coastal flooding or sea level rise may weaken certain components making them more prone to damage or collapse during an earthquake event. Flooding events can also leave some landscapes at a higher risk of landslides; an earthquake could potentially prompt a landslide in post-flooded areas.

7.2. Earthquakes

7.2.1 Setting and Recent Occurrences

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 3.3.5 of the Multi-Jurisdictional HMP. Despite the low probability of an earthquake occurrence, earthquake damage presents a potentially catastrophic hazard to the town. However, it is very unlikely that the town would be at the epicenter of such a damaging earthquake. No major earthquakes have affected the town since the last HMP.

7.2.2 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 Bozrah. The town has adopted these codes for new construction, and they are enforced by the Zoning Enforcement Officer.

Due to the infrequent nature of damaging earthquakes, town land use policies do not directly address earthquake hazards. However, the potential for an earthquake and emergency response procedures is addressed in the town's EOP.

Summary

In general, municipal capabilities to mitigate earthquake damage have not increased since the 2017 edition of the hazard mitigation plan was adopted. This is because the hazard continues to pose a low risk of damage to the Town.

7.2.3 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, areas along the Yantic River and its tributaries are underlain by stratified drift. These areas are likely more at risk for earthquake damage than the areas of the town underlain by glacial till. The best mitigation for future development in areas of sandy material is the application of the most stringent standards in the Connecticut Building Code, exceeding the building code requirements, or, if the town

deems necessary, the possible prohibition of new construction. Those areas not at increased risk during an earthquake due to unstable soils are the areas underlain by glacial till.

Two bedrock faults that are oriented east-west near the town line with Montville pinch the formations into east-west and v-orientations in the south-southeastern section of town. Unlike seismic activity in California, earthquakes in Connecticut are not associated with specific known active faults. However, bedrock in Connecticut and New England in general is typically formed from relatively hard metamorphic rock that is highly capable of transmitting seismic energy over great distances. For example, the relatively strong earthquake that occurred recently in Virginia was felt in Connecticut because the energy was transmitted over a great distance through such hard bedrock.

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

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

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

7.2.3.1 Hazard Losses

There are no reported losses for the Town of Bozrah related to earthquakes. Downscaled losses from the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document. In addition, a HAZUS-MH analysis of the potential economic and societal impacts to the SCCOG region from earthquake damage is detailed in the Multi-Jurisdictional HMCAP. 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. Potential economic impacts can be seen in Table 7-1, with additional information developed in the Multi-Jurisdictional document.

Table 7-1 HAZUS-MH Earthquake Related Economic Impacts

Bozrah	Residential	Commercial	Industrial	Others	Total
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	\$50,460,000	\$370,700,000	\$15,060,000	\$30,680,000	\$466,900,000
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8. Mitigation Strategies and Actions

8.1. Status of Mitigation Strategies and Actions

A total of eight hazard mitigation actions were developed in the previous edition of this plan. The status of each is listed below.

#	Action from 2013-2017 HMP	Status	Status Details
1	Encourage local officials to attend FEMA-sponsored training seminars held locally or through online remote trainings	Capability	The Town's EMD has taken some courses related to related preparedness and response issues.
2	Pursue the American Red Cross-certification of the main shelter, Fields Memorial School, and the back-up shelters which include both Bozrah Moose Lodge 950 (alternate shelter) and the Volunteer Fire Company.	Carry Forward	The Field School is not an ARC-certified shelter. This may have had to do with generator limitations. The generator and fuel tank are due to be replaced with ARPA money. The Moose lodge and Volunteer Fire Co. are secondary, but not certified shelters. The Field School needs to be formalized as a shelter, so this action may remain.
3	Post natural hazard education material to the Town's updated website, and make educational pamphlets available at the Town Hall and other public spaces	Carry Forward	Town is currently redesigning a new website, and will be able to make hazard information more accessible. The Town uses the "Text My Gov" system for notifications.
4	Encourage town residents to register with the service through the CT Alert ENS website (http://www.ct.gov/ctalert/site/default.asp).	Capability	Migrating to "Text My Gov" system for alerts, however the town anticipates an ongoing effort of encouraging registration.
5	Integrate elements of this HMP into the Plan of Conservation and Development during the 2013 update and beyond.	Carry Forward	The POCD update is forthcoming and this action may be carried forward.
6	Develop formalized guidance for culvert and bridge construction and replacement that requires utilization of the most up-to-date extreme rainfall data from http://precip.eas.cornell.edu	Carry Forward with Revisions	The Town's engineer is likely aware of design criteria and likely does this. B&L works on the Town's roadway design projects.
7	Install a snow fence along Brush Hill Road as needed, based on observations during the winter of 2016-2017.	Carry Forward	Several locations in town are noted where snow drifting is a problem, including Wawecus Hill. Trees along these roads are dying and being removed, which will reduce protection and could increase drifting. Many of the trees being removed are merely old (i.e. maple trees), but some removals are related to emerald ash.
8	Provide assistance to owners of lesser-ranked dams regarding resources available for inspections and maintenance. This includes seven additional registered dams within Bozrah according to the DEEP "1996 Dam Inventory" data layer and any DEEP updates	Carry Forward with Revisions	A privately owned dam recently received a letter from DEEP imploring action. The Town reportedly does not have a clear explanation of what is expected from DEEP and a sense of which "actions" are needed. DEEP may not provide a clear path on what the ultimate goals might be, and this includes Fitchville Dam. The Gilman Dam has been removed, and DEEP has been involved

		with the upstream Savin Lake Dam. A campground in the area could be affected by dam changes. A new action for dams is needed to provide more specificity.
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During the planning process, CIRCA and consultant staff facilitated a discussion with the Town staff to identify the greatest climate change concerns and challenges. The previous actions were re-evaluated in this context. Elements of six prior actions have been carried forward into the new hazard mitigation and climate adaptation actions.

8.2. Prioritization of Specific Actions

The proposed actions for the Town of Bozrah to undertake from 2023 through 2028 are listed in Table 8-1 on the next page. The full list of actions for the region with buildups for the PERSISTS and STAPLEE scores are available in the multi-jurisdiction document.

The actions with the highest PERSISTS score and the highest STAPLEE score are different, which is consistent with the intent of the two scores. PERSISTS scores tend to be higher for actions that maximize public safety while advancing climate science and being transferable to other communities, whereas STAPLEE scores tend to be higher for actions that are highly cost effective and technically feasible for reducing losses from hazards. The actions with the highest combined scores are:

- Partner with chicken farms and related facilities to develop emergency response plans that describe how to manage extreme heat events, droughts, power outages, and avian flu outbreaks.

Table 8-1 Town of Bozrah Actions and STAPLEE and PERSISTS Scores

Number	Hazard Mitigation and Climate Adaptation Actions	Hazard Mitigation and Climate Adaptation Goal	Type of Action	Responsible Department	Approx. Cost Range	Potential Funding Sources	Timeframe	Priority	PERSISTS Score	STAPLEE Score	PERSISTS x STAPLEE =
BZ1	Pursue the American Red Cross-certification to make Fields Memorial School the primary shelter and a cooling center, and additional certifications if needed for the back-up shelters which include both Bozrah Moose Lodge 950 (alternate shelter) and the Volunteer Fire Company.	Ensure that critical facilities are resilient, with special attention to shelters and cooling centers.	Preparedness & Emergency Response	Office of the Chief Elected Official	\$50,000 - \$100,000	Municipal Operating Budget	7/2023 - 6/2025	High	16	4	64
BZ2	Acquire standby power for Town Hall and Senior Center, especially given their importance as cooling centers; and secure reliable transportation options for people to access these cooling centers.	Ensure that critical facilities are resilient, with special attention to shelters and cooling centers.	Preparedness & Emergency Response	Office of the Chief Elected Official	\$100,000 - \$500,000	FEMA HMA; Other Preparedness Grants; STEAP	7/2023 - 6/2025	High	16	6	96
BZ3	Partner with chicken farms and related facilities to develop reliable, drought-resilience water supplies and standby power that is capable of operating cooling equipment.	Address risks associated with extreme heat events, especially as they interact with other hazards.	Preparedness & Emergency Response	Office of the Chief Elected Official	\$100,000 - \$500,000	USDA/NRCS; STEAP	7/2023 - 6/2026	High	17	6	102
BZ4	Partner with chicken farms and related facilities to develop emergency response plans that describe how to manage extreme heat events, droughts, power outages, and avian flu outbreaks.	Address risks associated with extreme heat events, especially as they interact with other hazards.	Preparedness & Emergency Response	Office of the Chief Elected Official	\$0 - \$10,000	USDA/NRCS; SCCOG funds	7/2023 - 6/2026	High	18	8	144
BZ5	Install a snow fence along areas with snow drift related challenges including along Brush Hill Road and Wawecus Road.	Invest in resilient corridors to ensure that people and services are accessible during floods and that development	Structural Projects	Public Works	\$10,000 - \$25,000	Municipal CIP Budget	7/2023 - 6/2024	Low	14	2	28

Number	Hazard Mitigation and Climate Adaptation Actions	Hazard Mitigation and Climate Adaptation Goal	Type of Action	Responsible Department	Approx. Cost Range	Potential Funding Sources	Timeframe	Priority	PERISTS Score	STAPLEE Score	PERSIST x STAPLEE =
		along corridors is resilient over the long term.									
BZ6	Consider flood mitigation study along Yantic River to characterize risks to properties and Stockhouse Road.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Property Protection	Office of the Chief Elected Official	\$50,000 - \$100,000	FEMA HMA Scoping Study; DEEP Climate Resilience Fund; CIRCA Resilient Connecticut	7/2024 - 6/2025	Low	18	6	108
BZ7	Partner with CT DEEP's Dam Safety team to deliver a unified message to dam owners that inspections and risk communication are necessary. Target year 1 for working with DEEP and year 2 for the messaging to dam owners.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Preparedness & Emergency Response	Emergency Management	\$0 - \$10,000	Municipal Operating Budget	7/2023 - 6/2025	Medium	12	6	72
BZ8	Require floodplain manager and land use staff to take free training at https://portal.ct.gov/DEEP/P2/Chemical-Management-and-Climate-Resilience/Chemical-Management-and-Climate-Resilience to reduce risks of spills from businesses during floods.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Education & Awareness	Land Use Staff	\$0 - \$10,000	Municipal Operating Budget	7/2023 - 12/2023	Low	14	6	84
BZ9	Integrate elements of this HMP into the Plan of Conservation and Development during the update.	More than one goal	Education & Awareness	Office of the Chief Elected Official	\$0 - \$10,000	Municipal Operating Budget	7/2024 - 6/2025	High	13	6	78