# TOWN OF SALEM ANNEX DOCUMENT

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

March 2023


PREPARED FOR:
Town of Salem
270 Hartford Road
Salem, CT 06420
www.salemct.gov

PREPARED BY:
Resilient Land and Water, LLC
With Assistance from
The Connecticut Institute for Resilience
and Climate Adaptation (CIRCA)

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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 Salem. Background information and the regional effects of pertinent hazards are discussed in the main body of the Southeastern Connecticut Council of Governments (SCCOG) 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 Salem 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

Salem comprises approximately 30 square miles in western New London County and is bordered by Montville to the east, Bozrah and Lebanon to the northeast, Colchester to the north, East Haddam to the west, and the municipalities of Lyme and East Lyme to the south.

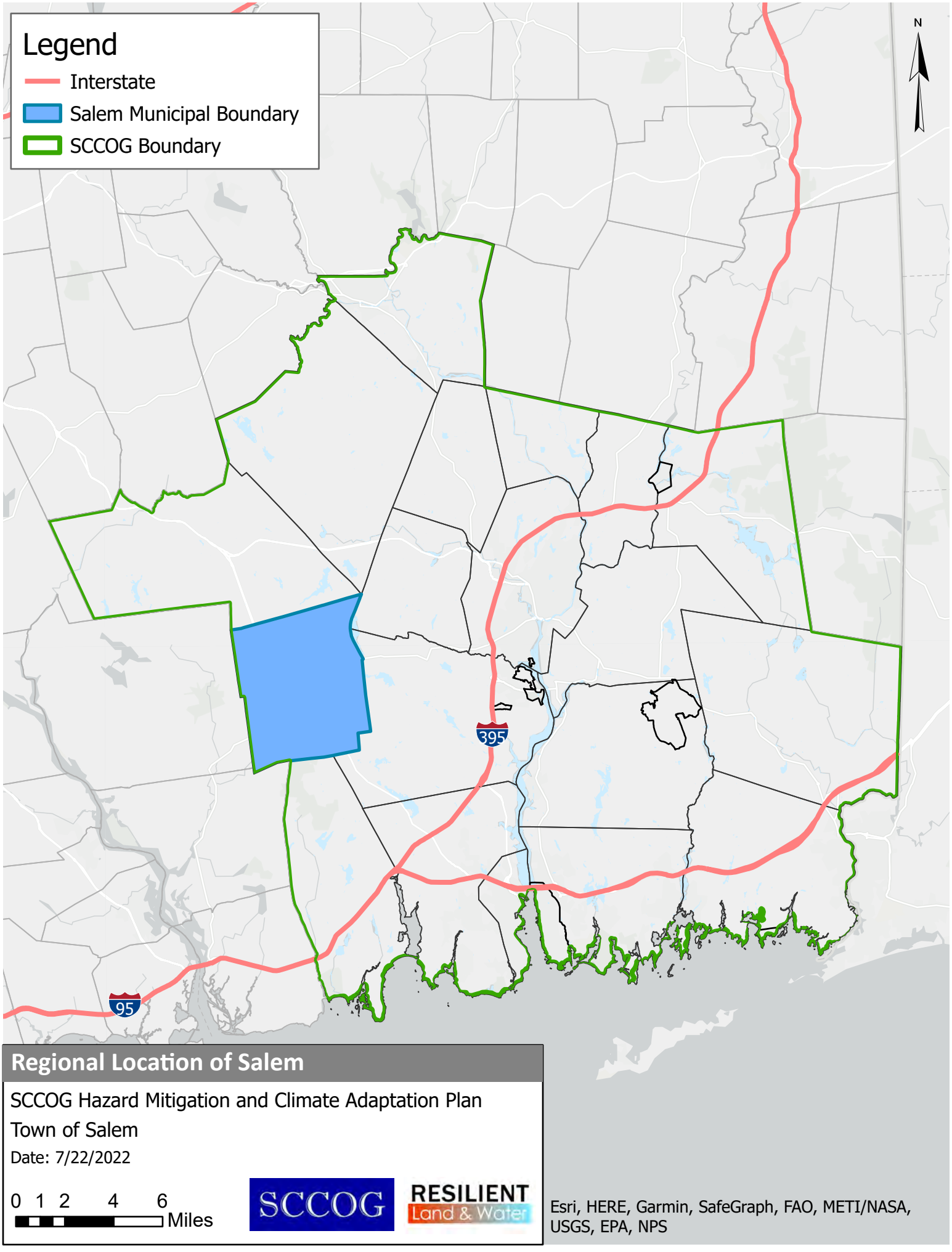
The most significant surface water body in Salem is Gardner Lake which is located in the northeast corner of Salem and stretches east into the neighboring municipalities of Bozrah and Montville. The water from Gardner Lake flows northeasterly towards the Fitchville village section of Bozrah. The major transportation routes through Salem include Route 82 which runs northeast-southwest through the central portion of town, Route 85 which runs north-south through the center of town, and Route 11 which runs north-south through the eastern half of town and connects Route 2 to Route 82. Other important roadways include Route 354 in the northeast corner of town which connects Colchester to Montville, Witch Meadow Road which enters Salem from East Haddam in the northwestern section of town and passes through Route 11 to Route 85, and Gungy Road/White Birch Road which extends from Route 82 in the southeastern portion of town to the south and into Lyme.

## 2.1. Physical Setting

Salem is located at the western edge of the SCCOG planning area. Elevations range from approximately 600 at the top of Round Hill just north of Rattlesnake Ledge Road to the east of Whittlesey Swamp in the northeast section of Salem to approximately 140 feet near the Lyme/East Haddam town line near the headwaters of an unnamed tributary to East Branch Eightmile River. The most densely populated area of town is between Rattlesnake Ridge Road and Music Vale Road along Route 85. This is also the area that most community members suggested that a future village center be located in Salem. Most of the town is rural and 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 Salem. Salem has eleven bedrock formations which are generally situated in a northeast-southwest orientation. Salem lies above two inactive faults that are also oriented in this direction. The Hebron Gneiss Formation, the Plainfield Formation, and the Hope Valley Alaskite Gneiss formation cover nearly an equal amount of land area in Salem and account for approximately 46% of the town's land area. The remaining land area is covered by the other formations.

Salem'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 Witch Meadow Brook, East Branch Eightmile River and its tributaries in southwestern Salem, Fairy Lake and its tributaries, Horse Pound Brook, and smaller tributaries have fairly extensive areas underlain by stratified drift. 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. The amount of stratified drift also has bearing on the relative intensity of earthquakes and the likelihood of subsidence.




## Regional Location of Salem

SCCOG Hazard Mitigation and Climate Adaptation Plan

Town of Salem

Date: 7/22/2022

## 2.2. Drainage Basins and Hydrology

As mentioned above, the most significant surface water body in Salem is Gardner Lake which is located in the northeast corner of Salem and stretches east into the neighboring towns of Bozrah and Montville. Additionally, the most significant watercourses include the East Branch Eightmile River, Harris Brook, Horse Pound Brook, Neck Brook, and Sucker Brook. The East Branch Eightmile River flows southwesterly from north-central Salem through East Haddam and towards Eightmile River in Lyme. Harris Brook, another substantial watercourse, flows south-southwesterly before it reaches East Branch Eightmile River in southwestern Salem. Shingle Mill Brook is a significant tributary which flows northerly before flowing into Harris Brook. In total, there are approximately 14 named watercourses and many unnamed small tributaries in Salem.

There are a total of eight subregional watershed basins in Salem. The subregional basins are: Deep River, Gardiner Brook, Eightmile River, East Branch Eightmile River, Harris Brook, Oxoboxo Brook, Latimer Brook and Beaver Brook. Not surprisingly, the subregional drainage basin of the largest watercourse in Salem, East Branch Eightmile River, covers the majority of land cover in the town. The East Branch Eightmile River accounts for approximately 7,763 acres or approximately 40.5% of land cover stretching from the town's northern to southern border along the western half of Salem. The second largest subregional basin accounts for only approximately 20% of the central portion of Salem extending from northern Salem to the southern town line with East Lyme. The remaining six subregional watershed basins account for the remaining approximately 39.5% of land cover.

The Eightmile River subregional basin covers a small portion of western Salem, while the dominant East Branch Eightmile River accounts for most of western Salem and Beaver Brook accounts for a small area in southwestern Salem. In eastern Salem, the Gardner Brook basin accounts for a majority of the land cover, while the Deep River basin accounts for a less substantial amount of land cover. In southeastern Salem, the Oxoboxo Brook accounts for a smaller portion of land, while the Latimer Brook basin accounts for the majority.

## 2.3. Land Cover

According to the 2016 1-meter resolution land cover developed by the NOAA Office of Coastal Management, Salem is predominantly comprised of mixed forest, with approximately 73.15% of the town classified as such. The second largest land cover type is developed open space, which covers about 5.32%, and next is palustrine forested wetland which is about 4.45% of land cover. Only about 3.60% of the town is developed impervious land cover. All land covers and their percent coverage can be found in Table 2-1.

*Table 2-1 Town of Salem Land Cover*

| Land Cover Type (2016) | % Coverage |
|---|---|
| Barren Land | 0.53 |
| Cultivated Crops | 0.98 |
| Developed, Impervious | 3.60 |
| Developed, Open Space | 5.32 |
| Grassland/Herbaceous | 2.13 |
| Mixed Forest | 73.15 |

| | |
|---|---|
| Open Water | 3.28 |
| Palustrine Aquatic Bed | 0.34 |
| Palustrine Emergent Wetland | 1.38 |
| Palustrine Forested Wetland | 4.45 |
| Palustrine Scrub/Shrub Wetland | 0.60 |
| Pasture Hay | 3.44 |
| Scrub/Shrub | 0.80 |

## 2.4. Population, Demographics, and Development Trends

Salem was incorporated in 1819 from lands that were formerly part of Montville, Lyme, and Colchester. The town has had numerous names throughout history including New Salem, Salem Parish, the Society of Salem, and Paugwonk. Salem has been a farming community with small population growth due to the town's landscape. Today, it still maintains the rural character. As a result, the town remains a residential community.

Developments in Salem prior to the 2017 HMP include:

- The Salem Multi-Purpose Path construction was completed in the spring of 2017. This path is located behind the Salem School and the Town Hall, connecting Music Vale Road to Round Hill Road. The path has seven stream and wetland crossings. It travels along the Eightmile River, a Wild and Scenic River. The Town has created a riparian corridor overlay zone for this area to help protect it, and special permits had to be acquired from DEEP and USACE to create the path.
- Harris Brook Commons is a mixed-use building located at 24 Hartford Road off Route 85, adjacent to Harris Brook. The building includes a pharmacy, apartments, and other businesses, and was recently completed.
- A medical office building located on Center Street off Route 82, adjacent to Harris Brook Commons, was completed.
- The Connecticut Department of Transportation (CT DOT) completed its conversion of the Route 82/Route 85 intersection into a roundabout. The house at the southwest corner of Routes 82 and 85 has been demolished to accommodate the roundabout. The new roundabout was constructed at an elevation two feet higher than the previous intersection, which may help reduce the potential for flooding.

It is likely that Salem will continue to be a rural-dominant community in the future, with limited industrial and commercial development. The housing stock in Salem consists primarily of single family homes. No housing developments are currently in front of the town. Among others, the POCD Update lists the encouragement of affordable housing development in town and the encouragement of cluster/conservation design subdivisions in town.

Overall, the limited new development and redevelopment in Salem 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.

As of the 2020 Decennial Census, the population for the town is 4,213, which equates to about 146 people per square mile. The 2020 American Community Survey 5-year estimates identified the annual average median income for Salem to be $104,725, with an average of 53.2% of the population holding a bachelor's degree or higher, and an average unemployment rate of 0.8% throughout the town.

## 2.5. Governmental Structure

Salem 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 Salem.

Salem has boards, commissions, and committees that can take an active role in hazard mitigation, including the Inland Wetlands and Conservation Commission, the Planning and Zoning Commission, the Emergency Management Committee, the Town Planning/Building Committee, the Plan of Conservation and Development Committee and the Board of Selectmen. Departments and commissions common to all municipalities in SCCOG were described in Section 2.9 of the Multi-Jurisdictional HMCAP. More specific information for the departments and commissions of Salem is noted below:

- The Salem Volunteer Fire Company (Station 21) and the Gardner Lake Volunteer Fire Company provide fire suppression, fire prevention, rescue, and hazardous materials response services to the town.
- The Building Official is responsible for the issuance of building, electrical, plumbing, mechanical, demolition and change of occupancy permits. The Building Official is also the Floodplain Manager and enforces NFIP regulations in Salem.
- The Planning & Zoning Commission prepares and adopts the local plan of development and adopts and administers local zoning regulations. The Planning, Zoning, and Wetlands Department assists applicants with the municipal approvals process, ensures that proposals comply with applicable regulations, and enforces local Zoning, Subdivision, and Inland Wetlands and Watercourses regulations.
- The Inland Wetlands and Conservation Commission mission is to produce and enforce regulations and amendments in conformity with the regulations of the State Commissioner of Environmental Protection and the Inland Wetlands and Watercourses Act, as amended, as are necessary to protect wetlands and watercourses in Salem.
- The Public Works Department provides services including maintaining safe, efficient, and well-maintained infrastructure of roads and bridges, snow removal and deicing on roads, conducting the removal of hazardous trees, and maintaining and upgrading storm drainage systems to prevent flooding caused by rainfall.
- The Zoning Board of Appeals mission is to resolve conflicts which may arise between the common law rights of a property owner to his land as he or she wishes and the efforts of the Planning and Zoning Commission to manage land use in order to promote the general welfare of Salem. The Zoning Board of Appeals is empowered by statute to grant variances to zoning regulations.

The roles of town departments have not changed since the time of the previous HMP. Thus, Salem 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

Salem has different plans and regulations that recommend or create policies related to hazard mitigation. These policies and regulations are outlined in the Emergency Operations Plan (2010), *Plan of Conservation and Development* (2012), Open Space Plan (2007), Zoning Regulations, Subdivision Regulations and Inland Wetlands and Watercourse Regulations. The Zoning Regulations were revised to October 1, 2011 to incorporate new NFIP requirements associated with the DFIRM available in 2011.

### Emergency Operations Plan

Salem has an Emergency Operations Plan (EOP) that is updated and certified by the First Selectman annually. This document provides general procedures to be instituted by the First Selectman and/or designee 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. The EOP was rewritten in 2016 to match the new State template.

### Plan of Conservation and Development (2012)

The POCD was most recently updated in 2012 with contributions from local boards, commissions, committees, citizens, and citizen groups. The Plan seeks to be a statement of policies, goals and standards for the physical and economic development of the Town and recommends the most desirable uses types and population densities in various parts of the municipality.

The 2012 Town of Salem POCD includes the following actions:

- Update Stormwater systems to be consistent with 2004 CT DEEP Stormwater manual, and create a Stormwater management plan
- Riparian Corridor Overlay Zone ensures that there is a continuous buffer of native forest and shrubs along watercourses.
- POCD contains the objective to routinely consider collaborating with regional partners in obtaining goods or services.
- Town supports using specialized assistance (i.e., licensed arborists) in order to assist the fire department in reducing wildfire risk.

Therefore, the Salem POCD is considered somewhat consistent with the current goals and actions of the hazard mitigation plan, as it does not directly address several of the hazards such as emergency hazard response, wind damage and winter storm hazards, among others. The next update to the POCD (scheduled for 2022, during the life of the current hazard mitigation plan) will continue to incorporate the elements of the hazard mitigation plan.

### Zoning and Subdivision Regulations (2021 & 2018)

Salem's Zoning Regulation has been revised to July 15, 2021, and Subdivision Regulations have been revised to February 15, 2018.

The NFIP regulations for Salem are in Section 3.13 of the Zoning Regulations, updated in July 2011 to incorporate the FEMA Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM) for New London County published July 18, 2011. These regulations define substantial improvement cumulatively over a

one year period. New construction and substantial improvement in a flood zone must be elevated or floodproofed to or above the base flood elevation.

The Subdivision Regulation discusses flood elevations in Section 5.9, floodway encroachments in Section 5.10 and lists flooding considerations including drainage systems in Section 5.11. The Zoning Regulations require a 0% net increase in post-development runoff.

### Inland Wetlands and Watercourses Regulations (2013)

The Inland Wetlands and Watercourses Regulations in Salem require a permit for certain regulated activities that are within 75 feet 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

Salem considers several facilities to be critical to ensure that emergencies are addressed while day-to-day management of the town continues. Critical facilities are presented on figures throughout this annex and summarized in

Table 2-2. No critical facilities are located within a Special Flood Hazard Area (SFHA). These facilities are described in more detail below.

*Table 2-2 Town of Salem Critical Facilities*

| Facility | Address or Location | Emergency Power | Shelter | Cooling Center | In SFHA |
|---|---|---|---|---|---|
| ***Emergency Services*** | | | | | |
| Gardner Lake Volunteer Fire Company | 429 Old Colchester Rd | ✓ | ✓ | | |
| Salem Volunteer Fire Company | 424 Hartford Road | ✓ | | | |
| ***Municipal Facilities*** | | | | | |
| Town Hall* | 270 Hartford Road | ✓ | | | |
| Public Works Garage | 270 Hartford Road | ✓ | | | |
| Elementary School | 200 Hartford Road | ✓ | ✓ | | |
| Salem Free Library | 264 Hartford Road | | | ✓ | |

* Emergency Operations Center (EOC)

### Gardner Lake & Salem Volunteer Fire Companies

Salem has two volunteer fire companies: the Gardner Lake and Salem (Station 21) Volunteer Fire Companies. Both fire companies work together to serve Salem with fire suppression and emergency response. The two fire companies are outfitted with standby power supply sources via generators. The Gardner Lake Fire Company is Salem's secondary shelter.

Station 21 is outfitted with three additional portable generators, a Polaris Ranger with a 75 gallon tank for all terrain emergency response, a 77 foot rescue ladder with a 300 gallon water tank, a 1,000 gallon rescue truck, a 2,500 gallon tanker, a 100 gallon forestry truck, a hazardous waste response truck with two portable generators, a rescue and service truck, and a service sports utility vehicle. Salem is exploring making this building into a backup or alternate Emergency Operations Center.

The Gardner Lake Volunteer Fire Company has an attack fire engine normally used on all calls aside from medicals, a service truck most often used during first responder calls or mutual aid calls in support of surrounding towns, a forestry truck used for wildland suppression, an ambulance used for emergency response, a 3,000 gallon tanker typically used for fire suppression, and a rescue trucked primarily used for response to vehicle accidents.

### Shelters

The Elementary School and Gardner Lake Volunteer Fire Company are the two primary shelters in town. In addition, the town has identified the Salem Free Library as the designated cooling center for use during an extreme heat event or heat wave.

### Town Hall

Salem's Emergency Operations Center (EOC) is the Town Hall. The facility is fitted with a generator. The Town Hall houses many of Salem's municipal departments including the Public Works, Planning, Zoning, and Wetlands Enforcement, the Building Department, and the Emergency Services Department.

A variety of useful information pamphlets regarding disaster preparations are on display at the Town Hall. These are focused on fire safety, fire prevention, evacuation procedures, evacuating people with special needs, and preparing disaster supply kits.

If it was necessary, the EOC is capable of going mobile, and could relocate from the Town Hall to another facility such as the shelter.

### Communications

Salem has a considerable amount of equipment for interdepartmental emergency response and communication which, in addition to the equipment discussed above, includes handheld and workstation-based radios operable at many different frequencies. Salem's dispatch services are through QV Dispatch out of the Borough of Danielson in Killingly. This center is larger and has more capabilities than the KX dispatch center in Colchester that was previously used.

Salem utilizes the CT Alert "Everbridge" Emergency Notification System for Reverse 9-1-1 system in Town, allowing it to alert residents and visitors of emergency situations. Town officials encourage residents to sign up for the service via the CT Alert Emergency Notification System web site. (http://www.ct.gov/ctalert/site/default.asp).

### Additional Facilities

The Public Works Garage is located next door to the Town Hall, is outfitted with a generator and is outfitted with gasoline pumps for town equipment and vehicles.

A new Public Works storage area, which is also accessible as storage for other Town departments, was recently acquired adjacent to Town Hall.

Salem Elementary School is the Town's primary shelter. In 2014 the building underwent a $6.2 million renovation.

### Evacuation Routes

Annex E of Salem's EOP describes Salem's evacuation plans. Section V, Part A entitled "Administration" states that the Evacuation Coordinator is responsible for maintaining complete records and reports associated with tracking the status of evacuation events including evacuation notices, the number of persons evacuated and the number of evacuees in shelter/mass care centers. Additionally, the Evacuation Coordinator is responsible for maintaining up-to-date evacuation route maps that depict designated primary and alternate evacuation routes.

The highest capacity egress routes from Salem include:

- Route 85, which is oriented north-south and runs from Colchester to Montville across the center of Salem,
- Route 11 which runs almost parallel and to the west of Route 85 but only extends from the Colchester/Salem town line to Route 82, and
- Route 82 extends from the Montville town line just below Gardner Lake southwest to the Lyme town line.

## 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, the Town of Salem has no RL properties.

## 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 Salem Exposure Analysis*

| Hazard | At-Risk Parcels | | At-Risk Facilities | | At-Risk Historic Assets | |
|---|---|---|---|---|---|---|
| | Value | Number | Value | Number | Value | Number |
| **Hurricane/Tropical Storm** | $400,778,540 | 1,924 | $12,024,200 | 4 | $1,271,490 | 4 |
| **Severe Thunderstorm** | $400,778,540 | 1,924 | $12,024,200 | 4 | $1,271,490 | 4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Severe Winter Storm** | $400,778,540 | 1,924 | $12,024,200 | 4 | $1,271,490 | 4 |
| **Tornado** | $400,778,540 | 1,924 | $12,024,200 | 4 | $1,271,490 | 4 |
| **Drought** | $357,828,250 | 1,580 | $12,024,200 | 4 | $1,271,490 | 3 |
| **Flood** | | | | | | |
| 1% Annual Chance | $21,873,510 | 82 | $719,500 | 1 | - | - |
| 0.2% Annual Chance | $82,025,260 | 343 | $719,500 | 1 | - | - |
| **Earthquakes** | $400,778,540 | 1,924 | $12,024,200 | 4 | $1,271,490 | 4 |
| **Wildfire** | $301,611,890 | 1,526 | $12,024,200 | 4 | $1,271,490 | 3 |

## 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 Salem

## What are the Town's Top Climate Change Concerns?

**Flooding:** Road/stream crossings at undersized culverts are a challenge throughout the town. Severe precipitation events can overwhelm structures at these crossings and damage roads

**Extreme Heat:** Elderly and other vulnerable segments of the population may not have access to permanent and accessible cooling centers.

**Others:** Towns in the region have 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.

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

**Flooding:** Conduct an inventory of stream crossings to determine if any should be upsized to reduce risks of flooding or washouts.

**Extreme Heat:** Designate a permanent cooling center and ensure that access, transportation to the center, and backup power are appropriate.

**Others**: Partner with livestock facilities and farms to develop reliable, drought-resilience water supplies and standby power that is capable of operating cooling equipment.

# 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.[1] 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 mean an increase in risk throughout town or for specific populations, more severe storm damage 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 0 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 and Superstorm Sandy remain some of the more impactful hurricane events in recent history. Regional impacts include:

- Tropical Storm Irene impacted the region in August 2011. Sections of trees fell throughout the town and the region causing power outages that lasted up to seven days in Salem. Salem learned that communication between the local officials and Connecticut Light & Power (CL&P) (now Eversource) needs to greatly improve in order to efficiently and effectively clear roadways

[1] https://nca2018.globalchange.gov/chapter/2/

throughout town in the future. According to local officials, town shelters were not needed following Tropical Storm Irene although the EOC was operational.

- In 2012, 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. The town of Salem received nearly $25,000 in disaster relief from FEMA to cover the cost of damages from the storm.

On August 2, 2020 Tropical Strom Isaias swept through the State brining 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.

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 basic design wind speed for Salem ranges from 115 to 140 miles per hour, and the ultimate design wind speed is 125; design speeds used vary 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. Salem has adopted the Connecticut Building Code as its building code. The Building Official makes information on wind-resistant construction techniques available to all building permit applicants.

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. The Tree Warden posts notification and schedule tree removal. Most tree maintenance is performed by the Town's Public Works Department. The budget for tree removal is built into the Public Works Department budget and is not stand-alone. Debris is collected and brought to the Salem Community Park, the designated brush disposal area. The Town will contract to private companies to assist with debris collection and disposal as needed and is a member of the Southeastern Connecticut Regional Resources Recovery Authority agreement, giving it access to regional debris disposal and reuse capabilities.

In response to the major power-outages caused by Tropical Storm Irene and Hurricane Sandy, as well as significant winter storm events, Eversource has taken an aggressive approach to tree maintenance and has improved communication and coordination with municipalities in the past decade. Municipal staff report that Eversource has enhanced its tree clearing efforts, has updated its facilities, and has been working to strengthen the power grid and build in redundancies. Eversource will even help with roadside tree trimming if it is near the powerlines. Communication and coordination have improved due to Eversource's liaison program. The liaison is stationed at the Emergency Operations Center during events to improve communication.

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. Salem 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 implement its EOP and encourage residents to take protective or evacuation measures if appropriate.

Although hurricanes that have impacted Salem 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 have not increased significantly since the 2017 HMP. This is likely because the town increased capabilities following Irene and Sandy and has continued to operate at a higher level.

### 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 0). 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 seven day power outage due to tree damage to utility lines following Tropical Storm Irene in 2011.

A majority of structures built in town do not meet current building codes and are particularly susceptible to roof and window damage from high wind events. This risk to structures will be reduced with time as these buildings are remodeled or replaced with buildings that meet current codes. Those newer structures put in place since the 1990s are less vulnerable to damage from hurricanes and/or tropical storms.

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

#### *3.2.3.1 Hazard Losses*

The Town of Salem did not receive FEMA PA funds in the wake of Tropical Storm Isaias. Since 2012, the town has received $24,219 in FEMA PA funds for project costs of $32,844. This was all received for Super Storm Sandy. These funds were received for debris removal, protective measures, and public buildings.

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 damage, debris, and sheltering needs. Table 3-1 through Table 3-3 presents hurricane related damages for the Town of Salem. 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*

| Salem | Return Period | Residential | Commercial | Industrial | Others | Total |
|---|---|---|---|---|---|---|
| | 10-year | $6,860 | $0 | $0 | $0 | $6,860 |
| | 20-year | $526,710 | $117,550 | $2,770 | $6,600 | $653,630 |
| | 50-year | $3,334,440 | $1,936,410 | $30,780 | $53,890 | $5,355,520 |
| | 100-year | $6,933,770 | $7,299,740 | $129,360 | $348,290 | $14,711,160 |
| | 200-year | $12,984,220 | $18,279,170 | $341,770 | $774,130 | $32,379,290 |
| | 500-year | $26,907,970 | $43,521,670 | $806,180 | $1,971,840 | $73,207,660 |
| | 1,000-year | $40,525,360 | $66,707,780 | $1,239,130 | $2,740,430 | $111,212,700 |

*Table 3-2 HAZUS-MH Hurricane Related Building Damage*

| Salem | Return Period | Minor | Moderate | Severe | Destruction | Total |
|---|---|---|---|---|---|---|
| | 10-year | 1 | 0 | 0 | 0 | 1 |
| | 20-year | 5 | 0 | 0 | 0 | 5 |
| | 50-year | 71 | 7 | 1 | 0 | 79 |
| | 100-year | 186 | 27 | 3 | 0 | 216 |
| | 200-year | 325 | 65 | 10 | 1 | 401 |
| | 500-year | 485 | 138 | 27 | 6 | 656 |
| | 1,000-year | 565 | 195 | 45 | 12 | 817 |

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

| Salem | Return Period | Debris Generated (Tons) | Households Displaced | Individuals Seeking Temporary Shelter |
|---|---|---|---|---|
| | 10-year | 0 | 0 | 0 |
| | 20-year | 52 | 0 | 0 |
| | 50-year | 1,058 | 0 | 0 |
| | 100-year | 1,854 | 1 | 0 |
| | 200-year | | 2 | 1 |
| | 500-year | 6,513 | 7 | 2 |
| | 1,000-year | 9,122 | 15 | 3 |

## 3.3. Tornadoes and High Wind Events

### 3.3.1 Setting and Recent Occurrences

Similar to hurricanes and winter storms, wind damage associated with summer storms and tornadoes has the potential to affect any area of Salem. 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. Some notable storm events in the past decade include:

- On February 25, 2016, a passing cold front triggered unusual late winter severe thunderstorms across Southern Connecticut. Multiple trees and power lines were reported down in the town of Salem.

Other recent severe storm events include:

- On July 1, 2020, severe thunderstorms in the region reportedly produced quarter sized hail near Salem Valley Farms on White Birch Road.
- On September 6, 2017, a cold front triggered severe storms in the county and caused tree damage in multiple communities in the region. Nearby 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. Salem 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 local officials to implement the EOP and encourage residents to take protective measures if appropriate as was the case during Tropical Storm Irene.

Aside from warnings, additional methods of mitigation for wind damage are employed by Salem as explained in Section 3.2.2 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 some of the changes described in Section 3.2.2.

### 3.3.3 Vulnerabilities and Risk Assessment

Severe thunder or 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 are 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 Salem'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 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*

Since 2017, there has been one NOAA reported event associated with a severe thunderstorm event. This event produced quarter sized hail; however no economic damage was reported. 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 summer 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.

Severe winter storms and nor'easters have affected the town in the past decade as reported to the NCDC and reported by local officials:

- The winter of 2010-2011 produced significant snowfall in Salem. A barn collapsed and Salem spent $30,000 to clear 115,000 square feet of snow off of the Elementary School. An evaluation was never conducted prior to the removal; however, additional snowfall was forecast and local officials believed that snow removal was necessary.
- Winter Storm Alfred in October 2011 caused tree damage because Salem received seven inches of wet, heavy snow. However, the damage was believed not to be as bad as it could have been because T.S. Irene had taken down so many trees and branches two months earlier.
- 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 snowstorm struck the region in mid-March 2013 dumping upwards of 1-2 feet of snow in some parts of the county. Although New London country escaped the 3 foot and higher totals of some areas in the mid-Atlantic, the vast quantity of snow was still a major disruption to the town. Salem received nearly $35,000 in federal aid from FEMA to cover storm cleanup costs.
- Heavy snow throughout the winter of 2015 required snow removal from the school and other roofs to avoid the possibility of overloading.

Some of the more recent significant events since 2017 include:

- A heavy storm came through the region on February 9, 2017, bringing blizzard conditions and heavy snowfall. The Town of Colchester reported 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 by 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.

# 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 consider the global changes, but also characterizes 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).

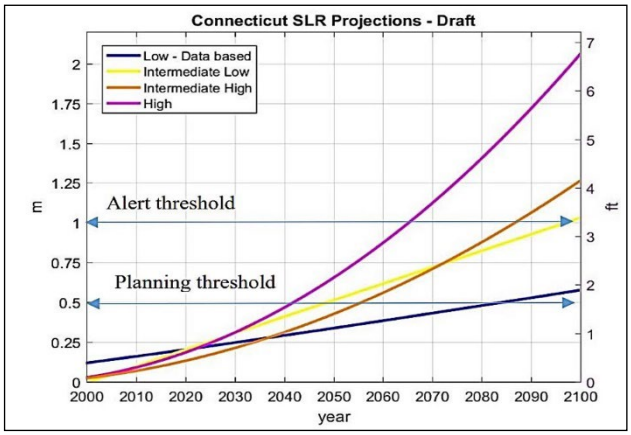



*Figure 4-1 Four Localized Sea Level Rise Scenarios for*

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 also 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

Salem 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 Salem related to coastal flooding.

## 4.3. Shoreline Change

### 4.3.1 Setting and Recent Occurrences

Salem is not located along the coastline nor is it located in a potential hurricane surge zone. Therefore, the town is not considered to be affected by shoreline change.

### 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 shoreline change.

### 4.3.3 Vulnerabilities and Risk Assessment

No areas of the town are vulnerable to shoreline change.

#### *4.3.3.1 Hazard Losses*

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

### 4.3.4 Existing Capabilities

Existing programs applicable to winter storm winds are the same as those discussed in Sections 3.2.2 and 3.3.2. Programs that are specific to winter storms are generally those related to preparing plows and sand and salt trucks; tree trimming and maintenance to protect power lines, roads, and structures; and other associated snow removal and response preparations.

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 Salem plows approximately 40 miles of roads by employing five crews in Salem trucks. A high priority is given to school bus routes that include steep hills. Sand and salt are both used for deicing in Salem. The Public Works Department, school officials and school buses, and Emergency Services, all have radios in vehicles that they can use to communicate with one another.

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. Salem monitors and shovels the roofs of municipal buildings when snow loads accumulate, and many residents and businesses shovel or plow their roofs. Many of the emergency calls in Salem in January 2011 were from people shoveling their roofs and falling. Salem feels its roof monitoring and snow removal procedure is robust despite not having a written prioritization plan. Town officials work closely with the Building Official to determine what needs to done and in what order.

Information for protecting Town residents during cold weather and for mitigating icing and insulating pipes at residences is posted on the Town website during the winter months.

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.

### 4.3.5 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 600 to approximately 140 feet, microclimates exist in Salem. This presents the possible situation of wintry weather impacting the highest elevations while the lowest elevations are not impacted. As such, snowfall amounts can vary significantly in Salem dependent on elevation.

In general, there are few steep slopes such that extra sanding and salting of the roadways in necessary locations alleviates any trouble spots. Town officials did not indicate this to be a major issue, rather an issue that deserves priority when staff begin treatment of roads. These areas are usually treated first by staff during and following winter storms.

#### *4.3.5.1 Hazard Losses*

There have been no reported winter storm losses for the Town of Salem since 2017. In the past decade, the Town has received FEMA PA funds in the amount of $68,994 for winter storms. Downscaled losses based on the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document.

# 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, damage 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 HMP. While riverine flooding is of primary concern, nuisance flooding and poor drainage are also issues 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 in Salem.

The March 2010 storms, which still remains one of the most notable events in over a decade, produced the most widespread flooding in Salem in recent history, causing basement flooding, roadway flooding, and a significant amount of nuisance flooding. Three notable road closures occurred during the floods: Routes 82 at Harris Brook, Route 85 at Harris Brook, and Witch Meadow Road off Route 85 north of the town center. Because of these three closures, school children had to be bused north on Route 85 into Colchester then back down West Road to reach the northwest corner of Salem. This underscored the fact that Witch Meadow Road is an important connection, and it floods easily.

The region has, however, seen some severe rainstorm events since the 2017 plan, with many neighboring communities having experienced serious flooding as a result.
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.

Hurricane 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. Washouts did occur in Town as a result of flooding near the former State Hospital and the future Riverwalk development.

After a period of prolonged drought, a severe rainstorm event on September 5, 2022, caused flooding in some areas of Southeastern Connecticut. Nearby 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

Salem attempts to mitigate inland flood damage and flood hazards by utilizing a wide range of measures including restricting activities in floodprone areas, replacing bridges and culverts, promoting flood insurance, maintaining drainage systems, through education and outreach, and by utilizing warning systems. Many mitigation measures are common to all hazards and therefore were listed in Section 2.6. No structural flood control projects are located within or upstream of Salem, 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 Public Works Director or either Fire Company typically handles complaints from residents. For example, the Public Works Department would inspect bridges and culverts and erect barricades to close roads, while the Fire Companies respond to calls requesting help for flooded basements. Drainage complaints are directed to the Public Works Director.

The new roundabout constructed at the intersection of Routes 82 and 85 was constructed two feet higher than the current intersection. Although not confirmed, it is believed that this may increase flood mitigation.

The Town recently applied for a Small Towns Economic Assistance Program (STEAP) gran to address concerns associated with the Darling Road Bridge.

#### Regulations, Codes, and Ordinances

Salem has planning and zoning tools in place that incorporate floodplain management. Salem 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.

#### Acquisitions, Elevations, and Property Protection

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

Salem has mutual aid agreements in place with other Fire Departments in New London County, and is able to request aid in case of emergencies from those sources.

#### Flood Watches and Warnings

The First Selectman and the Volunteer Fire Companies access weather reports through the National Weather Service and local media. Salem participates in the CT Alerts "Everbridge" Emergency Alerting and Notification Reverse 9-1-1 System, giving it the capability to telephone warnings into specific areas. The use of this service allows the town to receive geographically specific weather warnings when storms are imminent.

#### Public Education and Outreach

When new FEMA maps were published in 2011, the Town held a public hearing in order to give that information to residents. During this meeting, they discussed the availability of FEMA-provided flood insurance. The Town expects to continue providing relevant information during future public meetings about hazards. FEMA-provided flood insurance brochures are also available at the Town Hall.

The Salem building official provides technical assistance to owners of non-residential structures that suffer flood damage regarding flood mitigation measures upon request. After disasters occur, the Town encourages residents to submit insurance claims.

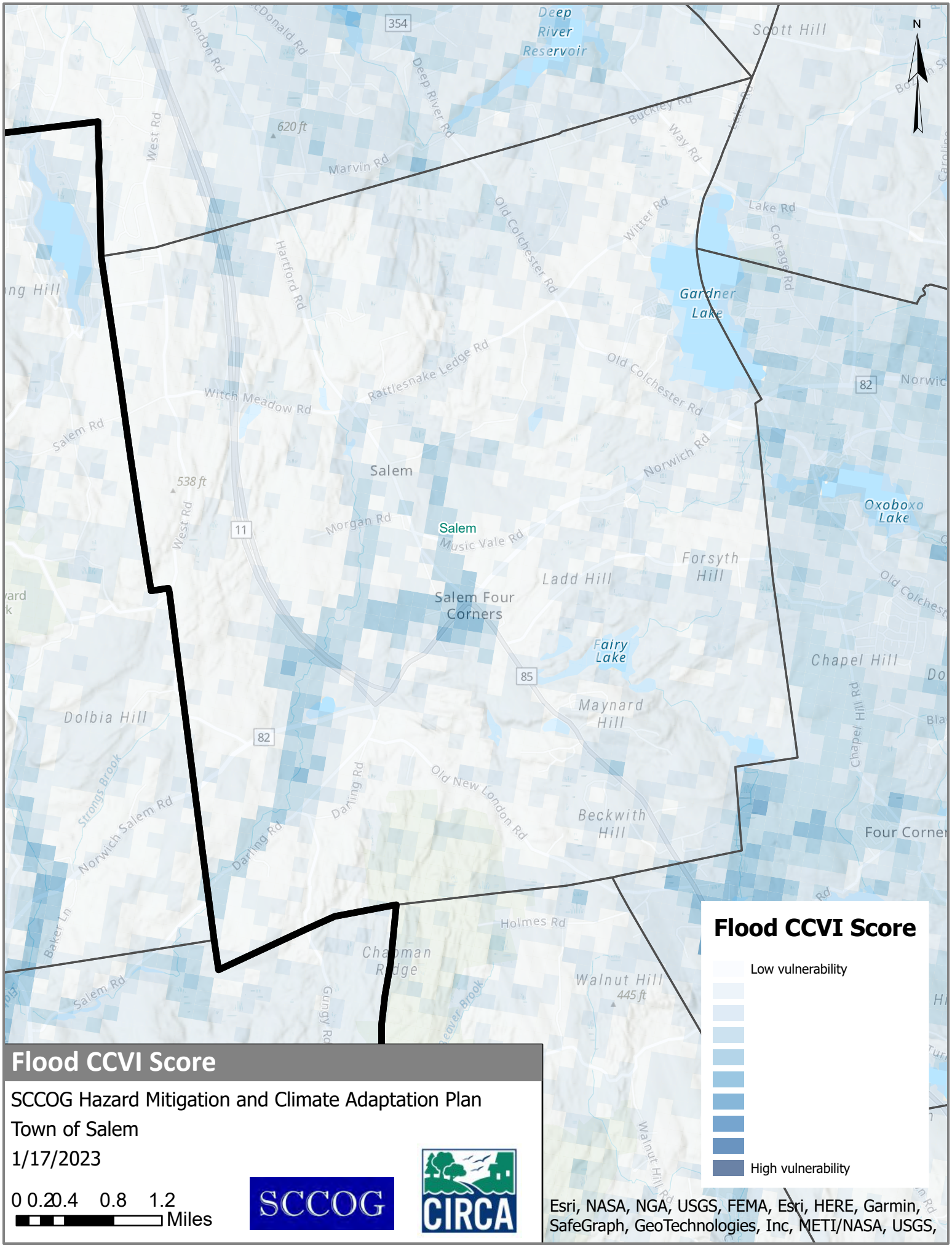
#### Summary

In general, municipal capabilities to mitigate flood damage have not increased significantly since the 2017 edition of the hazard mitigation plan was adopted.

### 5.2.3 Vulnerabilities and Risk Assessment

This section discusses specific areas at risk of inland flooding within Salem. As a general note, the DPW director has found that most drainage and minor flooding complaints stem from beaver-dam issues.

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 Salem. The distribution of flood vulnerability throughout the community can be seen in. The CCVI demonstrates that flood vulnerability in the town ranges from low to low-moderate. Most of the vulnerability score is due to coastal flood exposure.

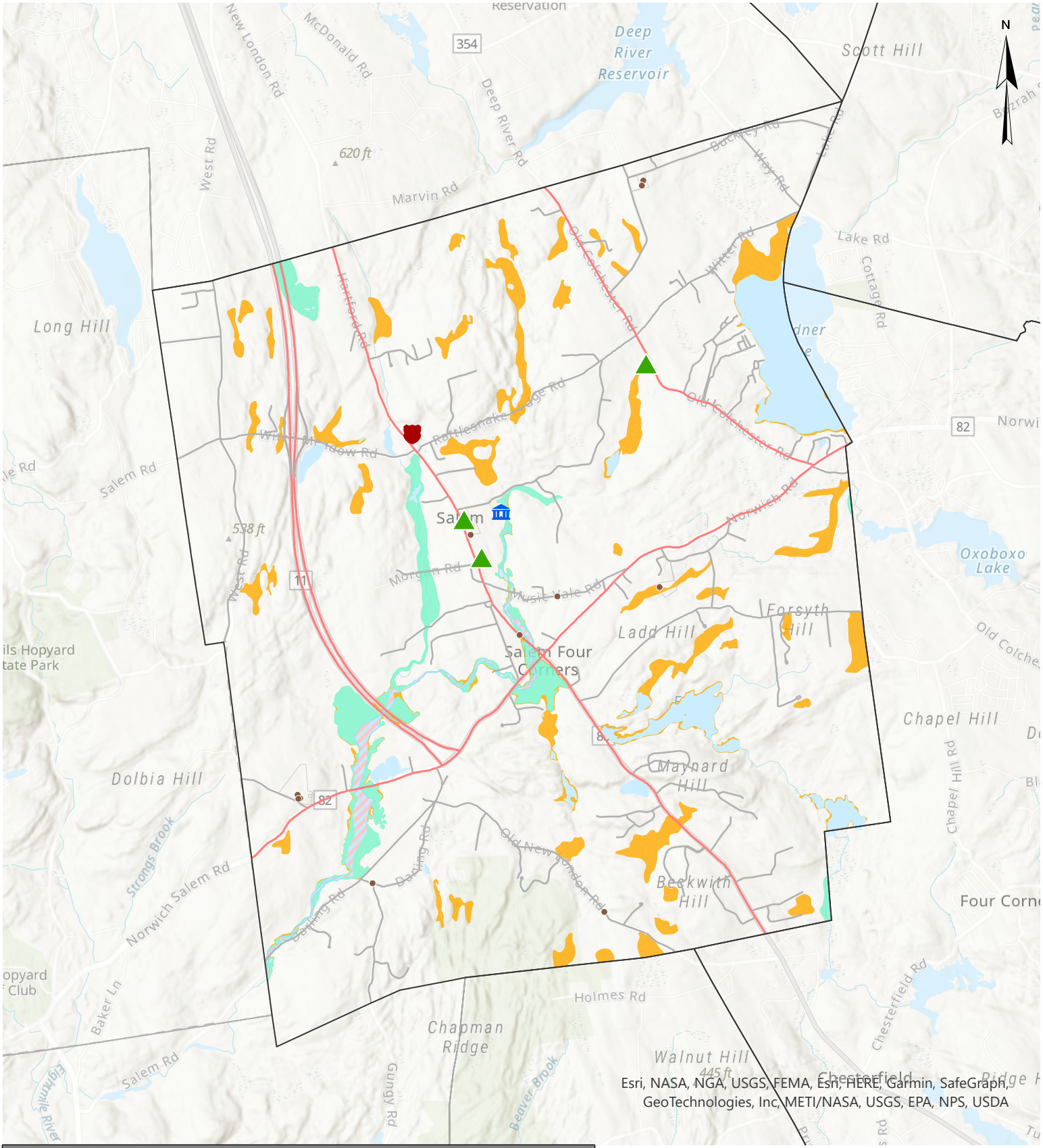

Flood CCVI Score
SCCOG Hazard Mitigation and Climate Adaptation Plan
Town of Salem
1/17/2023
0 0.20.4 0.8 1.2
Miles
SCCOG
CIRCA
Flood CCVI Score
Low vulnerability
High vulnerability
Esri, NASA, NGA, USGS, FEMA, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS,
N
Deep River Reservoir
Scott Hill
620 ft
Marvin Rd
West Rd
Deep River Rd
Buckley Rd
Way Rd
Witter Rd
Lake Rd
Cottage Rd
Old Colchester Rd
Hartford Rd
Gardner Lake
Rattlesnake Ledge Rd
Witch Meadow Rd
Salem Rd
Norwich Rd
Salem
538 ft
Morgan Rd
Music Vale Rd
Oxoboxo Lake
Forsyth Hill
Ladd Hill
Salem Four Corners
Fairy Lake
Chapel Hill
Maynard Hill
Dolbia Hill
Strongs Brook
Norwich Salem Rd
Darling Rd
Old New London Rd
Beckwith Hill
Holmes Rd
Chapman Ridge
Walnut Hill
445 ft
Baker Ln
Gungy Rd
Beaver Brook
Chapel Hill Rd
Four Corner
354
11
82
85

### Vulnerability Analysis of Areas along Watercourses

Parts of the East Branch Eightmile River, Harris Brook, Fraser Brook, Shingle Mill Brook, and Witch Meadow Brook have a Special Flood Hazard Area (SFHA) associated with them. Sections of the East Branch Eightmile River, Harris Brook, Fraser Brook, and Shingle Mill Brook are mapped as the SFHA Zone AE, indicating that flood elevations are available. Additional mapped SFHA floodplains are Zone A, indicating that elevations are not available. As previously discussed, there are a few areas of town where flooding is hazardous to residents, buildings, or roadways. Those areas are discussed in Section 5.2.1 and listed below; refer to Figure 5-2for the location of SFHAs within Salem:

- The Harris Brook corridor is floodprone where it crosses Routes 82 and 85 in the center of town. The roadways in this area are relatively low in elevation and can be flooded by one to 1.5 feet of water during significant storms. Construction of the Route 82/85 roundabout should mitigate some of this flooding.
- The area behind the "Salem Town Center" strip mall at the southwest corner of Routes 82 and 85 is in the SFHA of Harris Brook. Approximately one to 1.5 feet of water has historically inundated the rear of the plaza, which is a parking lot.
- During the March 2010 storms, there were three notable road closures: the intersection of Routes 82 and 85 at Harris Brook, Witch Meadow Road off Route 85 to the north of the town center, and the intersection of Darling Road and White Birch Road at a tributary of the East Branch Eightmile River which has a long standing history of inundation.
- Route 82 has a history of flooding at the East Branch Eightmile River, and beavers have historically contributed to the flooding of Rattlesnake Ledge Road near Whittlesey Swamp. The CT DOT is currently working on elevating the bridge and increasing the culvert capacity at this crossing.

Important transportation routes through town includes Routes 82 which runs northeast-southwest through the central portion of town, Route 85 which runs north-south through the center of town and Route 11 which runs north-south through the eastern half of town and connects Route 2 to Route 82. Other important roadways include Route 354 in the northeast corner of town which connects Colchester to Montville, Witch Meadow Road which enters Salem from East Haddam in the northwestern section of town and passes through Route 11 to Route 85, and Gungy Road / White Birch Road which extends from Route 82 in the southeastern portion of town to the south and into Lyme. The DFIRM mapping suggests that these transportation routes can be negatively affected by extreme flooding. The DFIRM mapping shows FEMA flood zones stretching across Routes 11, 82 and 85. According to town officials, the most problematic areas of flooding associated with transportation through town are the sections of Routes 82 and 85 described in Section 5.2.1.




## Critical Facilities and Historic Resources with Flood Zones

SCCOG Hazard Mitigation and Climate Adaptation Plan

Town of Salem

Date: 8/1/2022

0 0.4 0.8 1.2 1.6 Miles

SCCOG

RESILIENT Land & Water

### Legend

- Historic Resources
- Emergency Services
- Municipal
- Shelter or Cooling Center
- 1% Annual Chance Flood Hazard Area
- .2% Annual Chance Flood Hazard Area
- Floodway

### Vulnerability Analysis of Private Properties

The majority of structures in flood risk areas are located near the confluence of Fraser Brook with Harris Brook. Many of these structures are residential and only a few are commercial. Only one structure appears to be located within the Zone A floodplain (the SFHA floodplain without flood elevations defined), while the remaining six appear to be located either within Zone AE or the floodway in Zone AE.

Town personnel indicate that structures typically do not get flooded in Salem due to riverine or overbank flood conditions, despite their locations in SFHAs. As shown in the table in 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.

### Vulnerability Analysis of Critical Facilities

As noted in Section 2.7 no critical facilities are located within an SFHA flood zone. With respect to critical facilities, there are no serious concerns to the town in conjunction with flooding.

#### *5.2.3.1 Hazard Losses*

According to NFIP statistics, as of June 30, 2022, the Town of Salem had a total of two flood related losses, with a total of $1,627 paid towards the claims. FEMA HAZUS-MH 6.0 was used to develop losses associated with the 100-year riverine flood event. Table 5-1 presents flood related damages for the Town of Salem. Additional HAZUS-generated losses for the town and region can be found in the Multi-Jurisdictional document.

*Table 5-1 HAZUS-MH Riverine Flood Related Economic Impacts*

| Salem | 2022 Results | | | | |
|---|---|---|---|---|---|
| | **Residential** | **Commercial** | **Industrial** | **Other** | **Total** |
| **Direct** | | | | | |
| Building | $1,130,000 | $4,540,000 | $30,000 | $170,000 | $5,870,000 |
| Contents | $460,000 | $6,730,000 | $80,000 | $940,000 | $8,210,000 |
| Inventory | $0 | $150,000 | $10,000 | $0 | $160,000 |
| Subtotal | $1,590,000 | $11,420,000 | $120,000 | $1,110,000 | $14,240,000 |
| **Business Interruption** | | | | | |
| Income | $0 | $7,930,000 | $0 | $500,000 | $8,430,000 |
| Relocation | $460,000 | $2,100,000 | $0 | $270,000 | $2,830,000 |
| Rental Income | $130,000 | $1,590,000 | $0 | $10,000 | $1,730,000 |
| Wage | $0 | $3,850,000 | $0 | $1,350,000 | $5,200,000 |
| Subtotal | $590,000 | $15,470,000 | $0 | $2,130,000 | $18,190,000 |
| **Total** | **$2,180,000** | **$26,890,000** | **$120,000** | **$3,240,000** | **$32,430,000** |

## 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 sectors impacted more than others.

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 11$^{th}$ 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, 2022.

### 5.3.2 Existing Capabilities

The Town of Salem, like many communities, does not have specific regulations geared toward drought mitigation. Throughout the regulations, there are certain regulations and requirements to reduce adverse effects on water quality, and to reduce long-term degradation of groundwater supply.

Section 25A has been developed to protect and enhance the Eightmile River Watershed. Specifically noted, one intent of the regulation is to protect the regulation of water flow to promote groundwater recharge.

The U.S. Drought Monitor is a national resource that many state and local entities use to monitor regional conditions in relation to drought development. The weekly reporting issued by the partnership includes a drought intensity scale which includes five stages from “abnormally dry” to “exceptional drought”. While this resource is available to Town for determining drought conditions, the Connecticut Interagency Drought Workgroup (IDW) uses this and other resources to monitor drought conditions specifically for the state. The Town of Salem has this IDW and state-specific drought emergency declarations as a resource to prepare for, and respond to, droughts.

### 5.3.3 Vulnerabilities and Risk Assessment

The entire Town of Salem is vulnerable to drought, but the degree of vulnerability varies. A majority of the properties in town rely on private wells for their residential or commercial drinking water. These private well users may face challenges relative to water supply during periods of drought.

#### *5.3.3.1 Hazard Losses*

There have been no reported drought losses for the Town of Salem. Downscaled losses from the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document.

## 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 floodwater. In addition, a dam failure can cause a chain reaction where the sudden release of floodwater 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 Salem 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 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 HMCAP, Salem does not have a Class C (high hazard) dam or a Class B (significant hazard) dam within its municipal limits. All dams registered in the Town of Salem can be found in Table 5-2.

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.

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

| CT Dam# | Dam Name | Dam Class | Owner Type |
|---|---|---|---|
| 12106 | Horse Pond | A | State Owned |
| 12109 | Ransom Brook Dam | A | Private |
| 12111 | Bond Reservoir Dam | A | Municipal |
| 12112 | Hoffstot Pond Dam | A | Lake Association |
| 12116 | Witch Meadow Pond Dam | A | Private |
| 12103 | Mill Pond Dam | AA | Municipal |
| 12107 | Zemko Pond Dam | AA | State Owned |
| 12113 | Stecher Pond Dam | AA | Private |
| 12114 | Salter Farm Pond Dam | AA | Private |
| 12117 | Darling Pond Dam | AA | Private |
| 12119 | Bingham Pond Dam | AA | Land Trust |
| 12102 | Fairy Lake Dam | BB | Municipal |
| 12105 | Mitchell Pond Dam | BB | Private Corporation |
| 12118 | Fairy Lake Dike | BB | Municipal |
| 12121 | Dolbeare Dam | BB | Multi Private Municipal |

Summary

Municipal capabilities to mitigate dam failure damage have remained strong since the 2017 edition of the hazard mitigation plan was adopted, in particular due to the lack of Class B and C dams. In addition, changes in the State's regulation of dams have increased Statewide capabilities sharply.

### 5.4.3 Vulnerabilities and Risk Assessment

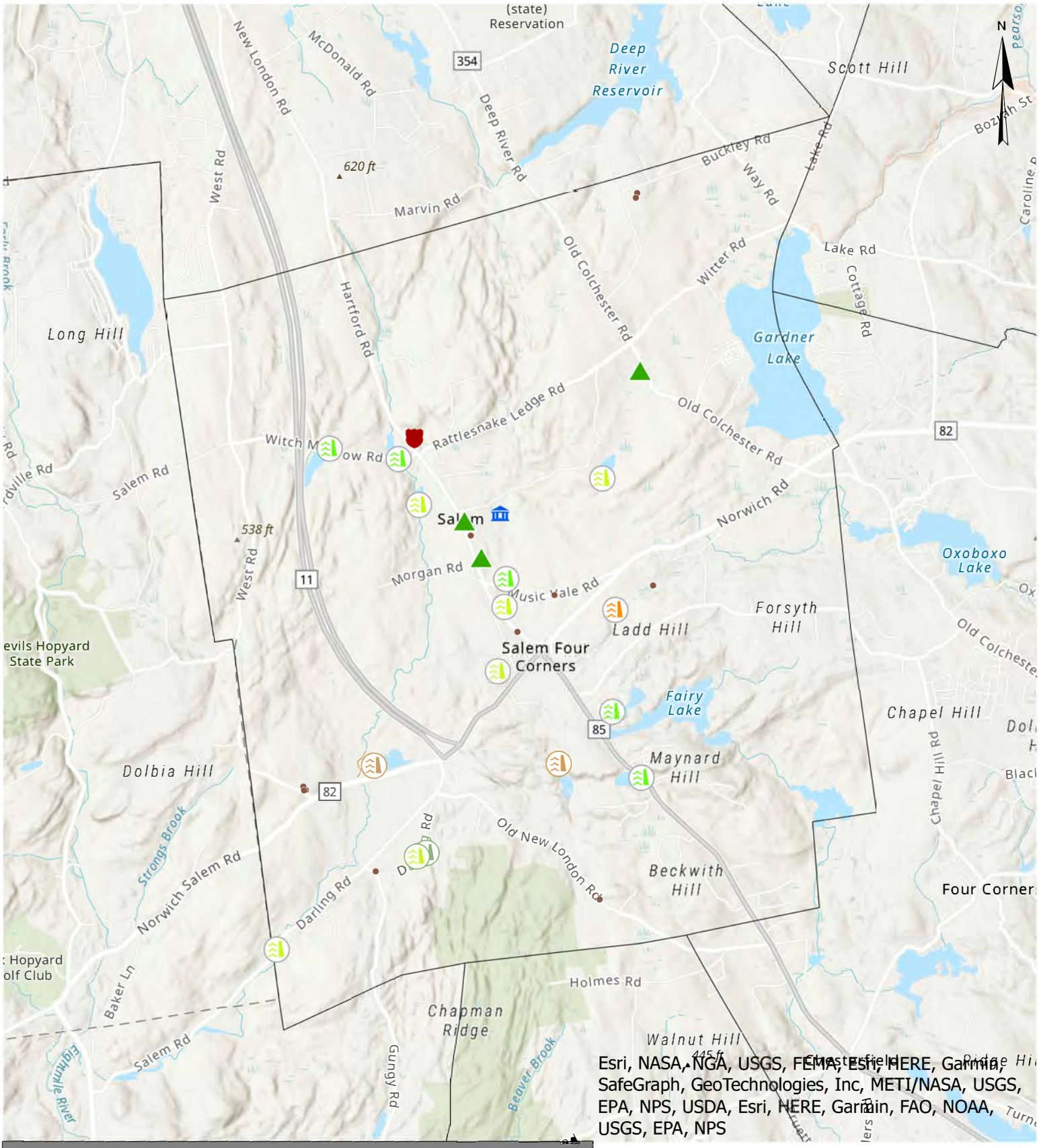
There are no high (Class C) or significant (Class B) hazard dams in Salem. However, according to the "Connecticut Dams" GIS shapefile published in 1996, the total number of CT DEEP-registered dams in Salem was 17. These dams were ranked as having a moderate hazard potential (Class BB), a low hazard potential (Class A), or were unranked. According to the same datafile, the Harris Brook subregional basin has the greatest number of dams with seven, followed by the East Branch Eightmile River basin with six and the Latimer basin with four. None of the remaining subregional basins have any CT DEEP-registered dams according to the datafile.

Town purchased land at the Salem Community Park prior to the 2017 HMP, an acquisition that included a minor dam. This dam does not pose any hazard, and no actions are planned for it.

Due to the absence of Class B and C dams, Salem is considered a low-risk area for dam failure.

#### *5.4.3.1 Hazard Losses*

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




## Dams and Dam Failure Inundation Areas

Southeastern Connecticut Council of Governments Town of Salem

Date: 2/23/2023

0 0.4 0.8 1.2 1.6 Miles

SCCOG

RESILIENT Land & Water

### Legend

Dams

- A
- AA
- BB

- Historic Resources
- Emergency Services
- Municipal
- Shelter or Cooling Center
- Dam Failure Inundation Area

# 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. 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.[2]

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 experienced 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 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 are 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 degrees. 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 above 90 degrees.

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

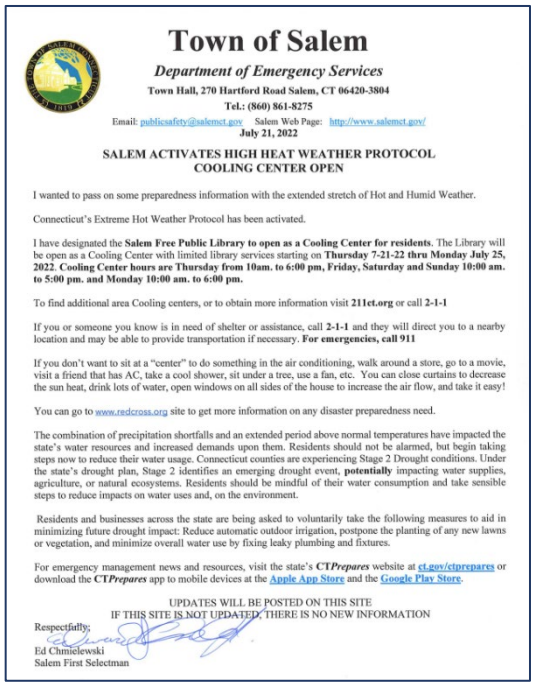
| | May | | June | | July | | August | | September | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *GNL* | *NPU* | *GNL* | *NPU* | *GNL* | *NPU* | *GNL* | *NPU* | *GNL* | *NPU* |
| 2017 | 85 | **93** | 89 | **94** | 88 | **92** | 87 | 89 | 86 | 89 |
| 2018 | 80 | **91** | 87 | **90** | 89 | **101** | 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 |
| GNL = Groton New London station & NPU = Norwich Public Utilities station | | | | | | | | | | |

[2] https://nca201758.globalchange.gov/chapter/2/

### 6.2.2 Existing Capabilities

Similar to the monitoring methods used for hurricanes, severe storms, and winter storms, the Town monitors National Weather Service and local forecasts for anticipated extreme heat event, and also monitors for NWS heat warnings and advisories. The Town of Salem has identified the Salem Free Library as a cooling center in town. In the event of a projected heat event or heat wave, the Town is prepared to open up the cooling centers for resident use.

In addition, the town works to promote available resources during extreme heat events. During an extreme heat event in July 2022, the Town developed a press release (Figure 6-1) which included information on cooling center hours, State resources, and additional ways to receive emergency management new and resources. This press release also included information on the ongoing drought; increasing resident awareness on developing hazards.



**Town of Salem**

***Department of Emergency Services***

**Town Hall, 270 Hartford Road Salem, CT 06420-3804**

**Tel.: (860) 861-8275**

Email: publicsafety@salemct.gov Salem Web Page: http://www.salemct.gov/

**July 21, 2022**

**SALEM ACTIVATES HIGH HEAT WEATHER PROTOCOL**
**COOLING CENTER OPEN**

I wanted to pass on some preparedness information with the extended stretch of Hot and Humid Weather.

Connecticut's Extreme Hot Weather Protocol has been activated.

I have designated the **Salem Free Public Library to open as a Cooling Center for residents**. The Library will be open as a Cooling Center with limited library services starting on **Thursday 7-21-22 thru Monday July 25, 2022**. **Cooling Center hours are Thursday from 10am. to 6:00 pm, Friday, Saturday and Sunday 10:00 am. to 5:00 pm. and Monday 10:00 am. to 6:00 pm.**

To find additional area Cooling centers, or to obtain more information visit **211ct.org** or call **2-1-1**

If you or someone you know is in need of shelter or assistance, call **2-1-1** and they will direct you to a nearby location and may be able to provide transportation if necessary. **For emergencies, call 911**

If you don't want to sit at a "center" to do something in the air conditioning, walk around a store, go to a movie, visit a friend that has AC, take a cool shower, sit under a tree, use a fan, etc. You can close curtains to decrease the sun heat, drink lots of water, open windows on all sides of the house to increase the air flow, and take it easy!

You can go to www.redcross.org site to get more information on any disaster preparedness need.

The combination of precipitation shortfalls and an extended period above normal temperatures have impacted the state's water resources and increased demands upon them. Residents should not be alarmed, but begin taking steps now to reduce their water usage. Connecticut counties are experiencing Stage 2 Drought conditions. Under the state's drought plan, Stage 2 identifies an emerging drought event, **potentially** impacting water supplies, agriculture, or natural ecosystems. Residents should be mindful of their water consumption and take sensible steps to reduce impacts on water uses and, on the environment.

Residents and businesses across the state are being asked to voluntarily take the following measures to aid in minimizing future drought impact: Reduce automatic outdoor irrigation, postpone the planting of any new lawns or vegetation, and minimize overall water use by fixing leaky plumbing and fixtures.

For emergency management news and resources, visit the state's ***CTPrepares*** website at ct.gov/ctprepares or download the ***CTPrepares*** app to mobile devices at the Apple App Store and the Google Play Store.

UPDATES WILL BE POSTED ON THIS SITE
IF THIS SITE IS NOT UPDATED, THERE IS NO NEW INFORMATION

Respectfully;
Ed Chmielewski
Salem First Selectman

*Figure 6-1 Town of Salem Extreme Heat Press Release from July 2022*

#### Summary

In general, the capabilities of mitigating extreme heat have increased since the 2017 edition of this plan as the town has a cooling center for use during an extreme heat event, and conducts public outreach in the event of a heat wave.

### 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 Salem. The elderly populations in town are more vulnerable to extreme heat events, particularly when in home cooling is not available. Also, those in town with certain health conditions may also be more vulnerable to the health factors associated with extreme temperatures.

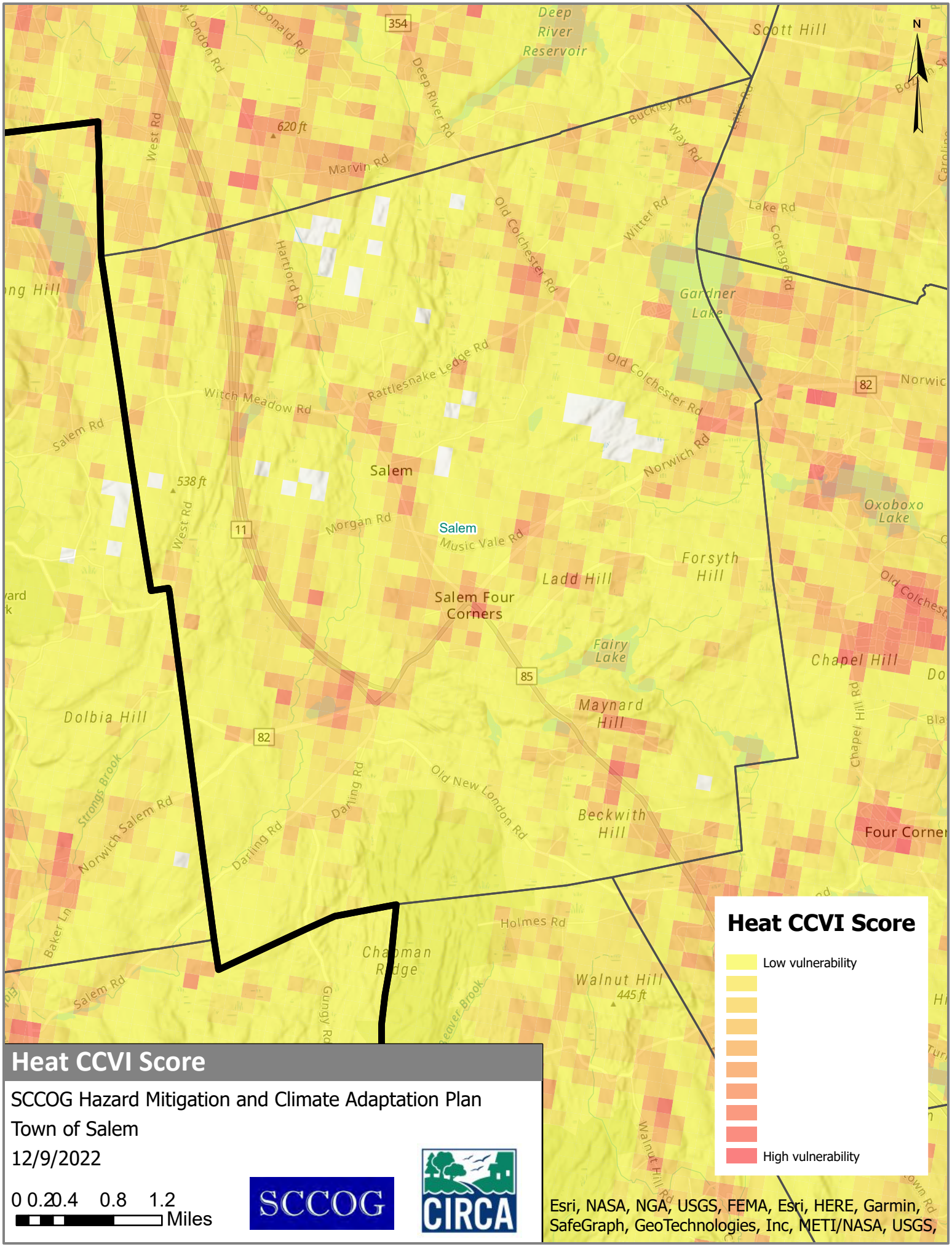
UConn CIRCA has developed a tool to aid in understanding extreme heat vulnerability for communities across the state. This tool, known as the Climate Change Vulnerability Index (CCVI), is comprised of dozens of factors that contribute to a community's heat sensitivity, exposure, adaptive capacity, and ultimately the overall heat vulnerability. The CCVI has been used as a tool to characterize heat vulnerability for Salem. The distribution of heat vulnerability throughout the community can be seen in Figure 6-2

Salem has relatively low heat exposure and sensitivity, with low building density, few impervious surfaces, and little social vulnerability. Adaptive capacity is moderate, as the low population of the town

suggests that the existing cooling center may be sufficient for the town's needs. Therefore, the overall heat vulnerability for Salem is low.

#### *6.2.3.1 Hazard Losses*

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


Heat CCVI Score
Low vulnerability
High vulnerability
Heat CCVI Score
SCCOG Hazard Mitigation and Climate Adaptation Plan
Town of Salem
12/9/2022
0 0.20.4 0.8 1.2
Miles
SCCOG
CIRCA
Esri, NASA, NGA, USGS, FEMA, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS,
N
Salem
Salem Four Corners
Deep River Reservoir
Scott Hill
Gardner Lake
Oxoboxo Lake
Fairy Lake
Ladd Hill
Forsyth Hill
Chapel Hill
Maynard Hill
Beckwith Hill
Walnut Hill
Dolbia Hill
Chapman Ridge
Old Colchester Rd
Rattlesnake Ledge Rd
Witch Meadow Rd
Morgan Rd
Music Vale Rd
Old New London Rd
Norwich Rd
Norwich Salem Rd
Darling Rd
Holmes Rd
Salem Rd
West Rd
Hartford Rd
Deep River Rd
Marvin Rd
Buckley Rd
Witter Rd
Lake Rd
Cottage Rd
Chapel Hill Rd
620 ft
538 ft
445 ft
354
11
82
85

## 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 Salem. Structural fires in higher density areas of the town are not directly addressed herein.

According to local officials, although most of Salem is not developed, no specific areas of wildfire risk or vulnerability are known. Small fires have historically occurred during dry spring weather in Connecticut. Fire ponds and cisterns are not required in Salem, although a few dry hydrants exist. That said, a series of water sources (surface water fire suppression sources) are located throughout town. Between both Volunteer Fire Companies' tanker trucks and several mutual aid agreements with neighboring towns, Salem believes their services are fully capable. Whenever water is needed for fire suppression, the tanker truck continuously moves to and from the nearest hydrant, or other water source, to maintain a constant water supply.

### 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. Salem can access this information over the internet. Salem 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 two Volunteer Fire Companies have a variety of equipment including a Polaris Ranger with a 75 gallon tank, a 100 gallon forestry truck, and a second forestry truck, all of which are used for wildland fire suppression. One of these trucks was replaced with a new tanker truck in 2016. The Fire Companies also have mutual aid agreements with surrounding communities. The Volunteer Fire Companies will continue to evaluate the level of risk and the need for additional hydrants as development continues in the future. They will also continue to support public outreach programs to increase awareness of forest fire danger, equipment usage, and protecting homes

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." Salem has designated 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.

Summary

In general, municipal capabilities to mitigate wildfire damage have increased slightly since the 2017 edition of the hazard mitigation plan was adopted, with continued public education and testing of dry hydrants.

### 6.3.3 Vulnerabilities and Risk Assessment

Forests and inaccessible tracks of land are at the highest risk for wildfires. However, according to local officials, there are no specific areas of wildfire risk or vulnerability in Salem and the Fire Department is outfitted with three wildland-specific rigs used in fire suppression. 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 Salem 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 Salem. Salem has adopted these codes for new construction, and they are enforced by the Building Official.

Due to the infrequent nature of damaging earthquakes, local land use policies do not directly address earthquake hazards. However, the potential for an earthquake and emergency response procedures is addressed in Salem'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 adjacent to Witch Meadow Brook, East Branch Eightmile River and its tributaries, Fairy Lake and its tributaries, Horse Pound Brook, and smaller tributaries have fairly extensive areas 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 local officials deem necessary, the possible prohibition of new construction.

Refer to Section 2.1 for a discussion regarding the two inactive faults in Salem which run in a northeast to southwest direction. 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. With a difference of upwards of five hundred feet in elevation, Salem has areas of steep slopes and bluffs, although the majority of these features occur in undeveloped areas. Thus, landslides are not a great 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 5.4. As noted previously, most utility infrastructure in the town is located above ground. A quick and coordinated response with Eversource 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 Salem EOP.

### 7.2.4 Hazard Losses

There are no reported losses for the Town of Salem 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*

| Salem | Residential | Commercial | Industrial | Others | Total |
|---|---|---|---|---|---|
| | $197,370,000 | $1,451,760,000 | $35,240,000 | $89,050,000 | 1,773,420,000 |

# 8. Mitigation Strategies and Actions

## 8.1. Status of Mitigation Strategies and Actions

A total of 15 hazard mitigation actions were developed in the previous edition of this plan. The status of each is listed below.

| # | Mitigation Actions and Strategies for Salem 2016 - 2021 | Status | Status Details |
|---|---|---|---|
| 1 | Develop a backup EOC at the Fire Department and identify a replacement EOC as the Town Hall has become outdated. | Remove | The EOC can become mobile and relocate if necessary. |
| 2 | Integrate elements of this HMP into the Plan of Conservation and Development into the 2012 update and beyond. | Capability | |
| 3 | Put hazard information on the website in an easy to access location. | | Likely a capability |
| 4 | Keep hazard-related flyers, etc., on display in the library. | | Likely a capability |
| 5 | Utilize the recently available extreme rainfall data to determine existing culvert sizing and encourage upgrades where undersized. | | |
| 6 | Work with the CT DOT to elevate the bridge and/or increase the culvert capacity for the Harris Brook corridor at the Route 82/85 crossing. | | |
| 7 | Pursue funding to install floodproofing measures, including elevations acquisitions, and/or flood walls behind the Salem Town Center strip mall. | Remove | This does not seem necessary anymore as the elevate roundabout seems to have reduced flooding here. |
| 8 | Pursue funding to elevate the bridges and/or increase the culvert capacity of Witch Meadow Road off Route 85. | | |
| 9 | Pursue funding to elevate the bridges and/or increase the culvert capacity of the intersection of Darling Road and White Birch Road. | Carry forward | Is this the what the STEAP grant was submitted for? |
| 10 | Work with the CT DOT to either elevate the existing bridge and/or increase the culvert capacity of Route 82 at the E. Branch Eightmile River. | | |
| 11 | Pursue funding to elevate Rattlesnake Ledge Road near Whittlesey Swamp where beavers have historically contributed to flooding. | | |
| 12 | Encourage commercial building owners to develop emergency response plans and identify mitigation opportunities. | | Unsure if this has ever been done. |
| 13 | Visit schools and educate children about the risks of wind events and how to prepare for them. | | |
| 14 | Survey Emergency Operations Center and Primary Emergency Shelter to determine wind loading capacities. | Remove | This is likely not necessary, and the town does not intend to pursue this. |

| | | | |
|---|---|---|---|
| 15 | Consider drafting a written plan for inspecting and prioritizing the removal of snow from town-owned structures. | | The town works with the building official to determine what needs to be done, and in what order. |

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 one prior action 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 Salem 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:

- Conduct an inventory of stream crossings to determine if any should be upsized to reduce risks of flooding or washouts.
- 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.

The Town intends to focus on the above actions, along with the sole action about cooling centers:

- Designate a permanent cooling and warming center and ensure that access, transportation to the center, and backup power are appropriate.

This is consistent with the State's emphasis on cooling center resilience.

*Table 8-1 Town of Salem 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 | PERISTS Score | STAPLEE Score | PERSISTS x STAPLEE = |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SA1 | Designate a permanent cooling and warming center and ensure that access, transportation to the center, and backup power are appropriate. | 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 | 7/2024 - 6/2026 | High | 16 | 6 | 96 |
| SA2 | 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 |
| SA3 | Conduct an inventory of stream crossings to determine if any should be upsized to reduce risks of flooding or washouts. | Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods. | Structural Projects | Public Works | $25,000 - $50,000 | DEEP Climate Resilience Fund; STEAP | 7/2024 - 6/2026 | Medium | 18 | 9 | 162 |
| SA4 | 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 |
| SA5 | 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 |