
TOWN OF NORTH STONINGTON ANNEX DOCUMENT

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

March 2023



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1. Introduction

1.1. Purpose of Annex

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

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

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

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

The purpose of this HMP annex is to provide an update to the hazard risk assessment and capability assessment provided in the previous HMP, and to evaluate potential hazard mitigation measures and prioritize hazard mitigation projects specific to mitigating the effects of hazards on the Town of North Stonington. 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 details for North Stonington 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

North Stonington is a rural community located on the eastern edge of New London County that was settled in 1687 and incorporated in 1807. The community has since grown to a population of 4,991 as of the 2000 census. Additional growth over the next decade brought the total population of the town to 5,267 as of the 2010 census. The town is approximately 54.9 square miles in area and includes the villages of Clarks Falls, Laurel Glen, and North Stonington Village. The Town also is home to the 1,130-member Eastern Pequot Tribal Nation, a State-recognized (but not federally recognized) Tribal Nation with a 225-acre reservation adjacent to Long Pond. The Town is bordered by Voluntown and Griswold to the north, Preston to the northwest, Ledyard to the southwest, Stonington to the south, and Hopkinton, Rhode Island to the east.

Several major transportation corridors traverse the town. Major roads include Interstate 95, Route 2, Route 49, Route 184, Route 201, Route 216, Route 617, and Route 627. No railroads currently exist in the town. Major waterways include the Pawcatuck River (which forms the town's southeastern border with Rhode Island), the Shunock River, Wyassup Brook, Green Fall River, Phelps Brook, and Ashwillet Brook. North Stonington has a several large water bodies that include Lake of Isles, Spalding Pond, Wyassup Lake, Blue Billings Lake, Assekonk Pond, Long Pond, and Andersons Pond.

2.1. Physical Setting

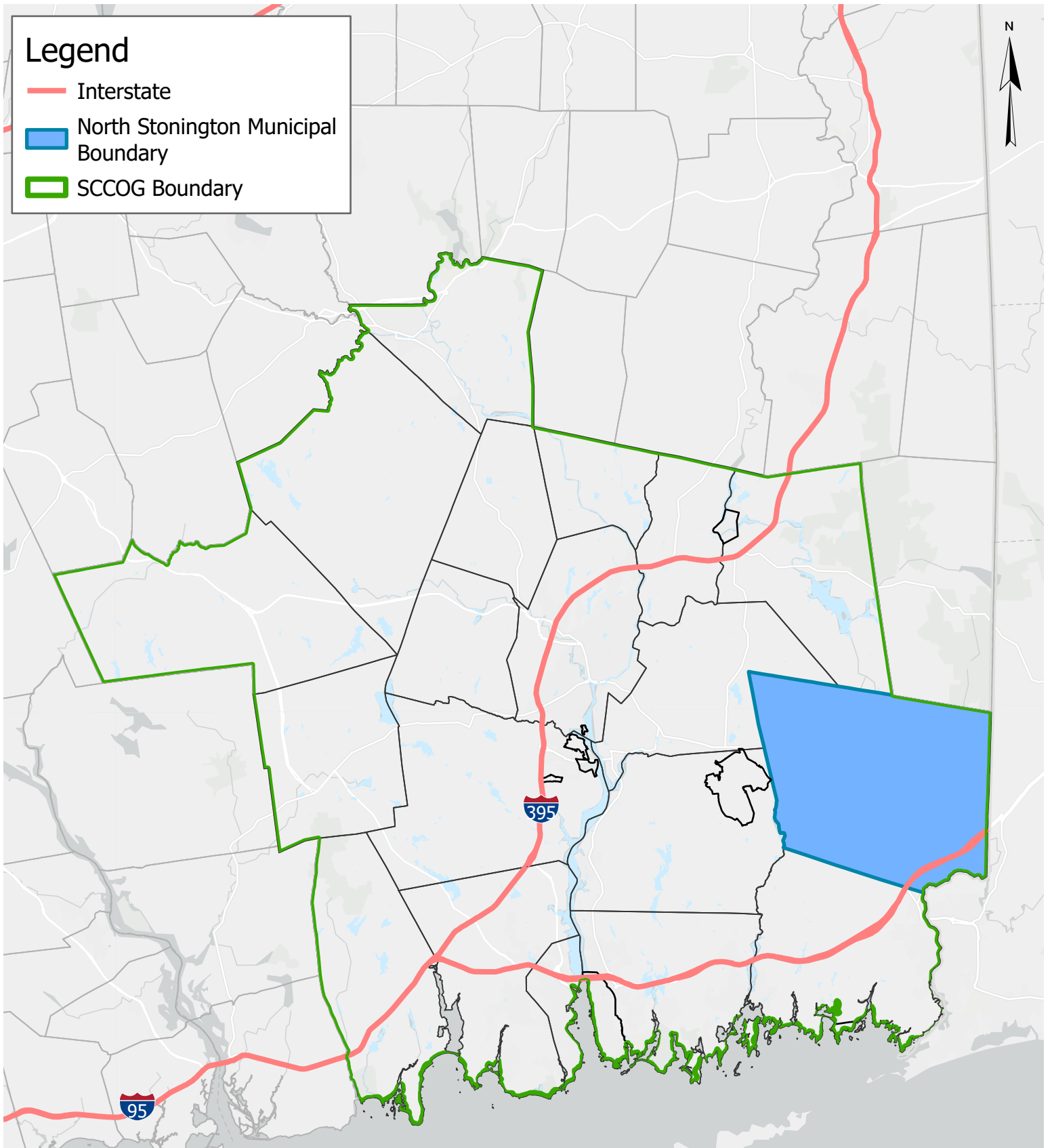
The Town of North Stonington is located in the north-central section of the SCCOG. Elevations range from less than 30 feet along the Pawcatuck River to just over 540 feet on Barns Hill in the western portion of the town. Most of the land in North Stonington is dedicated to agriculture or dairy farming, and commercial development is concentrated in North Stonington Village with additional businesses sporadically located along the State roads.

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 North Stonington.

North Stonington lies in an area of Connecticut where many fault lines intersect. Several fault lines traverse the northwestern corner town in the Barns Hill area, creating contacts between bedrock formations or denoting areas where the formations have shifted or fractured over time. Many of the faults are unclassified, but some are thrust faults believed to be Devonian, or Ordovician in origin. Such faults are associated with the Lake Char Fault (one of the oldest known fault lines on earth) or the Honey Hill Fault. The fault lines trend north to south, northwest to southeast, or southwest to north east, while the Honey Hill Fault and the Lake Char fault trend southwest to northeast.

Legend

- Interstate
- North Stonington Municipal Boundary
- SCCOG Boundary

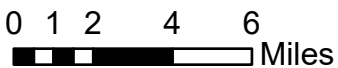


Regional Location of North Stonington

SCCOG Hazard Mitigation and Climate Adaptation Plan

Town of North Stonington

Date: 7/22/2022



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

North Stonington contains various bedrock types, which lie in fairly diagonal bands having a generally southwest-northeast orientation. The two predominant formations are Potter Hill Granite Gneiss and Hope Valley Alaskite Gneiss. Potter Hill Granite Gneiss is described as light pink to gray, tan-weathering, fine- to medium-grained, well-foliated granitic gneiss. Hope Valley Alaskite Gneiss is described as light pink to gray, medium- to coarse-grained granitic gneiss. Several other minor formations are associated with the formations near the mapped fault lines, including diorite, mylonite, and gabbro. Gneiss is a relatively hard metamorphic rock, with the remaining bedrock types consisting of relatively hard igneous intrusions.

The Town's surficial geologic formations include glacial till and stratified drift. Refer to the Multi-Jurisdictional HMP for a generalized view of surficial materials. The majority of the Town is underlain by glacial till. Till contains an unsorted mixture of clay, silt, sand, gravel, and boulders deposited by glaciers as a ground moraine. Areas adjacent to the Pawcatuck River, Shunock River, Phelps Brook, Ashwillet Brook, Miller Brook, Yawbucs Brook, Lantern Hill Brook, Anguilla Brook, Pendleton Hill Brook, Green Fall River, and Spaulding Pond have fairly extensive areas underlain by sand, sand and gravel or floodplain alluvium. In addition, several unnamed streams also have fairly significant areas of associated sand and gravel deposits. The amount of stratified drift present is important as areas of stratified materials are generally coincident with floodplains. These materials were deposited at lower elevations by glacial streams, and these valleys were later inherited by the larger of our present day streams and rivers. However, the smaller glacial till watercourses can also cause flooding. The amount of stratified drift also has bearing on the relative intensity of earthquakes and the likelihood of soil subsidence in areas of fill.

2.2. Drainage Basins and Hydrology

The majority of the land in central and eastern North Stonington eventually drains to the Pawcatuck River via the Shunock River and the Green Fall River. Major tributaries to the Shunock River include Assekong Brook, Yawbucs Brook, and Phelps Brook; major tributaries to Green Fall River include Wyassup Brook (and its tributaries Hetchel Swamp Brook and Pendleton Hill Brook) and Glade Brook. The northwestern corner of North Stonington eventually drains to the Thames River (via Main Brook and Lake of Isles Brook and their downstream watercourses in Preston and Ledyard), the Quinebaug River (via Prentice Brook and Miller Brook and their downstream watercourses in Preston), or to the Pachaug River in Griswold via Ashwillet Brook and Billings Brook. The remaining areas of town are part of the Southeast Eastern Complex regional drainage basin and drain to Long Island Sound through Lantern Hill Brook / Whitford Brook and Anguilla Brook.

In addition to the major watercourses noted above, North Stonington contains many ponds, lakes, swamps, and minor unnamed streams. In particular, Andersons Pond, Billings Lake, Wyassup Lake, and Long Pond have significant residential development located nearby, and Lake of Isles is surrounded by a large golf course.

2.3. Land Cover

According to the 2016 1-meter resolution land cover developed by the NOAA Office of Coastal Management, North Stonington is predominantly comprised of mixed forest, with approximately 70.88% of the town classified as such. The second largest land cover type is palustrine forested wetland, which covers about 7.05%, and next is developed open space which is about 4.47% of land cover. Only

about 2.91% 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 North Stonington Land Cover

Land Cover Type (2016)	% Coverage
Barren Land	0.78
Cultivated Crops	2.91
Developed, Impervious	2.91
Developed, Open Space	4.47
Grassland/Herbaceous	2.94
Mixed Forest	70.88
Open Water	1.74
Palustrine Aquatic Bed	0.25
Palustrine Emergent Wetland	0.97
Palustrine Forested Wetland	7.05
Palustrine Scrub/Shrub Wetland	0.45
Pasture Hay	3.32
Scrub/Shrub	1.29

2.4. Population, Demographics, and Development Trends

According to the 2003 *Plan of Conservation and Development*, North Stonington has been a rural community for all of its history. After World War II, the proliferation of the automobile and regional growth spurred North Stonington to become a bedroom community. With the two largest casinos in the world opening nearby and the downsizing of the military, tourism has replaced the defense industry as the major impact on the local economy as many visitors to these facilities travel along Route 2. The expansion of Pfizer in the Groton-New London area has also affected residential development in the town and provided employment opportunities.

Much of the town land area is devoted to the Pachaug State Forest in the northern part of town and the Assekongk Swamp Wildlife Management Area in the southern part of town.

In 2018 The Avalonia Land Conservancy acquired a large tract of forested land at the Griswold-Preston-North Stonington lines. This "Tri-Town Forest" will include 74 acres of land in Griswold, 302 acres in North Stonington, and 33 acres in Preston (409 acres of land overall). The Conservancy also acquired a 10.48-acre parcel in 2020 known as the Harlan J. and Anna N Coit Nature Preserve.

The downtown of North Stonington is located approximately in the North Stonington Village near the intersection of Route 2 and Route 627. North Stonington's library, schools, Post Office, Senior Center, Town Hall, Fire Department, Ambulance, and Town Garage are all located in this area. The Assekongk Swamp Wildlife Management Area is located just south of the Village, and public hiking trails are located to the north of the village along the Shunock River.

The 2003 *Plan of Conservation and Development* noted that most North Stonington residents worked in North Stonington or Groton. Local employment in North Stonington was approximately 500 jobs at that

time. These primarily included commercial, office, manufacturing, and tourism-related businesses. The town also had four working dairy farms, a vineyard, and five Bed and Breakfasts. According to the town's 2013 *Plan of Conservation and Development*, additional commercial development is to be prioritized along the Interstate 95 corridor which will generate additional jobs in North Stonington. The Town is working on an Economic Development Plan that will prioritize this area.

The vast majority of housing units in North Stonington are single family homes (more than 90%) although there are duplex residences, multi-family conversions, and seasonal communities bordering the town's six lakes. In addition, one mobile home park exists in town. A full one-third of the town's population lives in the high-density Kingswood-Meadowwood and Cedar Ridge subdivisions and in the Village area. There are several thousand acres of developable land remaining in the town after considering development constraints such as wetlands, steep slopes, rock outcrops, and floodplains. Development of this land could sharply increase the number of residents of North Stonington, and such an increase would require a noticeable increase in municipal services particularly with regard to emergency services. In total, the full build-out of the town under existing regulations could result in approximately 8,000 new homes and approximately 20,000 additional residents.

The majority of residential and other development is served by private drinking water wells. Several different water companies provide public water supply to the southern and western areas of town. Historically, the Town has pursued a "sewer-avoidance" policy and thus has no municipal sewer infrastructure or outside agreements. The lack of sewer service limits the size of potential new developments. As the Town wishes to expand commercial development in the vicinity of Interstate 95, a formal agreement with the Town of Stonington may occur in the future. Some private facilities in the southern part of town are already connected to the Stonington sewer system through private agreements.

Between 2005 and 2017, approximately 74 new housing units were constructed in North Stonington, and two major proposed developments have been abandoned: the mixed-use Milltown Commons that was to have 275 units of housing and 250,000 square feet of commercial space, and Meadow Court, which was to be an 84-unit affordable housing development next to Holly Green off Route 2.

Since 2017 there have not been any major new developments or subdivisions in town. There are currently two large solar farms projects in town: one is complete and located on the Mashantucket Pequot Tribal Nation property, and the other is still in progress. There is also a new winery that is under construction on Route 49 and is expected to be complete and open by early 2023. This winery location was already designated for agricultural use. North Stonington has also constructed a new high school at 297 Norwich Westerly Road. More details are provided in section 2.6.

Overall, new development and redevelopment in North Stonington 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 5,149, which equates to about 95 people per square mile. The 2020 American Community Survey 5-year estimates identified the annual average median income for North Stonington to be \$61,963, with an average of 40.3% of the population holding a bachelor's degree or higher, and an average unemployment rate of 3.6% throughout town.

2.5. Governmental Structure

North Stonington 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 the Town. The Public Works Department oversees the building and maintenance of all roads including plowing and sanding in the winter and cleanup following wind events. In addition to the First Selectman and the Public Works Department, the Building Department, Planning and Zoning Department, the Information Technology / Geographic Information Systems (IT/GIS) Department, and the Volunteer Fire Department also have an active role in hazard mitigation.

The Town of North Stonington has several commissions that can take an active role in hazard mitigation, including the Conservation Commission, the Inland Wetlands Commission, Planning and Zoning Commission, and the Zoning Board of Appeals. Departments and commissions common to all municipalities in SCCOG and were described in Section 2.8 of the Multi-Jurisdictional HMP. More specific information for the departments and commissions of the Town of North Stonington is noted below:

- The Building Department reviews plans for new development and significant redevelopment and inspects the work to ensure it meets current building codes. The Town of North Stonington utilizes the Connecticut Building Code.
- The Conservation Commission supervises the acquisition and management of open space in North Stonington.
- The IT/GIS Department supports all Town departments and commissions by compiling, storing, and making data accessible to the Town and the public. For example, this department electronically records the location of floodprone areas in the community. The Director of this department is also the Town's Emergency Management Director.
- The Inland Wetlands Commission is the Inland Wetlands Regulatory Agency for the Town of North Stonington and reviews plans for compliance with said regulations and maintains the Town's inland wetlands map.
- The Planning & Zoning Commission reviews land use applications, zoning regulation amendments, planning and development projects, and grant opportunities to ensure that development and growth in the town is consistent with existing land use, environmental policy, and the objectives of the *Plan of Conservation and Development*. They are assisted by the Zoning Enforcement Officer and the Town Planner in the Planning & Zoning Department.
- The Public Works Department provides services including safe, efficient and well-maintained infrastructure of roads, bridges, snow removal and deicing on roads; tree and tree limb removal in rights-of-way; and maintain and upgrade storm drainage systems to prevent flooding caused by rainfall. The Public Works Director is the Tree Warden and can post and remove trees in

rights-of-way or town land but needs permission from the Planning and Zoning Commission prior to performing tree removal along certain scenic roads.

- The North Stonington Volunteer Fire Department provides fire suppression, fire prevention, rescue, and hazardous materials response services to the town. The North Stonington Ambulance Association provides emergency medical services.
- The Zoning Board of Appeals reviews projects that were denied by the Planning & Zoning Commission or were cited by the Zoning Enforcement Officer, as well as those that require variances.

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

2.6. Review of Existing Plans and Regulations

The Town has several Plans and regulations that suggest or create policies related to hazard mitigation. These policies and regulations are outlined in the Emergency Operations Plan, *Plan of Conservation and Development*, Zoning Regulations, Subdivision Regulations, and Inland Wetland Regulations. The Zoning and Subdivision Regulations were both recently updated to incorporate new NFIP requirements.

Emergency Operations Plan

The Town 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 natural hazard events such as hurricanes and nor'easters as outlined in the Severe Weather Annex of the EOP. The EOP is directly related to providing emergency services prior to, during, and following a natural hazard event.

The most recent version of the EOP at the time of this plan was adopted on January 1, 2017.

Plan of Conservation and Development (2013)

The POCD was most recently updated in 2013 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 use types and population densities in various parts of the municipality.

The 2013 Town of North Stonington POCD includes the following actions:

- Development is restricted in wetlands and 100 year flood hazard zones.
- Town recognizes the need to adopt long term sustainability perspective with regards to damage from hurricanes, winter storms, and flooding.
- Town has plans to renovate emergency services complex, which would consolidate fire and ambulance services in one building.

Therefore, the North Stonington POCD is considered somewhat consistent with the current goals and actions of the hazard mitigation plan, although it does not directly address several of the hazards such as wind damage and winter storm hazards. The next update to the POCD (scheduled for 2023, beyond the

life of the current hazard mitigation plan) will continue to incorporate the elements of the hazard mitigation plan.

Zoning Regulations

The Zoning Regulations of the Town of North Stonington were last formally amended on July 14, 2022. The regulations include a variety of preventative regulations pertinent to mitigating natural hazards. These regulations are applied during the permitting process for new construction and during substantial improvement of existing structures.

Special Flood Hazard Area Regulations are covered in Section 307, within the general provisions. They reflect the new Flood Insurance Study released for New London County in July 2011.

The Zoning Regulations contain several other entries applicable to hazard mitigation. For example, certain types of development such as affordable housing, hotels, recreational campgrounds, utilities and communication towers, and all development within the Village Special Design District must locate utilities underground. New mobile homes are only permitted in mobile home parks unless the mobile home has been continuously occupied since 1964.

In chapter 10 of the regulations, the town also requires a water budget and management plan be submitted as part of the Environmental Management Report. This requires development to account for water requirements under normal, and drought conditions.

Subdivision Regulations

The Subdivision Regulations of the Town of North Stonington were last updated on March 8, 2016. Several of the design standards are pertinent to hazard mitigation, including encouraging the creation of through streets through cul-de-sac limitations, avoidance of steep grades for new roads, and that new facilities and utilities are designed to minimize flood damage. New developments are also required to set aside buildable land as open space.

Inland Wetland and Watercourses Regulations

The Inland Wetlands and Watercourses Regulations in the Town of North Stonington were last amended in March 2012. The regulations require a permit for certain regulated activities which take place within 100 feet of 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 and Subdivision Regulations by preventing fill and sedimentation that could lead to increased flood stages.

2.7. Critical Facilities, Sheltering Capacity, and Evacuation

The Town of North Stonington 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 the 1% annual chance floodplain. These facilities are described in more detail below.

Table 2-2 Town of North Stonington Critical Facilities

Facility	Address or Location	Emergency Power	Shelter	Cooling Center	In SFHA
Emergency Services					
Volunteer Fire Department & North Stonington Ambulance	25 Rocky Hollow Road				
Municipal Facilities					
New Town Hall*	40 Main Street	✓			
North Stonington Elementary School	311 Norwich-Westerly Road	✓	✓		
Old Town Hall	40 Main Street	✓			
Public Works Garage	11 Wyassup Road				
Parks and Recreation**	267 Norwich-Westerly Road	✓			
North Stonington High School	297 Norwich-Westerly Road	✓		✓	
Old North Stonington High School	298 Norwich-Westerly Road	✓		✓	

* Emergency Operations Center (EOC)

** Backup EOC

Emergency Services Building

The town completed the construction of a 19,000 square foot facility at 25 Rocky Hollow Road, across the street from the Volunteer Fire Company building in 2018. The 6.63 million dollar complex includes an eight-bay garage, full kitchen, residential wing, decontamination room, radio and data center, offices and a training room that doubles as the Emergency Operations Center (EOC). The building houses both the North Stonington Ambulance and the Volunteer Fire Department.

The Volunteer Fire Department provides fire suppression and rescue services out of a fire station located in the Village. The Fire Department has mutual aid agreements with all of the neighboring towns as well as Mashantucket Pequot Tribal Nation for fire and emergency response. Long Pond is also used by the fire department for equipment testing, cleaning and drills.

The North Stonington Ambulance Association provides emergency medical services to the town. This service is staffed by a core group of paid professionals who are supplemented with volunteers from the community. Patients are typically transported to Westerly Hospital in Westerly, Rhode Island.

The EOC is also located in this building.

Town Halls and Police Services

Governmental services are divided between the Old Town Hall building and the New Town Hall Building located at the same address. Both buildings house records, plans, and other documents important for administering the Town. The New Town Hall contains the emergency operations center and has a generator. The Old Town Hall houses the phone system and has a generator that can provide limited power to the building. In the past, a cord has been run between the two buildings to provide additional

electricity. The Town participates in the Resident State Trooper program for police protection and the Resident State Trooper has an office in the Old Town Hall. The Resident State Troopers operate out of Troop E in Montville.

The roof of the Town Hall was repaired in the fall of 2016, fixing an indoor leakage and flooding problem.

Public Works Garage

The Town Public Works garage is located north of the Village. It is used for vehicle and equipment storage and the facility also houses the Town's salt and sand supply.

Shelters

North Stonington Elementary School is the Town's shelter. The school has a generator, and the shelter is American Red Cross certified. The Town signed an updated multi-town sheltering agreement in 2016. If additional shelter space is needed, the Town is able to send residents to adjacent town shelters, including Stonington High School. In addition to Town departments, the American Red Cross and the Salvation Army provide services related to mitigation and emergency management. The American Red Cross and the Salvation Army help provide shelter and vital services during disasters and participate in public education activities.

The new high school can act as a cooling center in the event of an extreme heat wave. If necessary, the old high school could also be used for cooling as both of these facilities have air conditioning capabilities.

Communications

The Town's communication capability is considered adequate for most circumstances. Emergency communications are good except during long power outages. The Town relies on radios, cellular phones and email for much of its communications. Over the last five years the Town has brought its internal emergency communication capabilities up to date; for example, new radios with improved frequency ranges have been purchased.

The Town is also part of the CT Alerts "Everbridge" Reverse 9-1-1 system for emergency notification of residents. This system operates through the Town of Groton dispatch. Typically, Town personnel are alerted to upcoming hazardous conditions by FEMA or the State. These alerts are forwarded to the Town's IT department and the First Selectman, who post notifications on bulletin boards and on the Town website and also utilize local media (newspapers, television, and radio) to pass information during and after storms. Residents can also contact the First Selectman directly with comments related to natural hazards or emergency response.

Communication was difficult during the power outages following Tropical Storm Irene, Hurricane Sandy, and many of the winter and Winter Storm Alfred due to downed trees and power outages at the nearby cellular towers. Town personnel made personal contact with residents by going door-to-door during the outage to pass along necessary information. The Town also has a Natural Disaster Preparedness pamphlet on its website.

Evacuation Routes

North Stonington does not have a published evacuation map; residents utilize State roads or local roads to exit the town. The highest capacity egress routes from North Stonington include Interstate 95 into Stonington or Rhode Island, Route 2 into Stonington or Ledyard, Route 49 into Stonington or Voluntown, Route 184 into Stonington, Route 201 into Stonington or Griswold, and Route 216 into Rhode Island.

Schools

North Stonington considers its schools to be critical facilities. The elementary, middle, and high schools are all located on the same campus off of route 2. Some areas of the property are adjacent to wetlands and some sports fields fall within the Assekong Brook floodplain.

The elementary school has recently undergone improvements, is the Town's primary emergency shelter, and is equipped with an emergency generator. The School Modification Project that kicked off in 2017 will upgrade school buildings and will include installation of emergency generators in the Middle School and High School.

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 North Stonington has two RL properties, both of which are residential, with a total of \$36,691.99 in payments towards claims.

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 North Stonington Exposure Analysis

Hazard	At-Risk Parcels		At-Risk Facilities		At-Risk Historic Assets	
	Value	Number	Value	Number	Value	Number
Hurricane/Tropical Storm	\$530,653,190	3,082	\$25,560,780	6	\$11,169,690	55
Severe Thunderstorm	\$530,653,190	3,082	\$25,560,780	6	\$11,169,690	55
Severe Winter Storm	\$530,653,190	3,082	\$25,560,780	6	\$11,169,690	55
Tornado	\$530,653,190	3,082	\$25,560,780	6	\$11,169,690	55
Drought	\$463,461,535	2,513	\$21,467,810	4	\$8,904,490	45
Flood						
1% Annual Chance	\$120,189,140	608	\$12,392,940	2	\$5,045,670	25

0.2% Annual Chance	\$150,805,755	822	\$12,392,940	2	\$5,728,170	29
Earthquakes	\$530,653,190	3,082	\$25,560,780	6	\$11,169,690	55
Wildfire	\$350,660,820	1,723	\$21,467,810	4	\$8,904,490	45

2.10. Community Climate Change Challenges

As is with all of the SCCOG communities, the Town of North Stonington 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 North Stonington

What are the Town's Top Climate Change Concerns?

Flooding: The Town is concerned with flood and flood-related risks downstream of Long Pond Dam along Whitford Brook and Lantern Hill Road. The road crosses the stream and is located in various flood zones. It provides important access among several communities such as Ledyard, North Stonington, and Stonington.

Extreme Heat: The Town is challenged by a lack of overnight cooling center access in the town. Overnight accommodations may be needed for some vulnerable residents.

Others: The Town is highly concerned about private well vulnerabilities and water availability for agricultural operations during droughts.

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

Flooding: Work with DEEP to ensure that owners of high hazard dams have EAPs and keep copies locally for review during high-precipitation events. Participate in a dam failure tabletop exercise for Long Pond with Ledyard, Groton, and Stonington.

Extreme Heat: Establish an overnight shelter capable of providing cooling during extreme heat events. Ensure that standby power is installed and that transportation is available to bring elderly and those without vehicles to the facility.

Others: Extend public water systems to adjacent areas served by private wells to reduce drought risks to private properties and critical facilities. Secure funding for construction of a water tower for firefighting response or water during droughts.

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 equate to an increase in risk throughout the town, 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 or tornado 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 impacted the town in August 2011. Sections of trees fell throughout the area causing power outages lasting up to seven to nine days in the region.

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. Widespread significant statewide power outages of 667,598 customers lasted up to 8 days. The town of North Stonington

¹ <https://nca2018.globalchange.gov/chapter/2/>

received nearly \$50,000 in disaster relief aid from FEMA to cover the cost of damages from the storm. Town personnel report that residents had to discard food because there was no electricity for refrigeration.

On August 2, 2020, Tropical Storm Isaias swept through the State bringing severe winds which resulted in the highest number of outage events Connecticut has ever experienced. With over 620,000 outages reported by Eversource alone, the state's largest electric supplier, residents across the SCCOG region were without power, cable, and internet for extended periods of time. While this storm did not generate typical amounts of rainfall experienced during a tropical storm event, the wind damage exceeded expectations bringing down trees and power lines across the state. The Westerly Sun reported that North Stonington experienced severe damage from excessive winds. There were detours and closures along several roads including Wyassup Road, Tom Wheeler Road, Ryder Road, Wintechog Hill Road, Wrights Road, Northwest Corner road, Route 184 at Boombridge Road, and Route 2 at Mains Crossing. Firefighters reported 21 calls, primarily for downed trees and wires, before 7 pm that evening after winds picked up around 3:30 pm.

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 North Stonington ranges from 120 to 140 miles per hour, and the ultimate design wind speed is 127 miles per hour. Wind speeds use 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. North Stonington has adopted the Connecticut Building Code as its building code. The North Stonington Building Official enforces that code, and the Town feels this has been sufficient for protecting its buildings.

The North Stonington building inspector ensures that information on wind-resistant construction techniques is 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. The Public Works Director is also the Town's tree warden who can post notification and schedule tree removal. Trees located along scenic roads require approval from the Planning and Zoning Commission prior to trimming and removal. The Public Works staff also monitors trees as part of their normal rounds, performs informal inspections for the tree warden, and has a budget for minor tree maintenance which they are able to perform with their own equipment. The Town hires outside contractors for larger jobs and those near power lines. The Town reports that major trimming projects have been performed in the last five years.

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. 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. Communication and coordination have improved due to Eversource's liaison program.

The Town has designated two locations to be used for brush disposal operations to deal with debris following wind storms. These are the Town transfer station and the Grange Grounds / Fairgrounds. The Town also participates in the Southeastern Connecticut Regional Resource Recovery Authority agreement, allowing it to utilize regional debris disposal and reuse capabilities.

Certain types of new development such as affordable housing and communication towers are required to place utilities underground in order to mitigate storm-related damages. Placing utilities underground is also encouraged for other new developments. Utility lines are located underground in only a few areas of the town.

Warning is one of the best ways to prevent damage from hurricanes and tropical storms, as these storms often are tracked well in advance of reaching Connecticut. The Town can access National Weather Service forecasts via the internet as well as listen to local media outlets (television, radio) to receive information about the relative strength of the approaching storm. This information allows the Town to activate its EOP and encourage residents to take protective or evacuation measures if appropriate.

Prior to severe storm events, the Town ensures that warning/notification systems and communication equipment are working properly and prepares for the possible evacuation of impacted areas. Residents can sign up to receive warnings from the statewide CT "Everbridge" Reverse 9-1-1 system to receive critical information. Although hurricanes that have impacted North Stonington have historically passed in a day's time, additional regional shelters could be outfitted following a storm with the assistance of the American Red Cross on an as-needed basis for long-term evacuees.

Summary

In general, municipal capabilities to mitigate hurricane damage have increased since the 2017 edition of the hazard mitigation plan was adopted. This is likely because the Town has constructed a new emergency services building which has several increased capabilities for emergency response.

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) as well as inland flooding (Section 0) accompanying the storm. Of particular concern are the blockage of roads and the damage to the electrical power supply from falling trees and tree limbs. The Town has had extensive outages of up to ten days in some areas because of tree damage to utility lines following Tropical Storm Irene in August 2011 and Hurricane Sandy in October 2012. According to Town personnel, North Stonington is at the end of the power distribution system, and therefore power is restored there after many other areas have already become operational again. Residents have complained in the past about the false perception that power restoration work is performed in more populated areas first because that is where the money is. Town personnel understand that the center of the system must be fixed before the edges.

While the Town is not opposed to burying existing overhead utilities, this would be expensive and require extensive coordination with Connecticut Light & Power who own the lines. The placement of utilities underground for all new development is a more viable recommendation for North Stonington, as is continuing tree-trimming and removal on Town land and along rights-of-way.

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

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 HMP. A separate analysis was not performed specifically for North Stonington.

3.2.3.1 Hazard Losses

The Town of North Stonington did not receive FEMA PA funds in the wake of Tropical Storm Isaias. Since 2012, the town has received \$48,988 in FEMA PA reimbursements for project costs of \$65,317. This was all received for Hurricane Sandy. All of these funds were received for debris removal.

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 North Stonington. 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

North Stonington	Return Period	Residential	Commercial	Industrial	Others	Total
	10-year	\$46,010	\$0	\$0	\$0	\$46,010
	20-year	\$871,670	\$16,660	\$5,950	\$9,940	\$904,220
	50-year	\$4,156,780	\$174,840	\$93,210	\$111,100	\$4,535,930
	100-year	\$8,347,640	\$568,370	\$343,270	\$475,590	\$9,734,870
	200-year	\$15,536,230	\$1,285,740	\$864,430	\$1,276,350	\$18,962,750
	500-year	\$30,263,380	\$2,657,610	\$1,967,190	\$2,558,940	\$37,447,120
	1,000-year	\$46,094,550	\$3,982,100	\$3,023,630	\$3,607,110	\$56,707,390

Table 3-2 HAZUS-MH Hurricane Related Building Damage

North Stonington	Return Period	Minor	Moderate	Severe	Destruction	Total
	10-year	1	0	0	0	1
	20-year	8	0	0	0	8
	50-year	106	7	0	0	113
	100-year	253	28	1	0	282
	200-year	418	71	5	2	496
	500-year	602	151	17	9	779
	1,000-year	695	217	34	18	964

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

North Stonington	Return Period	Debris Generated (Tons)	Households Displaced	Individuals Seeking Temporary Shelter
	10-year	14	0	0
	20-year	112	0	0
	50-year	1,362	0	0
	100-year	2,121	0	0
	200-year	3,766	0	0
	500-year	4,166	1	0

	1,000-year	9,333	11	2
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3.3. Tornadoes and High Wind Events

3.3.1 Setting and Recent Occurrences

Similar to hurricanes and winter storms, wind damage associated with severe thunder or summer storms and tornadoes has the potential to affect any area of the town. 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. For example, the NCDRC reported that an isolated severe thunderstorm on June 24, 2008, blew down numerous trees in North Stonington, and a thunderstorm on May 26, 2010 produced quarter-sized hail in the town. No tornadoes have occurred in the town since the last HMP.

- The southeast corner of North Stonington on the south side of Clarks Falls Road is reportedly an area that experiences repetitive wind damage. The farmers in this area describe localized wind events that fit the description of microbursts (as described in the Multi-Jurisdictional HMCAP). The flat, open topography in this area is believed by the Town to be a possible cause of such localized weather conditions. The last microburst occurred in December 2011 and blew the roof off of a barn and damaged several "lean-to" structures.

On June 25, 2016, a passing cold front triggered a thunderstorm causing a lightning strike in New London County. Ten people were taken to the hospital after lightning struck the restroom they were in, between holes 4 and 13, at Lake of Isles Golf Course in North Stonington.

Other recent severe storm events include:

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

Aside from warnings, several other methods of mitigation for wind damage are employed by the Town 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

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 villages in town, and at campgrounds which have trailers and tents that are more vulnerable to summer storm damage than other structures. As noted in the historic record, the southeast corner of the town south of East Clarks Falls Road is an area that has experienced repetitive wind damage. The use of building designs and materials that meet the American Society of Civil Engineers suggested wind speed of 160 miles per hour may be useful in this area to prevent damage to structures.

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 the Town's strong fire response.

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 and mobile homes are most susceptible to lightning and hail damage since many were constructed prior to current building codes.

Although tornadoes pose a threat to all areas of Connecticut, their occurrence is least frequent in New London County as compared with the rest of the State. Thus, while the possibility of a tornado striking the 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 have been two NOAA reported events associated with a severe thunderstorm and wind event. The first event, on July 13, 2017, was a report of lightning that cause one injury. A man was struck by lightning at the North Stonington Fairgrounds. A severe thunderstorm wind event was

reported on November 13, 2021, having caused multiple trees down in town, with large sticks and branches blown a reported 150 away from trees. There was a reported \$2,000 in damages associated with this wind event. 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.

Winter storms and nor'easters have affected the town since the last HMP, as reported to the NCDRC and reported by Town officials. For example, a cattle barn collapsed during the 2009-2010 winter season due to a storm.

- The winter of 2010-2011 produced significant snowfall in North Stonington. The Town checked all town buildings and cleared several feet of snow. Many residents also cleared their own roofs or hired contractors, and no roof collapses are known to have occurred in the community.
- Winter Storm Alfred in late October 2011 caused minor to moderate tree damage, with power outages lasting a few days.
- 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 county escaped the 3 foot + totals of some areas in the mid-Atlantic, the vast quantity of snow was still a major disruption to the town. Colchester received nearly \$90,000 in federal aid from FEMA to cover storm cleanup costs.
- Town staff report the winter of 2015 saw a great deal of snow in Town.

The year 2013 featured exceptional snow events that severely taxed snow removal abilities of towns in the region. The blizzard of 2013 in early February dumped one to two feet of snow on the region. Another snowstorm struck the region in mid-March, 2013 dumping upwards of one to two feet of snow in some parts of the county. The public assistance reimbursement for the February 2013 storm was \$29,919.39.

Some of the more recent significant winter events 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 down 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.

3.4.2 Existing Capabilities

Existing programs applicable to winter storm winds are the same as those discussed in Sections 5.2 and 6.2. Programs that are specific to winter storms are generally those related to preparing plows and sand and salt trucks; tree trimming and maintenance to protect power lines, roads, and structures; and other associated snow removal and response preparations. Information for protecting Town residents during cold weather, and for mitigating icing and insulating pipes at residences, is posted on the Town website.

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 and stores salt and sand at the Public Works Garage. They have seven plow trucks and two bucket loaders used for this purpose. The Town has established plowing routes that prioritize access to and from critical facilities. Furthermore, the Town has a mutual aid agreement with one plowing business and can also contract with two other businesses to provide snow management services if necessary. The Connecticut Department of Transportation (DOT) plows State roads. Town staff report their road clearing program is effective, and they have both the equipment and manpower they need. They also report that clearing of State roads is not consistently completed in a timely manner. The Department of Public Works will dispatch a plow along with emergency vehicles when calls come in from difficult-to-access areas such as private roads or long driveways located in wooded areas.

Despite the effectiveness of the Town snow removal program, the snow removal budget has consistently been reduced over the course of the last five years.

The Connecticut Building Code specifies that a pressure of 30 pounds per square foot be used as the base "ground snow load" for computing snow loading for roofs. The Town monitors the roofs of municipal buildings when snow loads accumulate and shovel if necessary, and many residents and businesses also shovel or plow their roofs. Town staff have identified vulnerable roofs for which monitoring and clearing are a priority. A written plan prioritizing the removal of snow from Town-owned structures is used to guide clearing efforts. The school roofs are successfully monitored and maintained through the school administration.

Summary

In general, municipal capabilities to mitigate snowstorm damage have not increased significantly since the 2012 edition of the hazard mitigation plan was adopted. This is because the Town has found its snow clearing and response capabilities to be sufficient. Capabilities with regards to roof monitoring and clearing have increased as the Town continues to experience heavy snow each winter.

3.4.3 Vulnerabilities and Risk Assessment

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

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

The majority of buildings in North Stonington were constructed within the past several decades and therefore not particularly susceptible to damage from heavy snow. While some Town buildings could be susceptible to heavy snow loads, they will be cleared quickly if safety is a concern. For example, the schools and the fire station have flat roofs which make them more susceptible to snow load damage.

Icing is not a significant issue in the Town. In general, there are few steep slopes such that extra sanding and salting of the roadways in necessary locations alleviates any trouble spots. In addition, there are no issues with ice jams on any of the streams in the town. Town officials note that some areas of town, specifically those located off of backroads, on private roads or very long driveways, are sometimes difficult for fire and ambulances to access in the winter. As noted above, the DPW will dispatch a plow with emergency vehicles in such cases.

3.4.3.1 Hazard Losses

There have been no reported winter storm losses for the Town of North Stonington since 2017. In the past decade, the town has received FEMA PA funds in the amount of \$46,065 for winter storms. Downscaled losses based on the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document.

4. Sea Level Rise

4.1. Climate Change Impacts

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

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

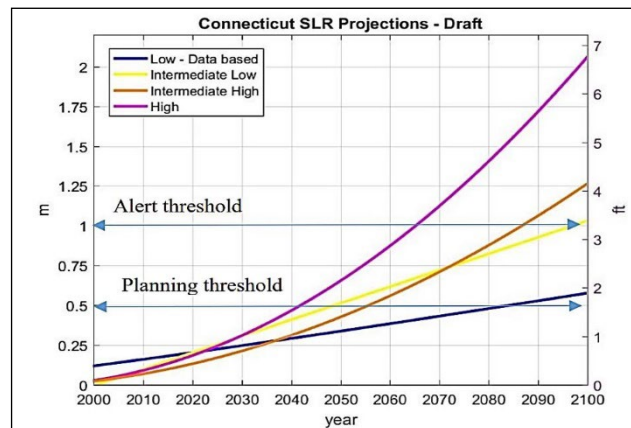


Figure 4-1 Four Localized Sea Level Rise Scenarios for

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

The Town of North Stonington is not located along the coastline or along any tidally influenced river. It is also not located in a potential hurricane surge zone. No coastal flooding or storm surge has affected the town since the last HMP. Therefore, the town is considered to be immune to the direct effects of coastal flooding and storm surge.

4.2.2 Existing Capabilities

The Town does not have any regulations in effect to restrict development due to coastal flooding hazards.

The Town understands that in an extreme case its shelter spaces may need to be utilized by non-North Stonington residents if a regional evacuation occurred due to a coastal flooding event as managed through its mutual aid agreements with SCCOG. The Town is prepared for this potential circumstance.

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 North Stonington related to coastal flooding.

4.3. Shoreline Change

4.3.1 Setting and Recent Occurrences

North Stonington 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 North Stonington related to shoreline change.

5. Changing Precipitation

5.1. Climate Change Impacts

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

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

These changes in precipitation can have various types of impacts. With an increase in intense precipitation, flooding events may become more frequent, 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 a concern, nuisance flooding and poor drainage have also created flooding 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.

The NCDC has recorded incidences of recent flooding in North Stonington. For example, on September 6, 2008, the remnants of Tropical Storm Hanna produced heavy rainfall that caused Route 2 in North Stonington to be closed due to flooding.

The March 2010 storm was a nor'easter that produced an extended period of heavy rainfall across southeastern Connecticut. The floodwaters rose so quickly that a car became trapped and needed to be pulled from the Shunock River. Floodwater caused extensive damage to the bridge over Shunock River on Main Street between Wyassup Road and Avery Lane and to a historic 150-year old building that housed the Watermark Café and the Village Hardware Store. Lantern Hill Road (at Lantern Hill Brook), Grindstone Hill Road (two locations), Loin Road, and Pinewoods Road were completely washed out and in need of major repairs. Many other roads throughout the Town were also closed, and basement flooding occurred in many areas. This storm caused an estimated four million dollars in damage between Stonington and North Stonington. This storm continues to be the most significant flood event in recent years.

The region has also 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.

After a period of severe flashy drought of summer 2022, a severe rainstorm event on September 5, 2022, caused flooding throughout 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.

The main flooding issue in North Stonington is flooding of basements.

5.2.2 Existing Capabilities

The Town attempts to mitigate inland flood damage and flood hazards by utilizing a wide range of measures including restricting activities in floodprone areas, replacing bridges and culverts, promoting flood insurance, acquiring floodprone structures, maintaining drainage systems, through education and outreach, and by utilizing warning systems. Many mitigation measures are common to all hazards and therefore were listed in Section 2.6 and Section 2.7.

As North Stonington is situated in the headwaters of several sub-regional watersheds, no major flood control structural projects exist within or upstream of North Stonington. The existing dams on the streams are former mill dams not designed to regulate flow. However, storm runoff intensity on many streams is greatly moderated by large areas of swamp, numerous ponds, and low gradients.

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. Town-owned land is inspected even more regularly. The Town strives to be proactive about drainage improvements, but due to staff and budget limitations is often forced to respond to issues reactively, solving problems as they arise.

When flooding occurs, the Public Works department or the Fire Department handles the complaints depending on the location. For example, Public Works inspects bridges and culverts and erects barricades to close roads, while the Fire Department responds to calls requesting help for flooded basements. The Town also fields phone calls related to drainage complaints. Drainage complaints are directed to the First Selectman.

The Department of Public Works continues to perform culvert and drainage system replacements and upgrades based on the damage caused by the March 2010 floods. For example, since the previous HMP was adopted, the headwall in Sleepy Hollow has been improved, correcting an issue noted after the 2010 flood.

Other bridge, culvert, and drainage improvement projects performed since 2017 include:

- The town works with state-licensed trappers to address beaver related drainage problems on Pinecrest Road in the Kingswood-Meadow Wood Subdivision.
- A new bridge was constructed near Spaulding Pond.
- A new bridge was constructed on route 49.
- The culver at Glade Brook on Pine Woods Road was replaced.
- Some work has been done in the Pendleton Hill Road area.
- A bridge or culvert was replaced on Babcock Road

Regulations, Codes, and Ordinances

The Town of North Stonington has planning and zoning tools in place that incorporate floodplain management. The Town utilizes the 1% annual chance floodplain as defined by FEMA to regulate floodplain and floodway activities. SFHA Requirements in the Town's Zoning Regulations refer to the FIS and FIRM published by FEMA on April 3, 2020, and any subsequent revisions. According to the Zoning Regulations, no permanent structures are allowed to be built within a floodway. The Town requires new construction or substantial renovations to be located at an elevation at least one foot greater than the base flood elevation. Substantial improvement is defined cumulatively over a five year period. The Planning and Zoning Commission can also require additional controls as part of its approval process. For example, the Commission required more frequent catch basin cleanings at the new truck stop to prevent flooding. FEMA is currently working on updating flood mapping in certain parts of the region, including in North Stonington. It is expected that new FEMA Flood Insurance Rate Maps (FIRMs) will be available in August 2023 and will be effective October 2025. These updates should then be incorporated into zoning regulations.

The Town's Subdivision Regulations require that adequate drainage be provided to reduce exposure to flood hazards and that buildings and utilities be located to minimize the effects of flood damage. Regulations covering development in or within 100 feet of inland wetland or watercourse areas were last updated in 2012 and are enforced by the Town's Inland Wetlands and Watercourses Commission. The Town has also adopted a map prepared by the Inland Wetlands Commission which regulates activities in wetland areas.

Acquisitions, Elevations, and Property Protection

The Avalonia Land Conservancy is very active in this region, and continually acquires land as opportunities arise. For example, in 2009 the Conservancy purchased the Parke Memorial Preserve as part of the Donald R. Henne Memorial Preserve. This is a 3.3-acre site that includes a historic mill and a pond with a dam off of Babcock Road. The North Stonington Historic Society has installed educational signage at the site, and there has been consideration of installing a fish ladder. There are no plans to remove the dam.

Avalonia also recently acquired a 10.48 acre parcel at 65 Denison Hill Road in 2020. This parcel, known as the Harlan J. and Anna N. Coit Nature Reserve, abuts the Green Fall River.

The Town of North Stonington has not performed acquisitions, relocations, or elevations of floodprone property. Property protection has focused instead on preventive measures and maintaining and

upgrading drainage systems. The Town is not opposed to performing such projects if property owners were willing and grant funding was available.

Flood Watches and Warnings

The First Selectman and the Fire Department access weather reports through the National Weather Service and local media. Residents can also sign up for the Statewide "Everbridge" Reverse 9-1-1 to receive warnings when storms are imminent. The Town can telephone warnings into potentially affected areas using this system. The Town has a list of areas that they monitor for flooding during heavy rainfall.

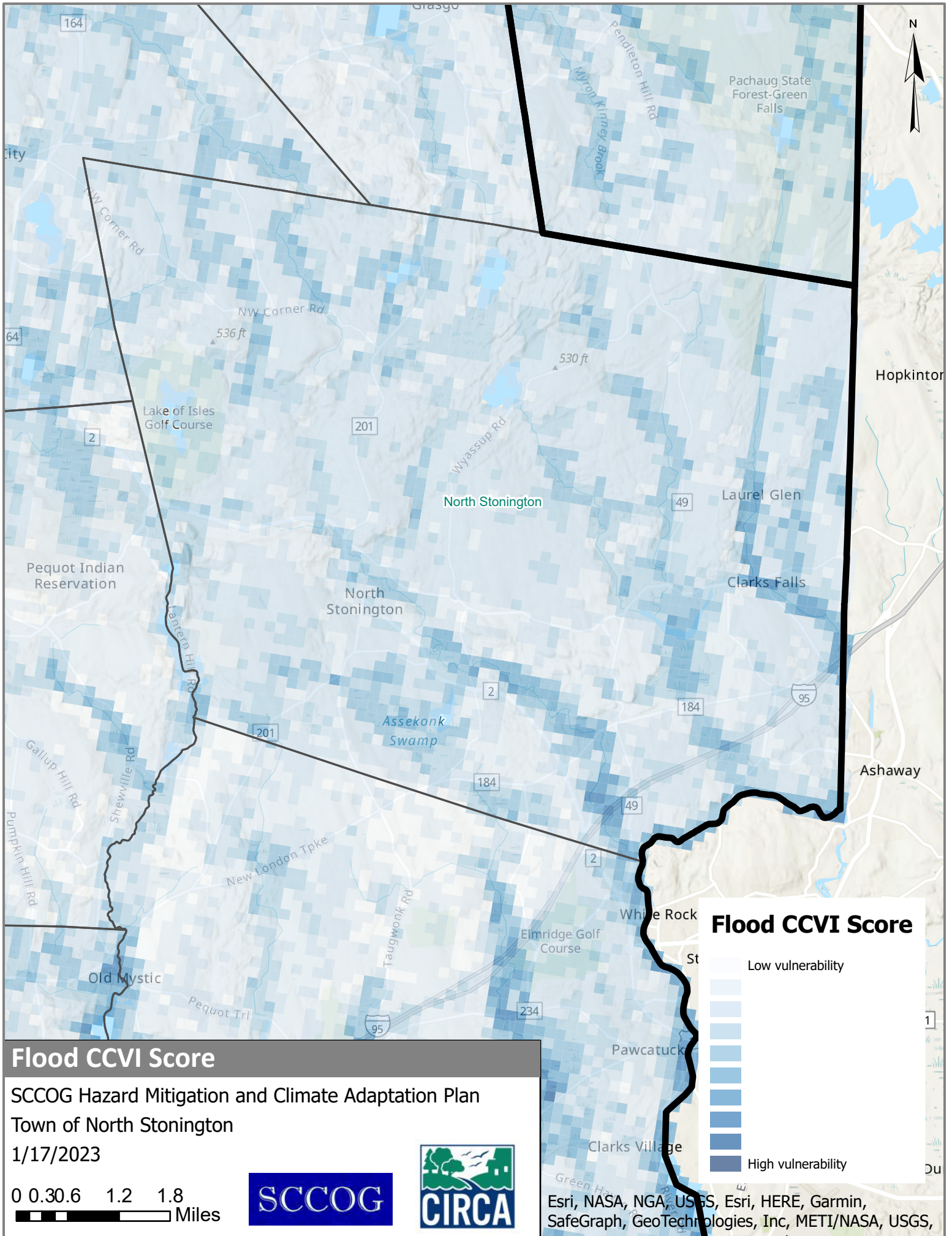
Summary

In general, municipal capabilities to mitigate flood damage have increased since the 2017 edition of the hazard mitigation plan was adopted. This is because the Town has continued to make investments in public works projects, planning, regulatory updates, and open space acquisition.

5.2.3 Vulnerabilities and Risk Assessment

This section discusses specific areas at risk of inland flooding within the Town. Overbank flooding is the most common type of flooding experienced in the town, with additional areas affected during more severe events. Nuisance flooding and poor drainage flooding also occur to a lesser extent.

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



Flood CCVI Score

SCCOG Hazard Mitigation and Climate Adaptation Plan
 Town of North Stonington
 1/17/2023

0 0.30.6 1.2 1.8 Miles



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

Flood CCVI Score



Vulnerability Analysis of Areas along Watercourses

Major inland watercourses and water bodies in North Stonington have the 1% annual chance floodplain defined by FEMA. The Pawcatuck River, the Shunock River, the Green Fall River, and Whitford Brook each have sections mapped as Zone AE indicating that flood elevations are available. The remaining streams are mapped as Zone A and include Ashwillet Brook, Assekonn Brook, Glade Brook, the upper reaches of the Green Fall River, Hetchel Swamp Brook, Lake of Isles Brook, Lantern Hill Brook, Miller Brook, Pendleton Hill Brook, Phelps Brook, Prentice Brook, the upper reaches of the Shunock River, Wyassup Brook, and Yawbucs Brook as well as several other unnamed streams, several ponds, and swamp areas. Refer to Figure 5-2 for the location of the 1% annual chance floodplains within North Stonington.

Based on the information in the previous HMP, the revised FEMA FIS for New London County, and data provided by Town officials, the following areas along watercourses are vulnerable to flooding damage as shown in Table 5-1. Ice jams have not previously been an issue along the rivers in North Stonington. Instead, this flooding occurs due to insufficient culvert sizes at crossings or due to overbank flooding.

Table 5-1 Floodprone Roadways in North Stonington

Flooding Source	Roadway	Flooded During March 2020
Ashwillet Brook	Cossaduck Hill Road (Route 201)	✓
Assekonn Brook	Jeremy Hill Road	
	Mystic Road (Route 201)	
	Norwich-Westerly Road (Route 2)	✓
Glade Brook	East Clarks Falls Road	✓
	Pine Woods Road	✓
Green Fall River	Putker Road	
Lantern Hill Brook	Milltown Road	✓
	Wintechog Hill Road	
	Lantern Hill Road	✓
Pendleton Hill Brook	Clarks Falls Road	
	Grindstone Hill Road	✓
	Pendleton Hill Road (Route 49)	✓
Prentice Brook	Northwest Corner Road	
Shunock River	Main Street	✓
	Norwich-Westerly Road near Ryder Road (Route 2)	✓
Unnamed Pond	Rocky Hollow Road	✓
Unnamed Streams	Babcock Road	✓
	East Clarks Falls Road	✓
	Loin Road	✓
	Miller Road	
	Reutemann Road at Wyassup Road	✓

	Reutemann Road west of Bergius Lane	✓
Whitford Brook	Hyde Mill Pentway	
	Lantern Hill Road	
Wyassup Brook	Grindstone Hill Road	✓
	Pendleton Hill Road (Route 49)	✓
	Wyassup Road	✓
Yawbucs Brook	Norwich-Westerly Road (Route 2)	
	Yawbux Valley Road	

Several of the areas listed in Table 5-1 are or have undergone culvert or bridge upgrades as noted in Section 5.2.2. The Pendleton Hill Road and Rocky Hollow Road crossing are particular areas of concern as these locations flood every year. While culvert replacements along Pendleton Hollow Road would mitigate the flooding issue, this is a State Road such upgrades will need to be performed by the Connecticut Department of Transportation. The Rocky Hollow Road flooding issue is caused by a pond with no apparent outlet. Diverting excess water to nearby fields or the Assekonk Swamp may be an option, although this may need to be coordinated with the property owners or Connecticut DEEP as the swamp is in a Wildlife Management Area.

Vulnerability Analysis of Private Properties

The majority of the structures in the FEMA SFHA are residential, but some commercial structures are also located in the floodplain.

The Town of North Stonington has several "watch areas" that they monitor for flooding during heavy rainfall. These watch areas include the areas in Table 5-1 as well as homes that are susceptible to basement flooding. Many such homes are located in the Kingswood-Meadowwood development as much of this area was constructed on fill materials adjacent to Assekonk Swamp. Meadow Wood Drive, Pine Crest Road, Old Colony Road, and Kingswood Drive are most affected by this type of flooding. As of 2022, two repetitive loss properties were listed. Historically, two repetitive loss properties are located in this development that were damaged by basement flooding from heavy rainstorms occurring on March 31, 2010, July 1, 2009 (both properties); and March 2, 2007. Floodproofing measures may help to reduce the incidence of basement flooding to these structures.

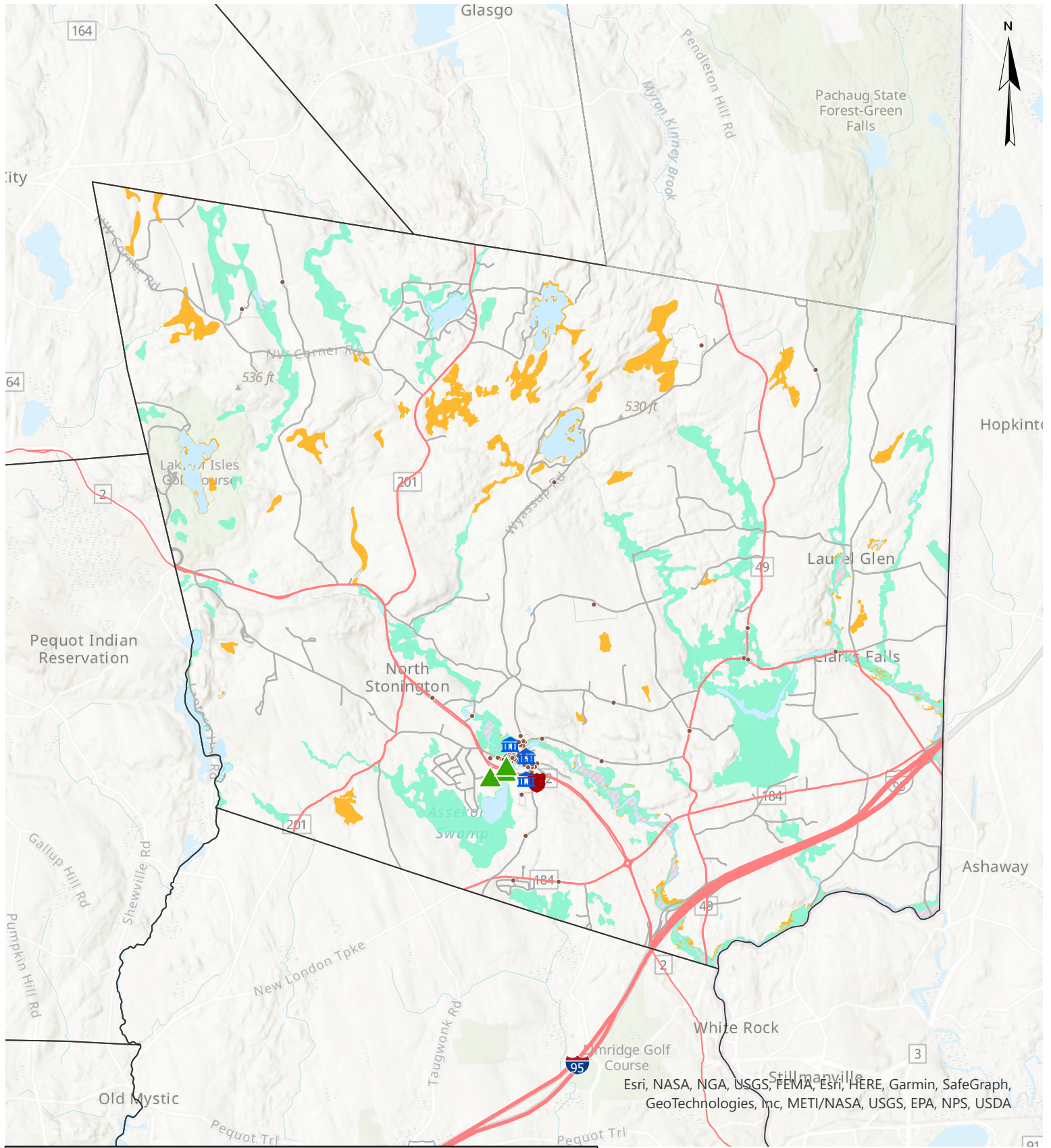
Structures most frequently affected by overbank flooding are located along Grindstone Hill Road near Wyassup Brook (note that homes are not within the 1% annual chance floodplain in this area), Yawbux Valley Road near Yawbucs Brook, East Clarks Falls Road near Glade Brook, and along the Shunock River in North Stonington Village. In particular, a historic commercial building was severely damaged by flooding during the March 2010 storm as noted in the historic record and subsequently torn down. The Town wishes to replace the culverts at Grindstone Hill Road to increase the conveyance capacity and therefore reduce future flooding damage to the road and nearby homes. The bridge replacement being performed on Main Street will increasing the conveyance capacity of the structure and helps reduce the frequency of flooding damages in the Village center.

Culvert upgrades should be prioritized in areas where backwater flooding occurs. Acquisition, elevation, relocation, or the installation of low floodwalls should also be considered to reduce flooding to private property along these and other streams. The Town should track damages to structures affected by flooding through outreach or building permits in order to develop a record of damage that be used to apply for grant funding for such projects. Providing information about potential grant funding to property owners should be part of the outreach process.

Note that repetitive flood insurance claims have not been filed at any properties located along watercourses over the past twenty-five years, suggesting that the flood damage to structures may be relatively minor. However, as noted in the Multi-Jurisdictional HMCAP, the incidence of severe flooding appears to be increasing such floodprone areas are expected to experience damage more often in the future. Additionally, it is recognized that property owners may not be reporting flooding damage and repairing damage themselves. Additional outreach regarding the availability of subsidized flood insurance will help to dispel the misconception that reporting flood claims will lead to an increase in insurance rates.

Vulnerability Analysis of Critical Facilities

As noted in Section 2.7, no critical facilities in North Stonington are located within the 1% annual chance floodplain. However, given the relatively limited development in North Stonington the closure of roadways and major transportation routes due to flooding is a concern for emergency personnel as such closures could impact emergency response.

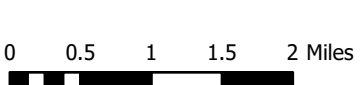


Critical Facilities and Historic Resources with Flood Zones

SCCOG Hazard Mitigation and Climate Adaptation Plan

Town of North Stonington

Date: 8/1/2022



Legend

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

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

5.2.3.1 Hazard Losses

According to NFIP statistics, as of June 30, 2022, the Town of North Stonington has had a total of 15 flood related losses, with a total of \$173,689 paid towards the claims.

Since 2017 there has also been one NOAA reported flash flood events, which occurred on August 17, 2019. There were no reported damage figures, however street flooding was reportedly as high as car tires in a North Stonington neighborhood.

FEMA HAZUS-MH 6.0 was used to develop losses associated with the 100-year riverine flood event. Table 5-2 presents flood related damages for the Town of North Stonington. Additional HAZUS-generated losses for the town and region can be found in the Multi-Jurisdictional document.

Table 5-2 HAZUS-MH Riverine Flood Related Economic Impacts

North Stonington	2022 Results				
	Residential	Commercial	Industrial	Other	Total
Direct					
Building	\$2,030,000	\$860,000	\$310,000	\$630,000	\$3,830,000
Contents	\$920,000	\$1,640,000	\$690,000	\$3,380,000	\$6,630,000
Inventory	\$0	\$90,000	\$120,000	\$30,000	\$240,000
Subtotal	\$2,950,000	\$2,590,000	\$1,120,000	\$4,040,000	\$10,700,000
Business Interruption					
Income	\$10,000	\$1,900,000	\$10,000	\$1,310,000	\$3,230,000
Relocation	\$1,140,000	\$430,000	\$10,000	\$990,000	\$2,570,000
Rental Income	\$400,000	\$330,000	\$0	\$130,000	\$860,000
Wage	\$30,000	\$920,000	\$30,000	\$26,570,000	\$27,550,000
Subtotal	\$1,580,000	\$3,580,000	\$50,000	\$29,000,000	\$34,210,000
Total	\$4,530,000	\$6,170,000	\$1,170,000	\$33,040,000	\$44,910,000

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 Southeastern Connecticut of wells going dry on residential and farming properties. Some of the more severe and impactful events include:

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

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

5.3.2 Existing Capabilities

The Town of North Stonington, like many communities, does not have specific regulations geared toward drought mitigation. One of the main purposes of the town’s zoning regulations is, however, to facilitate the adequate provision of water throughout the town.

In Chapter 10, the Supplemental Regulations (for golf course development), Site Development submissions must include a water budget/management plan for all groundwater withdrawal needs on a golf course development. This plan must include irrigation requirements under normal precipitation and under drought conditions.

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 North Stonington 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 North Stonington 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.

North Stonington is also largely an agricultural community, with several livestock farms throughout town. These operations could face challenges associated with irrigation and watering during times of drought as wells and surface water supplies run low, and water conservation measures are mandated.

5.3.3.1 Hazard Losses

There have been no reported drought losses for the Town of North Stonington. Downscaled drought losses from the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi Jurisdiction 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 North Stonington is considered a possible event each year with potentially significant effects.

While dam failures have not occurred in North Stonington since the time of the previous HMP, several dams were damaged by the March 2010 flooding at noted below:

- The Hewitt Farm Dam (also known as the Shunock River Dam) is a moderate hazard dam. The Hewitt Farm property, which includes a bridge and dam structure, was acquired by the Town in 2008. In 2015 the Town finished rebuilding the dam and the bridge overtop.
- The Gallup Pond Dam is a significant hazard dam. Repairs to this dam are being performed by the local fisherman's club.
- The Wyassup Lake dam is owned by Connecticut DEEP. It has undergone repairs and been greatly improved and updated over the last five years.

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 noted in the Multi-Jurisdictional HMP, North Stonington is home to one Class B (significant hazard) dams, and additional significant or high hazard dams do not appear to be located upstream of North Stonington whose failure could potentially lead to flooding within the town. These dams are listed on Table 5-3.

Table 5-3 Dams Registered with DEEP in the Town of North Stonington

CT Dam#	Dam Name	Dam Class	Owner Type
10232	Laurel Glen Pond Dam	-	Private
10209	Stone Pond Dam	A	Private Corporation
10210	Morgan Pond Dam	A	Private Corporation
10215	Prentice Brook Pond Dam	A	Private Club
10216	Simonds Pond	A	Private
10217	Lewis Pond Dam	A	Private Corporation
10218	Upper Glade Brook Pond	A	Private
10219	Lower Glade Brook Pond	A	Private
10220	Green River Pond Dam	A	Private
10221	Pendleton Pond Dam	A	Private
10222	Triangle Pond Dam	A	Private Corporation
10223	Small Pond Dam	A	Private
10224	Cemetery Pond Dam	A	Private
10225	Hewitt Pond Dam	A	Private Corporation
10233	Cheney Pond Dam	A	Private
10239	Krutman Pond Dam	A	Private
10241	Connell Pond Dam (See 10222)	A	Private
10247	Williams Pond Dam	A	Private
10226	Crescent Pond Dam	AA	Private

10234	Lotus Pond Dam	AA	Private Corporation
10238	Clark Pond Dam	AA	Private
10240	Croft Pond Dam	AA	Private
10242	Hewitt Pond Dam	AA	Private Corporation
10243	Dufton Pond Dam	AA	Private
10244	Drakos Pond Dam	AA	Private Corporation
10245	Patrick Pond Dam	AA	Private
10246	Olnck & Olnick Pond Dam	AA	Private
10202	Gallup Pond Dam	BB	Private Corporation
10204	Lake Of Isles Dam	BB	Private Corporation
10208	Spaulding Pond Dam	BB	Private
10227	Blue Lake Dam	BB	Private Corporation
10231	Pitcher Mountain Pond Dam	BB	Private
10248	Bush Pond Dam (Also See #10249)	BB	Private
10205	Clark Falls Dam	B	Private

* Dam is not registered with DEEP

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

Owners of high and significant hazard dams are required to maintain Emergency Action Plans (EAPs) for such dams. The Town of North Stonington owns one dam (the Hewitt Farm Pond Dam mentioned in the historic record), but this dam is not a significant or high hazard dam. The Town does not have copies of the EAPs for the three significant hazard dams in town.

Summary

In general, municipal capabilities to mitigate dam failure damage have remained strong since the 2017 edition of the hazard mitigation plan was adopted. This is in part due to the lack of high hazard dams in the Town and the reclassification of the Gallup Pond dam to Hazard Class BB. In addition, changes in the State's regulation of dams have increased Statewide capabilities sharply.

5.4.3 Vulnerabilities and Risk Assessment

The potential impacts related to the failure of Class B dams within North Stonington are described below. Where information was available, the descriptions below are based on information available at the Connecticut DEEP Dam Safety files.

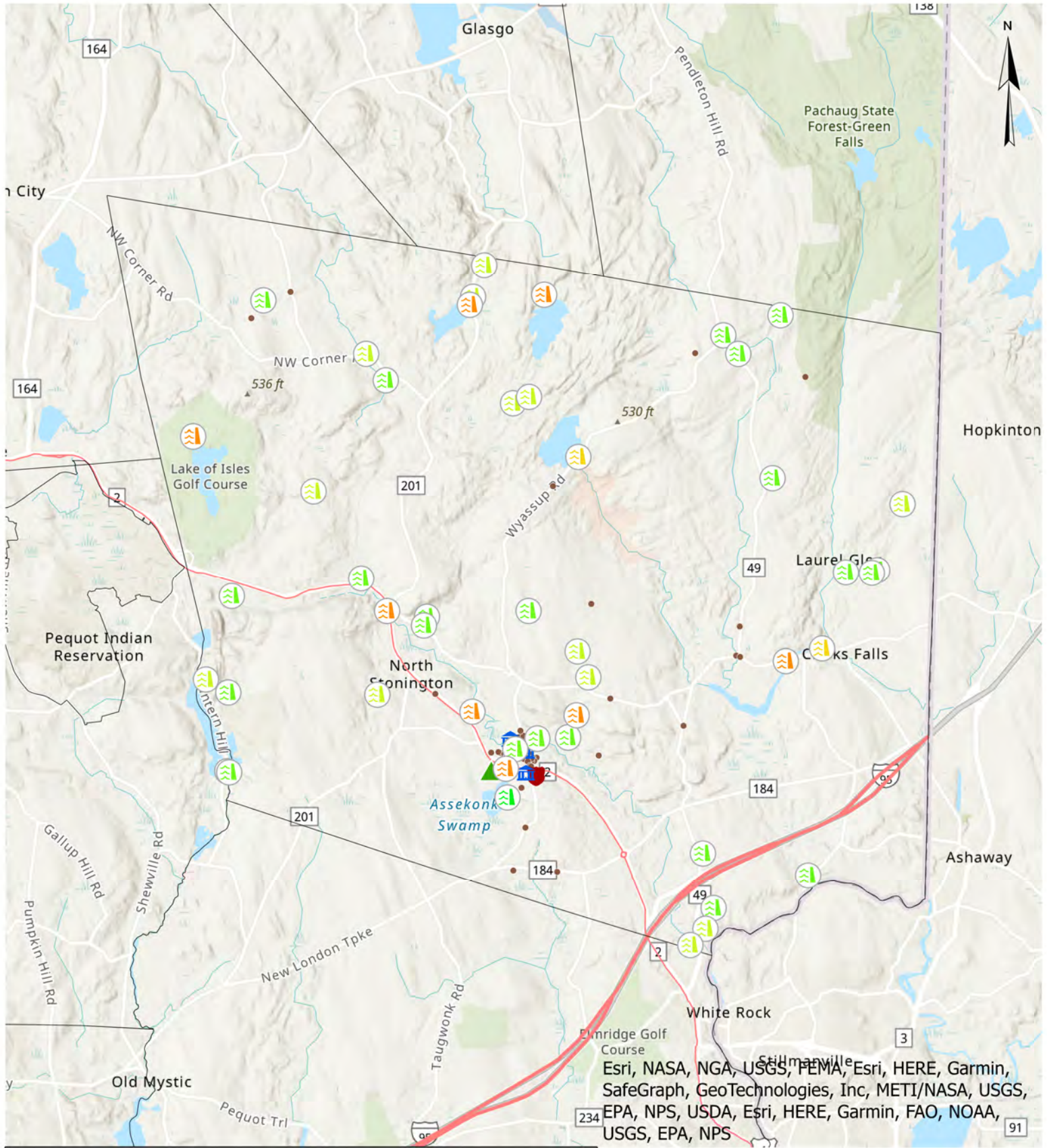
- Clarks Falls Dam – This privately-owned Class B dam impounds Clarks Falls Pond (Wyassup Brook) approximately 500 feet upstream of its confluence with the Green Fall River. The dam was originally installed to provide power to a mill downstream. Based on a review of the Dam Safety files at Connecticut DEEP, neither a dam failure analysis nor an EOP appear to have been developed for this structure. Failure of this dam could potentially cause flooding damage to two

structures located immediately downstream as well as impact an agricultural area and one structure downstream along the Green Fall River.

- Gallup Pond Dam – This privately-owned Class BB dam impounds the Shunock River just upstream of Route 2 near the western terminus of Ryder Road. This impoundment is currently used for recreation. An April 29, 2010, memorandum in the Dam Safety Files at Connecticut DEEP indicates that an engineer retained by the dam owner determined that failure of the dam would (1) not cause flooding of Route 2 downstream and (2) not cause significant flooding of downstream properties as floodwaters would be confined to the existing channel. The dam owner requested a determination regarding whether downgrading the hazard classification of the dam (it was classified as a Hazard Class B, or Significant Hazard, dam at the time) was appropriate. CT DEEP has since determined that such a downgrade was appropriate, and the dam is now listed as Hazard Class BB (moderate hazard). If the hazard classification for this dam remains at this level, this dam will be removed from future editions of this HMP.
- Wyassup Lake Dam – This Class B dam is owned by the Connecticut DEEP and an EOP and a dam failure analysis have been prepared for the structure. This structure impounds the headwaters of Wyassup Brook for recreational purposes. According to an EOP prepared by GZA in 1987, the limits of potential downstream flooding would extend just downstream of Grindstone Road and affect several structures adjacent to the dam as well as one structure on Grindstone Road.



5.4.3.1 Hazard Losses

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



Dams and Dam Failure Inundation Areas
 Southeaster Connecticut Council of Governments
 Town of North Stonington
 Date: 2/23/2023

0 0.55 1.1 1.65 2.2 Miles

Legend

	Dams		Historic Resources
	Unknown/Unclassified		Emergency Services
	A		Municipal
	AA		Shelter or Cooling Center
	B		Dam Failure Inundation Area
	BB		

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

6. Rising Temperatures

6.1. Climate Change Impacts

On average, the annual temperature across the U.S. has increased by 1.8 degrees Fahrenheit when looking at the entire period of record (1895-2016). Accelerated warming patterns between 1979 and 2016 have been observed with satellite and surface data, and paleoclimate records show that some of the recent decades have been the warmest in the past 1,500 years.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 the warmer months and can be defined as temperatures that hover 10 degrees or more above the average high temperature for the region. These events typically last for a prolonged period of time and 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 North Stonington has identified the High School as cooling centers in town, and the old high school as a secondary option. In the event of a projected heat event or heat wave, the Town is prepared to open up the cooling centers for resident cooling use.

Summary

In general, the capabilities of mitigating extreme heat have increased since the 2017 edition of this plan as the town has identified cooling centers for use during an extreme heat event.

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 North Stonington. 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.

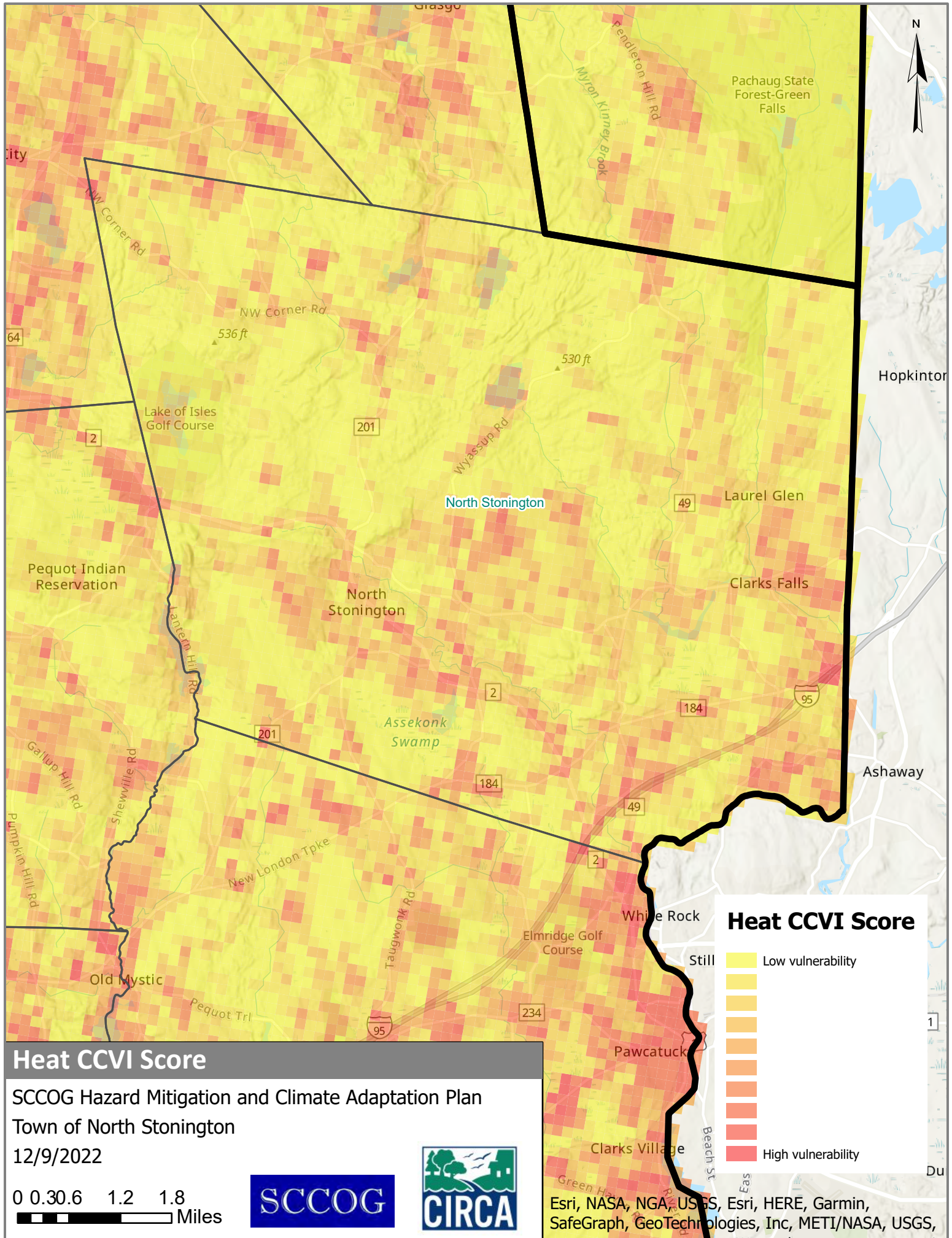
The Town is concerned about the impacts of extreme heat on residents, particularly during extended periods where overnight sheltering and cooling may be necessary. The town currently does not have a shelter or cooling center that could be used for overnight purposes; residents would be directed to Stonington or Norwich if necessary. The town would ideally like to designate an overnight location that could be used for sheltering and cooling if necessary to avoid residents having to travel outside of town during a heat event.

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 North Stonington. The distribution of heat vulnerability throughout the community can be seen in Figure 6-1

Heat exposure is relatively low in North Stonington, as the landscape has low building density and few impervious surfaces. Heat sensitivity is also relatively low across most of the municipality, although both built and social factors contribute to higher sensitivity in the area near Rt 49 and Rt 216. Abundant vegetation and three facilities that could serve as cooling centers in the center of town result in high scores for adaptive capacity. Therefore, the overall heat vulnerability for North Stonington is low to moderate depending on location.

6.2.3.1 Hazard Losses

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



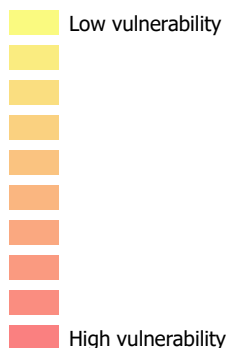
Heat CCVI Score

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

0 0.30.6 1.2 1.8 Miles



Heat CCVI Score



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

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 lightly developed areas of North Stonington. Structural fires in higher density areas of the town are not directly addressed herein.

North Stonington typically experiences several brush fires each year. Most brush fires are small and quickly contained to a few acres maximum. Recent examples include a brush fire off of Route 184 caused by an overheated private electric generator, and several brush fires in the Lantern Hill and Pachaug State Forest areas caused primarily by illegal burns and improper disposal of cigarettes. Town staff report that some property damage has occurred due to these minor fires, including the loss of the Wyasset Horse Barn.

In March 2018 a brush fire was sparked near the Rhode Island border that was accidentally sparked from wood stove embers. The fire burned some debris and tires and was under control within two hours.

No major fires could be recalled in recent history.

6.3.2 Existing Capabilities

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

The Fire Department has a budget of \$3,000 per year for public outreach. The department goes to schools to run educational programs. Information about wildfires and wildfire risk is posted on the Town website. The Fire Department also makes outreach materials and information donated by national fire safety organizations available to the public.

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 Volunteer Fire Company has a strong mutual aid relationship with the Connecticut DEEP firefighters to fight wildfires. The Town has pumping trucks that can carry water to distant fires, and the DEEP has tracked vehicles that can also access areas without roads. The Fire Department also has mutual aid agreements with surrounding communities.

The Fire Department goes to fires as quickly as possible in the town. Through a grant, the Department recently acquired new equipment to aid in wildfire fighting. This included helmets, rakes, suits, hoses, and a drone that can be used to spot fires in wooded areas. The Town has also set aside money to purchase an RAFL brush truck; this is an all-terrain-vehicle with a 50-gallon capacity local generator pump and a setup to transport wounded people.

Fire protection water is obtained through several dry hydrants located throughout North Stonington. In areas located far from the dry hydrants, they draft water from the various streams, ponds, and rivers in the town, and rely on pump trucks to carry water to distant areas. The Town is always pursuing installation of additional dry hydrants as necessary. Public water service is available only in limited areas. The Mashantucket Pequot Tribal Nation provides water service in the vicinity of Lake of Isles such that a source of fire protection water is available in this section of town. The Westerly Water Department and the Southeastern Connecticut Water Authority provide limited water service along Route 2 North Stonington in the southern section of town. According to the *Plan of Conservation and Development*, these latter entities could potentially install additional water mains along the Route 2 corridor in the future which would provide additional fire protection water to the southern portion of Town.

North Stonington does not feel it is necessary to extend its public water systems for the purpose of fire suppression. It is considering adding a water tower to give the existing system the pressure necessary to fight fires.

New developments are reviewed by the Fire Department who provide recommendations regarding the necessary fire protection equipment to be installed, including dry hydrants, cisterns, and sprinkler systems. The Fire Marshall also reviews other structures for the adequacy of fire protection. The amount of fire protection afforded by the dry hydrants and nearby streams is considered to be adequate for the development level of North Stonington. The Fire Department will continue to evaluate the level of risk and the need for additional hydrants as development continues in the future.

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." North Stonington 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 since the 2017 edition of the hazard mitigation plan was adopted, with continued public education and testing of dry hydrants; as well as the changes in the State's regulation of open burning, and the construction of the new emergency services building.

6.3.3 Vulnerabilities and Risk Assessment

As most of North Stonington is undeveloped or forested land, wildfires can occur almost anywhere due to the undeveloped nature of the town. State forest lands and inaccessible tracks of land are at the highest risk for wildfires. These areas are considered to be at moderate risk. Areas that are located near water bodies are considered to be low risk since a water supply is available. Refer to 3.-6 in the Multi-Jurisdictional HMCAP for a general depiction of wildfire risk areas within North Stonington.

6.3.3.1 Hazard Losses

There are no reported losses for the Town of North Stonington 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 North Stonington. The Town has adopted these codes for new construction, and they are enforced by the Building Department.

North Stonington officials expect that the school modification project and Emergency Services Facility construction will improve the resilience of the Town's suite of critical facilities to the impacts of an earthquake. The two projects will bring those structures to recent building code standards and will include installation of backup power and the storage of emergency supplies.

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

Summary

In general, municipal capabilities to mitigate earthquake damage have not increased since the 2017 edition of the hazard mitigation plan was adopted. This is because the hazard continues to pose a low risk of damage to the Town. Critical facility capabilities to withstand earthquakes will increase somewhat due to general improvements made to those facilities.

7.2.3 Vulnerabilities and Risk Assessment

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

Several bedrock faults believed to be inactive are located within North Stonington. 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 includes some more recent construction that is seismically designed. However, most buildings were built before the 1990's and therefore are not built to current building codes. In addition, there are mobile home parks containing structures 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. North Stonington has many areas of steep slopes and bluffs although the majority of these features occur in undeveloped areas. Thus, landslides are not a concern in the town.

Seismic activity can also break utility lines such as water mains, gas mains, electric and telephone lines, and stormwater management systems. Damage to utility lines can lead to fires, especially in electric and gas mains. Dam failure can also pose a significant threat to developed areas during an earthquake. For this HMP, dam failure has been addressed separately in Section 5.4. As noted previously, most utility infrastructure in the town is located above ground. A quick and coordinated response with Connecticut Light & Power and other utilities will be necessary to inspect damaged utilities following an earthquake, to isolate damaged areas, and to bring backup systems online. This is covered in the EOPs for these entities.

7.2.4 Hazard Losses

There are no reported losses for the Town of North Stonington 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

North Stonington	Residential	Commercial	Industrial	Others	Total
	\$17,800,000	\$16,750,000	\$7,110,000	\$10,570,000	52,230,000

8. Mitigation Strategies and Actions

8.1. Status of Mitigation Strategies and Actions

A total of 12 hazard mitigation actions were developed in the previous edition of this plan. The status of each is listed below.

#	Mitigation Actions and Strategies for North Stonington 2016 - 2021	Status	Status Details
1	Integrate elements of this HMP into the Plan of Conservation and Development during the next update	Underway	The POCD update is due in 2023, Land Use dept. is handling this now. CIRCA can send some text on climate adaptation if that would be helpful.
2	Compile a list of addresses of structures within the 1% annual chance floodplain and track repair costs		Unknown
3	Perform outreach to floodprone property owners regarding the availability of competitive grant funding for flood mitigation projects	Carry Forward	The town coordinates with local watershed associations and Wood-Pawcatuck Wild & Scenic Rivers on some of this but needs to check back for more details.
4	Utilize the recently available extreme rainfall data to determine existing culvert sizing and encourage upgrades where undersized	Capability	There is no engineer on staff, so the engineer is on-call. Check with Public Works (Don Hill). The town regularly replaces culverts.
5	Replace the culvert at Glade Brook on Pine Woods Road as proposed	Complete	Check with Public Works. ³
6	Work with the Connecticut Department of Transportation to upgrade culverts along Pendleton Hill Road (Route 49)	Carry Forward	Some work on Pendleton Hill Road has been completed, but it is unknown whether it was the Route 49 area. Check with Public Works. ⁴
7	Perform an assessment of options for addressing drainage problems associated with the undersized culvert under the Village Green.	Remove	Check with Public Works. ⁵
8	Work with the State to complete construction of new bridge on Route 49	Complete	Check with Public Works. Two bridges have been redone since the last HMP. One near Spaulding Pond the other on Route 49. ⁶
9	Improve drainage on Rocky Hollow Road near the Recreational Area	Complete	Check with Public Works. ⁷
10	Improve drainage on Pinecrest Road in the Kingswood-Meadow Wood Subdivision	Complete	This is complete. ⁸ Beavers create ongoing issues here; the town works with a state-licensed trapper on an annual basis to control this issue.
11	Extend fire protection to future at-risk areas through public water systems or the installation of dry hydrants		Partly completed – The town has dry hydrants and also has some collection areas where water is collected for the tanker. Bob will talk to the Fire Chief about whether this action should be retired.

³ DPW confirmed this was completed.

⁴ DPW suggested checking with DOT.

⁵ DPW reports that no problems are present here. Action can be retired.

⁶ DPW confirmed this was completed.

⁷ DPW confirmed this was completed with corrective action.

⁸ DPW confirmed this was completed.

12	Work with CT DEEP to ensure that the owners of high hazard dams have current EOPs and keep local copies	Carry Forward	Unknown, this might be a question for Planning and Zoning. There are 13 dams in town. There are three dams at Long Pond (two in North Stonington, one in Ledyard) that the town is currently supporting via ongoing coordination on repairs.
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During the planning process, CIRCA and consultant staff facilitated a discussion with the Town staff to identify the greatest climate change concerns and challenges. The previous actions were re-evaluated in this context. Elements of three prior actions have been carried forward into the new hazard mitigation and climate adaptation actions.

8.2. Prioritization of Specific Actions

The proposed actions for the Town of North Stonington 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:

- Utilize the recently available extreme rainfall data to determine existing stormwater infrastructure and culvert sizing and encourage upgrades where undersized, transitioning from NOAA Atlas 14 to NOAA Atlas 15 when available in 2023.
- Apply to DEEP Climate Resilience Fund award for Shunock River watershed flood mitigation study.

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

- Establish an overnight shelter in Town, capable of providing cooling during extreme heat events. Ensure that standby power is installed, and that transit or alternate means of transportation are available to bring elderly and those without vehicles to the facility.

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

Table 8-1 Town of North Stonington Actions and STAPLEE and PERSISTS Scores

Number	Hazard Mitigation and Climate Adaptation Actions	Hazard Mitigation and Climate Adaptation Goal	Type of Action	Responsible Department	Approx. Cost Range	Potential Funding Sources	Timeframe	Priority	PERSISTS Score	STAPLEE Score	PERSISTS x STAPLEE =
NS1	Establish an overnight shelter in Town, capable of providing cooling during extreme heat events. Ensure that standby power is installed and that transit or alternate means of transportation are available to bring elderly and those without vehicles to the facility.	Ensure that critical facilities are resilient, with special attention to shelters and cooling centers.	Preparedness & Emergency Response	Office of the Chief Elected Official	\$100,000 - \$500,000	FEMA HMA; Other Preparedness Grants; STEAP	7/2023 - 6/2025	High	16	6	96
NS2	Compile a list of addresses of structures within the 1% annual chance floodplain and track repair costs to help with substantial damage and substantial improvement (SD/SI) determinations.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Property Protection	Building Official	\$0 - \$10,000	Municipal Operating Budget	7/2023 - 6/2028	Low	14	10	140
NS3	Perform outreach to floodprone property owners regarding the availability of competitive grant funding for flood mitigation projects.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Property Protection	Floodplain Manager	\$0 - \$10,000	Municipal Operating Budget	7/2023 - 6/2024	High	13	5	65
NS4	Utilize the recently available extreme rainfall data to determine existing stormwater infrastructure and culvert sizing and encourage upgrades where undersized, transitioning from NOAA Atlas 14 to NOAA Atlas 15 when available in 2023.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Structural Projects	Public Works	\$0 - \$10,000	SCCOG Municipal Services Funds; Municipal Operating Budget	7/2023 - 6/2024	Medium	21	12	252
NS5	Partner with the Connecticut Department of Transportation to facilitate the upgrade of culverts along Pendleton Hill Road (Route 49).	Invest in resilient corridors to ensure that people and services are accessible during floods and that development	Structural Projects	Public Works	\$100,000 - \$500,000	CT DOT; IJJA AOP	7/2024 - 6/2026	High	13	6	78

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	PERISTS x STAPLEE =
		along corridors is resilient over the long term.									
NS6	Apply to DEEP Climate Resilience Fund award for Shunock River watershed flood mitigation study	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Natural Resources Protection	Office of the Chief Elected Official	\$100,000 - \$500,000	DEEP Climate Resilience Fund	7/2023 - 12/2023	High	21	8	168
NS7	Directly support the repairs to the Long Pond dams and spillway by issuing the required permits and approvals in parallel with CT DEEP approvals. Partner with the Town of Ledyard, Town of Stonington, Town of Groton, and the Native American tribes to ensure that risks are characterized in the new Emergency Action Plan for the Long Pond Dams.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Preparedness & Emergency Response	Office of the Chief Elected Official	\$10,000 - \$25,000	Municipal Operating Budget; SCCOG Municipal Service Funds	7/2023 - 6/2024	High	21	6	126
NS8	Work with SCCOG and CIRCA to scope a corridor study for Lantern Hill Road that evaluates its capabilities and risks relative to providing access between and among MPTN, Ledyard, North Stonington, the Eastern Pequots, Stonington, and the Old Mystic part of Groton	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.	Structural Projects	Office of the Chief Elected Official	\$100,000 - \$500,000	SCCOG Special Projects; DEEP Climate Resilience Fund; CIRCA Resilient Connecticut	7/2024 - 6/2025	High	24	3	72
NS9	Participate in a dam failure tabletop exercise for Long Pond with the Towns of Ledyard, Groton, and Stonington.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Preparedness & Emergency Response	Emergency Management	\$0 - \$10,000	Municipal Operating Budget	7/2025 - 6/2026	Medium	21	5	105

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	PERSIST Score	STAPLEE Score	PERSIST x STAPLEE =
NS10	Work with CT DEEP to ensure that the owners of high hazard dams have current EAPs and keep local copies on file for review during high-precipitation events in the area.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Preparedness & Emergency Response	Emergency Management	\$0 - \$10,000	Municipal Operating Budget	7/2023 - 6/2025	Medium	14	6	84
NS11	Work with CT DEEP to update the list of repetitive loss properties and ensure that errors and updates are incorporated by FEMA.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Property Protection	Floodplain Manager	\$0 - \$10,000	Municipal Operating Budget	7/2023 - 12/2023	High	12	6	72
NS12	Conduct direct outreach to property owners in repetitive loss areas with information about how to mitigation flood losses.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Property Protection	Floodplain Manager	\$0 - \$10,000	Municipal Operating Budget	1/2024 and annually during January	Medium	13	4	52
NS13	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
NS14	Partner with chicken farms and livestock 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
NS15	Partner with chicken farms and livestock facilities to develop emergency response plans that	Address risks associated with extreme heat events, especially as they	Preparedness & Emergency Response	Office of the Chief Elected Official	\$0 - \$10,000	USDA/NRCS; SCCOG funds	7/2023 - 6/2026	High	18	8	144

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	PERISTS x STAPLEE =
	describe how to manage extreme heat events, droughts, power outages, and avian flu outbreaks.	interact with other hazards.									
NS16	Extend fire protection to future at-risk areas through public water systems or the installation of dry hydrants.	Reduce losses from other hazards that are affected by climate change.	Water & Wastewater Utility Projects	Office of the Chief Elected Official	>\$1M	DWSRF; STEAP	7/2023 - 6/2026	Medium	14	6	84
NS17	Extend the existing public water systems to adjacent areas served by private wells to reduce drought risks to private properties and critical facilities.	Reduce losses from other hazards that are affected by climate change.	Water & Wastewater Utility Projects	Office of the Chief Elected Official	>\$1M	DWSRF; STEAP	7/2024 - 6/2028	Low	14	4	56
NS18	Secure funding for construction of a water tower near the fire department that could be used for firefighting response, or water needs during drought.	Reduce losses from other hazards that are affected by climate change.	Water & Wastewater Utility Projects	Office of the Chief Elected Official	>\$1M	DWSRF; STEAP	7/2024 - 6/2028	Medium	14	4	56