Climate and Stormwater Hazard Assessment

Executive Summary

The Western Connecticut Council of Governments (WestCOG) serves as a resource to implement planning, technology, and transportation initiatives cooperatively across its 18 member municipalities. WestCOG also aims to support the region's Metropolitan Planning Organizations (MPOs): the Housatonic Valley MPO and the South Western Region MPO, which are coextensive with WestCOG. Together, these frameworks and participants work to uphold shared regional values and advance the identified goals of WestCOG participating communities in transportation, land use, community development, the environment, and open space.

As identified in WestCOG's 2022-2027 Strategic Plan, climate resiliency is a key area of improvement for the region, including in environmental and conservation planning, master planning, and emergency management. Connecticut communities face a wide range of climate change concerns – flooding, increased temperatures, wildfires, sea level rise, and more – and can improve community resilience by implementing local Plans of Conservation and Development (POCDs). In support of local POCD development, the WestCOG *Climate and Stormwater Hazard Assessment* ("Assessment") provides all member municipalities with a thorough understanding of baseline regional climate data by outlining hazards and related planning considerations for the area. Climate and hazard data included in this Assessment are further refined for localities in subsequent documents, including the *Locally Variable Hazard Assessment* and the *Community POCD Climate Chapter Template*. Together, these resources enable a consistent approach to regional and local POCDs, future planning and mitigation efforts, and compliance with Public Act 25-33 (PA 25-33, also known as the "Climate Bill").

Table 1. Public Act 25-33 Required Hazards and Assessment Alignment

Required Hazard	Assessment Section	Page
Increased Temperatures	**Extreme Heat**	**24**
Drought	**Drought**	**24**
Flooding	**Flooding and Stormwater**	**11**
Wildfire	**Wildfire**	**30**
Storm Damage	**Extreme Storms**	**8**
Sea Level Rise	**Flooding and Stormwater**	**19**
Saltwater Intrusion	**Flooding and Stormwater**	**23**

See PA 25-33 Section 11(e)(2)(d).

The region is vulnerable to a wide range of climate- and stormwater-related hazards, particularly in and around urban centers and coastal areas. Assumptions of a stationary climate are inadequate for long-term planning regarding natural hazard impacts in the WestCOG region. As the global climate warms, the intensity of Atlantic tropical cyclones and thunderstorms is predicted to increase, leading to more severe flooding from heavier rainfall in the Northeast United States. These climate-driven trends will also lead to more substantial riverine, coastal, and storm-surge flooding. Combined flood risk most significantly affects tidal and coastal areas of the municipalities along the Long Island Sound, as well as heavily urbanized inland areas. Other climate hazards, such as increased temperatures, droughts, and wildfires, are also expected to intensify as the climate changes.

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ACRONYMS/ABBREVIATIONS

Acronym	Description
AMM	Average Monthly Maximum
ARI	Average Recurrence Interval

Acronym	Description
BMP	Best Management Practice
CCVI	Climate Change Vulnerability Index
CGS	Connecticut General Statutes
CIRCA	Connecticut Institute for Resilience & Climate Adaptation
CT ECO	Connecticut Environmental Conditions Online
CT NHMP	Connecticut Natural Hazard Mitigation Plan
CTPCSA	Connecticut Physical Climate Science Assessment Report
DEEP	Department of Energy and Environmental Protection
EF	Enhanced Fujita Scale
ENSO	El-Niño Southern Oscillation
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
IBHS	Institute for Business & Home Safety
IBTrACS	International Best Track Archive for Climate Stewardship
IDW	Interagency Drought Workgroup
LiDAR	Light Detection and Ranging
MHHW	Mean Higher High Water
MHW	Mean High Water
MLC	Mid-Latitude Cyclone

Acronym	Description
NAO	North Atlantic Oscillation
NFHL	National Flood Hazard Layer
NOAA	National Oceanic and Atmospheric Administration
NRCC	Northeast Regional Climate Center
HMP	Hazard Mitigation Plan
HUC	Hydrologic Unit Code
PDSI	Palmer Drought Severity
PFE	Precipitation Frequency Estimate
POCD	Plans of Conservation and Development
P-PET	Precipitation minus Potential Evapotranspiration
RCP	Representative Concentration Pathway
SFHA	Special Flood Hazard Area
SLOSH	Sea, Lake and Overland Surges from Hurricanes
SLR	Sea Level Rise
SPC	NOAA Storm Prediction Center
TC	Tropical Cyclone
USDA	United States Department of Agriculture
USFS	United States Forest Service
WUI	Wildland-Urban Interface

Introduction & Purpose

WestCOG developed this *Climate and Stormwater Hazard Assessment* as a resource to support regional compliance with Public Act 25-33. Among other facets of community planning, PA 25-33 outlines natural and climate hazard requirements for state, regional, and local Plans of Conservation and Development (POCDs), which address long-term land-use, infrastructure, and natural resource policies. These hazards include:

- Increased Temperatures
- Drought
- Flooding
- Wildfire
- Storm Damage
- Sea Level Rise
- Saltwater Intrusion

While addressing all hazards required by PA 25-33, this assessment identifies flooding and stormwater performance as the region's principal risks. By synthesizing regional climate trends, precipitation projections, and watershed characteristics, the document establishes baseline conditions, consistent hazard characterizations, and unified technical conclusions across all member municipalities.

Assessment results are based on the latest state-mandated climate and sea-level rise projections. The assessment further evaluates how shifting precipitation patterns, runoff volumes, and drainage exceedances are expected to affect the area. All other identified hazards are evaluated to characterize their risks and interactions with regional hydrology, land cover, and the built environment.

How can climate projections influence planning efforts?

These trends highlight a growing risk of heavy rain and flooding, both inland and along the coast. As such, traditional precipitation frequency estimates that assume a stationary climate may be inadequate for long-term climate planning. Projections should be chosen with risk tolerance in

Findings are presented with planning-scale technical detail such that governing bodies can connect hazard information in the WestCOG Multi-Jurisdictional Hazard Mitigation Plan (WestCOG HMP) to their adopted POCD policy and land-use guidance. The 2021 WestCOG HMP Update was the first plan to address all 18 municipalities served by WestCOG and is complemented by municipal annexes. Similarly, this assessment covers hazards with regional context, and municipality-specific information can be found in the accompanying *Locally Variable Hazard Assessment*.

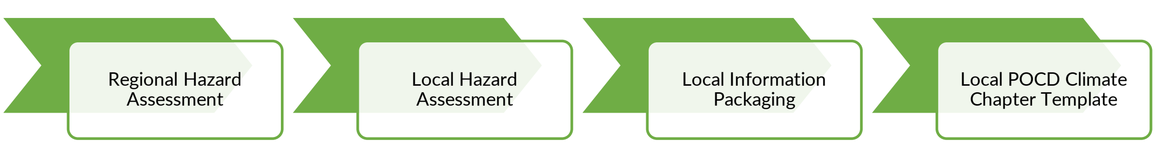

Figure 1. Hazard Assessment information workflow.

This document provides actionable climate data for direct integration into regional and local POCDs. Estimated frequencies, intensities, and quantities are summarized under "Key Planning Information" in each hazard section. "Identified Best Practices" highlight recommendations for using this information in community planning but are not prescriptive nor decisional.

All results are formatted as geospatial data compatible with state and municipal GIS systems, supplemented by maps and summary figures.

Regional Context

The WestCOG region is composed of 18 member municipalities: the principal cities of Stamford, Norwalk, and Danbury, and fifteen towns, including Bethel, Bridgewater, Brookfield, Darien, Greenwich, New Canaan, New Fairfield, New Milford, Newtown, Redding, Ridgefield, Sherman, Weston, Westport, and Wilton. The total study area is approximately 550 square miles in size, located in the southwest corner of Connecticut (Figure 2).

The region is characterized by predominantly forested suburban landscapes, punctuated by several concentrated urban centers and complemented by extensive inland wetlands and ecologically sensitive coastal areas along Long Island Sound. Southern coastal areas, including Stamford and Norwalk, are the most densely populated, as is the northern inland city of Danbury. Outside these highly developed urban areas and surrounding low- to medium-population-density areas, this region is primarily deciduous forest and various wetlands. The coastal region is most at risk to climate hazards; not only is it most densely populated, but it also contains ecologically sensitive tidal wetlands, which are particularly susceptible to climate-related hazards such as drought, storm surge, and coastal flooding.

Communities are thus categorized for this Assessment by coastal or inland geographies and further delineated by population density, from high to low. There are no Coastal-Low-Density communities in the study area.

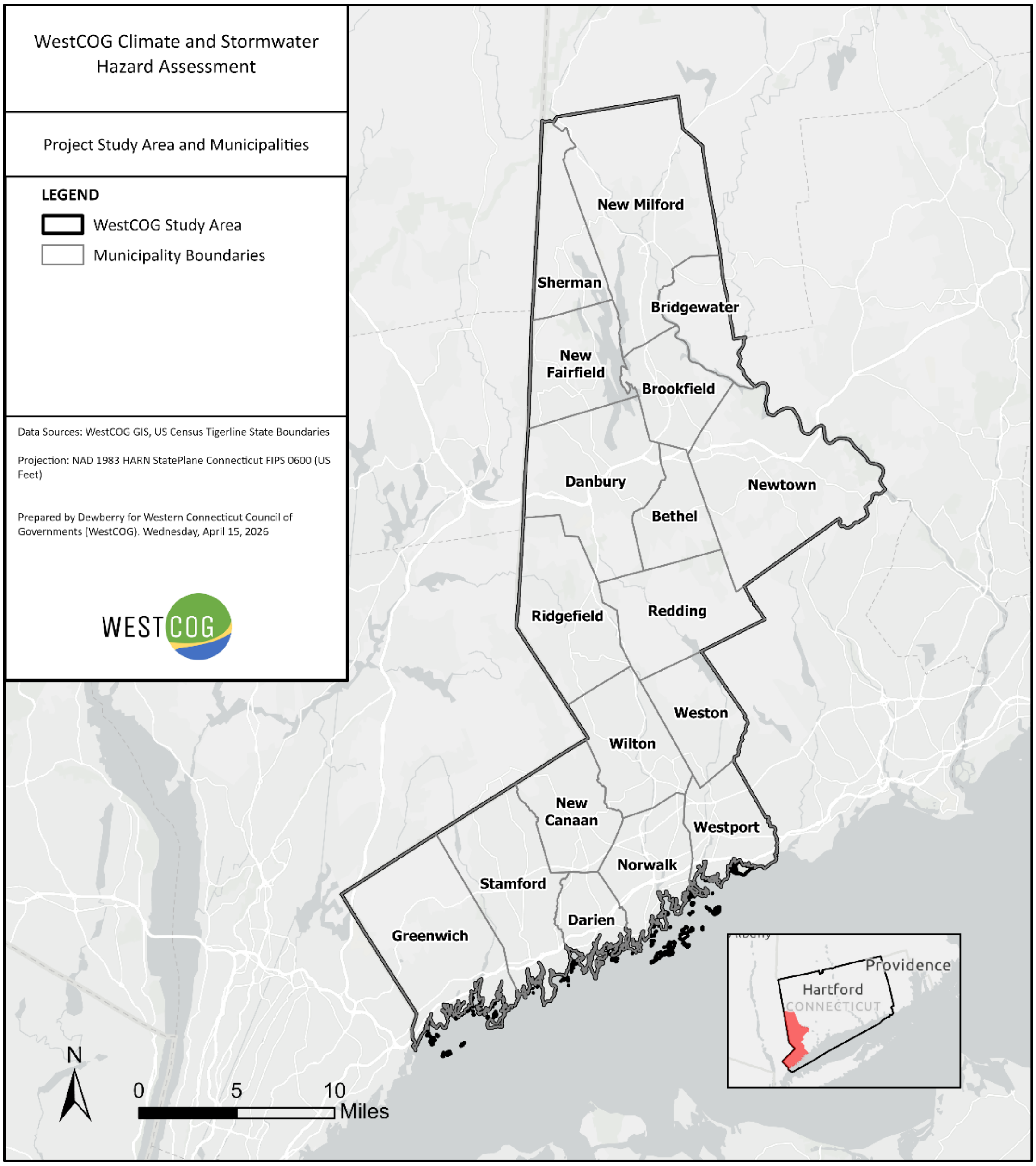

Figure 2. WestCOG Study Area and member municipalities.

Table 2. Community Categorization within WestCOG

Community	Community Category				
	Coastal-High	Coastal-Moderate	Inland-High	Inland-Moderate	Inland-Low
Norwalk	●				
Stamford	●				
Darien		●			
Greenwich		●			
Westport		●			
Danbury			●		
Bethel				●	
Brookfield				●	
New Canaan				●	
New Fairfield				●	
New Milford				●	
Newtown				●	
Ridgefield				●	
Weston				●	
Wilton				●	
Bridgewater					●
Redding					●
Sherman					●

Hazard Analysis Overview

The hazards analyzed in this assessment and associated data sources are summarized below in Table 3. Summary of hazards, descriptions, and data sources..

Table 3. Summary of hazards, descriptions, and data sources.

Hazard	Description	Source for Analysis
Extreme Storms	Tropical cyclones (also called tropical storms and hurricanes), mid-latitude cyclones, and severe thunderstorms are characterized by both high frequency and high variability in heavy precipitation and high winds, among other storm-damage impacts.	National Oceanic and Atmospheric Administration (NOAA) Extreme Precipitation in New York & New England Northeast Regional Climate Center (NRCC) International Best Track Archive for Climate Stewardship (IBTrACS)
Rainfall (Pluvial) Flooding	Prolonged or intense rainfall that inundates inland areas; runoff overwhelms natural or built drainage systems, leading to stormwater flooding, elevated groundwater levels, and ponding.	NOAA and NRCC
Riverine (Fluvial) Flooding	Precipitation accumulates in waterways and linked drainage systems, elevating water surface levels that exceed the capacity of a stream channel or riverbank.	Federal Emergency Management Agency (FEMA) National Flood Hazard Layer (NFHL) and FEMA Hazus tool
Coastal Flooding	Coastal flooding is associated with three related hazards: sea level rise, saltwater intrusion, and storm surge.	Connecticut Institute for Resilience & Climate Adaptation (CIRCA) Connecticut Physical Climate Science Assessment Report (CTPCSA) CT DEEP and Connecticut Environmental Conditions Online (CT ECO) NOAA Sea, Lake, and Overland Surges from Hurricanes (SLOSH)

Hazard	Description	Source for Analysis
Extreme Heat	High temperatures that persist over multiple days.	CIRCA Climate Change Vulnerability Index (CCVI) CTPCSA
Drought	A sustained period of low precipitation relative to established climatic norms, resulting in water deficits that affect water supply, agricultural productivity, ecological function, and infrastructure performance.	United States Department of Agriculture (USDA) Palmer Drought Severity Index (PDSI) US Drought Monitor CTPCSA CT Drought Preparedness and Response Plan CT State Water Plan
Wildfire	The uncontrolled burning of vegetation across natural or semi-natural landscapes.	USDA United States Forest Service (USFS) Wildland-Urban Interface (WUI)

Hazard Interactions and Compounding Risks

Each individual hazard is often associated with additional hazards during or directly because of the event, which compounds risk to communities. For example, a hurricane that produces heavy rain accompanied by high winds can exacerbate coastal flooding due to storm surge. This may become increasingly frequent in the future, as coastal flooding occurs more often due to sea level rise. Alternatively, prolonged extreme heat and drought provide the fuel conditions for wildfires to ignite and spread easily, creating a positive feedback loop that perpetuates dry conditions. After fires, burned areas are then particularly vulnerable to flooding and erosion.

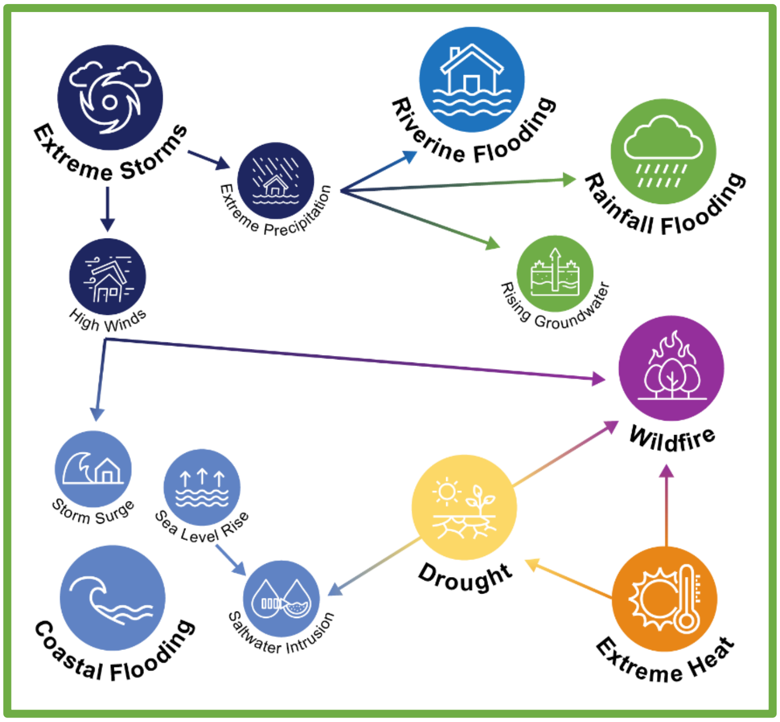

Figure 3. Interactions between regional hazards.

Some interactions are less intuitive than others. When coastal brackish areas experience prolonged drought, freshwater aquifers recede and saltwater intrudes, accelerating saltwater intrusion in areas already experiencing sea level rise.

Healthy, functioning ecosystems provide essential services that support community resilience, but these services are currently threatened by climate change. Understanding the nature and implications of ecosystem and wildlife interactions is a necessary component of a comprehensive regional hazard assessment for WestCOG.

Extreme Storms

Extreme storm events in Western Connecticut, namely tropical cyclones, mid-latitude cyclones, and severe thunderstorms, are characterized by both high frequency and high variability in heavy precipitation and strong winds, among other impacts. These weather systems are typically driven by the state's proximity to the jet stream and the interaction between moist Atlantic air and continental air masses. In summer and early fall, severe thunderstorms and tropical cyclones are prevalent, while late fall through spring is impacted by mid-latitude cyclones, including Nor'easters. Importantly, extreme storms have differing compounding impacts on flooding hazards (Rainfall, Riverine, and Coastal Flooding) and cascading impacts depending on the location and intensity of precipitation and wind. Storm types and future storm activity are discussed below, with compounding impacts referenced within subsequent sections.

Tropical Cyclones

Tropical cyclones (TCs), including tropical storms and hurricanes, are intensely rotating low-pressure systems that can produce strong winds, heavy rain, severe thunderstorms, and coastal storm surge over a widespread area. A tropical cyclone does not need to make direct landfall to impact an area, as spiral bands of thunderstorms can extend up to roughly 150 miles from the eye (center) of the storm. The North Atlantic hurricane season is June 1 – November 30, with peak storm activity typically occurring between late-August and early-October, making TC hazards a typically late-summer and early-fall phenomenon.

Historical TC frequency trends are variable and difficult to detect due to their influence from teleconnections such as the El-Niño Southern Oscillation (ENSO) and North Atlantic Oscillation (NAO), and less reliable data prior to the aircraft reconnaissance and satellite era. Over the past century, there has been no significant increase in North Atlantic Basin storm activity (frequency), including landfalls. However, TC activity has statistically significantly increased over the last several decades, as indicated by more recent remotely sensed observations. This trend is anticipated to continue, though with less confidence based on climate model projections. There is greater confidence that TC *intensity* will increase in the future due to a hotter, more humid atmosphere, with model-based studies projecting up to 5% increase for 2 degrees Celsius of warming, increasing the proportion of category 4 and 5 storms observed in the North Atlantic. This means that while there may not be a significant increase in TC events, those that do occur are likely to produce heavier rainfall and higher winds.

Observed tropical cyclone tracks within roughly 150 miles of WestCOG communities can provide historical context of tropical cyclone frequency. Maps of historical storm tracks from IBTrACS and inundation extents are available in Appendix A: Maps.

Mid-Latitude Cyclones

Mid-Latitude Cyclones (MLCs) are also large-scale, rotating low-pressure systems that can produce strong winds, heavy precipitation, and coastal flooding over a widespread region. However, unlike tropical cyclones, MLCs typically occur from late fall through spring, so precipitation is often frozen as snow, freezing rain, or sleet, which can result in blizzard conditions. This adds an additional hazard of MLCs associated with freezing temperatures and extreme wind chill. Nor'easters, which are MLCs that track along the Atlantic Coast, comprise most of the Northeast's extreme precipitation events. MLCs can include both continental and maritime low-pressure systems.

Over the last century, the number of cool-season MLC events has decreased, though the intensity of rainfall associated with MLCs has increased. This dichotomous trend is anticipated to continue in the future, with increased intensity due to higher energy available from greater water vapor in storms, but decreased frequency of extreme events. Cyclone tracks are also trending northward as ocean temperatures rise, though the impact of these shifts on Connecticut is less clear.

Severe Thunderstorms

Severe thunderstorms are smaller in scale than their larger cyclonic counterparts but can still incur significant damage. Impacts typically include high winds, straight-line or tornadic, that can down trees and power lines; high-intensity rainfall rates that produce runoff, especially in urban areas; large hail, which can damage crops, vehicles, and roofs; and lightning, which can damage power infrastructure and disrupt communication. Severe thunderstorms are most common from late spring through early fall, peaking in summer due to high humidity and solar heating, which provide the energy for convection. Connecticut and

New England experience significantly fewer severe thunderstorms and tornadoes than other parts of the country, such as the Southern and Central Plains. Annual probabilities of related severe thunderstorm hazards from NOAA Storm Prediction Center (SPC) are presented in Table 4. Historic tornado tracks that have crossed WestCOG geography are available in Appendix A: Maps. Similar to widespread precipitation trends, climate projections suggest that while the total number of thunderstorm days may not increase dramatically, the intensity of heavy rainfall is likely to increase due to higher surface temperatures and moisture levels, leading to greater instability.

Table 4. Hazard Climatology from NOAA Storm Prediction Center.

Storm Event Scenario	Annual Probability
Any tornado (1994-2024)	45.16 – 61.29%; higher probability inland
EF1+ tornado (1994-2024)	32.26-41.94%; higher probability inland
EF2+ tornado (1994-2024)	12.9-9.68%; higher probability along the coast
Severe thunderstorm-wind (1955-2024)	74.29 – 87.14%; higher probability inland
60+ mph wind (1955-2024)	57.14%
74+ mph wind (1955-2024)	38.71%
Days per Year with ≥ 1 Cloud to Ground Flash/Hour (1995-2024)	9.55%
Hail ≥ 0.5 inches (1955-2024)	61.43 – 70.0% (higher inland)
Hail ≥ 1.0 inches (1955-2024)	47.14 – 52.86% (higher inland)
Hail ≥ 1.5 inches (1955-2024)	18.57 - 37.51% (higher inland)
Hail ≥ 2.0 inches (1955-2024)	1.43 – 14.29% (higher inland)
Hail ≥ 3.0 inches (1955-2024)	0 – 2.86% (higher inland)

Tornado probability derived from 1994-2024 data; wind probability derived from 1955-2024 data; lighting data derived from data 1995-2024 data; hail probability derived from 1955-2024 data.

High Winds

Each storm type above can be associated with high winds accompanying heavy rainfall. However, high wind events can also be “dry” events, associated with strong atmospheric pressure gradients. Wind blows from areas of high pressure to low pressure, such as between two weather systems or a strong frontal boundary. As the pressure gradient tightens, wind speed increases over a widespread area. High wind events like this are most common in the spring, with strong pressure gradients developing between cold, continental airmasses over Canada and the warmer Atlantic, as well as the favorable position of the jet stream. Gusty outflows from summer thunderstorms can also produce localized high winds when thunderstorms are nearby but not directly impacting an area.

When high wind events are associated with otherwise dry conditions, fire risk increases. Low humidity and high winds can cause brush or forest fires to spread rapidly.

Key Planning Information for Extreme Storms

Planning for current and future vulnerabilities to extreme storm impacts is key to comprehensive community resilience. While the region's already frequent extreme storm events may not increase significantly, those that do occur are likely to produce heavier rainfall, stronger winds, and greater impacts.

- On average, a tropical cyclone impacts WestCOG once every 1.5 years according to 174 years of TC data from IBTrACS (note: an impact does not necessarily mean landfall or severe damage).
- Comparatively, mid-latitude cyclones occur more frequently and can impact Connecticut multiple times each winter, again to varying degrees of severity.
- Severe thunderstorms (high winds, large hail, tornadoes) impact WestCOG regularly each summer; high winds, heavy rain, and large hail are more common hazards than tornadoes.

Subsequent sections detail precipitation, sea level rise, heat, and drought projections that are exacerbated by these events.

Identified Best Practices Related to Extreme Storms

WestCOG municipalities can plan for extreme storms using the above probabilities and projections. As storm intensity increases, policies and procedures can account for the multivariate interactions between extreme storms and other hazards by:

- **Encouraging Resilient Design**: Communities can adopt the latest Insurance Institute for Business & Home Safety (IBHS) FORTIFIED standards focused on high-wind rated roofing and impact-resistant glazing.
- **Bolstering Natural Buffers**: Enhanced policies can transform underutilized land into bioswales and detention ponds, replace invasive, shallow-rooted species with native, wind-firm hardwoods that can better withstand storm gusts, or strategically place windbreak vegetation to slow or redirect wind.

Flooding & Stormwater

Flooding is the most common natural hazard encountered in the Region. Triggered by various events, floods can occur in any season, and risks in the area are often exacerbated by frequent extreme storm events. WestCOG communities experience multiple sources of flooding, including rainfall (pluvial), riverine (fluvial), and coastal flooding.

Rainfall (Pluvial) Flooding: Prolonged or intense rainfall can inundate inland areas when runoff overwhelms natural or built drainage systems, leading to stormwater flooding and ponding. Extreme rainfall events are projected to worsen over time (see Extreme Storms), and as sea levels rise, higher water levels can impede drainage infrastructure functions, leading to increased flooding.

Riverine (Fluvial) Flooding: Riverine flooding occurs when precipitation accumulates within waterways and linked drainage systems. This type of flooding manifests as surging water surface levels that exceed the capacity of a stream channel or riverbank. While often triggered by local rainfall, it also includes "sunny day" flooding, where riverine swelling is caused by snowmelt or rain in the upper portions of a watershed, far from the affected area.

Coastal Flooding: Coastal flooding is associated with three related hazards: sea level rise (SLR), saltwater intrusion, and storm surge. Rising sea levels exacerbate flooding by inundating typically dry areas during high tides and pushing water farther inland. This "sunny-day flooding" or “king tide flooding” may not pose immediate safety risks but can disrupt daily activities and damage infrastructure over time. As sea level rises, saltwater also seeps into freshwater aquifers, contaminating potable and agricultural water supplies. Coastal storm surge occurs when winds from hurricanes and tropical storms push ocean waters inland. The height and extent of storm surge depend on factors like wind speed and atmospheric pressure, as well as the shape of the coastline.

Understanding Regional Vulnerability to Flooding

To understand the region’s vulnerability to the flood types mentioned above, CIRCA developed a Flood CCVI for the state of Connecticut that combines flood exposure, sensitivity, and adaptive capacity.

Flood Exposure in this model combines:

- Storm surge, flood zone, and SLR exposure
- Soil drainage, erosion susceptibility, pooling areas, impervious surfaces, and a shoreline change rate

Flood sensitivity combines:

- Proximity to critical facilities and critical habitats
- Social data such as median income, age, disability, and race

Flood adaptive capacity combines factors such as:

- Distance to healthcare facilities, shelters, and major roadways
- Regulatory standards
- Open space in the Special Flood Hazard Area (SFHA)

While CIRCA’s Flood CCVI can be used to understand vulnerability throughout the region for all flood types, each of the flood types is broken down in more detail below, along with key planning information and best practices.

Rainfall (Pluvial) Flooding

Rainfall, or pluvial, flooding affects both inland and coastal areas when runoff overwhelms natural or built drainage systems, leading to stormwater flooding and ponding. Due to increased precipitation intensity described below, a greater volume of precipitation is expected to run off as surface flows, with less retained in the soil. Together with the temperature-induced acceleration of evapotranspiration (the sum of all processes by which water moves from the land surface to the atmosphere via evaporation and transpiration), there is an expected increase in the risk of rainfall-induced flooding. As such, rainfall-driven flooding in the context of precipitation must be discussed.

Precipitation Trends

Average annual precipitation (“climate-normal precipitation”, based on PRISM[1] data for 1991-2020) for WestCOG communities ranges from approximately 48 to 52 inches per year, with precipitation totals increasing from the coast to higher elevations and hilly terrain. Average annual precipitation has increased

[1] PRISM Group, Oregon State University, https://prism.oregonstate.edu, accessed 13 Apr 2026.

over the 20th and early 21st centuries, especially since the 1970s, and future projections indicate a continuing trend toward more frequent and more intense extreme precipitation.

Increased Annual Precipitation. According to the CTPCSA Report, in a high CO_2-emissions scenario, Representative Concentration Pathway (RCP) 8.5, the annual precipitation across the state is projected to increase by 8.5% (4-5 inches) and 9.5% (4.5-5.5 inches), by mid- and late-century, respectively, with the greatest increase projected in the winter (13.4% and 16.3% by mid- and late-century, respectively) and spring (10% and 16.5% by mid- and late-century, respectively).[2]

Increased Storm Intensity. Precipitation Frequency Estimates (PFEs) are statistical calculations used to determine the probability of an expected precipitation amount (in inches) likely to fall within a certain time (minutes to hours) at a given location, in a given year. PFE probabilities are represented by Average Recurrence Intervals (ARIs), or the estimated time, in years, between occurrences. A "1-year" storm has a 100% chance of occurring in a given year, whereas a "100-year" storm has a 1% chance of occurrence. A common PFE used for asset design is the "24-hour, 100-year rainfall", which represents the 24-hour rainfall total that is expected 1% of the time.

For the Northeastern States, PFEs were published by NOAA in 2015 and updated in 2019 as NOAA Atlas 14, Volume 10, Version 3.0 (NOAA14).[3] Additional PFEs are also available from the NRCC's Extreme Precipitation in New York & New England.[4] A sample of 24-hour PFEs for select ARIs at Norwalk, CT, is found in Table 5 below:

Table 5. Comparison of 24-hour PFEs (inches) for selected ARIs (years) for Norwalk, CT.

Source	1-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
NOAA14	2.88	3.49	4.50	5.34	6.49	7.34	8.26	9.34	11.00
NRCC	2.87	3.45	4.31	5.10	6.38	7.56	8.95	10.61	13.29

Estimates are from NOAA Atlas 14 and the Northeast Regional Climate Center.

The Intensity Duration Frequency Curves for New York State: Future Projections for a Changing Climate Project[5] produced ensemble-based projected rainfall intensity for two emission scenarios, RCP4.5 and RCP8.5, and mid-century (2040-2069) and late-century (2070-2099) time horizons for the state of NY. Portions of adjacent states, including 4 stations in or near WestCOG communities, were also included. Based on the average increase in intensity compared to 1970-1999 at these four stations, 24-hour 100-year intensity rainfall is projected to increase by 9% between 2040-2079 and 14% between 2070-2099 for emissions scenario RCP4.5, and by as much as 13% and 22% for the respective time periods with emissions scenario RCP8.5. This means the 24-hour 100-year storm at Norwalk, CT, could increase from 8.26 inches based on present-day NOAA14, to over 10 inches by the end of the century.

According to the CTPCSA, by the late century under a high emissions scenario (RCP8.5), global climate models project a 15-25% increase in overall northeastern US cool season precipitation associated with Mid-Latitude Cyclones, and a 20% increase in precipitation per cyclone. The number of heavy precipitation

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[2] https://circa.media.uconn.edu/wp-content/uploads/sites/1618/2019/11/CTPCSAR-Aug2019.pdf
[3] https://www.weather.gov/media/owp/oh/hdsc/docs/Atlas14_Volume10.pdf
[4] https://precip.eas.cornell.edu/#/data_and_products
[5] https://ny-idf-projections.nrcc.cornell.edu/

events associated with cool-season cyclones will rise 50% by the early 21st century and 4-5 times by the late 21st century. As global temperatures continue to rise, much of this increase will manifest as rainfall, with less snow expected in future extratropical cyclones over the eastern U.S.

Stormwater Infrastructure Design and Performance

Stormwater systems in much of the Northeast are struggling to keep up with the region's increasingly intense rainfall. Driven by rapid industrialization and population growth in the 18th and 19th centuries, natural streams were converted into drainage systems through urban burial and channelization. Early "pipes" were often rudimentary structures that removed meanders to speed up water flow and prevent stagnant pools. While these original channels have been replaced by more “modern” pipes, these systems are now outdated and overwhelmed by the volume of contemporary storms. Per the 2024 Connecticut Stormwater Quality Manual, new development must now manage the runoff from the 90th percentile rainfall event, or the 1.3-inch storm.[6] In 2021, Hurricane Ida dumped 7 to 8 inches of rain across parts of Connecticut in less than 24 hours. At its peak, rainfall intensity in some areas reached roughly 3.5 inches per hour.

Rising Groundwater Levels

It is also important to note how ground saturation is impacted by increased precipitation, runoff, and ponding. When heavy rain saturates the soil, the water table rises, creating hydrostatic pressure on basement floors and walls. For many structures built in naturally low-lying, saturated areas, rising groundwater can force its way through cracks in foundations or cause floors to buckle upward. Beyond structural impacts, septic systems submerged in groundwater can no longer treat waste, leading to backups into buildings or contaminating the surrounding groundwater. In coastal towns, rising groundwater isn't just freshwater – see Saltwater Intrusion for more information on the impacts of rising sea levels.

[6] https://portal.ct.gov/-/media/deep/water/water_quality_management/guidance/swm_mar_2024.pdf?rev=1dafea8e03ca4ec98f5ec011d803f4dc&hash=A49802ED8F721C491C85776C3E77CF51

What's the connection between groundwater levels and land subsidence?

Land subsidence happens when materials under the Earth's surface shift or are removed, e.g., water, soil, or rocks. Subsidence can happen gradually or suddenly, as soil instability can occur at varying geographic scales.

Land subsidence is primarily caused by *declining* groundwater levels, not rising ones. In the greater tri-state area, the conversation around subsidence is linked to lower groundwater levels due to extraction, the weight of the built environment, and continual geological shifts – thousands of years in the making.

Notably, areas experiencing land subsidence may be more susceptible to coastal flooding from sea level rise or storm surge as their land elevation drops.

Key Planning Information for Rainfall Flooding

Annual precipitation across the state is projected to increase by 8.5% (4-5 inches) and 9.5% (4.5-5.5 inches) by mid- and late century, respectively. Storm intensity is also projected to increase in the future, with 24-hour, 100-year precipitation frequency estimates increasing by 9-14% for mid-century and 13-22% by late-century.

Rainfall flooding influences both natural and built drainage systems and affects communities on a watershed-wide scale. The following data and resources should be used when choosing stormwater management design baselines:

- "Present-day" precipitation frequency estimates from NOAA14 or NRCC for durations ranging from 5 minutes to 3 days and average recurrence intervals from 1 year to 500 years.
- Future PFE adjustment factors based on the New York State Future Projections Project for RCPs 4.5 and RCP8.5, and mid-century and late-century time horizons.

Identified Best Practices Related to Rainfall Flooding

Several policies can be improved by WestCOG municipalities to mitigate the impacts of rainfall flooding, including:

- **Using More Conservative Design Storms**: Communities can update local stormwater management requirements to account for more frequent and intense storms
- **Modernizing Existing Stormwater Infrastructure**: Where feasible, communities can consider enhancing existing stormwater infrastructure capacity by right-sizing for future conditions
- **Expanding Green and Gray Catchment Systems**: Communities can slow the flow of stormwater runoff entering drainage systems by implementing storage or slow-release solutions in key areas.

Riverine (Fluvial) Flooding

Western Connecticut regularly experiences riverine flooding, as delineated in the FEMA Flood Insurance Rate Maps (FIRMs). FEMA FIRMs can be found in Appendix A: Maps (Note: Litchfield County does not have FIRMs). Riverine floodwaters cause massive damage to the lower levels of buildings, furniture, and sentimental belongings, strain social and community fabric, and stunt business operations. Floodwaters can also impede emergency and commercial egress, deteriorate municipal drainage systems, and divert municipal staff and resources.

As discussed above, precipitation in Connecticut has been increasing and will continue to do so as the climate changes, ultimately exacerbating riverine flood impacts. Human-altered landscapes significantly amplify rivers' responses to this extra water—whether through impervious surfaces or discharge from overwhelmed drainage systems. Intensifying precipitation will also result in higher river levels both locally and upstream, as well as increased riverine flood intensity and frequency.

Nearly 50% of flood insurance claims come from properties outside of FEMA-designated flood risk zones.[7]

The "1-in-1,000-year" Event

On August 18, 2024, southwestern Connecticut experienced a catastrophic storm that delivered "1,000-year" rainfall, fundamentally challenging the state's infrastructure and emergency response capabilities. Peak intensities exceeded 3 inches per hour, causing the Naugatuck River at Beacon Falls to rise from 2 feet to over 16 feet in roughly eight hours – its second-highest crest on record.

The "1,000-year" event does not mean this kind of flooding occurs once every thousand years; rather, it has a 1-in-1,000 chance of occurring each year. In some areas of Connecticut, a 100-year flood may occur once every 10 years.

Because FEMA FIRMs rely on data from the late 2000s or early 2010s, flood risk maps do not reflect current rainfall intensities or urban development patterns. To close this gap, Connecticut launched an online climate risk tool that uses forward-looking precipitation projections and impervious surface modeling.[8]

A critical hazard in coastal areas is the compound coastal-riverine flooding interaction between sea level rise and river discharge. Rising sea levels push tidal water further up the Norwalk River or the Saugatuck River. When heavy rain occurs during high tide, the rivers cannot drain into the Sound, causing water to

[7] https://portal.ct.gov/governor/news/press-releases/2025/09-2025/governor-lamont-announces-launch-of-online-climate-risk-mapping-tool-for-homeowners-and-businesses?language=en_US
[8] https://portal.ct.gov/cid/resource-library/free-climate-risk-mapping-tool?language=en_US

stack up and flood inland neighborhoods. See Coastal Flooding below to read more about coastal flood risk.

Key Planning Information for Riverine Flooding

The 1% and 0.2% annual chance floodplain extents will widen as precipitation trends continue to intensify. The following data and resources should be used when choosing stormwater management design baselines for riverine flooding:

- The 1% and 0.2% annual chance floodplains provided by FEMA's NFHL and FEMA's Hazus tool output were used in the Connecticut Natural Hazard Mitigation Plan (CT NHMP) for Litchfield County.
- The Connecticut Insurance Department's Climate Risk Mapping Tool
- CIRCA's Flood CCVI to understand compounding vulnerability

Identified Best Practices Related to Riverine Flooding

Several policies can be improved by WestCOG municipalities to mitigate the impacts of riverine flooding, including:

- **Implementing Developing Climate-Informed Zoning**: Updated flood risk maps and associated hazard areas can better inform developers and landowners about suitable and safe uses for impacted areas. Enhanced Low-Impact Development standards can also help mitigate impacts during and after riverine flooding events.
- **Enforcing Higher Floodplain Management Standards**: Higher standards, including freeboard, fill or development restrictions, and more stringent floodway requirements, can be leveraged to better protect people and property from riverine flooding. Municipalities can also adopt flood risk data and studies beyond FEMA FIRMs, referred to as Best Available Information, to regulate floodplain development.
- **Facilitating Voluntary Property Acquisitions**: For properties with repeated or high riverine flood risk, voluntary property acquisitions can be included in community plans and programs.

Coastal Flooding

Sea Level Rise

SLR is anticipated to increase the frequency and extent of coastal flood events, thereby increasing the risk of coastal flooding in WestCOG's shoreline communities. According to the Fifth National Climate Assessment, on a national scale, sea levels rose by approximately 0.05 inches (±0.01) per year between 1901 and 1900 and by approximately 0.13 inches (±0.02) per year between 1993 and 2022.[9] Additionally, rates accelerated further between 2013 and 2022 at 0.17 inches per year. It is estimated that a global warming increase of 2°C would likely lead to a rise in sea levels between 2 and 3 feet by 2100 and possibly 2.5 to 5 feet by 2150, relative to 2000 sea levels. SLR is not consistent worldwide and is affected

[9] https://toolkit.climate.gov/sites/default/files/2025-07/NCA5_2023_FullReport.pdf

by local variations in currents, temperature, and changes in land-surface elevation. The WestCOG communities along Long Island Sound are most likely to be affected by SLR.

The CIRCA Sea Level Rise Report (2016) explores trends and projections at a more local level for Connecticut. The Report notes that historic tidal data collected from the NOAA tide gauges (Bridgeport, New London, and Kings Point/Willets Point) clearly show a long-term increasing trend in sea levels.

A linear regression analysis conducted for the 2016 report found that between 1976 and 2016, the annual rate of increase at the Bridgeport station was 4.0mm (±1.8), at New London was 4.1mm (±2.6), and at Willets Point was 4.1mm (±2.4). As of April 2026, the NOAA stations report a trend of 3.43mm/year (±0.37) in Bridgeport from 1964 to 2025, a trend of 2.94mm/year (±0.21) in New London from 1938 to 2025, and 2.74mm/year (±0.19) at Kings Point from 1931 to 2024.[10] Figure 4 shows the relative SLR trend for Bridgeport, CT, the station closest to WestCOG.

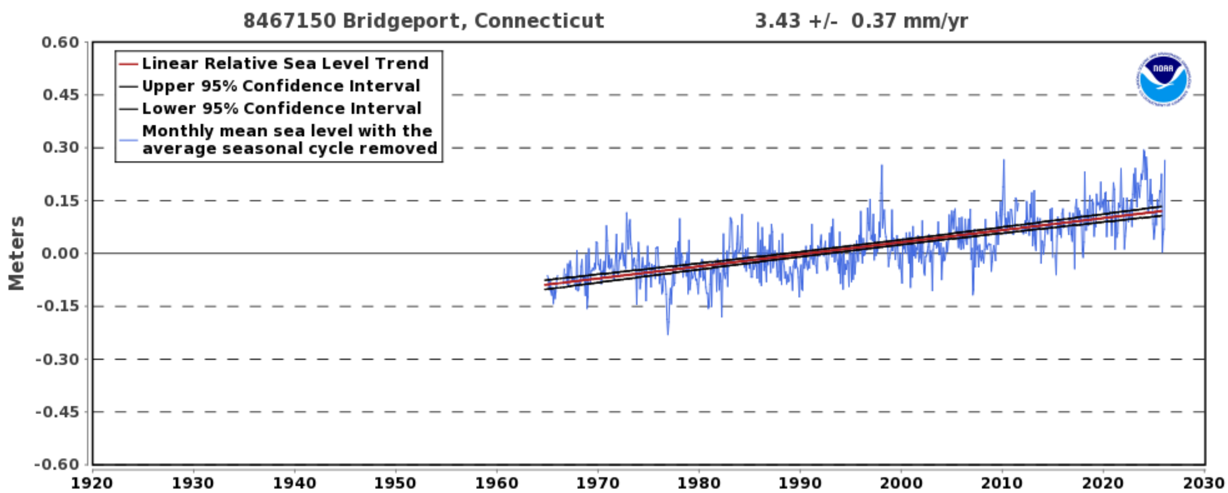

Figure 4. Relative SLR trend at Bridgeport, CT

According to the NOAA Technical Report OAR CPO-1, the worst-case scenario for SLR by 2100 is a global average of 6.6 feet above the 1992 mean sea level. CIRCA has developed SLR projections for Connecticut, establishing a “planning threshold” of a 0.5-meter (1.64 feet or nearly 20 inches) rise in sea level expected by 2050 and has defined a “caution threshold” of 1.0 meters (3.28 feet) in SLR expected in the period 2060-2090.[11] The planning threshold is required by Statute for certain types of planning in Connecticut.

CIRCA developed SLR layers for Mean Higher High Water (MHHW) and storm surge water levels at select recurrence intervals. These layers can be viewed via the Connecticut Sea Level Rise and Storm Surge Viewer.[12]

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[10] https://tidesandcurrents.noaa.gov/sltrends/
[11] https://circa.uconn.edu/wp-content/uploads/sites/1618/2019/02/SeaLevelRiseConnecticut-Final-Report-1.pdf
[12] https://circa.uconn.edu/sea-level-rise-and-storm-surge-viewer/

Additional SLR layers are also available on CT ECO, a partnership between UConn and CT DEEP.[13] Each reflects what inundation might look like at one of two tide levels: mean high water (MHW) or the average monthly maximum water level (AMM). AMM attempts to quantify the maximum extent of tidally influenced water levels. Table 6 below describes the sea level rise value, its source, and applicable time frame.

Table 6. SLR Visualization Data Available from CT DEEP.

SLR (in)	Approximate Relation to Scientific Data	Planning Horizon
6 in	Average 2004 Environmental Defense Hi/Low emissions	2020
12 in	Average 2004 Environmental Defense Hi/Low emissions	2050
18 in	2004 Environmental Defense High Emissions	2050
24 in	2007 IPCC High Emissions	2100
36 in	2004 Environmental Defense High Emissions	2080
60 in	N/A – gap filler*	n/a
79 in	Pfeffer et al. 2008	2100

*The 60 inches of SLR layer was developed, but does not have a global or regional estimate associated with a particular planning horizon backing its development.

The present-day baseline conditions and the 18 inches of SLR scenario are available for both MHW and the AMM in Appendix A: Maps. This SLR scenario aligns most closely with the 2050 time-horizon SLR scenario used in CIRCA's analysis, which asserts that municipalities should plan for 20 inches of SLR by 2050. Areas along the Saugatuck River in the Town of Westport and the Norwalk River in the City of Norwalk face the most acreage inundated along coastal WestCOG, according to these projections. Ultimately, all coastal communities in WestCOG will be affected by rising sea levels.

Rising sea levels will impact both the natural and man-made coastal environments. It could result in the disappearance of a large portion of WestCOG's tidal wetlands and the conversion of upstream wetlands to saltwater marshland. Beachfront communities will see increased erosion of sand and dune structures, potentially leading to more extreme and frequent flooding. Dikes and sea walls currently in place could rapidly lose effectiveness, increasing the frequency and extent of flooding in coastal areas.

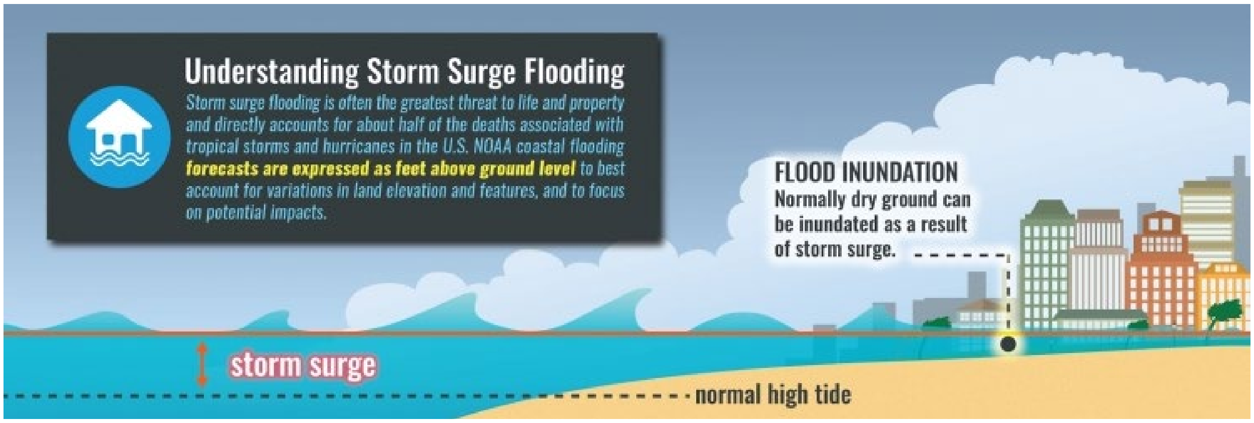
As sea levels rise, drainage systems will become less effective, potentially leading to greater flooding from even moderate rainfall events. Future storm events, especially those accompanied by strong storm surges, will pose an even greater threat to coastal and low-lying communities. Storm surges from hurricanes and nor'easters will reach farther inland, affecting a larger portion of the region.

[13] CT Environmental Conditions Online (ECO)

Storm Surge

Storm surge is an abnormal water level rise generated by a storm over and above the predicted astronomical tide. Coastal storm surge occurs when winds from hurricanes and tropical storms push ocean waters inland. The height and extent of storm surge depend on factors such as wind speed, atmospheric pressure, and the shape of the coastline.

Figure 5. Storm Surge Flooding Diagram (NOAA)[14]



CIRCA developed storm surge layers for the return periods of 10-, 30-, 100-, and 500-years or 10%, 3.33%, 1%, and 0.2% annual chance of occurrence, respectively. These modeled storm surge water levels used a coupled coastal circulation and wave model (FVCOM-SWAVE, a finite-volume coastal ocean model with the Simulating Wave Nearshore wave model) to hindcast the 44 highest storms between 1950 and 2018. This model is calibrated for the Long Island Sound to capture the complexity of Connecticut's geology and landscapes and improve accuracy for effective flood risk design. The floodwater elevations for different return periods were calculated empirically using a Poisson-GPD fit. The anticipated SLR of 20 inches by 2050 was also applied to these different flood events using 2016 Light Detection and Ranging (LiDAR) topographic data. The vertical datum for these storm surge layers is NAVD88.[15]

It is important to note that the 10-year return period + 20 inches of SLR is generally equivalent to the 100-year return period with no SLR, and thus, CIRCA provides no additional layer for the 10-year return period + 20 inches of SLR. This provides insight into what future conditions may look like. By 2050, with 20 inches of SLR, the 10-year storm event will be equal to a present-day 100-year storm. CIRCA also determined that an increase of 12 inches at the New London station mentioned above could make a 10-year event a 3.7-year event, and a rise of 24 inches could make the 10-year event a 1.25-year event.

Additional storm surge modeling for hurricanes is available from NOAA. SLOSH storm surge modeling can estimate the "near worst-case scenario of flooding for each hurricane category." The inundation extent of a category 1 through category 4 storm along the coast of WestCOG was mapped and can be found in Appendix A: Maps.

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[14] https://blog.response.restoration.noaa.gov/dangers-storm-surge-and-flooding
[15] https://resilientconnecticut.uconn.edu/datasets/connecticut-sea-level-rise-viewer/

Saltwater Intrusion

Saltwater intrusion is the landward and upward movement of saline water into freshwater aquifers and onto coastal land. Driven by rising sea levels and intense storm surges, this hazard can permanently alter Connecticut's infrastructure and ecosystems. Major impacts associated with saltwater intrusion include drinking water contamination, infrastructure corrosion, foundation damage, marsh migration and habitat loss, and agricultural loss. Saltwater intrusion also exacerbates the impacts of drought, as the lack of freshwater flow allows the salt line to move farther inland, widening areas exposed to high salinity and ultimately leading to greater habitat loss.

CIRCA has developed a saltwater intrusion vulnerability layer within its Coastal Vulnerability Viewer for planning purposes.[16]

Key Planning Information for Coastal Flooding

The municipalities of Greenwich, Stamford, Darien, Norwalk, and Westport are most susceptible to coastal hazards, including tropical cyclones, tidal flooding, storm surge, and sea-level rise. CIRCA has developed tidal MHHW layers, 10-, 30-, 100-, and 500-year recurrence interval storm surge layers, and SLR scenarios with a projected SLR of 20 inches by mid-century (2050), which can be used for planning considerations. Additionally, NOAA SLOSH simulations show the inundation extents of tropical cyclones ranging from category 1 to 4, and can be used for planning considerations.

The following data and resources should be used when choosing coastal flooding management design baselines:

- A "planning threshold" of 0.5-meter (1.64 feet or nearly 20 inches) SLR expected in the mid-term by 2050
- A "caution threshold" of 1.0 meters (3.28 feet) in SLR expected by the end-of-century by 2060-2090.
- Available data layers developed by CIRCA to be used for coastal flooding planning include:
    - MHHW
    - MHHW + 1ft
    - MHHW + 20 inches of SLR
    - 10-year return period
    - 10-year return period + 20 inches of SLR
    - 30-year return period
    - 30-year return period + 20 inches of SLR
    - 100-year return period
    - 100-year return period + 20 inches of SLR
    - 500-year return period
    - 500-year return period + 20 inches of SLR
- Category 1 through Category 4 NOAA SLOSH scenario simulations, estimating the "near worst-case scenario of flooding for each hurricane category."
- CIRCA's Coastal Vulnerability Viewer

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[16] https://vulnerability.circa.uconn.edu/

- CIRCA's Flood CCVI

Identified Best Practices Related to Coastal Flooding

Several policies can be improved by WestCOG municipalities to mitigate the impacts of coastal flooding, including:

- **Implementing Climate-Informed Zoning**: Updated flood risk maps and associated hazard areas can better inform developers and landowners about suitable and safe uses for impacted areas. Municipalities can encourage nature-based solutions in coastal areas such as beach/dune renourishment, wetland restoration, and living shorelines.
- **Enforcing Higher Floodplain Management Standards**: Higher standards, including development restrictions and detailed evacuation plan requirements, can be leveraged to better protect people and property from coastal flooding.
- **Facilitating Voluntary Property Acquisitions**: For properties with repeated or high coastal flood risk, voluntary property acquisitions can be included in community plans and programs.

Extreme Heat

Extreme heat, defined as high temperatures that persist over multiple days, is a growing risk due to climate change and a growing public health and infrastructure concern across the northeastern United States. For regional contexts, extreme heat is significant not only for its direct impacts on vulnerable populations but for its cascading effects on energy demand, water resources, and the performance of natural and built systems already under stress from other climate-driven hazards. Heat can worsen drought conditions, and hot, dry weather can, in turn, increase wildfire risk.

Heat islands are urbanized areas that experience higher temperatures than outlying areas. Impervious structures, such as buildings, roads, and other infrastructure, absorb and re-emit more of the sun's heat than natural landscapes, such as forests and water bodies. In urban areas, where these structures are highly concentrated and greenery is limited, they become "islands" of higher temperatures relative to outlying areas.[17]

Numerous studies have linked extreme heat and heat islands with illness and death among vulnerable populations such as older adults, very young children, and people with respiratory illnesses. Heat islands increase energy consumption and emissions by raising demand for cooling infrastructure. It is estimated that for each 1°C increase in temperature, energy demand rises by 0.5% to 5%, depending on the level of air conditioning penetration at the local level. Peak electricity demand and the highest heat island intensity tend to coincide, often during hot summer afternoons. During extreme heat events, increased demand for air conditioning can overload energy systems.[18]

Station observations with records beginning in 1895 have been averaged for Connecticut, showing statistically significant trends in annual (+0.3°F/decade) and seasonal temperatures, with the largest increase in winter (+0.4°F/decade). This approximately 120-year record shows that the annual average temperature is currently near 50°F, up from 47°F at the start of the 20th century. Winter temperatures averaged nearly 26°F at that time, well below freezing, and now average almost 30°F.

Downscaled multi-model projections (2010-2100) indicate significant, unabated increases in annual and seasonal temperatures throughout the 21st century. According to the CTPCSA Report, by 2050, in a high CO_2-emissions scenario (RCP 8.5), average temperatures are expected to rise by approximately 5°F and continue to increase thereafter.[19] Heat Wave Days, or Warm Spell Days (6 or more consecutive days with daily maximum temperatures above the 90th percentile), occur approximately 4 days per year under current conditions. By 2050, this is expected to rise from 4 days to 48 days annually. Similarly, Summer Days (the annual number of days when the daily maximum temperature is above 77°F) are projected to rise from 81 days annually to 118 days annually by 2050, and Tropical Nights (the annual number of days where the daily minimum is below 68°F) are projected to rise from 10 days annually in current conditions to approximately 40 days by 2050.

To further understand current and future vulnerability to extreme heat in WestCOG, CIRCA's Heat CCVI can be utilized. The CCVI process is based on combinations of exposure, sensitivity, and adaptive capacity

[17] https://www.epa.gov/heatislands/learn-about-heat-island-effects
[18] https://www.rff.org/publications/explainers/urban-heat-islands-101/
[19] https://circa.media.uconn.edu/wp-content/uploads/sites/1618/2019/11/CTPCSAR-Aug2019.pdf

applied to thousands of grid cells. For example, the sensitivity component includes many contributors across three different indicators – social, built, and ecological. Each indicator has its own final "score" based on the average of the contributors. The average of the 3 indicators represents the sensitivity score for one grid cell. This sensitivity score, along with the final exposure and adaptive capacity scores, is used to calculate the vulnerability score, yielding a range of gridded scores across a community. A map of heat vulnerability in the WestCOG region can be found in Appendix A: Maps.

Urban areas within the City of Danbury, the City of Norwalk, the City of Stamford, and the Town of Greenwich are among the most heat-vulnerable areas in the region. CIRCA has deployed heat sensor networks in the WestCOG region to evaluate whether and how street-level heat exposure compares with vulnerabilities identified in the CCVI. This data will be available in the future.

Key Planning Information for Extreme Heat

Extreme heat will impact the entire WestCOG region. The current condition baseline heat vulnerability can be viewed in CIRCA's Heat CCVI. Urbanized areas along the coast and inland near the City of Danbury and surrounding areas are at a higher risk of heat-related impacts due to the heat island effect. By 2050, in a high CO_2-emissions scenario (RCP 8.5), average temperatures are expected to rise by approximately 5°F and continue to increase thereafter.

- CIRCA's Heat CCVI can be used as a baseline for current condition planning considerations.
- By 2050, in a high CO_2-emissions scenario (RCP 8.5), average temperatures are expected to rise by approximately 5°F and continue to rise thereafter.
- Heat Wave Days (6 or more consecutive days with daily maximum temperatures above the 90th percentile) are expected to rise from 4 days annually to 48 days annually by 2050.
- Summer Days (the annual number of days when the daily maximum temperature is above 77°F) are projected to rise from 81 days annually to 118 days annually by 2050.
- Tropical Nights (the annual number of days where the daily minimum is below 68°F) are projected to rise from 10 days annually to 40 days annually by 2050.

Identified Best Practices Related to Extreme Heat

WestCOG municipalities can follow several best practices to mitigate the impacts of extreme heat, including:

- **Cooling Centers:** The identification and design of cooling centers, and campaigns to increase public awareness, particularly during heat waves.
- **Green Infrastructure:** Trees, green roofs, and vegetation can help reduce heat island effects by shading building surfaces, deflecting radiation from the sun, and releasing moisture into the atmosphere.
- **Building Code Enforcement:** Adherence to the most up-to-date building codes (2022 Connecticut State Building Code) will help keep residents insulated and protected from heat impacts.[20]
    - An update to the state building code will be released in 2026.

[20] https://portal.ct.gov/das/home/office-of-state-building-inspector/connecticut-state-building-code/regulations?language=en_US

Drought

Drought is a sustained period of low precipitation relative to established climatic norms, resulting in water deficits that affect water supply, agricultural productivity, ecological function, and infrastructure performance. Although Connecticut does not experience the chronic, multi-year drought conditions associated with arid climates, the state's shifting precipitation patterns and rising temperatures are increasing both the frequency and severity of short-duration drought events with meaningful implications for municipal planning and resource management across the WestCOG region.

The Connecticut Department of Agriculture provides resources for monitoring drought, including the U.S. Drought Monitor and Interagency Drought Workgroup (IDW). Additionally, the Connecticut Water Planning Council hosts drought-related resources and information on their website, including data, planning materials such as the Connecticut Drought Preparedness and Response Plan, and resources on related hazards and water conservation.

Overall, the WestCOG region has been heavily impacted over the decades by three types of droughts:

- The 1960s drought in Connecticut, which remains the most severe drought of the last 100 years in Connecticut, and is considered the drought of record for most water utility drought planning
- The northeastern drought of 2015-2017, which severely affected public water supply in the WestCOG region and directly led to the construction of the emergency pipeline from the Bridgeport region to the Stamford region
- Flash droughts of the last 15-20 years that develop quickly over a few months and then return to average conditions within 6-12 months; in the WestCOG region, the impacts of flash droughts are heavily influenced by the season in which they occur (for example, agricultural impacts occur when growing seasons are affected)

While droughts are difficult to predict, most Connecticut communities believe that flash droughts will need more attention in the coming years.

As presented in the Extreme Precipitation section, precipitation is projected to increase significantly in the future. However, increased precipitation may not translate into greater water availability due to higher evapotranspiration caused by higher temperatures. According to the CTPCSA Report, annual and summer P-PET (annual and summer precipitation minus potential evapotranspiration) show a slight upward trend in the early decades of the 21st century, followed by a decrease (indicating an increase in drought risk). This is especially true in the summer season. The mid-century projections for annual values are inconclusive due to a lack of model consensus. Table 7, pulled from the CTPCSA Report, presents annual and summer P-PET with projected changes in the mid- and late-century. [21]

[21] https://circa.media.uconn.edu/wp-content/uploads/sites/1618/2019/11/CTPCSAR-Aug2019.pdf

Table 7. Annual and Summer Water Availability/Deficit and Recurrence Intervals.

Variable	1970-99 Reference	2040-2069 Change	2070-2099 Change
Annual			
Annual P-PET mean	22.3±0.7	N/A	-4.9±3.3 (-22%)
Annual P-PET 10-year Recurrence Interval	12.2±1.4	N/A	-7±3.8 (-56%); **4**
Annual P-PET 20-year Recurrence Interval	9.4±1.6	N/A	-7.5±3.9 (-80%); **6**
Annual P-PET 50-year Recurrence Interval	6.2±1.9	N/A	-8.2±4.1 (-133%); **11**
Annual P-PET 100-year Recurrence Interval	4.0±2.1	N/A	-8.7±4.3 (-218%); **18**
Summer			
Summer P-PET mean	-3.8±0.5	-2.4±1.4 (64%)	-5.0±3.7 (133%)
Summer P-PET 10-year Recurrence Interval	-9.2±1.1	-3.8±1.8 (41%); **4**	-6.8±3.3 (74%); **3**
Summer P-PET 20-year Recurrence Interval	-10.8±1.4	-4.2±2.0 (39%); **6**	-7.4±3.6 (68%); **3.5**
Summer P-PET 50-year Recurrence Interval	-12.5±1.6	-4.7±2.3 (37%); **11.5**	-7.9±4.0 (63%); **5**
Summer P-PET 100-year Recurrence Interval	-13.7±1.8	-5.0±2.5 (36%); **20**	-8.3±4.2 (61%); **8**

The percentage values in parentheses indicate relative changes, where negative values reflect a decrease in potential water availability (annual) and positive values reflect an increase in water deficit (in summer); the values in bold font after the semicolon are future recurrence intervals (in years) for reference threshold values. "N/A" indicates the lack of model consensus on the direction of changes over most of the state.

While summer droughts typically will have a greater impact than winter droughts, a winter drought may limit groundwater recharge and reservoir refilling, which may affect water availability the following spring and summer if conditions do not improve.

Models project increased drought severity and frequency in Connecticut. The potential water deficit during summer droughts with recurrence intervals of 10-, 20-, 50-, and 100-years is all projected to become significantly more severe. The frequency of drought is expected to increase faster than its severity. For example, as shown in Table 7 above, it is estimated that a 20-year summer drought event that occurred in the late 20th century may occur every 6 years by 2050 and every 3 to 4 years by 2100.

Key Planning Information for Drought

Extreme heat intensification will lead to increasing issues with water availability, energy, and agriculture, among other sectors. This, in turn, will create worsening drought conditions.

The following information can be used for planning:

- Present-day drought conditions can be viewed via the U.S. Drought Monitor.
- Most Connecticut communities believe that flash droughts will need more attention in the coming years.

- The annual P-PET and summer P-PET, which can be defined as annual and summer precipitation minus potential evapotranspiration, both show a slight increasing trend in the early decades of the 21st century and a decrease afterward (indicating an increase in drought risk).
- It is estimated that a 20-year drought event in the summer that occurred in the late 20th century may occur every 6 years by 2050 and every 3 to 4 years by 2100.

Identified Best Practices Related to Drought

WestCOG municipalities can follow several best practices to mitigate the impacts of drought, including:

- **Drought Preparedness:** Follow the 2022 CT Drought Preparedness and Response Plan and subsequent after-action reports for additional guidance
- **Water Conservation:** Each major public water supplier must prepare a water supply plan that indicates ongoing water conservation actions as well as an emergency contingency planning component.
- **Public Outreach and Education:** Public outreach and education are critical components of long-term drought preparedness. Education should include discussion of best management practices (BMPs) for various industries and for homeowners.

Wildfire

Wildfire, the uncontrolled burning of vegetation across natural or semi-natural landscapes, has historically been a low-frequency hazard in the northeastern United States relative to other regions in the country. According to NOAA SPC, the annual probability (1992-2020) of a wildfire spanning more than 100 acres is 6.9% for coastal areas of WestCOG, versus 31.03% for inland areas. However, a combination of climate-driven changes in temperature, drought frequency, forest composition, and fuel accumulation is elevating wildfire risk across Connecticut.

An indicator of where wildfire impacts are more likely is the 2020 WUI areas. WUI areas are where houses and other development meet or mix with undeveloped natural areas. They are areas of transition and change. When housing expands near forests and undeveloped land, more houses and people are at risk of wildfire, and wildfire management becomes more complex.[22] A map of the WUI in WestCOG, along with housing density levels in non-WUI areas can be found in Appendix A: Maps. There are two zones in the WUI: the interface zone and the intermix zone. The interface zone is an area of high-density development adjacent to undeveloped wildland vegetation. The intermix zone is an area of lower-density housing mingled with undeveloped wildland vegetation.

The majority of WestCOG consists of the Intermix zone, with a lot of low-density housing interspersed with undeveloped wildland vegetation. Coastal WestCOG is the exception, as most of the coast is not as susceptible to wildfire.

Over the past several years, the state has faced a steady rise in brush fires, fueled by declining forest health and a warming climate that has brought more frequent drought conditions and higher temperatures. For example, in the fall of 2024, Connecticut saw a record 605 wildfires, which burned more than 500 acres and prompted a statewide emergency declaration, a temporary burn ban, and multi-agency firefighting support.[23]

Wildfires can lead to death, injury and the destruction of property. As the number of acres burned from wildfire has increased, so has the amount of smoke emitted, increasing the extent of the population of WestCOG exposed to smoke. Smoke contributes to poor air quality in communities both near and far from wildfire as smoke can travel hundreds to thousands of miles. The smoke from wildfires are associated with a range of health effects, from coughing to the exacerbation of more serious respiratory and cardiovascular diseases.

In the aftermath, burned areas are prone to flooding and erosion. Ash and contaminants from smoke can settle in water reservoirs, streams, and lakes, and pollute drinking water and aquatic ecosystems.

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[22] https://research.fs.usda.gov/nrs/projects/wuigrowth
[23] https://portal.ct.gov/deep/news-releases/news-releases---2025/deep-reminds-residents-to-exercise-caution-during-spring-brush-fire-season

Key Planning Information for Wildfire

Wildfire affects most of the region. A large portion of WestCOG is composed of the more susceptible intermix zone in the WUI, where undeveloped land and housing coincide. The coastal areas of WestCOG are at a lower risk to wildfire.

- The WUI can be used for baseline current condition planning considerations. WestCOG has a significant portion of its area that is low-density housing interspersed with undeveloped wildland vegetation (the intermix zone of the WUI) and is vulnerable to wildfire.
- Wildfire causes rippling effects like damaged habitat, degraded air quality causing health impacts, and drinking water supply contamination.
- Over the past several years, the state has faced a steady rise in brush fires, fueled by declining forest health and a warming climate that has brought more frequent drought conditions and higher temperatures.

Identified Best Practices Related to Wildfire

WestCOG municipalities can follow several best practices to mitigate the impacts of wildfire, including:

- **Zoning, Building Codes, and Landscape Management:** WUI Code and community wildfire protection plans encourage land conservation in the WUI and dense development in areas with less risk. Zoning and building code policies can also space homes to create barriers to stop wildfire from spreading and encourage use of fire-resistant building materials.
- **Vegetation Management and Forest Restoration:** Practices such as thinning and prescribed burns have shown large reductions in wildfire intensity.
- **Public Education and Preparedness:** Greater frequency of wildfire and longer wildfire seasons add to the importance of public safety officials regularly communicating with residents to encourage household or business-level risk mitigation, build public support for public wildfire risk management, and to inform residents about wildfire preparedness.

References

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Appendix A: Maps

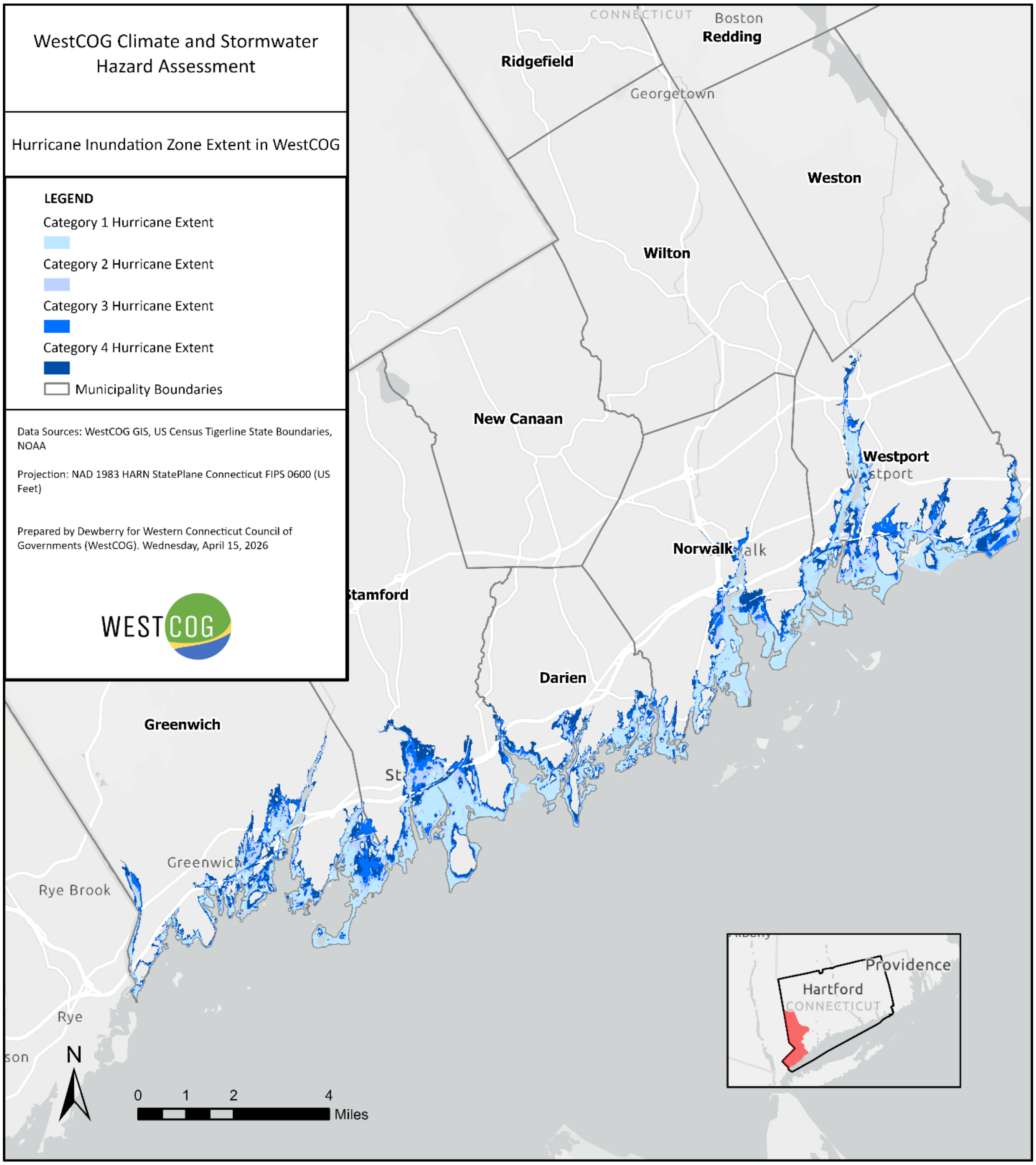

Figure 6. NOAA SLOSH Hurricane Inundation Zone Extents

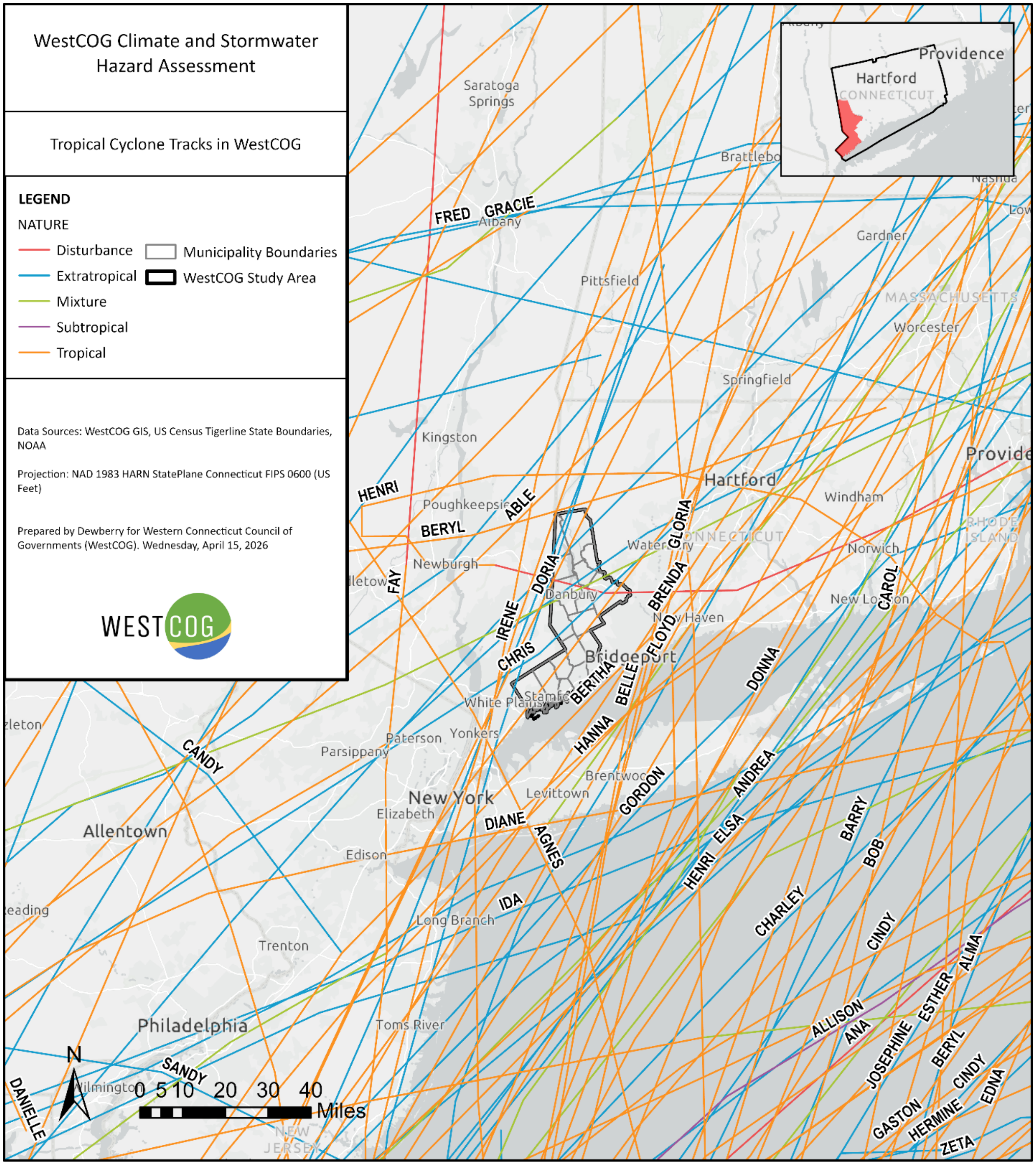

Figure 7. Tropical Cyclone Tracks Intersecting the WestCOG region

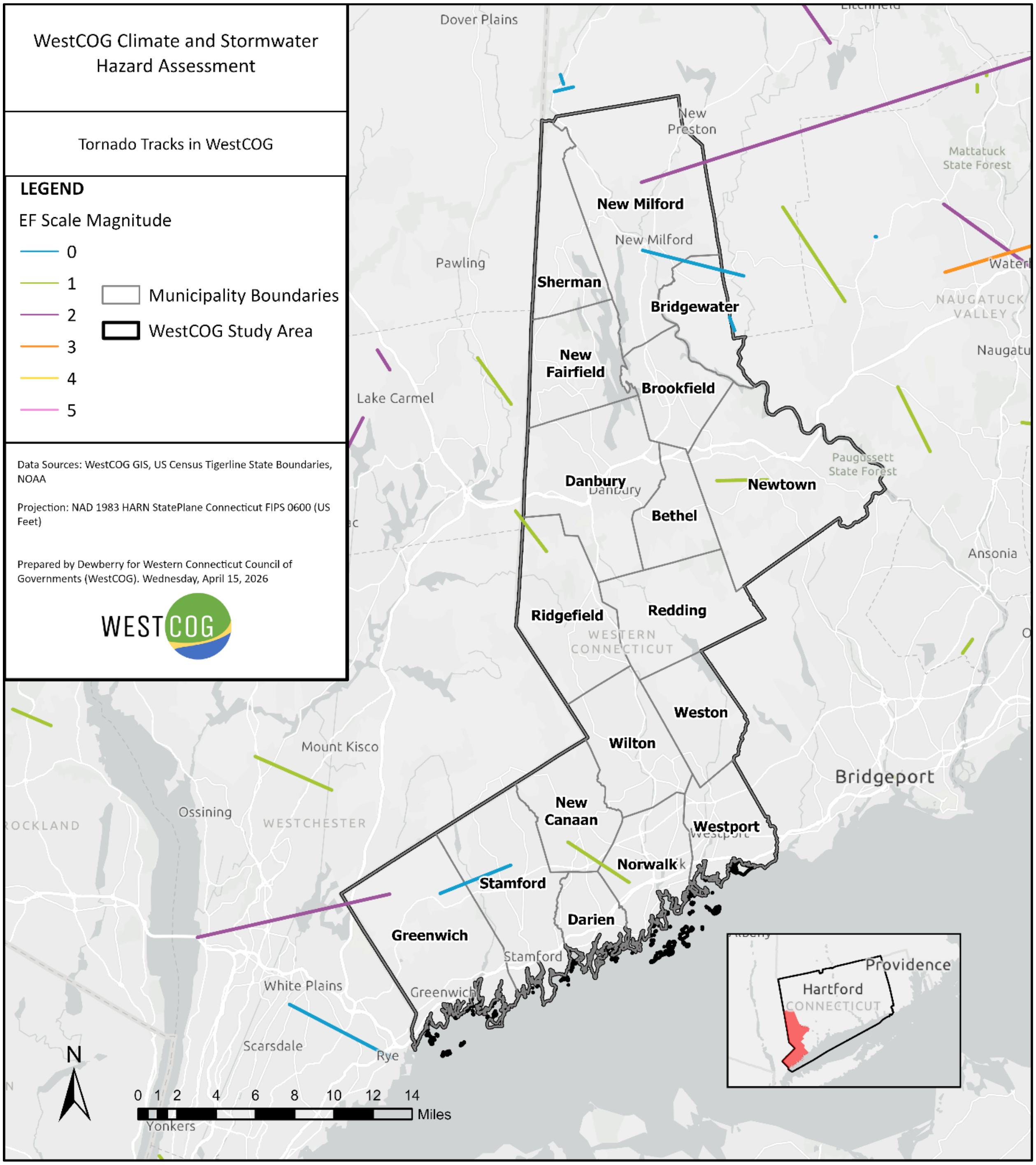

Figure 8. Historical Tornado Tracks Intersecting with WestCOG

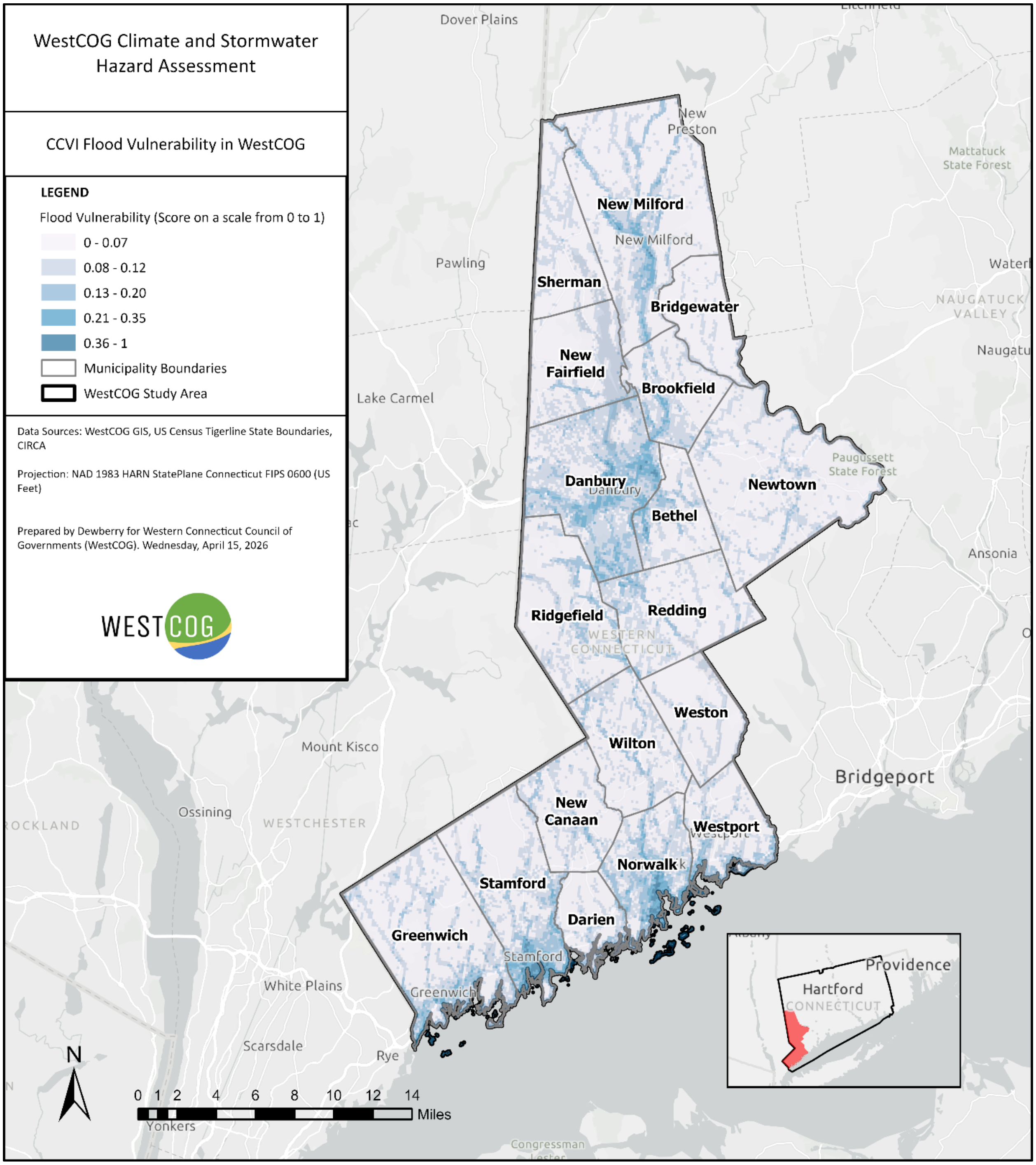

Figure 9. CIRCA Flood CCVI Flood Vulnerability

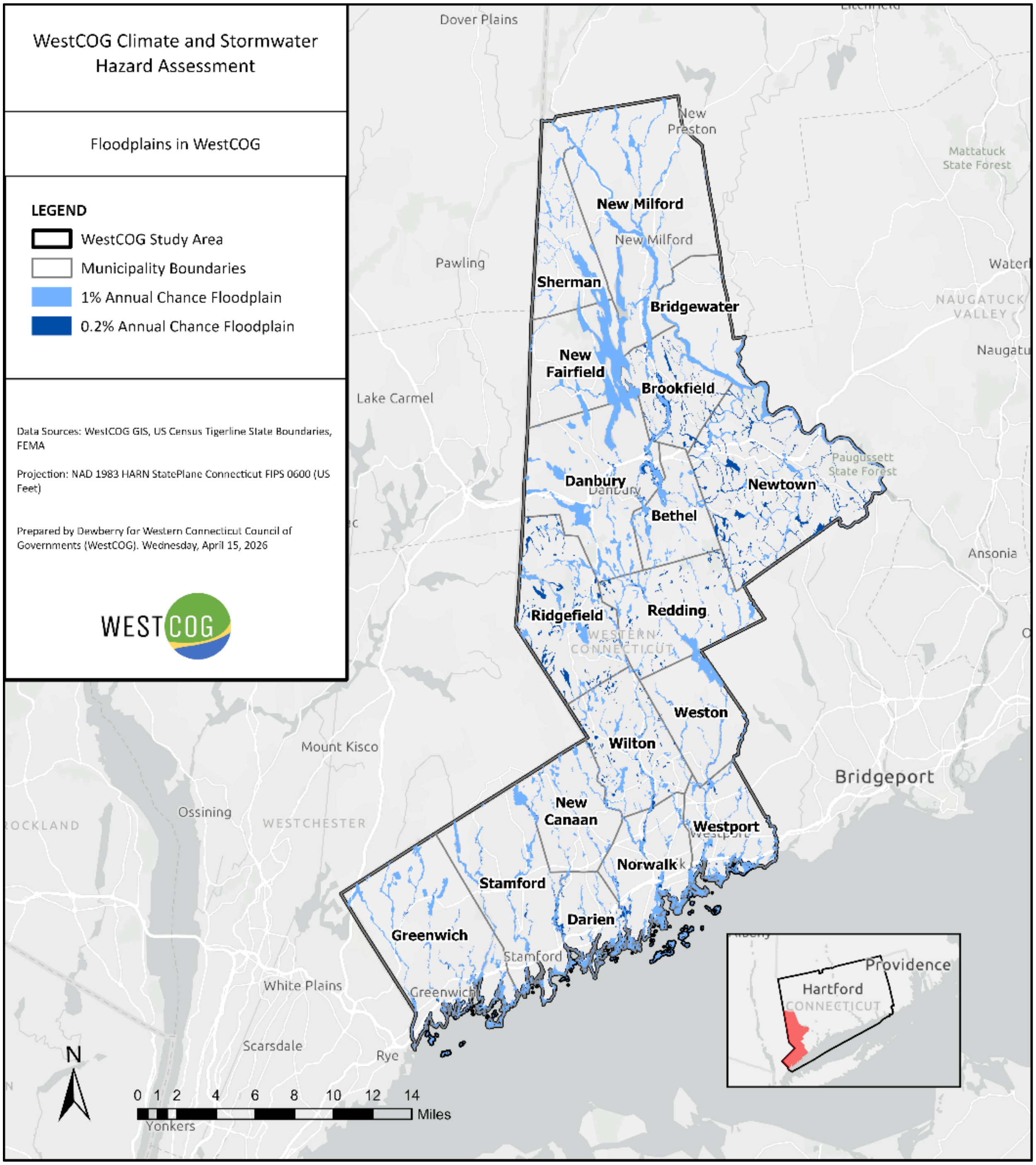

Figure 10. Floodplains in WestCOG

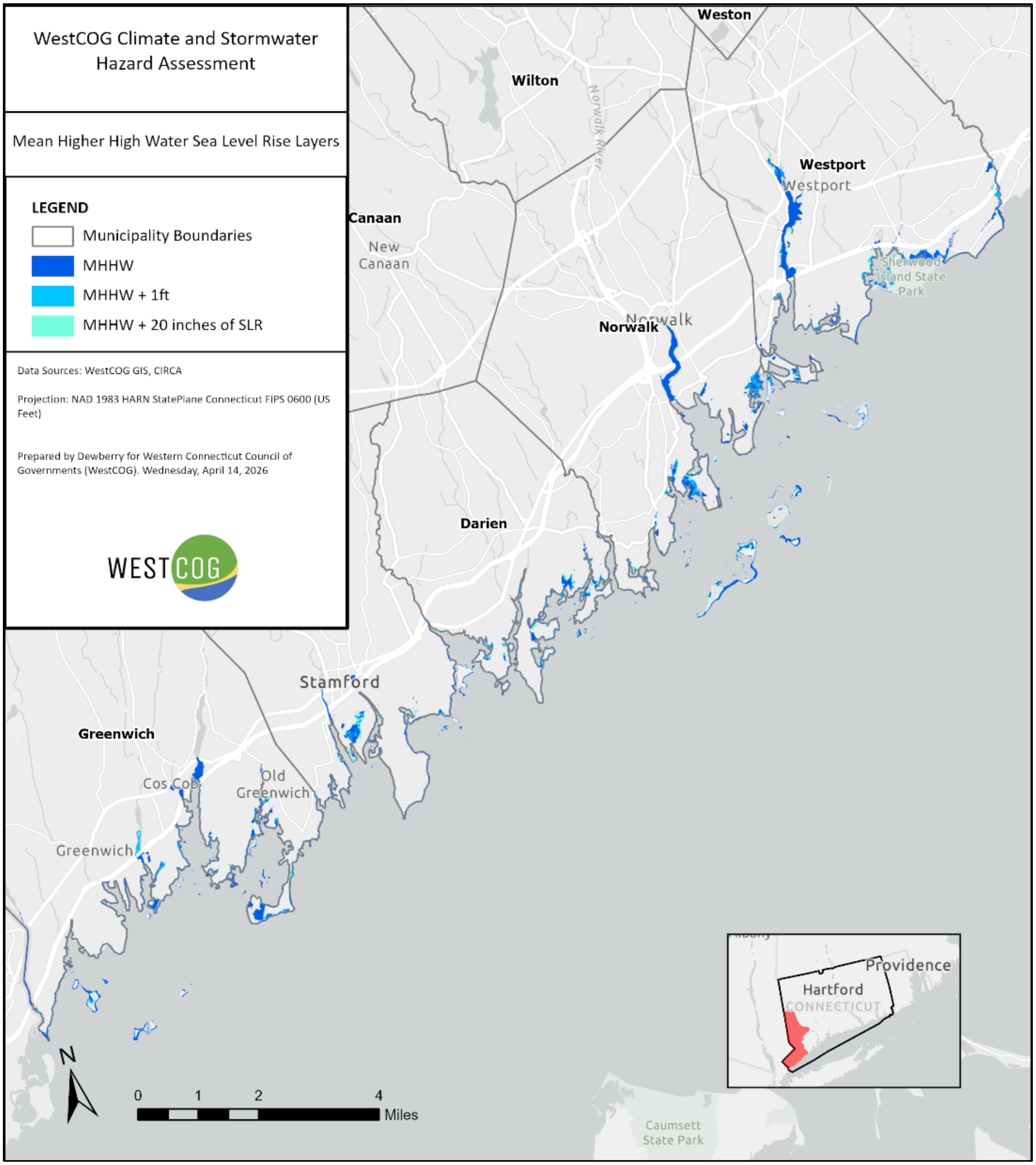

Figure 11. Baseline MHHW and MHHW with SLR Conditions in WestCOG

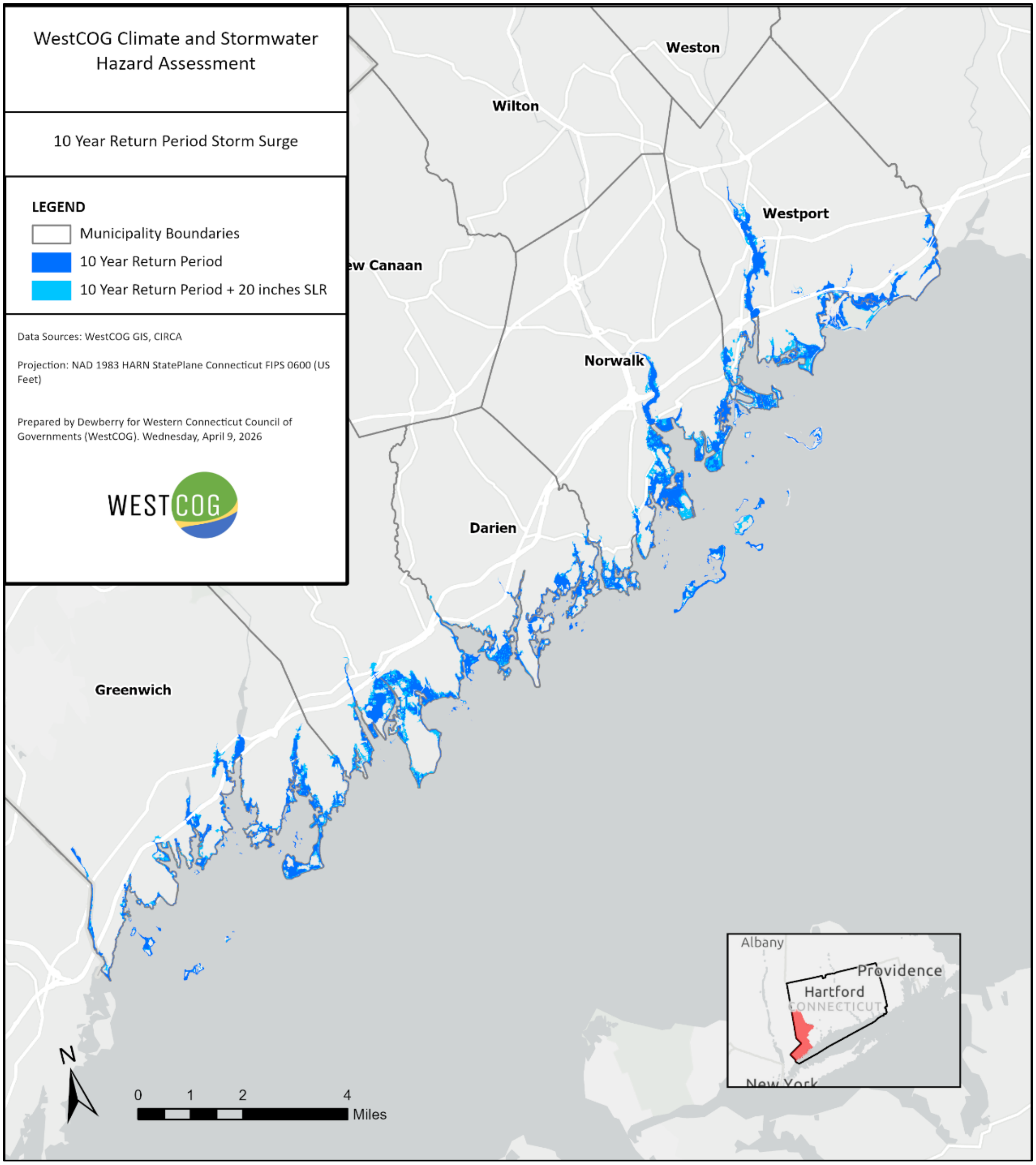

Figure 12. Baseline 10-year Storm Surge and 10-year Storm Surge with SLR Condition in WestCOG

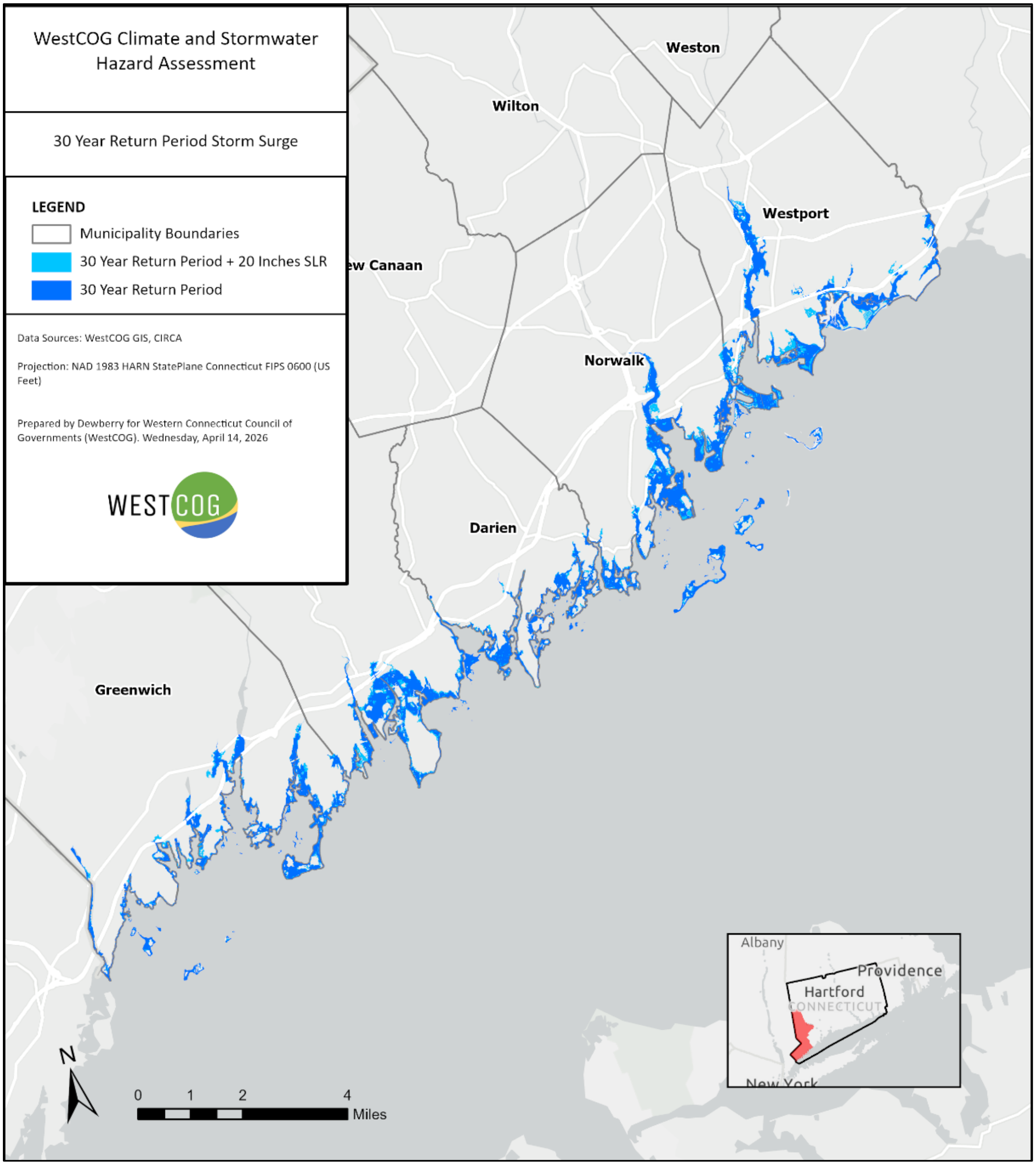

Figure 13. Baseline 30-year Storm Surge and 30-year Storm Surge with SLR Condition in WestCOG

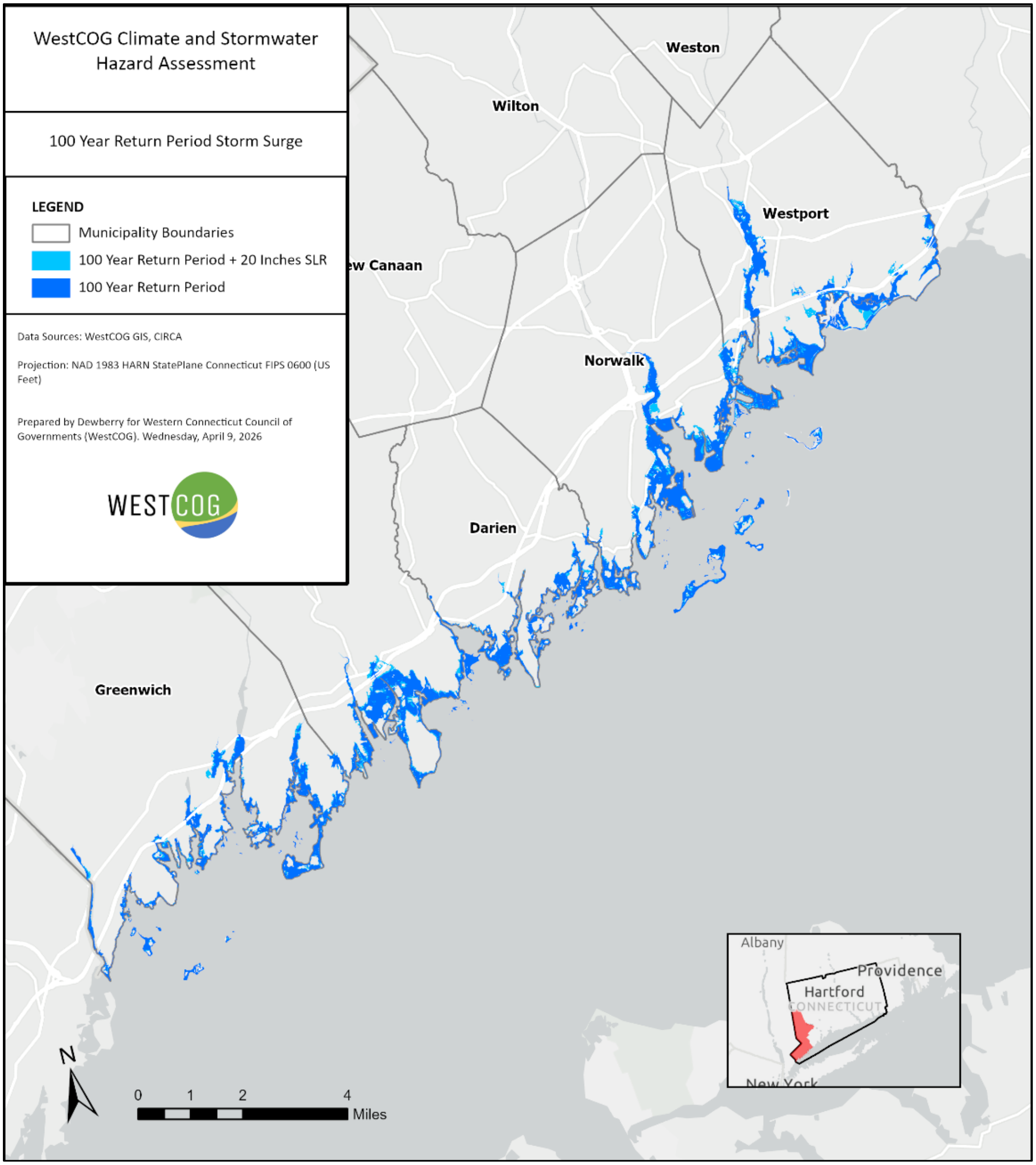

Figure 14. Baseline 100-year Storm Surge and 100-year Storm Surge with SLR Condition in WestCOG

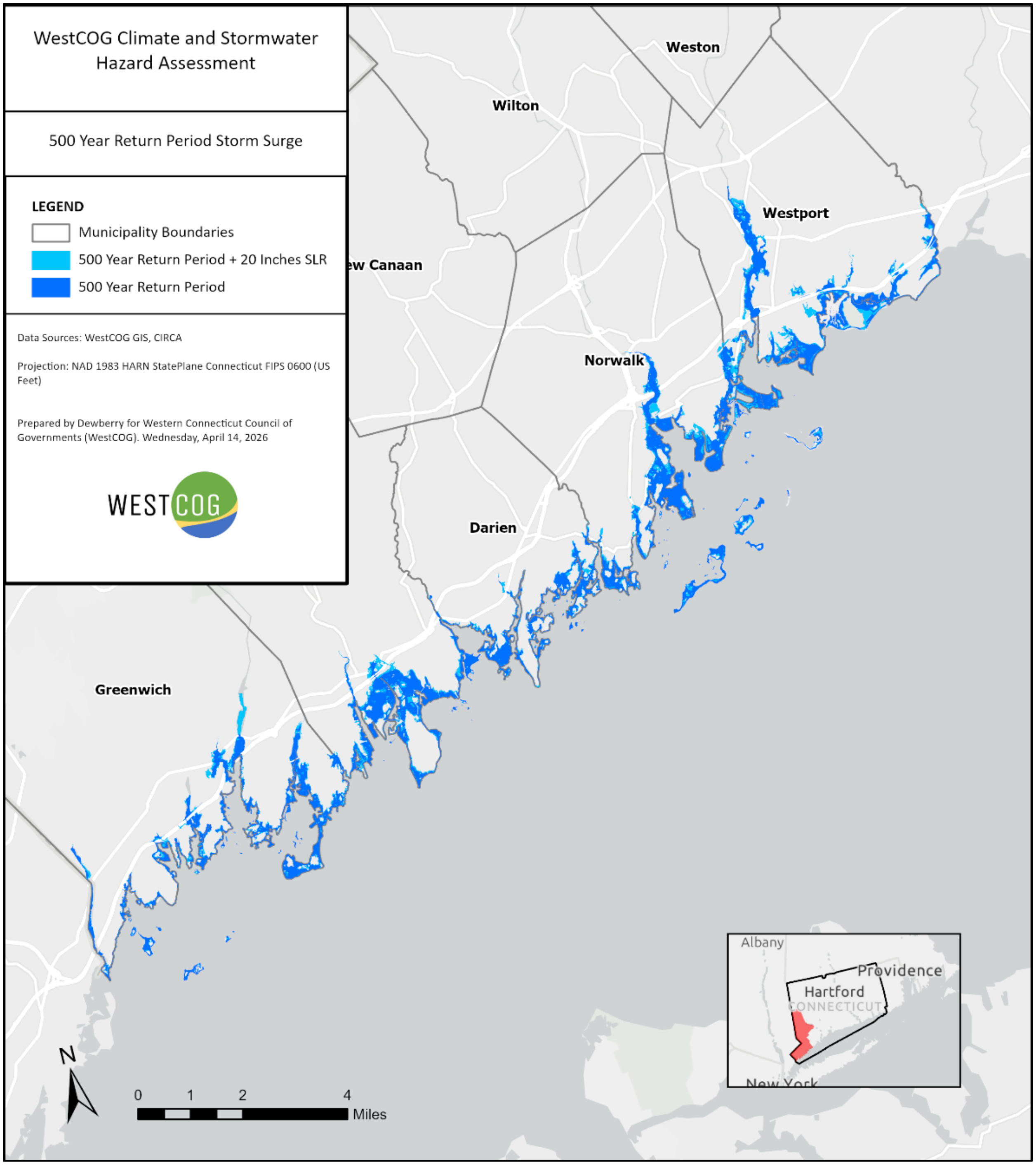

Figure 15. Baseline 500-year Storm Surge and 500-year Storm Surge with SLR Condition in WestCOG

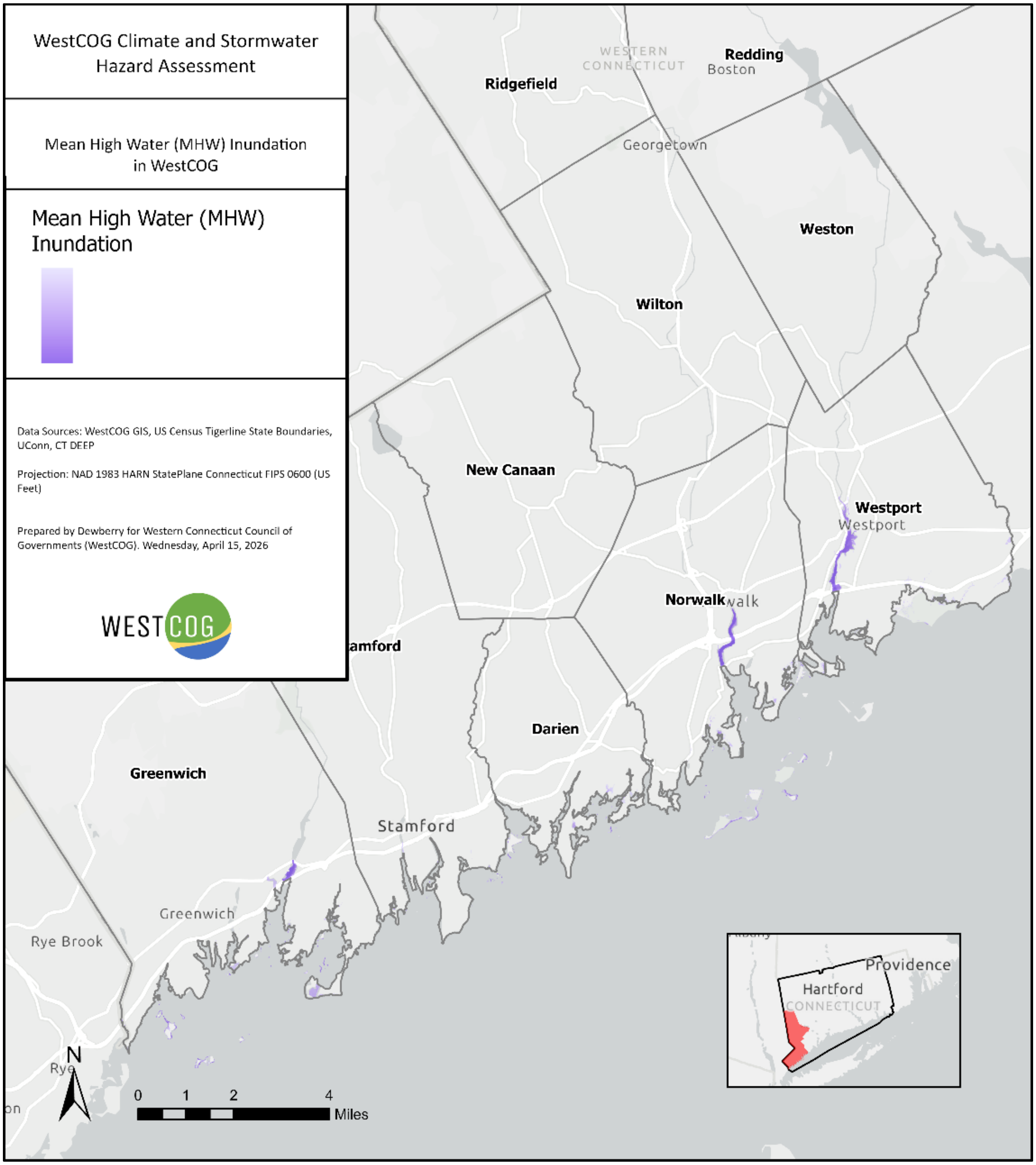

Figure 16. MHW Inundation in Baseline Conditions

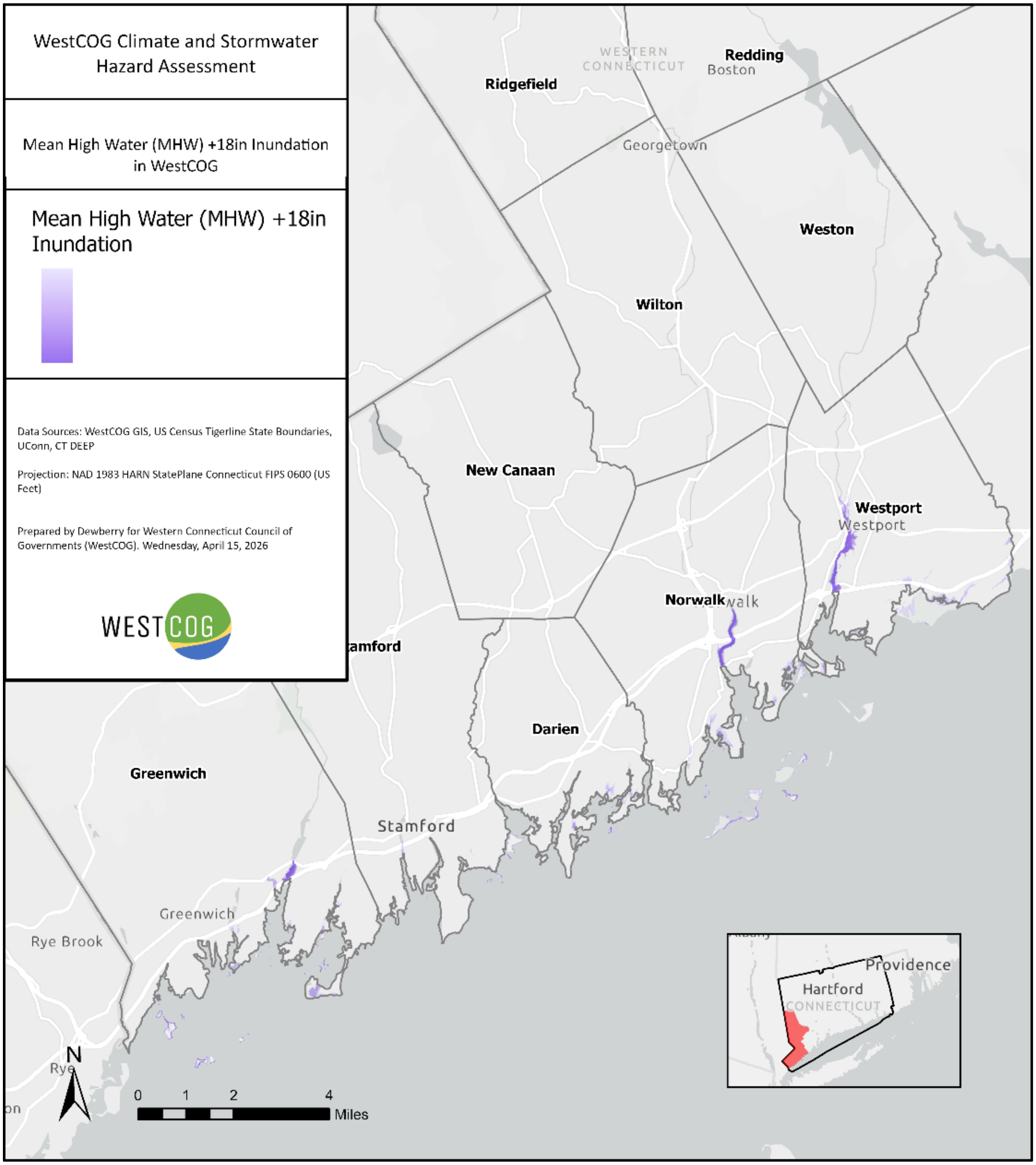

Figure 17. MHW Inundation with 18 inches of SLR

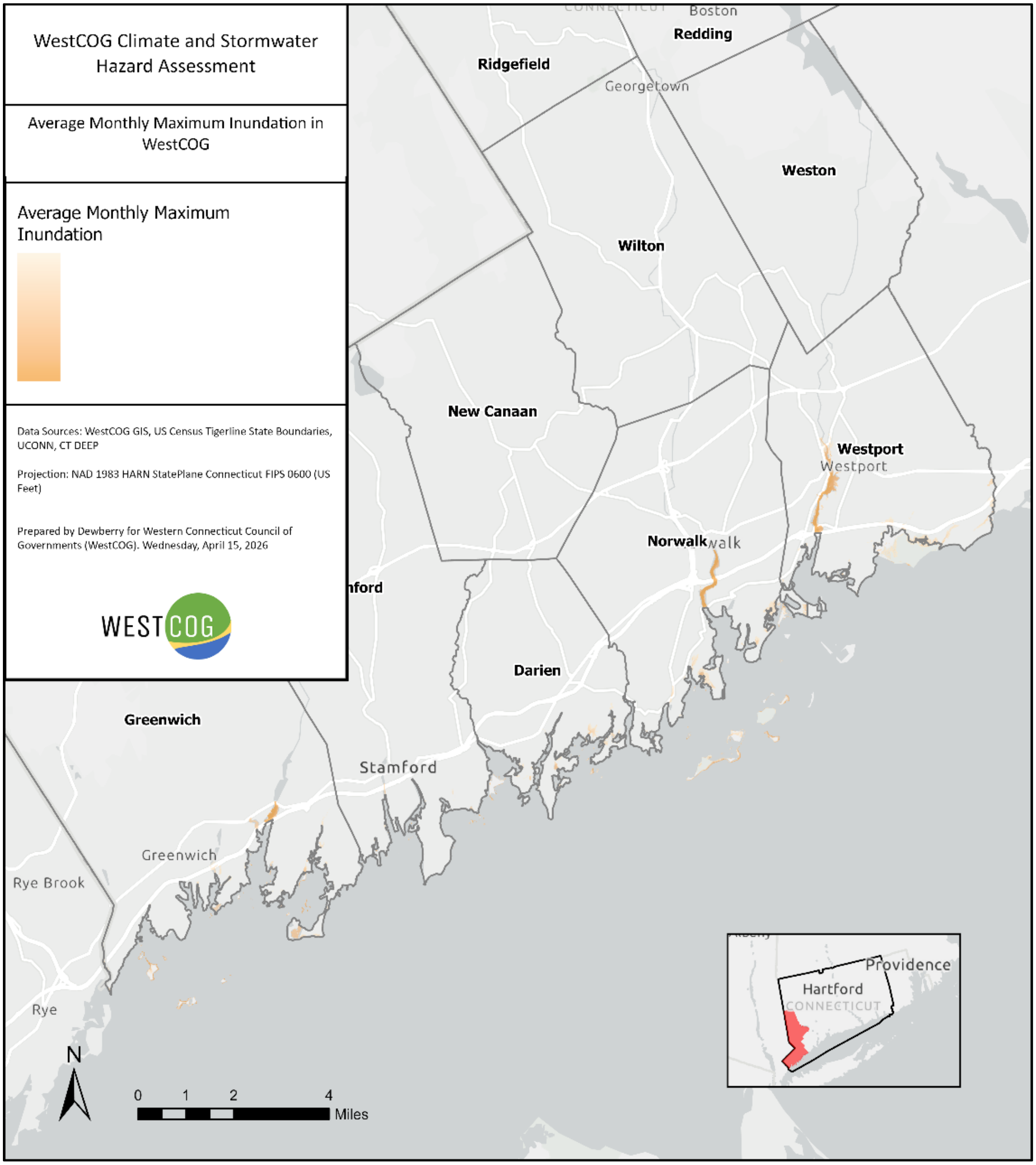

Figure 18. Average Monthly Maximum Inundation in Baseline Conditions

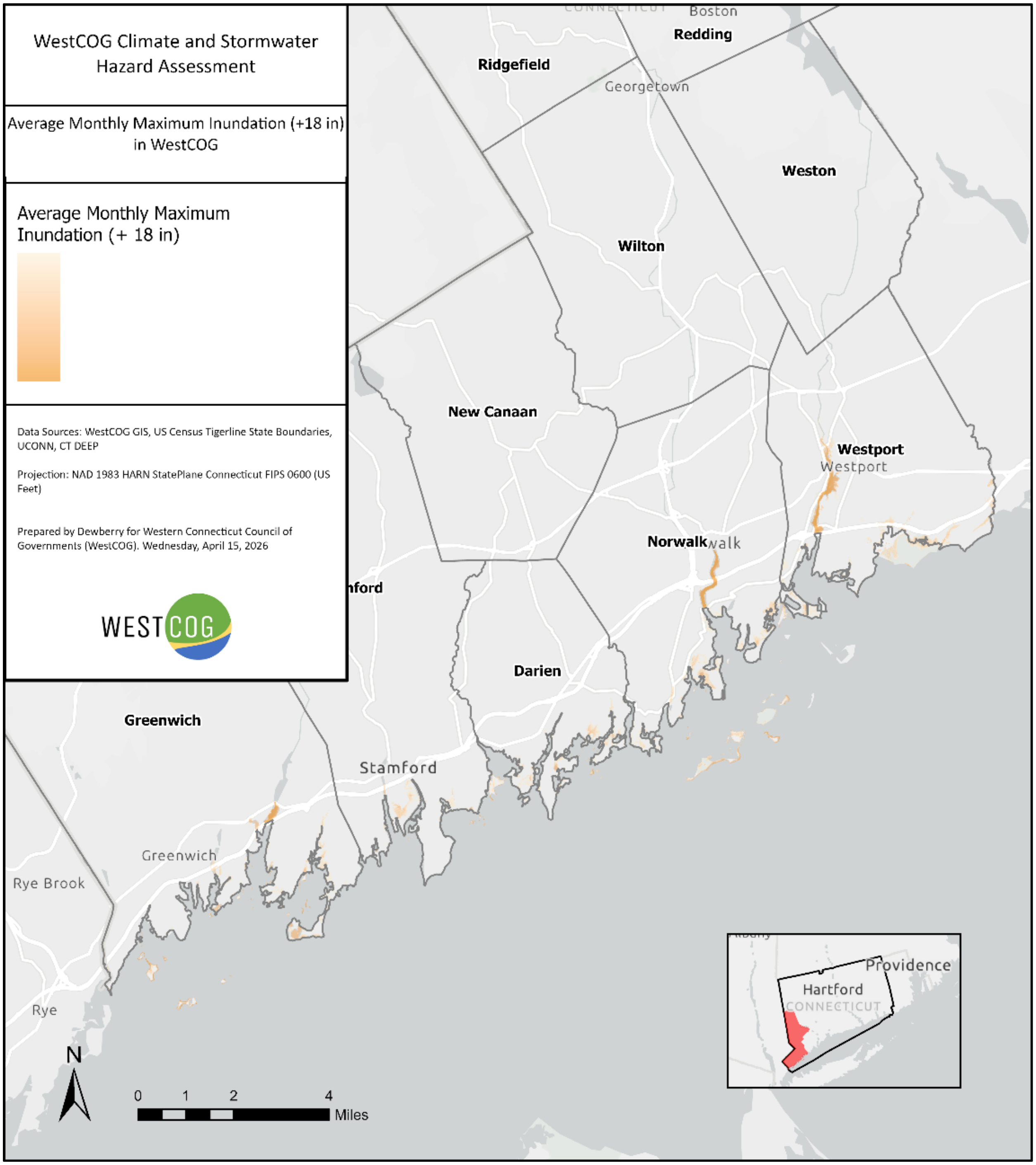

Figure 19. Average Monthly Maximum Inundation with 18 inches of SLR

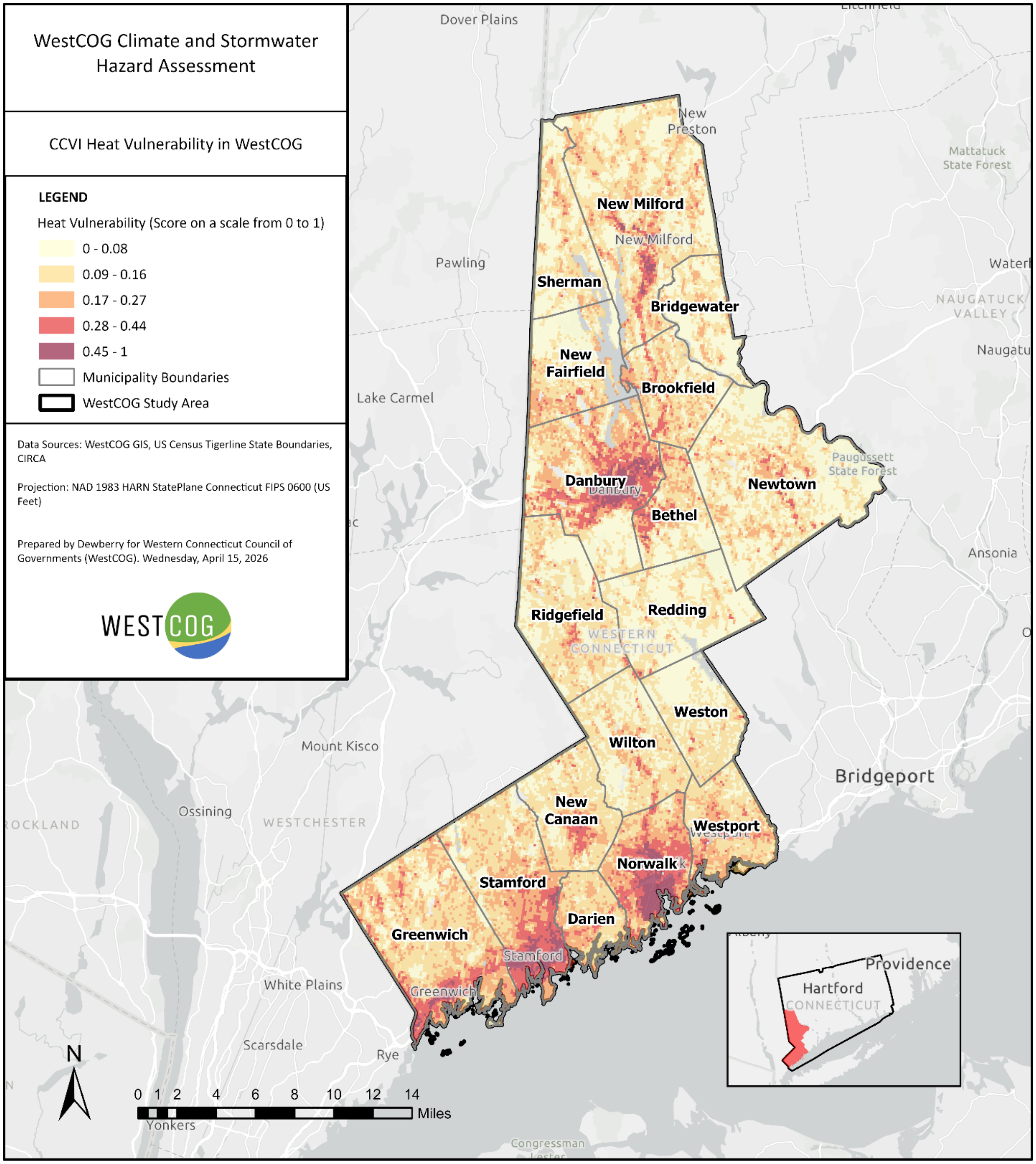

Figure 20. Heat CCVI in WestCOG

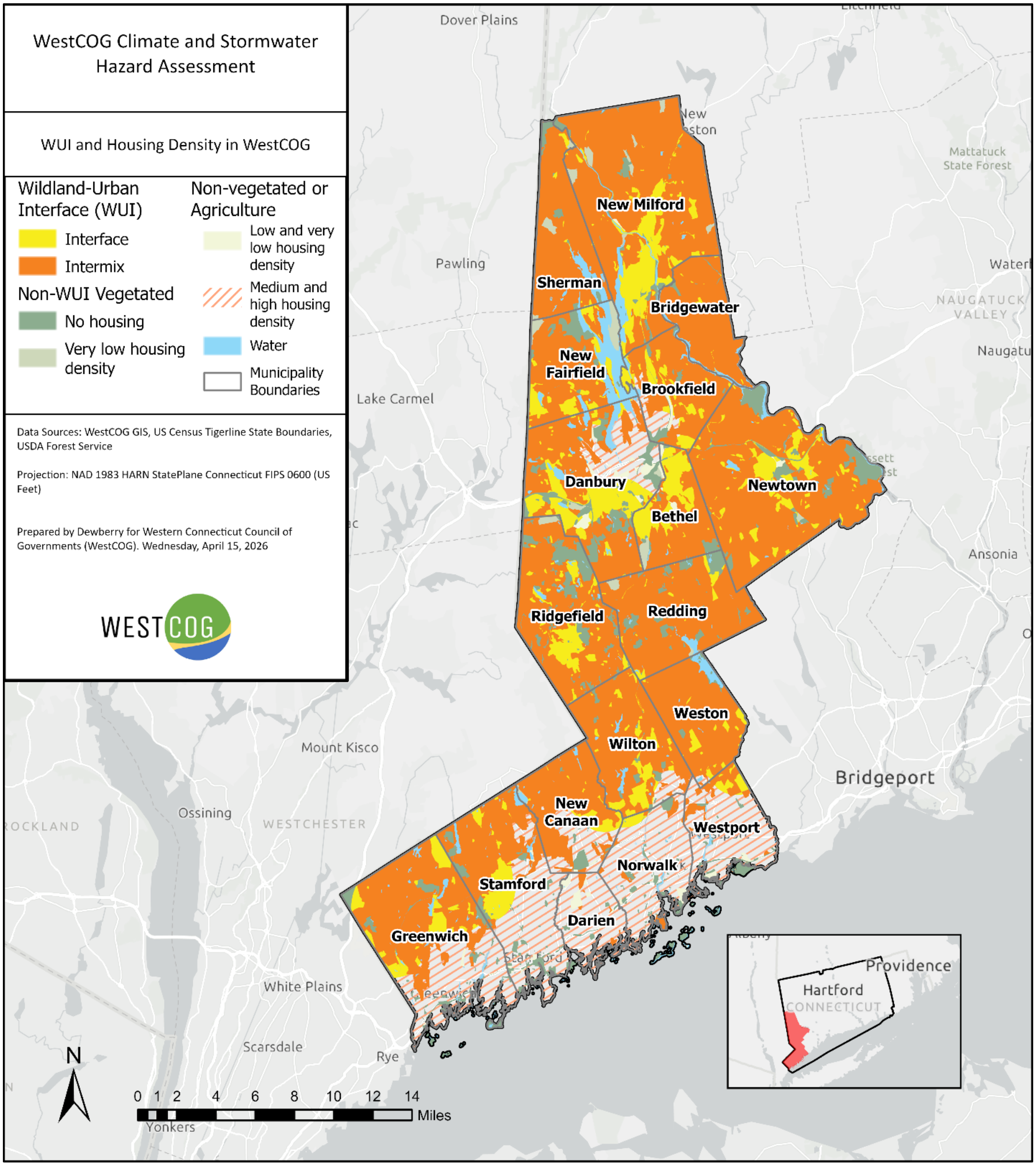

Figure 21. USDA WUI areas and Non-WUI Area Housing Density

Appendix B: Flood Risk Data Sources

FEMA Flood Hazard Information

To understand current impacts to the WestCOG region, FEMA's National Flood Hazard Layer (NFHL), a geospatial database containing current effective flood hazard data, was evaluated. Within this dataset, flood zone information is available geospatially for all of Fairfield County, yet, within the NFHL, there is no data available for Litchfield County. To compensate for this missing information, the 1% annual chance floodplain, otherwise known as the 100-year floodplain, from FEMA's Hazus tool output used in the 2023 CT NHMP was downloaded. The 0.2% annual chance floodplain, otherwise known as the 500-year floodplain, was pulled from the NFHL only for Fairfield County. A map of the 1% and 0.2% annual chance floodplains within the WestCOG region can be found in Appendix A: Maps.