

PUTNAM COUNTY

MULTI-JURISDICTIONAL ALL HAZARDS MITIGATION PLAN

2027 Update

**Volume I
Base Plan**

*Prepared for:
Putnam County
Bureau of Emergency Services
112 Old Route 6, Carmel, NY 10512*



TETRA TECH



Putnam County, New York—Hazard Mitigation Plan

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PREPARED FOR

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EXECUTIVE SUMMARY

Hazard Mitigation Overview

Hazard mitigation is the use of long-term and short-term policies, programs, projects, and other activities to minimize the loss of life, injury, and property damage that can result from a disaster. Communities, residents, and businesses across the United States have been faced with continually increasing costs associated with natural and human-caused hazards. Hazard mitigation is the first step in reducing risk and is the most effective way to reduce costs associated with hazards.

Putnam County has developed a hazard mitigation plan (HMP) to reduce risks from disasters to the people, property, economy, and environment within the County. Developed by the County and nine participating local jurisdictions (the Planning Partners), this HMP updates the 2021 Putnam County HMP. It includes countywide assessment of hazards, risk, and capabilities. The HMP complies with federal and state hazard mitigation planning requirements to establish the Planning Partners' eligibility for funding under Federal Emergency Management Agency (FEMA) grant programs.

The following are the jurisdictions in Putnam County that participated as Planning Partners:

- County of Putnam
- Town of Kent
- Town of Philipstown
- Village of Brewster
- Village of Nelsonville
- Town of Putnam Valley
- Town of Carmel
- Town of Patterson
- Town of Southeast
- Village of Cold Spring

The Planning Process

Overall Approach

To support the planning process, the Planning Partners accomplished the following:

- Developed a Steering Committee consisting of key Putnam County agency stakeholders and a Planning Partnership made up of the Steering Committee members, local fire and police departments, local supervisors and highway superintendents, and other regional stakeholders
- Reviewed the 2021 Putnam County Hazard Mitigation Plan
- Identified hazards of concern to the County to be included in the update
- Profiled the hazards of concern
- Estimated the inventory at risk and potential losses associated with these hazards
- Reviewed and updated the mitigation goals and objectives
- Reviewed mitigation strategy and actions outlined in the 2021 HMP to indicate progress
- Developed new mitigation actions to reduce the vulnerability of assets from hazards of concern
- Involved a wide range of stakeholders and the public in the HMP update process



- Developed mitigation plan maintenance procedures to be executed after obtaining approval of the HMP from the New York Division of Homeland Security and Emergency Services (DHSES) and FEMA

Multiple Agency Support for Hazard Mitigation

Primary responsibility for hazard mitigation lies with local governments. Partners at the regional, state, and federal levels are available to assist local communities with their mitigation strategies. FEMA provides grants, tools, guidance, and training to support mitigation planning. In New York, DHSES is the lead agency providing hazard mitigation planning assistance to local jurisdictions.

The participating jurisdictions provided significant input into the preparation of this HMP, in particular the preparation of jurisdiction-specific annexes included in Volume II. They fully coordinated with and solicited participation from county and local governments, relevant organizations and groups, state and federal agencies, and the general public. This coordination ensured that stakeholders had established communication channels and relationships to support mitigation planning and mitigation actions included in the plan.

Under the project management of the Putnam County Bureau of Emergency Services, the Putnam County Hazard Mitigation Steering Committee provided oversight for the preparation of this plan. The Steering Committee includes representatives from the following:

- Putnam County Bureau of Emergency Services
- Putnam County Department of Planning, Development, and Public Transportation
- Putnam County Soil and Water Conservation District
- Putnam County Economic Development Corporation
- Putnam County Department of Health
- Putnam County Department of Public Works
- Putnam County Climate Smart
- Putnam County Tourism Department
- Putnam County Parks and Recreation Department
- Putnam County Sheriff's Office
- Putnam County Department of Social Services and Mental Health
- Putnam County Public Information Office
- Putnam County Office of IT and GIS

Risk Assessment for Local Hazards of Concern

The Planning Partners evaluated each jurisdiction's risk and vulnerability due to each of the hazards of concern, based on past events, past and predicted future losses, and the expected probability of future occurrence. From these evaluations, hazards were ranked as high, medium, or low risk to each jurisdiction. The hazard rankings were used to focus and prioritize individual jurisdictional mitigation strategies. Summary overall hazard rankings for all of Putnam County are as follows:



- Dam Failure—Low
- Disease Outbreak—Medium
- Drought—High
- Earthquake—Low
- Extreme Temperatures—Medium
- Flood—Medium
- Harmful Algal Blooms—Low
- Severe Storm—High
- Severe Winter Storm—High
- Terrorism—Low
- Wildfire—Medium

Capability Assessment and Plan Integration into Other Local Mechanisms

Effective mitigation is achieved when hazard awareness and risk management become integral parts of public activities and decision-making. Putnam County has many plans and programs that support hazard risk management. This HMP integrates, complements, and references those plans and programs to the extent practical in order for it to be a comprehensive resource for hazard mitigation.

The HMP includes a capability assessment to review relevant local mechanisms for each participating jurisdiction. This assessment identifies where each jurisdiction is currently able to implement hazard mitigation measures and where each would benefit from improved capabilities for such measures. The capability assessment also provides a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county and local) that support hazard mitigation in the County. In the jurisdictional annexes, each participating jurisdiction identifies how it has integrated hazard risk management into its existing planning, regulatory and operational/administrative framework, and how it intends to continue to promote this integration.

Mitigation Strategy

Hazard Mitigation Plan Goals and Objectives

The HMP includes mitigation goals for reducing or avoiding long-term vulnerabilities to the identified hazards of concern. The planning process included a review and update of previous mitigation goals and objectives developed to guide the selection of mitigation actions. The goals and objectives were updated based on the updated risk assessment, discussions, research, and input from plan participants and stakeholders. The goal development process considered the goals expressed in the New York State Hazard Mitigation Plan, as well as other relevant county and local planning documents.

2027 Putnam County HMP Goals

Goal 1: Protect life and property.

Goal 2: Increase public awareness, education, and outreach efforts among all stakeholders to foster resilience, preparedness and mitigation opportunities in the public and private spheres.

Goal 3: Protect natural systems and encourage their use to mitigate natural hazards.

Goal 4: Enhance or develop programs to build regional, county, and local mitigation and related emergency management capabilities.

Goal 5: Promote resilient and sustainable land development practices to improve the ability to recover and bounce back faster from impacts of natural hazard events.

Goal 6: Address long-term vulnerabilities from high-hazard and vulnerable dams.



Implementation of the 2021 Plan

The status of the mitigation projects identified in the 2021 HMP was reviewed for this HMP. Numerous projects and programs have been implemented that have reduced hazard vulnerability to assets in the planning area. Uncompleted projects have been evaluated, modified as necessary, and incorporated into this plan. The Planning Partners' annexes describe these mitigation activities in more detail, and plan maintenance procedures have been developed to encourage thorough integration with local decisions and processes and regular review of implementation progress.

2027 Mitigation Strategy

Jurisdictional actions included in the mitigation strategy had a focus on the training and education of municipal officials, including the Floodplain Administrators; ensuring continuity of operations for critical facilities through the installation of emergency backup generators; the reduction of flood risk through the increase in capacity of stormwater infrastructure, including culverts, drainage systems, and catch basins; and working to identify safety measures and procedures of dams within the various jurisdictions.



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PART 1:

THE PLANNING

PROCESS AND

PLANNING AREA





1. INTRODUCTION

Putnam County has developed a hazard mitigation plan (HMP) to reduce risks from disasters to the people, property, economy, and environment within the County. Developed by the County and nine participating local jurisdictions, this HMP updates the 2021 Putnam County HMP. The updated 2027 HMP includes countywide analysis and assessment of hazards, risk, and capabilities.

1.1 OVERVIEW TO HAZARD MITIGATION PLANNING

1.1.1 What Is Hazard Mitigation?

Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk and effects that can result from hazards. The Federal Emergency Management Agency (FEMA) defines a hazard mitigation plan as the documentation of a state or local government's evaluation of natural hazards and strategies to mitigate them.

Effective mitigation planning helps people, organizations, and government agencies to better prepare for and respond when disasters occur. It also allows local governments to remain eligible for FEMA grant funding for mitigation projects that will reduce the impact of future disaster events. The long-term benefits of mitigation planning and implementation include the following:

- An increased understanding of hazards faced by local communities
- A more sustainable and disaster-resistant community
- Financial savings through partnerships that support planning and mitigation efforts
- Focused use of limited resources on hazards that have the biggest impact on the community
- Reduced long-term impacts and damage to human health and structures
- Reduced costs associated with response and recovery efforts, including repairs

The **Federal Emergency Management Agency** (FEMA) estimates that for every dollar spent on damage prevention (mitigation), twice that amount is saved by not having to perform post-disaster repairs.

1.1.2 Regulatory Framework

Federal policy encourages communities to assess their vulnerability to hazards before disaster strikes and then take actions to reduce potential risks. A disaster-resistant community can rebound more quickly and cost-effectively from a natural disaster, with less human injury or loss of property. This minimizes other losses associated with disasters, such as the time lost from productive activity by businesses and industries.

The federal Disaster Mitigation Act of 2000 (DMA) encourages hazard mitigation planning by states, tribes, and local governments. Under the DMA, communities seeking certain hazard-related federal funding must identify potential natural hazards and identify and prioritize actions that can be taken by the community to mitigate those hazards before disaster strikes.

Regulations implementing the DMA are included in Title 44 of the Code of Federal Regulations, Section 201 (44 CFR 201). To be eligible for hazard mitigation assistance from the federal government, communities must have



an approved hazard mitigation plan and must update it on a 5-year basis. Table 1-1 summarizes the 44 CFR 201 requirements and where each is addressed in this HMP.

Table 1-1. FEMA Hazard Mitigation Plan Review Crosswalk

Plan Criteria	Primary Location in Plan
Prerequisites	
Adoption by the Local Governing Body: §201.6(c)(5)	Chapter 2; Appendix A
Planning Process	
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Chapter 2
Risk Assessment	
Identifying Hazards: §201.6(c)(2)(i)	Chapter 5
Profiling Hazards: §201.6(c)(2)(i)	Chapters 6 – 16
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)	Chapter 3; Chapter 4; Chapters 6 – 16
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)	Chapter 3; Chapters 6 – 16
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)	Chapter 3; Chapters 6 – 16
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)	Chapter 3; Chapters 6 – 16; Volume II Annexes
Mitigation Strategy	
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Chapter 19; Volume II Annexes
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)	Chapter 19; Volume II Annexes
Implementation of Mitigation Actions: §201.6(c)(3)(iii)	Chapter 19; Volume II Annexes
Multi-Jurisdictional Mitigation Actions: §201.6(c)(3)(iv)	Chapter 19; Volume II Annexes
Plan Maintenance Process	
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)	Chapter 20
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Chapter 20; Volume II Annexes
Continued Public Involvement: §201.6(c)(4)(iii)	Chapter 20

One goal of the federal regulations is to facilitate cooperation between state and local authorities. This enables local and state governments to better articulate their mitigation needs, resulting in faster allocation of funding and more effective risk reduction projects. In New York, responsibility for fulfilling the requirements of the DMA and 44 CFR 201 has been delegated to the Division of Homeland Security and Emergency Services (DHSES).

1.1.3 Specialized Terms and Concepts

Hazard mitigation has developed its own set of terms and concepts over the years with particular meanings within the hazard mitigation practice. The list below provides a quick reference for specialized terms whose use is especially prominent in this HMP:

- **Asset**—anything that is important to the character and function of a community (e.g., people, structures, community lifelines, the economy, and natural, historic, and cultural resources) (FEMA 2023f)
- **Capability assessment**—an evaluation of which authorities, policies, programs, funding and resources a participant has to accomplish hazard mitigation (FEMA 2023f)



- **Cascading impacts**—a chain of consequences associated with a primary hazard event (National Academies of Sciences, Engineering, and Medicine 2022)
- **Community lifelines**—the most fundamental services in a community that, when stabilized, enable all other aspects of society to function (FEMA 2023f)
- **Extent**—the potential intensity of a hazard within a community, often expressed using quantitative scientific scales (FEMA 2022b)
- **Hazard profile**—a description of a hazard's location, extent, previous occurrences and probability of future events within a community (FEMA 2023f)
- **Hazard ranking**—the process of identifying the hazards that pose the greatest risk to a community, based on how likely the hazard is to occur, the potential consequences if the hazard does occur, and other relevant local factors
- **Impact**—the consequences or effects of a hazard on a community's assets (FEMA 2023f)
- **Integration**—the inclusion of hazard mitigation principles, vulnerability information and mitigation actions into other existing community planning to leverage activities that have co-benefits, reduce risk and increase resilience (FEMA 2022b)
- **Mitigation action**—measures, projects, plans or activities to reduce the current and future vulnerabilities identified in the risk assessment (FEMA 2023f)
- **Mitigation strategy**—the long-term blueprint for reducing the potential hazard-related losses identified in the risk assessment; the strategy consists of mitigation goals, mitigation actions, and a plan for implementing the actions (FEMA 2023f)
- **Natural hazard**—a source of harm or difficulty created by a meteorological, environmental or geological event (FEMA 2023f)
- **Plan maintenance**—monitoring and updating a hazard mitigation plan as warranted by changing conditions, availability of new information, and progress on the proposed mitigation actions (FEMA 2023f)
- **Planning process**—the procedures used to develop a hazard mitigation plan with broad acceptance across the community
- **Risk**—the potential for damage or loss when natural hazards interact with people or assets (FEMA 2023f)
- **Risk assessment**—a data-driven analysis to find where a local jurisdiction is vulnerable to hazards (FEMA 2023f)
- **Social vulnerability**—the potential for loss within an individual or social group, as affected by traits that influence an individual's or group's resilience, which is their ability to prepare, respond, cope or recover from an event (FEMA 2023f)
- **Stakeholder**—individuals or groups that a mitigation action or policy affects, including businesses, private organizations and residents (FEMA 2023f)
- **Vulnerability**—a description of which assets within locations identified to be hazard prone are at risk from the effects of the hazard (FEMA 2023f)

1.2 HISTORY OF HAZARD MITIGATION IN PUTNAM COUNTY

Putnam County has been included in 29 federal disaster declarations (major disaster, fire management, and emergency) since the first such declarations were issued in 1953. Through ongoing hazard mitigation activities, the



County has demonstrated that it is proactive in protecting its physical assets and citizens against losses from natural hazards. Examples of these activities include the following:

- The County facilitated the development of the original Putnam County HMP in 2015 and updated it in 2021. The most recent update identified the following as the greatest hazards of concern in Putnam County:
 - Disease outbreak
 - Flood
 - Severe winter storm
 - Drought
 - Harmful algal bloom
 - Terrorism
 - Earthquake
 - Severe storm
 - Wildfire
 - Extreme temperature
- All municipalities participating in this HMP update participate in the National Flood Insurance Program (NFIP), which requires the adoption of FEMA floodplain mapping and certain minimum standards for building within the floodplain.
- Reports, plans, and studies relating to or including information on natural hazards or natural hazard policies affecting Putnam County have been developed. As discussed in Chapter 2, these documents have been reviewed and incorporated into this HMP update as appropriate

1.3 THE CURRENT HMP UPDATE

1.3.1 Key Changes from the Previous HMP

This HMP update represents the regulatory five-year HMP update for the County. Its development included the participation of nine jurisdictions in the County, along with key County and regional stakeholders. The following are the most significant changes made between the previous County HMP (2021) and the current (2027) update:

- The 2021 Putnam County HMP did not identify dam failure as a hazard of concern. Members of the Steering Committee and Planning Partnership identified this as a hazard of concern for the 2027 HMP update.
- For the 2027 HMP update, the capability assessment was expanded and is presented as a stand-alone chapter. The discussion of capabilities in each jurisdictional annex has been expanded as well (Volume II).
- The 2027 HMP update considers and utilizes updated data for the GIS risk assessment, which was then integrated into applicable hazard profiles as well as jurisdictional annexes (Volume II).

1.3.2 Plan Organization

The Putnam County HMP provides a detailed review and analysis of each hazard of concern, resources, and relevant statistical information for the Planning Partners. The HMP is organized into two volumes: Volume I includes all information that applies to the entire planning area (Putnam County); and Volume II includes specific information for each participating jurisdiction.

Volume I includes a description of the County and its jurisdictions as well as information on mitigation planning and how the risk assessment and capability assessment were performed. It includes the following chapters:

- Part 1: The Planning Process and Planning Area
 - Chapter 1: Introduction



- Chapter 2: Planning Process—A description of the plan methodology and development process, committee and stakeholder roles and activities, and how the HMP will be incorporated into existing programs. Information regarding the adoption of the HMP by each participating jurisdiction
- Chapter 3: County Profile—An overview of Putnam County, including general information and physical conditions, land use patterns and trends, population and demographics, economy, general building stock inventory, community lifelines, and natural, historic, and cultural resources
- Part 2: Risk Assessment
 - Chapter 4: Methodology—Description of the methodology used to assess hazard risk and the status of local data
 - Chapter 5: Hazards of Concern Identification—Documentation of the process of identifying the natural hazards of concern for further profiling and evaluation
 - Chapters 6 – 16—Hazard profiles and findings of the risk assessment (estimates of the impact of hazard events on life, safety, and health; general building stock; critical facilities; the economy, and natural, historic, and cultural resources)
 - Chapter 17: Hazard Ranking—Description of the hazard ranking process and summary of results
- Part 3: Capability Assessment
 - Chapter 18: Capability Assessment—A summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, local) that support hazard mitigation within the County
- Part 4: Mitigation Strategy
 - Chapter 19: Mitigation Strategy—Information regarding the mitigation goals and objectives identified in response to priority hazards of concern, and the process by which mitigation strategies were developed for each Planning Partner
- Part 5: Plan Maintenance
 - Chapter 20: Plan Maintenance Procedures—A system to continue to monitor, evaluate, maintain, and update the plan

Volume II consists of annexes for each participating jurisdiction. Each annex summarizes the jurisdiction's planning, regulatory, and fiscal capabilities; evaluates vulnerabilities to hazards; describes the status of past mitigation actions; and provides a specific mitigation strategy. The annexes provide each jurisdiction with an expedient resource for implementing mitigation projects and maximizing future grant opportunities.

Appendices provide supplemental information that supports the main text but is too detailed to include within it.



2. PLANNING PROCESS

This chapter describes the planning process used to update the Putnam County HMP, including how it was prepared, who was involved in the process, and how the public was involved. The planning approach aimed to achieve the following results:

- The plan will be multi-jurisdictional, including all municipalities in the County. Putnam County invited all jurisdictions in the County to join in the planning process. To date, all nine local municipal governments in the County (the Planning Partnership) have participated in the 2027 plan update process:
 - County of Putnam
 - Town of Kent
 - Town of Philipstown
 - Village of Brewster
 - Village of Nelsonville
 - Town of Putnam Valley
 - Town of Carmel
 - Town of Patterson
 - Town of Southeast
 - Village of Cold Spring
- The format of this HMP is such that other entities can easily join at a later date as part of the regulatory 5-year plan update process.
- The HMP considers all natural hazards that pose a risk to the area, as required by 44 CFR 201. Non-natural hazards that pose significant risk were considered as well.
- The HMP was developed following FEMA regulations and prevailing FEMA and state guidance. This ensures that all the requirements are met and supports plan review. In addition, this HMP will meet criteria for the National Flood Insurance Program (NFIP) Community Rating System (CRS) and the Flood Mitigation Assistance (FMA) programs.

2.1 GENERAL MITIGATION PLANNING APPROACH

FEMA provides hazard mitigation planning support to local communities through guidance, resources, and plan reviews. This hazard mitigation plan was prepared in accordance with the following regulations and guidance:

- Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (FEMA January 2013)
- Integrating Hazard Mitigation into Local Planning (FEMA March 1, 2013)
- Plan Integration: Linking Local Planning Efforts (FEMA July 2015)
- Local Mitigation Planning Policy Guide (FEMA April 11, 2025)
- Local Mitigation Planning Handbook (FEMA June 2025)
- DMA (Public Law 106-390) (October 30, 2000)
- 44 CFR 201 and 206 Interim Final Rules (February 26, 2002, through September 13, 2004)
- Hazard Mitigation Planning Standard (NYS DHSES 2022)
- New York State Hazard Mitigation Plan (NYS DHSES 2024)



2.2 PLANNING PROCESS PARTICIPANTS

2.2.1 Project Management and Planning Consultant

Project management was the responsibility of the Putnam County Bureau of Emergency Services. A contract planning consultant (Tetra Tech) assisted with the following:

- Organization of Steering Committee and Planning Partnership
- Development and implementation of a public and stakeholder outreach program
- Data collection
- Facilitation of meetings (Steering Committee, municipal, stakeholder, public and other)
- Update of the hazards of concern, and hazard profiling and risk assessment
- Update of mitigation planning goals and objectives
- Review of past mitigation strategy progress
- Screening, selection, and prioritization of mitigation actions
- Preparation of the draft and final plan documents

2.2.2 Planning Partnership

In April 2026, the County notified all municipalities in the County of the pending planning process and invited them to formally participate. All participating jurisdictions, including the County, are recognized as Planning Partners and belong to the Planning Partnership for this HMP.

Designated Representatives

Each participating jurisdiction identified points of contact to facilitate their participation and represent the interests of their communities on the Planning Partnership. Representatives were charged with the following:

- Representing their jurisdiction throughout the planning process
- Ensuring participation of all departments and functions within their jurisdiction that have a stake in mitigation (e.g., planning, code enforcement, police, emergency services, public works)
- Assisting in gathering information for inclusion in the HMP update, including previously developed reports and data
- Promoting the public involvement process
- Reporting on progress of mitigation actions identified in prior or existing HMPs
- Identifying, developing, and prioritizing mitigation actions for the updated HMP
- Reporting on progress of integration of prior or existing HMPs into other planning processes and municipal operations
- Supporting the development of a jurisdictional annex
- Reviewing, amending, and approving all sections of the HMP update
- Adopting, implementing, and maintaining the HMP update



Table 2-1 shows the primary and alternate jurisdictional representatives of the Planning Partnership. Appendix D (Participation Matrix) identifies how each individual who represented the jurisdictions during this planning effort contributed to the planning process.

Table 2-1. Putnam County Hazard Mitigation Planning Partnership Members

Jurisdiction	Primary Point of Contact	Title	Alternate Point of Contact	Title
County of Putnam	Matthew Nadolny	Director of Emergency Management	James Oster	Commissioner of the Bureau of Emergency Services
Village of Brewster	James Schoenig	Mayor	Michelle Diebold	Village Clerk
Town of Carmel	Richard Franzetti	Town Engineer	Michael Cazzari	Town Supervisor
Village of Cold Spring	Abigail McKinney	Secretary to Zoning Board/Building Department Clerk	Kathleen Foley	Mayor
Town of Kent	Jaime McGlasson	Town Supervisor	Richard Othmer Jr.	Highway Superintendent
Village of Nelsonville	Chris Winward	Mayor	Melissa Harris	Village Clerk
Town of Patterson	Richard Williams Sr.	Town Supervisor	Edward Foster Jr.	Highway Superintendent
Town of Philipstown	John Van Tassel	Town Supervisor	Adam Hotaling	Highway Superintendent
Town of Putnam Valley	Alison Jolicoeur	Town Supervisor	Shawn Keeler	Highway Superintendent
Town of Southeast	Joseph Castellano	Town Supervisor	Michael Burdick	Highway Superintendent

The designated local NFIP floodplain administrator was identified as part of the municipality's hazard mitigation planning team (see the jurisdictional annexes in Volume II). Local floodplain administrators were informed of the planning process, reviewed the HMP documents, and provided direct input to the HMP update.

Planning Process Participation

The jurisdictions in Putnam County have differing levels of capabilities and resources for participation in the HMP update process, as well as differing levels of vulnerability to and impacts from the natural hazards being considered in this plan. It was Putnam County's intent to encourage participation by all jurisdictions, and to accommodate their specific needs and limitations while still meeting the intent and purpose of plan update participation. Such accommodations included establishing a Steering Committee, engaging a contract consultant to assume certain elements of the HMP update process on behalf of the jurisdictions, and providing alternative mechanisms for planning participation.

Ultimately, jurisdictional participation is evidenced by a completed annex of the HMP, wherein jurisdictions individually identify their planning points of contact, evaluate their risk from the hazards of concern, identify their capabilities to effect mitigation in their community, identify and prioritize a suite of actions to mitigate their hazard risk, and adopt the updated plan via resolution. Annexes are included in Volume II of this HMP.

After completion of the plan, the Planning Partnership will be responsible for assessing progress of the plan's implementation and soliciting public comment as part of an annual review and as part of the next five-year update.



2.2.3 Steering Committee

Putnam County developed a Steering Committee to guide the HMP update effort and to ensure that the resulting document will be accepted by local government leaders and all who live and work within the planning area. Steering Committee members were charged with the following:

- Providing guidance and oversight of the planning process on behalf of the general Planning Partnership
- Attending and participating in Steering Committee meetings
- Assisting with the development and completion of certain planning elements, including:
 - Reviewing and updating the hazards of concern
 - Developing a public and stakeholder outreach program
 - Ensuring that the data and information used in the HMP update process is the best available
 - Reviewing and updating the hazard mitigation goals
 - Identifying and screening appropriate mitigation strategies and activities
- Reviewing and commenting on plan documents prior to submission to DHSES and FEMA.

The Steering Committee acted as the point of contact for all participating jurisdictions and various interest groups in the planning area. Table 2-2 lists the members of the Steering Committee.

Table 2-2. Putnam County Hazard Mitigation Steering Committee Members

Affiliation	Name	Title
Putnam County Bureau of Emergency Services	James Oster	Commissioner
Putnam County Bureau of Emergency Services, Office of Emergency Management	Matthew Nadolny	Director
Putnam County Department of Planning, Development, and Public Transportation	Barbara Barosa	Commissioner
Putnam County Soil and Water Conservation District	Neal Tomann	Interim Soil and Water District Manager
Putnam County Economic Development Corporation	Kathleen Abels	President
Putnam County Department of Health	Rian Rodriguez	Public Health Director
Putnam County Department of Public Works	Thomas Feighery	Commissioner
Putnam County Climate Smart	Ilona Campo	Climate Smart Coordinator
Putnam County Tourism Department	Tara Keegan	Director of Tourism
Putnam County Parks and Recreation Department	Chris Ruthven	Director
Putnam County Sheriff's Office	Brian Hess	Sheriff
Putnam County Department of Social Services and Mental Health	Sara Servadio	Commissioner
Putnam County Public Information Officer	Chris Formisano	Public Information Officer
Putnam County Public Information Officer	Shanna Siegel	Public Information Officer
Putnam County Office of IT & GIS	Thomas Lannon	Director of IT & GIS



2.3 PLANNING ACTIVITIES

Members of the Planning Partnership (individually and as a whole), as well as key stakeholders, met and communicated as needed to share information. This included workshops to identify hazards, assess risks, update inventories of critical facilities, and assist in updating mitigation goals and strategies. All members of the Planning Partnership had the opportunity to review the draft plan, supported interaction with other stakeholders, and assisted with public involvement efforts. These activities provided continuity through the process to ensure that natural hazard vulnerability information and appropriate mitigation strategies were incorporated.

Table 2-3 summarizes meetings and other planning activities conducted during the development of the plan. It also identifies which 44 CFR 201 requirements each activity satisfies. Documentation of meetings (agendas, sign-in sheets, minutes, etc.) may be found in Appendix C (Public and Stakeholder Outreach). In addition to the activities listed in the table, there was a great deal of communication between Planning Partnership members and the consultant through individual local meetings, phone, and email.

Table 2-3. Summary of Mitigation Planning Activities

Date	44 CFR 201 Requirement ^a	Description of Activity	Participants
April 1, 2026	2	Project Startup Meeting: Discuss proposed planning process and scope of work, including documenting participation, schedule, and public and stakeholder outreach and involvement.	Putnam County Bureau of Emergency Services, Steering Committee, Planning Partnership, Tetra Tech
April 7, 2026	2, 3c	GIS data collection meeting	Putnam County Bureau of Emergency Services, Putnam County GIS Operations, Tetra Tech
April 10, 2026	2	All municipalities invited to participate in the planning process.	—
Monthly	—	Monthly project status meeting to discuss action items in support of the expedited planning process	Putnam County Bureau of Emergency Services, Tetra Tech
April 2026	2	County website identified to be used for engagement and to host the draft and final HMP.	Planning Team, Tetra Tech
April 21, 2026	2	Steering Committee Kickoff Meeting: Welcome and introductions, plan timing and administration, data collection and sharing, hazards of concern, public and stakeholder outreach, goals, next steps, and schedule	See Appendix D
April 21, 2026	2, 3c, 4a	Planning Partnership Kickoff Meeting: Welcome and introductions, overview of hazard mitigation, project scope review, project schedule review, next steps, and schedule	See Appendix D
April 28, 2026	2, 3e, 4d, 4e	Pre-populated jurisdictional annexes distributed.	Steering Committee, Planning Partnership
May 12, 2026	2	Online public survey developed and deployed	Planning Team, Tetra Tech



Date	44 CFR 201 Requirement ^a	Description of Activity	Participants
May 12, 2026	2	Online stakeholder survey developed and deployed	Planning Team, Tetra Tech
May 12, 2026	2	Online neighboring community survey developed and deployed	Planning Team, Tetra Tech
July 8, 2026	3b, 3c, 3d, 3e	Steering Committee Risk Assessment Meeting: Welcome and introductions, project report and status review, risk assessment overview, risk assessment results, hazard rankings, next steps	See Appendix D
July 8, 2026	3b, 3c, 3d, 3e	Planning Partnership Risk Assessment Meeting: Welcome and introductions, project report and status review, risk assessment overview, risk assessment results, hazard rankings, next steps	See Appendix D
July 22 – 23, 2026	2, 3b, 3c, 3d, 3e, 4a, 4b	Planning Partnership In-Person Jurisdictional Annexes Meetings: Identifying and developing mitigation strategies, developing new potential actions, workshop, next steps	See Appendix D
September 23, 2026	1b, 2	Draft Plan Review Meeting: Overview of entire plan and sections; confirmed plan maintenance schedule; public invited to attend.	See Appendix D
TBD	1b, 2	Public and stakeholder comments on draft plan received and incorporated into final plan.	Public and Stakeholders
September 24, 2026	All requirements	Final plan submitted to NYS DHSES	—
TBD	All requirements	Final plan submitted to FEMA Region 2	—
Upon plan approval by FEMA	1a	Plan adoption by resolution by the governing bodies of all participating municipalities	All Planning Partners

Note: TBD = to be determined.

a. Numbers in column 2 identify specific requirements of 44 CFR 201.6, as follows:

- 1a – Prerequisite – Adoption by the Local Governing Body (201.6.a.1)
- 1b – Public Participation (201.6.b)
- 2 – Planning Process – Documentation of the Planning Process (201.6.c.1)
- 3a – Risk Assessment – Identifying Hazards (201.6.c.2.i)
- 3b – Risk Assessment – Profiling Hazard Events (201.6.c.2.i)
- 3c – Risk Assessment – Assessing Vulnerability: Identifying Assets (201.6.c.2.ii.A)
- 3d – Risk Assessment – Assessing Vulnerability: Estimating Potential Losses (201.6.c.2.ii.B)
- 3e – Risk Assessment – Assessing Vulnerability: Analyzing Development Trends (201.6.c.2.ii.C)
- 4a – Mitigation Strategy – Local Hazard Mitigation Goals (201.6.c.3.i)
- 4b – Mitigation Strategy – Identification and Analysis of Mitigation Measures (201.6.c.3.ii)
- 4c – Mitigation Strategy – Implementation of Mitigation Measures (201.6.c.3.iii)
- 5a – Plan Maintenance Procedures – Monitoring, Evaluating, and Updating the Plan (201.6.c.4.i)
- 5b – Plan Maintenance Procedures – Implementation through Existing Programs (201.6.c.4.ii)
- 5c – Plan Maintenance Procedures – Continued Public Involvement (201.6.c.4.iii)



2.4 STAKEHOLDER OUTREACH AND INVOLVEMENT

Stakeholders are the individuals and entities that have a stake in managing hazard risk and mitigation. A comprehensive list of stakeholders—developed with the support of the Steering Committee and Planning Partnership—was invited to attend meetings, and key stakeholders served as members of the Steering Committee. Stakeholders also were invited to complete surveys about their association with hazards and mitigation. Survey results were reviewed by the Steering Committee and integrated where appropriate in the plan. Stakeholder outreach throughout the planning process ensured broad regional, county, and local participation in the plan's development. The full list of stakeholders invited to participate in this HMP is included in Appendix D.

2.4.1 Stakeholders Contacted

The following sections list stakeholders who contributed to the planning process and how they participated. Many stakeholders in addition to those listed were aware of or contributed to the HMP through formal and informal communication with Planning Partners throughout plan development.

Federal and State Agencies

The federal and state agencies listed in Table 2-4 were contacted during the planning process.

Table 2-4. Participation of Federal and State Agencies

Agency	Participation
FEMA Region 2	Provided updated planning guidance; provided aggregated NFIP data for planning area; conducted plan review.
- National Centers for Environmental Information (NCEI) - National Hurricane Center (NHC) - National Oceanic and Atmospheric Administration (NOAA) - National Weather Service (NWS) - Storm Prediction Center (SPC) - U.S. Army Corps of Engineers (USACE) - U.S. Census Bureau - U.S. Geological Survey (USGS)	Information regarding hazard identification and the risk assessment for this HMP update was requested and received or incorporated by reference
New York State Department of Homeland Security and Emergency Services (NYS DHSES: Headquarters and Region II)	Administered planning grant and facilitated FEMA review; provided updated planning guidance; attended meetings; participated in the jurisdictional annex and mitigation strategy meetings, provided review of Draft and Final Plan.
New York State Department of Environmental Conservation (NYSDEC)	Provided data and information on the number and locations of dams.

County and Regional Agencies

The county and regional agencies listed in Table 2-5 were invited to participate during the planning process.



Table 2-5. County and Regional Agencies

Agency	Participation
- Putnam County Economic Development Corporation - Putnam County Tourism Department	Served on steering committee, attended meetings, completed hazard of concern exercise and goals and objectives exercise, and reviewed draft plan.
- Putnam County Bureau of Emergency Services - Putnam County Department of Planning, Development, and Public Transportation - Putnam County Department of Health - Putnam County Department of Public Works - Putnam County Climate Smart - Putnam County Parks and Recreation Department - Putnam County Sheriff's Office - Putnam County Department of Social Services and Mental Health - Putnam County Public Information Officer - Putnam County Office of IT and GIS	Served on steering committee, attended meetings, provided input and reviewed draft plan.
Putnam County Soil and Water Conservation District	Served on the steering committee, provided input, and reviewed draft plan.
- Putnam County Board of Elections - Putnam County Executive - University of Rochester - American Red Cross Hudson Valley - Putnam Valley Community Food Pantry - Putnam/Northern Westchester Women's Resource Center - Putnam County Housing Corporation - Putnam Area Rapid Transit - Part Putnam Area Rapid Transit - MTA Metro-North (Hudson Line and Harlem Line)	Invited to take the stakeholder survey and review the draft plan.

Stakeholders by Community Lifeline Category

FEMA defines community lifelines as fundamental services in a community that, when stabilized, enable all other aspects of society. All participating jurisdictions were asked to invite their internal agencies associated with community lifeline categories to complete a stakeholder survey. Many jurisdictions also directly involved representatives of these agencies in the planning process, as identified in Table 2-1. This section describes outreach to and participation by other stakeholders in the planning process associated with the designated community lifeline categories. More detailed information about community lifelines in the planning area is provided in Section 3.9.

Safety and Security

Law Enforcement

The following police departments and law enforcement agencies were invited to complete a stakeholder survey and review the draft plan:

- Putnam County Sheriff's Office
- Town of Carmel Police Department
- Town Of Kent Police Department



- Village Of Brewster Police Department
- Village Of Cold Spring Police Department

Fire Departments

The following fire departments were invited to complete a stakeholder survey and review the draft plan:

- | | | |
|---------------------------------------|---------------------------------|-----------------------------------|
| • Brewster Fire Department | • Kent Fire Department | • North Highlands Fire Department |
| • Carmel Fire Department | • Lake Carmel Fire Department | • Patterson Fire Department |
| • Cold Spring Fire Department | • Mahopac Fire Department | • Putnam Lake Fire Department |
| • Continental Village Fire Department | • Mahopac Falls Fire Department | • Putnam Valley Fire Department |
| • Garrison Fire Department | | |

Dams

Outreach was conducted to the following dam owners and the dam safety agency:

- | | |
|--|---------------------------------------|
| • Town of Kent | • Town of Putnam Valley |
| • Town of Patterson | • Open Space Institute, Glynwood |
| • Watchtower Bible and Tract Society of New York Inc. | • Lake Peekskill Improvement District |
| • New York City Department of Environmental Protection Dams East of the Hudson River | • City of Beacon |
| • City of Peekskill | • Village of Cold Spring |
| • NYSDEC Division of Lands and Forests | |

The following information was requested:

- Information, data, or resources regarding the risk of dam failure as a result of deficiencies or exposure to hazards such as flooding, geologic impacts, and severe storms
- Concerns about dam safety due to changing climate conditions
- Concerns about emergency action plan deficiencies including warning time, evacuation needs, etc.
- Completed or in-progress repairs or improvements to dams
- Potential new mitigation actions that should be considered for inclusion in the HMP mitigation strategy

Food, Hydration, Shelter

The following stakeholders that provide food, hydration, shelter, and agricultural activities in the County were invited to complete a stakeholder survey and review the draft plan:

- American Red Cross Hudson Valley
- Putnam Valley Community Food Pantry
- Putnam/Northern Westchester Women's Resource Center
- Putnam County Housing Corporation



Health and Medical

Health-Care Facilities

The following health-care facilities were invited to complete a stakeholder survey and review the draft plan:

- Town of Kent EMS
- Putnam Hospital

Ambulance/Emergency Medical Services

The following ambulance and emergency medical service providers in the County were invited to complete a stakeholder survey and review the draft plan:

- Putnam Valley Ambulance
- Carmel Ambulance Corp.
- Garrison Ambulance Corp.
- Philipstown Ambulance Corp.
- Town of Patterson Ambulance

Energy

Municipal utilities and the following electrical, natural gas, and fuel companies were invited to complete a stakeholder survey and review the draft plan:

- Nolan Energy
- NYSEG

Communications

Each jurisdiction was asked to provide information on emergency communication and warning systems. In addition, the Putnam County Public Information Officer was invited to complete a stakeholder survey and review the draft plan.

Transportation

The following transportation companies and organizations were invited to complete a stakeholder survey and review the draft plan:

- Putnam Area Rapid Transit
- Putnam County Planning, Development and Public Transportation
- Part Putnam Area Rapid Transit
- MTA Metro-North (Hudson Line and Harlem Line)

Hazardous Materials

Putnam County Bureau of Emergency Services, which addresses hazardous materials in the County, was invited to complete a stakeholder survey and review the draft plan.



Water Systems

The following water utility companies were invited to complete a stakeholder survey and review the draft plan:

- Town of Carmel Sewer District
- Village of Cold Spring Water and Wastewater Department
- Town of Kent Sewer District
- Town of Southeast Special Districts Department

School Districts and Other Academic Institutions

The following school districts were invited to complete a stakeholder survey and review the draft plan:

- Brewster Central School District
- Carmel Central School District
- Garrison Union Free School District
- Haldane Central School District
- Mahopac Central School District
- Putnam Valley Central School District

Groups Supporting Socially Vulnerable Populations and Underserved Communities

The following groups and agencies that provide support to and work with socially vulnerable populations and underserved communities were invited to complete a stakeholder survey and review the draft plan:

- Child Advocacy Center of Putnam County
- Putnam County Department of Social Services and Mental Health
- Putnam County Youth Bureau
- Office for Senior Resources

Neighboring Jurisdictions

The County kept surrounding jurisdictions apprised of the project, invited them to complete a neighboring community survey, and requested their review of the draft plan. The following adjoining county and jurisdictional representatives were contacted to inform them about the availability of the project website, draft plan documents, and surveys and to invite them to provide input to the planning process:

- Dutchess County (NY)
 - Town of Fishkill
 - Town of East Fishkill
 - Town of Pawling
- Orange County (NY)
 - Town of Highlands
- Westchester County (NY)
 - Town of Cortlandt



- Town of Yorktown
- Town of Somers
- Town of North Salem
- Western Connecticut Council of Governments (WestCOG)

2.4.2 Stakeholder Survey Summary

The stakeholder survey was designed to identify general needs for hazard mitigation and resilience within Putnam County from the perspective of stakeholders, as well as to identify specific projects that may be included in the mitigation plan. It was distributed to identified stakeholders, including county and municipal departments and agencies. As of July 18, 2026, eight stakeholders completed the survey. Respondents were from the education sector, emergency services sector, or planning. Most represented groups serve Putnam County as a whole.

Hazard and Damage Identification

Respondents reported concerns about disease outbreak, flood, harmful algal blooms, severe storm (extreme heat, hail, lightning, high wind, thunderstorm, tornado) and severe winter storm (blizzard, extreme cold, heavy snow, ice storm) hazard events.

One of the eight respondents indicated that their organization has fixed or mobile assets that are located in the floodplain; another respondent indicated that they were unsure. One respondent listed that they do not have flood insurance and the other seven respondents were unsure.

Community Preparedness

The survey asked about vulnerable groups in the community that are at risk before, during, or after a hazard event. Respondents stated that they would be concerned about the following:

- Any persons located in proximity to the Hudson River and surrounding bodies of water
- Those that rely on a public transportation system, including students
- Older adults and disabled residents because they may need extra assistance in an emergency to ensure accessibility
- Non-native individuals who may not speak or understand English

Respondents listed the following as the most effective ways to communicate with at-risk populations:

- Face to face communication
- Print media and public airwaves in multi-lingual formats
- Layered communication with a mix of face to face, print media, online media, live stream, etc.

Project Identification

Respondents identified the following actions that could reduce their organization's vulnerability to damage:

- Strengthen codes, ordinances, and plans to require higher hazard risk management standards.
- Retrofit and strengthen essential facilities such as police, fire, emergency medical services, hospitals, schools, etc.



- Work on improving the damage resistance of utilities (electricity, communications, water / wastewater facilities, etc).
- Enhance stream maintenance programs/projects.
- Inform property owners of ways they can mitigate damage to their properties.

2.4.3 Neighboring Community Survey Summary

The neighboring community survey was sent to county and municipal governments that border Putnam County. As of July 18, 2026, responses were received from two counties (Westchester County, Orange County), one regional agency (Western Connecticut Council of Governments (WestCOG)), and one municipality (Town of North Salem).

Emergency Operations and Continuity of Operations Planning

All three county level entities answered survey questions regarding whether any shared service or mutual aid agreements are in place between their county and Putnam County. Westchester County stated that it provides mutual aid for ambulance and fire services and works with the Town of Southeast on issues relating to Peach Lake. WestCOG stated that it does not directly share services with Putnam County, but believes that its bordering municipalities have agreements in place. Orange County stated that it works with Putnam County regarding emergency staff for evacuations or disaster response, especially regarding the Indian Point Emergency Planning and Response Zone and the Hudson River Emergency Response Plan.

Risk and Vulnerability

Orange County noted that it shares risks and vulnerabilities relating to flooding along the Hudson River. Westchester County stated that there are shared vulnerabilities with the Newburgh-Beacon and Bear Mountain Bridges, the Hudson River Railroad Line and West Shore Railroad Line, and the Stewart New York International Airport. WestCOG stated that it shares some flood-related concerns as well as concerns with shared infrastructure, such as Interstate 84.

Evacuation and Sheltering

Orange County noted that there is collaboration with Putnam County on establishing evacuation routes or alternative evacuation routes, noting the Indian Point Emergency Planning Zone and coordination of the Bear Mountain Bridge between four counties. Orange County also coordinates with Putnam County for shelter locations.

Westchester County stated that it does not coordinate with Putnam County relating to sheltering or evacuation routes and plans. WestCOG stated that it is unsure if coordination is done with Putnam County at the local level but is sure that Connecticut Department of Emergency Management coordinates with Putnam County's neighboring jurisdictions.

Information Sharing

WestCOG stated that establishing points of contact and requesting coordination on planning efforts would be an opportunity for improvement for information sharing. Orange County states that the creation of more regional meetings would enhance information sharing.



Projects, Grants, Education, and Outreach

Westchester County noted that there are collaboration efforts on flood-related issues, including stormwater flooding and watershed/floodplain improvements that require collaboration across jurisdictional boundaries and stated that it works with the Town of Southeast on these issues. Westchester County also stated that it has collaborated with Putnam County on grant applications in the past, typically in relation to flood and bridge mitigation. Orange County stated that there are connected roadway improvements and public education that can be collaborated on.

Respondents identified potential for cross-collaboration between county boundaries on training opportunities and planning collaboration through regional meetings.

2.5 PUBLIC OUTREACH

2.5.1 Resources and Events

The Steering Committee and Planning Partnership made the following efforts toward public participation in the development and review of the HMP update:

- The public was informed of the hazard mitigation planning effort commencement at the kickoff meeting and through press releases, news articles, and public service announcements released throughout the planning process. Copies of these announcements may be found in Appendix C.
- The County's website was utilized to present information pertinent to the HMP, including the chapters of the HMP for public review and comment (<https://www.putnamcountyny.gov/pcbcs>).
- All participating jurisdictions were encouraged to distribute press releases on the project, including links to the project webpage and public and stakeholder surveys.
- Surveys were distributed to the public.
- A public information meeting on the HMP update process was held on September 23, 2026.
- The digital plan was accessible through the Putnam County library system, for those who otherwise do not have access to the internet; librarians were available to assist those who wished to review the plan.
- The draft plan was posted to the public website as of September 23, 2026, for public review and comment. All public comments were directed to the Putnam County Bureau of Emergency Services for collection and review by the Steering Committee. Responses were forwarded to appropriate jurisdictions and/or agencies and incorporated into the final plan as appropriate.
- Once submitted to NYS DHSES and FEMA, the final plan will be available for public review and comment in the same manner and format as the draft plan, as well as in hard-copy format at the locations identified in Chapter 20.

2.5.2 Public Survey Summary

An online survey was developed to gauge household preparedness for hazards that may impact Putnam County and to assess the level of knowledge about tools to help reduce risk from those hazards. The survey addresses citizen perception of risk, knowledge about mitigation, and support for community programs. It also asks demographic questions to help analyze trends.



The survey was available through July 17, 2026, for public input. All Planning Partners were requested to advertise the availability of the survey via local homepage links, and other available public announcement methods (Facebook, X, email blasts, etc.). As of July 18, 2026, the survey received 45 responses. A summary of survey results follows. An example survey and full results are included in Appendix C. Jurisdiction-specific responses can be found in Volume II.

Survey respondents were from seven municipalities within Putnam County, with 64.4 percent having lived in the County for 20 years or more. The most common age range of respondents was between 55 and 64 (28.9 percent).

The following hazard types were most commonly listed by respondents as being among the five most frequently occurring hazard events in Putnam County in the past five years:

- Severe winter storms—blizzard, extreme cold, heavy snow, ice storm
- Severe storms—extreme heat, hail, lightning, high wind, thunderstorm, tornado
- Extreme temperatures
- Flood
- Drought

Most residents (68.9 percent) said they receive information concerning a natural hazard before it happens through social media. Fewer than half receive information through online news sources (44.4 percent) or TV news (44.4 percent). Respondents identified the following as desired projects to reduce damage due to natural hazards:

- Create and implement a Climate Change Adaptation and Resilience Plan
- Backup Emergency Service Center/911 Center
- Tree pruning and cutting programs
- Jurisdiction-level hazard mitigation education
- Studies on flood-prone road systems, including bridge and culvert upsizing

Only one respondent indicated that their property is located in a designated floodplain, and one indicated that they are covered by flood insurance.

2.6 INCORPORATION OF EXISTING PLANS, STUDIES, REPORTS AND TECHNICAL INFORMATION

The Putnam County HMP uses the best available information to support hazard profiling, risk assessment, review and evaluation of mitigation capabilities, and the development and prioritization of County and local mitigation strategies. Plans, reports, and other technical information were identified and accessed online through independent research by the planning consultant or provided directly by the County, participating jurisdictions, and stakeholders involved in the planning effort. Information about natural hazards and local capabilities was obtained from municipal and regional agencies, as well as federal and state agencies, non-governmental organizations, and County residents. Their input has been included throughout the HMP. Detailed sources of technical data and information used are listed in the References section.

The County and participating jurisdictions provided relevant jurisdiction-specific planning and regulatory documents, which were reviewed to identify the following:

- Existing jurisdictional capabilities



- Needs and opportunities to develop or enhance capabilities, which may be included in Planning Partners' mitigation strategies
- Mitigation-related goals or objectives (see Section 19.1)
- Proposed, in-progress, or potential mitigation actions to be incorporated into the updated County and local mitigation strategies

The following regulations, codes, ordinances, and plans were reviewed to develop mitigation planning goals and objectives and mitigation strategies that are consistent across local and regional planning and regulatory mechanisms:

- | | |
|---|--|
| • Comprehensive/master plans | • Stormwater management plans |
| • Building codes | • Emergency management and response plans |
| • Zoning and subdivision ordinances | • Land use and open space plans |
| • Flood insurance studies | • Capital plans |
| • Flood insurance rate maps | • Climate smart community program |
| • NFIP flood damage prevention ordinances | • Community rating system |
| • Site plan requirements | • 2023 New York State Hazard Mitigation Plan |
| • Local waterfront revitalization plans | |

The County and participating jurisdictions were tasked with updating the assessment of their planning and regulatory capabilities (see capability assessment section of each jurisdictional annex in Volume II). They reviewed relevant plans contributing to the capability of the County and each jurisdiction to integrate effective mitigation efforts into their daily activities. This review is reflected in the capability assessment tables in the municipal annexes. These tables list plan types, names, and dates, as well as a summary of how each plan supports mitigation and resilience.

2.7 INTEGRATION WITH EXISTING PLANNING MECHANISMS AND PROGRAMS

Effective mitigation is achieved when hazard awareness and risk management approaches and strategies become an integral part of public activities and decision-making. Many existing plans and programs support hazard mitigation in the County. It is critical that this HMP integrate, coordinate with, and complement, those existing plans and programs.

The capability assessments in Chapter 18 provide a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county and local) that support hazard mitigation in the County. In the jurisdictional annexes in Volume II, each participating jurisdiction identifies how it has already integrated hazard mitigation into its planning, regulatory and administrative framework ("integration capabilities") and how it intends to promote this integration ("integration actions").

A description of continued efforts toward a holistic approach to hazard mitigation is presented in Chapter 20.



2.8 PLAN ADOPTION AND APPROVAL

Adoption by the local governing bodies of each participating jurisdiction demonstrates the commitment of the Planning Partners to fulfill the mitigation goals and strategies outlined in this HMP. Adoption via a municipal resolution legitimizes the HMP and authorizes responsible agencies to execute their responsibilities. In addition to being required by the DMA, adoption of the HMP is necessary for the following reasons (FEMA 2023b):

- It lends authority to the plan to serve as a guiding document for all local and state government officials.
- It gives legal status to the plan in the event it is challenged in court.
- It certifies to program and grant administrators that the plan's recommendations have been properly considered and approved by the jurisdictions' governing authority and citizens.
- It helps to ensure the continuity of mitigation programs and policies over time because elected officials, staff, and other community decision-makers can refer to the official document when making decisions about the community's future.

FEMA allows two options for submitting adoption resolutions:

- **Submittal of adoption resolutions with plan**—All participating jurisdictions provide documentation of plan adoption when the HMP is initially submitted to the state for review. After receiving the draft plan from the state, FEMA conducts its review and will approve the HMP if it meets all requirements.
- **Approvable pending adoption**—A draft HMP is submitted to the state and FEMA for approval prior to adoption by the jurisdictions. When FEMA determines that the HMP as a whole and each participating jurisdiction have met all the requirements except adoption, FEMA will inform the state that the HMP is “approvable pending adoption” (APA). After that, once FEMA receives documentation of adoption resolutions from at least one jurisdiction, the status is changed from APA to approved for the entire plan and for that jurisdiction. Other jurisdictions that participated in the planning process then receive approval once they pass their own adoption resolutions. A jurisdiction with a plan in APA status does not meet the requirement for an approved mitigation plan to apply for and receive funding assistance.

Each jurisdiction must submit a copy of its formal adoption resolution or other legal instrument to the Putnam County HMP Coordinator in the Putnam County Bureau of Emergency Services. Putnam County will forward the executed resolutions to the New York Division of Homeland Security and Emergency Services (DHSES), after which they will be forwarded to FEMA for the record.

FEMA will transmit acknowledgement of verification of formal plan adoption and the official approval of the HMP to the Putnam County HMP Coordinator. The plan approval date begins the five-year approval period and sets the expiration date for the plan. All participating jurisdictions will have the same expiration date regardless of their own jurisdiction's adoption date. The date indicated on FEMA's approval letter is the official approval date.

The resolutions issued by each jurisdiction to support adoption of this HMP are included in Appendix A.

2.9 CONTINUED PUBLIC INVOLVEMENT

The Planning Partners are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will be posted online (<https://www.putnamcountyny.gov/pcbcs>), and jurisdictions will be encouraged to maintain links to the HMP website. Further, the County will make hard copies of the HMP available for review upon request. Each jurisdiction's governing body will be responsible for receiving, tracking, and filing public comments regarding this plan.



The public will have an opportunity to comment on the HMP as a part of the annual mitigation planning evaluation process and the next five-year mitigation plan update. The HMP Coordinator is responsible for coordinating the plan evaluation portion of the meeting, soliciting feedback, collecting, and reviewing the comments, and ensuring their incorporation in the 5-year plan update as appropriate; however, members of the Planning Partnership will assist the HMP Coordinator. Additional meetings may also be held as deemed necessary by the Planning Partnership. The purpose of these meetings would be to provide the public an opportunity to express concerns, opinions, and ideas about the plan.

After completion of this plan, implementation and ongoing maintenance will continue to be a function of the Planning Partnership. The Planning Partnership will review the HMP and accept public comment as part of an annual review and as part of five-year mitigation plan updates.

A notice regarding annual updates of the HMP and the location of plan copies will be publicized annually after the HMP Committee's annual evaluation and posted on the public web site.

Mr. Matthew W. Nadolny of the Bureau of Emergency Services has been identified as the ongoing County HMP Coordinator, and is responsible for receiving, tracking, and filing public comments regarding this HMP update. Contact information is:

Mailing Address:	Putnam County Bureau of Emergency Services 112 Old Route 6, Carmel, NY 10512
Contact Name:	Matthew W. Nadolny, Director Office of Emergency Management
Email Address:	Matthew.Nadolny@putnamcountyny.gov
Telephone:	(845) 808-4000 ext. 41120



3. COUNTY PROFILE

The planning area for this HMP is the entirety of Putnam County. This chapter presents general information about the land, people, and assets of Putnam County. This information provides a baseline for understanding the economic, structural, and demographic assets at risk from the hazards addressed in this HMP.

3.1 LOCATION

Putnam County covers roughly 230 square miles along the east side of the Hudson River in southeastern New York State. It is bordered by Dutchess County to the north, Orange County and a very short portion of Rockland County to the west, Westchester County to the south, and Connecticut to the east. Figure 3-1 shows Putnam County and its municipalities.

3.2 JURISDICTIONS WITHIN THE COUNTY

Putnam County includes nine municipalities – six towns, and three villages, as listed in Table 3-1. The Putnam County seat is the Town of Carmel. The Town of Philipstown is the largest municipality by area in Putnam County, at 47.3 square miles. The Village of Brewster is the smallest, at 0.5 square miles.

Table 3-1. Putnam County Municipalities

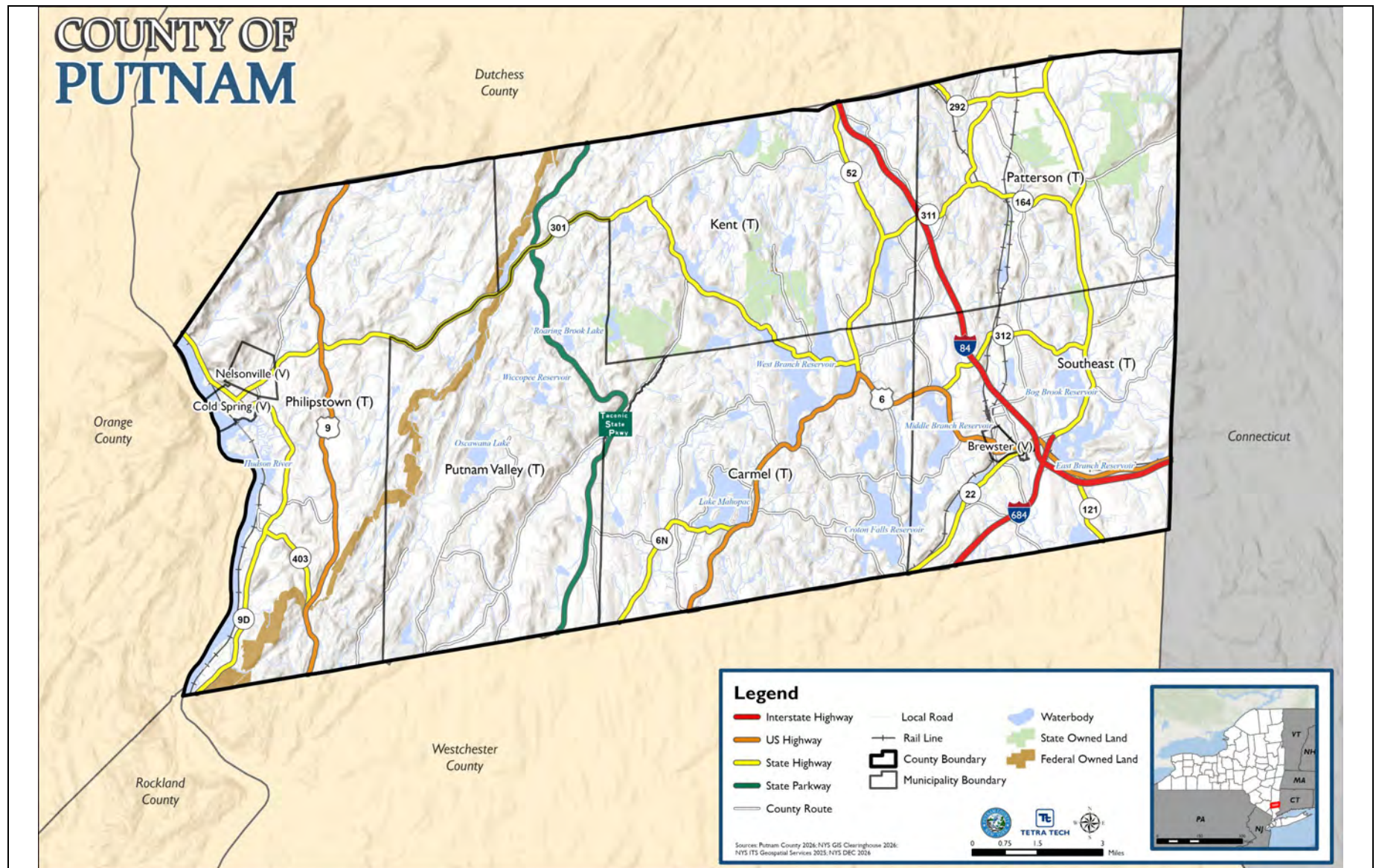
Villages	
Village of Brewster Village of Cold Spring Village of Nelsonville	
Towns	
Town of Carmel Town of Kent Town of Patterson	Town of Philipstown Town of Putnam Valley Town of Southeast

3.3 HISTORY

Putnam County was formed from Dutchess County in 1812. In the mid-19th century, two railroads from New York City were operating in Putnam County—one along the Hudson River to Cold Spring and the other in the Harlem Valley to Brewster's Station. Many of the County's dirt roads were first paved during the Great Depression. After World War II, returning veterans and many workers in New York City and lower Westchester County relocated to Putnam to commute to work on paved roads and rail connections. During the last half century, Putnam ceased to be a primarily rural area and became part of the New York City outer suburbs (Putnam County n.d.).



Figure 3-1. Putnam County Hazard Mitigation Plan Area



3.4 PHYSICAL SETTING

3.4.1 Water Resources

Numerous ponds, lakes, creeks, and rivers make up the waterscape of Putnam County. The major water bodies in the County are East Branch Reservoir, West Branch Reservoir, Croton Falls Reservoir, the Hudson River, the East Branch Croton River, the West Branch Croton River, and Canopus Creek. The eastern half of Putnam County is drained by tributaries of the Croton River. The western half is drained by streams flowing directly into the Hudson River or by tributaries of Canopus and Peekskill Hollow Creeks. The major streams in the County follow pre-glacial valleys whose alignment was determined by the structure or hardness of the underlying bedrock (Greenways n.d.).

Putnam County is located in the Lower Hudson Watershed, which makes up about 40 percent of the Hudson/Mohawk River Basin. The Lower Hudson Watershed extends from the Battery at the southern end of Manhattan to the Troy Dam at the confluence of the Mohawk River. This watershed covers 4,982 square miles of land and contains 8,861 miles of freshwater rivers and streams. There are 324 significant freshwater lakes, ponds and reservoirs located within the watershed. This includes the Muscoot/Upper New Croton Reservoir in Putnam and Westchester counties (NYSDEC n.d.-g).

The Croton Watershed—the New York City water supply system’s southernmost watershed—spans much of Putnam County. Most water bodies in the Croton Watershed are part of the Croton Water System, but three water bodies in north central Putnam County (Boyd’s Corner Reservoir, West Branch Reservoir, and Lake Gleneida) are part of the Catskill/Delaware Water System (NYC Environmental Protection n.d.). Figure 3-2 shows Croton Watershed its reservoirs.

A **watershed** is the area of land that drains into a body of water such as a river, lake, stream, or bay. It is separated from other systems by high points such as hills or slopes. It includes the waterway and all land area that drains to it. Drainage basins generally refer to large areas that encompass the watersheds of many smaller rivers and streams. Watersheds can cross municipal and county boundaries.



Source: (Hudson River Watershed Alliance n.d.)

Figure 3-2. The Croton Watershed



Source: (NYCEM n.d.-b)



3.4.2 Topography and Geology

Putnam County is largely within the New England uplands physiographic province. This province is geologically complex and exhibits moderate relief. Landforms in this area show a strong correlation to the hardness of the underlying bedrock. Elevation rises to more than 1,000 feet in the Hudson Highlands, which in New York State extend from the southwest corner of Rockland County through northern Westchester County and into Putnam County. The Highlands also extend into Connecticut, New Jersey, and Pennsylvania. More than nine-tenths of Putnam County's land area is part of the Hudson Highlands. The remainder of the County is part of a geological formation known as the Manhattan Prong. This area is found in the northeast and southeast corners of the County (Putnam County 2012).

Putnam County's highest elevation is in the Town of Philipstown at Scofield Ridge (1,540 feet above sea level). The Towns of Philipstown and Putnam Valley and the western part of the Town of Kent have the most rugged terrain, with many high peaks at elevations over 1,000 feet. Several ranges in these municipalities form a natural east-west barrier. These ranges are separated by Peekskill Hollow Creek (Putnam County 2012).

The northern and western portions of the County are similar due to the number of high peaks. These peaks range from Mount Ninham in the Town of Kent (elevation of 1,270 feet above sea level) to Birch Hill in the Town of Patterson (1,260 feet above sea level). The Towns of Carmel, Southeast, and Patterson and the eastern portion of the Town of Kent have relatively high peaks and variable relief but maintain more of a consistent terrain characterized by a greater number of level parcels (Putnam County 2012).

3.4.3 Climate

Putnam County has a continental climate; airflow and weather systems that affect the area are primarily of continental origin. The climate is designated as humid because the major circulation patterns of the atmosphere carry generous quantities of moisture toward the northeastern U.S. The climate of Putnam County is one of long summers and short winters. The average annual temperature is 48 °F and the average annual precipitation for the County is 50.4 inches. The distribution of precipitation throughout the year is fairly uniform, with slightly higher amounts during the summer (NOAA n.d.-g).

3.4.4 Land Cover

The dominant land cover in Putnam County is forested land. Wetlands, undeveloped vacant land, and water bodies are also prevalent. Large areas of forested and vacant land are found in the western and northwestern portions of the County. Major lakes and reservoirs are found in the eastern part of the County. Figure 3-3 and Table 3-2 summarize the land cover across the County.



Figure 3-3. Putnam County Land Cover

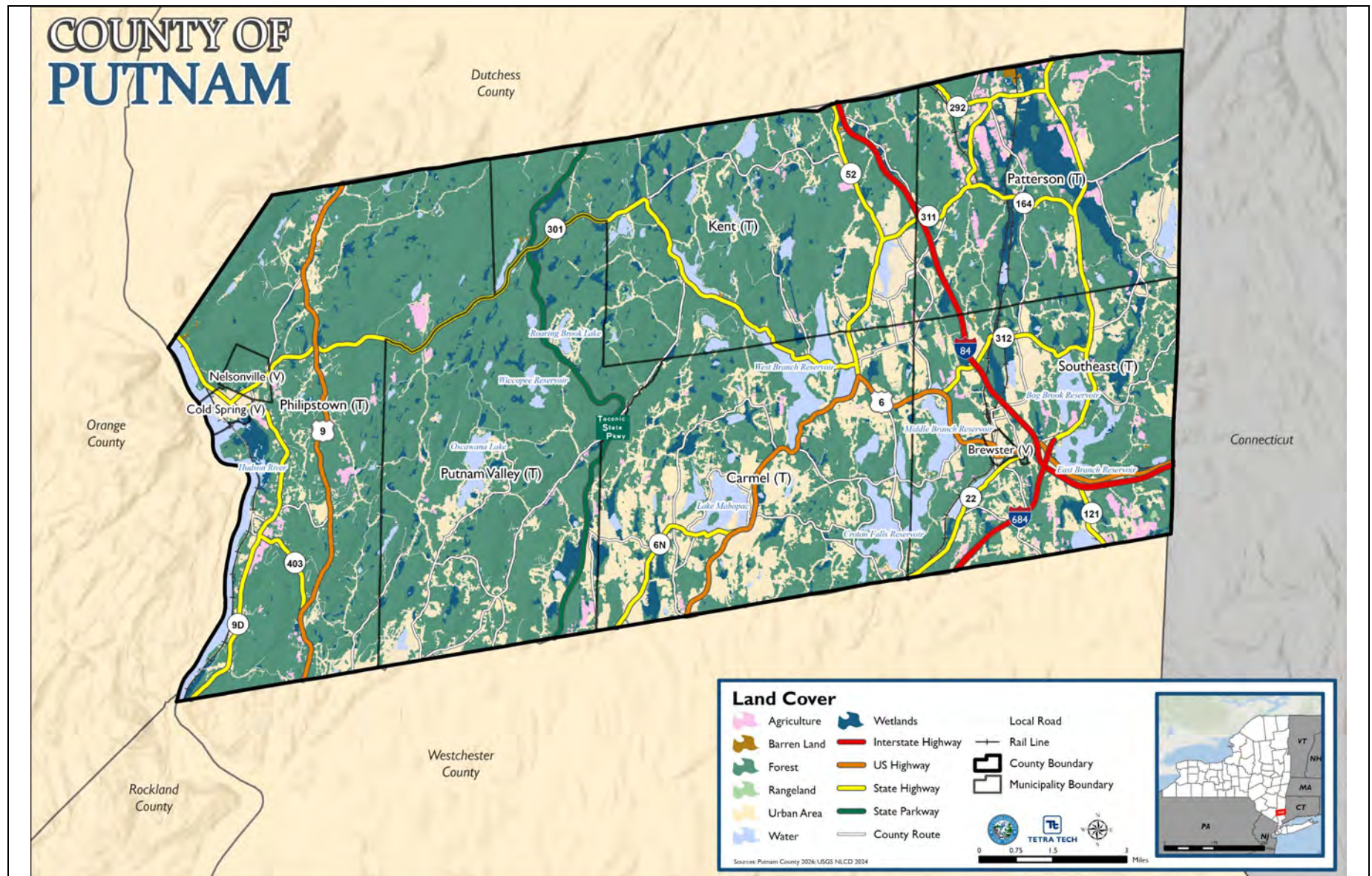




Table 3-2. Putnam County 2024 Land Cover Classification

Category Description	Total Area in Category	
	Acres	% of Total
Agriculture	3,065	1.9%
Barren Land	145	0.1%
Forest	102,426	65.1%
Rangeland	439	0.3%
Urban Area	32,706	20.8%
Water	8,977	5.7%
Wetland	9,691	6.2%
Putnam County (Total)	157,450	100.0%

Source: USGS NLCD 2024

3.5 CURRENT LAND USE

Hazard mitigation planning considers land use trends, which can impact the need for and priority of mitigation options over time. Land use trends can significantly affect vulnerability to hazards and the potential impacts from hazard events. For example, significant development in a hazard area increases the building stock and population exposed to that hazard. In New York State, land use regulatory authority is vested in towns, villages, and cities. However, many development and preservation issues transcend local political boundaries.

3.5.1 Residential

Residential land uses in Putnam County are typically represented by single-family detached homes. More concentrated areas of residential development occur in the County's three villages, lake communities, and several condominium complexes.

3.5.2 Commercial and Industrial

Commercial and industrial land uses are found in and around the villages of the County and along State Routes 6, 9, 22, and 52. Commercial uses are also found at the intersections of Interstate 84 (I-84) and Route 312 and I-84 and Ludingtonville Road. Industrial uses are scattered throughout the County and include the hospital, government buildings, non-profit affiliated facilities, and schools. Significant blocks of land occupied by institutional uses are found in the Towns of Philipstown, Patterson, Kent, Putnam Valley, and Carmel.

3.5.3 Agriculture

Agriculture in Putnam County has undergone significant changes in recent decades as expanding non-farm development put pressure on landowners for farmland conversion and the profitability of certain agricultural markets decreased. According to the U.S. Department of Agriculture's 2022 Census of Agriculture, the number of farms in Putnam County decreased by 24 percent from the previous (2017) census—from 89 to 68. Total farmland declined



47 percent (3,480 acres), and the average size of each farm fell 30 percent. The market value of products sold in the Putnam County agricultural economies decreased by 52 percent (USDA 2022).

Putnam County has a well-developed nursery, greenhouse, floriculture, and sod sector, and is ranked 44th in the state in terms of value of sales by this commodity group. The County ranks 46th in the state for the value of its horses, ponies, mules, burros and donkeys (USDA 2022).

The New York State Agriculture and Markets Law allows counties to create agricultural districts to protect and promote the agriculture industry (Article 25AA Agricultural Districts). The law requires that each district be reviewed on an 8-, 10-, or 12-year basis to see if it is still achieving its intended purpose. Putnam County has one agricultural district—the Putnam County Agricultural District—created in 2003. The district went through an 8-year review in 2011 and in 2019. The next review is scheduled for April 2027.

3.6 POPULATION AND DEMOGRAPHICS

3.6.1 Current Population

According to the U.S. Census Bureau's 2024 American Community Survey (ACS) 5-year estimates, Putnam County has a population of 98,107 people. Of this total, 34.5 percent resides in the Town of Carmel. Figure 3-4 shows the distribution of the total population per square mile in Putnam County.

3.6.2 Population Trends

Population trends can provide a basis for decisions on mitigation approaches to consider and where to apply them. This information can also be used to support planning decisions regarding future development in vulnerable areas. As seen in Table 3-3, Putnam County's population increased each decade from 1960 to 2010 and declined slightly from 2010 to 2020. While the overall population of Putnam County decreased by 1.02 percent between 2010 and 2020, some areas of the County experienced an increase in population during that period. A 2017 profile of Putnam County by Cornell University's Program on Applied Demographics projected growth in the County through 2040.

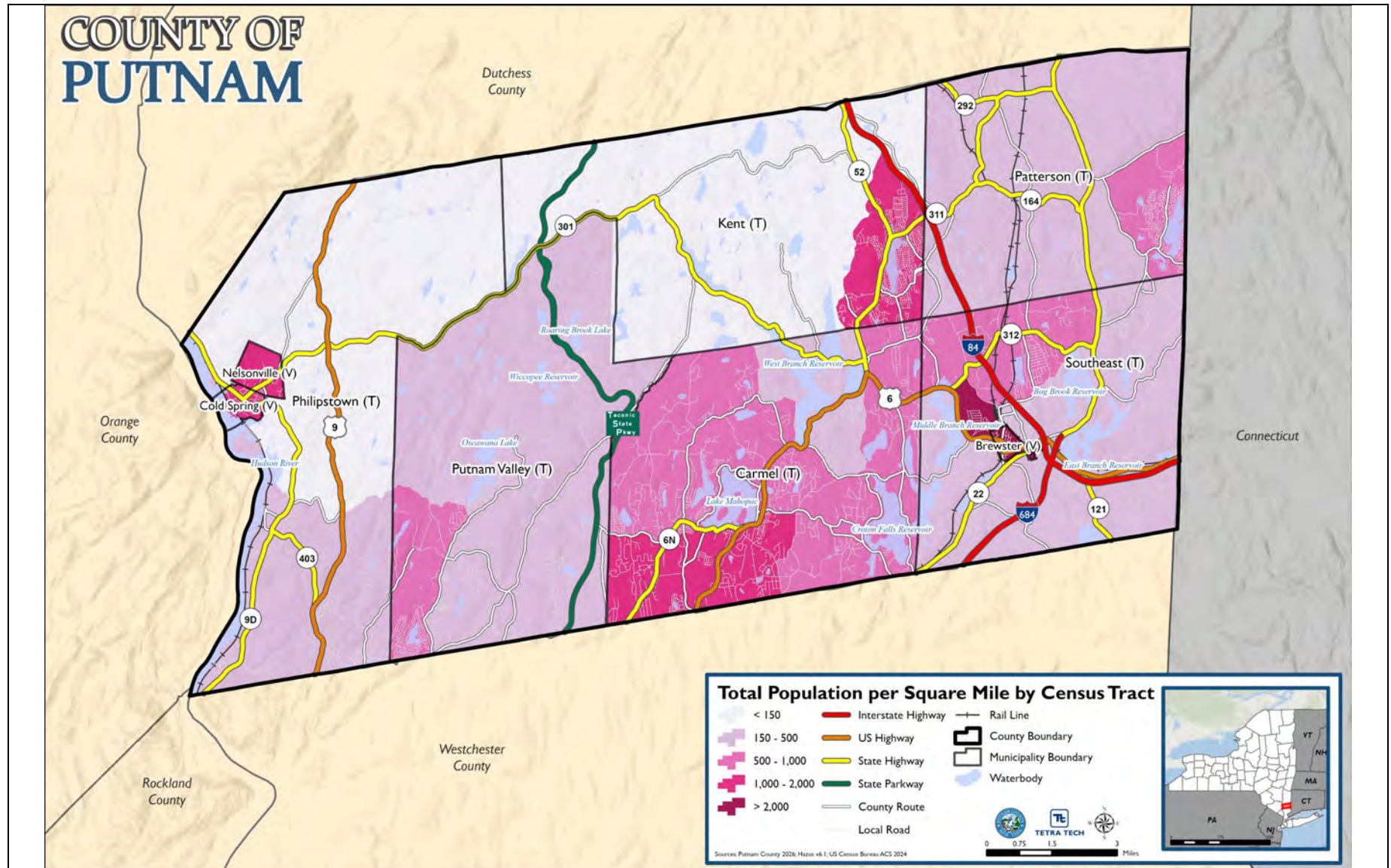
Table 3-3. Historical and Projected Population Change in Putnam County

Historical Putnam County Population							Projected Putnam County Population	
1960	1970	1980	1990	2000	2010	2020	2030	2040
31,722	57,074	77,193	83,941	95,745	99,710	97,668	104,507	104,816

Source: (Cornell University 2017)



Figure 3-4. Total Population per Square Mile by Census Tract in Putnam County





3.6.3 Socially Vulnerable Populations

Socially vulnerable populations are groups of people who can be more susceptible to hazard events based on factors such as their physical and financial ability to react or respond during a hazard, or the location and construction quality of their housing. This HMP considers several socially vulnerable populations: persons over the age of 65, under the age of 5, non-English speaking, living with disabilities, or living below the poverty level (as defined by the U.S. Census Bureau). Table 3-4 presents populations of socially vulnerable groups for each municipality in Putnam County based on the 2024 ACS. Figure 3-5 shows population density (persons per square mile) for these groups.

Countywide, the largest of these groups is the population over 65; the municipality with the highest percent population in this group is the Town of Philipstown at 24.1 percent. The Town of Kent has the highest percent population of people under 5, at 6.3 percent. The Village of Brewster has the highest percentage of non-English speakers (21.7 percent) and people with a disability (14.3 percent). The highest percentage of people living in poverty is in the Town of Patterson (16.8 percent).

3.7 ECONOMY

Putnam County's economy is developing into a more diverse economy focused on education, health care, and a growing small and mid-sized business sector.

3.7.1 Supporting Small Business/Institutions

Putnam County also has a plethora of small businesses to bolster the local economy including Hudson Valley IV, which is a clinic that offers personalized IV vitamin therapy, and Putnam County Service Dogs, which is a nonprofit that trains rescue dogs to be service dogs (Putnam County Economic Development Corporation n.d.).

3.7.2 Employment

The 2023 Economic Surveys Business Patterns data identified 2,868 establishments in Putnam County employing 22,380 people. The construction industry has the greatest number of establishments in the County, with 596. This is followed by other services with 312 establishments and retail trade with 282 establishments (U.S. Census 2025). The unemployment rate for the County in June 2026 was 3.2 percent, which was a 0.2 percent increase from the unemployment rate in June 2024 (U.S. Department of Labor 2025).

For the 12-month period ending April 2026, the private sector job count in the Hudson Valley Region rose by 7,500, or 0.9 percent, to 850,300. Job gains were largest in private education and health services (+2,700), trade, transportation and utilities (+1,700), financial activities (+1,200), professional and business services (+600), leisure and hospitality (+500), mining, logging and construction (+400) and manufacturing (+300) (NYS DOL 2026).

3.7.3 Income

Today, Putnam County is one of the most affluent counties in the State of New York, ranked 2nd by median household income (Mid Hudson News 2025). According to the 2024 ACS, the average salary in Putnam County in 2024 was \$126,257, above the state (\$85,974) and national (\$80,734) figures (U.S. Census 2025).



Table 3-4. Putnam County Socially Vulnerable Populations

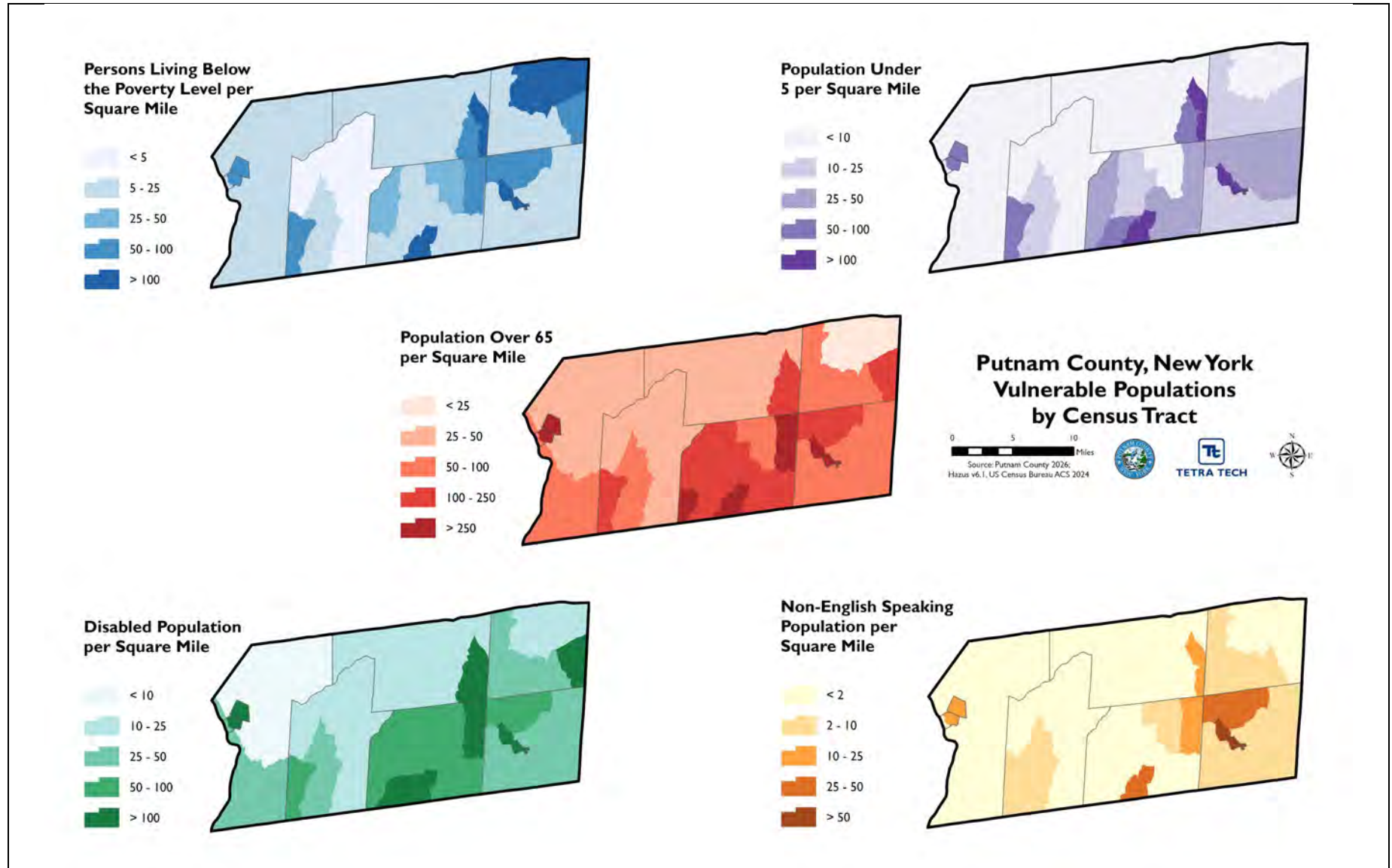
Jurisdiction	Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Total	% of Jurisdiction Total	Total	% of Jurisdiction Total	Total	% of Jurisdiction Total	Total	% of Jurisdiction Total	Total	% of Jurisdiction Total
Brewster (V)	330	13.1%	72	2.9%	544	21.7%	360	14.3%	362	14.4%
Carmel (T)	6,694	19.8%	1,358	4.0%	517	1.5%	3,607	10.7%	1,498	4.4%
Cold Spring (V)	427	22.9%	90	4.8%	70	3.8%	154	8.3%	84	4.5%
Kent (T)	2,224	17.2%	815	6.3%	239	1.9%	1,314	10.2%	852	6.6%
Nelsonville (V)	101	14.1%	27	3.8%	0	0.0%	62	8.7%	21	2.9%
Patterson (T)	1,878	16.2%	522	4.5%	193	1.7%	1,048	9.1%	1,939	16.8%
Philipstown (T)	1,763	24.1%	258	3.5%	24	0.3%	747	10.2%	536	7.3%
Putnam Valley (T)	2,208	18.8%	606	5.2%	204	1.7%	986	8.4%	493	4.2%
Southeast (T)	3,285	21.0%	882	5.6%	984	6.3%	1,589	10.1%	1,115	7.1%
Putnam County (Total)	18,910	19.3%	4,630	4.7%	2,775	2.8%	9,867	10.1%	6,900	7.0%

Source: U.S. Census Bureau 2024 ACS Vulnerable Population

Note: ACS data presents the non-English speaking population by households. Population counts in this table assume 2.68 persons per household



Figure 3-5. Socially Vulnerable Populations in Putnam County, by Census Tract





3.8 GENERAL BUILDING STOCK

3.8.1 Existing Development

The countywide asset inventory developed for this HMP includes 38,632 structures, identified by tax data and spatial data. These structures account for a replacement cost value of approximately \$26.8 billion. Table 3-5 presents building statistics by occupancy class. Residential structures account for 80.4 percent of all inventoried buildings in the County.

Census data identified 38,713 housing units in the county in 2020 and 35,545 households. A housing unit is any house, apartment, mobile home, trailer, group of rooms, or single room intended for occupancy as separate living quarters. A household includes all the people who occupy a housing unit as their usual residence (U.S. Census 2024).

Figure 3-6 through Figure 3-9 show the distribution and value density of residential, commercial, industrial, and other buildings in Putnam County. Value density is the dollar value of structures per unit area, including building content value. Value density maps can help communities identify areas of high loss potential and evaluate areas in relation to the specific hazard risks.

3.8.2 New Development

The County intends to discourage development in hazard-vulnerable areas, areas with high population density, and the Special Flood Hazard Area; and encourage higher regulatory standards at the local level. In order to avoid potential exposure of development to hazard events where possible, Putnam County uses best available data to identify planned new development, which is defined for this HMP as development over the previous five years and anticipated development within the next five years. Figure 3-10 shows the areas of new development, as submitted by the participating jurisdictions. Individual development projects are detailed in Volume II under each jurisdictional annex.

3.9 CRITICAL FACILITIES

Facilities that are essential to the health and welfare of the population and that maintain essential and emergency functions are designated as critical facilities. These typically include police and fire stations, schools, emergency operations centers, and infrastructure such as roads, bridges and utilities that provide water, electricity, and communications. Facilities that use or store hazardous materials are designated as critical facilities as well. All of these facilities are especially important after any hazard event (FEMA 1997b).

FEMA defines some types of critical facilities, as well as public services or activities, as “community lifelines.” Community lifelines provide the fundamental services in a community that, when stabilized, enable all other aspects of society. Following an emergency or disaster event, intervention is required to stabilize lifelines. FEMA defines eight categories of community lifelines as summarized in Table 3-6.



Table 3-5. Building Stock Count and Replacement Cost Value (RCV) by Occupancy Class

Jurisdiction	Residential		Commercial		Industrial		Other	
	Building Count	Total Replacement Cost Value	Building Count	Total Replacement Cost Value	Building Count	Total Replacement Cost Value	Building Count	Total Replacement Cost Value
Brewster (V)	396	\$138,587,475	148	\$144,977,260	8	\$17,771,571	17	\$67,604,555
Carmel (T)	10,140	\$5,493,409,567	1,926	\$2,708,617,991	64	\$170,974,989	91	\$676,627,071
Cold Spring (V)	596	\$248,084,161	139	\$139,669,849	6	\$8,097,775	20	\$79,047,742
Kent (T)	4,822	\$2,155,885,187	817	\$563,581,097	12	\$32,640,964	109	\$295,367,321
Nelsonville (V)	217	\$87,518,888	59	\$41,578,796	2	\$4,999,912	5	\$8,992,894
Patterson (T)	3,344	\$1,661,607,279	631	\$686,283,521	16	\$112,379,060	127	\$666,340,280
Philipstown (T)	2,806	\$1,519,769,749	1,144	\$806,090,990	12	\$20,265,215	87	\$288,105,911
Putnam Valley (T)	4,412	\$2,136,157,600	924	\$652,327,856	4	\$14,640,929	43	\$186,005,085
Southeast (T)	4,335	\$2,533,616,943	1,046	\$1,837,695,132	65	\$384,909,399	42	\$293,247,310
Putnam County (Total)	31,068	\$15,974,636,849	6,834	\$7,580,822,494	189	\$766,679,813	541	\$2,561,338,169

Source: Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; RSMeans 2026

Note: Other = Government, Religion, Agricultural, and Education



Figure 3-6. Distribution of Residential Building Stock and Value Density in Putnam County

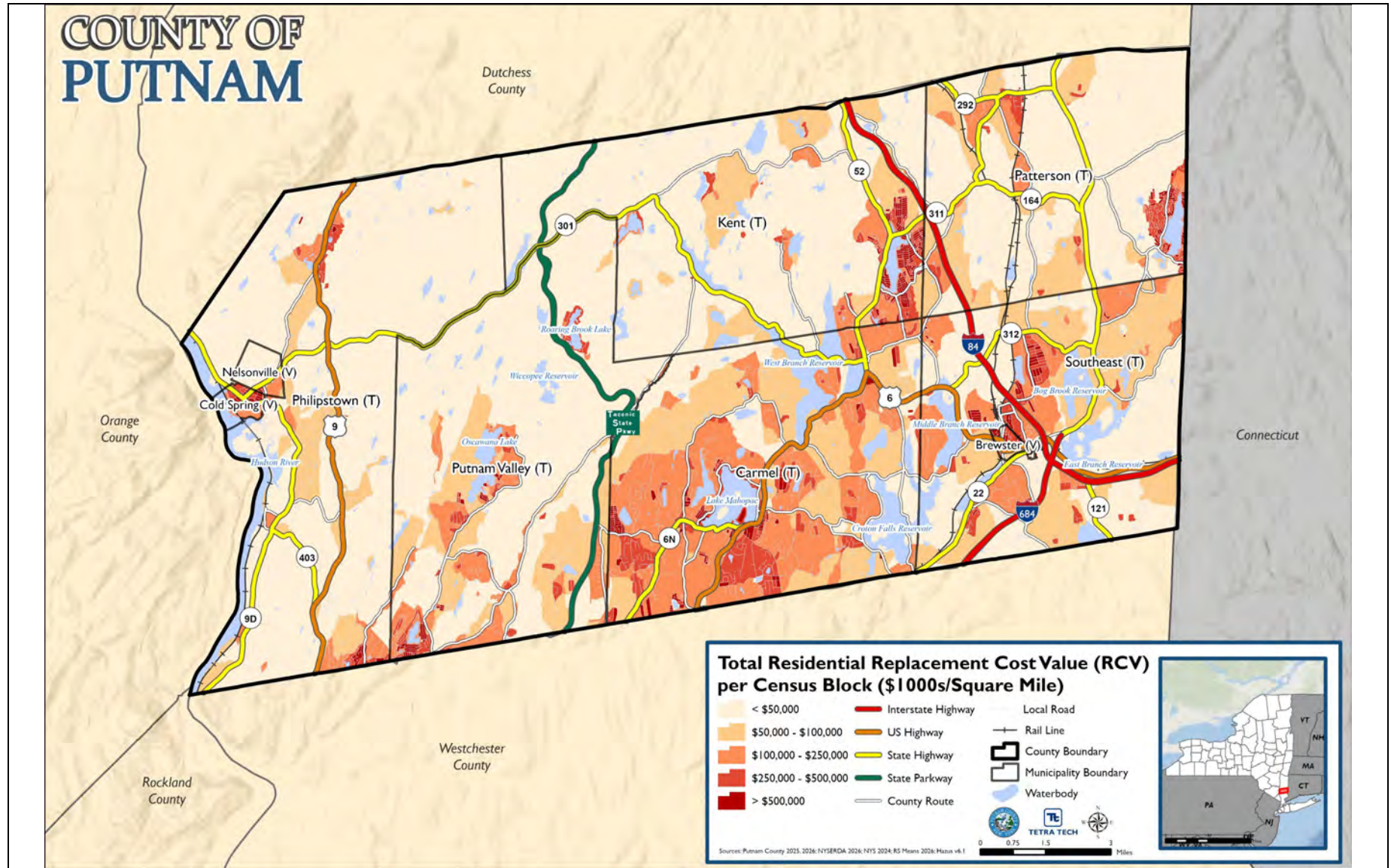




Figure 3-7. Distribution of Commercial Building Stock and Value Density in Putnam County

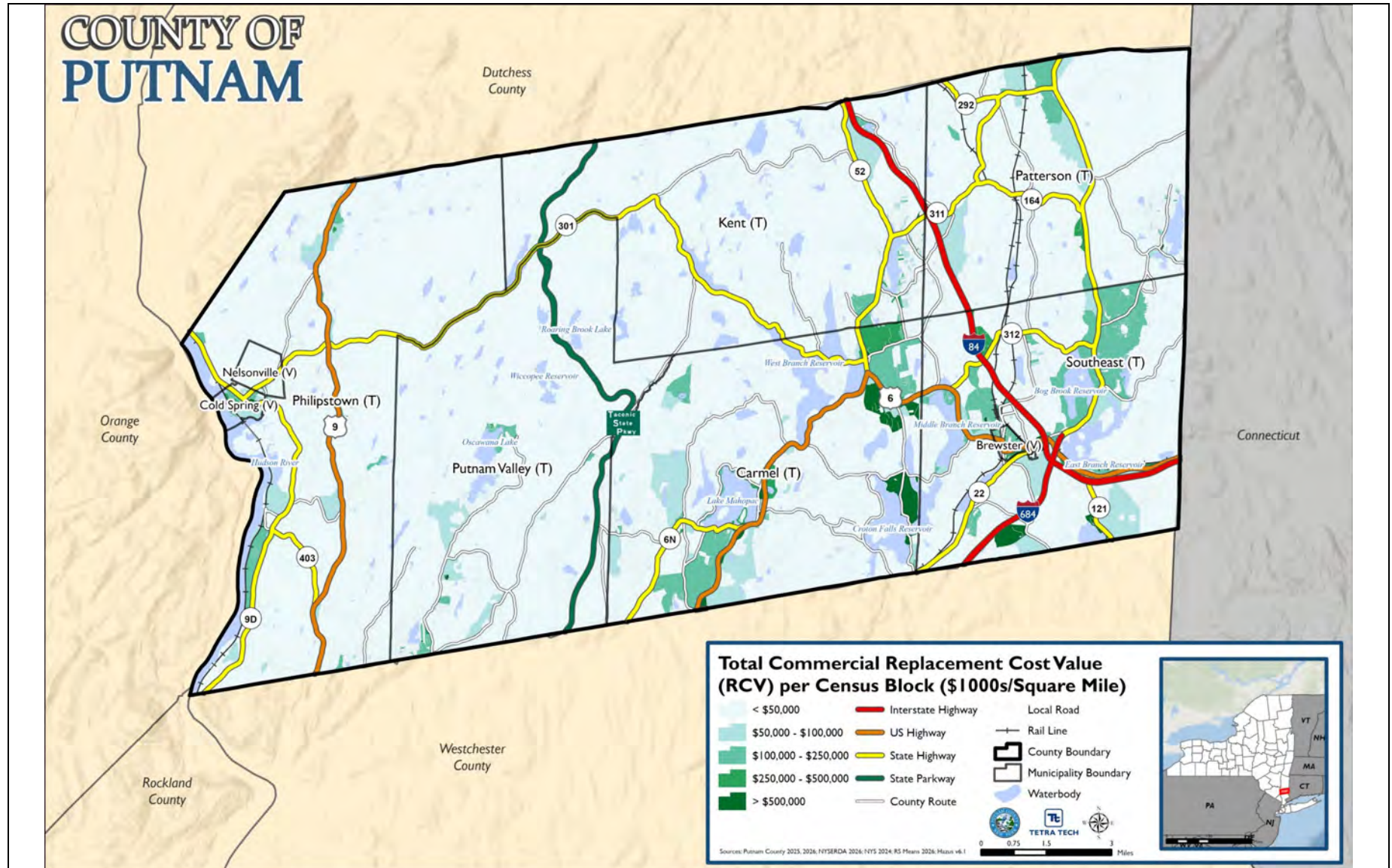




Figure 3-8. Distribution of Industrial Building Stock and Value Density in Putnam County

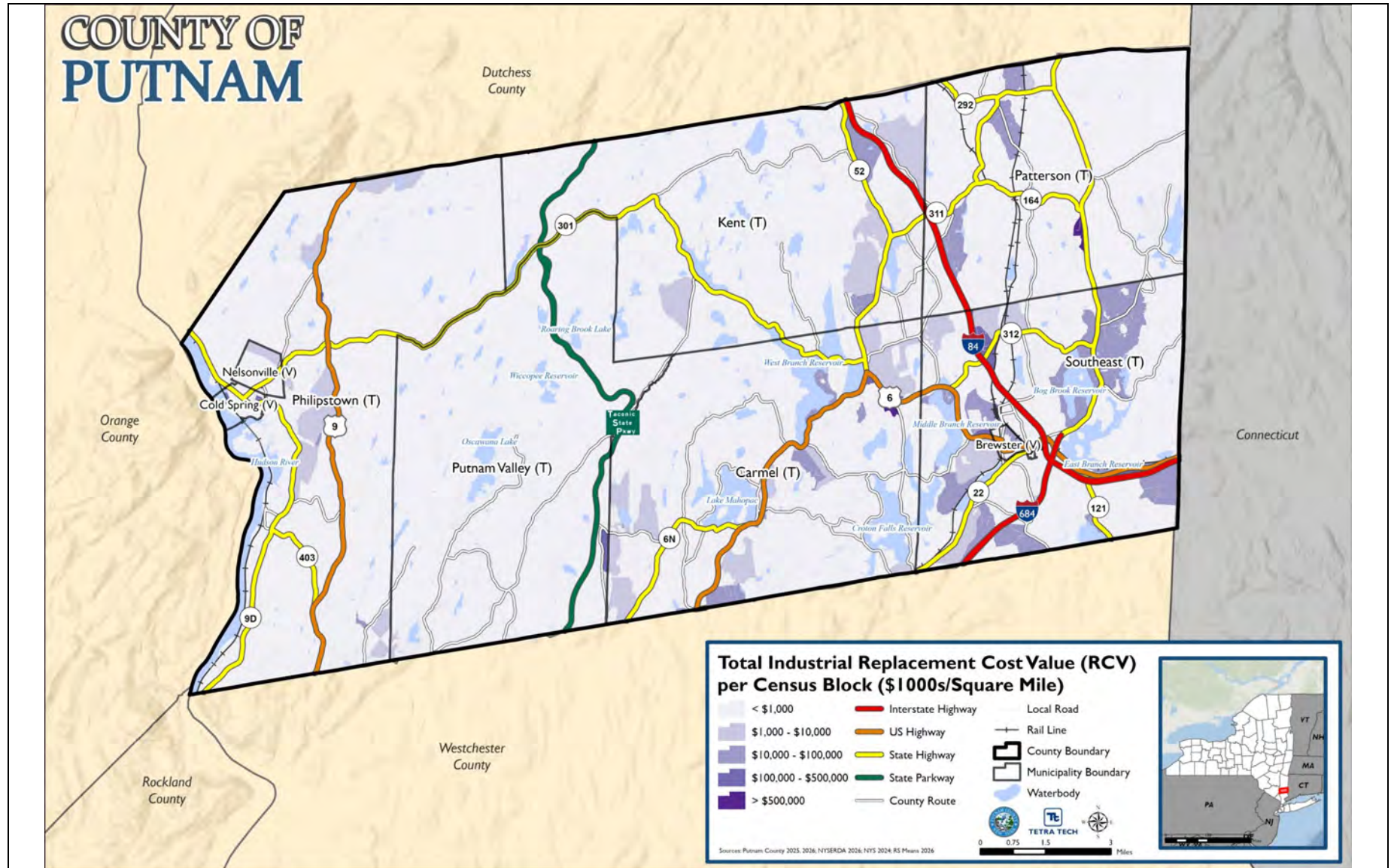




Figure 3-9. Distribution of Other Building Stock and Value Density in Putnam County

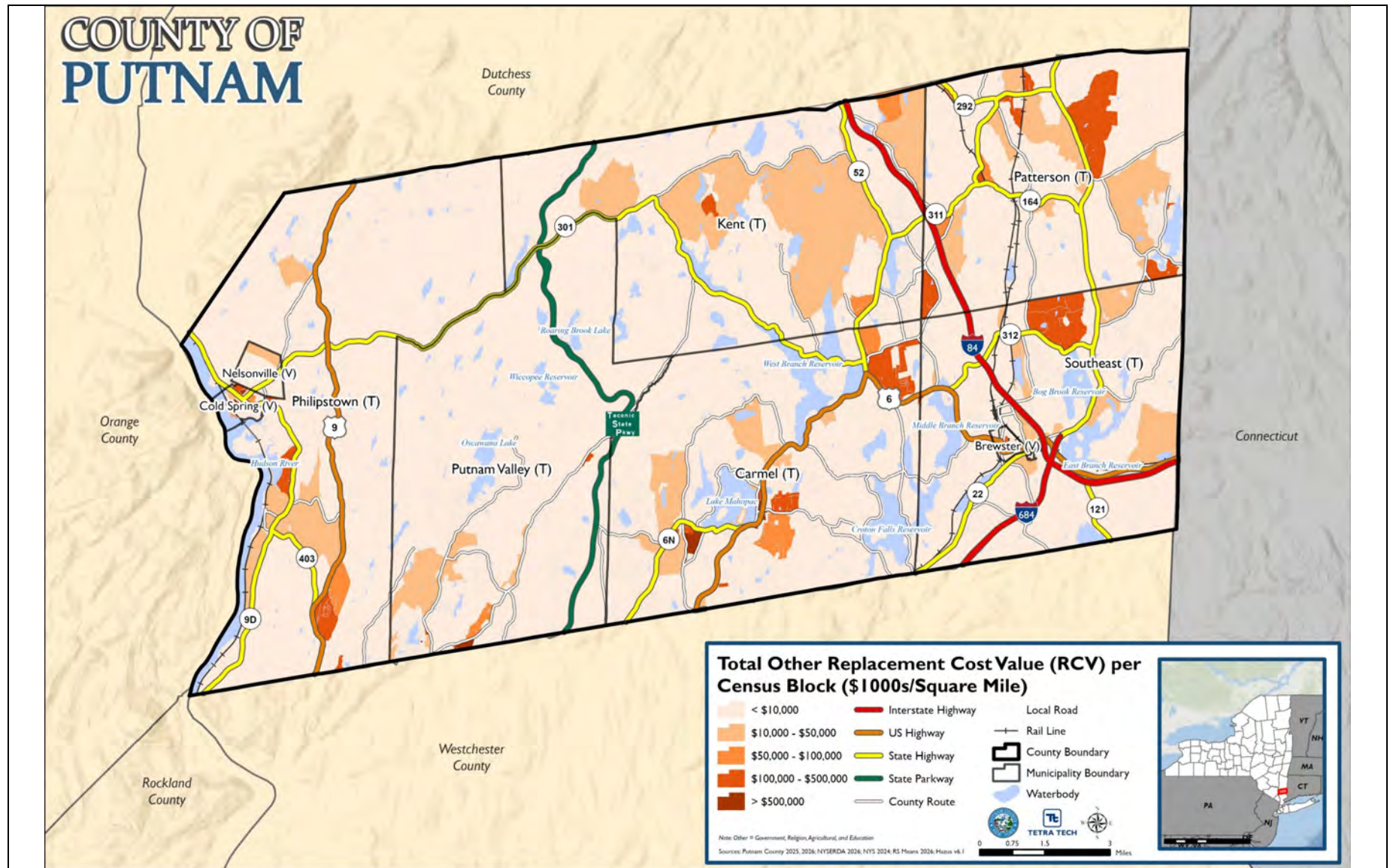




Figure 3-10. Putnam County New Development

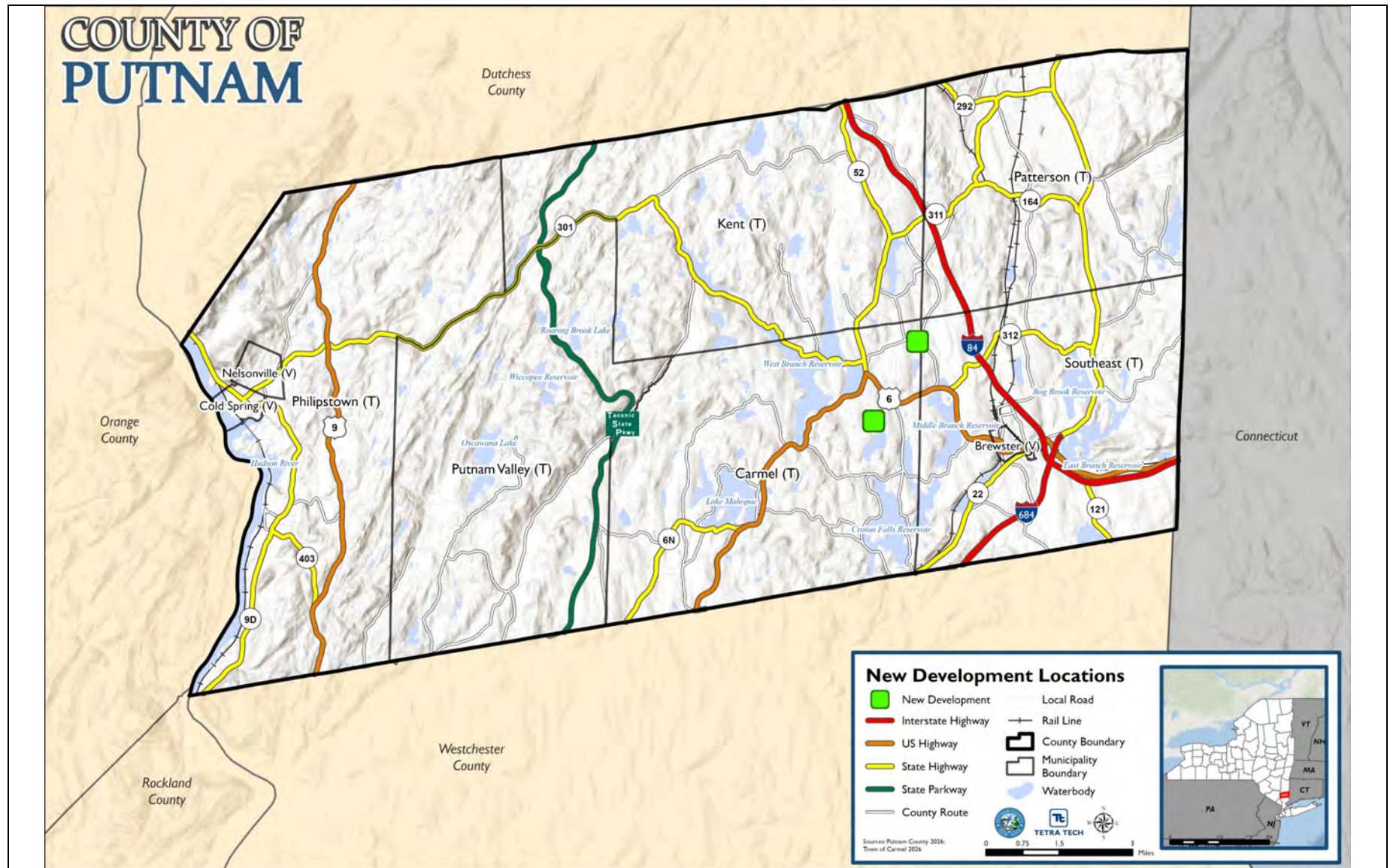




Table 3-6. FEMA-Defined Categories of Community Lifelines

Community Lifeline Category		Types of Facilities and Services Included
	Safety and security	Law enforcement/security, fire service, search and rescue, government service, community safety
	Food, hydration, shelter	Food, hydration, shelter, agriculture
	Health and medical	Medical care, public health, patient movement, medical supply chain, fatality management
	Energy	Power grid, fuel
	Communications	Infrastructure, responder communications, alerts warnings and messages, finance, 911 and dispatch
	Transportation	Highway/roadway/motor vehicle, mass transit, railway, aviation, maritime
	Hazardous materials	Facilities, hazmat, pollutants, contaminants
	Water systems	Potable water infrastructure, wastewater management

Source: FEMA 2023

A comprehensive inventory of community lifelines in Putnam County was developed from various sources, including input from the Steering Committee and Planning Partnership. The following sections describe the inventory of community lifelines that was used for the risk assessment in this HMP. Although many lifeline facilities could fall within numerous categories, each lifeline facility identified for this planning effort was categorized according to its primary function.



3.9.1 Safety and Security

Figure 3-11 shows the location of safety and security facilities included in the lifelines inventory. Key facilities and services considered for the inventory under this category are as follows:

- There is one emergency operation center in the County.
- There are 14 fire department facilities in Putnam County.
- There are eight total police facilities in the County. Police enforcement and public safety is maintained by the New York State Police Department, Putnam County Sheriff's Office, and local departments.
- New York State data lists 121 dams in Putnam County, with 21 listed as high hazard, 19 listed as intermediate hazard, and 78 listed as low hazard; three were not assigned a hazard classification.
- The U.S. Army Corps of Engineers' National Levee Database lists no levees in Putnam County.
- There are nine secondary education facilities and 19 primary education facilities in Putnam County, along with 43 other facilities identified as educational.
- There is one DMV facility, seven post offices, nine municipal halls, and 18 municipal public works facilities in Putnam County, along with 16 other facilities identified as county buildings.

3.9.2 Food, Hydration, Shelter

Figure 3-12 shows the location of food, hydration, and shelter facilities included in the lifelines inventory. Key facilities and services considered for the inventory under this category are as follows:

- The County identified 22 shelter facilities and 18 lodging facilities. The county references an inventory of suitable shelter and lodging locations with support and cooperation of the American Red Cross and local jurisdictions.
- There are seven facilities identified as food pantries located throughout the County.
- The County identified 10 facilities that are classified as senior housing.

3.9.3 Health and Medical

Figure 3-13 shows the location of health and medical facilities included in the lifelines inventory. Key facilities and services considered for the inventory under this category are as follows:

- Putnam County has one hospital—Putnam County Hospital.
- Five urgent care centers for non-emergency health care needs are located throughout the County. Some of these clinics are open 24 hours per day, and most have evening and weekend hours.
- The County has seven alcohol/drug treatment facilities.
- The County has an extensive system of programs and services for the senior population, including nine pharmacies, three nursing homes, and 10 ambulance/EMS facilities. These facilities are highly vulnerable to impacts from disasters and knowing their location facilitates pre- and post-disaster response planning.



Figure 3-11. Safety and Security Facilities In Putnam County

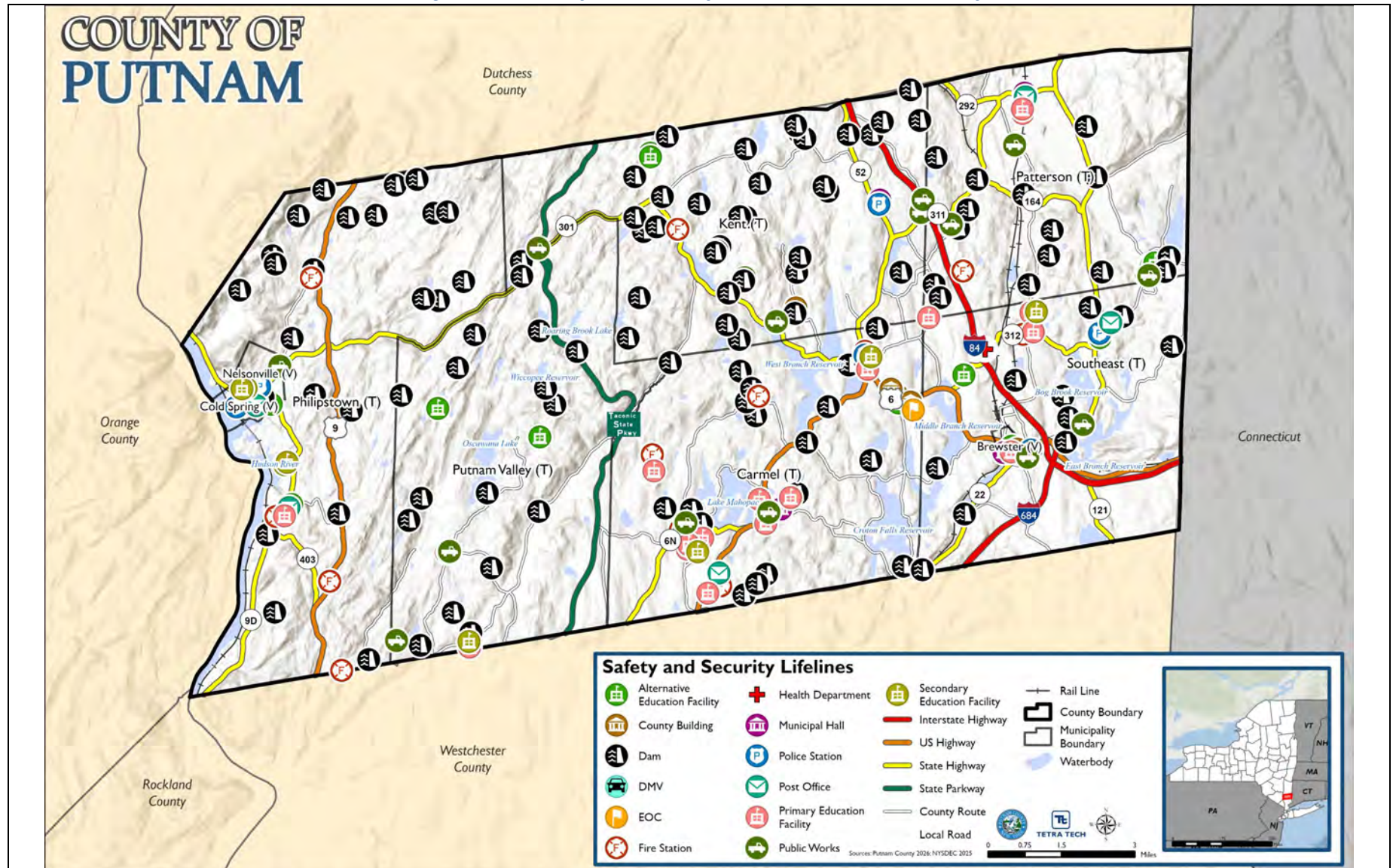




Figure 3-12. Food, Hydration, and Shelter Facilities in Putnam County

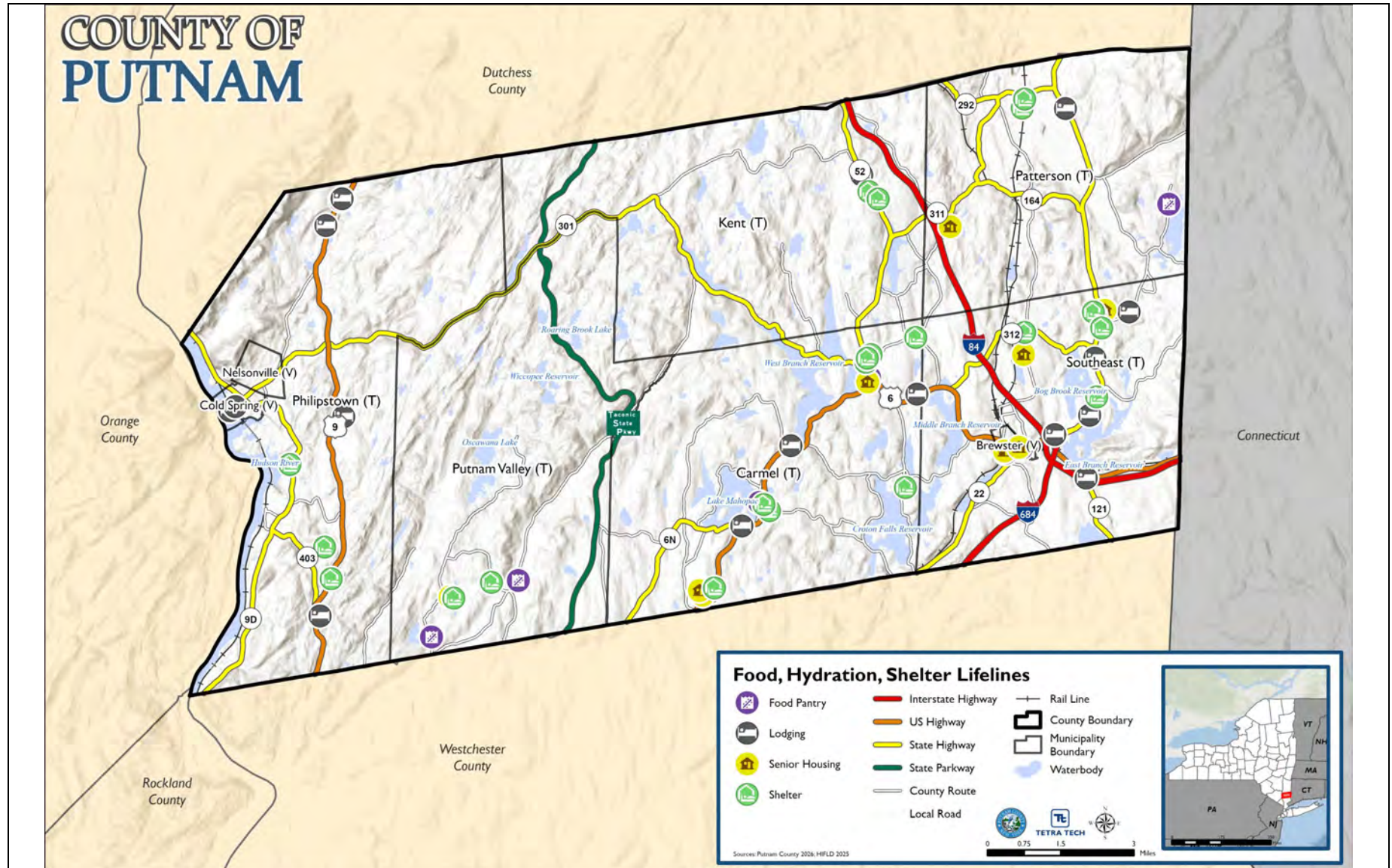
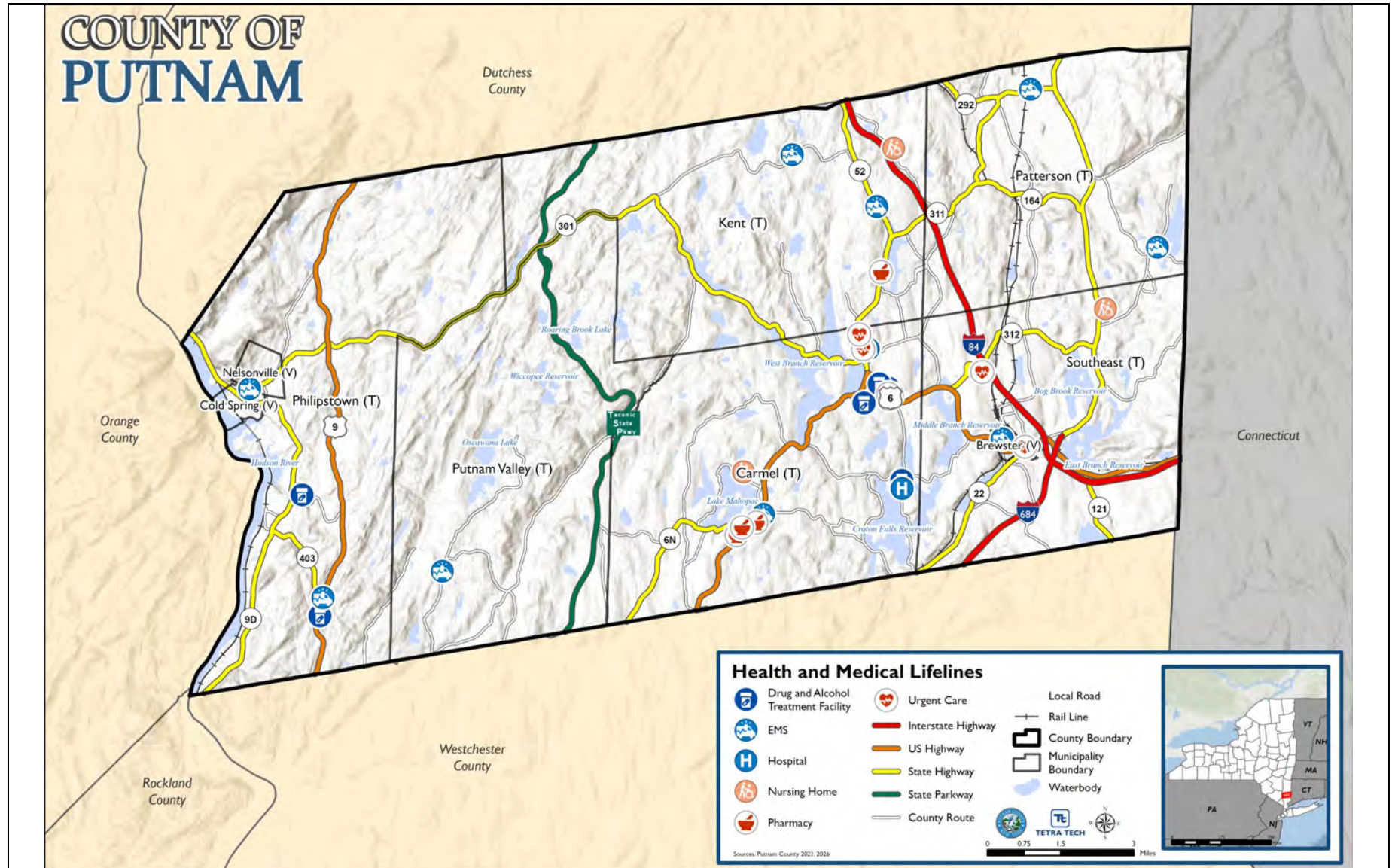




Figure 3-13. Health and Medical Facilities in Putnam County





3.9.4 Energy

Figure 3-14 shows the location of energy facilities included in the lifelines inventory. Key facilities and services considered for the inventory under this category are as follows:

- There are 14 electric substations that are identified throughout the County. New York State Electric and Gas Corporation (NYSEG) is the primary electric and gas utility company in Putnam County. Natural gas services are also provided by smaller, private companies.
- There are four propane gas facilities, eight natural gas facilities and seven oil facilities located throughout the County. Most homes in the County are heated by utility gas or fuel oil. Some areas are dependent on residential propane tanks.

3.9.5 Communications

Figure 3-15 shows the location of communications facilities included in the lifelines inventory. Key facilities and services considered for the inventory under this category are as follows:

- Putnam County Bureau of Emergency Services' 911 Communications Center is the sole public safety answering point for Putnam County. The center coordinates communication with 8 police agencies, 7 EMS agencies, and 13 fire departments.
- Communications systems in Putnam County include traditional land line, fiber optic, and cellular service provided by multiple companies, such as Verizon and AT&T. Each carrier has individual plans for emergency situations during hazard events and post-disaster recovery efforts.
- Putnam County has an extensive radio communications network that is utilized by emergency services agencies, hospitals, law enforcement, public works, transportation, and other supporting organizations.
- There are 292 communication facilities in Putnam County identified as critical facilities.



Figure 3-14. Energy Facilities in Putnam County

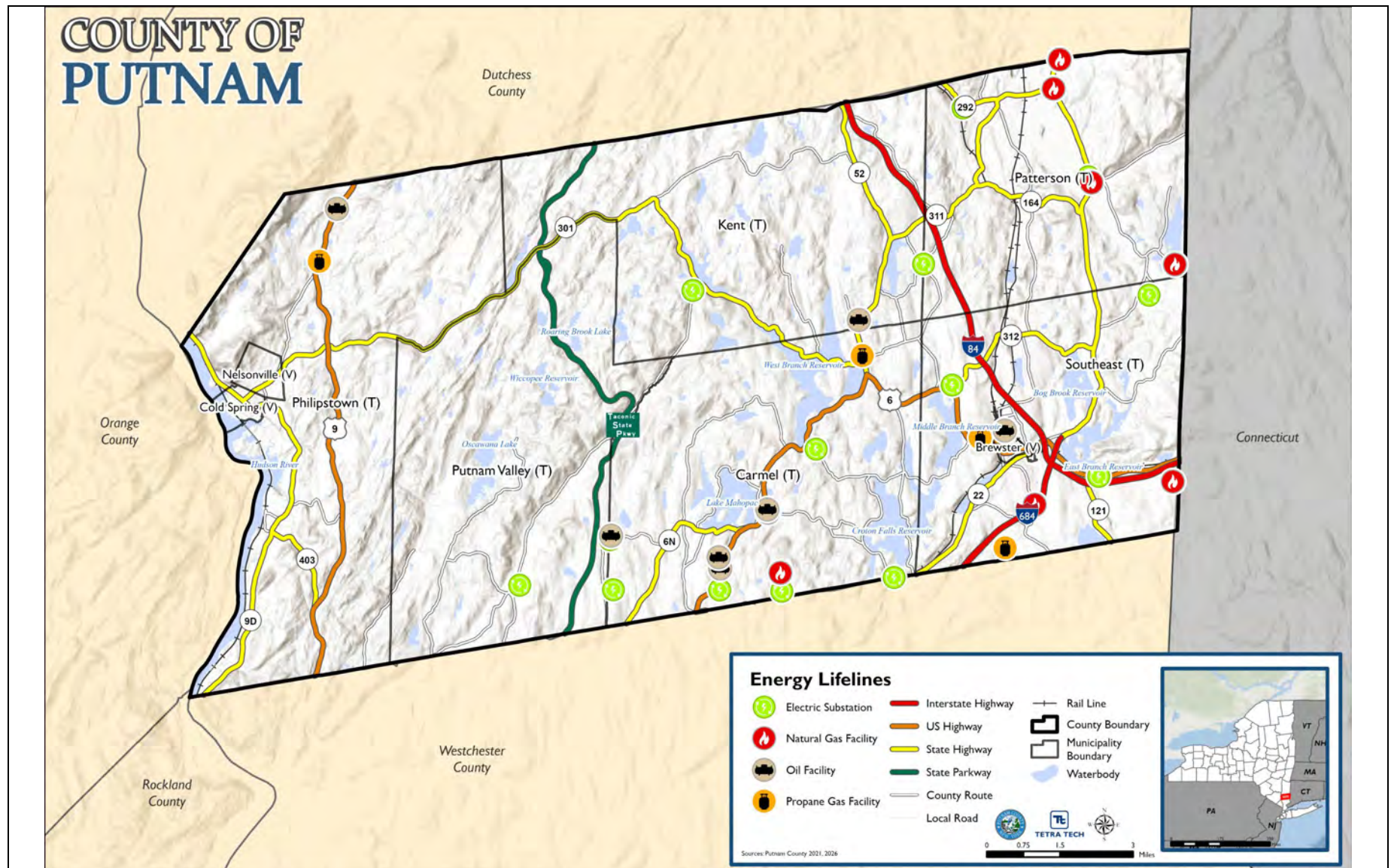
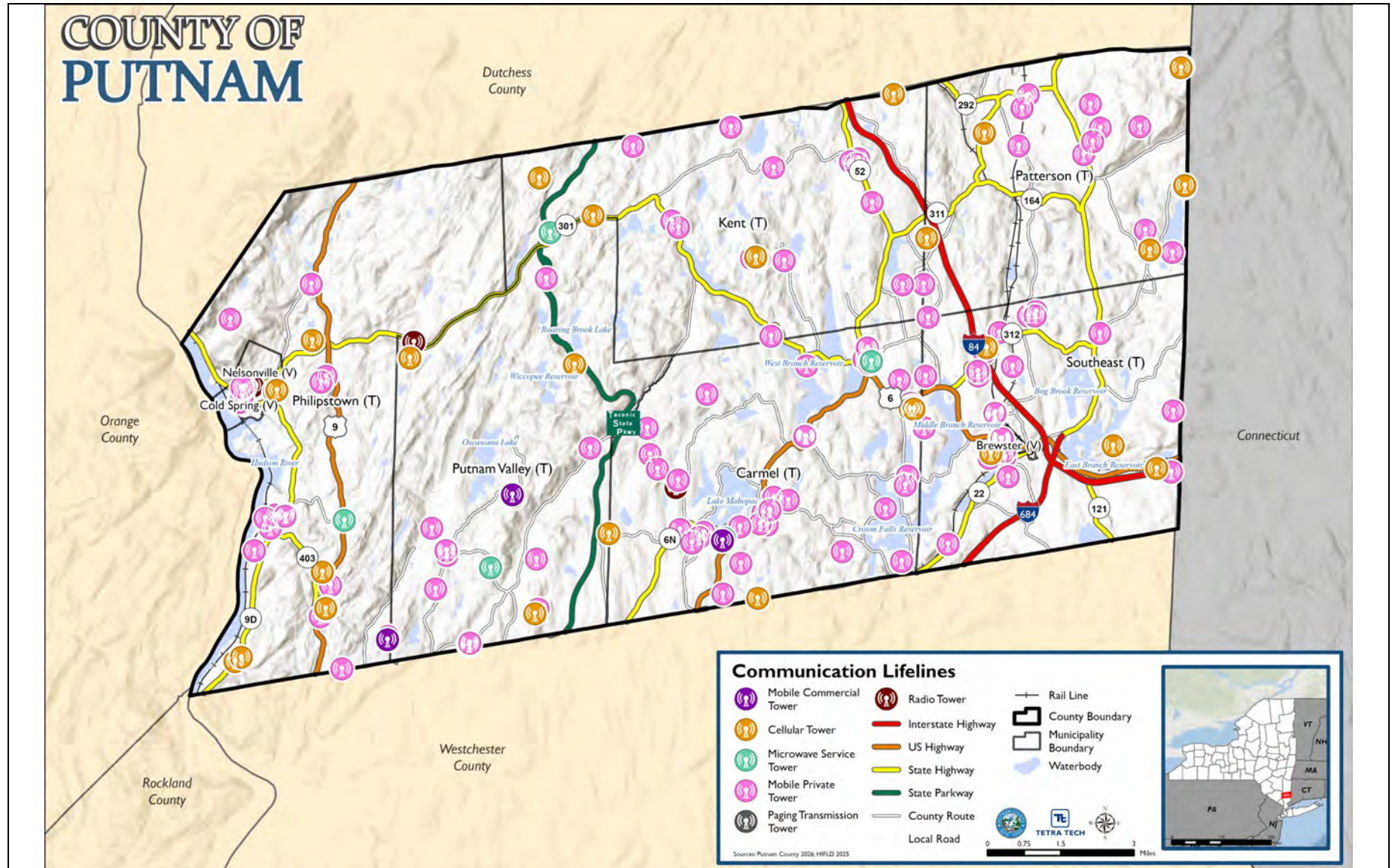




Figure 3-15. Communications Facilities in Putnam County





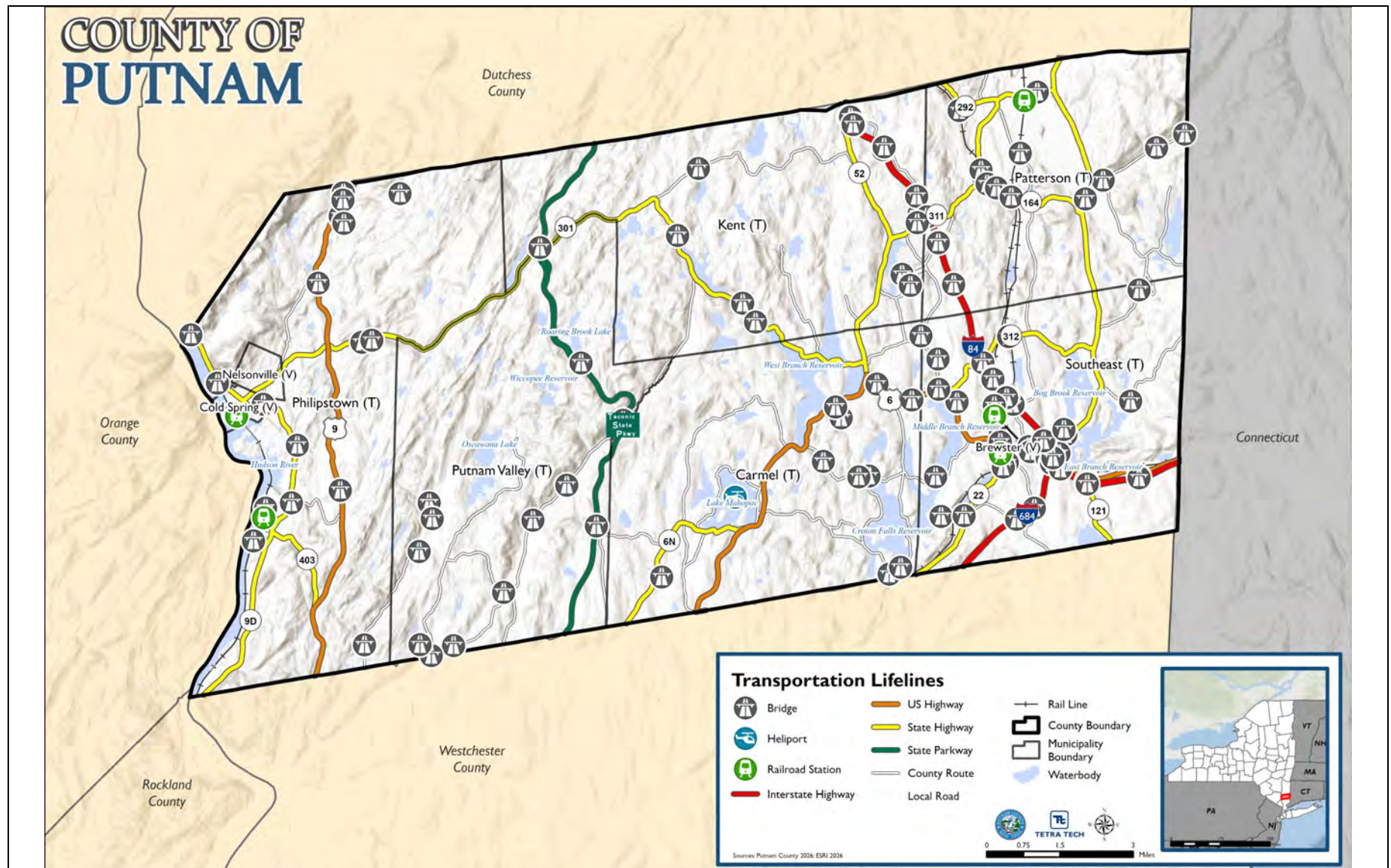
3.9.6 Transportation

Figure 3-16 shows the location of transportation facilities included in the lifelines inventory. Key facilities and services considered for the inventory under this category are as follows:

- Roadways
 - Interstate 84 runs diagonally through eastern Putnam County.
 - Route 684 runs in a general north and south direction, connecting the eastern half of the County to surrounding counties, as well as New Jersey and Connecticut.
 - The Taconic Parkway, runs in a north and south direction, connecting the western half of the County to the same regions as the Interstates.
 - U.S. Routes 6 and 9 serve as important roadways for intra and inter-county travel.
 - Putnam County Department of Public Works maintains over 200 miles of roads from the Hudson River to the Connecticut border. The Department maintains a fleet of over 300 vehicles.
- Railroads
 - Two Metro-North rail lines run north and south through the eastern and western halves of the County. The Harlem Line in the east and the Hudson Line in the west connect the County to Albany, New York City, and farther regions via Grand Central Terminal. There are seven railroad stops in Putnam County: Brewster Village, Brewster North, Patterson, Cold Spring, Garrison, Breakneck, and Manitou.
- Bus and Other Transit Facilities
 - Public bus service in Putnam County consists of the County's bus system, Putnam Area Rapid Transit (PART), several Westchester County Bee Line routes, and a Housatonic Area Regional Transit route that operates between Danbury, Connecticut and Brewster.
 - PART service is generally concentrated in the eastern part of the County, where service can be provided to more densely populated areas and where linkages can be made to other buses and train services. The Westchester Bee Line provides commuter service through the Town of Carmel, along Route 6 from the hamlet of Carmel to White Plains, and a Croton Falls commuter run between the Croton Falls train station and the Mahopac area, along Croton Falls Road.



Figure 3-16. Transportation Facilities in Putnam County





3.9.7 Hazardous Materials

Figure 3-17 shows the location of hazardous materials facilities included in the lifelines inventory. Due to security concerns, local hazardous materials lifeline data was only partially obtained. Key facilities and services considered for the inventory under this category are as follows:

- There are 80 recycling centers identified throughout the County.
- The NYSDEC's Bulk Storage Program Database requires registration for all petroleum bulk storage facilities with a total storage capacity of 1,100 gallons or more; all chemical bulk storage underground tanks and all stationary aboveground tanks with a capacity of 185 gallons or more; and all major oil storage facilities sites storing more than 400,000 gallons of petroleum products. As of June 2026, there were 381 Putnam County sites in the database (NYSDEC 2026a).
- The U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) (Superfund) Public Access Database reports that there are two Superfund sites in Putnam County. Superfund sites are contaminated locations designated for federal cleanup due to hazardous substances that may threaten human health or the environment.
- Abandoned hazardous waste sites on the federal National Priorities List include those that the EPA has determined present "a significant risk to human health or the environment," with the sites being eligible for remediation under the Superfund Trust Fund Program. As of 2026, Putnam County has no inactive hazardous sites in the federal Superfund Program that are included on the priorities list (CERCLIS 2026).

3.9.8 Water Systems

Figure 3-18 shows the location of water system facilities included in the lifelines inventory. Due to security concerns, water system lifeline data was only partially obtained. Key facilities and services considered for the inventory under this category are as follows:

- Most County water users obtain their water from deep wells that tap groundwater resources. Many community systems in Putnam County rely on deep wells, and a few rely on surface water. Many of the rural areas are dependent on private wells.
- Putnam County has a combination of public and privately owned treatment plants and collection systems. All community supplies have a distribution system. The Town of Carmel has the most public sewer districts. Other public districts are found in the Villages of Cold Spring and Brewster, and the Town of Southeast. All but seven of the treatment plants are located in the New York City watershed. Many residents and businesses rely on individual septic systems.

3.9.9 Other Critical Facilities

Some facilities that are identified as critical for hazard mitigation in Putnam County do not fit in any of FEMA's community lifeline categories. These include churches, polling sites, libraries, daycare facilities and marinas. Figure 3-19 shows the location in Putnam County of these other critical facilities.



Figure 3-17. Hazardous Material Lifelines in Putnam County

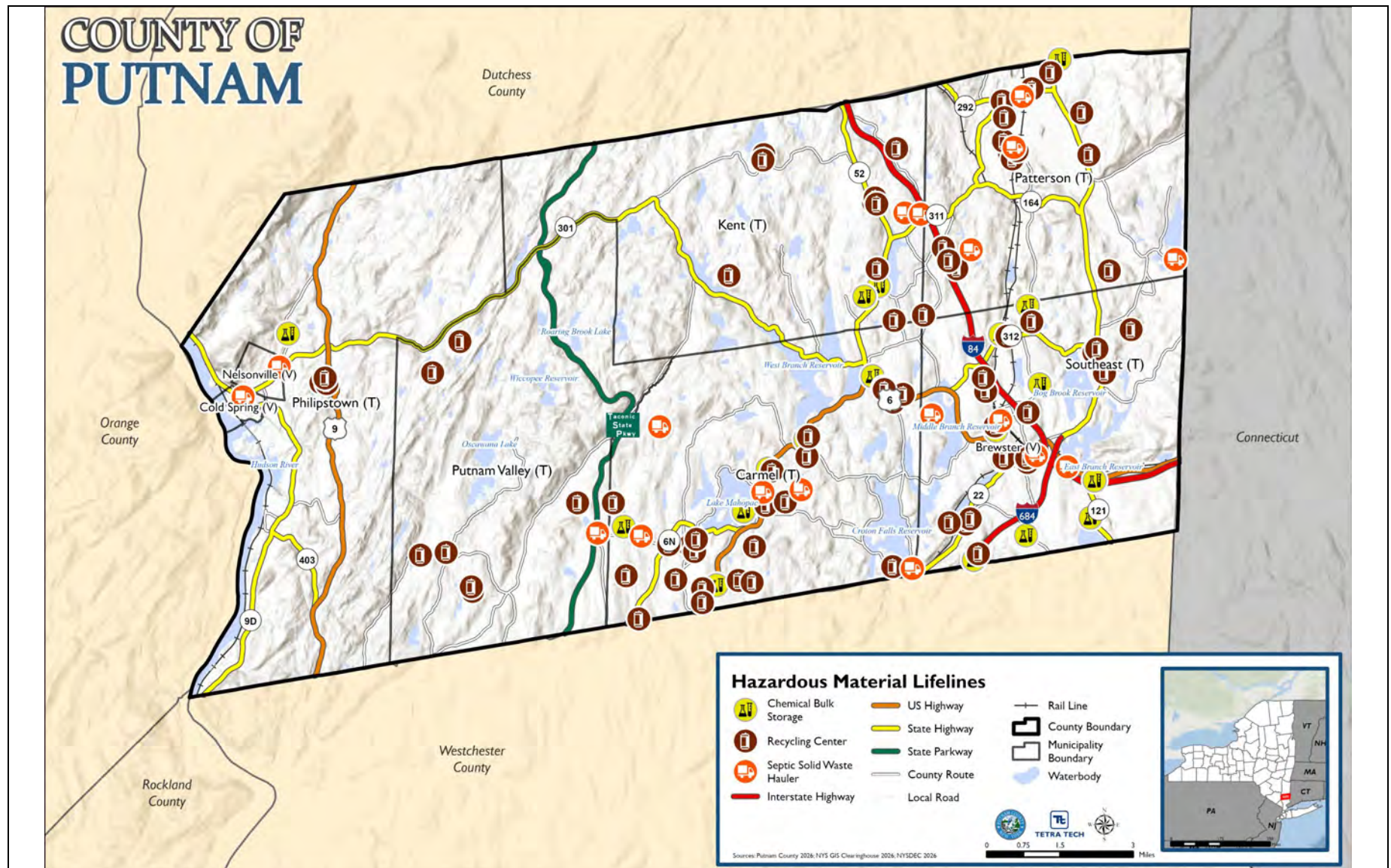




Figure 3-18. Water Systems Lifelines in Putnam County

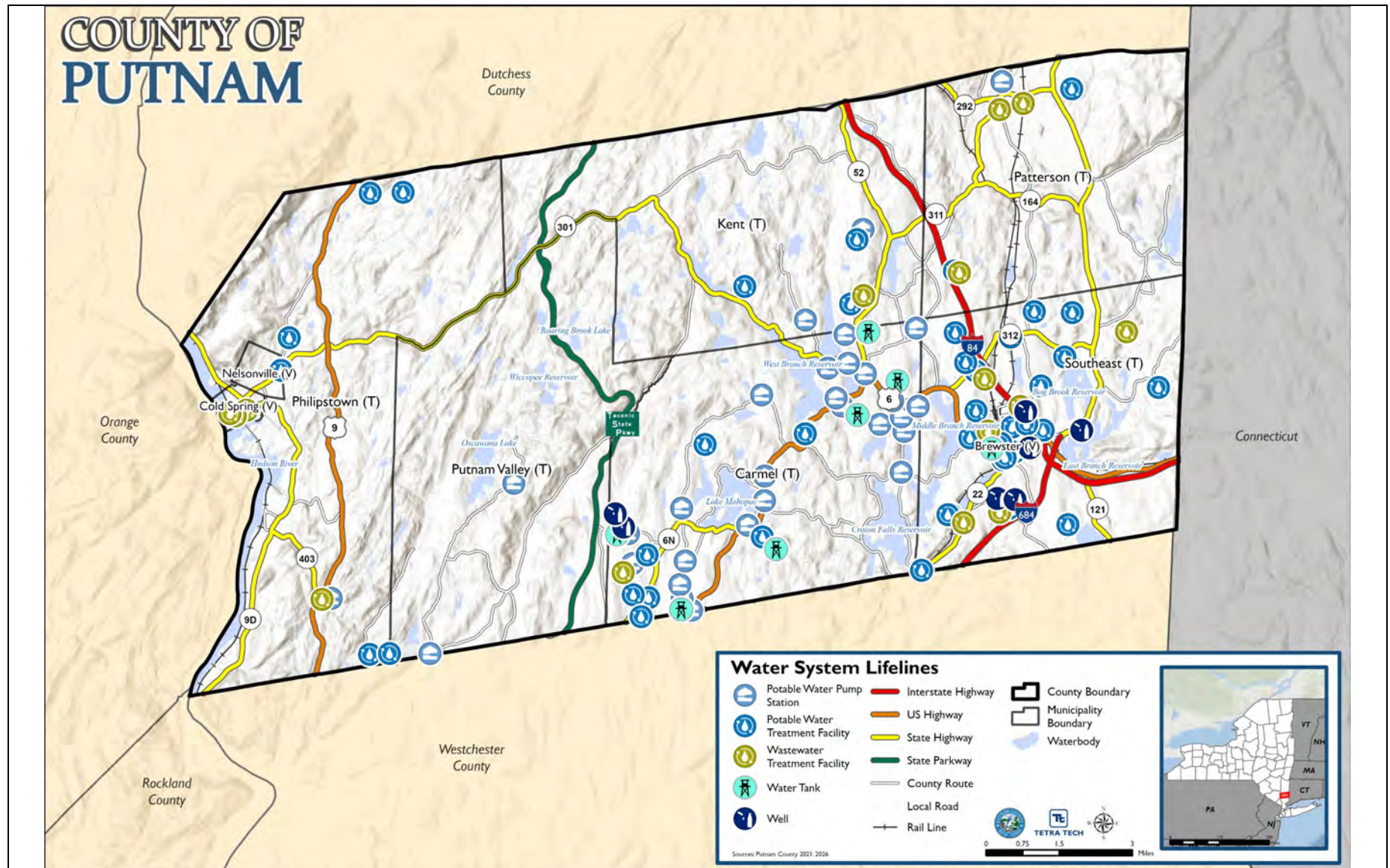
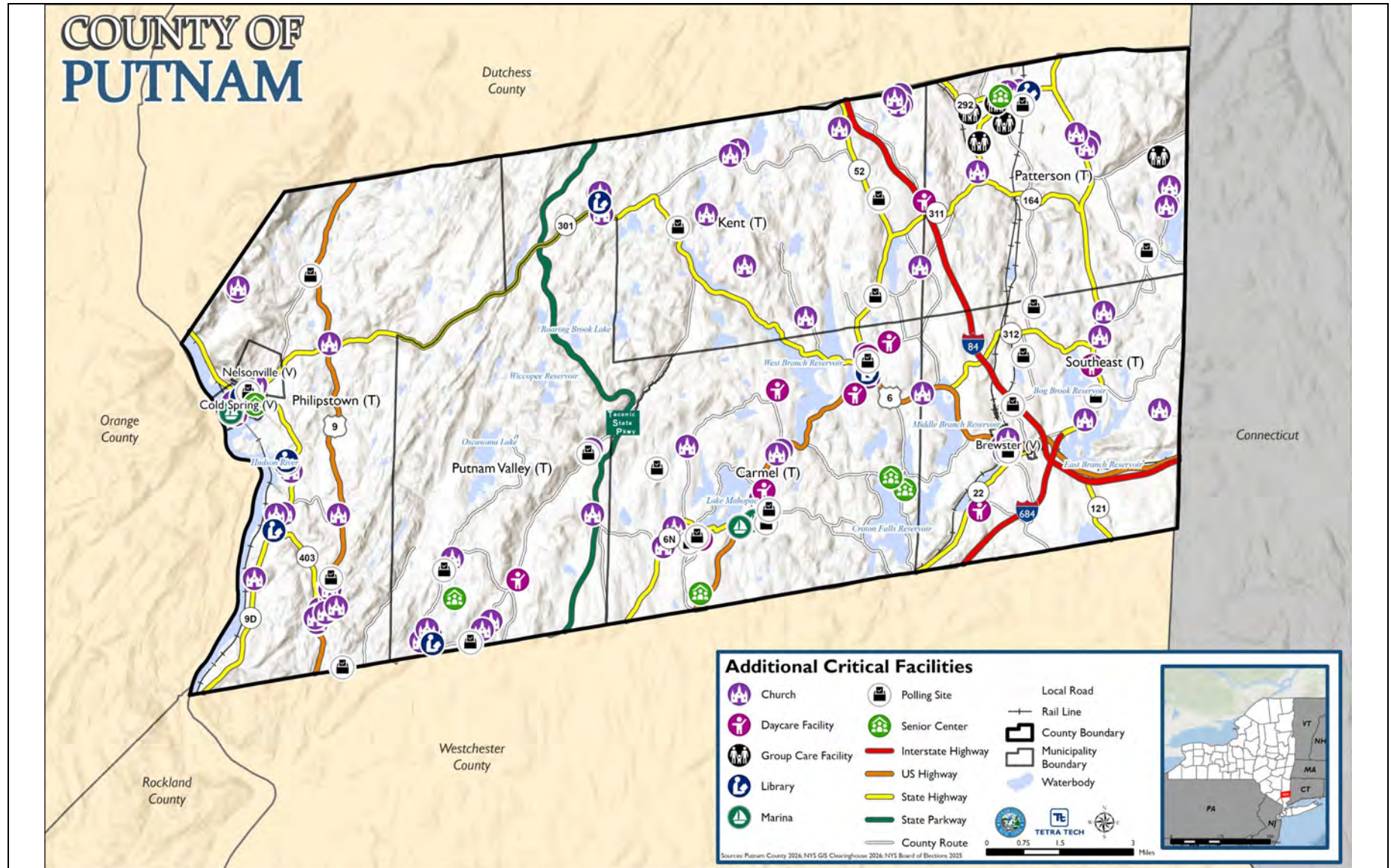




Figure 3-19. Other Critical Facilities in Putnam County



PART 2:

RISK ASSESSMENT





4. RISK ASSESSMENT METHODOLOGY AND TOOLS

A risk assessment is the process of evaluating the potential loss of life, personal injury, and economic and property damage that could result from identified hazards. Identifying potential hazards and vulnerable assets allows planning personnel to address and reduce hazard impacts and allows emergency management personnel to establish early response priorities. Results of the risk assessment are used in subsequent mitigation planning processes, including determining and prioritizing mitigation actions that reduce each jurisdiction's risk from each hazard. The process focuses on the following elements:

- **Identify Hazards of Concern**—Use all available information to determine what types of hazards may affect a jurisdiction.
- **Profile Each Hazard**—Understand each hazard in terms of:
 - Description—The common causes of the hazard, hazard behavior, and significant impacts
 - Location—Geographic area most likely to be affected by the hazard
 - Extent—The potential severity of the hazard within the planning area
 - Previous occurrences
 - Probability of future hazard events
- **Assess Vulnerability and Impacts**—Use all available information to estimate to what extent people and assets may be adversely affected by a hazard now and in the future:
 - Determine vulnerability—Estimate the total number of assets in the jurisdiction that are likely to experience a hazard event if it occurs by overlaying hazard maps with the asset inventories.
 - Estimate potential impacts/losses—Assess the impact of hazard events on the people, property, economy, and lands of the region, including estimates of the losses associated with potential damage or cost that can be avoided by mitigation.
 - Evaluate future changes that may affect vulnerability and impacts—Analyze how demographic changes, projected development, and climate change impacts can alter current vulnerability and potential impacts.

4.1 ASSET INVENTORIES

Putnam County assets were identified to assess potential vulnerability and impacts associated with the hazards of concern. The HMP update assesses vulnerability and potential hazard impacts for the following types of assets: population, buildings, critical facilities/community lifelines, land cover, and new development. Each asset type is described below. To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual properties.

4.1.1 Population

Statistics from the 2020 Decennial Census Population estimate and 2024 ACS 5-year estimate were used to assess risk to the County's population. Socially vulnerable populations included in the risk assessment are people under 5 years old or over 65 years old, non-English speaking individuals, people with a disability, and people living below the poverty level.



Jurisdiction-specific populations (total and at-risk) were determined based on the following assumptions and calculations:

- To determine population statistics for villages and towns, village population totals were subtracted from the total town population.
- Population counts at the jurisdictional level were averaged among the residential structures in the county to estimate the population at the structure level. This provides a more precise distribution of population across the county compared to only using census block or census tract boundaries.
- Where villages were split between towns, the percentage of the geographic area of the village within each town was calculated and applied to the total population of the village to estimate the population that would be subtracted from each town.

4.1.2 Buildings

The general building stock was updated countywide with a custom-building inventory using the most current parcel and New York State Department (2024) tax assessment data provided by Putnam County (2025).

Location and Structure Characteristics

The tax assessment data was joined to the spatial layer of structure footprints provided by the County. The centroid of each building footprint was used to estimate the building location. Attributes provided in the data files were used to further define each structure, such as year built, number of stories, basement type, occupancy class, and square footage.

Occupancy Class

Buildings were assigned to occupancy classes defined in Hazus. The Hazus classes were condensed into the categories of residential (including multi-family and single-family), commercial, industrial, and other (agricultural, religious, governmental, and educational).

Replacement Cost Value

Structural and content replacement cost values (RCV) were calculated for each building using the available assessor data, the building footprint, and RSMeans 2026 values. RCV is the current cost of returning a destroyed asset to its pre-damaged condition using present-day cost of labor and materials. Total RCV consists of the structural cost to replace a building and the estimated value of building contents. Content value was estimated as 50 percent of the structure value for residential buildings, and 100 percent of the structure value for non-residential buildings.

A regional location factor was applied to the RCV estimates based on the first three digits of the individual block stock's zip code as follows:

- Zip codes beginning in 105 (Mount Vernon)
 - Location factor for residential buildings = 1.13
 - Location factor for non-residential buildings = 1.16
- Zip codes beginning in 125 – 126 (Poughkeepsie)
 - Location factor for residential buildings = 1.21
 - Location factor for non-residential buildings = 1.17



4.1.3 Critical Facilities and Community Lifelines

Data to create a critical facility inventory was provided by Putnam County (2021, 2026); HIFLD (2025); NYS GIS Clearinghouse (2026); NYSDEC (2025, 2026); ESRI (2026); NYS Board of Elections (2025). The development involved a review for accuracy, additions, or deletions of new or moved critical assets, identification of backup power for each asset (if known) and whether the critical facility is considered a lifeline as described in Section 3.9.

4.1.4 Land Cover

National land cover data created by the U.S. Geological Survey (USGS) in 2024 was converted from a raster to a vector polygon to define areas of urban and non-urban land cover. Urban areas include developed open space and low, medium, and high intensity locations. Non-urban areas include agricultural, barren land, forest, rangeland, water, and wetlands land use categories.

4.1.5 New Development

New development in the planning area was defined as development that occurred over the last 5 years or that is expected to occur over the next 5 years. Each jurisdiction was asked to provide a list by address of major development that has taken place within these timeframes. The location of new development projects was submitted via ArcGIS Survey123. A geographic information system (GIS) analysis was conducted to determine hazard exposure of these development sites. Results are presented in the jurisdictional annexes in Volume II.

4.2 HAZARD EVENT HISTORY AND PROBABILITY OF OCCURRENCE

The following were the primary sources for identifying the history of previous occurrences of hazard events:

- **FEMA disaster declarations**—The president of the United States has the authority to issue disaster declarations for hazard events that cause more damage than state and local governments can manage without assistance from the federal government. The declaration triggers funding for emergency and recovery efforts led by FEMA. The first federal disaster declaration was issued in 1953. Initially, declarations applied to entire states. Beginning in 1969, the process was refined to specify individual affected counties. Federal disaster declarations are classified as major disaster (DR), emergency declaration (EM), or fire management assistance (FM).
- **U.S. Department of Agriculture disaster declarations**—The U.S. Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties.
- **Hazard-specific databases**—Sources that provide records of specific types of hazard events include the National Centers for Environmental Information's Storm Events Database, the National Integrated Drought Information System's U.S. Drought Monitor, and the USGS Earthquake Catalog.
- **News reports and previously published planning documents** such as the New York State Hazard Mitigation Plan and the previous Putnam County HMP.

Based on records of previous hazard events and consideration of potential future changes that could affect the frequency of future events, the risk assessment for each hazard assigns a rating for the probability of occurrence of that hazard in the future. These ratings were assigned as follows:

- **Unlikely**—less than 1 percent annual chance of occurring



- Possible—between 1 and 49.9 percent annual chance of occurring
- Likely—between 50 and 90 percent annual chance of occurring
- Highly Likely—greater than 90 percent chance occurring; occurs multiple times a year

4.3 VULNERABILITY AND IMPACT EVALUATION APPROACH

4.3.1 Levels of Analysis

Putnam County used standardized tools, combined with local, state, and federal data and expertise to assess potential vulnerability and losses associated with hazards of concern. Three levels of analysis were used, depending upon the data available for each hazard:

- **Qualitative Review**—This analysis includes an examination of historical impacts to understand potential impacts of future events of similar size. Potential impacts and losses are discussed qualitatively using best-available data and professional judgment.
- **Vulnerability Analysis**—This analysis involves overlaying available spatial hazard layers, for hazards with defined locations, on asset mapping in GIS to determine which assets are located in the hazard area.
- **Loss Estimation**—The FEMA Hazus modeling software was used to estimate impact in terms of potential losses for the following hazards: flood, earthquake, and hurricane.

Table 4-1 summarizes the type of analysis conducted by hazard of concern.

Table 4-1. Summary of Risk Assessment Analyses

Hazard	Population	General Building Stock	Critical Facilities	New Development
Dam Failure	V	V	V	V
Disease Outbreak	Q	Q	Q	Q
Drought	Q	Q	Q	Q
Earthquake	V, L	V, L	V, L	V
Extreme Temperature	Q	Q	Q	Q
Flood	V, L	V, L	V, L	V, L
Harmful Algal Bloom	Q	Q	Q	Q
Severe Storm	L	L	L	L
Severe Winter Storm	Q	Q	Q	Q
Terrorism	Q	Q	Q	Q
Wildfire	V	V	V	V

Notes: V = vulnerability analysis; L = loss estimation; Q = qualitative review

4.3.2 Hazus Model

FEMA's Hazus model is a GIS-based software tool that uses engineering and scientific risk calculations to estimate damage and loss. Hazus uses GIS technology to produce detailed maps and analytical reports that estimate direct physical damage to building stock, critical facilities, transportation systems and utility systems.



Hazus provides default data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. Custom critical facility and building inventories are formatted to be compatible with the Hazus Comprehensive Data Management System. Analyses that use the default Hazus data are called basic analyses, and those that update the Hazus default with current local data are called advanced analyses.

For this HMP, losses were estimated in Hazus using depth grids for the flood hazard and mean return period (MRP; e.g., 100- and 500-year) for hurricane wind and earthquake hazards. To estimate potential impacts on people (shelter requirements and potential deaths and injuries) from flood, hurricane, and seismic hazards, the risk assessment used the Hazus v6.1 model, which incorporates the 2020 Decennial Population statistics.

4.3.3 Hazard-Specific Data Sources and Approaches

Dam Failure

To estimate vulnerability to the dam failure events, the dam inundation boundaries were overlaid on the centroids of updated assets (population, building stock, critical facilities, and new development). Assets with their centroid in the hazard areas were totaled to estimate the numbers and values vulnerable to the dam hazard.

The following dams were aggregated into one inundation boundary:

- Bog Brook Dam #1
- Bog Brook Dam #2
- Boyds Corner Dam
- Cargill Reservoir Dam
- Carmel Auxiliary Dike
- Cold Spring Dam (Lower)
- Cold Spring Dam (Upper)
- Croton Falls Dam
- Diverting Reservoir Dam
- Lake Carmel Dam
- Lake Peekskill Dam
- Lower (South) Wiccopee Dam
- Marcell Roth Lake Dam
- Middle Branch Dam
- Mountain Brook Dam
- Perkins Estate Pond Dam
- Putnam Lake Dam
- Roaring Brook Dam
- Sodom Dam
- Upper (North) Wiccopee Dam
- West Branch Dam.

These dam inundations were developed through FEMA DSS-WISE (2026).

Disease Outbreak

All of Putnam County is at risk from the impacts of disease outbreak events. A qualitative analysis was conducted to assess the county's vulnerability to this hazard of concern.

Drought

All of Putnam County is at risk from the impacts of drought events. A qualitative analysis was conducted to assess the county's risk from this hazard of concern.

Earthquake

Vulnerability Analysis

Ground shaking is the primary cause of earthquake damage to structures, and soft soils amplify ground shaking. The National Earthquake Hazard Reductions Program (NEHRP) defines five soil classifications (A to E) based on



the soil's effect on ground shaking—"A" represents hard rock that reduces ground shaking from an earthquake and "E" represents soft soils that amplify ground shaking. NEHRP Class D and E soils are the soils most susceptible to ground shaking during an earthquake.

A vulnerability analysis was conducted for the county's assets (population, building stock, critical facilities, and new development) using NEHRP soil data provided by New York State. The vulnerability analysis defined the hazard area as all areas with Class D or E soil types. Assets with their centroid in the hazard areas were totaled to estimate the numbers and values vulnerable to the earthquake hazard.

Loss Estimation

A probabilistic assessment was conducted for the 2,500-year MRP earthquake event through an advanced analysis in Hazus. The probabilistic method uses information from historical earthquakes and inferred faults, locations, and magnitudes to compute probable ground shaking levels, by census tract, for a seismic event of a selected a recurrence period. Hazus' potential loss estimates are acceptable for the planning-level purposes of this HMP.

Data from New York State was used in Hazus to replace default NEHRP soils. Groundwater was set at a depth of 5 feet (default setting). The default assumption is a magnitude 7.0 earthquake for all return periods. Although damage is estimated at the census tract level, results were presented at the municipal level. Because there are multiple census tracts that contain more than one jurisdiction, an area analysis was used to extract the percent of each tract that falls within individual jurisdictions. The percentage was multiplied against the results calculated for each tract and summed for each jurisdiction.

Damage estimates were calculated for losses to buildings (structural and non-structural) and contents. Structural losses include load carrying components of the structure. Non-structural losses include those to architectural, mechanical, and electrical components of the structure, such as nonbearing walls, veneer and finishes, HVAC systems, boilers, etc.

Extreme Temperature

All of Putnam County is at risk from the impacts of extreme temperature events. A qualitative analysis was conducted to assess the county's vulnerability to this hazard of concern.

Flood

The 1 percent and 0.2 percent annual chance flood events were examined to evaluate the planning area's risk from the flood hazard. The following data were used to evaluate vulnerability and determine potential future losses for this HMP update:

- The Putnam County FEMA Digital Preliminary Flood Insurance Rate Map (DFIRM) dated March 4, 2013
- A depth grid created using the 1-meter digital elevation model from NYS ITS Geospatial Services 2026

Vulnerability Analysis

To estimate vulnerability to the 1 percent and 0.2 percent annual chance flood events, the DFIRM flood boundaries were overlaid on the centroids of updated assets (population, building stock, critical facilities, and new development). Assets with their centroid in the hazard areas were totaled to estimate the numbers and values vulnerable to the flood hazard.



Loss Estimation

The depth grid generated using the DFIRM and 1-meter digital elevation model was integrated into the Hazus riverine flood model and used to estimate potential losses for the 1 percent annual chance flood event based on default Hazus damage functions. An advanced analysis was performed to estimate potential impacts on the population (displacement and shelter needs) using default 2020 U.S. Census data, potential damage to the general building stock, and potential damage to critical facilities.

Harmful Algal Blooms

All of Putnam County is at risk from the impacts of harmful algal blooms. A qualitative analysis was conducted to assess the county's vulnerability to this hazard of concern.

Severe Storm

A Hazus probabilistic advanced analysis was performed to analyze the wind-related losses in Putnam County for a 100-year and 500-year MRP hurricane-wind event. The probabilistic Hazus hurricane model activates a database of thousands of storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated with Putnam County. Hazus includes surface roughness and vegetation (tree coverage) maps for the area to support the modeling of wind force across various types of land surfaces.

Default demographic and updated building and critical facility inventories in Hazus were used for the analysis. Although damage is estimated at the census tract level, results were presented at the municipal level. A density analysis was used to extract the percent of building structures in each tract and jurisdiction. The percentage was multiplied against the results calculated for each tract and summed for each jurisdiction.

Severe Winter Storm

All of Putnam County is exposed and vulnerable to the winter storm hazard. Current modeling tools are not available to estimate specific losses for this hazard. A qualitative analysis was conducted to assess the county's vulnerability to this hazard of concern.

Terrorism

All of Putnam County is at risk from the impacts of terrorism incidents. A qualitative analysis was conducted to assess the county's vulnerability to this hazard of concern.

Wildfire

Maps of wildland-urban interface (WUI) areas (interface and intermix) were referenced to delineate wildfire hazard areas. The maps were obtained through the U.S. Forest Service from the SILVIS Laboratory at the University of Wisconsin – Madison. The SILVIS hazard areas are based on the 2020 Census and 2023 National Land Cover Dataset and the Protected Areas Database. Separate hazard areas were assessed for the interface WUI and intermix WUI. GIS asset data were overlaid with the hazard areas, and assets with their centroids located in the hazard areas were totaled to estimate the numbers and values at risk from the impacts of a wildfire event.



4.4 DATA SOURCE SUMMARY

Table 4-2 summarizes the data sources used for the risk assessment for this plan.

Table 4-2. Risk Assessment Data Documentation

Data	Source	Date	Format
Population data	U.S. Census Bureau; ACS 5-Year Estimates	2020; 2024	CSV
Building Inventory	Putnam County; NYSERDA; NYS	2025, 2026; 2026; 2024	Digital (GIS)
Critical Facilities	Putnam County; NYSDEC; ESRI; NYS GIS Clearinghouse; NYS Board of Elections; HIFLD	2021, 2026; 2025, 2026; 2026; 2026; 2025; 2025	Digital (GIS)
New Development	Town of Carmel	2026	Digital (GIS)
Land Cover	USGS, NLCD	2024	Digital (GIS)
Digitized Preliminary FIRM Data	FEMA	2013	Digital (GIS)
Digital Elevation Model (1-meter)	NYS ITS Geospatial Services; FEMA	2026; 2019	Digital (GIS)
NEHRP Soils	New York State	n.d.	Digital (GIS)
WUI Interface and Intermix	SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison	2020	Digital (GIS)
Dam Inundation	DSS-WISE	2026	Digital (GIS)

Note: DSS-WISE = Decision Support System for Water Infrastructure Security; ESRI = Environmental Systems Research Institute; FEMA = Federal Emergency Management Agency; HIFLD = Homeland Infrastructure Foundation-Level Data; NLCD = National Land Cover Database; NYS ITS = New York State Office of Information Technology Services; NYSERDA = New York State Energy Research and Development Authority; NYS = New York State; NYSDEC = New York State Department of Environmental Conservation; USGS = U.S. Geological Survey

4.5 LIMITATIONS

Loss estimates, vulnerability analyses, and hazard-specific impact evaluations rely on the best-available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct such a study
- Incomplete or dated inventory, demographic, or economic parameter data
- The unique nature, geographic extent, and severity of each hazard
- Mitigation measures already employed by the participating jurisdictions
- The amount of advance notice residents have to prepare for a specific hazard event
- Uncertainty of climate change projections

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential vulnerability and loss estimates are approximate. These results do not predict precise results and should



be used to understand relative risk. Over the long term, Putnam County will collect additional data and update and refine existing inventories to assist in estimating potential losses.

Potential economic loss is based on the present value of the general building stock using best-available data. The county acknowledges significant impacts may occur to critical facilities and infrastructure as a result of these hazard events causing great economic loss. However, monetized damage estimates to critical facilities and infrastructure, and economic impacts were not quantified and require more detailed loss analyses. In addition, economic impacts to industry such as tourism and the real-estate market were not analyzed.

4.6 CONSIDERATIONS FOR MITIGATION AND NEXT STEPS

The following items are to be discussed for considerations for the next plan update to enhance the risk assessment:

- All Hazards
 - Create an updated user-defined general building stock dataset using up-to-date parcels, footprints, and RSMeans values.
 - Utilize updated and current demographic data.
- Dam Failure
 - Obtain the most current dam inundation hazard areas in order to support vulnerability and loss estimation analyses.
- Earthquake
 - Identify unreinforced masonry in critical facilities and privately owned buildings (i.e., residences) by accessing local knowledge, tax assessor information, and/or pictometry/orthophotos. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response or recovery efforts at these properties can be developed.
- Extreme Temperatures
 - Track extreme temperature data for injuries, deaths, shelter needs, pipe freezing, agricultural losses, and other impacts to determine distributions of most at-risk areas.
- Flood
 - The general building stock inventory can be updated to include attributes regarding first floor elevation and foundation type (basement, slab on grade, etc.) to enhance loss estimates.
 - Conduct a Hazus loss analysis for more frequent flood events (e.g., 10- and 50-year flood events).
 - Conduct a repetitive loss area analysis.
 - Continue to expand and update urban flood areas to further inform mitigation.
 - As more current FEMA floodplain data become available (i.e., DFIRMs), update the vulnerability analysis and generate a more detailed flood depth grid that can be integrated into the current Hazus version.
- Severe Storm
 - The general building stock inventory can be updated to include attributes regarding protection against strong winds, such as hurricane straps, to enhance loss estimates.
 - Integrate evacuation route data that are currently being developed.
- Wildfire



4. Risk Assessment Methodology and Tools

- General building stock inventory can be updated to include attributes such as roofing material, fire detection equipment, or distance to fuels as another measure of vulnerability.



5. IDENTIFICATION OF HAZARDS OF CONCERN

5.1 REVIEW OF POTENTIAL HAZARDS

To provide a strong foundation for mitigation actions in this plan, Putnam County considered a full range of hazards that could impact the area and then identified and ranked those that present the greatest concern. These hazards of concern were identified based on the following:

- Input from all Planning Partners
- Review of the New York State Hazard Mitigation Plan
- Review of the 2021 Putnam County HMP
- Research on the frequency, magnitude, and costs associated with hazards that have previously or could feasibly impact the region
- Qualitative information regarding natural (not human-caused) hazards and the perceived vulnerability of the study area's assets to them.

Hazards of Concern are hazards that are most likely to impact a community. These are identified using available data and local knowledge.

Natural Hazards are a source of harm or difficulty created by a meteorological, environmental, or geological event.

Table 5-1 documents the process of identifying the hazards of concern for further profiling and evaluation.

Based on the review of potential hazards of concern, 11 hazards of concern were identified as significant hazards affecting the entire County, to be addressed at the County level in this HMP (shown here in alphabetical order):

- | | | |
|--------------------|-----------------------|-----------------------|
| • Dam failure | • Extreme temperature | • Severe winter storm |
| • Disease outbreak | • Flood | • Terrorism |
| • Drought | • Harmful algal bloom | • Wildfire |
| • Earthquake | • Severe storm | |

Other natural and human-caused hazards of concern have occurred within Putnam County, but have a low potential to occur, are addressed by other planning mechanisms, and/or do not result in significant impacts within the County. Therefore, these hazards are not addressed in this update. If deemed necessary by the County, these hazards may be considered in future plan updates.



Table 5-1. Identification of Hazards of Concern for Putnam County

Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Avalanche	No	No	The 2023 New York State HMP identifies avalanche as a hazard of concern. Avalanche was identified as a hazard in the New York State HMP, and there have been occurrences in the state; however, there were no occurrences in Putnam County. The topography and climate of Putnam County do not support the occurrence of an avalanche. The Steering Committee and Planning Partnership do not consider the hazard to be a significant concern.	NYS DHSES Input from Steering Committee and Planning Partnership
Coastal Hazards	Yes	No	The New York State HMP identifies coastal hazards as a hazard of concern for New York State. Coastal hazards can impact all the state's coastal counties along Lake Erie and the Niagara River, Lake Ontario and the St. Lawrence River, Atlantic Ocean and Long Island Sound, Hudson River south of the federal dam in Troy, the East River, the Harlem River, the Kill van Kull, and Arthur Kill, and all connecting water bodies, bays, harbors, shallows, and wetlands. Coastal hazards may also impact inland counties and communities. Putnam County does not have coastline. The Steering Committee and Planning Partnership did not identify coastal hazards as a hazard of concern.	NYS DHSES Input from Steering Committee and Planning Partnership
Dam Failure	Yes	Yes	The 2023 New York State HMP does not identify dam failure as a hazard of concern for New York State, though it is included in the Flood hazard profile. According to the NYSDEC, there are 121 dams in Putnam County: 78 low hazard, 19 intermediate hazard, 21 high hazard, and three with no hazard classification code (NYSDEC 2026b). Dam failure was given an individual hazard profile.	NYS DHSES NYSDEC NYS GIS Input from Steering Committee and Planning Partnership
Disease Outbreak/Pandemic	Yes	Yes	The 2023 New York State HMP does not identify disease outbreak/pandemic as a hazard of concern for New York State. Putnam County was included in three pandemic-related disaster declarations: • EM-3155; May 22–November 1, 2000; New York Virus Threat • EM-3434; January 20, 2020–May 11, 2023; New York COVID-19 • DR-4480; January 20, 2020–May 11, 2023; New York COVID-19 Pandemic The Steering Committee and Planning Partnership identified disease outbreak/pandemic as a hazard of concern for Putnam County.	NYS DHSES FEMA Input from Steering Committee and Planning Partnership



5. Identification of Hazards of Concern

Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Drought	Yes	Yes	The New York State HMP identifies drought as a hazard of concern for the state. Putnam County has been impacted by several drought events that have occurred in New York State. Agriculture is a substantial industry in Putnam County. Drought conditions would severely impact the County's economy. Putnam County was included in five drought-related USDA disaster declarations: • S3427—2012; Drought • S3759—2014; Drought • S3928—2015; Drought • S5300—2022; Drought • S5306—2022; Drought The Steering Committee and Planning Partnership identified drought as a hazard of concern for Putnam County.	NYS DHSES FEMA USDA NOAA-NCEI NRCC USDA Input from Steering Committee and Planning Partnership
Earthquake	Yes	Yes	The New York State HMP identified earthquake as a hazard of concern for New York State. New York State was included in one FEMA earthquake-related disaster declaration (DR-1415); Putnam County was not included in this declaration. From 2020 to 2025, there was one significant earthquake with an epicenter in Putnam County, in the Town of Putnam Valley. Based on input from the Steering Committee and Planning Partnership, earthquake was identified as a hazard of concern for Putnam County.	NYS DHSES (USGS) Earthquake Hazards Program, USGS Seismic Maps Input from Steering Committee and Planning Partnership
Extreme Temperature	Yes	Yes	The New York State HMP identifies both extreme cold and extreme heat as hazards of concern for New York State. Putnam County was included in six extreme temperature-related USDA disaster declarations: • S3246—2012; Frost and Freeze • S3251—2012; Frost and Freeze • S3696—2013; Freeze • S3886—2015; Frost, Freeze, and Excessive Snow • S4048—2016; Frost and Freeze • S5485—2023; Frost and Freeze The Steering Committee and Planning Partnership identified extreme temperature as a hazard of concern for Putnam County.	NOAA-NCEI USDA Input from Steering Committee and Planning Partnership



5. Identification of Hazards of Concern

Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Flood (riverine, lakeshore, ice jam, urban flooding, and flash flooding)	Yes	Yes	The New York State HMP identifies flooding as a hazard of concern for New York State. Between 1956 and 2025, Putnam County was included in 15 flood-related declarations: • DR-311; September 13, 1971; Severe Storms and Flooding • DR-487; October 2, 1975; Storms, Rains, Landslides, and Flooding • DR-1095; January 24, 1996; Severe Storms and Flooding • EM-3149; September 19, 1999; Hurricane Floyd • DR-1296; September 19, 1999; Hurricane Floyd • DR-1534; August 3, 2004; Severe Storms and Flooding • DR-1589; April 19, 2005; Severe Storms and Flooding • DR-1692; April 24, 2007; Severe Storms and Inland and Coastal Flooding • EM-3351; October 30, 2012; Hurricane Sandy • DR-4085; October 30, 2012; Hurricane Sandy • DR-4567; October 2, 2020; Tropical Storm Isaias • EM-3565; August 22, 2021; Hurricane Henri • EM-3572; September 5, 2021; Remnants of Hurricane Ida • DR-4615; September 5, 2021; Remnants of Hurricane Ida • DR-4723; July 22, 2023; Severe Storms and Flooding Based on the history of flooding and its impacts on Putnam County and input from the Steering Committee and Planning Partnership, flooding has been identified as a hazard of concern for Putnam County.	NYS DHSES NOAA-NCEI USACE Ice Jam Database FEMA Input from Steering Committee and Planning Partnership
Hail	Yes	Yes	See Severe Storm Profile	
Harmful Algal Bloom	Yes	Yes	The 2023 New York State HMP does not identify harmful algal bloom as a hazard of concern. Based on the yearly history of harmful algal blooms and their impacts on Putnam County, the Steering Committee and Planning Partnership did identify harmful algal bloom as a hazard of concern.	NYS DHSES NYSDEC Input from Steering Committee and Planning Partnership
Hurricane	Yes	Yes	Severe Storm Profile addresses Tropical Storms and Hurricane events.	
Ice Jams	Yes	Yes	See Flood Profile	
Ice Storm	Yes	Yes	See Severe Winter Storm Profile	



5. Identification of Hazards of Concern

Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Land Subsidence	Yes	No	The 2023 New York State HMP does not identify land subsidence as a hazard of concern. The Steering Committee and Planning Partnership did not identify land subsidence as a hazard of concern for Putnam County.	NYS DHSES USGS Input from Steering Committee and Planning Partnership
Landslide	Yes	No	The 2023 New York State HMP includes landslide as a hazard of concern for New York State. Between 1954 and 2025, New York State was not included in any landslide-related disaster declarations. Based on previous occurrences and input from the Steering Committee and Planning Partnership, the landslide hazard was identified as a hazard of concern for Putnam County.	NYS DHSES NOAA NCEI FEMA Input from Steering Committee and Planning Partnership
Lightning	Yes	Yes	See Severe Storm Profile	



Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Severe Storm (wind, extreme temperature, thunderstorms, hail, lightning, hurricanes, and tornadoes)	Yes	Yes	The New York State HMP identifies severe storm as a hazard of concern for New York State; however, for the state HMP, the hazards were profiled in individual sections hail, high winds, hurricanes, lightning, thunderstorms, and tornadoes. For the Putnam County HMP, the hazards were combined into one profile. Between 1954 and 2024, Putnam County was included in 18 severe storm-related declarations: • DR-311; September 13, 1971; Severe Storms and Flooding • DR-487; October 2, 1975; Storms, Rain, Landslide and Flooding • DR-1095; January 19 – 30, 1996; Severe Storms and Flooding • EM-3149; September 16 – 18, 1999; Hurricane Floyd Emergency Declarations • DR-1296; September 16 – 18, 1999; Hurricane Floyd Major Disaster Declarations • DR-1534; May 13-June 17, 2004; Severe Storms and Flooding • DR-1589; April 2 – 4, 2005; Severe Storms and Flooding • EM-3262; August 29-October 1, 2005; Hurricane Katrina Evacuation • DR-1692; April 14 – 18, 2007; Severe Storms and Inland and Coastal Flooding • EM-3328; August 25-September 5, 2011; Hurricane Irene • DR-4020; August 26-September 5, 2011; Hurricane Irene • EM-3351; October 27-November 8, 2012; Hurricane Sandy • DR-4085; October 27-November 8, 2012; Hurricane Sandy • DR-4567; August 4, 2020; Tropical Storm Isaias • EM-3565; August 21 – 24, 2021; Hurricane Henri • EM-3572; September 1 – 3, 2021; Remnants of Hurricane Ida • DR-4615; September 1 – 3, 2021; Remnants of Hurricane Ida • DR-4723; July 9 – 10, 2023; Severe Storms and Flooding Based on previous occurrences and input from the Steering Committee and Planning Partnership, severe storm is identified as a hazard of concern for Putnam County.	NYS DHSES FEMA NOAA-NCEI SPC Input from Steering Committee and Planning Partnership



Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Severe Winter Storm (heavy snow, blizzards, ice storms)	Yes	Yes	The New York State HMP identifies severe winter storm as a hazard of concern for New York State; however, for the state HMP, the hazards were profiled in individual sections ice storm and snowstorm. For the Putnam County HMP, the hazards were combined into one profile. Between 1954 and 2024, Putnam County was included in five winter storm-related declarations: • DR-801; October 4, 1987; Severe Winter Storm • EM-3107; March 13–17, 1993; Severe Blizzard • DR-1083; January 6 – 12, 1996; Blizzard of '96 (Severe Snow Storm) • EM-3184; February 17 – 18, 2003; Snow • EM-3299; December 11 – 31, 2008; Severe Winter Storm Based on previous occurrences and input from the Steering Committee and Planning Partnership, severe winter storm is identified as a hazard of concern for Putnam County.	NYS DHSES FEMA NOAA-NCEI Input from Steering Committee and Planning Partnership
Snowstorm	Yes	Yes	See Severe Winter Storm	
Terrorism	Yes	Yes	The 2023 New York State HMP does not identify terrorism as a hazard of concern. Based on previous occurrences and input from the Steering Committee and Planning Partnership, terrorism is identified as a hazard of concern for Putnam County.	NYS DHSES NYSDEC Input from Steering Committee and Planning Partnership
Tornado	Yes	Yes	See Severe Storm	
Utility Failure	Yes	Yes	The 2023 New York State HMP does not identify utility failure as a hazard of concern for the state. Putnam County experiences utility failures (generally power outages) several times each year. These failures are usually due to severe storms or severe winter storms that affect the County. Putnam County was included in one utility failure-related disaster declaration: • EM-3186; August 14–16, 2003; Power Outage. The Steering Committee and Planning Partnership consider utility failure to be a cascading impact of severe storm and severe winter storm events, and it is therefore incorporated in the vulnerability assessment of those profiles.	NYS DHSES NOAA NCEI Input from Steering Committee and Planning Partnership



5. Identification of Hazards of Concern

Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Wildfire	Yes	Yes	The New York State HMP identifies wildfire as a hazard of concern for New York State. Putnam County was not included in any FEMA wildfire-related disaster declarations. Wildfires have occurred within Putnam County. The County's agriculture industry could be severely impacted by a large wildfire. Based on previous occurrences and input from the Steering Committee and Planning Partnership, wildfire is identified as a hazard of concern for Putnam County.	NYS DHSES FEMA Input from Steering Committee and Planning Partnership
Wind	Yes	Yes	See Severe Storm	

Note: DR = Presidential Disaster Declaration Number; EM = Presidential Disaster Emergency Number; FEMA = Federal Emergency Management Agency; NCEI = National Centers for Environmental Information; NRCC = Northeast Regional Climate Center; NYSDEC = New York State Department of Environmental Conservation; NYS DHSES = New York State Division of Homeland Security and Emergency Services; SPC = Storm Prediction Center; USDA = U.S. Department of Agriculture; USGS = U.S. Geologic Survey



5.2 HAZARD DEFINITIONS AND GROUPINGS

As evaluated in this HMP, the selected hazards of concern may be described as follows:

- The dam failure hazard addresses any malfunction or abnormality outside of a dam's design that leads to a sudden, rapid, and uncontrolled release of water.
- The disease outbreak hazard exists when there are more cases of a particular disease than expected in a given area, or among a specific group of people, over a particular period of time.
- A drought is a period characterized by long durations of below normal precipitation.
- An earthquake is the sudden movement of the earth's surface caused by the release of stress accumulated within or along the edge of the earth's tectonic plates, a volcanic eruption, or a human activities that cause geologic stresses.
- The extreme temperature hazard includes both heat and cold events that have potential significant impact on human health and commercial/agricultural businesses, with primary and secondary effects on infrastructure (e.g., burst pipes and power failure).
- The flood hazard includes riverine flooding, flash flooding, shallow flooding, stormwater and urban flooding, and ice jam flooding. Inclusion of various forms of flooding under a general flood hazard is consistent with FEMA's Multi-Hazard Identification and Risk Assessment guidance and the New York State HMP.
- Harmful algal blooms are colonies of cyanobacteria that produce harmful toxins that threaten animal life.
- For this HMP update, severe storm includes thunderstorms, hail, lightning, high winds, tornadoes, and hurricanes or tropical storms.
- The severe winter storm hazard includes blizzards, heavy snow, and ice storms.
- Terrorism is the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.
- Wildfire is any non-structural fire that occurs in the wildland.

These groupings are the same as those provided by FEMA (FEMA 2001, FEMA 2023d) and take into consideration the hazard groupings in the New York State HMP.



6. DAM FAILURE

6.1 HAZARD PROFILE

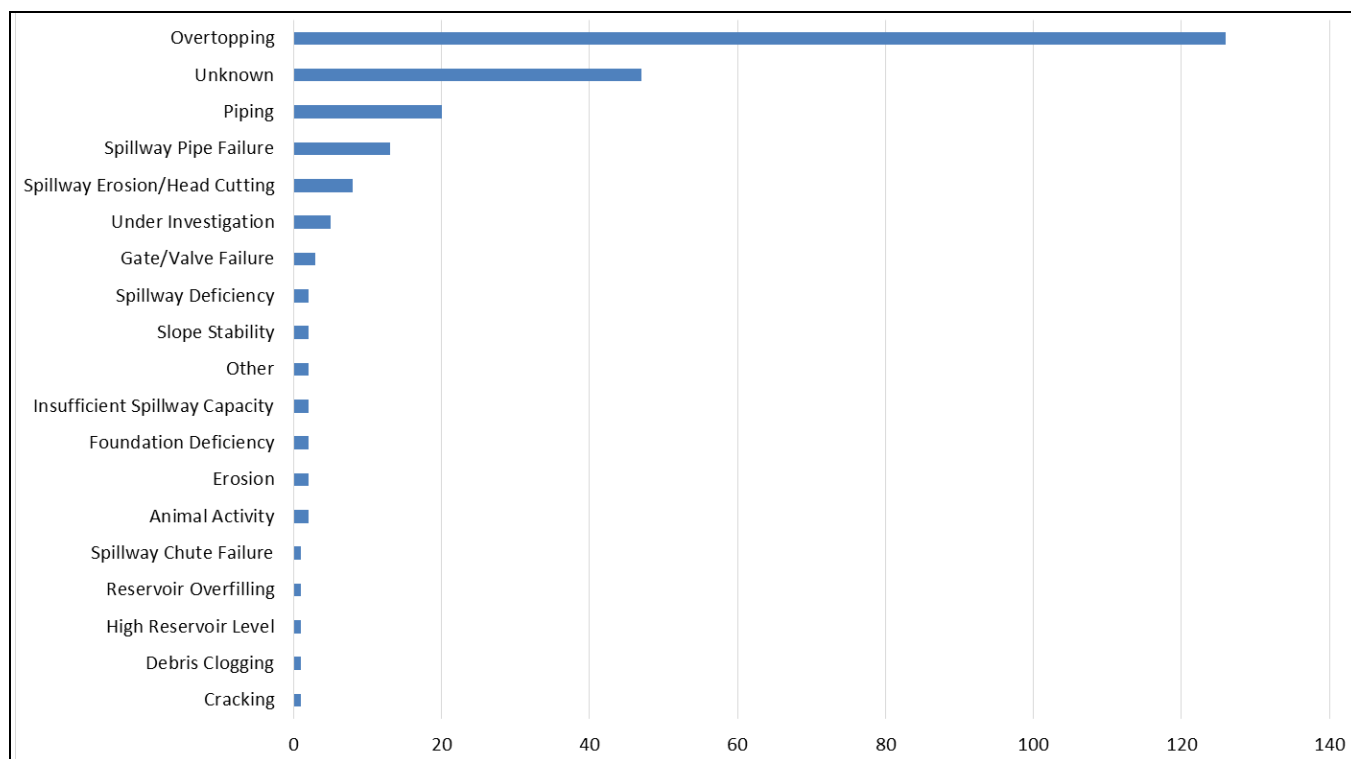
6.1.1 Hazard Description

A dam is an artificial barrier allowing storage of water, wastewater, or liquid-borne materials (ASDSO 2026). The water stored behind a dam represents potential energy that can endanger downstream life and property if released suddenly. Dam failure is any malfunction or abnormality outside of a dam's design that leads to a sudden, rapid, and uncontrolled release of water (USSD 2023).

Causes of Failure

Figure 6-1 shows the primary causes of dam failures nationally. Dams typically fail when spillway capacity is inadequate and excess flow overtops the dam or when internal erosion (piping) through the dam or foundation occurs. During a large storm event, significant rainfall can cause floodwaters to overwhelm a reservoir. If the spillway of the dam cannot safely pass the resulting flows, water will begin flowing in areas not designed for such flows, and a failure may occur. Complete failure occurs if internal erosion or overtopping results in a complete structural breach, releasing a high-velocity wall of debris-filled water that rushes downstream, damaging or destroying anything in its path (FEMA 2016a). Dam failures also can occur suddenly, without warning, and under normal operating conditions (referred to as a “sunny-day” failure).

Figure 6-1. Dam Failure Causes, 2010 – 2019



Source: (ASDSO 2024)



Dam failures can result from one or a combination of the following (ASDSO 2026):

- Overtopping caused by floods that exceed the capacity of the dam
- Deliberate acts of sabotage
- Structural failure of materials used in dam construction
- Movement or failure of the foundation supporting the dam
- Settling and cracking of concrete or embankment dams
- Piping and internal erosion of soil in embankment dams
- Inadequate maintenance and upkeep

More than a third of the country's dams are 50 or more years old. Approximately 15,000 of those dams pose a significant hazard to life and property if failure occurs. About 2,000 unsafe dams are dispersed throughout the United States in almost every state.

Regulatory Oversight of Dams

The risks associated with dams must be minimized at all times, which requires proper maintenance, safety inspections, technical review of proposed new dams, enforcement of dam safety criteria, and emergency preparedness planning (NYSDEC n.d.-a). The following sections describe the roles of state and federal agencies with responsibilities related to dam safety.

New York State Department of Environmental Conservation

The New York State Department of Environmental Conservation (NYSDEC) Dam Safety Section is responsible for safety inspection of dams, technical review of proposed dam construction or modification, monitoring of remedial work for compliance with dam safety criteria, and emergency preparedness for all dams in the state. NYSDCE is responsible for more than 100 flood control projects throughout the state, most of which were constructed by USACE and are operated and maintained by NYSDCE.

The NYSDCE Bureau of Flood Protection and Dam Safety assigns dam hazard classifications according to the potential impacts of a dam failure as follows (Title 6 of New York Codes Rules and Regulations Part 673.3) (NYSDEC n.d.-d):

- *Low Hazard (Class A)*—A dam in an area where failure will damage nothing more than isolated buildings, undeveloped lands, or township or county roads; and/or will cause no significant economic loss or serious environmental damage. Failure or misoperation will result in no probable loss of human life. Losses will be principally limited to the owner's property.
- *Intermediate Hazard (Class B)*—A dam in an area where failure may damage isolated homes, main highways, or minor railroads; interrupt the use of relatively important public utilities; and/or cause significant economic loss or serious environmental damage. Failure or misoperation will result in no probable loss of human life but may cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Dams classified as intermediate hazard dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- *High Hazard (Class C)*—A dam in an area where failure may cause loss of human life, serious damage to homes, industrial or commercial buildings, important public utilities, main highways or railroads, and/or will cause extensive economic loss. This is a downstream hazard classification for dams in which excessive economic loss (urban area including extensive community, industry, agriculture, or outstanding natural resources) will occur as a direct result of dam failure.



- *Negligible or No Hazard (Class D)*—A dam that has been breached or removed, has failed, no longer materially impounds waters, or was planned but never constructed. Class “D” dams are defunct dams posing negligible or no hazard. NYSDEC may retain pertinent records regarding such dams.

The state generally inspects high-hazard (Class C) dams every two years and moderate-hazard (Class B) dams every four years. To support emergency planning efforts and raise awareness among local officials and emergency managers, a copy of each inspection report is sent to the chief executive of the community in which the dam is located. Municipal officials or emergency managers from any municipality in the dam’s inundation area may receive a copy of the inspection report upon request (NYSDEC n.d.-a).

Dam safety emergency action plans (EAP) are formal, site-specific procedures written by the dam owner/operator for preventing or mitigating the occurrence of a catastrophic dam failure. NYSDEC regulates dam safety and EAPs for all dams in New York State.

U.S. Army Corps of Engineers Dam Safety Program

USACE is responsible for safety inspections of dams in the United States that meet size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams and has surveyed each state and federal agency’s capabilities, practices, and regulations regarding the design, construction, operation, and maintenance of dams. USACE has also developed guidelines for inspection and evaluation of dam safety (USACE 2014). USACE also is responsible for submitting an EAP for each dam it owns, operates, and maintains.

Table 6-1 outlines the level of impact that a dam failure would have based upon the hazard potential classification as rated by the U.S. Army Corps of Engineers (USACE n.d.).

Table 6-1. U.S. Army Corps of Engineers Hazard Potential Classification

Hazard Category ^a	Direct Loss of Life ^b	Lifeline Losses ^c	Property Losses ^d	Environmental Losses ^e
Low	None (rural location, no permanent structures for human habitation)	No disruption of services (cosmetic or rapidly repairable damage)	Private agricultural lands, equipment, and isolated buildings	Minimal incremental damage
Significant	Rural location, only transient or day-use facilities	Disruption of essential facilities and access	Major public and private facilities	Major mitigation required
High	Certain (one or more) extensive residential, commercial, or industrial development	Disruption of essential facilities and access	Extensive public and private facilities	Extensive mitigation cost or impossible to mitigate

Source: (USACE n.d.)

- Categories are assigned to overall projects, not individual structures at a project.
- Loss-of-life potential is based on inundation mapping of area downstream of the project. Analyses of loss-of-life potential should take into account the population at risk, time of flood wave travel, and warning time.
- Lifeline losses include indirect threats to life caused by the interruption of lifeline services from project failure or operational disruption; for example, loss of critical medical facilities or access to them.
- Property losses include damage to project facilities and downstream property and indirect impact from loss of project services, such as impact from loss of a dam and navigation pool, or impact from loss of water or power supply.
- Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.



National Dam Safety Program

Grant assistance from FEMA through the National Dam Safety Program provides support for the improvement of dam safety programs that regulate most dams in the United States. Funds have allowed participating states to improve their programs through increased inspections, emergency action planning, and purchase of needed equipment. FEMA has also expanded existing training programs and initiated new training programs (FEMA 2023e).

Federal Energy Regulatory Commission Dam Safety Program

FERC has the largest dam safety program in the United States. FERC cooperates with many federal and state agencies to ensure and promote dam safety. FERC staff inspect hydroelectric projects on an unscheduled basis to investigate the following (FERC 2023a):

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with terms and conditions of a license

Every five years, an independent consulting engineer, approved by FERC, must inspect and evaluate projects with dams higher than 32.8 feet (10 meters) or with a total storage capacity of more than 2,000 acre-feet (FERC 2023a).

FERC evaluates seismic research in areas where seismic activity is a concern and applies it to analyze hydroelectric projects in these areas. FERC also evaluate the effects of potential and actual large floods on the safety of dams. FERC staff visit dams and licensed projects during and after floods, assess the extent of damage, and direct any studies or remedial measures the licensee must undertake. FERC's *Engineering Guidelines for the Evaluation of Hydropower Projects* guides FERC engineering staff and licensees in evaluations of dam safety. The publication is frequently revised to reflect current information and methodologies (FERC 2023b).

FERC requires licensees to prepare EAPs and conducts training sessions on developing and testing these plans. The plans outline an early warning system in the event of an actual or potential sudden release of water from a dam failure. The plans include operational procedures that may be implemented during regulatory measures, such as reducing reservoir levels and downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that all applicable parties are informed of the proper procedures in emergencies (FERC 2023a).

6.1.2 Location

According to New York State data, 121 dams are present in Putnam County, as shown on Figure 6-2. Most of these dams pose little risk; however, there are 21 high hazard potential dams in the County, as listed in Table 6-2. Figure 6-3 shows the area that could be inundated by failure of each of the high-hazard dams, as identified by the Decision Support System for Water Infrastructure Security (DSS-WISE). The dam failure hazard area for this HMP is an aggregation of all of these mapped dam failure inundation areas.



Figure 6-2. Dams Located in Putnam County

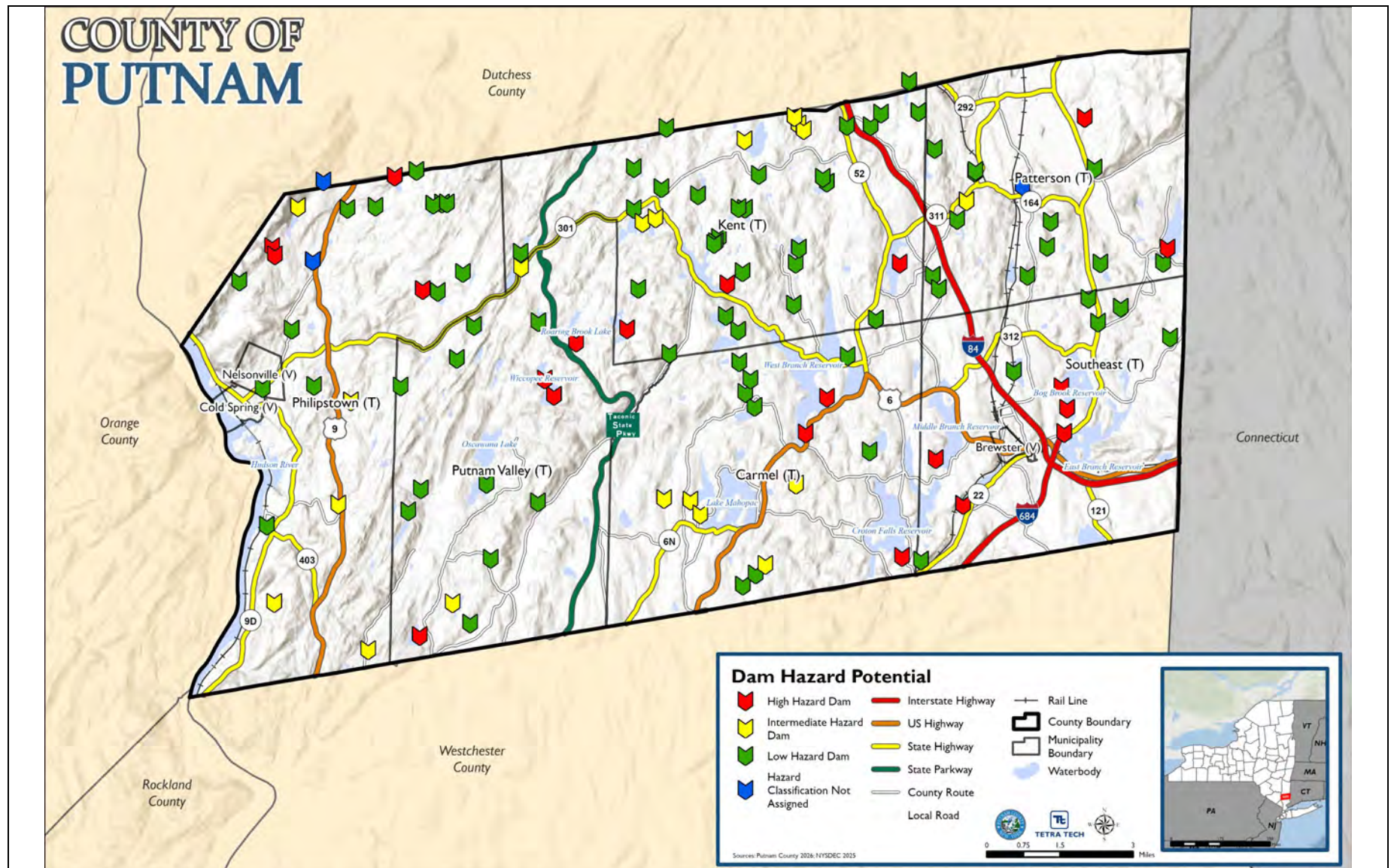




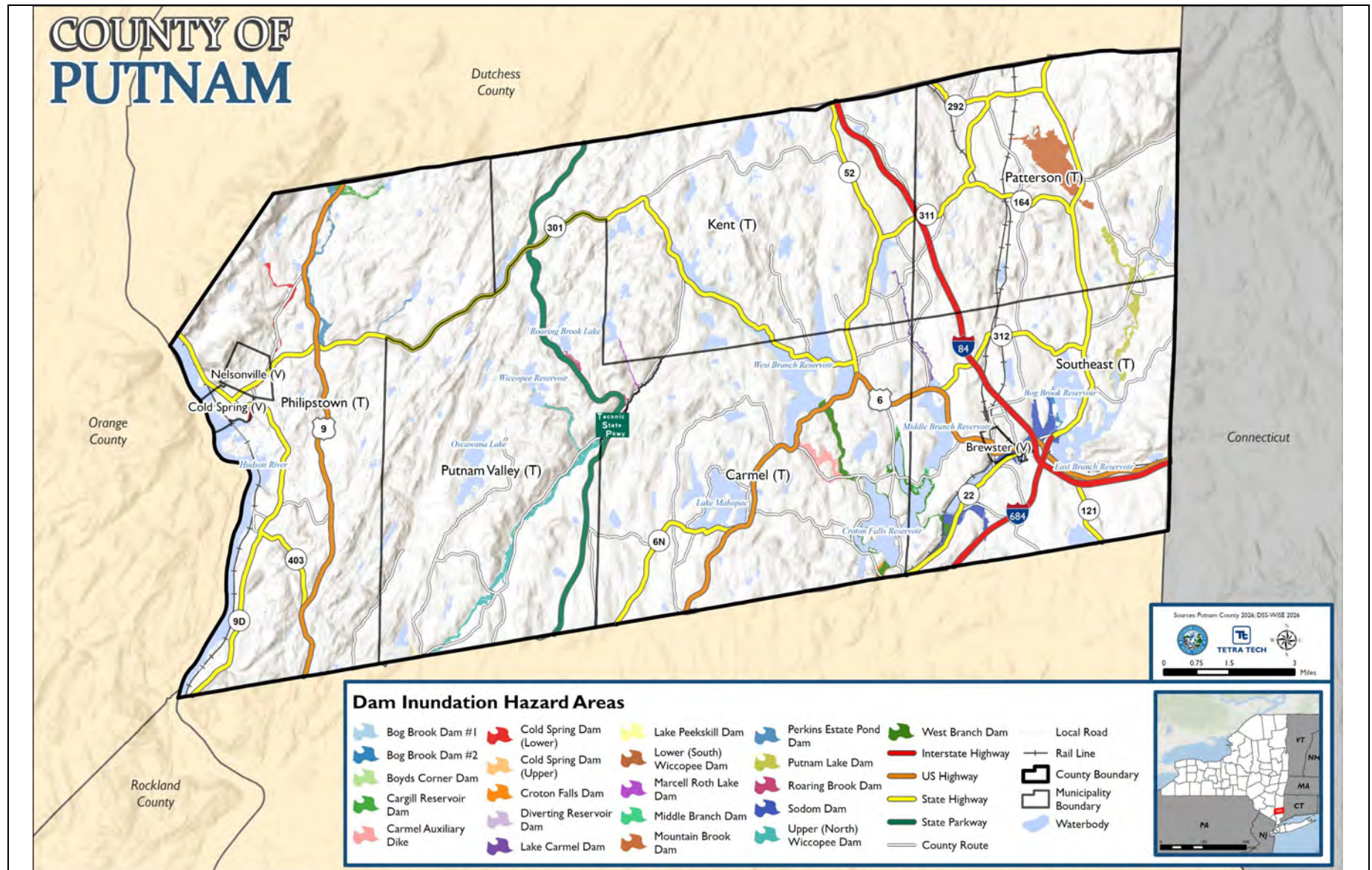
Table 6-2. High Hazard Dams in Putnam County

Dam Name	Body of Water	Municipality	Date Last Inspected
Lake Carmel Dam	Middle Branch Croton River	Town of Kent	March 7, 2024
Putnam Lake Dam	Bog Brook	Town of Patterson	March 7, 2024
Mountain Brook Dam	Mountain Brook	Town of Patterson	January 24, 2025
Croton Falls Dam	West Branch Croton River	Town of Carmel	March 7, 2024
Diverting Reservoir Dam	East Branch Croton River	Town of Southeast	March 7, 2024
Middle Branch Dam	Middle Branch Croton River	Town of Southeast	March 7, 2024
West Branch Dam	West Branch Croton River	Town of Carmel	March 17, 2025
Carmel Auxiliary Dike	West Branch Croton River	Town of Carmel	March 17, 2025
Sodom Dam	East Branch Croton River	Town of Southeast	March 7, 2024
Bog Brook Dam #2	Tributary of the East Branch Croton River	Town of Southeast	March 7, 2024
Bog Brook Dam #1	Tributary of the East Branch Croton River	Town of Southeast	March 7, 2024
Boyds Corner Dam	West Branch Croton River	Town of Kent	March 17, 2025
Lower (south) Wiccopee Dam	Wiccopee Brook	Town of Putnam Valley	March 24, 2025
Marcell Roth Lake Dam	Tributary of the Peekskill Hollow Creek	Town of Kent	September 24, 2024
Roaring Brook Dam	Raring Book	Town of Putnam Valley	May 6, 2024
Perkins Estate Pond Dam	Clove Creek	Town of Philipstown	March 17, 2025
Lake Peekskill Dam	Hollow Brook	Town of Putnam Valley	March 24, 2025
Cargill Reservoir Dam	Cargill Brook	Town of Philipstown	July 31, 2024
Cold Spring Dam (upper)	Foundry Brook	Town of Philipstown	January 24, 2025
Cold Spring Dam (lower)	Foundry Brook	Town of Philipstown	July 31, 2024
Upper (north) Wiccopee Dam	Wiccopee Brook	Town of Putnam Valley	March 24, 2025

Source: (NYSDEC 2026b)



Figure 6-3. Dam Failure Inundation Hazard Area in Putnam County





6.1.3 Extent

New York State has undergone significant property damage including damage or loss of dams, bridges, roads, and buildings as a result of storm events and dam failures. With 21 high-hazard dams in Putnam County, the potential extent of damage from a dam failure is as described in the NYSDEC definition of the high-hazard rating; i.e., the failure could cause loss of human life, serious damage to homes, industrial or commercial buildings, important public utilities, main highways or railroads, and/or extensive economic loss.

6.1.4 Previous Occurrences

FEMA Disaster Declarations

Putnam County has not been included in any major disaster or emergency declarations for dam failure-related events (FEMA 2026a).

USDA Declarations

Putnam County has not been included in any dam failure-related USDA agricultural disaster declarations (USDA 2026).

All Recent Events

There were no reported dam failure hazard events that have impacted Putnam County between January 2020 and December 2025 (Stanford University 2023, ASDSO 2026). For events prior to 2020, refer to the 2021 Putnam County HMP.

6.1.5 Probability of Future Occurrences

Dam failure events are infrequent and usually coincide with events that cause them, such as earthquakes, landslides, and excessive rainfall and snowmelt. There is a residual risk associated with dams, which is the risk that remains after decisions related to a specific dam safety issue are made and prudent actions have been taken to address this risk (FEMA 2018).

Information on previous dam failure occurrences in the County was used to calculate the probability of future occurrence of such events. Based on historical records and input from the Steering Committee, the probability of occurrence for dam failure in the County is considered “unlikely.”

6.1.6 Cascading Impacts on Other Hazards

Dam failures can greatly increase the impacts of other natural hazards, raising the overall risk to communities. A sudden release of water can cause severe downstream flooding and may trigger landslides or erosion. Floodwaters can destabilize slopes, threatening infrastructure and homes, and in areas with saturated soils, rapid inundation can heighten the risk of soil liquefaction during earthquakes. If a dam fails during extreme storms, emergency response systems already strained by flooding may become overwhelmed, complicating evacuation and recovery efforts. These interconnected risks show that dam failure should be considered not as an isolated event, but as a potential driver of multiple hazards.



6.2 VULNERABILITY AND IMPACT ASSESSMENT

The assessment of vulnerability to dam failure for this HMP was based on the hazard area consisting of the aggregated dam failure inundation areas for Putnam County's 21 high-hazard dams, as described in Section 6.1.2. Potential impacts were evaluated qualitatively.

6.2.1 Life, Health, and Safety

Overall Population

An estimated 1,038 Putnam County residents live within the dam failure hazard area, as shown on Table 6-3. The Town of Philipstown has the greatest number of people living within the hazard area, with 255 persons exposed, followed by the Town of Putnam Valley, which has 226 persons exposed. These is the only one jurisdictions (Village of Cold Spring) that does not have any individuals located within the dam failure hazard area.

Table 6-3. Population in the Aggregated Dam Inundation Hazard Area

Jurisdiction	Total Population 2024 ACS	Population in the Aggregated Dam Inundation Hazard Area	
		Number of Persons	% of Jurisdiction Total
Brewster (V)	2,512	145	5.8%
Carmel (T)	33,837	133	0.4%
Cold Spring (V)	1,863	0	0.0%
Kent (T)	12,896	32	0.2%
Nelsonville (V)	714	6	0.8%
Patterson (T)	11,560	17	0.1%
Philipstown (T)	7,302	255	3.5%
Putnam Valley (T)	11,755	226	1.9%
Southeast (T)	15,668	224	1.4%
Putnam County (Total)	98,107	1,038	1.1%

Source: U.S. Census Bureau 2024 ACS Vulnerable Population; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; DSS-WISE 2026

Vulnerability to the dam failure hazard is not limited to people living in or near inundation areas. Individuals may also be affected while traveling through flooded areas or if access to emergency services is disrupted during a dam failure event.

Dam failure impacts depend on the severity of the event and whether adequate warning time is provided to residents. Flooding resulting from dam failure and its aftermath presents numerous threats to public health and safety. These include exposure to unsafe food, contaminated drinking and washing water, mosquitoes, animals, mold, and mildew. The degree of these impacts can vary widely and is not strictly measurable. Residents may be affected by isolation issues if a dam failure damages transportation or communication infrastructure. Such damage can limit emergency response and evacuations.



Socially Vulnerable Population

Table 6-4 summarizes the socially vulnerable populations living within the dam failure hazard area. The Town of Philipstown has the highest population over 65 (61) and largest population with a disability (26) in the hazard area; the Town of Southeast has the highest population under 5 (12); and the Village of Brewster has the greatest non-English speaking population (31) and largest number individuals living in poverty (21).

Table 6-4. Vulnerable Persons Living in the Aggregated Dam Inundation Hazard Area

Jurisdiction	Vulnerable Persons Living in the Aggregated Dam Inundation Hazard Area									
	Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Total	% of Total	Total	% of Total	Total	% of Total	Total	% of Total	Total	% of Total
Brewster (V)	19	5.8%	4	5.6%	31	5.7%	20	5.6%	21	5.8%
Carmel (T)	26	0.4%	5	0.4%	2	0.4%	14	0.4%	5	0.3%
Cold Spring (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Kent (T)	5	0.2%	2	0.2%	0	0.0%	3	0.2%	2	0.2%
Nelsonville (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Patterson (T)	2	0.1%	0	0.0%	0	0.0%	1	0.1%	2	0.1%
Philipstown (T)	61	3.5%	9	3.5%	0	0.0%	26	3.5%	18	3.4%
Putnam Valley (T)	42	1.9%	11	1.8%	3	1.5%	18	1.8%	9	1.8%
Southeast (T)	46	1.4%	12	1.4%	14	1.4%	22	1.4%	15	1.3%
Putnam County (Total)	201	1.1%	43	0.9%	50	1.8%	104	1.1%	72	1.0%

Source: U.S. Census Bureau 2024 ACS Vulnerable Population; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; DSS-WISE 2026

Socially vulnerable populations can experience exacerbated impacts from a dam failure and prolonged recovery after the event due to their physical and financial ability to react. Economically disadvantaged populations may lack the financial resources to evacuate. The population over age 65 are more likely to need medical attention that may not be available due to isolation during a dam failure event. They also may have more difficulty evacuating.

6.2.2 General Building Stock

As shown in Table 6-5, there are 557 buildings within the dam failure hazard area, with a total replacement cost value of \$455 million. The Town of Southeast has the greatest number of buildings in the hazard area (148) and the highest replacement cost value (\$170 million). Table 6-6 lists buildings in the hazard area by occupancy class. The residential occupancy class is the most vulnerable, with 327 buildings exposed.



Table 6-5. Buildings in the Aggregated Dam Inundation Hazard Area

Jurisdiction	Jurisdiction Total Buildings		Buildings in the Aggregated Dam Inundation Hazard Area			
			Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Brewster (V)	569	\$368,940,861	47	8.3%	\$50,659,589	13.7%
Carmel (T)	12,221	\$9,049,629,618	62	0.5%	\$35,936,779	0.4%
Cold Spring (V)	761	\$474,899,526	2	0.3%	\$2,035,375	0.4%
Kent (T)	5,760	\$3,047,474,569	16	0.3%	\$5,955,769	0.2%
Nelsonville (V)	283	\$143,090,491	3	1.1%	\$941,611	0.7%
Patterson (T)	4,118	\$3,126,610,140	19	0.5%	\$30,124,393	1.0%
Philipstown (T)	4,049	\$2,634,231,865	133	3.3%	\$85,811,018	3.3%
Putnam Valley (T)	5,383	\$2,989,131,470	127	2.4%	\$73,931,723	2.5%
Southeast (T)	5,488	\$5,049,468,784	148	2.7%	\$170,422,390	3.4%
Putnam County (Total)	38,632	\$26,883,477,324	557	1.4%	\$455,818,648	1.7%

Source: Putnam County 2025, 2026; NYSERDA 2026; NYS 2024; RSMeans 2026; DSS-WISE 2026

Table 6-6. Buildings in the Aggregated Dam Inundation Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the Aggregated Dam Inundation Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Other
Brewster (V)	23	24	0	0
Carmel (T)	40	17	5	0
Cold Spring (V)	0	2	0	0
Kent (T)	12	4	0	0
Nelsonville (V)	2	1	0	0
Patterson (T)	5	3	0	11
Philipstown (T)	98	34	1	0
Putnam Valley (T)	85	39	0	3
Southeast (T)	62	79	5	2
Putnam County (Total)	327	203	11	16

Source: Putnam County 2025, 2026; NYSERDA 2026; NYS 2024; RSMeans 2026; DSS-WISE 2026

Note: Other = Government, Religion, Agricultural, and Education

Properties closest to the dam inundation area would experience the largest, most destructive surge of water and greatest impacts. Low-lying areas are also at risk since they are where the dam waters would collect. Buildings that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge.



6.2.3 Community Lifelines and Other Critical Facilities

Table 6-7 summarizes critical facilities located within the dam failure hazard area. Overall, 98 lifelines are exposed to this hazard area. Each lifeline category has at least one critical facility exposed.

Wastewater, potable water, and other community facilities can be affected by dam failure, and recovery time to restore critical functions after an event may be lengthy. Water supplies and wastewater treatment could be off-line for weeks. Transportation routes have the potential to be wiped out. This includes all roads, railroads and bridges in the path of the dam inundation. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. Emergency response may be hindered by the loss of transportation routes as well as by any damage to protective-function facilities in the inundation zone.

6.2.4 Economy

Dam failure events can significantly impact the local and regional economy. Potential losses include damage to buildings and infrastructure, agricultural losses, business interruption, and impacts on the tax base. Severe flooding caused by dam failures may transport large volumes of sediment and debris, which require great community expense to remove.

6.2.5 Natural Resources

Dam failure inundation may introduce foreign elements into local waterways. The rush of water downstream can rapidly increase flow rate and turbidity of streams and rivers, overwhelming downstream habitat and impacting animal and plant species, including endangered species.

Dam failures can result in the release of hazardous materials swept up in floodwaters or in sediment that is contained behind the dam as is often the case in areas that have had mining activities that take place upstream. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to floodwaters. Floodwaters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate waterways. After the floodwaters subside, contaminated and flood-damaged building materials and contents must be properly disposed of.

6.2.6 Historic and Cultural Resources

Historic structures, sites, monuments, districts, and documents may become damaged or destroyed in the floodwaters following a dam failure. Artifacts, statuary, artwork, and important documents or repositories housed in libraries, museums, archives, historical repositories, or historic properties are at risk from damage due to floodwaters following a dam failure.



Table 6-7. Number of Facilities in the Dam Failure Hazard Area

Jurisdiction	Number of Facilities in the Dam Failure Hazard Area									Total Facilities in Hazard Area	
	Commu- nications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Brewster (V)	1	0	2	1	0	2	1	4	0	11	20.4%
Carmel (T)	3	2	0	1	0	3	8	0	0	17	5.2%
Cold Spring (V)	0	0	0	0	0	0	1	0	0	1	2.6%
Kent (T)	1	0	0	0	0	0	4	0	0	5	2.8%
Nelsonville (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Patterson (T)	0	0	0	0	0	6	1	0	0	7	3.9%
Philipstown (T)	0	0	2	1	0	4	7	1	0	15	9.8%
Putnam Valley (T)	1	0	0	0	0	4	7	1	1	14	11.6%
Southeast (T)	1	1	1	2	0	6	13	4	0	28	14.1%
Putnam County (Total)	7	3	5	5	0	25	42	10	1	98	7.8%

Source: Putnam County 2021, 2026; NYS GIS Clearinghouse 2026; NYSDEC 2025 – 2026; ESRI 2026; NYS Board of Elections 2025; HIFLD 2025; DSS-WISE 2026



6.3 FUTURE CHANGES THAT MAY AFFECT RISK

6.3.1 Potential or Planned Development

Any new development could be impacted by a dam failure if the structures are within the failure inundation area and mitigation measures are not considered. Therefore, it is the intention of Putnam County to discourage development in vulnerable areas and to pursue higher regulatory standards.

6.3.2 Projected Changes in Population

Any changes in the density of population can impact the number of persons living in dam failure hazard areas. Higher density can create issues for local residents during evacuation of a dam failure event and can have an effect on commuters who travel into and out of the County for work.

6.3.3 Climate Change

Future projections indicate increased rainfall accumulations are possible, which can impact stored water systems as cause dams to be overtopped. Dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Increased precipitation may result in overtopping, as the hydrographs are based on historical events (USBR 2014).



7. DISEASE OUTBREAK

7.1 HAZARD PROFILE

7.1.1 Hazard Description

An outbreak or a pandemic occurs when new cases of a certain disease in a given population substantially exceed what is expected. An epidemic may be restricted to one locale, or it may be global, at which point it is called a pandemic. A pandemic is defined as an outbreak of an infectious disease occurring over a wide geographical area that affects a large portion of the world's population (Britannica 2024). Emerging diseases are difficult to contain or treat and present significant challenges to risk communication since the mechanics of transmission, laboratory identification, and effective treatment protocols may be unknown (NYCEM 2019).

Most pandemics occur due to highly contagious respiratory viruses that spread easily from person to person and for which there is little human immunity. Previous events that exemplify this include the 1918 Spanish flu and 2009 swine flu pandemics, the 2003 SARS outbreak, which had pandemic potential, and the COVID-19 pandemic (NYCEM 2019).

The sections below describe the infectious diseases addressed in this HMP update.

Influenza

Influenza is a contagious virus that affects the nose, throat, lungs, and other parts of the body. It can quickly spread from one person to another, causing mild to severe illness, and can lead to death. Symptoms include fever, cough, sore throat, runny or stuffy nose, muscle or body aches, headache, and tiredness (New York State Department of Health 2021). While flu symptoms are typically mild, vulnerable populations, such as older adults, younger children, pregnant persons, and people with pre-existing conditions, are more likely to experience flu-related complications (NYS DOH 2023).

Pandemic influenza differs from seasonal influenza because outbreaks of seasonal flu are caused by viruses already living among people. Seasonal flu happens annually and usually peaks between December and February. Pandemic influenza is a global outbreak of a new influenza A virus, which can infect people easily and spread from person to person in an efficient and sustained manner (CDC 2020).

The risk of a global influenza pandemic has increased over the last several years. This disease can claim thousands of lives and adversely affect critical infrastructure and key resources. An influenza pandemic can reduce the health, safety, and welfare of the essential services workforce; immobilize core infrastructure; and induce fiscal instability.

West Nile Virus

West Nile Virus (WNV) disease is spread by the bite of a mosquito infected with the virus. It is the leading cause of mosquito-borne disease in the United States. Mosquitoes become infected when they feed on infected birds (NYS DOH 2017). WNV was first found in New York State in 1999. WNV is usually diagnosed during mosquito season, starting in the summer months and continuing through the fall (CDC 2022c).



WNV can cause serious illness, and in some cases, death. The symptoms of severe infection can include headache, high fever, neck stiffness, muscle weakness, stupor, disorientation, tremors, seizures, paralysis, and coma. Usually, symptoms occur from 3 to 14 days after being bitten by an infected mosquito (NYS DOH 2017).

Lyme Disease and Other Tick-Borne Diseases

Lyme disease is the most common vector-borne disease in the United States. It is an illness caused by infection with the bacterium *Borrelia burgdorferi*, which is carried by ticks. Typical symptoms include fever, headache, fatigue, and skin rash. If left untreated, symptoms can be severe. Lyme disease is spread to people by the bite of an infected tick (CDC 2021b).

Tick-borne diseases in general are bacterial illnesses that spread to humans through ticks that become infected by microorganisms when feeding on small, infected mammals (mice and voles). Anyone who is bitten by an infected tick may get a tick-borne disease. Different tick-borne diseases are caused by different microorganisms, and it is possible to be infected with more than one tick-borne disease at a time.

The three types of ticks in New York that may carry disease-causing micro-organisms are the blacklegged tick (*Ixodes scapularis*, also known as deer tick), Lone Star tick (*Amblyomma americanum*), and the American dog tick (*Dermacentor variabilis*) (New York State Department of Health 2019).

COVID-19

COVID-19 (a specific coronavirus disease identified in 2019) is an infectious disease caused by the SARS-CoV-2 virus that was first identified in 2019 and spread into a global pandemic by spring of 2020. The virus can spread from an infected person's mouth or nose, in small liquid particles, through coughing, sneezing, speaking, singing, or breathing (WHO 2022).

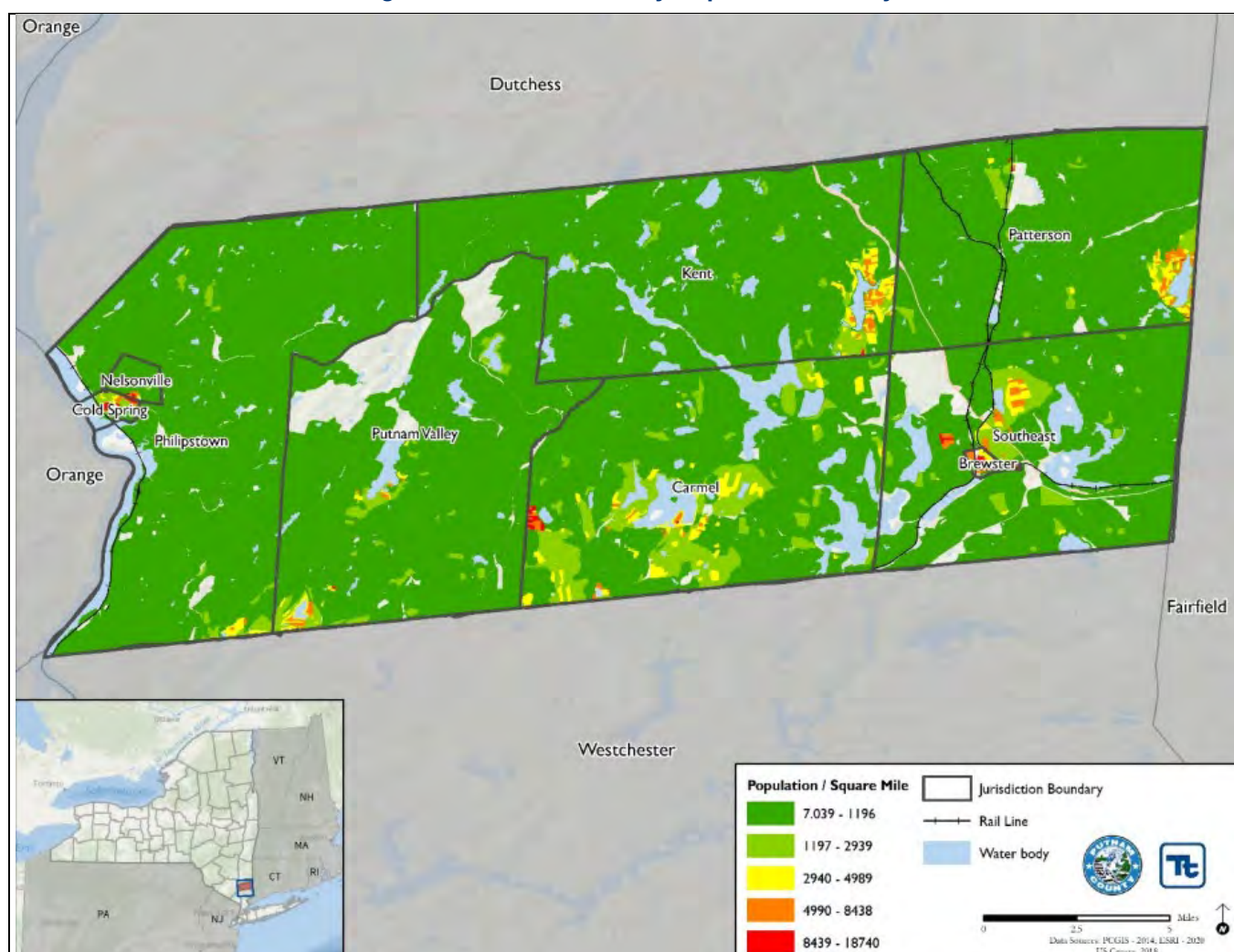
The disease may range from mild to severe illness or death. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illnesses (WHO 2022). Symptoms include difficulty breathing and shortness of breath, fever or chills, cough, fatigue, muscle or body aches, loss of smell or taste, sore throat, congestion, and nausea or vomiting. Emergency symptoms that require immediate medical attention include trouble breathing, persistent pain or pressure in the chest, confusion, or inability to wake or stay awake, and bluish lips or face. Symptoms may appear 2 to 14 days after exposure to the virus (CDC 2021a).

7.1.2 Location

Vulnerability to infectious diseases is influenced by factors such as population density and the nature of public meeting areas. Densely populated areas spread diseases more quickly than less densely populated areas. As shown on Figure 7-1, Putnam County's population density is relatively low, with small population centers and distributed settlements among large tracts of preserved land.

Forest stands and wetlands in the County provide ideal habitats for ticks and mosquitos, rendering the County vulnerable to diseases from those vectors. Standing water can provide breeding grounds for mosquitoes, and wooded areas are favored by ticks. These areas need to be addressed as well as possible to control mosquitoes and the viruses they can spread.

Figure 7-1. Putnam County Population Density



7.1.3 Extent

The magnitude of disease outbreaks ranges from nuisance to widespread, depending on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas. The transmission rate of infectious diseases depends on the mode of transmission of a given illness, and whether a vaccine, cure, or treatment is available. The severity and length of the next pandemic cannot be predicted; however, experts anticipate that its effect on the United States could be severe.

7.1.4 Previous Occurrences

FEMA Disaster Declarations

Table 7-1 lists all disease outbreak-related presidentially declared disasters that have included Putnam County.

**Table 7-1. FEMA Disaster Declarations for Disease Outbreak Events in Putnam County**

Event Date	Declaration Date	Declaration Number	Description
May 22, 2000–November 1, 2000	October 11, 2000	EM-3155	West Nile Virus
January 20, 2020–May 11, 2023	March 20, 2020	EM-3434, DR-4480	COVID-19 Pandemic

Source: (FEMA 2026b)

USDA Declarations

Putnam County has not been included in any USDA pandemic-related agricultural disaster declarations (USDA 2026).

All Recent Events

Table 7-2 lists major recorded disease outbreak-related events that impacted Putnam County since the previous HMP was developed. For earlier events, refer to the previous HMP.

Table 7-2. Disease Outbreak Events in Putnam County (2020 to 2025)

Event Date	Location Impacted	Description
2019 – 2020	Countywide	There were 494 reported cases of influenza in the County.
2020 – 2021	Countywide	There were 144 reported cases of influenza in the County.
January 20, 2020 – May 11, 2023	Countywide	Putnam County incurred 153 fatalities related to the COVID-19 pandemic. Federal disaster declarations EM-3434 and DR-4480
2020	Countywide	There were 53 reported cases of Lyme disease in the County.
2021 – 2022	Countywide	There were 1,523 reported cases of influenza in the County.
2021	Countywide	There were 72 reported cases of Lyme disease in the County.
2022 – 2023	Countywide	There were 3,125 reported cases of influenza in the County.
2022	Countywide	There were 276 reported cases of Lyme disease in the County.
2023	Countywide	There were 347 reported cases of Lyme disease in the County.
2023 – 2024	Countywide	There were 2,769 reported cases of influenza in the County.
2024 – 2025	Countywide	There were 4,243 reported cases of influenza in the County.
2025 – 2026	Countywide	There were 2,138 reported cases of influenza in the County.

Source: (NYS DOH 2025c); (CDC 2025); (NYS DOH 2025b); (NYS DOH 2025a)

Note: The NYS Flu Tracker did not have data for flu seasons prior to 2023 – 2024.

Putnam County had no reported cases of West Nile Virus between 2020 – 2025.

Lyme disease data was available through 2023.

Influenza totals for the 2025 – 2026 season are through December 31, 2025

7.1.5 Probability of Future Occurrences

As long as mosquitoes and ticks are found in Putnam County, the risk of contracting WNV, Lyme disease, or other diseases carried by these vectors exists. Instances of WNV have been generally decreasing throughout the northeast United States due to planning and eradication efforts. However, some scientists anticipate an increase



in WNV and other mosquito-borne diseases due to changing climate conditions creating suitable habitats for mosquitoes (CDC 2013). Disease-carrying ticks will continue to inhabit Putnam County, and the threat of Lyme disease and other tick-borne diseases will continue. There are eradication efforts in place to control the tick population (Steere, Coburn and Glickstein 2004).

Information on previous disease outbreak occurrences in the County was used to calculate the probability of future occurrences of such events. Based on these records and input from the Steering Committee, the probability of occurrence for disease outbreak in the County is considered “unlikely.”

7.1.6 Cascading Impacts on Other Hazards

Disease outbreaks can produce widespread cascading effects that extend beyond public health. High infection rates may result in workforce absenteeism across multiple sectors, disrupting essential services such as healthcare, public safety, transportation, utilities, education, and government operations. Healthcare systems may become overwhelmed due to increased hospitalizations and demand for medical supplies, personnel, and treatment capacity. School closures and social distancing measures can interrupt childcare arrangements and reduce workforce availability. Supply chains may also be affected if production facilities, distribution centers, or transportation networks experience staffing shortages. In severe cases, public health measures such as quarantine, isolation, or restrictions on gatherings may disrupt economic activity and community functions. Loss of public confidence and increased demand for emergency services can further strain local resources.

7.2 VULNERABILITY AND IMPACT ASSESSMENT

This section provides a qualitative description of the disease outbreak risk to Putnam County.

7.2.1 Life, Health, and Safety

Overall Population

The entire population of Putnam County is vulnerable to the disease outbreak hazard. Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. Areas with a higher population density have an increased risk of transmission of disease. Outdoor workers and residents in wooded or coastal environments may face additional exposure to mosquito- and tick-borne illnesses.

Socially Vulnerable Population

Vulnerable populations, including older adults, individuals with underlying medical conditions, immunocompromised individuals, and those with limited access to healthcare—may experience more severe health outcomes.

7.2.2 General Building Stock

No structures are anticipated to be directly affected by disease outbreaks.



7.2.3 Community Lifelines and Other Critical Facilities

A pandemic will not directly impact the actual structures of County and municipal buildings, critical facilities, and infrastructure. However, the effect of worker absenteeism will impact local government services.

Increased service demands, such as hospitalization and emergency room visits, would be seen because of a pandemic. This would create a greater demand for related critical facilities, staff, and resources. The healthcare system would be severely strained, if not overwhelmed, from the large number of illnesses and complications requiring hospitalization and critical care. Ventilators would be the most critical shortage if a respiratory outbreak were to occur (Homeland Security Council 2006).

A pandemic may quickly rise to the level of a catastrophic incident that results in mass fatalities, which would place extraordinary demands (including religious, cultural, and emotional burdens) on local jurisdictions and the families of the victims (Homeland Security Council 2006). Mortuary services could be substantially impacted due to the anticipated increased numbers of deaths. The timely, safe, and respectful disposition of the deceased is an essential component of an effective response.

7.2.4 Economy

Disease outbreaks can result in substantial economic consequences at the local and regional levels. Direct costs may include increased healthcare expenditures, emergency response operations, vaccination campaigns, public health communications, and disease surveillance efforts. Indirect costs may stem from workforce absenteeism, temporary business closures, supply chain disruptions, and reduced consumer spending. Tourism, hospitality, food service, and retail sectors may be particularly affected if public gatherings are restricted or if travel declines. Long-term outbreaks may also impact tax revenues and require increased public assistance expenditures. In addition, agricultural and food industries may face economic losses if foodborne illness outbreaks occur.

The COVID-19 outbreak resulted in significant negative impacts to economic activity owing to the identified need to enforce social distancing and quarantine conditions until the disease spread was lessened. Decreased economic activity caused large-scale unemployment. During the height of the COVID outbreak, all non-essential businesses were forced to close. The outbreak had a deleterious impact on government finances owing to tax delinquency and loss of user fees. Decreased revenues led to service cuts and prevented the County and community from procuring necessary supplies to weather the outbreak.

Smaller-scale disease outbreaks can also cause negative economic impacts, though the extent of impact is variable. For example, an outbreak in mosquito or tick-borne diseases can impact Putnam County's local economies associated with lakes and parks.

7.2.5 Natural Resources

Disease management activities can have direct or indirect impacts on natural resources. Efforts to control disease vectors—such as pesticide applications, larviciding, or habitat modification—may affect non-target species and local ecosystems if not carefully managed. In addition, wildlife populations may serve as reservoirs for certain pathogens, potentially altering ecosystem dynamics. Large-scale outbreaks may also influence the use of parks, beaches, and open spaces, resulting in temporary closures or reduced public access.



7.2.6 Historic and Cultural Resources

Disease outbreaks generally do not result in direct physical damage to historic or cultural resources; however, indirect impacts may occur. Public health restrictions, such as capacity limits, temporary closures, or event cancellations, may reduce access to museums, historic sites, cultural centers, and community gathering spaces. Reduced visitation can result in revenue losses that affect the maintenance and preservation of these resources. In addition, staffing shortages or operational disruptions may delay routine upkeep, conservation efforts, or restoration projects. Over time, prolonged interruptions in funding or public access could impact the long-term preservation and cultural vitality of historic properties and heritage sites within Putnam County.

7.3 FUTURE CHANGES THAT MAY AFFECT RISK

7.3.1 Potential or Planned Development

Any areas of new development could be impacted by a disease outbreak because the entire planning area is exposed and vulnerable. Additional development of structures in close proximity to water bodies or areas with high population density are at an increased risk.

7.3.2 Projected Changes in Population

Changes in the density of population when households move throughout the County could influence the number of persons exposed to disease outbreaks. Higher density jurisdictions are not only at risk of greater exposure to disease outbreak, density may also reduce available basic services provided by critical facilities such as hospitals and emergency facilities for persons that are not affected by a disease.

7.3.3 Climate Change

Climate change may influence the frequency and geographic range of certain disease outbreaks, particularly vector-borne illnesses. Warmer temperatures and longer warm seasons can expand mosquito and tick populations, potentially increasing the incidence of diseases such as West Nile Virus and Lyme disease. Changes in precipitation patterns may create additional breeding habitats for mosquitoes, and milder winters may allow greater survival of tick populations. Extreme weather events and flooding can also contribute to sanitation challenges and increased exposure to pathogens. As climate conditions continue to evolve, Putnam County may experience shifts in seasonal disease patterns and increased public health monitoring needs.



8. DROUGHT

8.1 HAZARD PROFILE

8.1.1 Hazard Description

Drought is a period characterized by long durations of below-normal precipitation. Drought conditions occur in virtually all climatic zones, yet its characteristics vary significantly from one region to another, since it is relative to the normal precipitation in that region. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life. Droughts can be classified as one or more of the following types (NDMC 2013):

- **Meteorological** drought is a departure of precipitation from normal. It is defined solely by the relative degree of dryness. Due to climatic differences, what might be considered a drought in one location of the country may not be a drought in another location.
- **Agricultural** drought is when there is not enough water available for a particular crop to grow at a particular time due to precipitation shortages, soil water deficits, reduced groundwater or reservoir levels, and other parameters. Agricultural drought is defined in terms of soil moisture deficiencies relative to water demands of plant life.
- **Hydrological** drought when surface or subsurface water supply is below normal because periods of precipitation shortfalls (including snowfall) have lowered stream flows and reservoir, lake, and groundwater levels.
- **Socioeconomic** drought occurs when the demand for an economic good exceeds the supply as a result of a weather-related shortfall in the water supply. The supply of many economic goods depends on the weather (for example, water, forage, food grains, fish, and hydroelectric power).
- **Ecological** drought is a prolonged and widespread deficit in naturally available water supplies that creates multiple stresses across ecosystems.

8.1.2 Location

Drought is a regional phenomenon that has the potential to impact the entire planning area. A drought affects all aspects of the environment and the community simultaneously and has the potential to impact every person directly or indirectly in the planning area as well as adversely affect the local economy. Since water shortage happens on a regional scale, the entirety of Putnam County is at risk.

The New York State Department of Environmental Conservation (NYSDEC) has divided the state into nine drought management regions based on drainage basins and county lines. Putnam County is part of Drought Region II, NYC/Westchester.

8.1.3 Extent

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts (USDA 2023).



NYSDEC monitors precipitation, lake and reservoir levels, stream flow, and groundwater level at least monthly in each region and more frequently during periods of drought. NYSDEC and the New York State Drought Management Task Force use this data to assign each region one of the following drought stages (NYSDEC 2023d):

- **Normal** is characterized by standard moisture soil levels.
- **Drought watch** is the first stage of drought, intended to give advance notice of a developing drought. At this stage, the general public is urged to conserve water. Public water purveyors and industries are urged to update and begin to implement individual drought contingency plans.
- **Drought warning**, the second stage of drought, is a notice of impending and imminent severe drought conditions. A warning declaration includes stepping up public awareness and increasing voluntary conservation. Public water supply purveyors and industries are urged to continue to implement local drought contingency plans. Federal, state, and local water resources agencies are notified to prepare for emergency response measures.
- **Drought emergency** is declared by the NYS DHSES. It is a notice of existing severe and persistent drought conditions. It notifies local water resources agencies to mandate conservation and implement other emergency response measures.
- A continuing and worsening drought emergency may result in the New York State governor declaring a **drought disaster**. It is a notice of the most severe and persistent drought conditions. At this stage, a significant proportion of communities in the impacted area is likely unable to respond adequately.

The State of New York uses the following methodologies to assess drought conditions:

- The Palmer Drought Severity Index (PDSI) is a commonly used drought indicator primarily based on soil conditions, which are typically the first indicators of a moisture deficit. PDSI values range from negative 5 to positive 5, where positive values indicate wetter conditions and negative values represent drier conditions (NDMC n.d.).
- The Standardized Precipitation Evapotranspiration Index (SPEI), along with the PDSI, is used to evaluate the levels of soil moisture and forecast potential impacts on agriculture (NYSDEC 2023c).
- The State Drought Index (SDI) compares four parameters to normal historical values to evaluate drought conditions: stream flows, precipitation, lake and reservoir storage levels, and groundwater levels. Indicators of these parameters are weighted on a regional basis to reflect the unique circumstances of each drought management region. The SDI is used to establish drought levels for each drought management region based on the following scale (NYSDEC 2023c):
 - Normal Conditions—SDI = 100 to 150
 - Drought Watch—SDI = 75 to 100
 - Drought Warning—SDI = 50 to 70
 - Drought Emergency—SDI = 0 to 50
- The U.S. Drought Monitor (USDM) is a map that shows the intensity of drought across the United States, based on temperature, soil moisture, water levels in streams and lakes, snow cover, and meltwater runoff. The USDM uses a five-category system to classify ongoing drought conditions (NIDIS n.d.) The categories correlate to PDSI values as shown in Table 8-1 and to SPEI values as shown in Table 8-2.



Table 8-1. Palmer Drought Category and Palmer Drought Index Descriptions

USDM Category	Description	Possible Impacts	PDSI Value
D0	Abnormally Dry	- Producers begin supplemental feeding for livestock - Planting is postponed; forage germination is stunted; hay cutting is reduced - Grass fires increase - Surface water levels decline	-1.0 to -1.99
D1	Moderate drought	- Dryland crops are stunted - Early cattle sales begin - Wildfire frequency increases - Stock tanks, creeks, streams are low; voluntary water restrictions are requested	-2.0 to -2.99
D2	Severe drought	- Pasture conditions are very poor - Soil is hard, hindering planting; crop yields decrease - Wildfire danger is severe; burn bans are implemented - Wildlife moves into populated areas - Hydroelectric power is compromised; well water use increases; mandatory water restrictions are implemented	-3.0 to -3.99
D3	Extreme drought	- Soil has large cracks; soil moisture is very low; dust and sandstorms occur - Row and forage crops fail to germinate; decreased yields for irrigated crops and very large yield reduction for dryland crops are reported - Need for supplemental feed, nutrients, protein, and water for livestock increases; herds are sold - Increased risk of large wildfires is noted - Many sectors experience financial burden - Severe fish, plant, and wildlife loss reported - Water sanitation is a concern; reservoir levels drop significantly; surface water is nearly dry; river flow is very low; salinity increases in bays and estuaries	-4.0 to -4.99
D4	Exceptional drought	- Exceptional and widespread crop loss is reported; rangeland is dead; producers are not planting fields - Culling continues; producers wean calves early and liquidate herds due to importation of hay and water expenses - Seafood, forestry, tourism, and agriculture sectors report significant financial loss - Extreme sensitivity to fire danger; firework restrictions are implemented - Widespread tree mortality is reported; most wildlife species' health and population are suffering - Devastating algae blooms occur; water quality is very poor - Exceptional water shortages are noted across surface water sources; water table is declining - Boat ramps are closed; obstacles are exposed in water bodies; water levels are at or near historic lows	-5.0 or less

Source: (NDMC n.d.)



Table 8-2. Drought Classification

USDM Category	Description	Example Percentile Range for Most Indicators	SPEI Value
None	Normal or wet conditions	30.01 or Above	-0.49 or above
D0	Abnormally Dry	20.01 to 30.00	-0.5 to -0.79
D1	Moderate Drought	10.01 to 20.00	-0.8 to -1.29
D2	Severe Drought	5.01 to 10.00	-1.3 to -1.59
D3	Extreme Drought	2.01 to 5.00	-1.6 to -1.99
D4	Exceptional Drought	0.00 to 2.00	-2.0 or less

Source: (NDMC 2025)

8.1.4 Previous Occurrences

FEMA Disaster Declarations

Table 8-3 lists the single drought-related presidentially declared disaster that included Putnam County.

Table 8-3. FEMA Disaster Declarations for Drought Events in Putnam County

Event Date	Declaration Date	Declaration Number	Description
August 18, 1965	August 18, 1965	DR-204-NY	Water Shortage

Source: (FEMA 2026b)

USDA Declarations

Table 8-4 lists drought-related USDA agricultural disaster declarations that have included Putnam County.

Table 8-4. USDA Declarations for Drought Events in Putnam County

Event Date	USDA Declaration Number	Description
June 2, 2012	S3427	Drought
August 15, 2014	S3759	Drought
April 1, 2015	S3928	Drought
August 9, 2022	S5300, S5306	Drought

Source: (USDA 2026)

All Recent Events

Table 8-5 lists major recorded drought-related events that impacted Putnam County since the previous HMP was developed. For earlier events, refer to the previous HMP.



Table 8-5. Drought Events in Putnam County (2020 to 2025)

Event Date	Location Impacted	Description
March 17 – 24, 2020	Countywide	Abnormally dry conditions
June 23 – August 4, 2020	Countywide	Abnormally dry conditions
September 22 – October 27, 2020	Countywide	Abnormally dry conditions
April 13 – May 25, 2021	Countywide	Abnormally dry conditions
March 22 – April 5, 2022	Countywide	Abnormally dry conditions
July 12 – 26, 2022	Countywide	Abnormally dry conditions
July 27 – August 8, 2022	Countywide	Abnormally dry to moderate drought conditions
August 9 – November 14, 2022	Countywide	Abnormally dry to severe drought conditions; Disaster declarations S5300 and S5306
November 15 – December 20, 2022	Countywide	Abnormally dry to moderate drought conditions
December 21, 2022 – January 24, 2023	Countywide	Abnormally dry conditions
April 11 – 17, 2023	Countywide	Abnormally dry conditions
April 18 – 24, 2023	Countywide	Abnormally dry to moderate drought conditions
April 24 – May 2, 2023	Countywide	Abnormally dry conditions
June 13 – 19, 2023	Countywide	Abnormally dry conditions
June 20 – 26, 2023	Countywide	Abnormally dry to moderate drought conditions
June 27 – July 4, 2023	Countywide	Abnormally dry conditions
September 24 – October 28, 2024	Countywide	Abnormally dry conditions
October 29 – November 11, 2024	Countywide	Abnormally dry to moderate drought conditions
November 12, 2024 – March 10, 2025	Countywide	Abnormally dry to severe drought conditions
March 11 – May 12, 2025	Countywide	Abnormally dry to moderate drought conditions
May 13 – 26, 2025	Countywide	Abnormally dry conditions
August 5 – 25, 2025	Countywide	Abnormally dry conditions
September 2 – 29, 2025	Countywide	Abnormally dry conditions
September 30 – November 10, 2025	Countywide	Abnormally dry to moderate drought conditions
November 11, 2025, Ongoing	Countywide	Abnormally dry conditions

Source: (U.S. Drought Monitor 2026, USDA 2026)

8.1.5 Probability of Future Occurrences

Based upon risk factors and past occurrences, it is likely that droughts will occur in Putnam County in the future. As temperatures increase, the probability of future droughts will likely increase. Based on records, climate projections, and input from the Steering Committee, the probability of occurrence for drought in the County is considered “likely.”

8.1.6 Cascading Impacts on Other Hazards

Dry conditions increase the likelihood of wildfires, especially in forested or rural areas. While wildfires are less common in New York than in other parts of the U.S., drought can heighten this risk. Fires also endanger wildlife, degrade air quality, and strain emergency services.



8.2 VULNERABILITY AND IMPACT ASSESSMENT

This section provides a qualitative description of the drought risk to Putnam County.

8.2.1 Life, Health, and Safety

Overall Population

The entire population of Putnam County is vulnerable to drought events. Drought conditions can affect people's health and safety, including health problems related to low water flows and poor water quality, and health problems related to dust. Droughts also can lead to loss of human life (NDMC 2023).

Other possible impacts on health from drought include increased recreational risks; effects on air quality; diminished living conditions related to energy, air quality, and sanitation and hygiene; compromised food and nutrition; and increased incidence of illness and disease. Health implications of drought are numerous. Some drought-related health effects are short-term while others can be long-term (CDC 2012a).

Socially Vulnerable Population

Socially vulnerable populations may be more susceptible to drought due to their physical and financial ability to react or respond during a drought. Vulnerable populations include homeless persons, persons over 65 years old, low income or linguistically isolated populations, people with life-threatening illnesses, and residents that may have limited access to water. The population over the age of 65 may require extra water supplies or need assistance to obtain water and are more likely to need medical attention.

8.2.2 General Building Stock

A drought event is not expected to directly affect any structures. However, droughts contribute to conditions conducive to wildfires and reduce fire-fighting capabilities. Risk to life and property is greatest within those areas where forested areas adjoin urbanized areas (high-density residential, commercial, and industrial) or wildland urban interface (WUI).

8.2.3 Community Lifelines and Other Critical Facilities

Drought events can impact critical facilities that are associated with water supplies such as potable water and fire-fighting services. Aging infrastructure may be strained as cities and towns attempt to meet water demand, which can further reduce water quality or increase the risk of water shortages. Lower water levels can concentrate pollutants in drinking water supplies, increasing treatment costs and putting pressure on municipal water systems.

Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to problems such as water supply wells going dry. Shallow wells are more susceptible than deep wells.

With lower water levels during a drought, hydroelectric plants may produce less electricity, potentially increasing reliance on other sources and driving up energy costs. Additionally, water is needed for cooling in fossil fuel and nuclear power plants, which may also face operational constraints during droughts.



8.2.4 Economy

Drought can produce a range of impacts that span many economic sectors and can reach beyond an area experiencing physical drought. Water withdrawals are used in the commercial/industrial/mining sectors and power generation. When drought conditions persist with little to no relief, water restrictions may be put into place by local or state governments. These restrictions may include placing limitations on recreational/commercial outdoor uses of water supplies (NC State University 2013). Although most businesses will still be operational, they may be impacted aesthetically. These aesthetic impacts are most significant within the recreation and tourism industry.

Drought stresses crops and livestock, reducing yields and increasing the risk of crop failure. This can lead to financial losses for farmers, disruptions in food supply, and higher prices for consumers. Droughts in other areas can impact the food supply and price of food for residents within the County.

Industries such as tourism, recreation, and hydroelectric power generation may face setbacks. Reduced water levels impact activities like fishing, boating, and hiking, affecting tourism in areas like the Adirondacks and the Catskills.

8.2.5 Natural Resources

Drought can impact the environment because it can trigger wildfires, increase insect infestations, and exacerbate the spread of disease (NOAA 2000). Droughts will also impact water resources that are relied upon by aquatic and terrestrial species. Ecologically sensitive areas, such as wetlands, can be particularly vulnerable to drought because they are dependent on steady water levels and soil moisture for growth.

Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest. Reduced water flow in rivers, streams, and wetlands can harm fish and wildlife, disrupt migration patterns, and damage habitats. Aquatic species, including fish populations in the Hudson River and its tributaries, may experience population declines due to low water levels and poor water quality.

Drought can cause long-term damage to forests and green spaces, weakening trees and vegetation and making them more susceptible to disease and pests. This can affect biodiversity, reduce carbon sequestration, and change the landscape over time.

Drought depletes soil moisture, making it more susceptible to erosion and reducing its fertility. Over time, this can lead to lower land productivity and may also contribute to dust storms, which can reduce air quality.

8.2.6 Historic and Cultural Resources

The primary impacts on historic and cultural resources from drought would be an increased risk of wildfires, which could threaten these assets, and impacts on structure foundations from the shrink-swell cycle of expansive soils. Droughts may impact the traditional and customary practices of Indigenous persons, who rely on healthy terrestrial ecosystems. These practices may include the collection of plants, animals, and minerals and other practices.



8.3 FUTURE CHANGES THAT MAY AFFECT RISK

8.3.1 Potential or Planned Development

Any areas of new development could be impacted by the drought hazard because the entire County is exposed and vulnerable to droughts. Future growth and development could impact the amount of potable water available due to a drain on the available water resources. An increased use of water resources would impact the County's population and exacerbate impacts on other areas of the County, including agriculture and recreational facilities.

8.3.2 Projected Changes in Population

An increase in the population throughout Putnam County will increase the County's risk from drought events and may put more stress on available water supplies.

8.3.3 Climate Change

The State of New York is expected to experience a rise in average annual temperatures, fostering a heightened frequency of drought. Climate projections anticipate an increased likelihood and severity of drought events, prolonging their duration and intensifying their impact. Over the past five decades, there has been a notable increase in average annual temperatures within the state, with an increment of 0.6 °F per decade since 1970.



9. EARTHQUAKE

9.1 HAZARD PROFILE

9.1.1 Hazard Description

An earthquake is a sudden, rapid shaking of the earth usually caused by the movement of tectonic plates beneath the earth's surface or a volcanic eruption (FEMA 2023a). Most earthquakes occur at the boundaries where tectonic plates meet (faults), although New York State is in an area where earthquakes occur on plate interiors. As plates continue to move and plate boundaries change over geologic time, weakened boundary regions become part of the interiors of the plates. Earthquakes come without warning and can last up to several minutes. Aftershocks, which are normally smaller than the initial earthquake, can continue for weeks.

Earthquake Hazards

According to the U.S. Geological Society (USGS) Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect resident's normal activities. The following are common earthquake hazards (USGS 2012):

- Surface faulting—Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes (those with an epicenter less than 12 miles below the ground surface).
- Ground shaking—The movement of the earth's surface produced by energy waves that are generated by the earthquake and travel through the earth and along its surface. The intensity of ground shaking at any given location depends on the amount of energy released at the site of the earthquake, the depth of the earthquake beneath the earth's surface, the given location's distance from the earthquake, and the type of underlying soil or bedrock at that location.
- Liquefaction—A process by which shaking causes water-saturated sediment to temporarily lose strength and act as a fluid. This effect can damage foundations built on the liquefied soils.

Earthquakes in New York

The importance of the earthquake hazard in New York State is often underestimated because other natural hazards occur more frequently and major hurricanes and floods have occurred more recently (NYS DHSES 2024). However, the potential for earthquakes exists across the northeastern United States. The New York City Area Consortium for Earthquake Loss Mitigation ranks New York State as having the third highest earthquake activity level east of the Mississippi River (Tantala 2003).

Since the first recorded earthquake on December 19, 1737, New York has had over 550 earthquakes within its state boundaries. The state has also experienced strong ground shaking from earthquakes in nearby U.S. states and Canadian provinces. Three general regions in New York State have a higher seismic risk than other parts of the state (NYS DHSES 2024):

- The north and northeast third of the state, which includes the North Country/Adirondack region and a portion of the greater Albany-Saratoga region
- The southeast corner, which includes the greater New York City area and western Long Island
- The northwest corner, which includes Buffalo and its surrounding area.



Of these regions, the north-northeast portion has the higher seismic risk, and the northwest corner of the state has the lower seismic risk (NYS DHSES 2024).

There are two major fault lines within New York State's borders: the Ramapo Fault Zone that extends from New Jersey into southeastern New York, and the Clarendon-Linden fault system in western New York State. Numerous smaller fault lines run throughout New York City and the Adirondack Mountains, where some of New York's biggest earthquakes have occurred (NYS DHSES 2024).

9.1.2 Location

Faults

Figure 9-1 shows documented fault lines that run through Putnam County. The concentration of faults is primarily in the western and northeastern parts of the county.

Earthquake-Sensitive Soils

The New York State Geological Survey has categorized soils in the state at or near the earth's surface according to the National Earthquake Hazard Reduction Program's (NEHRP) soil classifications. NEHRP defines five soil classifications that indicate the potential severity of an earthquake based on the velocity with which certain energy waves from earthquakes move through the soil. Seismic waves travel faster through hard rock than through softer rock and sediments. Shaking tends to be stronger at locations with softer surface layers where seismic waves move more slowly. Ground shaking above an unconsolidated landfill or soft soils can be more than 10 times stronger than at neighboring locations on rock (FEMA 2016b).

The NEHRP soil classification system ranges from A to E, as noted in Table 9-1, where A represents hard rock that reduces ground shaking from an earthquake and E represents soft soils that magnify ground shaking and increase building damage. The strongest amplification of shaking due to earthquakes is expected for Classes D and E. Figure 9-2 shows the location of NEHRP Class D and E soils in Putnam County.

Table 9-1. NEHRP Soil Classifications

Soil Classification	Description
A	Hard Rock
B	Rock
C	Very dense soil and soft rock
D	Stiff soils
E	Soft soils

Source: (FEMA 2021a)



Figure 9-1. Faults in Putnam County

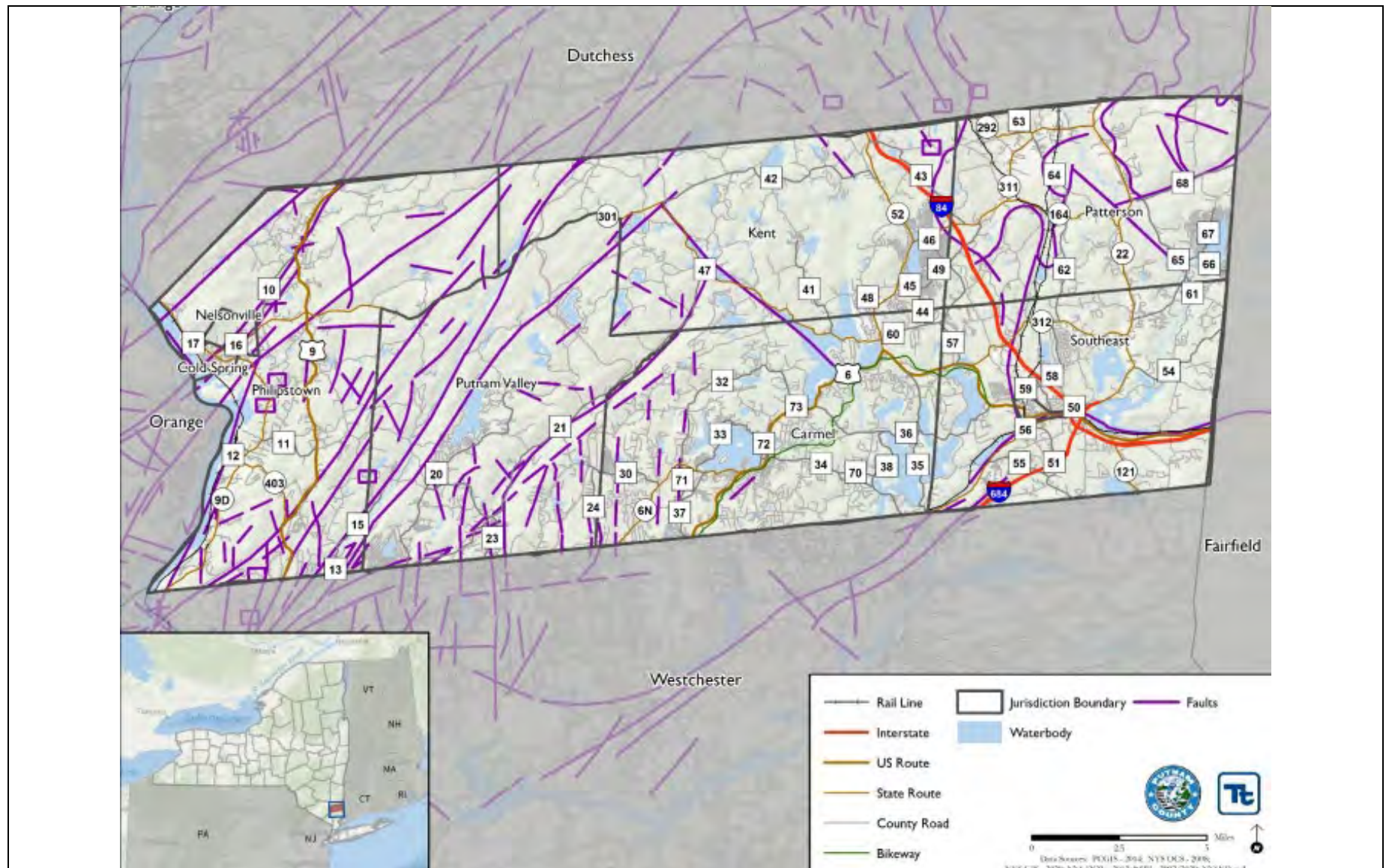
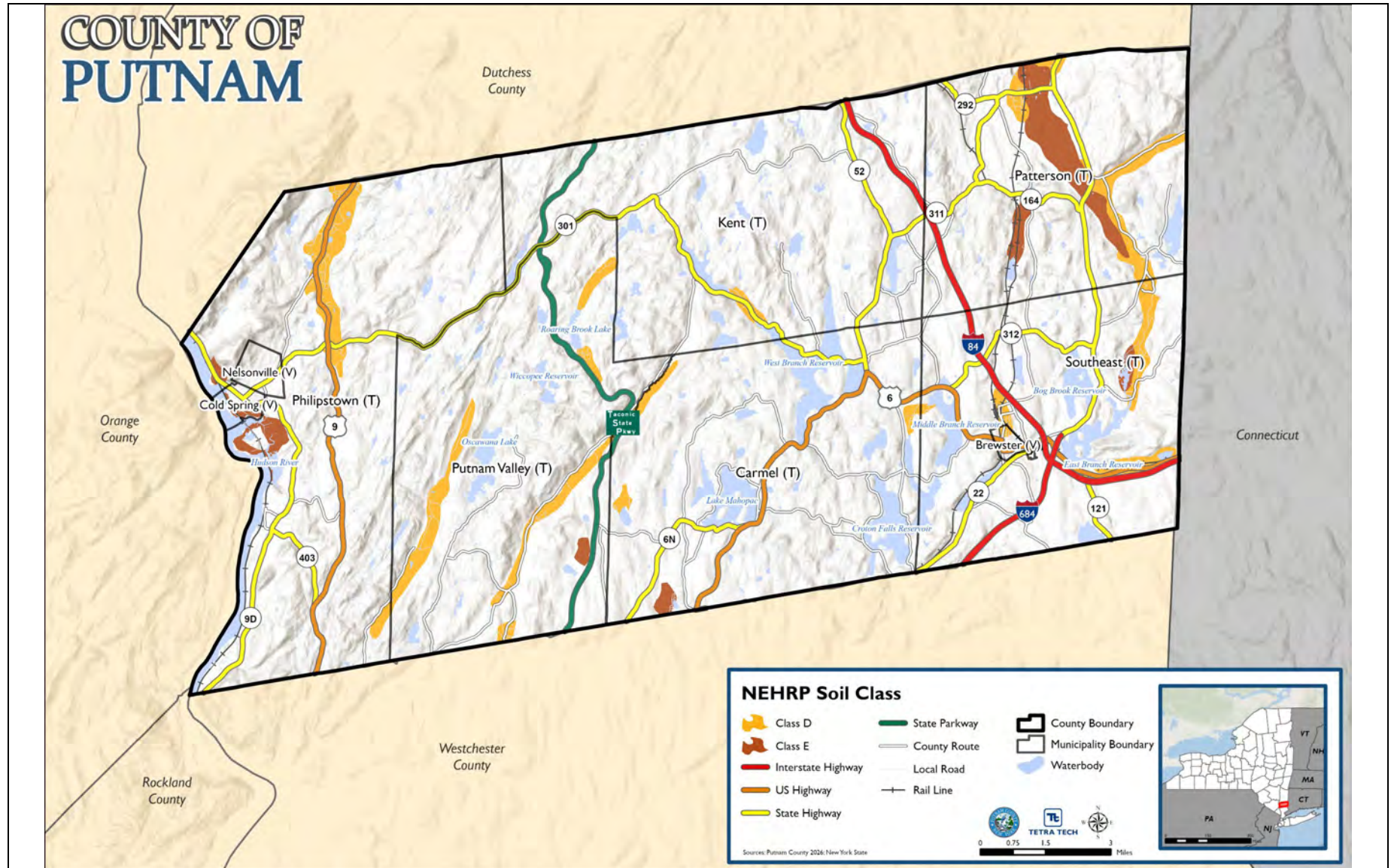




Figure 9-2. NEHRP Soils in Putnam County





9.1.3 Extent

Earthquake severity is measured by magnitude and intensity. Magnitude describes the energy released at the focus of an earthquake; intensity describes the severity of shaking at any given location affected by the earthquake.

Earthquake Magnitude

Moment is a physical quantity related to the total energy released by an earthquake. The total moment release of an earthquake is the product of the distance a fault moved and the force required to move it. It can be estimated from seismograms and from geodetic measurements. The moment magnitude (M_w) scale uses a standard formula to convert measured moment into a number representing magnitude (USGS 2023a). This scale provides an estimate of earthquake size that is valid over the complete range of magnitudes. For very large earthquakes, moment magnitude gives the most reliable estimate of earthquake size. The scale is as follows (USGS 2023a):

- Great $M_w > 8$
- Major $M_w = 7.0 - 7.9$
- Strong $M_w = 6.0 - 6.9$
- Moderate $M_w = 5.0 - 5.9$
- Light $M_w = 4.0 - 4.9$
- Minor $M_w = 3.0 - 3.9$
- Micro $M_w = 3.0 - 3.9$

Earthquake Intensity

Intensity is the overall severity of shaking felt during an earthquake event. Earthquake intensity is based on the observed effects of ground shaking on people, buildings, and natural features, and varies across affected locations. The Modified Mercalli Intensity (MMI) scale expresses how strong a shock was felt at a particular location. Table 9-2 summarizes earthquake intensity as expressed by the MMI scale.

Peak ground acceleration (PGA) is the maximum acceleration of ground shaking at any location during an earthquake event. PGA is expressed as a percent of the acceleration associated with gravity (%g). For example, a PGA of 10%g means that the ground acceleration is 10 percent of the acceleration due to gravity (USGS 2019). Table 9-2 shows PGA equivalents to ratings on the MMI scale. Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Table 9-3

Figure 9-3 shows expected MMI and PGA across Putnam County for the 2,500-year mean return period (MRP) earthquake. For that event, the entire county is projected to experience an acceleration of 9.2%g to 18%g and an MMI of VI (Strong).

**Table 9-2. Modified Mercalli Intensity (MMI) Scale**

MMI	Shaking	Typical Damage	Typical PGA (%g)	Description
I	Not Felt	None	< 0.17	Not felt except by a very few under especially favorable conditions.
II	Weak	None	0.17 – 1.4	Felt only by a few persons at rest, especially on upper floors of buildings.
III				Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	None	1.4 – 3.9	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Very Light	3.9 – 9.2	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Light	9.2 – 18	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very Strong	Moderate	18 – 34	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Moderate to Heavy	34 – 65	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Heavy	65 – 124	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Very Heavy	>124	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: (USGS n.d-a)

Table 9-3. Damage Levels Experienced in Earthquakes

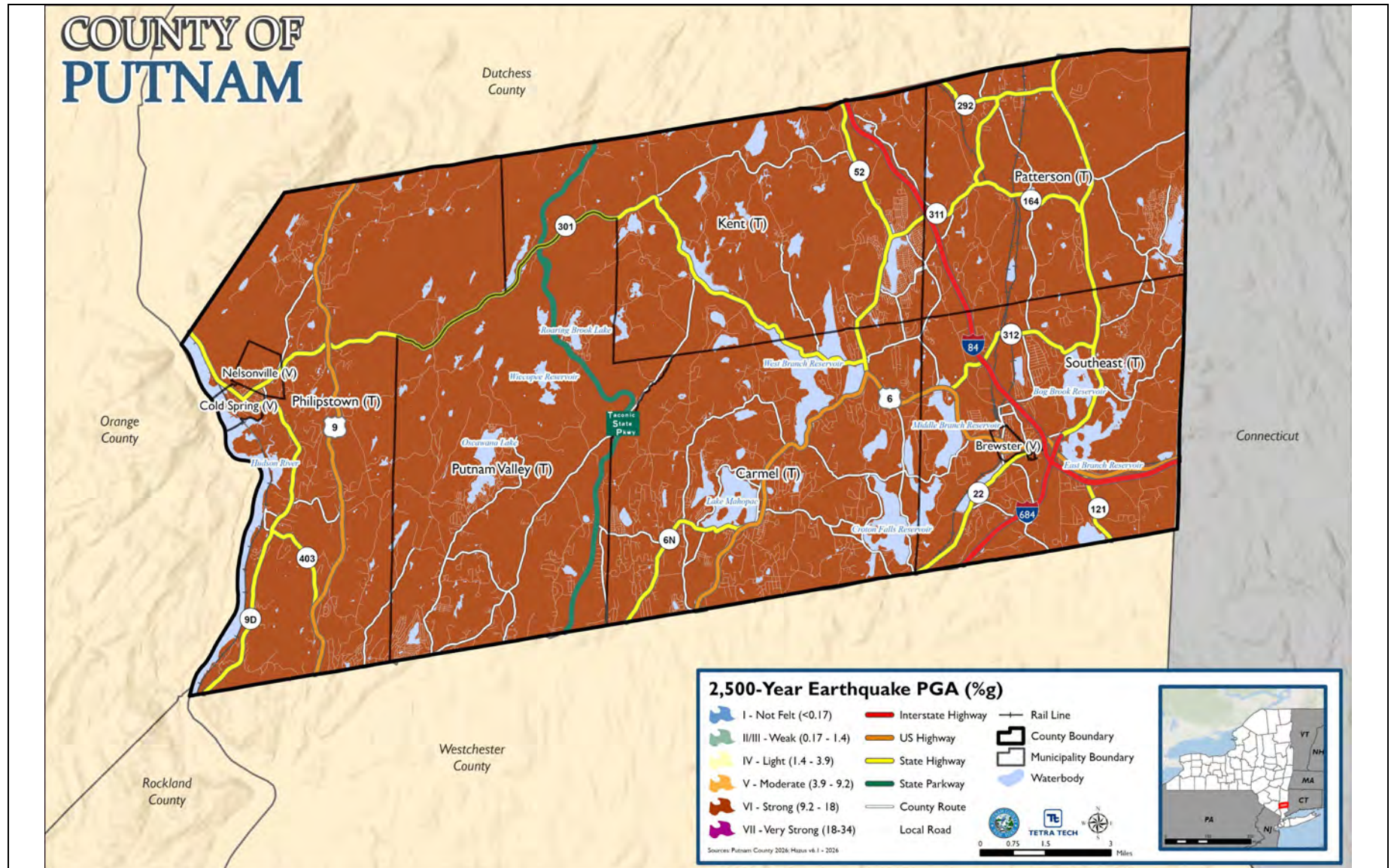
Peak Ground Acceleration	Explanation of Damages
1 – 2%g	Motions are widely felt by people; hanging plants and lamps swing strongly, but damage levels, if any, are usually very low.
< 10%g	Usually causes only slight damage, except in unusually vulnerable facilities.
10 – 20%g	May cause minor-to-moderate damage in well-designed buildings, with higher levels of damage in poorly designed buildings. At this level of ground shaking, only unusually poor buildings would be subject to potential collapse.
20 – 50%g	May cause significant damage in some modern buildings and very high levels of damage (including collapse) in poorly designed buildings.
≥50%g	May causes higher levels of damage in many buildings, even those designed to resist seismic forces.

Source: (USGS 2019)

Note: %g = acceleration as a percent of the acceleration due to gravity

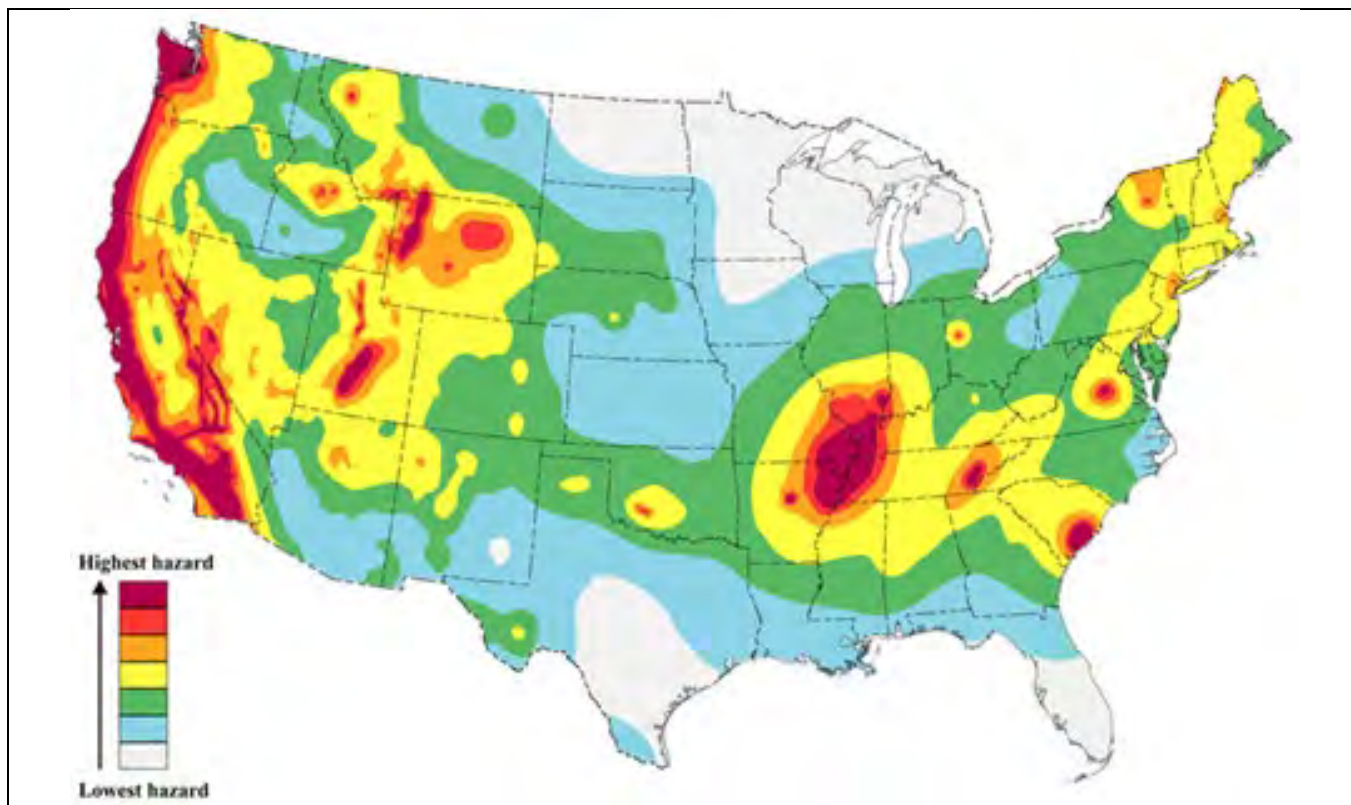


Figure 9-3. 2,500-Year MRP Earthquake Intensity for Putnam County



National maps of earthquake shaking hazards provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown 2001). The USGS updated the National Seismic Hazard Maps in 2023 and new seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps. Figure 9-4 represents the best available data, as determined by the USGS.

Figure 9-4. USGS National Seismic Hazard Model



Source: (USGS 2022)

9.1.4 Previous Occurrences

FEMA Disaster Declarations

Putnam County has not been included in any major disaster or emergency declarations for earthquakes. There has been one federally declared disaster in New York State due to an earthquake, following an event of Magnitude 5.1 that occurred in the far northeastern part of the state in April 2002 (with aftershocks in May 2002) (FEMA 2026b).

USDA Declarations

Putnam County has not been included in any earthquake-related USDA agricultural disaster declarations (USDA 2026).



All Recent Events

Table 9-4 lists recorded earthquake-related events that impacted Putnam County since the previous HMP was developed. For earlier events, refer to the previous HMP.

Table 9-4. Earthquake Events in Putnam County (2020 to 2025)

Event Date	Location Impacted	Description
October 22, 2020	Countywide	A magnitude 2.2 earthquake with epicenter in the Town of Putnam Valley

Source: (USGS 2026)

9.1.5 Probability of Future Occurrences

It is anticipated that Putnam County will experience some direct and indirect impacts from future earthquakes that may affect the general building stock and local economy. However, based on historical records and input from the Steering Committee, the probability of occurrence for earthquakes in the County is considered “unlikely.”

9.1.6 Cascading Impacts on Other Hazards

Earthquakes can trigger surface ruptures, tsunamis, landslides, dam failures, and sloshing water in closed basins. Should a significant earthquake occur in New York, one of the most likely impacts, and the one which people can most readily mitigate, is post-earthquake fires—both household fires and wildfires. About one in four fires after an earthquake is related to natural gas leaks. Earthquake shaking can cause movement or damage of equipment and household appliances. Particularly in urban areas, gas leaks can start fires that can quickly spread and cause severe damage to homes and neighborhoods, potentially leading to an uncontrolled wildfire.

Secondary impacts of earthquakes and landslides could be magnified by climate change. Soils saturated by repetitive storms could experience liquefaction during seismic activity due to the increased saturation.

9.2 VULNERABILITY AND IMPACT ASSESSMENT

For the earthquake risk assessment, the hazard area was defined as all areas with the Class D and E NEHRP soils. Population, structures, critical facilities, and lifelines located in these hazard areas are considered to be vulnerable. Potential impacts on people and assets were estimated using a Hazus advanced analysis for the 2,500-year MRP event.

9.2.1 Life, Health, and Safety

Overall Population

The earthquake risk to people varies with the age and type of construction people live in, the soil types their homes are located on, and the intensity of the earthquake. Table 9-5 lists the estimated Putnam County population living on NEHRP Class D and E soil types, representing about 5.5 percent of the total County population.



Table 9-5. Approximate Population Living on NEHRP Class D and E Soils

Jurisdiction	Total Population 2024 ACS	Population in the NEHRP Class D and E Soils Hazard Area	
		Number of Persons	% of Jurisdiction Total
Brewster (V)	2,512	342	13.6%
Carmel (T)	33,837	597	1.8%
Cold Spring (V)	1,863	215	11.5%
Kent (T)	12,896	21	0.2%
Nelsonville (V)	714	0	0.0%
Patterson (T)	11,560	874	7.6%
Philipstown (T)	7,302	1,389	19.0%
Putnam Valley (T)	11,755	1,015	8.6%
Southeast (T)	15,668	983	6.3%
Putnam County (Total)	98,107	5,436	5.5%

Source: U.S. Census Bureau 2024 ACS Vulnerable Population; Putnam County 2025, 2026; NYSERDA 2026; NYS 2024

Public safety impacts and loss of life from an earthquake in the County would be minimal for low magnitude events. There is a higher risk to people inside buildings at the time of the event, due to structural damage, or to people walking below buildings with ornamentations or chimneys that may be shaken loose and fall. Residents also can be affected by business closures, road closures that isolate populations, and loss of function of critical facilities and utilities.

Residents may be displaced or require temporary to long-term shelter as a result of the event. The number of people requiring shelter is generally less than the number displaced, as some displaced persons use hotels or stay with family or friends after a disaster event. The Hazus analysis for this HMP estimated that 24 persons in the County would be displaced and nine would require shelter for the 2,500-year MRP earthquake event, as shown in Table 9-6.

Table 9-6. Persons Seeking Shelter Due to the 2,500-Year MRP Earthquake Event

	Displaced Households	Persons Seeking Short-Term Shelter
Brewster (V)	1	0
Carmel (T)	10	5
Cold Spring (V)	1	0
Kent (T)	2	1
Nelsonville (V)	0	0
Patterson (T)	1	0
Philipstown (T)	0	0
Putnam Valley (T)	1	0
Southeast (T)	8	3
Putnam County (Total)	24	9

Source: Hazus v6.1; U.S. Census Bureau 2020, 2024 ACS



Hazus estimated the number of people who might be injured or killed by the 2,500-year MRP earthquake occurring at 2:00 AM, 2:00 PM, or 5:00 PM. The 2:00 AM estimate represents maximum residential occupancy, the 2:00 PM estimate represents peak occupancy in educational, commercial, and industrial sectors, and the 5:00 PM estimate represents peak commute time. Table 9-7 presents the results.

Table 9-7. Casualties from the 2,500-Year MRP Earthquake Event

Time of Day Event Occurs	Non-Hospitalized Injuries	Hospitalizations	Deaths
2:00 a.m.	16	2	0
2:00 p.m.	14	2	0
5:00 p.m.	11	2	0

Source: Hazus v6.1

Socially Vulnerable Population

Socially vulnerable populations may be more susceptible to earthquakes than the general population due to decreased mobility or financial ability to react or respond during a hazard, as well as the location and construction quality of their housing. Table 9-8 details the total number of vulnerable persons living in areas of Class D and E soil.

9.2.2 General Building Stock

Buildings on Soils at Risk

Table 9-9 summarizes the number and replacement cost value of buildings in Putnam County located on NEHRP Class D and E soils, which are at increased risk of damage from an earthquake. There are an estimated 2,338 buildings within the NEHRP Soil Classes D and E Hazard Areas, representing 6.3 percent of the County's total general building stock replacement cost value. The Town of Philipstown has the greatest number of buildings in areas of Class D and E soils (704). Table 9-10 shows the at-risk buildings by general occupancy classes.

Estimated Level of Damage

Table 9-11 shows estimated damage to buildings due to a 2,500-year MRP earthquake in Putnam County. Most residential buildings would sustain no damage, with 91.9 percent undamaged. Minor damage is expected in a small percentage, with 6.3 percent. Commercial, industrial, and other buildings show similar trends, with most buildings remaining undamaged. Extensive to complete destruction are rare across all building types. A key factor in degree of damage is the age of facilities and infrastructure, which correlates with building standards in place at times of construction.

Estimated Cost of Damage

Table 9-12 shows estimated damage to structures and contents in Putnam County from the 2,500-year MRP earthquake. The total replacement cost value (RCV) for the County general building stock inventory is \$26.8 billion, and estimated damage for all occupancy classes is \$138 million, or 0.5 percent of the total County RCV. The Town of Carmel is estimated to experience the highest total damage at \$45 million.



Table 9-8. Vulnerable Persons Living on NEHRP Class D and E Soils

	Over 65		Under 5		Non-English-Speaking		Living with a Disability		Below Poverty Level	
	Number	% of Jurisdiction	Number	% of Jurisdiction	Number	% of Jurisdiction	Number	% of Jurisdiction	Number	% of Jurisdiction
Brewster (V)	45	13.6%	9	12.5%	74	13.6%	49	13.6%	49	13.5%
Carmel (T)	118	1.8%	23	1.7%	9	1.7%	63	1.7%	26	1.7%
Cold Spring (V)	49	11.5%	10	11.1%	8	11.4%	17	11.0%	9	10.7%
Kent (T)	3	0.1%	1	0.1%	0	0.0%	2	0.2%	1	0.1%
Nelsonville (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Patterson (T)	142	7.6%	39	7.5%	14	7.3%	79	7.5%	146	7.5%
Philipstown (T)	335	19.0%	49	19.0%	4	16.7%	142	19.0%	102	19.0%
Putnam Valley (T)	190	8.6%	52	8.6%	17	8.3%	85	8.6%	42	8.5%
Southeast (T)	206	6.3%	55	6.2%	61	6.2%	99	6.2%	69	6.2%
Putnam County (Total)	1,088	5.8%	238	5.1%	187	6.7%	536	5.4%	444	6.4%

Source: U.S. Census Bureau 2024 ACS 5-Year Estimates; Putnam County 2025, 2026; NYSERDA 2026; NYS 2024



Table 9-9. Number and Replacement Cost Value of Buildings Located on NEHRP Class D and E Soils

Jurisdiction	Total Number of Buildings	Total RCV (Structure and Contents)	Buildings Located in NEHRP Class D and E Soil			
			Number Exposed	% of Total Number	RCV Exposed	% of Total RCV
Brewster (V)	569	\$368,940,861	75	13.2%	\$49,649,056	13.5%
Carmel (T)	12,221	\$9,049,629,618	211	1.7%	\$153,447,126	1.7%
Cold Spring (V)	761	\$474,899,526	102	13.4%	\$60,070,874	12.6%
Kent (T)	5,760	\$3,047,474,569	10	0.2%	\$5,742,257	0.2%
Nelsonville (V)	283	\$143,090,491	0	0.0%	\$0	0.0%
Patterson (T)	4,118	\$3,126,610,140	404	9.8%	\$408,135,556	13.1%
Philipstown (T)	4,049	\$2,634,231,865	704	17.4%	\$450,381,173	17.1%
Putnam Valley (T)	5,383	\$2,989,131,470	478	8.9%	\$271,839,228	9.1%
Southeast (T)	5,488	\$5,049,468,784	354	6.5%	\$300,958,732	6.0%
Putnam County (Total)	38,632	\$26,883,477,324	2,338	6.1%	\$1,700,224,003	6.3%

Source: Putnam County 2025, 2026; NYSERDA 2026; NYS 2024; RSMeans 2026

Table 9-10. Buildings on NEHRP Class D and E Soils by General Occupancy Class

Jurisdiction	Residential	Commercial	Industrial	Other ^a
Brewster (V)	54	16	5	0
Carmel (T)	179	32	0	0
Cold Spring (V)	69	28	4	1
Kent (T)	8	2	0	0
Nelsonville (V)	0	0	0	0
Patterson (T)	253	102	5	44
Philipstown (T)	534	164	3	3
Putnam Valley (T)	381	95	0	2
Southeast (T)	272	77	5	0
Putnam County (Total)	1,750	516	22	50

Source: Putnam County 2025, 2026; NYSERDA 2026; NYS 2024; RSMeans 2026

a. Other = Government, Religion, Agricultural, and Education



Table 9-11. Building Damage Levels Due to the 2,500-Year MRP Earthquake

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 2,500-Year MRP	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	31,070	NONE	28,560	91.9%
		SLIGHT	1,943	6.3%
		MODERATE	490	1.6%
		EXTENSIVE	69	0.2%
		COMPLETE	8	<0.1%
Commercial Buildings	6,834	NONE	6,023	88.1%
		SLIGHT	539	7.9%
		MODERATE	231	3.4%
		EXTENSIVE	38	0.6%
		COMPLETE	3	<0.1%
Industrial Buildings	189	NONE	164	86.8%
		SLIGHT	16	8.5%
		MODERATE	8	4.2%
		EXTENSIVE	1	0.5%
		COMPLETE	0	0.0%
Government, Religion, Agricultural, and Education Buildings	542	NONE	480	88.6%
		SLIGHT	42	7.8%
		MODERATE	17	3.1%
		EXTENSIVE	3	0.5%
		COMPLETE	0	0.0%

Source: Hazus v6.1; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024



Table 9-12. Building Damage Costs Due to 2,500-Year MRP Earthquake

Jurisdiction	Total Replacement Cost Value (RCV)	2,500-Year MRP Estimated Losses					
		Estimated Total Damage	% of Total Building and Contents Replacement Cost Value	Estimated Residential Damage	Estimated Commercial Damage	Estimated Industrial Damage	Estimated Damages for All Other Occupancies ^a
Brewster (V)	\$368,940,861	\$2,279,707	0.6%	\$982,014	\$894,137	\$128,582	\$274,974
Carmel (T)	\$9,049,629,618	\$45,431,576	0.5%	\$25,802,624	\$15,034,785	\$1,022,932	\$3,571,235
Cold Spring (V)	\$474,899,526	\$3,647,596	0.8%	\$1,805,121	\$1,195,114	\$82,110	\$565,250
Kent (T)	\$3,047,474,569	\$13,573,118	0.4%	\$8,930,882	\$2,934,016	\$176,072	\$1,532,148
Nelsonville (V)	\$143,090,491	\$1,357,475	0.9%	\$671,742	\$444,581	\$30,580	\$210,571
Patterson (T)	\$3,126,610,140	\$12,465,543	0.4%	\$5,937,106	\$3,119,061	\$522,079	\$2,887,297
Philipstown (T)	\$2,634,231,865	\$13,898,633	0.5%	\$7,253,781	\$4,804,887	\$121,214	\$1,718,750
Putnam Valley (T)	\$2,989,131,470	\$16,877,671	0.6%	\$11,303,744	\$4,313,888	\$97,920	\$1,162,119
Southeast (T)	\$5,049,468,784	\$28,486,095	0.6%	\$12,799,300	\$11,695,470	\$2,305,175	\$1,686,149
Putnam County (Total)	\$26,883,477,324	\$138,017,414	0.5%	\$75,486,315	\$44,435,939	\$4,486,666	\$13,608,494

Source: Hazus v6.1; Putnam County 2025, 2026; NYSERDA 2026; NYS 2024; RSMeans 2026

a. Other = Government, Religion, Agricultural, and Education



9.2.3 Community Lifelines and Other Critical Facilities

Critical facilities and community lifelines located in areas of Class D or Class E soils are more susceptible to earthquake impacts. Table 9-13 summarizes the number of critical facilities by lifeline category located on NEHRP Soil Classes D and E. Another key factor in degree of vulnerability is age of facilities and infrastructure, which correlates with building standards in place at times of construction.

The Hazus earthquake model was used to estimate the average probability of each damage category to County critical facilities for the 2,500-Year MRP event, as shown in Table 9-14. For most lifeline categories, the probability of sustaining no damage is very high, ranging from 85.8 percent to 96.9 percent. Slight damage is expected in a small percentage of cases, while moderate, extensive, and complete damage are rare. For instance, the health and medical lifeline has a 96.9 percent chance of sustaining no damage and less than a 0.1 percent chance of extensive or complete damage.

Table 9-14 also presents the average probability of facilities being functional at specified time increments after the event. For example, a facility might have a 5 percent chance of being fully functional at Day 3 and a 95 percent chance of being fully functional at Day 90. Most lifelines are expected to recover quickly. By Day 1, functionality ranges from 85.9 percent to 99.0 percent, and by Day 7, it improves to between 95.1 percent and 99.6 percent. By Day 30 and Day 90, nearly all lifelines are expected to be fully functional, with percentages close to or at 100 percent.

Earthquakes can significantly affect roadway bridges. Because softer soils generally follow floodplain boundaries, bridges that cross watercourses are especially vulnerable. While this analysis does not include damage estimates for individual roadway segments or rail lines, it is assumed that these features would sustain damage due to ground failure, resulting in interruptions to regional transportation and distribution networks.

9.2.4 Economy

Earthquakes impacts on the economy include loss of business function, damage to inventory, relocation costs, wage loss, and rental loss as buildings are repaired or replaced. Debris cleanup costs can be a significant economic impact from earthquakes. Table 9-15 outlines the estimated debris generated in Putnam County during an earthquake with a 2,500-year MRP. The total debris includes 18,442 tons of brick or wood and 6,893 tons of concrete or steel. The Town of Carmel is projected to generate the most debris, with 5,844 tons of brick or wood and 2,048 tons of concrete or steel.

9.2.5 Natural Resources

Earthquakes can cause damage to the surface of the earth. Surface faulting that creates wide ruptures in the ground is one of the major seismic impacts of earthquakes. Ruptures can have a direct impact on the natural environment, disconnecting habitats for miles, isolating animal species, or tearing apart plant roots (USGS n.d.-b).

Furthermore, ground failure and slides as a result of soil liquefaction can have an impact on soil pores and retention of water resources. The greater the seismic activity and liquefaction properties of the soil, the more likely it is that drainage of groundwater can occur, which depletes groundwater resources. In areas where there is higher pressure of groundwater retention, the pores can build up more pressure and make soil behave more like a fluid rather than a solid, increasing risk of localized flooding and deposition or accumulation of silt (USGS n.d.-b).



Table 9-13. Number of Critical Facilities in the NEHRP Soils (D&E) Hazard Area

Jurisdiction	Number of Facilities in the NEHRP Soils (D&E) Hazard Area									Total Facilities in Hazard Area	
	Communi- cations	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Brewster (V)	0	1	0	0	0	0	0	0	0	1	1.9%
Carmel (T)	11	0	0	0	0	1	0	1	0	13	4.0%
Cold Spring (V)	0	0	0	0	0	0	2	1	1	4	10.3%
Kent (T)	0	0	0	0	0	0	2	0	0	2	1.1%
Nelsonville (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Patterson (T)	3	3	2	4	1	32	6	1	4	56	31.3%
Philipstown (T)	1	2	3	0	0	3	7	0	2	18	11.8%
Putnam Valley (T)	1	0	1	1	0	1	7	0	2	13	10.7%
Southeast (T)	1	1	0	1	0	0	4	1	0	8	4.0%
Putnam County (Total)	17	7	6	6	1	37	28	4	9	115	9.1%

Source: Putnam County 2021, 2026; NYS GIS Clearinghouse 2026; NYSDEC 2025 – 2026; ESRI 2026; NYS Board of Elections 2025; HIFLD 2025; New York State (n.d.)



Table 9-14. Average Percent Probability of Sustaining Damage from the 2,500-Year MRP Earthquake

Lifeline	Average % Probability of Sustaining Damage					Average % Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Communications	86.0%	9.2%	4.0%	0.7%	0.1%	85.9%	95.2%	99.2%	99.9%
Energy	86.4%	8.3%	4.4%	0.9%	<0.1%	87.8%	96.2%	99.4%	99.9%
Food, Hydration, Shelter	86.1%	9.2%	4.0%	0.7%	0.1%	86.0%	95.2%	99.2%	99.9%
Hazardous Materials	85.8%	9.4%	4.1%	0.7%	0.1%	85.7%	95.1%	99.2%	99.9%
Health and Medical	96.9%	2.7%	0.4%	<0.1%	<0.1%	96.9%	99.5%	99.9%	99.9%
Safety and Security	86.0%	9.3%	4.0%	0.7%	0.1%	85.9%	95.1%	99.2%	99.8%
Transportation	98.8%	0.9%	0.3%	<0.1%	<0.1%	99.0%	99.6%	99.8%	99.9%
Water Systems	86.2%	8.1%	4.6%	1.0%	<0.1%	88.6%	96.7%	99.3%	99.9%

Source: Hazus v6.1; Putnam County 2021, 2026; NYS GIS Clearinghouse 2026; NYSDEC 2025 – 2026; ESRI 2026; HIFLD 2025

Note: Results shown exclude critical facilities not categorized as community lifelines.



Table 9-15. 2,500-Year MRP Earthquake Event Debris

	Debris Generated for the 2,500-Year MRP Earthquake (tons)	
	Brick/Wood	Concrete/Steel
Brewster (V)	300.9	128.3
Carmel (T)	5,844.3	2,048.3
Cold Spring (V)	468.3	233.9
Kent (T)	1,977.8	644.0
Nelsonville (V)	174.3	87.1
Patterson (T)	1,723.4	615.1
Philipstown (T)	1,812.8	665.1
Putnam Valley (T)	2,270.2	776.4
Southeast (T)	3,870.2	1,694.6
Putnam County (Total)	18,442.1	6,892.8

Source: Hazus v6.1; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024

9.2.6 Historic and Cultural Resources

Earthquakes can damage historic and cultural landmarks and surrounding property. Many historic and cultural buildings may not be built to withstand earthquakes and are more vulnerable than other structures. Risks to historical assets include impacts on historic structure foundations.

9.3 FUTURE CHANGES THAT MAY AFFECT RISK

9.3.1 Potential or Planned Development

It is anticipated that vulnerability to earthquake impacts in newly developed areas will be similar to those that currently exist within the County. Development in areas with softer NEHRP soil classes, areas of liquefaction, and landslide-susceptible areas may experience shifting or cracking in the foundation during earthquakes because of the loose soil characteristics of these soil classes. However, seismic provisions included in current building codes should render new construction less vulnerable to earthquakes than older buildings that may have been built to lower construction standards.

9.3.2 Projected Changes in Population

Persons who move into older structures in the County are at greater risk of being impacted by earthquake events because older structures are more vulnerable to ground shaking.

9.3.3 Climate Change

The potential impacts of future climate conditions on earthquake probability are unknown. Soils saturated by increased precipitation could experience liquefaction during seismic activity. Dams storing increased volumes of water could fail during seismic events.



10. EXTREME TEMPERATURES

10.1 HAZARD PROFILE

10.1.1 Hazard Description

Extreme temperature includes both heat and cold events, which can have a significant impact on human health, commercial/agricultural businesses and primary and secondary effects on infrastructure (e.g., burst pipes and power failure). What constitutes “extreme cold” or “extreme heat” can vary across different areas of the country, based on what the population is accustomed to.

Extended periods of extreme cold or warm temperatures are a result of the movement of great high-pressure systems into and through the eastern United States. New York State’s typical air masses and atmospheric circulation make the entire state susceptible to extreme temperatures. Changes in land elevations and landscape, and the proximity of large bodies of water play a significant role in the state’s temperatures (NYS DHSES 2024).

Extreme Cold

Extreme cold events are when temperatures drop well below normal for an area. In regions where temperatures below freezing are not uncommon, extreme cold might refer to temperatures below 0 °F. In regions where winter storms are rare, temperatures near freezing may be considered extreme cold (NWS n.d.-a). For this HMP, extreme cold temperatures are defined as temperatures around 0 °F or below.

Extreme Heat

The National Weather Service generally defines a heat wave as a period of abnormally hot weather (typically 10 °F or more above average temperatures) generally lasting more than two consecutive days. Extreme heat-related events can occur during all seasons. Summer extreme heat events are most likely to affect public health, but extreme heat events in winter can result in significant damage to winter crops.

The National Weather Service issues heat advisories, excessive heat warnings and excessive heat watches based on the heat index, along with related communications that inform state and local emergency response and preparations. The heat index, occasionally referred to as the apparent temperature, is a relative measure of humidity and temperature to more accurately reflect physiological experiences of extreme heat than absolute air temperature alone (NYS DHSES 2024).

10.1.2 Location

Extreme Cold

Extreme cold temperatures throughout the state occur throughout most of the winter and generally accompany winter storm events. When atmospheric pressures are higher than normal and Arctic air masses enter the area, extreme cold temperatures impact Putnam County, flowing southward from central Canada or Hudson Bay.



Extreme Heat

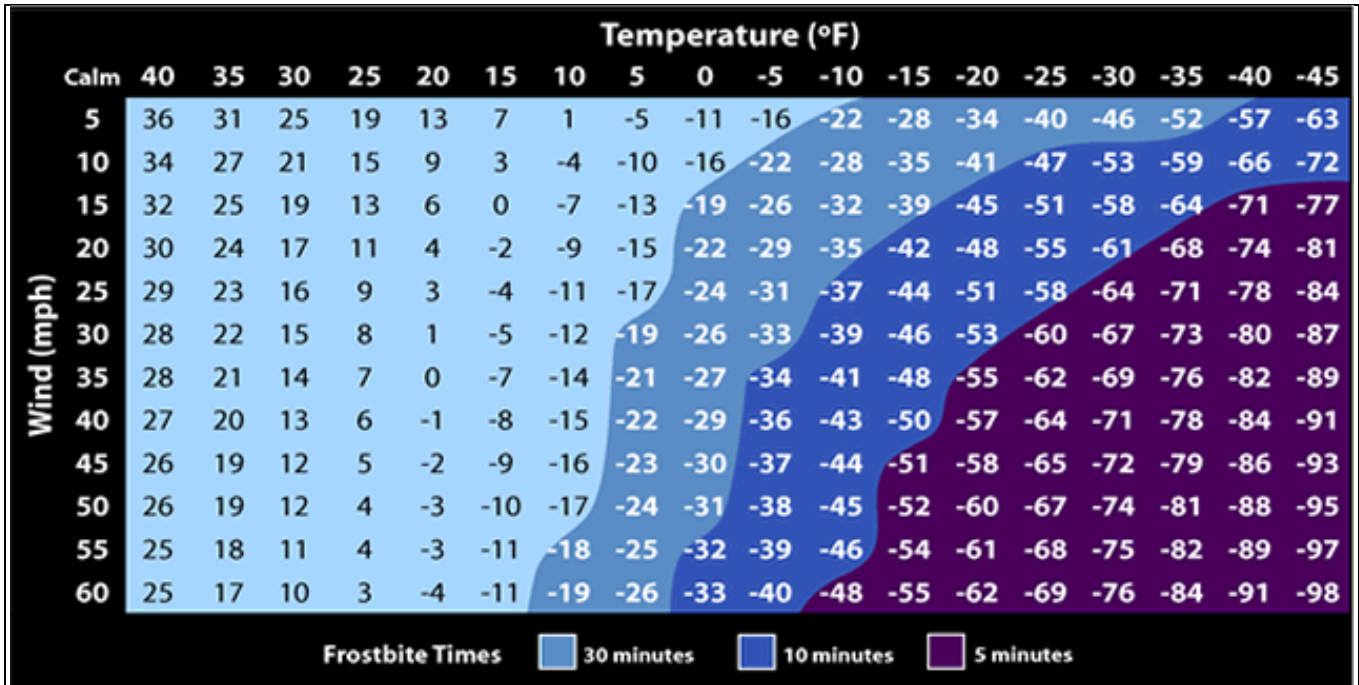
Extreme high temperatures occur throughout the county for most of the summer, except for areas with high altitudes. High-pressure systems can move off the Atlantic coast and become stagnant for several days. A persistent airflow from the southwest or south affects the local weather. This circulation brings the very warm, often humid weather of summer and the mild, more pleasant temperatures during fall, winter, and spring. Areas of dense urban development are prone to the urban heat island effect, which can further raise temperatures

10.1.3 Extent

Extreme Cold

The extent of extreme cold temperatures is generally measured by the wind chill temperature index, which indicates the danger from winter winds and freezing temperatures using a time-based scale as shown on Figure 10-1.

Figure 10-1. Wind Chill Temperature Index



Source: (NWS 2024)

The National Weather Service (NWS) issues the following alerts related to wind chill:

- Wind Chill Advisory—Issued when seasonably cold wind chill values, but not extremely cold values, are expected or occurring
- Wind Chill Watch—Issued when dangerously cold wind chill values are possible
- Wind Chill Warning—Issued when dangerously cold wind chill values are expected or occurring

The NWS also issues the following alerts related to freezes and frost:

- Frost Advisory—Issued when areas of frost are expected or occurring, posing a threat to sensitive vegetation.



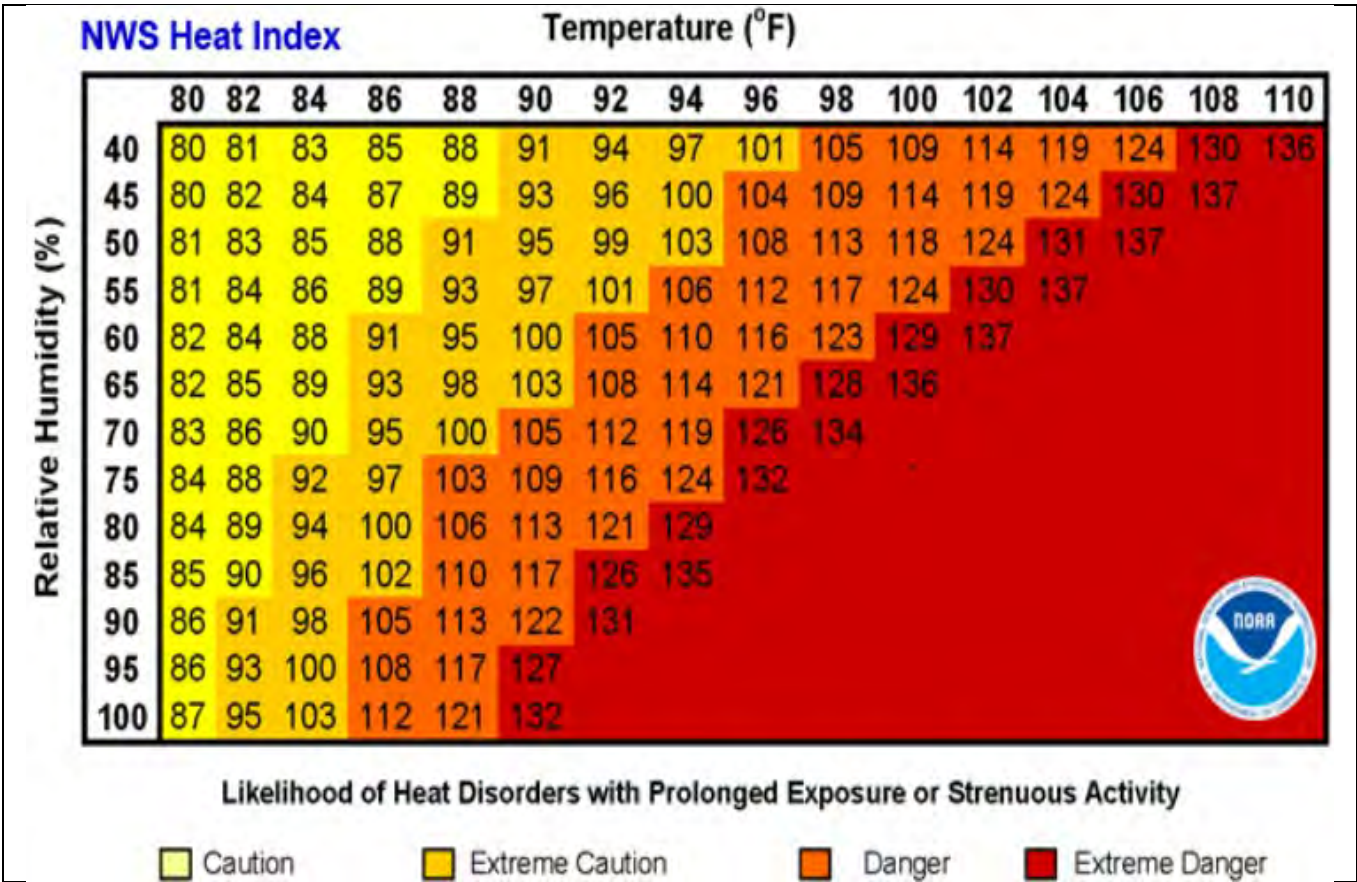
- Freeze Watch—Issued when there is a potential for significant, widespread freezing temperatures within the next 24 to 36 hours. Freeze watches may be issued in autumn until the end of the growing season and in the spring at the start of the growing season.
- Freeze Warning—Issued when temperatures are forecasted to go below 32°F for a long period of time. This temperature threshold kills some types of commercial crops and residential plants.
- Hard Freeze Warning—Issued when temperatures are expected to drop below 28 °F for an extended period, killing most types of commercial crops and residential plants.

Extreme Heat

The combination of heat and humidity can have greater impacts on human health than high temperatures alone. Therefore, the extent of extreme high temperatures is generally measured through the NWS heat index, which indicates how hot it feels when relative humidity is factored in with air temperature (see Figure 10-2). The heat index expresses an “apparent temperature” that combines the effects of temperature and humidity. Heat index values were devised for shady, light wind conditions; exposure to full sunshine can increase heat index values by up to 15 °F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

The National Weather Service urges “extreme caution” with heat index values above 90 °F, classifies values above 103 °F as “dangerous,” and classifies values above 125 °F as “extremely dangerous.” The New York State Department of Health urges caution at a heat index of 85 °F.

Figure 10-2. Heat Index Chart



Source: (NWS 2025)



10.1.4 Previous Occurrences

FEMA Disaster Declarations

Table 10-1 lists all extreme temperature-related presidentially declared disasters that have included Putnam County.

Table 10-1. FEMA Disaster Declarations for Extreme Temperature Events in Putnam County

Event Date	Declaration Date	Declaration Number	Description
October 4, 1987	November 10, 1987	DR-801	Severe Winter Storm
January 6, 1996	January 12, 1996	DR-1083	Severe Snow Storm
February 17, 2003	March 27, 2003	EM-3184	Snow
December 11, 2008	December 18, 2008	EM-3299	Severe Winter Storm

Source: (FEMA 2026b)

USDA Declarations

Table 10-2 lists extreme temperature-related USDA agricultural disaster declarations that have included Putnam County.

Table 10-2. USDA Declarations for Extreme Temperature Events in Putnam County

	USDA Declaration Number	Description
March 1, 2012	S3249	Frosts and freezes
March 26, 2012	S3251	Frosts and freezes
December 22, 2013	S3696	Freeze
January 1, 2015	S3886	Frost, Freeze, and Excessive Snow
February 12, 2016	S4048	Frost and Freeze
May 14, 2023	S5485	Frost and Freeze

Source: (USDA 2026)

All Recent Events

Table 10-3 lists major recorded extreme temperature-related events that impacted Putnam County since the previous HMP was developed. For earlier events, refer to the previous HMP. To identify the events in Putnam County, the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) Storm Events database were examined. The database did not identify any records for excessive heat or extreme cold; events listed reflect instances in which extreme temperatures were likely to have occurred.

**Table 10-3. Extreme Temperature Events in Putnam County (2020 to 2025)**

Event Date	Location Impacted	Description
December 16, 2020	Countywide	Moderate to locally heavy snowfall occurred, changing over to a mixture of sleet and rain.
February 1, 2021	Countywide	A major winter storm occurred in southeast New York. Near-blizzard conditions then occurred into the early afternoon with snowfall rates of 1 to 3 inches per hour.
February 7, 2021	Countywide	Moderate to heavy snow developed. Snowfall rates within the bands were as high as 2 inches per hour at times. A steady snowfall occurred through much of the day.
February 18, 2021	Countywide	Snow mixed with sleet at times during the late morning and early afternoon hours.
February 22, 2021	Countywide	Moderate to locally heavy snow transitioned to rain during the late afternoon and early evening as temperatures rose above freezing.
February 27, 2023	Countywide	Heavy snow was reported across the county. Snowfall reports included 6.5 inches at Putnam Valley, 6.0 inches at Cold Spring, and 5.0 inches at Carmel.
March 13, 2023	Countywide	Very heavy wet snow fell across Putnam County into the morning commute.
May 14, 2023	Countywide	Persistent low temperatures in May led to a USDA declaration for agriculture. Disaster declaration S5485
January 6, 2024	Countywide	An accumulating snow took place across portions of Putnam County, reaching winter storm criteria.
February 13, 2024	Countywide	Heavy wet snow fell across Putnam County with amounts averaging well over warning criteria. Snowfall totals included 12.1 inches at Fahnestock State Park,
November 22, 2024	Countywide	Heavy rain changed to heavy wet accumulating snow in higher elevations.
December 15, 2024	Countywide	A light accumulating snowfall occurred.
December 20, 2024	Countywide	Snow fell across a good portion of Orange and Putnam counties. Temperatures were often at or below freezing.
January 19, 2025	Countywide	A cold front pushed through, with a secondary cold frontal boundary lingering back to the west.
February 9, 2025	Countywide	3 to 4 inches fell across the zone.
February 15, 2025	Countywide	1 to 2 inches of snowfall occurred around the county before a change to freezing rain.

Source: (NOAA NCEI 2026); (USDA 2026)

10.1.5 Probability of Future Occurrences

As a result of climate change, the maximum heat index and the number of days with a potentially harmful heat index are projected to increase across the state (NYS DHSES 2024). Based on the historic and more recent extreme temperature events in Putnam County, and the future climate projections for this region, the County has a moderate probability of future extreme temperature events. Based on historical records and input from the Steering Committee, the probability of occurrence for extreme temperature in the County is considered “likely.”



10.1.6 Cascading Impacts on Other Hazards

Extreme high temperature events can exacerbate the drought hazard, increase the potential risk of wildfires, and escalate severe storm events. Extreme heat events may accelerate evaporation rates, drying out the air and soils. Extreme heat can also dry out terrestrial plant species, making them more susceptible to catching fire. Extreme variation in temperatures could create ideal atmospheric conditions for severe storms or worsen the outcome of severe winter storm during freezing and thawing periods.

10.2 VULNERABILITY AND IMPACT ASSESSMENT

This section qualitatively discusses potential impacts of extreme temperatures on Putnam County.

10.2.1 Life, Health, and Safety

Overall Population

The entire population of Putnam County is exposed to extreme temperature events. Extreme temperature events have potential health impacts, including injury and death. Those who overexert during work or exercise during extreme heat events are especially vulnerable. People spending extended time outdoors during extreme cold events are at risk of hypothermia (WHO 2018). Designating and developing emergency cooling or heating facilities can enhance the resilience and safety of communities.

Extreme cold can cause emergencies for those without shelter, those who are stranded, or those who live in a home that is poorly insulated or without heat (CDC 2012b). Health hazards related to extensive exposure to extreme cold temperatures and wind chill include the following (CDC 2023):

- Frostbite is damage to body tissue caused by extreme cold. Frostbite can cause a loss of feeling and a white or pale appearance in extremities. A wind chill of -20 °F will cause frostbite in 30 minutes.
- Hypothermia is a potentially deadly condition brought on when the body temperature drops to less than 95 °F. Warning signs of hypothermia include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion.

Socially Vulnerable Population

According to the CDC, populations most at risk to extreme cold and heat events include the following groups: older people are less able to withstand temperature extremes due to their age, health conditions, and limited mobility to access shelters; infants and children up to four years of age; individuals with chronic medical conditions (e.g., heart disease, high blood pressure), and low-income persons that cannot afford proper heating and cooling (CDC 2022b, CDC 2005).

10.2.2 General Building Stock

Extreme heat generally does not impact buildings; however, elevated summer temperatures increase the energy demand for cooling. Losses can be associated with the overheating of heating, ventilation, and air conditioning (HVAC) systems. Extreme cold temperature events can damage buildings through freezing and bursting of pipes and freeze/thaw cycles, as well as increasing risk home fires caused by heating. Manufactured homes and antiquated or poorly constructed facilities can have inadequate capabilities to withstand extreme temperatures.



10.2.3 Community Lifelines and Other Critical Facilities

All critical facilities in the County are exposed to the extreme temperature hazard; however, direct impacts are expected to be minimal. It is essential that critical facilities remain operational during natural hazard events. Extreme heat events can cause short periods of utility failures, commonly referred to as “brown outs,” created by increased usage from air conditioners, appliances, and similar equipment. Heavy snowfall and ice associated with extreme cold temperature events can interrupt power as well. Backup power is recommended for critical facilities and infrastructure.

10.2.4 Economy

Extreme temperature events impact the economy due to loss of business function and damage to and loss of inventory. Business-owners can be faced with increased financial burdens due to unexpected repairs to their buildings (e.g., repair of burst pipes), higher than normal utility bills, or business interruption due to power failure. Disruptions in public transportation service impact the economy for both commuters and customers.

The agricultural industry is most at risk of economic impact from extreme temperature events. Crops and livestock can be damaged by extreme heat and extreme cold. Based on the 2022 Census of Agriculture, Putnam County farms had a total market value of products sold of \$1.5 million. The top three agricultural categories sold in the County were nursery, greenhouse, floriculture, and sod at \$788,000; vegetables, melons, potatoes, sweet potatoes at \$290,000; and poultry and eggs at \$101,000 (USDA 2022).

10.2.5 Natural Resources

Freezing and warming weather patterns create changes in natural processes. An excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources (USGS 2020). Extreme heat events can have particularly negative impacts on aquatic systems, contributing to fish kills, aquatic plant die-offs, and increased likelihood of harmful algal blooms. Extreme temperature events can also affect surrounding ecosystems, destroying food webs and depleting resources in the environment.

10.2.6 Historic and Cultural Resources

Historic and cultural sites may be susceptible to damage from extreme temperature conditions. Extreme heat can increase the risk of fires. Fire causes material loss and deformation of cultural heritage assets and may also increase the probability of cracking or splitting in built structures. Under extreme heat, stones can face degradation, leading to structural instability. The long-term impacts include weakened stones and increased susceptibility to deterioration processes such as salt weathering and temperature cycling (Sesana, et al. 2021).

Proper strategies help safeguard buildings and their contents. Sudden and dramatic fluctuations in heating or cooling should be minimized. Slower heating and cooling give building materials and stored contents time to acclimate to new temperatures in the building and corresponding new humidity levels (CCAHA 2019).



10.3 FUTURE CHANGES THAT MAY AFFECT RISK

10.3.1 Potential or Planned Development

The ability of new development to withstand extreme temperature impacts can be enhanced through land use practices and consistent enforcement of codes and regulations for new construction. New development will change the landscape where buildings, roads, and other infrastructure potentially replace open land and vegetation. Transformation of pervious surfaces (including vegetation) to impervious surfaces causes an island of higher temperatures.

10.3.2 Projected Changes in Population

Any changes in the density of population may require utility system upgrades to keep up with utility demands (e.g., water, electric) during extreme temperature events. With increasing development, green space preservation will need to continue to be a priority to mitigate increased heat islands.

10.3.3 Climate Change

The Northeast is warming faster than many other U.S. regions. Extreme cold events will likely become less frequent because of this and have already become milder (NYS DHSES 2024). For much of North America, including the Northeast, extreme cold events have become less severe over time due to warming temperatures. High-profile severe cold events have still occurred in recent years, but this is due to natural variability (NYS DHSES 2024). Impacts from climate change on the duration of individual cold waves are uncertain currently.

Climate change will significantly increase the frequency, severity, and duration of extreme heat events, including multi-day events, in every region of New York State, with an expected corresponding increase in impacts without adequate adaptation. The state is expected to see a five-fold increase in heat wave days by 2050. By that same year, different regions of New York State are projected to experience 11 to 30 more days above 90 °F each year than occurred annually from 1981 to 2010. By the 2050s, the number of extreme heat events (periods of three or more days above 90 °F) per year in different regions is expected to rise by one to four incidents above the rate of zero to two per year that occurred from 1981 to 2010 (NYS DHSES 2024).

Due to the relatively rapid change in frequency, severity, and duration of extreme heat events, New York State will experience new impacts, and existing impacts may be significantly exacerbated if no adaptive measures are taken.



11. FLOOD

11.1 HAZARD PROFILE

11.1.1 Hazard Description

Flooding is a general, temporary condition of partial or complete inundation on normally dry land as a result of rising surface waters or drainage system flows. Floods are one of the most common of natural hazards. They can develop slowly over a period of days or quickly in minutes or hours. Disastrous effects of flooding can be local (impacting a neighborhood or community) or regional (affecting entire river basins, coastlines and multiple counties or states) (FEMA 2007b).

Flooding potential is influenced by climatology, meteorology, and topography (elevations, latitude, and water bodies and waterways). It depends on the intensity and duration of rainfall, the steepness of the watershed, the number of impervious surfaces within the watershed, and vegetation.

Types of Flooding

Riverine Flooding

Riverine floods are the most common flood type. They occur along a channel and include overbank and flash flooding. Channels are defined ground features that carry water through and out of a watershed. They may be called rivers, creeks, streams, or ditches. When a channel receives too much water, the excess water flows over its banks and inundates low-lying areas.

Flash Flooding

Flash floods are swift-flowing waters through riverbeds, streets, or canyons caused by heavy rainfall in a short period of time, generally less than 6 hours. They can occur within minutes or hours of excessive rainfall (NWS 2009b).

Stormwater and Urban Flooding

Stormwater and urban flooding are caused by local drainage issues and high groundwater levels when heavy precipitation results in flooding in areas other than delineated floodplains or along recognizable channels, such as streets, underpasses, low-lying areas, or storm drains. If the rainfall is too much to accommodate through a combination of infiltration and surface runoff, water may accumulate and cause flooding. While riverine flooding is mapped and studied by FEMA, urban flooding is not.

Flooding issues of this nature generally occur in areas with flat gradients and increase with urbanization, which speeds the accumulation of floodwaters because of impervious areas. Urban development and inadequate drainage systems can increase precipitation runoff, elevating the risk of flooding. Shallow street flooding can occur unless channels have been improved to account for increased flows (FEMA 2020b). Urban flooding can be worsened by aging or inadequate infrastructure and over-development of land. The growing number of extreme rainfall events that produce intense precipitation are resulting in increased urban flooding (Center for Disaster Resilience 2016).



High groundwater levels can cause problems even where there is no surface flooding. Seasonally high groundwater is common in many areas, while elsewhere high groundwater occurs only after a long period of above-average precipitation (USGS 2016). During winter and spring, frozen ground and snow accumulations may contribute to inadequate drainage and localized ponding. Basements are susceptible to high groundwater levels.

Drainage systems remove surface water by channeling water away from developed areas as quickly as possible to prevent localized flooding on streets and other urban areas. This bypasses the natural processes of water filtration through the ground, containment, and evaporation of excess water. Because drainage systems reduce the amount of time the surface water takes to reach surrounding streams, flooding in those streams can occur more quickly and reach greater depths than prior to development in that area (Harris 2008).

Ice Jam Flooding

An ice jam occurs when pieces of floating ice are carried with a stream's current and accumulate behind an obstruction to the stream flow. Obstructions may be river bends, mouths of tributaries, points where the river slope decreases, dams, or bridges. The water held back by the ice jam can cause flooding upstream. If the jam suddenly breaks, flash flooding can occur.

The formation of ice jams depends on the weather and physical condition of the river and stream channels. They are most likely where the channel slope naturally decreases, in culverts, and along shallows where channels may freeze solid. Ice jams and resulting floods can result from various conditions (NYS DHSES 2024):

- Freeze-up jams occur in winter when frazil ice—a slush-like form of floating ice—slows or stops due to a change in water slope as it reaches an obstruction to movement.
- Stream channels can freeze solid in mid-winter, forming anchor ice.
- Break-up jams occur during periods of thaw, generally in late winter and early spring, when rising water levels from snowmelt or rainfall break existing ice cover into pieces that accumulate at points of obstruction.

Floodplains

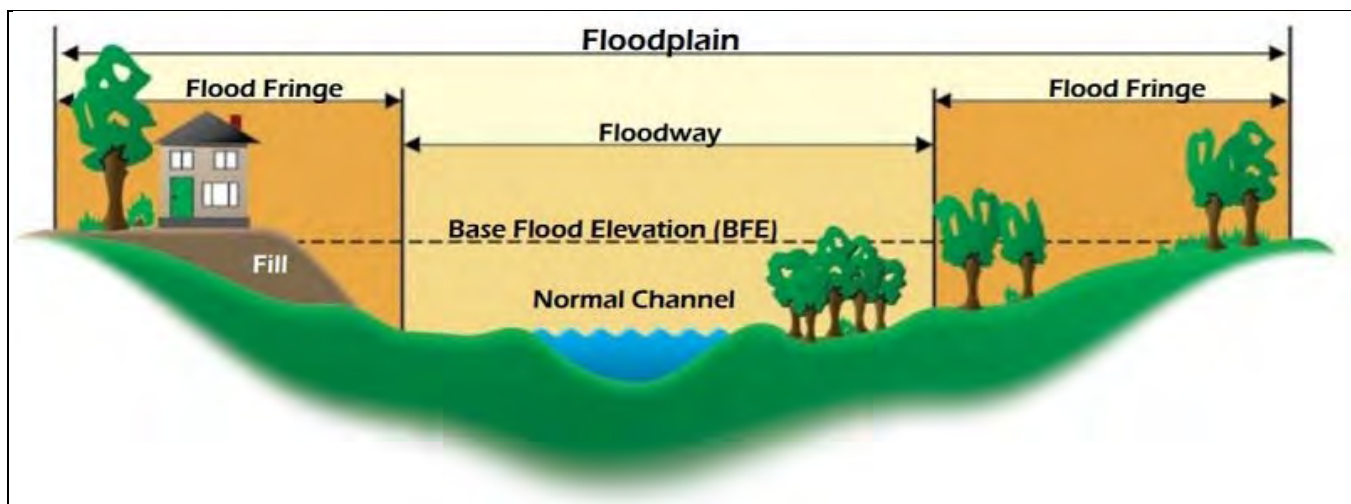
A floodplain is the land adjoining the channel of a river, stream, ocean, lake, or other water body that becomes inundated with water during a flood. Figure 11-1 depicts the components of a floodplain, which include the following (FEMA n.d.-d):

- *Floodway* is the channel of a river or other waterway and the adjacent land areas that are under water or reserved to carry and discharge the overflow of water caused by flooding.
- *Flood Fringe* is the area within the floodplain but outside the floodway. This area extends from the outer banks of a floodway to the river valley, where the elevation begins to rise.

Flood Mapping

FEMA prepares maps of floodplains based on existing riverine flooding conditions. FEMA flood maps identify Special Flood Hazard Areas (SFHA), which are the areas that will be inundated by the flood event that has a 1 percent chance of being equaled or exceeded in any given year. The 1 percent annual chance flood is also referred to as the base flood or 100-year flood, though it is statistically possible for such floods to occur more than once every 100 years. The 1 percent annual chance floodplain is the area where flood insurance and floodplain management requirements apply (FEMA 2020a). FEMA maps also show the 0.2 percent annual chance floodplain, sometimes called the 500-year floodplain. Additional definitions relating to flood maps can be seen in Table 11-1.

Figure 11-1. Characteristics of a Floodplain



Source: (FEMA n.d.-d)

Table 11-1. Flood Map Terms

Term	Description
Special Hazard Flood Areas (SFHAs)	Labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30
Zone B or Zone X (shaded)	Moderate flood hazard areas; the areas between the limits of the base flood and the 0.2 percent annual chance (or 500-year) flood
Zone C or Zone X (unshaded)	Areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2 percent annual chance flood

Source: (FEMA 2022d)

The mapped boundaries of the floodplains are updated to account for changes in land use, the amount of impervious surface, placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic models.

Flooding outside of the SFHA may include stormwater or urban flooding and flash flooding. Urban and stormwater flooding and flooding associated with changing future conditions (e.g., sea level rise and increased or decreased rainfall) are not reflected in the FEMA maps. As such, the maps may underestimate flood risk in some areas.

11.1.2 Location

Riverine Flooding

The following are known areas in Putnam County with persistent riverine flooding concerns (FEMA 2013):

- The East Branch Croton River has flooded the Village of Brewster well fields located near I-84. Tonetta Brook has been the source of problem flooding near the Brewster Railroad Station.
- In the Town of Carmel, an abandoned racetrack south of Fair Street was prone to flooding during storm conditions. Previous flooding has been reported to have reached the level of the track surface. Wetlands



are located in areas to the north of the railroad grade, on either side of Michael Brook, adding additional flooding concerns.

- Flooding in the Village of Cold Spring is caused primarily by backwater effects of the Hudson River in the low-lying areas along the shore.
- In the Town of Patterson, flooding of Route 292 by Muddy Brook Tributary 1 has occurred. Reconnaissance indicated that open areas along the East Branch Croton River, particularly in the vicinity of the confluence of Muddy Brook, were subject to flooding.
- In the Town of Philipstown, Clove Creek rose 5 to 10 inches after a heavy rainfall, causing an abutment of a bridge to erode significantly. This erosion continued along Clove Creek's overbanks. At another time, the channel water level reached the top of the bridge behind a restaurant near U.S. Route 9.
- In the Town of Southeast, the East Branch Croton River floods low-lying floodplain areas near I-84. Tonetta Brook has been the source of flooding along the railroad right-of-way. Holly Stream caused localized flooding in the areas north of I-684.

Locations of flood zones in Putnam County as depicted on the FEMA preliminary Digital Flood Insurance Rate Map (DFIRM) are shown in Figure 11-2. Total land area in the floodplain, exclusive of water bodies, is summarized in Table 11-2.

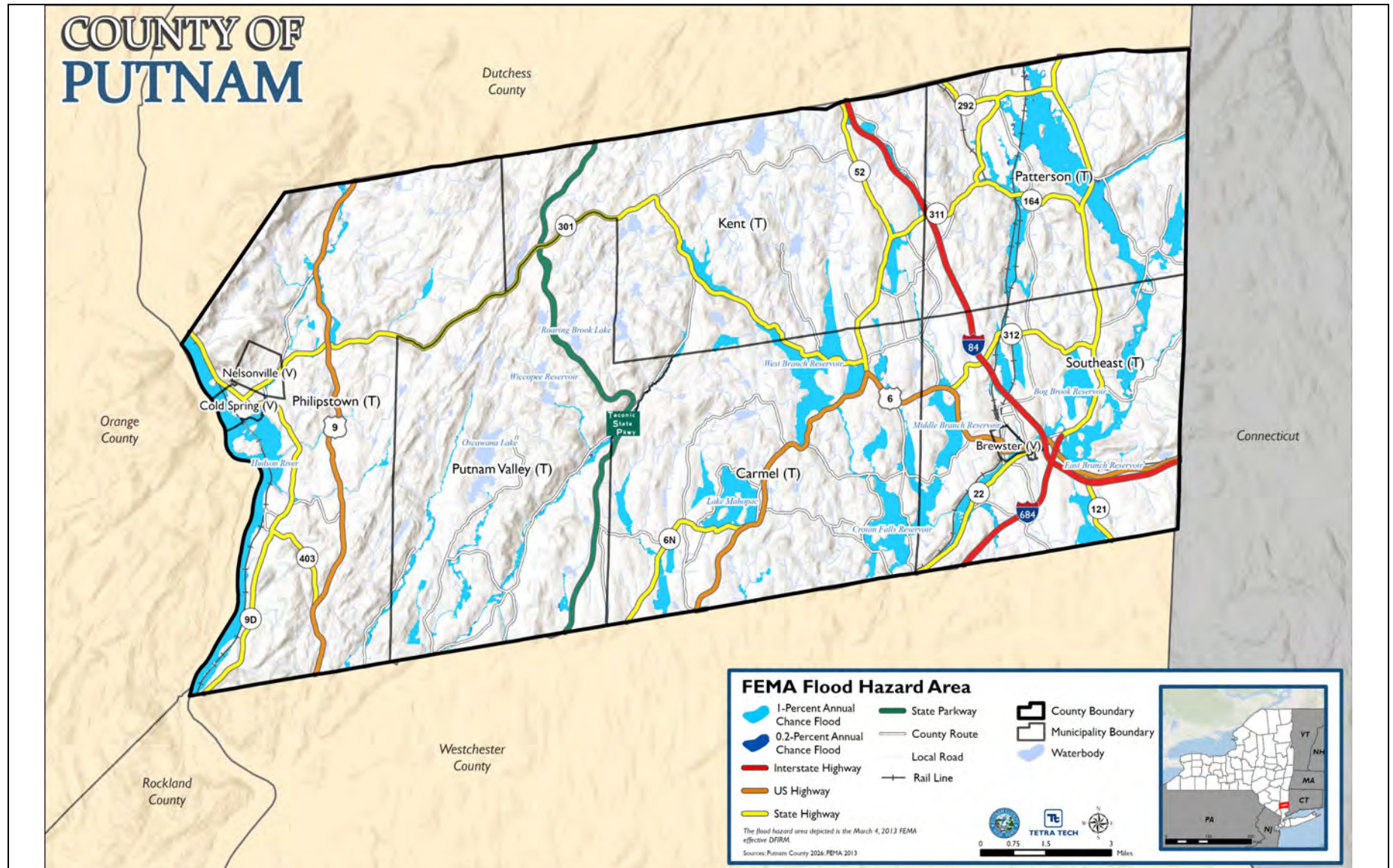
Table 11-2. Number of Acres Exposed to the 1 and 0.2 Percent Annual Chance Floods

Jurisdiction	Total Acres of Land Area	Total Acres in the Flood Hazard Area (Excluding Water Bodies)			
		1 Percent Annual Chance		0.2 Percent Annual Chance	
		Total Acres	Percent of Total	Total Acres	Percent of Total
Brewster (V)	301	27.1	9.0%	30.6	10.1%
Carmel (T)	23,025	742.1	3.2%	785.3	3.4%
Cold Spring (V)	380	46.9	12.3%	54.2	14.2%
Kent (T)	25,512	245.3	1.0%	284.9	1.1%
Nelsonville (V)	669	14.7	2.2%	17.6	2.6%
Patterson (T)	20,337	2,488.9	12.2%	2,634.5	13.0%
Philipstown (T)	30,272	858.9	2.8%	926.5	3.1%
Putnam Valley (T)	26,429	625.9	2.4%	712.2	2.7%
Southeast (T)	20,043	1,181.7	5.9%	1,275.3	6.4%
Putnam County (Total)	146,968	6,231.6	4.2%	6,721.1	4.6%

Source: Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; FEMA 2013



Figure 11-2. FEMA Flood Hazard Areas in Putnam County





Flash Flooding

Areas surrounding major rivers and their tributaries in the County may be susceptible to flash flooding. The distinctive flash flood event that is characterized by fast moving water and damaging impacts requires a steep topography. These floods develop quickly and can impact roads, homes, and local infrastructure (NYS DHSES 2024).

Stormwater and Urban Flooding

Stormwater and urban flooding have been reported at various locations in the County. Impacts are generally limited to roadways with underlying culverts. In various communities—such as the area surrounding Lake Mahopac in the Town of Carmel, the vicinity of Wiccopee Road in the Town of Putnam Valley, and Holmes in the Town of Patterson—poor drainage and rainstorms lead to localized flooding on streets and in residential developments.

Ice Jam Flooding

There have been three instances of reported ice jams in Putnam County. According to the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory database, ice jams in 2000 and 2003 were reported along Horse Pond Brook near Lake Carmel in the Town of Kent. In 2001, a freeze-up event was reported along the Croton River near the intersection of John Simpson Road and Fair Street in the City of Carmel (USACE 2026).

11.1.3 Extent

Riverine Flooding

Flood severity depends on the amount of water that accumulates in a period of time and on the land's ability to convey or absorb this water. When land is saturated or frozen, infiltration rates decrease and rainfall must flow as runoff. The severity of riverine flooding is determined by factors such as river and basin topography; precipitation and weather patterns; soil moisture conditions; and degree of vegetative clearing and impervious surface (Harris 2008).

Once a river reaches flood stage, the NWS rates flood severity as follows based on property damage and public threat (NOAA NSSL n.d.-a):

- **Minor Flooding** produces minimal or no property damage, but possibly some public threat or inconvenience.
- **Moderate Flooding** produces some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- **Major Flooding** produces extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations are necessary.

Flash Flooding

The extent of a flash flood is consistent with that of a riverine flood, as described above.

Stormwater and Urban Flooding

Currently, there is no measurement used to further define the severity of stormwater and urban flooding.



Ice Jam Flooding

Ice jam flooding often occurs suddenly and is difficult to predict, allowing little time for preparation and warning. The size of the snowpack and the rate of snowmelt controls the extent of an ice jam (Rokaya 2018).

11.1.4 Previous Occurrences

FEMA Disaster Declarations

Table 11-3 lists all flood-related presidentially declared disasters that have included Putnam County.

Table 11-3. FEMA Disaster Declarations for Flood Events in Putnam County

Event Date	Declaration Date	Declaration Number	Description
September 13, 1971	September 13, 1971	DR-311	Severe Storms and Flooding
October 2, 1975	October 2, 1975	DR-487	Storms, Rains, Landslides, and Flooding
January 19, 1996 – January 30, 1996	January 24, 1996	DR-1095	Severe Storms and Flooding
September 16, 1999 – September 18, 1999	September 19, 1999	EM-3149, DR-1296	Hurricane Floyd
May 13, 2004 – June 17, 2004	August 3, 2004	DR-1534	Severe Storms and Flooding
April 2, 2005 – April 4, 2005	April 19, 2005	DR-1589	Severe Storms and Flooding
April 14, 2007 – April 18, 2007	April 24, 2007	DR-1692	Severe Storms and Inland and Coastal Flooding
October 27, 2012 – November 8, 2012	October 30, 2012	EM-3351, DR-4085	Hurricane Sandy
August 4, 2020	October 2, 2020	DR-4567	Tropical Storm Isaias
August 21 – 24, 2021	August 22, 2021	EM-3565	Hurricane Henri
September 1 – 3, 2021	September 5, 2021	EM-3572, DR-4615	Remnants of Hurricane Ida
Jul 9, 2023 – Jul 10, 2023	July 22, 2023	DR-4723	Severe Storms and Flooding

Source: (FEMA 2026b)

USDA Declarations

Table 11-4 lists flood-related USDA agricultural disaster declarations that have included Putnam County.

Table 11-4. USDA Declarations for Flood Events in Putnam County

Event Date	USDA Declaration Number	Description
May 1, 2013	S3593	Excessive Rain and Related Flooding, High Winds, and Hail
April 1, 2014	S3747	Excessive Rain, Flash Flooding, Flooding, High Winds, and Hail
July 23, 2018	S4479	Excessive Precipitation
August 1, 2018	S4478	Excessive Rainfall
June 13, 2023	S5607, S5641	Flash Flooding and Excessive Rain
July 2, 2023	S5482	Excessive Rain
August 5, 2024	S5875	Hurricane Debby

Source: (USDA 2026)



All Recent Events

Table 11-5 lists major recorded flood-related events that impacted Putnam County since the previous HMP was developed. For earlier events, refer to the previous HMP.

Table 11-5. Flood Events in Putnam County (2020 to 2025)

Event Date	Location Impacted	Description
July 9 –10, 2023	Mahopac Mines, Lake Carmel, Mahopac Falls, Tompkins Corners, Patterson	A stalled frontal boundary over the area produced multiple rounds of torrential rainfall. Disaster declarations DR-4723, S5607, S5641, S5482
December 18, 2023	Nelsonville	Significant amounts of moisture along the warm front ahead of a low pressure system resulted in widespread areas of heavy rainfall over 12 to 18 hours.
June 30, 2024	Sodom	A slow moving cold front allowed for widespread thunderstorm development.
Jul 14, 2025	Haviland Hollow, Putnam Lake	A weak front from the west resulted in heavy rainfall across the area. 4 to 6.5 inches of rainfall totals were reported.

Source: (USDA 2026); (FEMA 2026b); (NOAA NCEI 2026)

11.1.5 Probability of Future Occurrences

Putnam County is expected to continue experiencing flooding in the future. Based on historical records and input from the Steering Committee, the probability of occurrence for flood (due to ice jam, flash flood, or flood) in the County is considered “likely.”

11.1.6 Cascading Impacts on Other Hazards

Some flooding events may induce secondary hazards:

- Riverine flooding often results in bank erosion. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much property damage, but scour the banks, edging properties closer to the floodplain or causing them to fall in.
- Flooding is responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail.
- Severe storms, which are often a precursor to flooding events, can result in large quantities of rain upstream of a dam that could result in overtopping of the dam or flooding of properties upstream of the dam.

11.2 VULNERABILITY AND IMPACT ASSESSMENT

The 1 percent and 0.2 percent annual chance flood events were examined to evaluate the county’s vulnerability to the flood hazard. Potential impacts were estimated using the Hazus riverine flood model for the 1 percent annual chance flood event.



11.2.1 Life, Health, and Safety

Overall Population

Table 11-6 summarizes the population exposed to the flood hazard by jurisdiction. There are an estimated 265 residents living in the 1 percent annual chance floodplain, or 0.3 percent of the County's total population. There are an estimated 413 residents living in the 0.2 percent annual chance floodplain, or 0.4 percent of the County's total population. The Town of Philipstown has the greatest number of residents living in the 1 percent annual chance floodplain (57) and while the Town of Patterson has the largest population living in the 0.2 percent annual chance floodplain (93).

Table 11-6. Population Exposed to the 1 Percent Annual Chance Flood Event Hazard Area

Jurisdiction	Total Population (2024 ACS)	Population in the 1% Annual Chance Flood Hazard Area		Population in the 0.2% Annual Chance Flood Hazard Area	
		Number of Persons	% of Jurisdiction Total	Number of Persons	% of Jurisdiction Total
Brewster (V)	2,512	0	0.0%	0	0.0%
Carmel (T)	33,837	26	0.1%	50	0.1%
Cold Spring (V)	1,863	34	1.8%	40	2.1%
Kent (T)	12,896	8	0.1%	13	0.1%
Nelsonville (V)	714	9	1.3%	16	2.2%
Patterson (T)	11,560	51	0.4%	93	0.8%
Philipstown (T)	7,302	57	0.8%	80	1.1%
Putnam Valley (T)	11,755	55	0.5%	71	0.6%
Southeast (T)	15,668	25	0.2%	50	0.3%
Putnam County (Total)	98,107	265	0.3%	413	0.4%

Source: U.S. Census Bureau 2024 ACS Vulnerable Population; Putnam County 2025, 2026; NYSERDA 2026; NYS 2024; FEMA 2013

The impact of flooding on life, health, and safety depends on the severity of the event and whether adequate warning time is provided to residents. The total number of injuries and casualties resulting from flooding is generally limited based on advance weather forecasting, blockades, and warnings. Therefore, injuries and deaths generally are not anticipated if proper warning and precautions are in place. Ongoing mitigation efforts should help to avoid the most likely cause of injury, which results from persons trying to cross flooded roadways or channels during a flood.

Persons can become displaced from their homes or may seek shelter due to the impacts of a flood event. For the 1 percent flood event, Hazus estimates 812 individuals will be displaced, and 227 people will seek short-term shelter, as shown in Table 11-7.



Table 11-7. People Displaced or Seeking Short-Term Shelter Due to 1 Percent Annual Chance Flood Event

Jurisdiction	Total Population (2024 ACS)	1% Annual Chance Flood Impacts on People	
		Displaced Population	Persons Seeking Short-Term Shelter
Brewster (V)	2,512	16	15
Carmel (T)	33,837	119	52
Cold Spring (V)	1,863	63	8
Kent (T)	12,896	45	7
Nelsonville (V)	714	15	0
Patterson (T)	11,560	127	25
Philipstown (T)	7,302	126	20
Putnam Valley (T)	11,755	168	42
Southeast (T)	15,668	133	58
Putnam County (Total)	98,107	812	227

Source: Hazus v6.1; U.S. Census Bureau 2020, 2024 ACS; FEMA 2013, 2019; NYS ITS Geospatial Services 2026

Other common public health risks from flooding include the following (FEMA 2022a):

- Floodwater contamination by sewage, pesticides, fertilizers, oil, asbestos, or rusting building materials
- The growth of mold in buildings
- Unsafe food
- Mosquitos and animals
- Carbon monoxide poisoning
- Secondary hazards associated with re-entering/cleaning flooded structures
- Mental stress and fatigue

Socially Vulnerable Population

Some populations are more susceptible to flood events based on factors including their physical and financial ability to react or respond during a flood. Some may require extra time to evacuate or need assistance to evacuate and are more likely to need medical attention. Table 11-8 and Table 11-9 provide a summary of the estimated number of vulnerable individuals living within flood hazard areas in Putnam County. Countywide, there are 50 people living in the 1 percent annual chance flood hazard zone who are over 65 (0.3 percent of the County population) and 17 who live below the poverty level (0.2 percent of the County population). In the 0.2 percent annual chance flood hazard area, there are 79 people over the age of 65 (0.4 percent of the County population) and 29 people living below the poverty level (0.4 percent of the County population).



Table 11-8. Vulnerable Persons Living in the 1 Percent Annual Chance Flood Hazard Area

Jurisdiction	Vulnerable Persons Living in the 1% Annual Chance Flood Hazard Area									
	Persons Over 65	Percent of Total	Persons Under 5	Percent of Total	Non-English Speaking Persons	Percent of Total	Persons with a Disability	Percent of Total	Persons in Poverty	Percent of Total
Brewster (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Carmel (T)	5	0.1%	1	0.1%	0	0.0%	2	0.1%	1	0.1%
Cold Spring (V)	7	1.6%	1	1.1%	1	1.4%	2	1.3%	1	1.2%
Kent (T)	1	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Nelsonville (V)	1	1.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Patterson (T)	8	0.4%	2	0.4%	0	0.0%	4	0.4%	8	0.4%
Philipstown (T)	13	0.7%	2	0.8%	0	0.0%	5	0.7%	4	0.7%
Putnam Valley (T)	10	<0.1%	2	0.3%	0	0.0%	4	0.4%	2	0.4%
Southeast (T)	5	0.2%	1	0.1%	1	0.1%	2	0.1%	1	0.1%
Putnam County (Total)	50	0.3%	9	0.2%	2	<0.1%	19	0.2%	17	0.2%

Source: U.S. Census Bureau 2024 ACS Vulnerable Population; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; FEMA 2013



Table 11-9. Vulnerable Persons Living in the 0.2 Percent Annual Chance Flood Hazard Area

Jurisdiction	Vulnerable Persons Living in the 0.2% Annual Chance Flood Hazard Area									
	Persons Over 65	Percent of Total	Persons Under 5	Percent of Total	Non-English Speaking Persons	Percent of Total	Persons with a Disability	Percent of Total	Persons in Poverty	Percent of Total
Brewster (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Carmel (T)	9	0.1%	2	0.1%	0	0.0%	5	0.1%	2	0.1%
Cold Spring (V)	9	2.1%	1	1.1%	1	1.4%	3	1.9%	1	1.2%
Kent (T)	2	0.1%	0	0.0%	0	0.0%	1	0.1%	0	0.0%
Nelsonville (V)	2	2.0%	0	0.0%	0	0.0%	1	1.6%	0	0.0%
Patterson (T)	15	0.8%	4	0.8%	1	0.5%	8	0.8%	15	0.8%
Philipstown (T)	19	1.1%	2	0.8%	0	0.0%	8	1.1%	5	0.9%
Putnam Valley (T)	13	0.6%	3	0.5%	1	0.5%	6	0.6%	3	0.6%
Southeast (T)	10	0.3%	2	0.2%	3	0.3%	5	0.3%	3	0.3%
Putnam County (Total)	79	0.4%	14	0.3%	6	0.2%	37	0.4%	29	0.4%

Source: U.S. Census Bureau 2024 ACS Vulnerable Population; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; FEMA 2013



11.2.2 General Building Stock

Buildings in the Flood Hazard Area

Table 11-10 and Table 11-11 summarize the building stock and RCV for the 1 percent and 0.2 percent annual chance flood hazard areas. There are an estimated 238 and 339 buildings in the 1 percent and 0.2 percent annual chance flood hazard areas, respectively. The Town of Carmel has the greatest number of buildings in both flood hazard areas. Table 11-12 lists the number of buildings in the flood hazard areas by occupancy class.

Table 11-10. General Building Stock Exposure to the 1 Percent Annual Chance Flood Event

Jurisdiction	Jurisdiction Total Buildings		Buildings in the 1% Annual Chance Flood Hazard Area			
			Number of Buildings		RCV	
	Count	RCV	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Brewster (V)	569	\$368,940,861	3	0.5%	\$2,932,030	0.8%
Carmel (T)	12,221	\$9,049,629,618	60	0.5%	\$139,401,574	1.5%
Cold Spring (V)	761	\$474,899,526	24	3.2%	\$15,334,525	3.2%
Kent (T)	5,760	\$3,047,474,569	10	0.2%	\$5,692,508	0.2%
Nelsonville (V)	283	\$143,090,491	9	3.2%	\$6,725,894	4.7%
Patterson (T)	4,118	\$3,126,610,140	40	1.0%	\$32,457,782	1.0%
Philipstown (T)	4,049	\$2,634,231,865	38	0.9%	\$19,832,897	0.8%
Putnam Valley (T)	5,383	\$2,989,131,470	35	0.7%	\$15,785,076	0.5%
Southeast (T)	5,488	\$5,049,468,784	19	0.3%	\$31,707,226	0.6%
Putnam County (Total)	38,632	\$26,883,477,324	238	0.6%	\$269,869,512	1.0%

Source: Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; RSMeans 2026; FEMA 2013

Table 11-11. General Building Stock Exposure to the 0.2 Percent Annual Chance Flood Event

Jurisdiction	Jurisdiction Total Buildings		Buildings in the 0.2% Annual Chance Flood Hazard Area			
			Number of Buildings		RCV	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Brewster (V)	569	\$368,940,861	4	0.7%	\$5,571,946	1.5%
Carmel (T)	12,221	\$9,049,629,618	77	0.6%	\$145,797,314	1.6%
Cold Spring (V)	761	\$474,899,526	29	3.8%	\$17,505,630	3.7%
Kent (T)	5,760	\$3,047,474,569	20	0.3%	\$14,457,399	0.5%
Nelsonville (V)	283	\$143,090,491	13	4.6%	\$10,514,629	7.3%
Patterson (T)	4,118	\$3,126,610,140	61	1.5%	\$47,114,077	1.5%
Philipstown (T)	4,049	\$2,634,231,865	51	1.3%	\$30,384,891	1.2%
Putnam Valley (T)	5,383	\$2,989,131,470	47	0.9%	\$22,022,768	0.7%
Southeast (T)	5,488	\$5,049,468,784	37	0.7%	\$47,976,999	1.0%
Putnam County (Total)	38,632	\$26,883,477,324	339	0.9%	\$341,345,653	1.3%

Source: Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; RSMeans 2026; FEMA 2013

**Table 11-12. Buildings in the Flood Hazard Areas by General Occupancy Class**

Jurisdiction	Buildings in the 1% Annual Chance Flood Hazard Area				Buildings in the 0.2% Annual Chance Flood Hazard Area			
	Residential	Commercial	Industrial	Other	Residential	Commercial	Industrial	Other
Brewster (V)	0	3	0	0	0	4	0	0
Carmel (T)	8	40	4	8	15	50	4	8
Cold Spring (V)	11	12	1	0	13	15	1	0
Kent (T)	3	5	0	2	5	11	0	4
Nelsonville (V)	3	6	0	0	5	8	0	0
Patterson (T)	15	19	0	6	27	26	0	8
Philipstown (T)	22	16	0	0	31	20	0	0
Putnam Valley (T)	21	12	0	2	27	18	0	2
Southeast (T)	7	12	0	0	14	23	0	0
Putnam County (Total)	90	125	5	18	137	175	5	22

Putnam County 2025, 2026; NYSERDA 2026; NYS 2024; RSMeans 2026; FEMA 2013

Note: Other = Government, Religion, Agricultural, and Education

Estimated Cost of Damage

Hazus estimates losses that could occur to the exposed inventory due to damage to building structures and contents. Table 11-13 summarizes the results for the 1 percent annual chance flood. The total RCV for the County is over \$26.8 billion. The estimated loss for all occupancies amounts to over \$29 million. This includes \$2.7 million for residential properties, \$20.6 million for commercial properties, \$901,537 for industrial properties, and \$5.2 million for all other occupancies.

National Flood Insurance Program Statistics

The flood risk assessment included an analysis of FEMA data on flood insurance policies, claims, and repetitive loss (RL) for properties insured under the National Flood Insurance Program (NFIP). A property is considered a repetitive loss property when there are two or more reported losses since 1978 that were paid more than \$1,000 for each loss. The two losses must be within 10 years of each other and be at least 10 days apart.

FEMA Region 2 provided an aggregate report of number of losses, repetitive loss events, and net payments, as of May 2026. The data was organized by jurisdiction, as shown in Table 11-14. Table 11-15 lists the building occupancy type for the RL structures in the County.



Table 11-13. Building Stock Potential Loss Due to the 1 Percent Annual Chance Flood Event

Jurisdiction	Total Replacement Cost Value (RCV)	Potential Loss for 1% Annual Chance Flood					
		Total All Occupancies		Residential	Commercial	Industrial	Other Occupancies
		Loss	Loss as % of Total RCV				
Brewster (V)	\$368,940,861	\$3,402	<0.1%	\$0	\$3,402	\$0	\$0
Carmel (T)	\$9,049,629,618	\$23,563,701	0.3%	\$51,298	\$18,693,373	\$769,216	\$4,049,814
Cold Spring (V)	\$474,899,526	\$367,014	0.1%	\$133,349	\$101,343	\$132,322	\$0
Kent (T)	\$3,047,474,569	\$71,383	<0.1%	\$0	\$69,175	\$0	\$2,208
Nelsonville (V)	\$143,090,491	\$553,466	0.4%	\$315,546	\$237,920	\$0	\$0
Patterson (T)	\$3,126,610,140	\$1,619,736	0.1%	\$194,526	\$474,044	\$0	\$951,166
Philipstown (T)	\$2,634,231,865	\$748,488	<0.1%	\$389,828	\$358,660	\$0	\$0
Putnam Valley (T)	\$2,989,131,470	\$1,056,364	<0.1%	\$529,794	\$299,632	\$0	\$226,938
Southeast (T)	\$5,049,468,784	\$1,522,947	<0.1%	\$1,106,990	\$415,957	\$0	\$0
Putnam County (Total)	\$26,883,477,324	\$29,506,500	0.1%	\$2,721,331	\$20,653,506	\$901,537	\$5,230,126

Source: Hazus v6.1; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; RSMeans 2026; FEMA 2013, 2019; NYS ITS Geospatial Services 2026

Note: Other = Government, Religion, Agricultural, and Education



Table 11-14. NFIP Statistics for Putnam County as of May 2026

Jurisdiction	Number of Losses	Repetitive Loss Events	Net Building Payment	Net Contents Payment	Total Net Payment
Brewster (V)	-	-	-	-	-
Carmel (T)	14	6	\$63,093	\$11,665	\$74,758
Cold Spring (V)	16	7	\$1,128,265	\$45,870	\$1,174,135
Kent (T)	2	1	\$5,930	\$345	\$6,276
Nelsonville (V)	13	4	\$390,270	\$35,316	\$425,585
Patterson (T)	21	6	\$561,426	\$44,521	\$605,948
Philipstown (T)	2	1	\$6,445	\$0.00	\$6,445
Putnam Valley (T)	-	-	-	-	-
Southeast (T)	-	-	-	-	-
Putnam County (Total)	68	25	\$2,155,429.00	\$137,717.00	\$2,293,147.00

Source: FEMA Region 2 2026

Note: "-" = Data not provided

Table 11-15. Occupancy Type for RL Structures for Putnam as of July 2026

Residency Type	Total Losses	Total Net Payment
Single Family	72	\$1,933,908
2 – 4 Family	2	\$105,334
Other Residential	3	\$425,405
Non-Residential Commercial (Non-Small Business)	5	\$70,962
Total	82	\$2,535,609

Source: FEMA Region 2 2026

11.2.3 Community Lifelines and Other Critical Facilities

Critical facility exposure to the 1 percent and 0.2 percent annual chance flood hazard event boundary was examined. Results are summarized in Table 11-16 and Table 11-17. There are 99 critical facilities in the 1 percent annual chance flood hazard area and 107 in the 0.2 percent annual chance flood hazard area. The transportation lifeline category has the greatest number of facilities in both hazard areas (55 in the 1 percent annual chance flood hazard area and 57 in the 0.2 percent annual chance flood hazard area).

Hazus was used to estimate the potential damage to critical facilities from the 1 percent annual chance flood, as summarized in Table 11-18. Of the 40 facilities predicted to experience any damage from that flood scenario, none are predicted to experience 40 percent or greater damage, and only four would face between 20 to 39 percent damage. More than half of affected facilities (23) would experience less than 5 percent damage.



Table 11-16. Number of Critical Facilities in the 1 Percent Annual Chance Flood Hazard Area

Jurisdiction	Number of Facilities in the 1 Percent Annual Chance Flood Hazard Area									Total Facilities in Hazard Area	
	Communi- cations	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Brewster (V)	1	0	0	0	0	0	2	0	0	3	5.6%
Carmel (T)	5	0	0	5	2	8	8	3	0	31	9.6%
Cold Spring (V)	0	0	1	0	0	0	1	1	1	4	10.3%
Kent (T)	1	0	0	0	0	2	7	0	0	10	5.6%
Nelsonville (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Patterson (T)	3	0	0	0	0	1	6	0	0	10	5.6%
Philipstown (T)	0	0	0	1	0	2	10	0	0	13	8.5%
Putnam Valley (T)	1	0	0	0	0	2	9	0	1	13	10.7%
Southeast (T)	0	1	0	0	0	1	12	1	0	15	7.6%
Putnam County (Total)	11	1	1	6	2	16	55	5	2	99	7.9%

Source: Putnam County 2021, 2026; NYS GIS Clearinghouse 2026; NYSDEC 2025 – 2026; ESRI 2026; NYS Board of Elections 2025; HIFLD 2025; FEMA 2013



Table 11-17. Number of Facilities in the 0.2 Percent Annual Chance Flood Hazard Area

Jurisdiction	Number of Facilities in the 0.2 Percent Annual Chance Flood Hazard Area									Total Facilities in Hazard Area	
	Communi- cations	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Brewster (V)	1	0	0	0	0	0	2	0	0	3	5.6%
Carmel (T)	5	0	0	5	2	8	8	3	0	31	9.6%
Cold Spring (V)	0	0	1	0	0	0	1	1	1	4	10.3%
Kent (T)	1	0	0	0	0	2	7	0	0	10	5.6%
Nelsonville (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Patterson (T)	3	1	2	0	0	1	7	1	0	15	8.4%
Philipstown (T)	0	0	0	1	0	3	10	0	0	14	9.2%
Putnam Valley (T)	1	0	0	0	0	2	10	0	1	14	11.6%
Southeast (T)	0	1	0	0	0	1	12	2	0	16	8.1%
Putnam County (Total)	11	2	3	6	2	17	57	7	2	107	8.5%

Source: Putnam County 2021, 2026; NYS GIS Clearinghouse 2026; NYSDEC 2025 – 2026; ESRI 2026; NYS Board of Elections 2025; HIFLD 2025; FEMA 2013

**Table 11-18. Number of Facilities Experiencing Damage Due to the 1 Percent Annual Chance Flood Event**

Lifeline	Number of Facilities Experiencing Damage Due to the 1% Annual Chance Flood				
	<5% Damage	5 – 19% Damage	20 – 39% Damage	40 – 49% Damage	50% or Greater Damage
Communications	8	2	1	0	0
Energy	0	1	0	0	0
Food, Hydration, Shelter	1	0	0	0	0
Hazardous Materials	3	3	0	0	0
Health and Medical	1	0	1	0	0
Safety and Security	6	9	1	0	0
Transportation	1	0	0	0	0
Water Systems	3	1	1	0	0

Source: Hazus v6.1; Putnam County 2021, 2025, 2026; NYS GIS Clearinghouse 2026; NYSDEC 2025 – 2026; ESRI 2026; HIFLD 2025; FEMA 2013, 2019; NYS ITS Geospatial Services 2026

Note: Results shown exclude critical facilities not categorized as community lifelines.

Critical services during and after a flood event may not be available if critical facilities are damaged or transportation routes to access them are impacted. Potential impacts include the following:

- Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area to many service providers needing to get to vulnerable populations or to make repairs.
- Oversaturated soils from periods of heavy rain and flooding may cause utility poles to tip over or fall completely, potentially interrupting the power grid for a large area, especially if a transformer is impacted.
- Utility service to individual flooded buildings may be disrupted if a service panel, generator, meter, etc. is not elevated above the flood level.
- Floodwater picks up debris, increasing the amount of bacteria, sewage, and other industrial waste and chemicals in the water supply. Contamination at any step of the water flow process puts consumers at risk from toxins that could result in wound infections, skin rashes, gastrointestinal illnesses, or tetanus. In extreme cases, death may occur.
- Excess water makes it more difficult for water treatment plants to treat water effectively.
- Floodwater can contaminate private drinking water sources, such as wells and springs.
- Without access to clean drinking and cooking water, consumers become reliant on bottled water. People who live in impoverished communities may not have the financial resources to stock up on bottled water. Moreover, retail locations are often inaccessible after a flood or low on water supply.

11.2.4 Economy

Flood events can significantly impact the local and regional economy. This includes general building stock damage and associated tax loss, impacts on utilities and infrastructure, business interruption, and impacts on tourism.

Debris management may also be a large expense after a flood event. Hazus estimates the amount of structural debris generated during a flood event in three categories: finishes (dry wall, insulation, etc.); structural (wood, brick, etc.); and foundations (concrete slab and block, rebar, etc.). These distinctions recognize the different types of



equipment needed to handle debris. Table 11-19 summarizes Hazus debris estimates for the 1 percent annual chance flood event. Hazus only estimates structural debris generated by flooding; it does not include non-structural debris or any debris generated by wind associated with a storm that causes flooding. Overall, Hazus estimates that there will be 389 tons of debris generated during the 1 percent annual chance flood event in Putnam County.

Table 11-19. Debris Generated from the 1 Percent Annual Chance Flood Event

Jurisdiction	Debris Created During the 1 Percent Annual Chance Flood Event			
	Finish (tons)	Structure (tons)	Foundation (tons)	Total (tons)
Brewster (V)	1.5	0.1	0.2	1.8
Carmel (T)	35.5	9.7	7.4	52.6
Cold Spring (V)	17.7	0.0	0.0	17.7
Kent (T)	13.4	<0.1	<0.1	13.4
Nelsonville (V)	15.1	<0.1	0.1	15.2
Patterson (T)	28.6	0.1	0.2	28.9
Philipstown (T)	61.7	0.6	0.5	62.8
Putnam Valley (T)	81.7	9.4	6.9	98.0
Southeast (T)	62.4	19.7	16.6	98.7
Putnam County (Total)	317.6	39.6	31.8	389.2

Source: Hazus v6.1; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; FEMA 2013, 2019; NYS ITS Geospatial Services 2026

11.2.5 Natural Resources

Flooding can damage wetlands and forests, altering local biodiversity and affecting natural flood defenses. In addition, severe erosion caused by flooding can negatively impact local ecosystems. Flooding also can lead to contamination of surface waters through multiple mechanisms:

- Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate the flooded waterway.
- The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to flood waters.
- After the flood waters subside, contaminated and flood-damaged building materials and contents must be properly disposed of.

11.2.6 Historic and Cultural Resources

Historic places, community facilities, cultural institutions, parks and open spaces, and religious institutions are all vulnerable to impacts from flooding. Venues such as museums and historic buildings face structural damage during flood events, with additional risk of damage to important cultural artifacts housed within. Parks, recreation, and community space closures due to flood events can disrupt residents' lives and hinder access to critical community services. Historic structures often are not built to modern building code requirements, including design flood elevation and construction standards. Historic resources and structures, as well as parks and recreational areas, were often built closely to waterways, increasing their flood risk. Although these facilities often experience flooding, they are positioned with flooding in mind, as many parks are considered as open space to disallow development.



11.3 FUTURE CHANGES THAT MAY AFFECT RISK

11.3.1 Potential or Planned Development

Flood events may increase in frequency and/or severity as land use changes, more structures are built, and impervious surfaces expand. Any areas of new development in the special flood hazard area could be impacted by flooding. Areas outside of the special flood hazard can also be impacted by urban flooding and less frequent and more severe flooding events.

11.3.2 Projected Changes in Population

Changes in population density can influence the number of people exposed to flood hazards and complicate evacuation during flood events.

11.3.3 Climate Change

Changing climate conditions can alter the frequency and severity of events that lead to flooding. The change will heighten the risk of riverine flooding.

12. HARMFUL ALGAL BLOOMS

12.1 HAZARD PROFILE

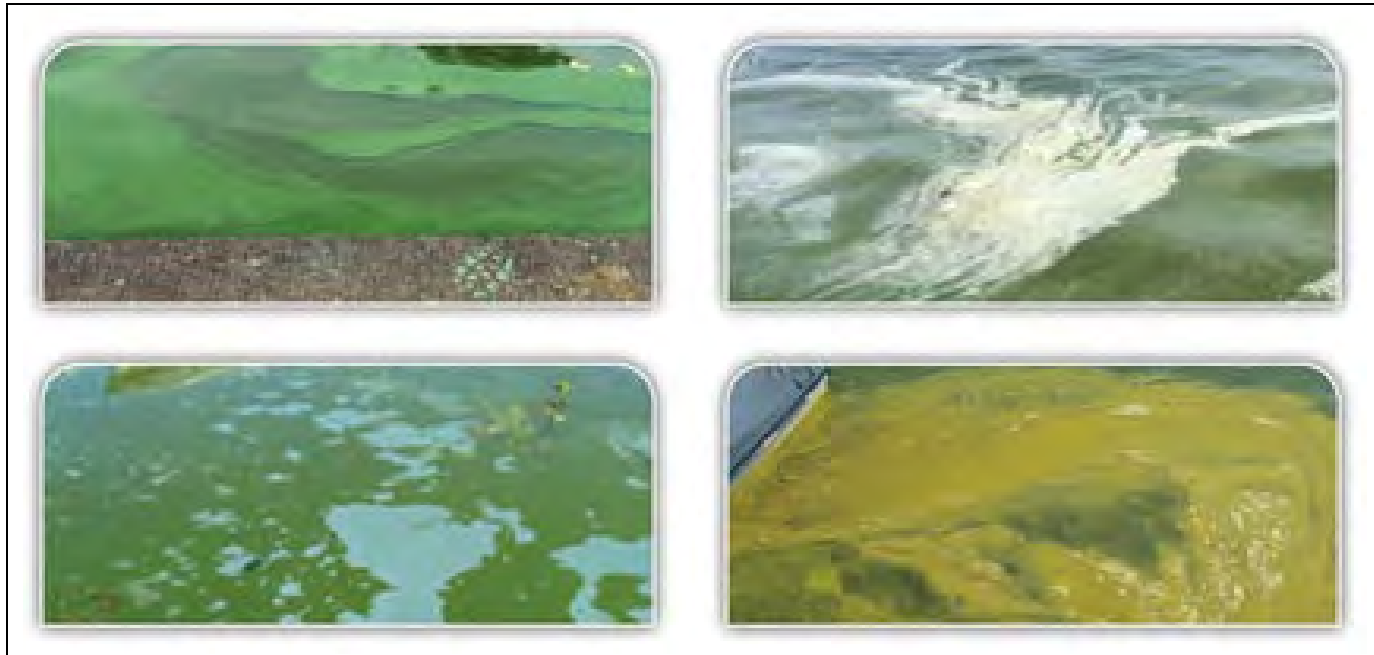
12.1.1 Hazard Description

Algae are a part of a diverse group of aquatic organisms characterized by photosynthesizing. They are found in lakes, ponds, oceans, hot springs, and springs, as well as on land. Some species of algae can grow rapidly, forming blooms that cover large areas. These blooms can have negative impacts on the ecosystem and other species that reside there.

Most algae are harmless and are key components of the food chain. One exception is blue-green algae (cyanobacteria). Some forms of cyanobacteria produce toxins that in large quantities can threaten humans and animals. When cyanobacteria form colonies, they are referred to as harmful algal blooms (HABs). There are over 40 cyanobacterial species that can produce toxins harmful to humans and animals (Mohamed 2019).

HABs can be difficult to identify without laboratory testing. They often look like areas of a water body that are shades of green, blue-green, yellow, brown, red, or white. Blooms are often clumps but can also be seen in the form of floating dots or streaks (NYS DOH 2022). Figure 12-1 illustrates the differing appearance of blue-green algal blooms on a water surface.

Figure 12-1. Blue-Green Algae Bloom in Surface Water



Source: NYS DOH n.d.

HABs can also form along the bottom of a water body in what are referred to as benthic blooms. Figure 12-2 illustrates the common appearance of blue-green algal benthic blooms in a water body.

Figure 12-2. Blue-Green Algae Benthic Blooms



Source: NYS DOH n.d.

Cyanobacteria are known to produce toxins from the following classes and have impacts on human health:

- **Endotoxins**—Endotoxins associated with cyanobacteria have been tied to fever and inflammation in humans.
- **Hepatotoxins**—Hepatotoxins are commonly tied to animal poisonings from cyanobacterial blooms. Animals may exhibit weakness, heavy breathing, paleness, cold extremities, vomiting, diarrhea, and bleeding in the liver. In humans, hepatotoxins have been found to promote tumors and may lead to increases in liver cancer. Some types of hepatotoxins, such as microcystin, can persist in fresh water for up to 2 weeks before being naturally broken down.
- **Neurotoxins**—Neurotoxins act to block transfers between neurons. Extreme cases can result in paralysis.

Algal Bloom Monitoring and Identification

HAB events in New York State are monitored by the NYSDEC's Lake Classification and Inventory Program, which is largely operated by citizens and volunteers. This and other HAB monitoring programs report the status of water bodies in the state on the DECinfo Locator (NYSDEC 2022). These events are identified by visual observations, photographs, and laboratory sampling to help determine the cyanobacteria or other algae present. Suspicious blooms are reported to NYSDEC, local health departments, or the New York State Department of Health (NYS DOH).

NYSDEC assigns the following statuses for water bodies experiencing HAB events (NYSDEC n.d.-e):

- **Suspicious Bloom (Type S)**—NYSDEC has determined that visual observations and photographs indicate a cyanobacteria HAB. However, laboratory sampling has not been conducted to confirm this determination. Toxins present in the water body are to be determined.
- **Confirmed Bloom (Type C)**—Water samples confirm the presence of a cyanobacteria HAB, which has the potential to produce harmful toxins.
- **Confirmed with High Toxins Bloom (Type HT)**—Water samples confirm the presence of a cyanobacteria HAB as well as toxins in the water body. The toxin quantity is enough to potentially cause health problems for human and animals that come into contact with the water body by swimming or drinking.



12.1.2 Location

NYSDEC has prepared HAB action plans for Palmer Lake, Lake Carmel, and Putnam Lake in Putnam County. These lakes account for one-quarter of the 12 priority water bodies identified by the New York State Water Quality Rapid Response Team. Each lake was identified for focus due to its function as part of the Croton System of the New York City water supply reservoirs and historical occurrence of HABs, in addition to impaired water body status. Putnam County's exposure and vulnerability to the HAB hazard includes the following:

- Shorelines of the Putnam County water bodies with documented HABs are publicly accessible, which can increase the chance of exposure. Many of the county's lakes are popular recreation areas and have an abundance of lake users, tourism, and shoreline development.
- HABs are generally limited to lakes and ponds but any surface water can experience HABs as evidenced by prior events in Putnam Lake and Lake Carmel.
- The widespread use of septic systems in the County is a major contributing factor to HABs.
- Putnam County's water bodies are relied upon as part of the Croton Aqueduct system, which delivers waters to the southern section of the state, including 10 percent of New York City's drinking water.
- Locations that rely on surface water intake for drinking water are most exposed to the impacts of HABs. However, most of the County relies on groundwater from deep wells.

Wind currents can play a large role in the concentrations of algae that float at or near the water surface. Consistent winds can accumulate algae at downwind shorelines. In Lake Carmel and Putnam Lake, prevailing wind patterns result in accumulations of cyanobacteria in the northern and eastern ends of the lakes. Shorelines containing coves or other features that could capture floating algae may be more susceptible to HABs. In instances where freshwater intakes are impacted by these blooms, the extent may also include the area that is serviced by the impacted water utility or the private/residential intake.

12.1.3 Extent

The extent for HABs is measured based on the impacted area of the water body. There are four category classifications, defined by the NYSDEC monitoring program (NYSDEC n.d.-e):

- **Small localized**—When a HAB affects a small area of the water body. Limited to just one or a few neighboring properties.
- **Large localized**—When a HAB affects multiple properties within a large area of a shoreline or specific region of the water body.
- **Widespread/Lake-wide**—When a HAB affects the water body in entirety, or majority the shoreline.
- **Open Water**—When a HAB is located toward the center of the water body. Conditions may be widespread, and toxins can be higher towards the shoreline areas.

12.1.4 Previous Occurrences

FEMA Disaster Declarations

Putnam County has not been included in any major disaster or emergency declarations for HAB (FEMA 2026b).



USDA Declarations

Putnam County has not been included in any HAB-related USDA agricultural disaster declarations (USDA 2026).

All Recent Events

Table 12-1 lists major recorded HAB-related events that impacted Putnam County since the previous HMP was developed. For earlier events, refer to the previous HMP.

Table 12-1. HAB Events in Putnam County (2020 to 2025)

Year	Location Impacted	Description
2020	Barger Pond, Croton Falls Reservoir, Herrlich Pond, Kentwood Lake, Kirk Lake, Lake Carmel, Lake Macgregor, Lake Peekskill, Putnam Lake, Roaring Brook Lake, White Pond	11 confirmed blooms in Putnam County
2021	Barger Pond, Cortlandt Lake, Croton Falls Reservoir, Kentwood Lake, Kirk Lake, Lake Carmel, Lake Casse, Lake Peekskill, Lake Tibet, Oscawana Lake, Peach Lake, Putnam Lake, Roaring Brook Lake, Sagamore Lake	14 confirmed blooms in Putnam County
2022	Barger Pond, Barrett Pond, Croton Falls Reservoir, Diverting Reservoir, Kirk Lake, Lake Carmel, Lake Casse, Lake Peekskill, Oscawana Lake, Peach Lake, Putnam Lake, Roaring Brook Lake, Seven Hills Lake	13 confirmed blooms in Putnam County
2023	Barrett Pond, Bog Brook Reservoir, Lake Carmel, Lake Casse, Lake Peekskill, Lake Tonetta, Oscawana Lake, Peach Lake, Putnam Lake, Roaring Brook Lake, White Pond	11 confirmed blooms in Putnam County
2024	Barger Pond, Bog Brook Reservoir, Cortlandt Lake, Diverting Reservoir, East Branch Reservoir, Lake Carmel, Lake Casse, Lake Celeste, Lake Peekskill, Lake Tonetta, Middle Branch Reservoir, Oscawana Lake, Peach Lake, Putnam Lake, Roaring Brook Lake, Seven Hills Lake, White Pond	17 confirmed blooms in Putnam County
2025	Barger Pond, Croton Falls Reservoir, Kirk Lake, Lake Carmel, Lake Peekskill, Lake Tonetta, Putnam Lake, Roaring Brook Lake, Secor Lake, White Pond, Wiccopee Reservoir	11 confirmed blooms in Putnam County

Source: (NYS GIS 2025)

12.1.5 Probability of Future Occurrences

HABs are an annual occurrence in Putnam County. Information on previous HAB occurrences in the County was used to calculate the probability of future occurrence of such events. Based on these records and input from the Steering Committee, the probability of occurrence for HAB in the County is considered “likely.”

12.1.6 Cascading Impacts on Other Hazards

HABs cause increased water quality degradation. This may put strains on water needs and may worsen during drought conditions when water is already scarce or over-utilized.



12.2 VULNERABILITY AND IMPACT ASSESSMENT

12.2.1 Life, Health, and Safety

Overall Population

Impacts of HABs on life, health, and safety can result if residents and tourists become exposed to waters containing HABs. Routes of exposure include consumption, inhalation, and dermal exposure. The population living near or visiting water bodies is at risk for exposure, including those that use the water bodies for recreation, fishing, or water supply. Contact with water containing HABs can cause various health effects including diarrhea, nausea or vomiting; skin, eye, or throat irritation; and allergic reactions or breathing difficulties (NYS DOH n.d.).

Socially Vulnerable Population

Socially vulnerable populations may be more susceptible to HAB events based on their physical ability to react and recover after HAB exposure. Vulnerable populations include homeless persons, people over 65 years old, low income or linguistically isolated populations, people with life-threatening illnesses, individuals under the age of five, and residents with limited access to healthcare. Some of these populations are more likely to need medical attention for pre-existing conditions and may not have the capacity to respond or recover quickly from HAB exposure.

12.2.2 General Building Stock

A HAB event is not expected to directly affect any structures within the County.

12.2.3 Community Lifelines and Other Critical Facilities

When a HAB event occurs within the County, drinking water can become unsafe for consumption, which puts a strain on drinking water treatment costs. Water treatment facilities within the County may need to implement additional treatment procedures and invest in advanced monitoring technologies to mitigate the impacts of HABs on drinking water supplies. Additionally, a potential financial strain on water treatment facilities will lead to higher water utility bills for County residents.

12.2.4 Economy

Overall, Putnam County may experience the greatest economic impact from HAB events in its tourism sector. News of a closure of a body of water or beach can result in tourists avoiding the area. Even after closures are lifted, negative public reaction can persist and continue to impact tourism revenue and property values.

Recreational fishing is popular along the bodies of water throughout the County, with several species stocked by the NYSDEC to enhance fishing opportunities and restore native species. Other recreational activities in the area include hunting, hiking, boating, bird watching, snowmobiling, canoeing, and camping. Property values, as residences are concentrated around the County's water bodies could also be impacted.



12.2.5 Natural Resources

HABs can release toxins that can kill fish and invertebrate. Animals that prey on fish and invertebrates in surface waters, such as birds and mammals, may be affected if they ingest impacted prey (CDC 2022a). Both harmful and non-harmful algal blooms can have drastic impacts on oxygen levels in surface waters. When the algae begin to die off following a bloom, bacteria starts to decompose the organic material which consumes dissolved oxygen and releases carbon dioxide. If the bloom and die off is large enough, dissolved oxygen levels in aquatic systems can rapidly crash which creates dead zones in the water. Anoxic conditions connected to algal blooms have resulted in large fish and invertebrate kills which can heavily impact a local aquatic ecosystem (NOAA 2023f).

12.2.6 Historic and Cultural Resources

HAB events have the potential to impact cultural and historical activities that rely on access to clean water and healthy aquatic environments, such as fishing practices, water-based community events, and cultural ceremonies. These impacts can negatively affect a community's cohesion and cultural identity, particularly among communities with a strong connection to the aquatic resources in the area.

12.3 FUTURE CHANGES THAT MAY AFFECT RISK

12.3.1 Potential or Planned Development

HABs could impact any areas of new development near vulnerable water bodies. As increased development is often associated with stormwater and runoff issues, HABs may become more likely in areas of increased development.

12.3.2 Projected Changes in Population

Changes in the density of the population can impact the number of people exposed to HAB and reliance upon water resources.

12.3.3 Climate Change

Climate change increases the severity and frequency of HABs by altering the salinity and temperature levels in water bodies, increasing carbon dioxide levels and changing precipitation events (EPA 2022). Toxic blue-green algae thrive on warm waters, which allow for the algae to float along the surface to absorb necessary sunlight for growth. Drought events are also increasing, which contribute to increased freshwater salinity levels. Saltier water bodies are allowing for toxic marine algae to invade freshwater systems, resulting in significant increase in fish kills since 2000 (EPA 2022). Higher levels of carbon dioxide are optimal for HABs, as toxic algae need carbon dioxide to survive and grow. The increase in carbon dioxide in both the atmosphere and water is leading to more frequent booms in algal growth.

Changes in precipitation due to climate change can impact the severity and intensity of storm events. As more rainfall-induced flooding occurs, increased runoff and pollution enters water body systems, which allows for toxic algae to multiply (EPA 2022).



13. SEVERE STORM

13.1 HAZARD PROFILE

13.1.1 Hazard Description

Severe storms in the County have damaged property and infrastructure, disrupted power, downed trees and power lines, and caused injuries and fatalities. The following sections describe the weather conditions addressed in this profile for the severe storm hazard.

Hailstorms

Hail forms inside a thunderstorm where there are strong updrafts of warm air and downdrafts of cold water. A water droplet freezes when it is picked up by the updrafts and carried well above the freezing level. When the frozen droplet falls, it can begin to thaw and then be picked up again by another updraft and carried back into the cold air to re-freeze. With each trip above and below the freezing level, the frozen droplet adds another layer of ice. Finally, frozen droplet, with many layers of ice, falls to the ground as hail (NOAA NSSL 2021b).

High Winds

Wind is the rough horizontal movement of air caused by uneven heating of the earth's surface. Wind occurs at all scales, from local breezes lasting a few minutes to global winds resulting from solar heating of the earth. High winds are often associated with severe storm events such as thunderstorms, tornadoes, hurricanes, and tropical storms (NWS 2012). The following are types of damaging straight-line winds (winds that do not rotate as tornadoes do) (NOAA n.d.-e):

- **Down draft**—A small-scale column of air that sinks toward the ground
- **Microburst**—An outward burst of relatively strong winds near the surface caused by a small, concentrated down draft
- **Macroburst**—An outward burst of strong winds that is more than 2.5 miles in diameter
- **Gust front**—Leading edge of rain-cooled air that clashes with a warm thunderstorm inflow
- **Derecho**—Long-lived windstorm associated with rapidly moving precipitation or thunderstorms with a wind damage swath of more than 240 miles and gusts of wind that reach 58 mph or greater

Hurricanes and Tropical Storms

Hurricanes, along with tropical depressions and tropical storms, are all forms of tropical cyclones, which are rotating, organized system of clouds and thunderstorms that originate over tropical or sub-tropical waters. A hurricane is a tropical cyclone that reaches wind speed of at least 74 mph.

Hurricanes develop in the Atlantic Ocean between the Lesser Antilles and the African coast, or in the warm tropical waters of the Caribbean and Gulf of Mexico. These storms may move up the Atlantic coast or through the the Gulf Coast states, bringing wind and rain as far north as New England before moving offshore and heading east. Almost all hurricanes in the Atlantic Basin form between June and November. August and September are peak months for hurricane development in the North Atlantic Basin (NHC 2020).



These storms are accompanied by heavy rain and strong winds. As a hurricane approaches, its strong winds cause waves to build up. These waves can extend far from the storm's center, impacting coastal areas even before landfall. Hurricane landfall is when the storm's center moves from over the ocean onto land, leading to a range of impacts:

- **Storm surge**—Storm surge is an abnormal rise of water generated by a storm, over and above the predicted astronomical tides. Storm surge occurs when water is pushed toward the shoreline by the force of winds from the storm. Friction between the water and the moving air creates drag that, depending upon the distance of water and velocity of the wind, can pile water up to depths greater than 20 feet from the shoreline inland. The rise in water level can cause extreme flooding in coastal areas, especially when storm surge coincides with normal high tide.
- **Wind damage**—The size of a hurricane-force wind field (with sustained wind speeds greater than 73 mph) is typically about 100 miles across. Hurricanes can also create microbursts—sudden and intense downdrafts—and mini swirls, which are localized wind bursts that can exceed speeds of 200 mph.
- **Rain**—Hurricanes often produce widespread, torrential rains in excess of 6 inches, which may result in deadly and destructive flooding. Rainfall amounts are not directly correlated with the storm's intensity, but rather with its speed and size; larger, slower-moving storms typically produce more precipitation.

Lightning

Lightning is a bright flash of electrical energy produced by a thunderstorm. The resulting clap of thunder is the result of a shock wave created by the rapid heating and cooling of the air in the lightning channel (NWS n.d.-b). There are four types of lightning:

- Cloud to sky lightning is a discharge jumping from a cloud into the surrounding sky.
- Intra-cloud lightning is the most common. Intra-cloud lightning occurs when oppositely charged centers within the same cloud ignite and cause a bright flash.
- Inter-cloud lightning occurs between oppositely charged areas of different clouds.
- Cloud to ground lightning is the most dangerous to people and therefore the most researched. It travels from the negative charge of the bottom of a cloud to the positively charged ground below.

On average, 55 people are killed and hundreds are injured each year by lightning strikes in the United States. Lightning can strike communications equipment (e.g., radio or cell towers, antennae, satellite dishes, etc.) and hamper communication and emergency response. Lightning strikes can also cause significant damage to buildings, critical facilities, and infrastructure, largely by igniting a fire. Lightning can also ignite a wildfire (NWS n.d.-b).

Thunderstorms

A thunderstorm is a local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder (NOAA NSSL n.d.-d). A thunderstorm forms from a combination of moisture, warm air, and a force capable of lifting the air, such as a warm or cold front, a sea breeze, or a mountain. Although thunderstorms generally affect a small area when they occur, they have the potential to become dangerous due to their ability to generate tornadoes, hailstorms, strong winds, flash flooding, and lightning. During the warm season, thunderstorms are responsible for most of the rainfall in the United States.

Typical thunderstorms are 15 miles in diameter and last an average of 30 minutes. The National Weather Service (NWS) considers a thunderstorm severe if it produces wind gusts of 58 mph or higher, hail 1 inch in diameter or larger, or tornadoes (NWS n.d.-c).



Tornadoes

A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground (NOAA 2011). A tornado becomes visible when it forms a condensation funnel made up of water droplets, dust, and debris. Tornadoes are the most violent of all atmospheric storms and the most hazardous when they occur in populated areas. Tornadoes can topple mobile homes, lift cars, snap trees, and turn objects into destructive missiles. Among the most unpredictable weather phenomena, tornadoes can occur at any time of day, in any state in the nation, and in any season. While most tornadoes cause little or no damage, some are capable of tremendous destruction with wind speeds potentially exceeding 200 mph (NOAA 2023b).

From 1996 to 2023, an average of 18 tornadoes occurred each year in the state, causing 317 injuries and 27 fatalities (NOAA n.d.-d).

13.1.2 Location

Hailstorms

Hailstorms are most likely in areas that have the most thunderstorms, which feature the updrafts and downdrafts that lead to the formation of hail. Smaller hailstones may be blown away from the updraft by horizontal winds, so larger hail typically falls closer to the updraft than smaller hail (NOAA n.d.-f).

High Winds

The entire County is subject to high winds from severe storm events.

Hurricanes and Tropical Storms

All locations along the U.S. East and Gulf coasts are vulnerable to storm surges associated with hurricanes and tropical storms. Storm surge can even travel up rivers and canals, reaching well inland from the coastline.

Lightning

Tall objects such as trees, mountains, and skyscrapers are more likely than the surrounding ground to be struck by lightning. Lightning generally starts within a cloud and may develop a channel downward toward the surface. When the channel gets less than a hundred yards from the ground, tall objects like trees and buildings start sending up sparks to meet it. When one of the sparks connects to the downward developing channel, an electric current surges rapidly down the channel to the object that produced the spark. (NOAA n.d.-b).

Thunderstorms

Thunderstorms affect relatively small, localized areas, rather than large regions like those affected by winter storms or hurricanes (NOAA 2023c). Thunderstorms can strike anywhere in Putnam County.

Tornadoes

The entire State of New York is susceptible to tornado activity and impacts. The County can experience a tornado at any time when suitable conditions are present.



13.1.3 Extent

Hailstorms

Hail can exhibit a variety of sizes, though only the largest hail stones pose serious risk to people. The size is often estimated by comparing it to a known object, such as a pea or golf ball. Most hailstorms are made up of a mix of sizes (NOAA NSSL 2021a). The NWS considers a weather event to be severe if hailstones exceed 1 inch in diameter.

High Winds

Table 13-1 describes wind levels used by the NWS and their associated sustained wind speed.

Table 13-1. NWS Wind Descriptions

Descriptive Term	Sustained Wind Speed (mph)
Strong, dangerous, or damaging	≥40
Very windy	30–40
Windy	20–30
Breezy, brisk, or blustery	15–25
None	5–15 or 10–20
Light or light and variable wind	0–5

Source: (NWS 2009c)

The NWS issues advisories and warnings when wind speeds can pose a hazard or are life threatening. The NWS wind warnings and advisories for New York State are as follows (NWS n.d.-f):

- **Wind Advisories** are issues when sustained winds of 30 to 39 mph are forecast for one hour or longer, or wind gusts of 46 to 57 mph for any duration.
- **High Wind Warnings** are issued when sustained wind speeds of 40 mph or greater lasting for one hour or longer or winds of 58 mph or greater for any duration or widespread damage are possible.

Hurricanes and Tropical Storms

The wind gust speed is a primary determinant of wind damage from a hurricane. Hazus estimates peak wind gust speeds for hurricanes based on the mean return period (MRP) of the event. Figure 13-1 and Figure 13-2 show peak wind gust speeds across Putnam County for the 100-year and 500-year MRP events. Most of the County would experience peak wind gusts of 50 to 75 mph for the 100-year MRP event, with lower speeds in the northeast part of the county. The 500-year MRP event would have peak wind gusts of 100 to 125 mph over the central County, with slightly lower speeds on the east and west sides of the County.

Hurricane magnitude is measured using the Saffir-Simpson Hurricane Scale, which rates storms from Category 1 to Category 5 (from least to most severe) based on a sustained wind speed (which is generally lower than the wind gust speed described above). As shown in Table 13-2, this scale includes estimates of potential property damage and flooding expected when a hurricane makes landfall. Hurricanes at Category 3 and higher are considered major hurricanes, with potential for significant damage and loss of life. Category 1 and 2 storms are still dangerous and require preventive measures (NOAA 2023e). Putnam County has been impacted in the past by hurricanes up to Category 3, but has only been intersected by a Category 1 hurricane's track (NOAA 2026).



Figure 13-1. 100-Year Peak Wind Gusts for Putnam County

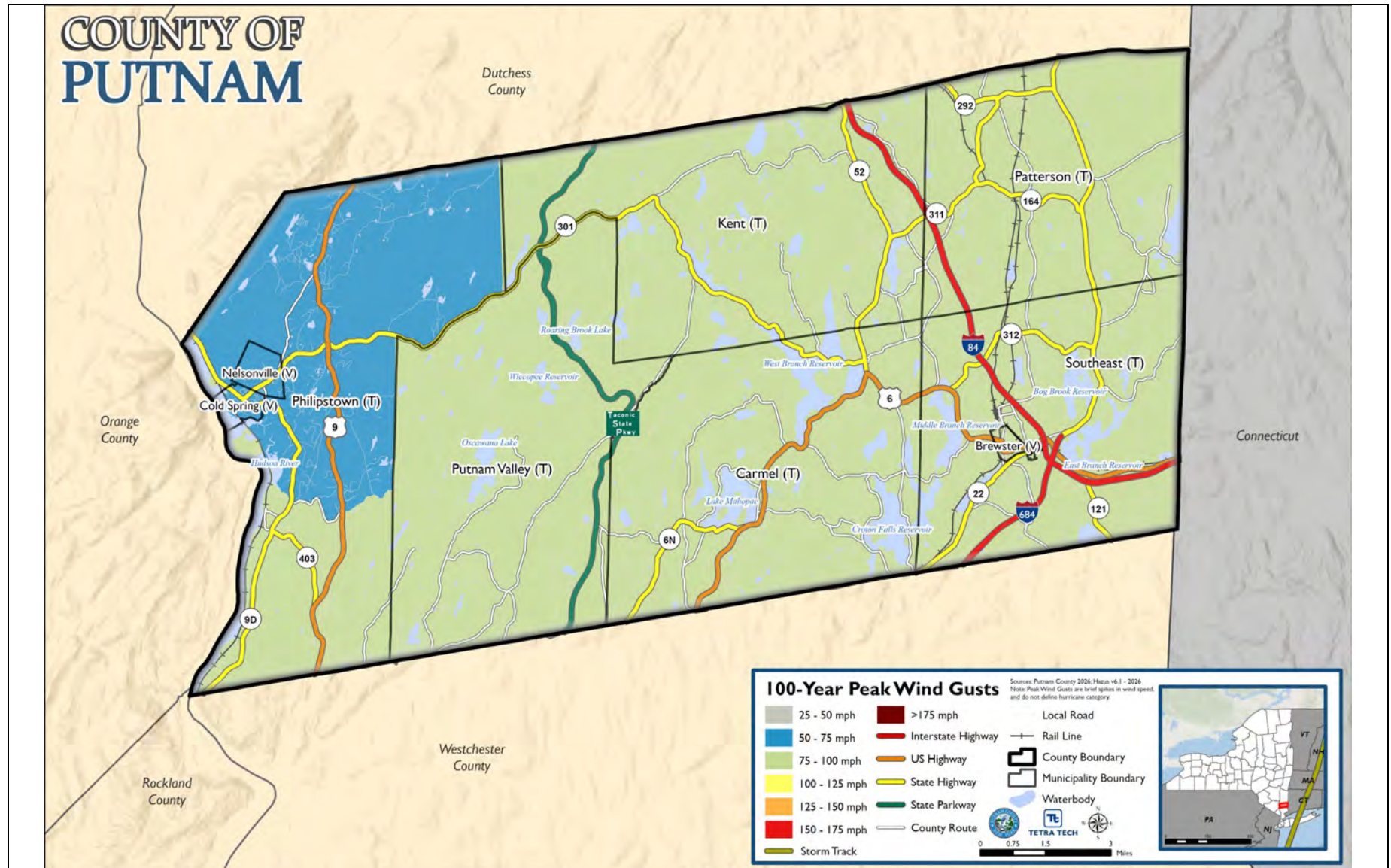




Figure 13-2. 500-Year Peak Wind Gusts for Putnam County

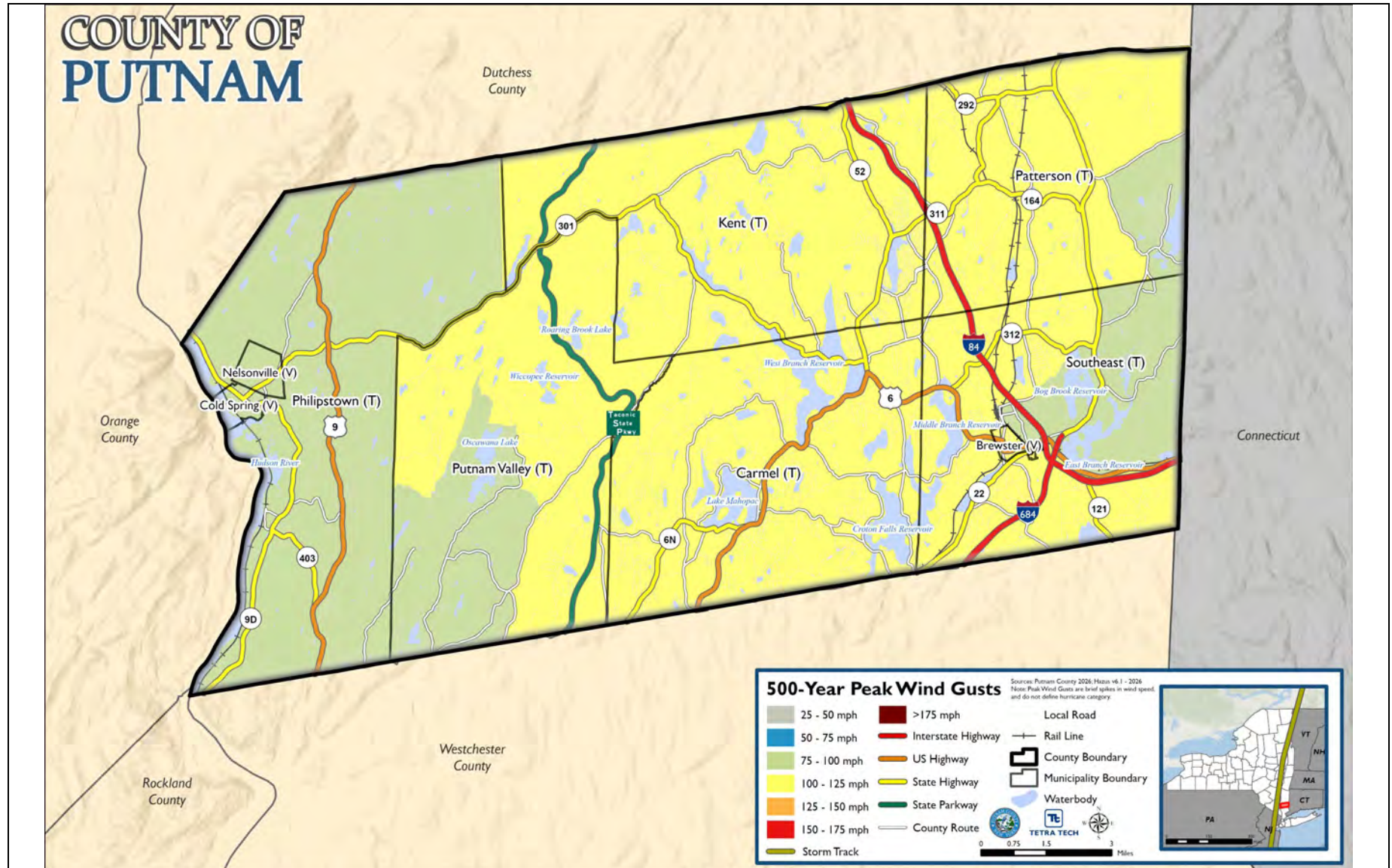




Table 13-2. The Saffir-Simpson Hurricane Scale

Category	Sustained Wind Speed (mph)	Expected Damage
1	74 to 95	Very dangerous winds will produce some damage: Homes with well-constructed frames could have damage to roof, shingles, vinyl siding, and gutters. Large tree branches will snap and shallow-rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96 to 110	Extremely dangerous winds will cause extensive damage: Homes with well-constructed frames could sustain major roof and siding damage. Many shallow-rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111 to 129	Devastating damage will occur: Homes with well-built frames may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130 to 156	Catastrophic damage will occur: Homes with well-built frames can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	>157	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: (NOAA 2023e)

Lightning

Lightning severity is determined by the frequency of lightning strikes during a storm. The Lightning Activity Level Guide (LAL) is a scale 1 to 6 based on intensity and cloud configurations.

- LAL 1—No thunderstorms.
- LAL 2—Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud-to-ground strikes in a 5-minute period.
- LAL 3—Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud-to-ground strikes in a 5-minute period.
- LAL 4—Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud-to-ground strikes in a 5-minute period.
- LAL 5—Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud-to-ground strikes in a 5-minute period.
- LAL 6—Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with Red Flag Warning.

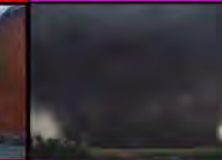
Lightning strikes in New York State average 3.8 strikes per square mile each year (NYCEM n.d.-a)



Thunderstorms

The NWS has five risk categories for thunderstorms expressing the best estimate of a severe storm event occurring within 25 miles of a point, as shown in Figure 13-3 (NWS 2022).

Figure 13-3. Severe Thunderstorm Risk Categories

THUNDERSTORMS (no label)	1 - MARGINAL (MRGL)	2 - SLIGHT (SLGT)	3 - ENHANCED (ENH)	4 - MODERATE (MDT)	5 - HIGH (HIGH)
No severe* thunderstorms expected	Isolated severe thunderstorms possible	Scattered severe storms possible	Numerous severe storms possible	Widespread severe storms likely	Widespread severe storms expected
Lightning/flooding threats exist with <u>all</u> thunderstorms	Limited in duration and/or coverage and/or intensity	Short-lived and/or not widespread, isolated intense storms possible	More persistent and/or widespread, a few intense	Long-lived, widespread and intense	Long-lived, very widespread and particularly intense
					
• Winds to 40 mph • Small hail	• Winds 40-60 mph • Hail up to 1" • Low tornado risk	• One or two tornadoes • Reports of strong winds/wind damage • Hail ~1", isolated 2"	• A few tornadoes • Several reports of wind damage • Damaging hail, 1 - 2"	• Strong tornadoes • Widespread wind damage • Destructive hail, 2" +	• Tornado outbreak • Derecho

Source: (NWS 2022)

The local NWS office and the NOAA Storm Prediction Center issue watches and warnings for severe thunderstorms as follows (NWS 2020):

- **Special Weather Statement**—Issued for strong storms that are below severe levels but may have impacts. Usually reserved for the threat of wind gust of 40 to 58 mph with no hail larger than 1 inch in diameter.
- **Severe Thunderstorm Watch**—Severe thunderstorms with large hail, damaging winds, and/or tornadoes are possible, but the exact time and location of storm development is uncertain. A watch means be prepared for storms.
- **Severe Thunderstorm Warning**—A severe thunderstorm is imminent or occurring; it is either detected by weather radar or reported by storm spotters. A severe thunderstorm is one that produces winds 58 mph or stronger and/or hail 1 inch in diameter or larger. A warning means to take shelter.

Tornadoes

The Enhanced Fujita Scale (EF-Scale) is the standard used to measure the strength of a tornado. It assigns a rating based on wind speeds and related damage. When tornado-related damage is surveyed, it is compared to a list of damage indicators and degrees of damage to estimate the range of wind speeds produced by the tornado. From that, a rating is assigned from EF0 to EF5, representing increasing degrees of damage. The EF-Scale considers how most structures are designed (NWS n.d.-d). Figure 13-4 illustrates the relationship between EF ratings, wind speed, and expected tornado damage. The County may experience tornadoes that range from EF0 to EF1.

Figure 13-4. Explanation of EF-Scale Ratings

EF Rating	Wind Speeds	Expected Damage	
EF-0	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.	
EF-1	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.	
EF-2	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.	
EF-3	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.	
EF-4	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.	
EF-5	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.	

Source: (NWS 2015)

The NOAA Storm Prediction Center issues watch and warning alerts for tornadoes (NOAA NSSL n.d.-c).

- A tornado watch is when conditions are favorable for a tornado to form. A watch can cover parts of a state or span several states.
- A tornado warning is when a tornado is spotted by a radar, and action should be taken to ensure safety and shelter.

The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible (NWS n.d.-e).

13.1.4 Previous Occurrences

FEMA Disaster Declarations

Table 13-3 lists all severe storm-related presidentially declared disasters that have included Putnam County.

**Table 13-3. FEMA Disaster Declarations for Severe Storm Events in Putnam County**

Event Date	Declaration Date	Declaration Number	Description
September 16 – 18, 1999	September 18, 1999	EM-3149, DR-1296	Hurricane Floyd
May 13 – June 17, 2004	August 3, 2004	DR-1534	Severe storms and flooding
April 2 – 4, 2005	April 19, 2005	DR-1589	Severe storms and flooding
April 14 – 18, 2007	April 24, 2007	DR-1692	Severe storms and inland and coastal flooding
August 25 – September 5, 2011	August 31, 2011	EM-3328, DR-4020	Hurricane Irene
October 27 – November 8, 2012	October 30, 2012	EM-3351, DR-4085	Hurricane Sandy
August 4, 2020	October 2, 2020	DR-4567	Tropical Storm Isaias
August 21 – 24, 2021	August 22, 2021	EM-3565	Hurricane Henri
September 1 – 3, 2021	September 5, 2021	EM-3572, DR-4615	Remnants of Hurricane Ida
July 9 – 10, 2023	Jul 22, 2023	DR-4723	Severe storms and flooding

Source: (FEMA 2026b)

USDA Declarations

Table 13-4 lists severe storm-related USDA agricultural disaster declarations that have included Putnam County.

Table 13-4. USDA Declarations for Severe Storm Events in Putnam County

Event Date	USDA Declaration Number	Description
May 1, 2013	S3593	Excessive rain and related flooding, high winds, and hail
April 1, 2014	S3747	Excessive rain, flash flooding, flooding, high winds, and hail
May 15, 2018	S4366	Excessive and strong winds, hail, lightning, and tornado
July 23, 2018	S4479	Excessive precipitation
August 1, 2018	S4478	Excessive rainfall
June 13, 2023	S5607, S5641	Flash flooding and excessive rain
July 2, 2023	S5482	Excessive rain
August 5, 2024	S5875	Hurricane Debby

Source: (USDA 2026)

All Recent Events

Table 13-5 lists major recorded severe storm-related events that impacted Putnam County since the previous HMP was developed. For earlier events, refer to the previous HMP.



Table 13-5. Severe Storm Events in Putnam County (2020 to 2025)

Event Date	Location Impacted	Description (Including Disaster Declaration Where Applicable)
April 13, 2020	Countywide	Deep low pressure passed to the west of the area resulting in high winds. A tree was reported down on U.S. 6 eastbound in Carmel; a tree and wires laid across NY 9D in both directions north of Main Street in Cold Spring.
May 15, 2020	Countywide	Severe thunderstorms moved through interior southeastern New York. Multiple trees and power lines were down along Route 9 in Philipstown.
August 4, 2020	Countywide	Hurricane Isaias—weakened to Tropical Storm strength and with sustained wind speeds from 35 to 55 mph and gusts of 60 to 80 mph—caused widespread wind damage and power outages. Rainfall amounts of 1/2 to 4-1/2 inches were observed across the Lower Hudson Valley. The winds resulted in numerous trees and tree limbs being downed, power outages, damage to homes and automobiles, and disruption to mass transit. Disaster declaration DR-4567
August 21 – 24, 2021	Countywide	Hurricane Henri brought heavy rains, flooded roadways, strong winds, and downed trees and utility lines in Putnam County. Disaster declaration EM-3565
August 27, 2020	Countywide	Numerous severe thunderstorms occurred across southeastern New York. Numerous trees were snapped and uprooted, and power lines were downed.
August 11, 2021	Countywide	Severe thunderstorms occurred across southeastern New York. Wires were downed near Maple Terrace and Ceder Street in Nelsonville.
September 1 – 3, 2021	Countywide	The remnants of Hurricane Ida brought heavy rains, flooded roadways, strong winds, and downed trees and utility lines in Putnam County. Disaster declarations EM-3572, DR-4615
November 13, 2021	Countywide	Strong to severe thunderstorms impacted southeastern New York. Hail of 1 inch in diameter was reported.
July 21, 2022	Countywide	Severe thunderstorms occurred in southeastern New York. A tree down caused a road closure on NY 22 northbound at Reed Farm Drive in Southeast; all lanes were blocked.
December 23, 2022	Countywide	High winds occurred over southeastern New York. A tree was reported down on Route 121 southbound at Red Fox Lane in Southeast. This blocked one lane.
June 2, 2023	Countywide	Severe thunderstorms produced large hail and damaging winds. One inch hail was reported near Thunder Ridge in Patterson.
June 13, 2023	Countywide	A USDA agricultural disaster declaration was declared as a result of several drenching downpours from recent storms. Disaster declarations S5607, S5641
July 2 – 3, 2023	Countywide	Severe thunderstorms produced damaging wind gusts and large hail as they moved through southeastern New York. A tree was reported down on Taconic State Parkway southbound south of exit 25, Peekskill Hollow Road in Carmel. Disaster declaration S5482
July 9 – 10, 2023	Countywide	Severe storms and flooding occurred across Putnam County. Disaster declaration DR-4723
August 12, 2023	Countywide	Severe thunderstorms produced damaging wind gusts. Downed trees impacted roadways and wires, causing traffic problems and power outages.
September 8, 2023	Countywide	Thunderstorms moved through southeastern New York. A tree fell on a school bus on Agor Lane in Carmel with 25 children and a driver inside; no injuries were reported.
December 18, 2023	Countywide	Storms produced high winds over southeastern New York. Trees were downed across Putnam County.



Event Date	Location Impacted	Description (Including Disaster Declaration Where Applicable)
May 23, 2024	Countywide	Isolated thunderstorms produced damaging winds and large hail. Multiple trees were reported down across the south portion of Carmel on Stoneleigh Avenue, Drewville Road, Weber Hill Road, and Seminary Hill Road near Willow Road.
June 23, 2024	Countywide	Thunderstorms become severe, producing damaging winds across southeastern New York. Trees and wires were reported down across the County. Trees fell on houses in Southeast and Patterson. A tree fell on a car in Carmel, resulting in one injury.
June 26, 2024	Countywide	Showers and thunderstorms produced damaging winds across southeastern New York. Trees were downed across the County.
July 17, 2024	Countywide	Severe thunderstorms produced damaging wind gusts across southeastern New York. Trees and wires were downed across the County.
August 9, 2024	Countywide	The remnants of tropical system Debby produced strong winds over southeastern New York. Trees and wires were downed across the County. Disaster declaration S5875

Source: (FEMA 2026b); (USDA 2026); (NOAA NCEI 2026)

13.1.5 Probability of Future Occurrences

Information on previous severe storm occurrences in the County was used to calculate the probability of future occurrence of such events. Based on these records and input from the Steering Committee, the probability of occurrence for severe storm in the County is considered “highly likely.”

13.1.6 Cascading Impacts on Other Hazards

Severe storms can create cascading impacts that intensify other natural hazards. Collectively, the elements of severe storms can amplify the occurrence and severity of wildfires and floods. Hail and high winds can damage infrastructure and power lines, leading to power outages. Lightning often ignites wildfires, especially in dry areas. Thunderstorms and tornadoes can cause flooding through heavy rainfall. Tornadoes can directly destroy infrastructure, compounding recovery challenges.

13.2 VULNERABILITY AND IMPACT ASSESSMENT

A qualitative assessment was performed to evaluate what assets are vulnerable to the extreme storm hazard. To provide a range of loss estimates due to wind impacts, a probabilistic assessment was conducted for the 100-year and 500-year MRP wind event through an advanced analysis in Hazus.

13.2.1 Life, Health, and Safety

Overall Population

All County residents are at risk from severe storm events. The impacts of extreme wind events—such as downed trees, damaged buildings, and debris carried by high winds—can lead to injury or loss of life.



The Hazus analysis found that no persons will be displaced from their homes or will require shelter as a result of the 100-year MRP hurricane wind event in Putnam County; however, during the 500-year MRP wind event 34 households will be displaced and 26 persons will seek short-term shelter. Table 13-6 summarizes these results.

Table 13-6. Displaced Persons as a Result of the 100- and 500-Year MRP Hurricane Wind Event

Jurisdiction	Total Population 2024 ACS	100-Year MRP Wind Event		500-Year MRP Wind Event	
		Displaced Households	Persons Seeking Short- Term Shelter	Displaced Households	Persons Seeking Short- Term Shelter
Brewster (V)	2,512	0	0	1	1
Carmel (T)	33,837	0	0	18	13
Cold Spring (V)	1,863	0	0	0	0
Kent (T)	12,896	0	0	5	3
Nelsonville (V)	714	0	0	0	0
Patterson (T)	11,560	0	0	1	1
Philipstown (T)	7,302	0	0	0	0
Putnam Valley (T)	11,755	0	0	3	3
Southeast (T)	15,668	0	0	6	5
Putnam County (Total)	98,107	0	0	34	26

Hazus v6.1; U.S. Census Bureau 2020, 2024 ACS

Socially Vulnerable Population

Some populations are more susceptible to severe storm events based on their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Populations are at risk if power loss results in interruption of heating and cooling services, stagnated hospital operations, or potable water supplies. Populations most at risk from these events include the following (CDC 2022b, CDC 2005):

Meteorologists can accurately forecast extreme heat development and the severity of the associated conditions with several days of lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations, implement short-term emergency response actions, and focus on surveillance and relief efforts for those at greatest risk.

13.2.2 General Building Stock

Storm damage to buildings is dependent on storm duration, wind speed, the path of the storm, and building construction. Wood and masonry construction that is most common for residential structures tends to experience more damage than concrete or steel buildings that are more common for commercial uses.

The Hazus wind model was run to estimate potential damage to buildings, based on the wind damage categories described in Table 13-7. Table 13-8 summarizes building damage levels as a result of the 100- and 500-year MRP hurricane wind events for each municipality. Most of the impacted buildings are in the residential occupancy class for both events. Analysis of the 100-year MRP event did not indicate any buildings incurring severe damage or complete destruction. For the 500-year MRP event, severe damage is predicted for 15 buildings and destruction for 19 buildings.



Table 13-7. Description of Damage Categories

Damage Category	Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
No Damage or Very Minor Damage	Little or no visible damage from the outside. No broken windows or failed roof deck. Minimal loss of roof cover, with no or very limited water penetration.	≤2%	No	No	No	No	No
Minor Damage	Maximum of one broken window, door, or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.	>2% and ≤15%	One window, door, or garage door failure	No	<5 impacts	No	No
Moderate Damage	Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.	>15% and ≤50%	> 1 and ≤ the larger of 20% or 3	1 to 3 panels	Typically 5 to 10 impacts	No	No
Severe Damage	Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.	>50%	> the larger of 20% or 3 and ≤50%	>3 and ≤25%	Typically 10 to 20 impacts	No	No
Destruction	Complete roof failure and/or failure of wall frame. Loss of more than 50 percent of roof sheathing.	Typically >50%	>50%	>25%	Typically >20 impacts	Yes	Yes

Source: (FEMA 2024)

Table 13-8. Building Damage Levels from the 100-Year and 500-Year MRP Hurricane Wind Events

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	100-Year MRP Wind Event		500-Year MRP Wind Event	
			Building Count	Percent Buildings in Occupancy Class	Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	31,068	None	30,391	97.8%	26,524	85.4%
		Minor	658	2.1%	4,137	13.3%
		Moderate	19	0.1%	376	1.2%
		Severe	0	0.0%	12	0.0%
		Destruction	0	0.0%	19	0.1%
Commercial Buildings	6,834	None	6,695	98.0%	6,180	90.4%
		Minor	120	1.8%	510	7.5%
		Moderate	19	0.3%	141	2.1%
		Severe	0	0.0%	3	0.0%
		Destruction	0	0.0%	0	0.0%



Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	100-Year MRP Wind Event		500-Year MRP Wind Event	
			Building Count	Percent Buildings in Occupancy Class	Building Count	Percent Buildings in Occupancy Class
Industrial Buildings	189	None	184	97.4%	169	89.4%
		Minor	4	2.1%	16	8.5%
		Moderate	1	0.5%	4	2.1%
		Severe	0	0.0%	0	0.0%
		Destruction	0	0.0%	0	0.0%
Government, Religion, Agricultural, and Education Buildings	540	None	530	98.1%	493	91.3%
		Minor	9	1.7%	35	6.5%
		Moderate	1	0.2%	12	2.2%
		Severe	0	0.0%	0	0.0%
		Destruction	0	0.0%	0	0.0%

Source: Hazus v6.1; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024

Note: The number of damaged buildings may be over or under estimated.

Table 13-9 and Table 13-10 summarize the Hazus results of damage by dollar amount for the 100-year and 500-year MRP hurricane wind events, respectively. For the 100-year event, Hazus estimates \$32 million in damage to structures, with residential damage making up 87 percent of that. For the 500-year event, Hazus estimates \$126 million in damage to structures, with residential damage making up 84 percent of the total.

Table 13-9. Building Losses Caused by the 100-Year MRP Hurricane Wind Event

Jurisdiction	Building Loss—100-Year MRP Wind Event				
	All Occupancies	Residential	Commercial	Industrial	Other
Brewster (V)	\$545,275	\$443,561	\$66,009	\$6,905	\$28,800
Carmel (T)	\$11,815,326	\$10,292,241	\$1,031,886	\$36,945	\$454,255
Cold Spring (V)	\$162,790	\$140,843	\$11,340	\$475	\$10,132
Kent (T)	\$3,790,225	\$3,547,413	\$148,659	\$5,426	\$88,727
Nelsonville (V)	\$60,507	\$52,346	\$4,212	\$177	\$3,773
Patterson (T)	\$4,351,409	\$3,673,453	\$263,428	\$23,056	\$391,472
Philipstown (T)	\$1,227,217	\$1,088,390	\$90,321	\$965	\$47,541
Putnam Valley (T)	\$2,509,645	\$2,330,078	\$120,653	\$1,749	\$57,165
Southeast (T)	\$7,877,047	\$6,519,076	\$924,761	\$113,864	\$319,347
Putnam County (Total)	\$32,339,441	\$28,087,401	\$2,661,268	\$189,562	\$1,401,211

Source: Hazus v6.1; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; RSMears 2026

Note: Other = Government, Religion, Agricultural, and Education

**Table 13-10. Building Losses Caused by the 500-Year MRP Hurricane Wind Event**

Jurisdiction	Building Loss—500-Year MRP Wind Event				
	All Occupancies	Residential	Commercial	Industrial	Other
Brewster (V)	\$1,592,227	\$1,239,670	\$230,653	\$24,161	\$97,743
Carmel (T)	\$50,466,419	\$41,897,942	\$5,873,906	\$198,468	\$2,496,103
Cold Spring (V)	\$1,286,630	\$1,030,124	\$124,955	\$5,692	\$125,859
Kent (T)	\$17,417,466	\$15,621,858	\$1,044,889	\$35,884	\$714,835
Nelsonville (V)	\$478,357	\$382,947	\$46,426	\$2,119	\$46,865
Patterson (T)	\$12,631,775	\$10,018,245	\$1,065,684	\$109,571	\$1,438,274
Philipstown (T)	\$7,721,301	\$6,483,315	\$792,024	\$11,315	\$434,647
Putnam Valley (T)	\$13,627,052	\$12,175,591	\$968,313	\$13,987	\$469,162
Southeast (T)	\$20,368,703	\$16,053,185	\$2,896,186	\$383,116	\$1,036,216
Putnam County (Total)	\$125,589,930	\$104,902,877	\$13,043,036	\$784,313	\$6,859,704

Source: Hazus v6.1; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; RSMMeans 2026

Note: Other = Government, Religion, Agricultural, and Education

13.2.3 Community Lifelines and Other Critical Facilities

The potential impacts of severe storm events on critical facilities include the following:

- High winds can cause direct structural damage, damage from falling tree limbs or flying debris, and loss of power.
- Emergency personnel such as police, fire, and emergency medical services (EMS) will not be able to effectively respond in a power loss event to maintain the safety of the population. Backup power is recommended for critical facilities and infrastructure.

Hazus estimates the probability that critical facilities may sustain damage as a result of the 100- and 500-year MRP hurricane wind events. Additionally, Hazus estimates the loss of use for each facility in number of days.

As shown in Table 13-11, Hazus estimates a low average probability of critical facilities experiencing minor damage from the 100-year MRP hurricane wind event, ranging from less than 0.1 percent to 6.2 percent across lifeline categories. The average probability of moderate damage ranges from less than 0.1 percent to 1 percent across lifeline categories. The average probability of severe or complete damage is negligible.

As shown in Table 13-12, Hazus estimates a somewhat higher average probability that critical facilities will incur minor damage from the 500-year MRP hurricane wind event, ranging from 0.3 percent to 25.5 percent across lifeline categories. The average probability of moderate damage is much lower, ranging from less than 0.1 percent to 8.2 percent. The average probability of severe or complete damage is negligible.

The Hazus analysis did not identify any facilities experiencing loss of days due to wind damage for either of the modeled hurricane wind events.



Table 13-11. Probability of Damage to Critical Facilities for the 100-Year MRP Hurricane Wind Event

Lifeline ^a	Loss of Days ^b	Average % Probability of Sustaining Damage, 100-Year MRP Wind Event			
		Minor	Moderate	Severe	Complete
Communications	-	6.2%	1.0%	0.0%	0.0%
Energy	-	0.8%	0.1%	0.0%	0.0%
Food, Hydration, Shelter	-	0.8%	0.1%	<0.1%	0.0%
Hazardous Materials	-	3.1%	0.6%	0.1%	<0.1%
Health and Medical	0	0.3%	<0.1%	0.0%	0.0%
Safety and Security	0	4.9%	0.7%	0.0%	0.0%
Transportation	-	<0.1%	<0.1%	<0.1%	<0.1%
Water Systems	-	2.4%	0.2%	0.0%	0.0%

Source: Hazus v6.1; Putnam County 2021, 2026; NYS GIS Clearinghouse 2026; NYSDEC 2025 – 2026; ESRI 2026; NYS Board of Elections 2025; HIFLD 2025

a. Results shown exclude critical facilities not categorized as community lifelines.

b. Only essential facilities are analyzed for loss of days.

Table 13-12. Probability of Damage to Critical Facilities for the 500-Year MRP Hurricane Wind Event

Lifeline ^a	Loss of Days ^b	Average % Probability of Sustaining Damage, 500-Year MRP Wind Event			
		Minor	Moderate	Severe	Complete
Communications	-	25.5%	8.2%	0.1%	0.0%
Energy	-	2.8%	0.7%	<0.1%	0.0%
Food, Hydration, Shelter	-	3.8%	0.6%	<0.1%	0.0%
Hazardous Materials	-	11.0%	4.4%	1.8%	0.1%
Health and Medical	0	1.7%	0.4%	0.0%	0.0%
Safety and Security	0	19.9%	6.8%	0.1%	0.0%
Transportation	-	0.3%	<0.1%	<0.1%	0.0%
Water Systems	-	9.6%	1.6%	<0.1%	0.0%

Source: Hazus v6.1; Putnam County 2021, 2026; NYS GIS Clearinghouse 2026; NYSDEC 2025 – 2026; ESRI 2026; HIFLD 2025

a. Results shown exclude critical facilities not categorized as community lifelines.

b. Only essential facilities are analyzed for loss of days.



13.2.4 Economy

Severe storm events can have short- and long-lasting impacts on the economy. Overall, economic impacts include the loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings. Specific potential impacts of severe storm events on critical facilities include the following:

- Utility infrastructure damage (power lines, gas lines, electrical systems) can result in a loss of power, which can impact business operations.
- When a business is closed during storm recovery, there is lost economic activity in the form of day-to-day business and wages to employees.
- Business owners may be faced with costs associated with repairs to damaged buildings or higher than normal utility bills.
- Impacts on transportation lifelines affect the economy's travel-related functions such as day-to-day commuting and transport of goods.

Debris management can also impact the local economy. Hazus estimated the amount of building and tree debris that may be produced as a result of the 100- and 500-year MRP hurricane wind events, as summarized in Table 13-13 and Table 13-14, Hazus estimates that the 100-year MRP wind event may result in 2,348 tons of brick and wood debris and 32,715 tons of tree debris. The 500-year MRP event may result in 12,087 tons of brick and wood debris and 101,897 tons of tree debris. Because the Hazus hurricane wind estimates do not include debris generated by flooding, these are conservative estimates.

Table 13-13. Debris Created During the 100-Year MRP Hurricane Wind Event

JURISDICTION	Estimated Debris Created During the 100-Year MRP Wind Event			
	Brick and Wood (tons)	Concrete and Steel (tons)	Trees (tons)	Eligible Trees (tons)
Brewster (V)	52.5	0.0	196.0	137.9
Carmel (T)	828.5	0.0	7,347.7	3,200.1
Cold Spring (V)	10.9	0.0	0.0	0.0
Kent (T)	233.8	0.0	6,022.8	1,261.4
Nelsonville (V)	4.1	0.0	0.0	0.0
Patterson (T)	337.5	0.0	7,431.9	1,515.1
Philipstown (T)	71.0	0.0	527.9	105.2
Putnam Valley (T)	134.5	0.0	3,238.4	551.4
Southeast (T)	675.2	0.0	7,950.3	2,529.1
Putnam County (Total)	2,348.0	0.0	32,715.0	9,300.2

Source: Hazus v6.1; Putnam County 2025, 2026; NYSERDA 2026; NYS 2024

Note: "Trees" is the weight of all wind-generated tree debris. "Eligible Trees" is the weight of wind-generated tree debris that would likely be collected and disposed of at public expense.

**Table 13-14. Debris Created During the 500-Year MRP Hurricane Wind Event**

Jurisdiction	Estimated Debris Created During the 500-Year MRP Wind Event			
	Brick and Wood (tons)	Concrete and Steel (tons)	Trees (tons)	Eligible Trees (tons)
Brewster (V)	170.3	0.0	364.6	256.4
Carmel (T)	4,893.1	0.0	18,273.6	7,910.9
Cold Spring (V)	122.5	0.0	351.8	189.1
Kent (T)	1,665.3	0.0	20,616.8	3,638.7
Nelsonville (V)	45.5	0.0	127.4	70.1
Patterson (T)	1,195.4	0.0	12,986.6	2,602.2
Philipstown (T)	694.2	0.0	17,559.9	2,567.4
Putnam Valley (T)	1,267.8	0.0	18,189.7	3,686.6
Southeast (T)	2,032.8	0.0	13,426.6	4,257.8
Putnam County (Total)	12,087.0	0.0	101,897.0	25,179.2

Source: Hazus v6.1; Putnam County 2025, 2026; NYSERDA 2026; NYS 2024

Note: "Trees" is the weight of all wind-generated tree debris. "Eligible Trees" is the weight of wind-generated tree debris that would likely be collected and disposed of at public expense.

13.2.5 Natural Resources

Specific potential impacts of severe storm events on natural resources include the following:

- Severe storms that create long periods of rainfall can erode natural banks along waterways and degrade soil stability for terrestrial species.
- Tornadoes can tear apart habitats causing fragmentation across ecosystems (U.S. Environmental Protection Agency 2023).
- Researchers believe that a greater number of diseases will spread across ecosystems because of impacts that severe storms have on water supplies (U.S. Climate Resilience Toolkit 2016).

13.2.6 Historic and Cultural Resources

Severe storms can cause damage or destruction to the County's historical and cultural resources. Many historical buildings and homes are not built to modern building code standards to withstand high winds and are more vulnerable than other infrastructure. Specific potential impacts of severe storm events on historical and cultural resources include the following:

- Outdoor events are likely to be postponed or cancelled as the result of severe storm conditions.
- Cultural heritage sites, particularly those exposed to the elements, are subject to weathering.
- Lightning can increase the risk of ignition of fires and their propagation. Fire causes material loss and deformation of cultural heritage assets and may increase the probability of cracking or splitting in built structures.



13.3 FUTURE CHANGES THAT MAY AFFECT RISK

13.3.1 Potential or Planned Development

Any areas of growth could be impacted by the severe storm hazard, which poses risk to the entirety of the County. However, due to increased standards and codes, new development may be less vulnerable to the severe storm hazard than the aging building stock in the County.

13.3.2 Projected Changes in Population

Changes in population density can influence the number of people exposed to flood hazards and complicate evacuation during severe storm events. Historically, flooding has severely impacted transportation corridors, limiting access for emergency services and residents.

13.3.3 Climate Change

Anticipated future conditions may lead to an increase in the frequency and severity of extreme storms and rainfall. Major clusters of summertime thunderstorms in North America are anticipated to grow larger, more intense, and more frequent, unleashing far more rain and posing a greater threat of flooding across wide areas (NASA 2013). Heavy rainstorms are projected to happen more often and can become more intense, a change which has the potential to affect drinking water and increase delays and hazards related to extreme weather events (such as flooding).

An increase in storms will produce more wind events. An increase in temperature will provide more energy to produce storms that generate tornadoes (NASA 2013). Research also suggests that there is a greater risk of more off-season tornadoes in a warmer future, which suggests that more tornadic activity may occur when people are least expecting it (NOAA 2023d). With an increased likelihood of strong winds and tornado events, all the County's assets will experience additional risk for wind-related losses.

Winds and associated flooding from hurricanes and tropical storms are expected to increase. The number of hurricanes and tropical storms in the Atlantic basin may not increase, but storms that form are projected to be stronger and shift farther north (Stevens & Lamie 2024). The length of hurricane season is likely to expand due to rising water temperatures.



14. SEVERE WINTER STORM

14.1 HAZARD PROFILE

14.1.1 Hazard Description

A winter storm is a weather event in which the main types of precipitation are snow, sleet, or freezing rain, often with blowing snow and dangerous wind chills. The three basic components of a winter storm are as follows (NOAA NSSL n.d.-b):

- Moisture to form clouds and precipitation, such as air blowing across a large lake or the ocean
- A lifting force that raises moist air to form clouds and cause precipitation (such as warm air colliding with cold air and being forced to rise over the cold dome or air flowing up a mountainside)
- Below freezing air temperatures in the clouds and near the ground to make snow and ice

Some winter storms can immobilize an entire region, while others might affect only a single community. Potential impacts include cold temperatures, flooding, storm surge, closed and blocked roadways, downed utility lines, and power outages. The aftermath of a winter storm can have an impact on a community or region for days, weeks, or even months.

Putnam County's winter storms include blizzards, heavy snow, and ice storms, as described in the following sections.

Blizzard

A blizzard is a winter snowstorm with sustained wind or frequent wind gusts of 35 miles per hour (mph) or more over a 3-hour period, accompanied by falling or blowing snow reducing visibility to 0.25 miles or less. Extremely cold temperatures often are associated with blizzard conditions but are not part of the formal definition. The hazard created by the combination of snow, wind, and low visibility, significantly increases when temperatures are below 20 °F. A severe blizzard is categorized as having temperatures near or below 10 °F, winds exceeding 45 mph, and visibility reduced by snow to near zero.

Storm systems powerful enough to cause blizzards usually form when the jet stream dips far to the south, allowing cold air from the north to clash with warm, moist air from the south. Blizzard conditions often develop on the northwest side of an intense storm system. The difference between the lower pressure in the storm system and the higher pressure surrounding it creates a tight pressure gradient, resulting in strong winds and extreme conditions caused by the blowing snow (Lam 2019).

Heavy Snow

Snow is precipitation in the form of ice crystals. It originates in clouds when temperatures are below the freezing point (32 °F) and water vapor in the atmosphere condenses directly into ice without going through the liquid stage. Once an ice crystal has formed, it absorbs and freezes additional water vapor from the surrounding air, growing into a snow crystal or snow pellet, which then falls to the earth.



Snowflakes are clusters of ice crystals that form from a cloud (NOAA 2024). Snow pellets are opaque ice particles that form when ice crystals fall through super-cooled cloud droplets, which are below freezing but remain a liquid. The cloud droplets then freeze to the crystals.

Ice Storm

An ice storm is a damaging accumulation of ice—usually 0.25 inches or more—during freezing rain (FEMA n.d.-b). The accumulations of ice can bring down trees, power lines, utility poles, and communication towers. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians (Dolce 2012).

14.1.2 Location

New York State experiences abundant snowfall. Winter storms can reach the state as early as October and are usually in full force by late November. Inland regions of the state receive more snow than most other communities in the United States. Although the entire state is subject to winter storms, the easternmost and west-central portions of the state are the most likely to see such storms (NYS DHSES 2024). An area that is somewhat more vulnerable to severe winter storm is the floodplain, where a winter storm can cause flooding through blockage of streams or through snow melt.

14.1.3 Extent

The magnitude of a severe winter storm is defined by snowfall rates, wind speeds, temperatures, visibility, and storm duration. A severe winter storm can be classified by meteorological measurements and by societal impacts. NOAA's Regional Snowfall Index (RSI) rates significant snowstorms that impact the eastern two-thirds of the United States from 1 to 5, based on the spatial extent of the storm, the amount of snowfall, and the affected population. NOAA has assigned RSI values to over 500 storms since 1900 (NOAA n.d.-a). Table 14-1 presents the five RSI ranking categories.

Table 14-1. RSI Ranking Categories

Category	Description	Regional Snowfall Index Value
1	Notable	1–3
2	Significant	3–6
3	Major	6–10
4	Crippling	10–18
5	Extreme	18.0+

Source: (NOAA n.d.-a)

The National Weather Service (NWS) classifies the magnitude of severe winter storms into five categories as shown in Table 14-2 (NWS 2021). The NWS also issues winter weather watches, warnings, and advisories as described in Figure 14-1 to help people know what to expect prior to an approaching storm (NWS 2021).



Table 14-2. Winter Storm Category Thresholds

Winter Storm Type	Threshold
Heavy Snowstorm	Accumulations of 4 inches or more of snow in a 6-hour period, or 6 inches of snow in a 12-hour period.
Sleet Storm	Significant accumulations of solid pellets that form from the freezing of raindrops or partially melted snowflakes causing slippery surfaces, posing a hazard to pedestrians and motorists.
Ice Storm	Significant accumulation of rain or drizzle freezing on objects (trees, power lines, roadways) as it strikes them, causing slippery surfaces and damage from sheer weight of ice accumulations.
Blizzard	Wind velocity of 35 mph or more, temperatures below freezing, considerable blowing snow with visibility frequently below one-quarter mile prevailing over an extended period.
Severe Blizzard	Wind velocity of 45 mph, temperatures of 10°F or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period.

Source: (NWS 2021)

Figure 14-1. Winter Storm Warning Thresholds



Source: (NWS 2021)

14.1.4 Previous Occurrences

FEMA Disaster Declarations

Table 14-3 lists the severe winter storm-related presidentially declared disasters that have included Putnam County.

USDA Declarations

Table 14-4 lists the single severe winter storm-related USDA agricultural disaster declaration that included Putnam County.



Table 14-3. FEMA Disaster Declarations for Severe Winter Storm Events in Putnam County

Event Date	Declaration Date	Declaration Number	Description
October 4, 1987	November 10, 1987	DR-801	Severe winter storm
March 13 – 17, 1993	March 17, 1993	EM-3107	Severe blizzard
January 6, 1996	January 12, 1996	DR-1083	Severe snowstorm
February 17, 2003	March 27, 2003	EM-3184	Snow
December 11, 2008	December 18, 2008	EM-3299	Severe winter storm

Source: (FEMA 2026b)

Table 14-4. USDA Declarations for Severe Winter Storm Events in Putnam County

Event Date	USDA Declaration Number	Description
January 1, 2015	S3886	Frost, freeze, and excessive snow

Source: (USDA 2026)

All Recent Events

Table 14-5 lists major recorded severe winter storm-related events that impacted Putnam County since the previous HMP was developed. For earlier events, refer to the previous HMP.

Table 14-5. Severe Winter Storm Events in Putnam County (2020 to 2025)

Event Date	Location Impacted	Description
December 16 – 17, 2020	Countywide	Snow changed to a mixture of sleet and rain. Temperatures fell significantly below freezing with snow returning. The storm significantly impacted travel during the evening commute on December 16 and the morning commute on December 17. Strong wind gusts also occurred with the storm.
February 1 – 3, 2021	Countywide	A major winter storm occurred with near blizzard conditions and snowfall rates of 1 to 3 inches per hour. Strong winds combined with these heavy snow rates to produce visibilities one quarter mile or less at times. Some warmer air caused the snow to change to sleet and some light rain. Colder air returned, changing all precipitation back to light snow. Snowfall totals ranged from 12 to 18 inches.
February 7, 2021	Countywide	Snowfall rates were around 1 to 2 inches per hour at times. Surrounding this moderate to heavy band was a steady snowfall through much of the day. Snowfall accumulation ranged from 4 to 5 inches of snow.
February 18 – 19, 2021	Countywide	Moderate to heavy snowfall mixed with sleet at times. The precipitation became light and changed to spotty freezing rain and freezing drizzle. Snowfall totals ranged from 3 to 5 inches.
February 22, 2021	Countywide	Moderate to locally heavy snow quickly transitioned to rain. 2.5 inches of snow was reported in Putnam Valley.
January 7, 2022	Countywide	Moderate snowfall occurred across the Lower Hudson Valley. 3 inches of snow was reported in Putnam Valley.
January 16 – 17, 2022	Countywide	Snowfall switched to a wintry mix, followed by rain. An estimated 3 to 6 inches of snow fell across Putnam County before a brief changeover to freezing rain, then to rain.



Event Date	Location Impacted	Description
January 28 – 29, 2022	Countywide	A nor'easter brought moderate snowfall with strong gusty winds across Putnam County. 4 inches of snow was reported in Putnam Valley, with a general 3 to 5 inches across the county.
February 13, 2022	Countywide	Snowfall occurred across southeastern New York. Impacts were minimal as the snow was wet and had difficulty sticking on cement surfaces. Snowfall amounts in and around Putnam County were at or close to 3 inches.
February 27 – 28, 2023	Countywide	Accumulating snowfall was reported across the county. Snowfall reports included 6.5 inches in Putnam Valley, 6.0 inches in Cold Spring, and 5.0 inches in Carmel Hamlet.
March 13 – 14, 2023	Countywide	Very heavy wet snow fell across Putnam County into the morning commute. 11.9 inches of snow was reported in Putnam Valley.
January 6 – 7, 2024	Countywide	An accumulating snow took place across southeastern New York. Putnam county reached winter storm criteria. Heavy snow was reported, with 6.5 inches in Cold Spring and 6.0 inches in Nelsonville.
February 13, 2024	Countywide	Heavy wet snow fell across Putnam County with amounts averaging well over warning criteria. Snowfall totals included 12.1 inches at Fahnestock State Park, 11.1 inches in Cold Spring, and 10.0 inches in Putnam Valley.
November 22, 2024	Countywide	Heavy rain changed to heavy wet accumulating snow in higher elevations. Snowfall was reported to reach 4.5 inches in Cold Spring.
December 15 – 16, 2024	Countywide	An accumulating and advisory level snowfall occurred in southeastern New York. Snowfall was reported to be 4.5 inches in Nelsonville and 3.5 inches in Cold Spring.
December 20 – 21, 2024	Countywide	Snowfall accumulated to roughly 3 inches in Putnam County.
January 19, 2025	Countywide	Accumulating snow reached winter storm criteria in Putnam County. Snowfall was reported at 6.5 inches in Fahnestock State Park, 6.3 inches in Nelsonville, 6.0 inches at Cold Spring, and 5.6 inches in Putnam Valley.
February 8 – 9, 2025	Countywide	A light accumulating snow changed to a prolonged period of freezing rain. Snowfall was reported at 3.5 inches in Nelsonville, and 3.0 inches in Cold Spring.

Source: (NOAA NCEI 2026)

14.1.5 Probability of Future Occurrences

Information on previous severe winter storm occurrences in the County was used to calculate the probability of future occurrence of such events. Based on these records and input from the Steering Committee, the probability of occurrence for severe winter storm in the County is considered “highly likely.”

14.1.6 Cascading Impacts on Other Hazards

Severe winter storms are often accompanied by extreme cold temperatures, which may require warming shelters to be opened. Snow and ice conditions on the road make transportation accidents more likely, which may lead to utility and power lines being knocked over. Electrical utility failure has the potential to start fires that can damage infrastructure and woodlands. Snow and ice melt may contribute to flooding. Responding to winter weather hazards with snow and ice removal could minimize the potential risk of flooding during a warming period.



14.2 VULNERABILITY AND IMPACT ASSESSMENT

All of Putnam County is exposed and vulnerable to the winter storm hazard. Current modeling tools are not available to estimate specific losses for this hazard. A qualitative analysis was conducted to assess the County's vulnerability to this hazard of concern.

14.2.1 Life, Health, and Safety

Overall Population

The entire population of Putnam County is exposed to severe winter storm events. Winter storms kill hundreds of people in the United States each year, primarily from automobile accidents, overexertion, and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow and drifting snow. People can die in traffic accidents on icy roads or from heart attacks while shoveling snow (NOAA NSSL 2021c).

Socially Vulnerable Population

People who experience homelessness, are over the age of 65, or are under the age of 5 are the most susceptible to this hazard. Older adults are susceptible due to their increased risk of injuries and death from falls and overexertion and/or hypothermia from attempts to clear snow and ice.

14.2.2 General Building Stock

The entire general building stock is vulnerable to the severe winter storm hazard. Structural impacts usually include damage to roofs and building frames but not building contents. Damage can include roof damage from heavy snow loads, structural damage from downed trees, and power outages. Severe winter storms can cause flooding through blockage of streams or through snow melt. Generally, losses resulting from such flooding is less than that associated with a 1 percent annual chance flood.

14.2.3 Community Lifelines and Other Critical Facilities

Severe winter storm damage to critical facilities can include roof damage from heavy snow loads, structural damage from downed trees, and power outages. Full functionality of critical facilities such as police, fire, and medical facilities is essential for response during and after severe winter storm events. These critical facility structures are largely constructed of concrete and masonry; therefore, they should suffer minimal structural damage from severe winter storms. Because power interruption can occur, backup power is recommended.

Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires clearing roadways and alerting citizens to dangerous conditions. Following the winter season, resources are required for road maintenance and repair of winter weather related damage, including cracks and potholes caused by freezing or plowing (NWS 2019b).

Heavy accumulations of snow and ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the damage. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NWS



2019a). Heavy snow can immobilize a region, shutting down air and rail transportation and disrupting medical and emergency services (NOAA 2023g).

14.2.4 Economy

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. Severe winter storms also affect the ability of people to commute to and from work, which may cause a loss in economic productivity.

14.2.5 Natural Resources

Excessive snowfall can affect natural processes such as river or stream flows. Rain-on-snow events, which occur when rain falls onto an existing snowpack and melts it, can exacerbate runoff rates during warming winter weather. Consequentially, stream flow rates and excess volumes of water can erode banks, tear apart habitat along the banks and coastline, and disrupt terrestrial plants and animals (NSIDC n.d.).

The methods communities use to maintain their infrastructure during winter storms also can have impacts on the environment. Road-salt runoff can cause groundwater salinization, modify the soil structure, and result in loss or reduction in lake turnover. Additionally, road salt can cause changes in the composition of aquatic invertebrate assemblages and pose threats to birds, roadside vegetation, and mammals (Tiwari and Rachlin 2018).

14.2.6 Historic and Cultural Resources

Historic and cultural buildings, archaeological sites, and artifacts are vulnerable to severe winter storms. Freeze-thaw cycles can cause significant damage as water seeps into cracks, freezes, expands, and then thaws, leading to the gradual breakdown of materials like stone, brick, and mortar. Proper strategies help safeguard buildings and their contents. Sudden and dramatic fluctuations in heating or cooling should be minimized. Slower heating and cooling give building materials and stored contents time to acclimate to new temperatures in the building and corresponding new humidity levels (CCAHA 2019).

Snow and ice introduce moisture into structures and artifacts, which can freeze and cause expansion and cracking, while fluctuating humidity levels can deteriorate organic materials like wood and textiles. The weight of accumulated snow and ice can stress roofs and other structural elements, potentially leading to collapses. Sudden temperature changes can cause thermal shock, damaging delicate artifacts. Severe winter storms can hinder access and maintenance, making it challenging to perform necessary upkeep and repairs (NPS 2016).

14.3 FUTURE CHANGES THAT MAY AFFECT RISK

14.3.1 Potential or Planned Development

Any areas of growth could be impacted by severe winter storm events. Implementing the following activities can eliminate or reduce the loss of life and property and infrastructure damage during winter storm events:

- Remove snow from roadways
- Remove dead trees and trim trees/brush from roadways to lessen falling limbs and trees
- Ensure proper road signs are visible and installed properly



- Bury electrical and telephone utility lines to minimize downed lines
- Remove debris/obstructions in waterways and develop routine inspections/maintenance plans to reduce potential flooding
- Install backup generators in evacuation facilities and facilities critical to essential services for residents
- Install cell towers in areas where limited telecommunication is available to increase emergency response and cell phone coverage.

14.3.2 Projected Changes in Population

Historically, winter storms with associated snowfall and ice accumulation have severely impacted transportation corridors as well as infrastructure. Any changes in the density of population may impact the ability of persons in the County to mobilize or receive essential services during severe winter storm events.

14.3.3 Climate Change

Studies project that New York State will see an increase in average annual temperatures and precipitation. Annual precipitation amounts in the region are projected to increase, primarily in the form of heavy rainfall. As the century progresses, snowfall is likely to become less frequent, with the snow season decreasing in length. As winters continue to warm, ice is projected to become rarer, which may lead to more lake-effect snow in the short term due to additional moisture available in the atmosphere to create precipitation. Over the long term, however, more of this is likely to fall as rain (Stevens & Lamie 2024).



15. TERRORISM

15.1 HAZARD PROFILE

15.1.1 Hazard Description

The Federal Bureau of Investigation (FBI) defines terrorism as “the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives” (28 CFR § 0.85.l). FEMA has defined three main goals of terrorism: to cause public fear; to convince the community that the government cannot protect them from terrorist attacks; to make the terrorist cause and motivation known to the community.

Types of Terrorist Acts

The following are commonly recognized terrorist activities:

- **Agriterrorism**—Agriterrorism includes food contamination or use of pests or disease to destroy crops.
- **Armed Attacks and Assassinations**—Armed attacks include raids and ambushes. An assassination is the killing of a selected victim, usually by bombings or small arms. A drive-by shooting is a common technique employed by unsophisticated or loosely organized terrorist groups. Historically, terrorists have assassinated specific individuals for psychological effect.
- **Arson and Firebombing**—Arson and fire-bombings are easily conducted by terrorist groups that may not be as well organized, equipped, or trained. An act of arson or firebombing against a public facility portrays an image to the public that the government is incapable of maintaining order.
- **Bioterrorism**—Bioterrorism is the intentional release of toxic biological agents to terrorize civilians in the name of a political or other cause. The Category A biological diseases most likely to cause the greatest harm include anthrax, botulism, plague, smallpox, tularemia, and hemorrhagic fever (CDC 2018)
- **Bombings**—Bombings are the most common type of terrorist act. Modern devices are smaller and harder to detect. Terrorists can use materials readily available to the average consumer to construct a bomb.
- **Chemical Agent**—Chemical terrorism is the spread of toxic chemicals with the intent to do harm. Often can include chemical weapons developed for military use (U.S. Department of Homeland Security 2022).
- **Cyber Terrorism**—Cyber terrorists use information technology to attack civilians and draw attention to the terrorists’ cause. They may use computer systems or telecommunications as a tool to orchestrate a traditional attack. More often, cyber terrorism is an attack on information technology itself in a way that would radically disrupt networked services. For example, cyber terrorists could disable networked emergency systems or hack into networks that house critical financial information.
- **Ecoterrorism**—Ecoterrorism is “the use or threatened use of violence of a criminal nature against innocent victims or property by an environmentally oriented... group for environmental-political reasons” (Farboe 2002). In general, environmental extremists sabotage property to inflict economic damage on industries, businesses, or persons perceived as harming animals or the natural environment.
- **Hijackings and Skyjackings**—Hijacking, also known as cargo theft, is seizure by force of a surface vehicle, its passengers, or its cargo (FBI 2019). Skyjacking is taking of an aircraft. Skyjacking provides mobility for terrorists to relocate to a country that supports their cause and provides them with a human shield, making retaliation difficult.



- **Intentional Hazardous Material Release**—The intentional release of substances that pose a threat to human health and safety may include substances that are explosive, toxic, or radioactive (U.S. Department of Homeland Security 2023).
- **Kidnappings and Hostage-Takings**—Terrorists use kidnapping and hostage-taking to establish a bargaining position and to elicit publicity. A successful kidnapping can gain terrorists money, publicity, or release of jailed comrades. Hostage-taking involves seizure of a facility or location and taking hostages present in that facility. Unlike a kidnapping, hostage-taking provokes a confrontation with authorities. It is overt and designed to attract and hold media attention. The intended target is the audience affected by the hostage's confinement, not the hostage.
- **Nuclear Terrorism**—Nuclear terrorism exploits nuclear materials as a terrorist tactic. It includes attacking nuclear facilities, purchasing nuclear weapons, building nuclear weapons, or otherwise finding ways to disperse radioactive materials.

Responses to Terrorism

The National Terrorism Advisory System provides detailed information about terrorist threats to the public, government agencies, first responders, airports and other transportation hubs, and the private sector. The system alerts are posted online and released to the news media for distribution. An alert may include specific information about the nature of the threat, including the geographic region, mode of transportation, or critical infrastructure potentially affected, as well as steps that individuals and communities can take to protect themselves and help prevent, mitigate, or respond to the threat. The alert indicates whether the threat is elevated or imminent. An elevated threat is issued when no specific information is available about timing or location. An imminent threat is issued when the threat is believed to be impending or to very soon result in an incident (DHS 2022).

New York State Governor's Executive Order 18 requires each County and City of New York State to develop plans to respond to domestic terrorism, especially against racially driven attacks against minority groups (NYS Governor 2022). Executive Order 18 also establishes a new unit within the New York State Intelligence Center with the purpose of tracking domestic terrorism and increasing social media monitoring to target violent extremism.

15.1.2 Location

Acts of terrorism could occur anywhere at any time of day. Terrorism can stem from a wide range of political, personal, and cultural agendas, making any location a potential target. In Putnam County, numerous critical facilities and infrastructure vital to the daily functioning and safety of the community could be targeted:

- An attack on a hospital or other medical facility could result in significant loss of life and hinder the ability to provide medical care to those in need. It would also strain the healthcare system, making it difficult to respond to other emergencies.
- An attack on a police or fire station could impair the County's ability to protect residents and respond to crises, leading to increased vulnerability and chaos.
- Damage to bridges and other transportation infrastructure could disrupt commerce, hinder emergency response efforts, and isolate parts of the County, causing significant economic and logistical challenges.
- An attack on utility facilities, including water, electricity, and gas services, could lead to widespread outages, affecting the quality of life and economic stability of the County.
- An attack on government buildings could disrupt governance and public services, leading to confusion and instability.



15.1.3 Extent

A terrorism event can create fear among members of the public. Communication systems, both public and private, can fail because of an overwhelming amount of use or damage to the communications infrastructure. Healthcare facilities can become quickly inundated and must be prepared to triage injured patients, handle mass casualties, and conduct decontamination operations. Examples of potential incidents include the following:

- If an explosive goes off in a public park, the severity depends on the number of people nearby, the presence of critical assets, and the size of the explosive.
- Cyberterrorism can range from smaller attacks such as taking control of a website to larger attacks such as using networked resources to cause direct destruction and harm to a community. Cyberterrorists are difficult to identify due to the internet providing connections between people on a global scale. Those who plan to carry out cyber-attacks are not organized like other terrorist groups; they can be geographically separated but still plan and communicate virtually.

Most terrorist attacks occur with very little, if any, advanced warning. Warning signs of some terrorist attacks may appear, such as a suspicious package left unattended. Local, state, and federal officials, as well as the public, are responsible for recognizing warning signs of terrorism incidents and for taking appropriate actions to mitigate against possible attacks. Thwarting terrorist attacks is possible through intelligence monitoring.

15.1.4 Previous Occurrences

FEMA Disaster Declarations

The only terrorism-related presidential disaster declaration that included Putnam County was for the terrorist attacks on September 11, 2001 (see Table 15-1). Five Putnam County residents perished in the attacks.

Table 15-1. FEMA Disaster Declarations for Terrorism Events in Putnam County

Event Date	Declaration Date	Declaration Number	Description
September 11, 2001	September 11, 2001	DR-1391	Fire

Source: (FEMA 2026b)

USDA Declarations

Putnam County was not included in any USDA terrorist-related agricultural disaster declarations (USDA 2026).

All Recent Events

No known major terrorist activities have taken place in Putnam from 2020 to 2025. This may be due to limited reporting and records for tracking terrorist activity. For events prior to 2020, refer to the previous HMP.

Nationwide, there were 231 incidents (meaning attacks or plots) that met the definition of domestic terrorism between 2010 and 2021, according to DHS. They occurred across the United States, but the greatest number of incidents occurred in states with major metropolitan areas—such as California (Los Angeles, San Diego, and San Francisco), New York (New York City), and Washington, D.C. (U.S. Government Accountability Office 2023)



15.1.5 Probability of Future Occurrences

The potential for future terrorism incidents in Putnam County is difficult to predict. Efforts of local, state, and federal officials must be coordinated to prevent occurrences of future terrorist incidents. However, despite the best efforts of these entities, the reality is that a terrorist attack may occur in Putnam County or the surrounding areas. Based on historical records and input from the Steering Committee, the probability of occurrence for terrorism in the County is considered “unlikely.”

15.1.6 Cascading Impacts on Other Hazards

Terrorism can exacerbate other hazard events identified in this plan. For example, if chemical terrorism were to occur during a pandemic, the community impacts would be severely worse than if the incidents happened on separate occasions. Terrorist activity can leave the community more vulnerable to other hazards, by separating people and causing terror during a time of stress.

15.2 VULNERABILITY AND IMPACT ASSESSMENT

Regarding terrorism events, the whole County has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities, and lifelines) are potentially vulnerable. The section provides a qualitative discussion of risk from terrorism.

15.2.1 Life, Health, and Safety

The number of people in the United States who are harmed or die because of terrorism fluctuates each year depending on the specific incidents that occur. Large-scale incidents have the potential to kill or injure many residents in the immediate vicinity of the attack, and they may also affect people located a distance from the initial event.

A 2018 study found that some people are more vulnerable than others to impacts of terror attacks—in particular mental health impacts—and need specific public health attention. The study identified first responders, survivors, relatives of victims, bereaved persons who lost a loved one, and young children as especially vulnerable (Bilsen and Lindert 2018). A National Institute of Justice study reported that the most prominent terrorism risk profiles are people living in areas with the following characteristics (NIJ 2023):

- High population density
- Low white population
- Less-than-high-school education
- Moderate unemployment
- Low percentage of families below the poverty line
- Moderate percentage of families living in the same residence as one year prior (stability measure)
- Low percentage of vacant houses
- High percentage of foreign born



15.2.2 General Building Stock

The entire general building stock inventory in Putnam County is vulnerable to the threat of terrorism, and all types of structures can suffer significant damage in the event of a terrorist attack. Structural impacts typically include damage to roofs, building frames, windows, and the contents within these buildings.

15.2.3 Community Lifelines and Other Critical Facilities

Critical facilities are particularly vulnerable to terrorism. These include schools, community centers, libraries, and other public spaces that are essential to the fabric of the community. These areas are not only important for their functional roles but also as places where people gather, socialize, and spend time. An attack on a school, for instance, can have devastating psychological and emotional impacts on students, staff, and families, disrupting education and creating a climate of fear. Community centers and libraries serve as hubs for social interaction, learning, and cultural activities. An attack on these facilities could disrupt community cohesion and access to essential services.

The full functionality of critical facilities, such as police stations, fire departments, and medical facilities, is essential for both the immediate response to and the aftermath of a terrorist event. These facilities are the backbone of the community's safety and security, providing the necessary services to protect and assist residents during emergencies. Ensuring their protection from terrorist attacks is paramount, as they are the first responders to safeguard the community when incidents occur.

Police stations are crucial for maintaining law and order, coordinating emergency responses, and providing security during a terrorist attack. Fire departments are vital for managing fires, hazardous materials, and rescue operations, which are often necessary in the chaotic aftermath of an attack. Medical facilities, including hospitals and emergency medical services, are indispensable for treating the injured, managing casualties, and providing ongoing care to those affected by the incident.

15.2.4 Economy

Terrorism can immobilize a region and paralyze a city, shutting down all transportation and disrupting medical and emergency services as they respond and control the impacted location. It can take several weeks, months, and even years for the economy in the affected areas to fully bounce back from a terrorist attack.

The economy itself can be a target for terrorist attacks. By disrupting the economy, terrorist groups can instill fear and create additional vulnerabilities within the community. This can have long-lasting effects on residents and neighboring areas. In response, new measures are often implemented after a terrorist attempt to prevent future incidents and to build a more resilient economy and community.

15.2.5 Natural Resources

Terrorist events, particularly those involving biological or chemical agents, can have severe and long-lasting impacts on the natural environment. Chemical agents can seep into groundwater, contaminating water sources like rivers and lakes, making drinking water unsafe, and harming aquatic wildlife. Toxic agents can also degrade soil, affecting plant life and leading to long-term agricultural issues. The release of chemical gases can cause air pollution, leading to respiratory problems and other health issues for humans and wildlife. It is important to prioritize preparedness and response strategies to mitigate the effects of such attacks on the environment.



15.2.6 Historic and Cultural Resources

The core aim of terrorism is to instill fear and terror among large groups of people by targeting community events and public spaces. Therefore, historical or culturally sensitive locations may be more vulnerable to experiencing an act of terrorism. These resources and locations often symbolize the heritage and identity of a community, making them potential targets for terrorist activities aiming to disrupt and demoralize the community. Historical structures, especially those built 50 years ago or more, as well as landmarks deemed exceptionally significant, hold immense cultural, historical, and emotional value for the community. These sites often symbolize the heritage and identity of a city, making them potential targets as well.

15.3 FUTURE CHANGES THAT MAY AFFECT RISK

15.3.1 Potential or Planned Development

Any areas of new development could be impacted by terrorism because the entire County is exposed and vulnerable.

15.3.2 Projected Changes in Population

Terrorism has the potential to impact a growing population by targeting large public events such as sporting events, public spaces, concerts, schooling, and more. Further mitigation and planning mechanisms for safety and emergency personnel on how to prevent and respond to terrorist attacks should be implemented within the County to combat these impacts on residents.

15.3.3 Climate Change

Although it is not clear how the impacts of climate change can affect the severity and frequency of terrorist activity, it can be assumed that climate change will have a negative impact, as it increases civil unrest and can cause panic through natural disasters, potentially leaving a community more vulnerable to terrorism.



16. WILDFIRE

16.1 HAZARD PROFILE

16.1.1 Hazard Description

A wildfire is any fire that is not planned, controlled, or supervised in a natural area such as a forest, grassland, or prairie (New York State 2023). Wildfires cause both short-term and long-term losses. Short-term losses can include destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and the destruction of cultural and economic resources and community infrastructure.

In New York State, wildfires are not as frequent or intense as in the western United States, but they still pose a significant hazard, particularly in areas with dense forests, brush, and grasslands, and particularly due to increasing climate variability and the presence of wildland-urban interface zones.

Types of Wildfire

Wildfires include those commonly referred to as forest fires, brush fires, grass fires, range fires, or ground fires. There are three classes of wildfires: surface fires, ground fires, and crown fires. Surface fires are the most common type and burn along the forest floor, moving slowly and killing or damaging trees. Ground fires are usually started by lightning and burn on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along the tops of trees.

The term wildfire typically excludes agricultural fires, which are intentional fires to manage croplands. It also excludes so-called beneficial fire, which is a wildland fire intentionally set or intentionally allowed to burn for cultural, ecosystem, or public-safety purposes. Common types of beneficial fire include cultural fire, which can be part of indigenous cultural practices, and prescribed burns, which are conducted in a controlled manner to simulate the fires an ecosystem has evolved to require or to remove dangerous fuel loads from near communities.

Wildfire Causes

Wildfires often begin unnoticed and spread quickly. Most wildfires in New York State are caused by human activities such as debris burning, campfires, equipment use, smoking and arson. Lightning is the second most common source of ignition. The likelihood of a lightning strike starting a wildfire depends on the intensity of the strike and the type and dryness of the fuel it contacts.

The major fire seasons in New York are in the spring and in the fall, when there is an increase of dead grass and leaves on the ground, combined with bare trees that allow direct sunlight to hit the dry ground. Additionally, spring and fall weather patterns sometimes lead to extended dry periods, drying the fire fuels, dead grass and leaves further. Typically, the spring fire season is larger than the fall season.

Wildfire Behavior

Almost all actions in response to a wildfire depend on an understanding of how the fire behaves. Fire behavior is defined as the way fuel ignites, flame develops, and fire spreads, which depend on interactions among fuel, weather, and topography.



Fuel

Fuels are classified by weight or volume (fuel loading) and by type. Fuel loading is the amount of vegetative material available. If this amount doubles, energy released can also double. Each fuel type is given a burn index—an estimate of amount of potential energy that may be released, effort required to ignite a fire in a given fuel and expected flame length. Different fuels have different burning qualities, and some burn more easily than others. Grass fires release relatively little energy but can sustain very high rates of spread. A forest stand may consist of several layers of fuels (USFS 2013):

- Surface fuels consist of grasses, shrubs, litter, and woody material lying on the ground. Surface fires burn low vegetation, woody debris, and litter. Under the right conditions, surface fires reduce the likelihood that future wildfires will grow into crown fires. Surface fuels are generally defined to be less than 6 feet in height off the ground and are categorized into one of six types: grass, grass/shrub, shrub, timber/understory, timber litter and slash. Fire behavior fuel models are used to compute surface fire behavior, including rate of spread, flame length, and fire line intensity.
- Ladder fuels consist of live and dead small trees and shrubs; live and dead lower branches from larger trees, needles, vines, lichens, mosses; and any other combustible biomass between the top of surface fuels and bottom of overstory tree crowns.
- Crown fuels are suspended above the ground in treetops or other vegetation and consist mostly of live and dead fine material. When historically low-density forests become overcrowded, tree crowns may merge and form a closed canopy. Tree canopies constitute the primary fuel layer in a forest crown fire.

Weather / Air Mass

Weather factors that affect wildfire include temperature, relative humidity, local wind speed and direction, cloud cover, precipitation amount and duration, and stability of the atmosphere (NWS 2009a). Extreme weather leads to extreme events, and often a subsidence of severe storms marks the end of a wildfire's growth and the beginning of successful containment. High temperatures and low humidity can produce vigorous fire activity. Fronts and thunderstorms can produce winds that radically and suddenly change in speed and direction, causing similar changes in fire activity. The rate of spread of a fire varies directly with wind velocity. Winds may play a dominant role in directing the course of a fire. The most damaging firestorms are typically marked by high winds (FEMA 1997a).

Topography

Movement of air over the terrain tends to direct a fire's course. A gulch or canyon can funnel air and act as a chimney, intensifying fire and inducing faster spread. Saddles on ridgetops tend to offer lower resistance to passage of air and draw fires. Solar heating of drier, south-facing slopes produces upslope thermal winds that can complicate behavior. Slope is an important factor. If the percentage of uphill slope doubles, the rate the wildfire spreads will most likely double as well. Terrain can inhibit wildfires: fire travels downslope much more slowly than it does upslope, and ridgetops often mark the end of a wildfire's rapid spread (FEMA 1997a).

16.1.2 Location

Wildfire risk is greatest in areas of high fuel loading and steep slopes. Areas typically considered to be prone to wildfires include large tracts of wild lands containing heavier fuels with high continuity such as forested areas in many parts of the County. Wildfires are also likely to occur in open grasslands. Areas that are typically considered



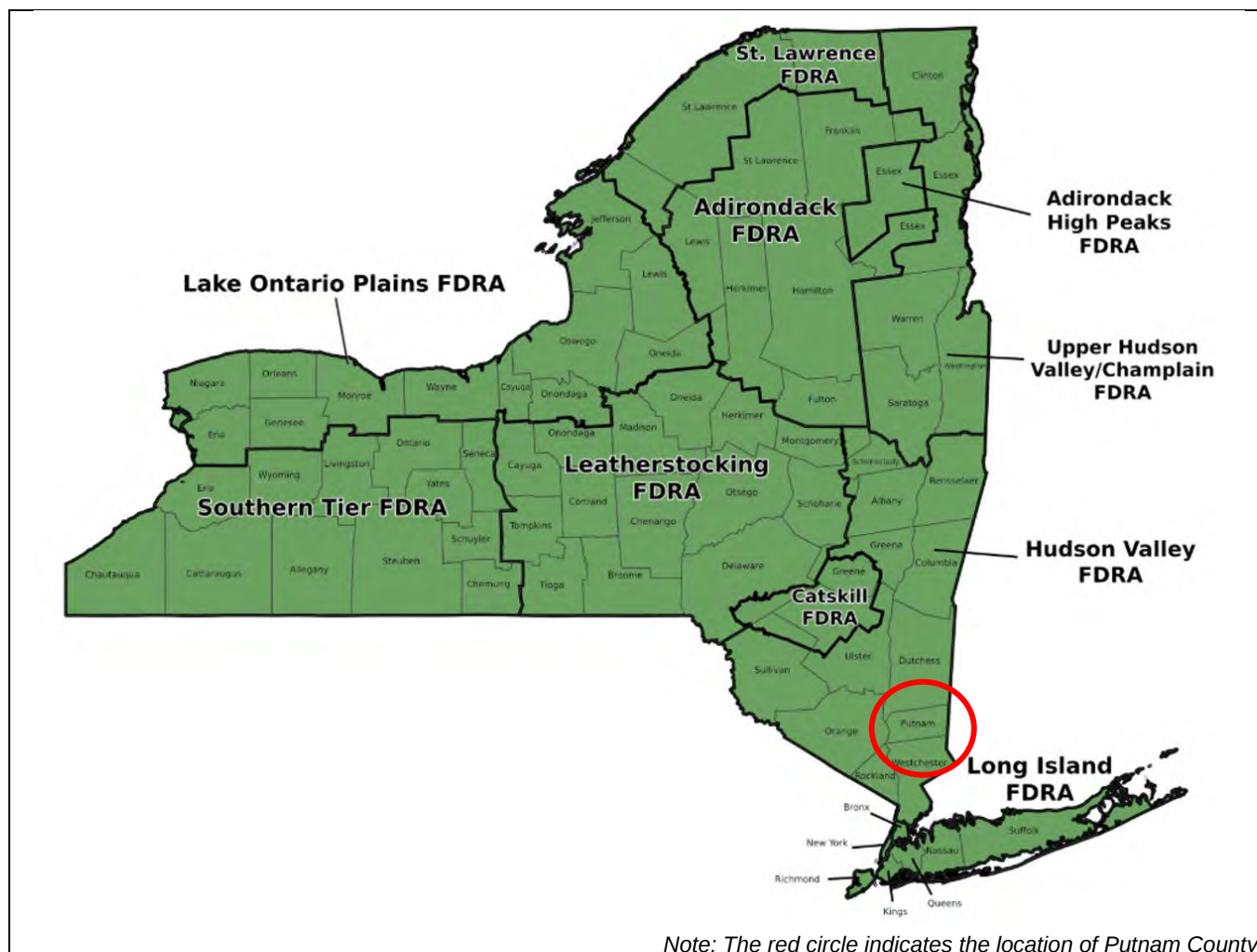
to be safe from wildfires include highly urbanized, developed areas that are not contiguous with vast areas of wild lands.

Putnam County has significant areas of forest cover. Some of these forest covered areas are state-owned lands, including California Hill State Forest, Cranberry Mountain Wildlife Management Area, Great Swamp Wildlife Management Area, Bog Brook Unique Area, Big Buck State Forest, Ninham Mountain Multiple Use Area, White Pond Multiple Use Area, Castle Rock Unique Area, Donald Trump State Park, and Fahnestock State Park.

Wildfire Risk by Region

The State of New York is divided into 10 fire danger rating areas (FDRAs) as shown in Figure 16-1. FDRAs are defined by areas of similar vegetation, climate, and topography in conjunction with agency regional boundaries, National Weather Service (NWS) fire weather zones, political boundaries, fire occurrence history, and other influences. The Forest Ranger Division issues daily fire danger warnings when the fire danger rating is at high or above in one or more FDRAs. Putnam County is in the Hudson Valley FDRA.

Figure 16-1. New York Fire Danger Rating Areas



Note: The red circle indicates the location of Putnam County.

Source: (NYSDEC 2025a)



Wildland-Urban Interface

The threat to people and property is greatest in the fringe areas where developed areas meet open grasslands, called wildland-urban interface (WUI) zones (USFS 2013). These fringe zones combine flammable vegetation with human structures and activities. In these areas, wildfires pose a particular risk to humans. WUI areas grow nationwide by approximately 2 million acres each year as communities continue to expand, often due to the pressures of high housing costs in more densely populated areas.

The WUI is divided into two categories:

- The WUI intermix is where structures and wildlands intermingle, with no clear boundary between the two. In an intermix area, homes and other structures are scattered throughout a wildland area. These structures are often surrounded by trees and vegetation and are only accessible by narrow roads. This makes it difficult to reach these areas if a fire occurs. WUI interface accounts for 5.4 percent (7,599 square miles) of New York State (Radeloff, et al. 2020).
- The WUI interface is where human development is adjacent to natural environments, such as forests, grasslands, or shrublands. WUI intermix accounts for 21.9 percent (30,890 square miles) of New York State.

Recent maps show that almost every county in New York State has both WUI interface and WUI intermix zones. Figure 16-2 shows these areas in Putnam County.

16.1.3 Extent

Wildfire events can range in size and intensity. The extent (that is, magnitude or severity) of wildfires depends on weather and human activity. There are several tools available to estimate fire potential, extent, danger, and growth, several of which are described in the following sections.

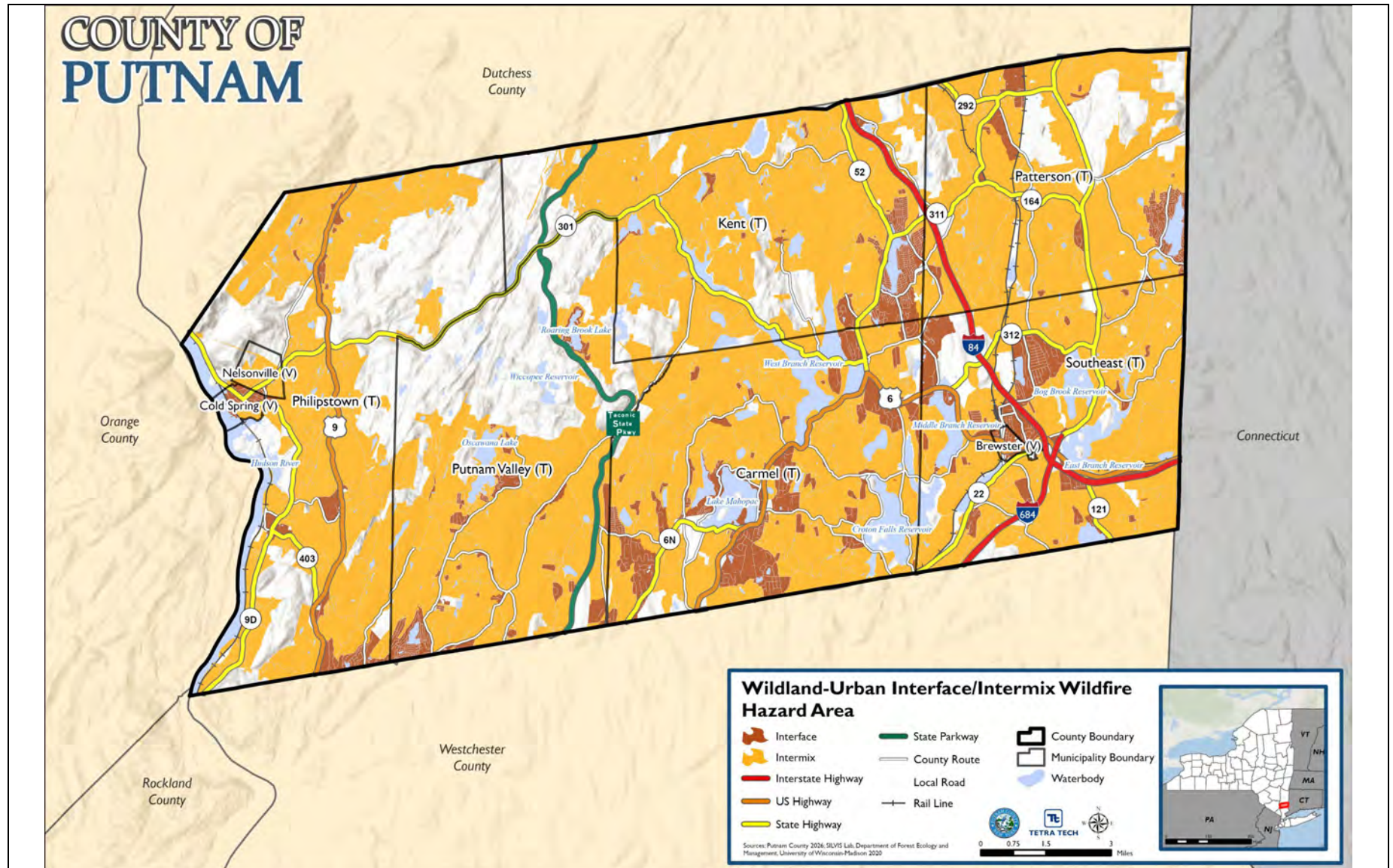
Wildland Fire Assessment System | National Fire Danger Rating System

The Wildland Fire Assessment System (WFAS) is an internet-based system that provides a national view of weather and fire potential, including national fire danger, weather maps and satellite-derived “greenness” maps. It was developed by the Fire Sciences Laboratory in Missoula, Montana and is maintained at the National Interagency Fire Center in Boise, Idaho (WFAS 2023).

Each day during the fire season, the WFAS produces national maps of selected fire weather and fire danger components of the National Fire Danger Rating System. Fire Danger Rating level considers current and antecedent weather, fuel types, and both live and dead fuel moisture. This information is provided by local station managers (WFAS 2023). Table 16-1 shows the fire danger rating and color code, which is also used by the NYSDEC to update state fire danger rating maps, as identified in the following section.



Figure 16-2. Wildfire Hazard Areas in Putnam County



**Table 16-1. Description of Fire Danger Ratings in New York State**

Adjective Rating Class and Color Code	Class Description
Red Flag	A short-term, temporary warning, indicating the presence of a dangerous combination of temperature, wind, relative humidity, fuel, or drought conditions that can contribute to new fires or rapid spread of existing fires. A Red Flag Warning can be issued at any Fire Danger level.
Extreme (Red)	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous, except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks until the weather changes, or the fuel supply lessens.
Very High (orange)	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
High (yellow)	All fine dead fuels ignite readily, and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly, and short-distance spotting is common. High intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Moderate (blue)	Fires can start from most accidental causes but, with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur but is not persistent. Fires are not likely to become serious and control is relatively easy.
Low (green)	Fuels do not ignite readily from small firebrands, although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting.

Source: (NYSDEC 2025a)

NYSDEC Fire Danger Rating Map

A current fire danger rating map is updated daily on the NYSDEC website (NYSDEC 2025a). The map is developed by information obtained from the Division of Forest Protection and Division of Air Resources (impact assessment and meteorology section). The figure is color coded and indicates where there are red flag warning areas at the time the map is issued.

Fire Potential Index

The Fire Potential Index (FPI) is a moisture-based vegetation flammability indicator. The FPI indicates the estimated proportion (percentage) of the vegetation that is dry enough to burn, thus the FPI is highest when dead fuel moistures and vegetation greenness are low. The FPI is calculated once daily for the continental United States at a resolution of 1 square kilometer. Although these maps provide a relative measure of fuel flammability across the nation, they do not indicate the chance that a large fire will occur (USGS 2023d).



Fuel Moisture

Fuel moisture is a measure of the amount of water in a fuel (vegetation) available to a fire and is expressed as a percent of the dry weight of that specific fuel. When fuel moisture content is high, fires do not ignite readily, or at all, because heat energy must be used to evaporate and drive water from the plant before it can burn. When the fuel moisture content is low, fires start easily and will spread rapidly because all the heat energy goes directly into the burning flame itself. When the fuel moisture content is less than 30 percent, that fuel is essentially considered to be dead. Dead fuels respond solely to current environmental conditions and are critical in determining fire potential (NOAA 2023a).

Table 16-2 outlines four fuel classifications based on response time, or time lag. A fuel's time lag is based on how long it would take for two-thirds of the dead fuel to respond to atmospheric moisture.

Table 16-2. Fuel Moisture Classifications

1-hour fuels	10-hour fuels	100-hour fuels	1000-hour fuels
Up to ¼-inch diameter – fine, flashy fuels that respond quickly to weather changes. Computed from observation time, temperature, humidity, and cloudiness.	¼-inch to one-inch in diameter—computed from observation time, temperature, humidity, and cloudiness or can be an observed value.	One-inch to three-inch in diameter—computed from 24-hour average boundary condition composed of day length (daylight hours), hours of rain, and daily temperature/humidity ranges.	Three-inch to eight-inch in diameter—computed from a seven-day average boundary condition composed of day length, hours of rain, and daily temperature/humidity ranges.

Source: (NPS 2025)

Keetch-Byram Drought Index

The Keetch-Byram Drought Index (KBDI) assesses the risk of fire by representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers. The KBDI attempts to measure the amount of precipitation necessary to return the soil to full field capacity. The index ranges from zero, the point of no moisture deficiency, to 800, the maximum drought that is possible, and represents a moisture regime from 0 to 8 inches of water through the soil layer. At 8 inches of water, the KBDI assumes saturation. At any point along the scale, the index number indicates the amount of net rainfall that is required to reduce the index to zero, or saturation (NIDIS 2023).

16.1.4 Previous Occurrences

FEMA Disaster Declarations

Putnam County has not been included in any major disaster or emergency declarations for wildfire-related events (FEMA 2026b).

USDA Declarations

Putnam County has not been included in any wildfire-related USDA agricultural disaster declarations (USDA 2026).



All Recent Events

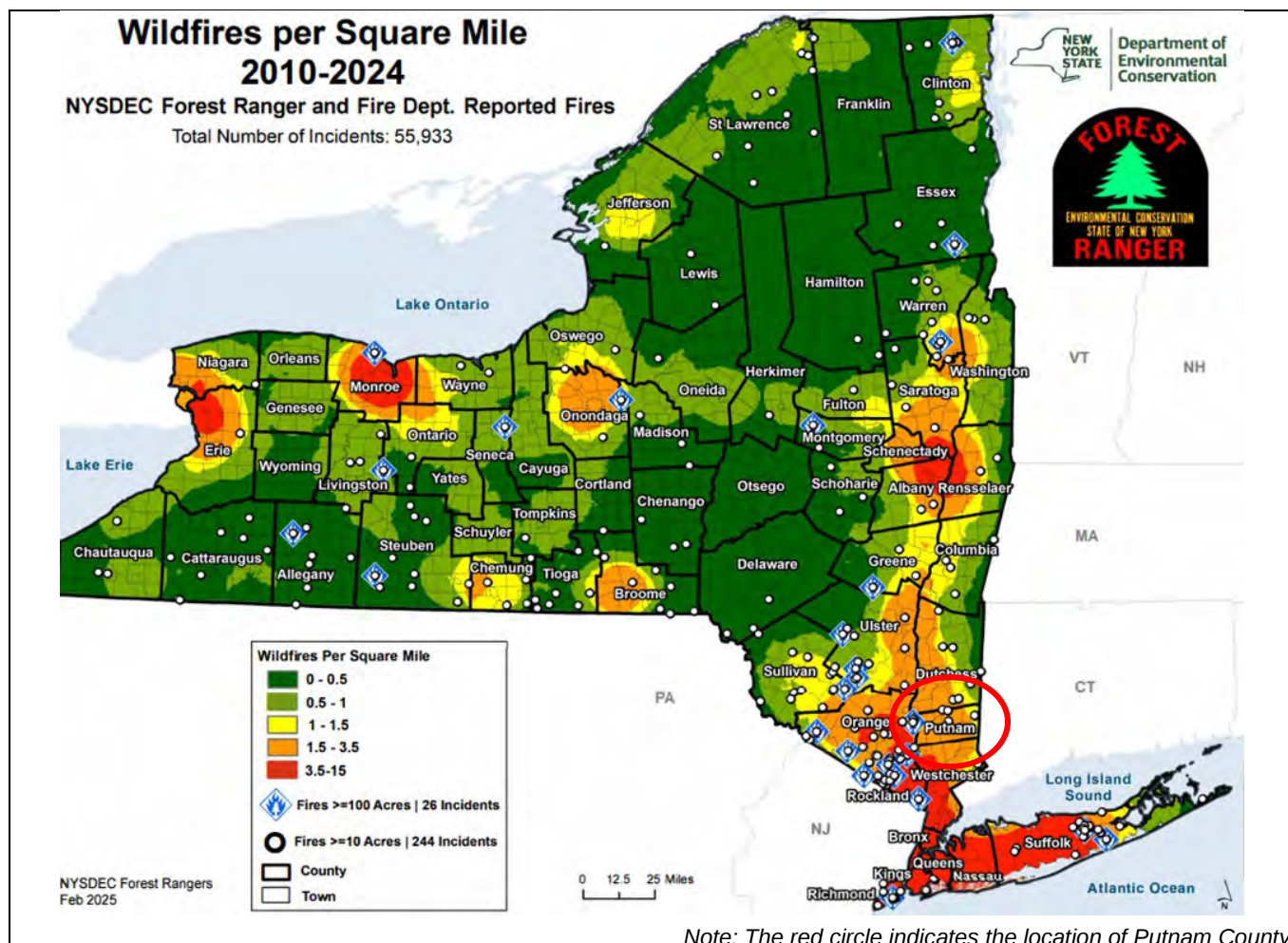
Table 16-3 lists major recorded wildfire-related events that impacted Putnam County since the previous HMP was developed. For earlier events, refer to the previous HMP. Figure 16-3 shows the distribution of wildfires per square mile across New York State from 2010 to 2024. The New York State Hazard Mitigation Plan identifies wildfire as a recurring hazard, especially in rural and forested regions.

Table 16-3. Wildfire Events in Putnam County (2020 to 2025)

Event Date	Location Impacted	Description
March 9 – 11, 2020	Kent	The Dean Road Fire has a listed cause of debris burning. A total of 27.9 acres burned on private property.
November 7, 2020	Carmel	The Wire Fire has a listed cause of a power line. A total of 0.1 acres burned on State Parks property.
March 13 – 14, 2021	Kent	The Peekskill Hollow Fire has a listed cause of combustible materials (incendiary). A total of 4.8 acres burned on private property.
March 30, 2021	Patterson	The Fireside Court has a listed cause of campfire. A total of 0.2 acres burned on private property.
August 10 – 13, 2022	Putnam Valley	The Appa Fire has a listed cause of campfire. A total of 0.1 acres burned on State Parks property.
August 16 – 31, 2022	Philipstown	The Ironstone Fire has a listed cause of smoking. A total of 3 acres burned on State Parks property.
August 22 – 24, 2022	Kent	The Big Buck Fire has a listed cause of smoking. A total of 0.3 acres burned on private property.
August 27 – 30, 2022	Carmel	The Commerce Fire has a listed cause of debris burning. A total of 0.4 acres burned on private property.
February 15 – 16, 2023	Carmel	The Astor Road Fire has a listed cause of human activity. A total of 3 acres burned on private property.
March 7, 2023	Southeast	The Vescio Farm Fire has a listed cause of debris burning. A total of 2 acres burned on private property.
April 8 – 10, 2023	Patterson	The Stagecoach Fire has a listed cause of combustible materials (incendiary). A total of 3 acres burned on government property.
April 11 – 12, 2023	Kent	The Manning Fire has a listed cause of debris burning. A total of 1 acre burned on private property.
April 14 – 18, 2023	Philipstown	The Defiance Road Fire has a listed cause of combustible materials (incendiary). A total of 41 acres burned on Federal Lands.
June 2 – 16, 2023	Philipstown	The Garrison Train Station Fire has a listed cause of campfire. A total of 1.5 acres burned on State Parks property.
October 22 – November 15, 2024	Kent	The Golf Ridge Fire has a listed cause of miscellaneous. A total of 33 acres burned on government property.
November 6 – 9, 2024	Carmel	The Hickory Nut Fire has a listed cause of smoking. A total of 1 acre burned on government property.

Source: (NYSDEC 2025b)

Figure 16-3. Wildfires per Square Mile in the State of New York, 2010 – 2024



Source: (NYSDEC 2025c)

16.1.5 Probability of Future Occurrences

Information on previous wildfire occurrences in the County was used to calculate the probability of future occurrence of such events. Based on these records and input from the Steering Committee, the probability of occurrence for wildfire in the County is considered “possible.”

It is likely that the State of New York will experience small wildfires throughout the state on a yearly basis (as the state has regularly experienced in the past). However, advanced methods of wildfire management and control and a better understanding of the fire ecosystems should help in reducing the number of devastating fires in the future.

Several factors impact the potential for a fire to occur, and some conditions (for example, ongoing land use development patterns, location, fuel sources, and construction sites) exert increasing pressure on the WUI zone. Based on available data, wildfires will continue to present a risk to Putnam County. Given the numerous factors that can impact urban fire and wildfire potential, the likelihood of a fire event starting and sustaining itself should be gauged by professional fire managers on a continuous basis.



16.1.6 Cascading Impacts on Other Hazards

Cascading impacts of wildfires are secondary effects that result from the primary wildfire event. The following are potential cascading impacts of wildfires on other hazards:

- **Flooding**—Loss of vegetation increases runoff and reduces soil absorption, heightening flood risks, especially in areas with heavy rainfall following a fire.
- **Landslides**—Burned hillsides may become unstable, especially in areas of steep slopes.
- **Extreme Weather**—Wildfires release significant amounts of greenhouse gases, contributing to an increased likelihood of future extreme weather events.

16.2 VULNERABILITY AND IMPACT ASSESSMENT

For the wildfire risk assessment, WUI interface and intermix areas were analyzed as hazard areas, using methodologies described in Chapter 4.

16.2.1 Life, Health, and Safety

Overall Population

Table 16-4 summarizes the estimated population exposed to the wildfire hazard. An estimated 44,605 residents live in the WUI interface hazard area, and 51,067 residents live in the WUI intermix hazard area. The Town of Carmel has the greatest number of individuals located in the WUI interface (14,949) and WUI intermix (16,908) hazard areas.

Table 16-4. Population Living Within the Wildfire Threat Hazard Areas

Jurisdiction	Total Population (2024 ACS)	Population in the WUI Interface Hazard Area		Population in the WUI Intermix Hazard Area	
		Number of Persons	% of Jurisdiction Total	Number of Persons	% of Jurisdiction Total
Brewster (V)	2,512	2,378	94.7%	126	5.0%
Carmel (T)	33,837	14,949	44.2%	16,908	50.0%
Cold Spring (V)	1,863	1,662	89.2%	200	10.7%
Kent (T)	12,896	6,889	53.4%	5,918	45.9%
Nelsonville (V)	714	401	56.2%	299	41.9%
Patterson (T)	11,560	4,850	42.0%	6,654	57.6%
Philipstown (T)	7,302	1,904	26.1%	5,316	72.8%
Putnam Valley (T)	11,755	4,254	36.2%	7,348	62.5%
Southeast (T)	15,668	7,318	46.7%	8,298	53.0%
Putnam County (Total)	98,107	44,605	45.5%	51,067	52.1%

Source: U.S. Census Bureau 2024 ACS Vulnerable Population; Putnam County 2025, 2026; NYSERDA 2026; NYS 2024; SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison 2020



Vulnerable populations include emergency responders, who are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke. Common public health impacts related to wildfire are associated with the following:

- **Wildfire Smoke**—Wildfire smoke contains particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Public health impacts associated with smoke include difficulty in breathing, odor, and reduction in visibility. Exposure to smoke can exacerbate respiratory diseases such as asthma, bronchitis, and COPD. Wildfire smoke is generated by both planned beneficial wildfire and unplanned hazardous wildfire. Planned burns can be carried out in a way that mitigates adverse health impacts, such as by planning for days with specific weather patterns and by notifying the public in advance. The duration of smoke impacts is set by a combination of the size and duration of the fires that create smoke and the duration of the weather pattern bringing the smoke into the state or moving it within the state.
- **Heat Stress**—Combined with extreme heat events, wildfires can increase risks of heat-related illnesses.
- **Mental Health Strain**—Anxiety, depression, and post-traumatic stress disorder can arise from evacuation, property loss, and environmental devastation.
- **Evacuations and Displacement**—Communities in affected areas may face temporary or prolonged displacement, creating challenges for housing and social services.

Socially Vulnerable Population

Certain populations may face heightened vulnerability to wildfire impacts. Older people, children, and individuals with respiratory or cardiovascular conditions may be particularly susceptible to smoke-related health effects. Low-income households may have limited ability to implement property-level mitigation measures such as defensible space or fire-resistant improvements. Residents without reliable transportation may encounter challenges evacuating during wildfire events. Targeted outreach, evacuation planning, and air quality communication strategies are essential to minimizing disproportionate impacts.

Table 16-5 presents the estimated socially vulnerable populations located in the WUI interface hazard area. Of the 44,605 persons located in the WUI interface hazard area, there are 8,473 over the age of 65 years, 2,114 under the age of 5 years, 1,550 who are non-English speakers, 4,536 with a disability, and 3,193 living in poverty.

Table 16-6 presents the estimated socially vulnerable populations located in the WUI intermix hazard area. Of the 51,067 persons located in the WUI intermix hazard area, there are 9,951 over the age of 65 years, 2,407 under the age of 5 years, 1,177 who are non-English speakers, 5,068 with a disability, and 3,578 living in poverty.



Table 16-5. Vulnerable Populations Located in the WUI Interface Hazard Area

Jurisdiction	Vulnerable Persons Living in the Wildland Urban Interface (WUI) Hazard Area									
	Persons Over 65	Percent of Total	Persons Under 5	Percent of Total	Non-English-Speaking Persons	Percent of Total	Persons with a Disability	Percent of Total	Persons in Poverty	Percent of Total
Brewster (V)	312	94.5%	68	94.4%	515	94.7%	340	94.4%	342	94.5%
Carmel (T)	2,957	44.2%	599	44.1%	228	44.1%	1,593	44.2%	661	44.1%
Cold Spring (V)	381	89.2%	80	88.9%	62	88.6%	137	89.0%	74	88.1%
Kent (T)	1,188	53.4%	435	53.4%	127	53.1%	701	53.3%	455	53.4%
Nelsonville (V)	56	55.4%	15	55.6%	0	0.0%	34	54.8%	11	52.4%
Patterson (T)	787	41.9%	219	42.0%	80	41.5%	439	41.9%	813	41.9%
Philipstown (T)	459	26.0%	67	26.0%	6	25.0%	194	26.0%	139	25.9%
Putnam Valley (T)	799	36.2%	219	36.1%	73	35.8%	356	36.1%	178	36.1%
Southeast (T)	1,534	46.7%	412	46.7%	459	46.6%	742	46.7%	520	46.6%
Putnam County (Total)	8,473	44.8%	2,114	45.7%	1,550	55.9%	4,536	46.0%	3,193	46.3%

Source: U.S. Census Bureau 2024 ACS Vulnerable Population; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison 2020



Table 16-6. Vulnerable Populations Located in the WUI Intermix Hazard Area

Jurisdiction	Vulnerable Persons Living in the Wildland Urban Intermix (WUI) Hazard Area									
	Persons Over 65	Percent of Total	Persons Under 5	Percent of Total	Non-English-Speaking Persons	Percent of Total	Persons with a Disability	Percent of Total	Persons in Poverty	Percent of Total
Brewster (V)	16	4.8%	3	4.2%	27	5.0%	18	5.0%	18	5.0%
Carmel (T)	3,345	50.0%	678	49.9%	258	49.9%	1,802	50.0%	748	49.9%
Cold Spring (V)	45	10.5%	9	10.0%	7	10.0%	16	10.4%	9	10.7%
Kent (T)	1,020	45.9%	374	45.9%	109	45.6%	603	45.9%	391	45.9%
Nelsonville (V)	42	41.6%	11	40.7%	0	0.0%	26	41.9%	8	38.1%
Patterson (T)	1,081	57.6%	300	57.5%	111	57.5%	603	57.5%	1,116	57.6%
Philipstown (T)	1,283	72.8%	187	72.5%	17	70.8%	543	72.7%	390	72.8%
Putnam Valley (T)	1,380	62.5%	378	62.4%	127	62.3%	616	62.5%	308	62.5%
Southeast (T)	1,739	52.9%	467	52.9%	521	52.9%	841	52.9%	590	52.9%
Putnam County (Total)	9,951	52.6%	2,407	52.0%	1,177	42.4%	5,068	51.4%	3,578	51.9%

Source: U.S. Census Bureau 2024 ACS Vulnerable Population; Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison 2020



16.2.2 General Building Stock

Buildings located within the WUI intermix and interface hazard areas are vulnerable to the wildfire hazard. Buildings constructed of wood or vinyl siding are generally more likely to be impacted by the wildfire hazard than buildings constructed of brick or concrete.

Table 16-7 shows the estimated number and replacement cost value of buildings in the wildfire hazard areas. There are an estimated 15,982 buildings in the WUI interface hazard area, representing 33.6 percent of the County's total general building stock inventory replacement cost value. There are an estimated 21,172 buildings in the WUI intermix hazard area, representing 57.7 percent of the County's total general building stock inventory replacement cost value. The Town of Carmel has the greatest number of buildings in the WUI interface (5,165) and intermix hazard areas (6,210).

Table 16-8 shows the breakdown of buildings in the hazard areas by occupancy class. The occupancy class with the most buildings in both hazard areas is residential.

16.2.3 Community Lifelines and Other Critical Facilities

Table 16-9 and Table 16-10 summarize the number of critical facilities exposed to the wildfire hazard. Of 300 critical facilities located in the WUI interface, the greatest number (84) are not within a defined lifeline category (listed as "other critical facilities"). Of 107 critical facilities located in the WUI intermix, the greatest number (95) are also listed as "other critical facilities".

Common impacts on critical facilities related to wildfire are associated with the following:

- **Communication Facilities**—Damage to key facilities can disrupt communication in the planning area.
- **Emergency Services**—Increased demands are placed on firefighters, EMS, and public health services during and after a wildfire event. If fire stations are compromised, it would make fire suppression even more challenging.
- **Energy Sources**—Wildfires can damage power lines, transformers, and other critical infrastructure, leading to outages and repair costs.
- **Hazardous Materials and Fuel Storage**—During a wildfire, hazardous material containers could rupture due to excessive heat and act as fuel for the fire, escalating the fire to unmanageable levels. Contents could leak into surrounding areas, saturating soils, and seeping into surface waters.
- **Transportation**—Wildfires may impact transportation routes, blocking residents and commuters from getting in and out of the County during a wildfire. Char and debris can pollute the air and make it difficult to drive. Flames near roadways can make travel unsafe. Fires can create conditions that block or prevent access, isolating residents and emergency service providers.
- **Water Supplies**—Wildfires can impact water supplies throughout the County because of residual pollutants like char or debris landing in water resources which can clog wastewater pipes, culverts, etc.



Table 16-7. Building Stock within the WUI in Putnam County

Jurisdiction	Total Number of Buildings	Total RCV	Estimated Number and Total RCV of Structures in the WUI Hazard Areas							
			Number of Buildings in WUI Interface Hazard Area	% of Total	Total RCV of Buildings in WUI Interface Hazard Area	% of Total	Number of Buildings in WUI Intermix Hazard Area	% of Total	Total RCV of Buildings in WUI Intermix Hazard Area	% of Total
Brewster (V)	569	\$368,940,861	520	91.4%	\$320,592,499	86.9%	24	4.2%	\$7,862,116	2.1%
Carmel (T)	12,221	\$9,049,629,618	5,165	42.3%	\$3,487,117,633	38.5%	6,210	50.8%	\$4,613,196,731	51.0%
Cold Spring (V)	761	\$474,899,526	688	90.4%	\$432,342,366	91.0%	73	9.6%	\$42,557,160	9.0%
Kent (T)	5,760	\$3,047,474,569	2,813	48.8%	\$1,166,743,241	38.3%	2,828	49.1%	\$1,760,666,073	57.8%
Nelsonville (V)	283	\$143,090,491	160	56.5%	\$69,818,082	48.8%	115	40.6%	\$66,992,343	46.8%
Patterson (T)	4,118	\$3,126,610,140	1,583	38.4%	\$790,984,374	25.3%	2,427	58.9%	\$1,907,976,567	61.0%
Philipstown (T)	4,049	\$2,634,231,865	886	21.9%	\$501,194,636	19.0%	3,071	75.8%	\$2,026,330,831	76.9%
Putnam Valley (T)	5,383	\$2,989,131,470	1,775	33.0%	\$859,032,507	28.7%	3,435	63.8%	\$1,930,035,225	64.6%
Southeast (T)	5,488	\$5,049,468,784	2,392	43.6%	\$1,407,851,154	27.9%	2,989	54.5%	\$3,153,554,545	62.5%
Putnam County (Total)	38,632	\$26,883,477,324	15,982	41.4%	\$9,035,676,491	33.6%	21,172	54.8%	\$15,509,171,591	57.7%

Source: Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; RSMeans 2026; SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison 2020



Table 16-8. Buildings In the WUI Interface and Intermix Hazard Areas by General Occupancy Class

Jurisdiction	Buildings in the WUI Interface Hazard Area				Buildings in the WUI Intermix Hazard Area			
	Residential	Commercial	Industrial	Other	Residential	Commercial	Industrial	Other
Brewster (V)	375	125	4	16	20	4	0	0
Carmel (T)	4,480	633	20	32	5,067	1,072	30	41
Cold Spring (V)	532	130	6	20	64	9	0	0
Kent (T)	2,576	235	0	2	2,213	524	11	80
Nelsonville (V)	122	33	1	4	91	22	1	1
Patterson (T)	1,403	159	9	12	1,925	420	7	75
Philipstown (T)	732	137	1	16	2,043	972	9	47
Putnam Valley (T)	1,597	168	1	9	2,758	643	3	31
Southeast (T)	2,025	342	20	5	2,296	619	38	36
Putnam County (Total)	13,842	1,962	62	116	16,477	4,285	99	311

Source: Putnam County 2025, 2026; NYSEDA 2026; NYS 2024; RSMeans 2026; SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison 2020

Note: Other = Government, Religion, Agricultural, and Education



Table 16-9. Number of Facilities in the WUI interface

Jurisdiction	Number of Facilities in the WUI interface									Total Facilities in Hazard Area	
	Communi- cations	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Brewster (V)	2	1	4	1	1	4	0	4	17	34	63.0%
Carmel (T)	20	2	6	8	10	15	2	9	20	92	28.4%
Cold Spring (V)	5	0	2	1	1	8	3	2	16	38	97.4%
Kent (T)	1	0	0	3	0	1	5	3	0	13	7.3%
Nelsonville (V)	0	0	0	0	0	2	0	2	1	5	41.7%
Patterson (T)	0	1	2	9	0	4	1	1	8	26	14.5%
Philipstown (T)	5	1	3	0	2	6	5	2	13	37	24.2%
Putnam Valley (T)	4	0	0	0	0	5	5	2	5	21	17.4%
Southeast (T)	3	1	3	9	0	2	4	8	4	34	17.2%
Putnam County (Total)	40	6	20	31	14	47	25	33	84	300	23.9%

Source: Putnam County 2021, 2026; NYS GIS Clearinghouse 2026; NYSDEC 2025 – 2026; ESRI 2026; NYS Board of Elections 2025; HIFLD 2025; SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison 2020



Table 16-10. Number of Facilities in the WUI intermix Hazard Area

Jurisdiction	Number of Facilities in the WUI intermix Hazard Area									Total Facilities in Hazard Area	
	Communi- cations	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Brewster (V)	0	0	0	0	0	0	1	0	0	1	1.9%
Carmel (T)	45	9	11	19	7	22	5	27	24	169	52.2%
Cold Spring (V)	0	0	0	0	0	0	0	1	0	1	2.6%
Kent (T)	18	2	2	9	4	22	4	3	18	82	46.3%
Nelsonville (V)	3	0	0	1	0	2	0	0	1	7	58.3%
Patterson (T)	12	6	2	11	2	53	11	5	15	117	65.4%
Philipstown (T)	32	1	4	3	1	18	11	5	21	96	62.7%
Putnam Valley (T)	31	1	3	6	1	11	4	0	9	66	54.5%
Southeast (T)	22	4	8	16	1	16	10	25	7	109	55.1%
Putnam County (Total)	163	23	30	65	16	144	46	66	95	648	51.6%

Source: Putnam County 2021, 2026; NYS GIS Clearinghouse 2026; NYSDEC 2025 – 2026; ESRI 2026; NYS Board of Elections 2025; HIFLD 2025; SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison 2020



16.2.4 Economy

Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed business and decrease in tourism. Wildfires can cost thousands of taxpayer dollars to suppress and control and can involve hundreds of operating hours on fire apparatus and thousands of volunteer man hours from the volunteer firefighters. There are also many direct and indirect costs to local businesses that excuse volunteers from working to fight these fires. Impacts on specific industries include the following:

- **Agriculture**—Crops, livestock, and farmland can be destroyed, disrupting the local food supply and economy.
- **Tourism**—Popular natural and recreational areas may become inaccessible or less attractive to visitors post-fire.

16.2.5 Natural Resources

Wildfires are a necessary part of ecosystem health, but intense wildfires severely damage the environment, including burning and killing of plant and animal life. Intense fires can also heat narrow and shallow waterways, resulting in damage to aquatic systems. Common environmental impacts related to wildfire are associated with the following:

- **Air Quality Degradation**—Wildfire smoke releases fine particulate matter and harmful gases, leading to poor air quality across large areas.
- **Altered Ecosystems**—Post-fire runoff polluted with debris and contaminants can harm terrestrial ecosystems (USGS 2023c). Changes in vegetation and habitat can reduce biodiversity and affect ecosystem services.
- **Invasive Species Proliferation**—Intense wildfire events that destroy existing ecosystems can result in an increase in invasive species that may be able to move into an area with a lack of natural competitors (U.S. Department of the Interior 2012).
- **Soil Degradation and Erosion**—High-intensity fires can destroy vegetation and organic matter, reducing soil stability and leading to erosion, sedimentation in waterways, and loss of soil fertility.
- **Water Quality Decline**—Ash and debris from burned areas can wash into streams and rivers, increasing turbidity and contaminating water supplies with chemicals and heavy metals. Chemicals such as iron, lead, and zinc may leach into the stormwater and contaminate nearby streams. Post-fire runoff polluted with debris and contaminants can be extremely harmful to aquatic life (USGS 2023c).

16.2.6 Historic and Cultural Resources

Wildfires can destroy historic sites, cultural landmarks, and sacred spaces. Historic and cultural documents and physical artifacts that must be stored in a climate-controlled facility are at risk from wildfires. Additionally, the factors that can spur a wildfire, such as severe storms and high winds, can impact the structural integrity of historically or culturally significant buildings. Many historically or culturally significant structures are made of weakened materials and not up to current building codes, which increases the risk of incurring damage.



16.3 FUTURE CHANGES THAT MAY AFFECT RISK

16.3.1 Potential or Planned Development

Any changes in development can impact the County's risk to the wildfire hazard, especially new development in WUI areas. Pressure to develop some forested areas and open land adjacent to forested areas, especially for residential use, will generally result in increases to the WUI and the value of improved property within these areas in most jurisdictions, and hence an increased risk of future property damage and public danger due to wildfires.

The County should implement wildfire management strategies in existing building code to protect structures against the residual impacts from wildfire such as heat, debris, and char. Furthermore, development should be built with access to transit routes that will enable easier evacuation during a wildfire event.

16.3.2 Projected Changes in Population

Changes in the density of the population can impact the number of persons exposed to wildfires and the draw upon water resources. Fire suppression capabilities are high at the state and local levels. However, new development and changes in population with a mix of additional structures, ornamental vegetation, and wildland fuels will require continued assessment of the hazard and mitigation of risk.

16.3.3 Climate Change

Warmer temperatures, changes in rainfall, and increased periods of drought may create an atmospheric and fuel environment that is more conducive to large, severe fires (United Nations 2021). Climate models project the following changes in New York State (NOAA n.d.-c):

- Warmer average temperatures, especially in spring and summer
- More frequent and intense heatwaves
- Earlier snowmelt and longer dry periods
- Increased variability in precipitation, including both droughts and heavy rainfall events

These changes may lead to a longer and earlier wildfire season, particularly in areas with dense vegetation and limited moisture retention. Future conditions indicate the likelihood of an increased number of droughts, prolonged fire seasons, and extreme heat, which can exacerbate wildfire risks and cascading impacts. When fuel loads and fuel moisture become altered, forest susceptibility to wildfires changes. An increase in winds may assist in the rapid spread fires, making them harder to contain and more likely to expand into residential areas. Changes in conditions may impact the distribution and perseverance of insect outbreaks that create dead trees (increase fuel).

Some studies project that the Northeast's fire season may start earlier and last longer due to warming temperatures. The risk of air quality impacts from wildfire smoke from local and regional wildfire events will increase if the fire season starts earlier and lasts longer (Stevens & Lamie 2024). Additionally, warmer winters may reduce snowpack and allow for earlier vegetation growth, which can dry out and become fuel for spring wildfires.

The frequency and intensity of wildfires in New York are projected to increase modestly (NOAA n.d.-c). Proactive mitigation strategies, such as forest thinning, controlled burns, and public education, are critical to reducing these risks. The spring burn ban (March 16 to May 14) enforced by the New York State Department of Environmental Conservation is likely to remain a critical tool for managing risk.



17. HAZARD RANKING

Each jurisdiction participating in this HMP needs to recognize the hazards that pose the greatest risk to its community and direct its attention and resources accordingly to manage risk and reduce losses. To achieve this, the hazards of concern were ranked using methodologies promoted by FEMA's hazard mitigation planning guidance and input from all participating jurisdictions.

Hazard rankings were one of the bases for identifying the hazard mitigation strategies included in Volume II. These rankings may vary among jurisdictions. A hazard may be ranked as a low risk for one municipality but a high risk for another, due to differences in vulnerability and impact. Jurisdictional ranking results are presented in each jurisdictional annex in Volume II.

17.1 HAZARD RANKING METHODOLOGY

17.1.1 Categories Used in Ranking

A relative hazard risk ranking process was conducted for this HMP. The Risk Factor (RF) approach produces numerical values that allow identified hazards to be ranked against one another (the higher the RF value, the greater the hazard risk). The ranking methodology is based on five risk assessment categories (probability of occurrence, impact, spatial extent, warning time, and duration), with the following scoring parameters defined for each category:

1. **Level**—The level is a qualitative description of how each hazard rates in each category (such as low to high, or unlikely to frequent)
2. **Criteria**—The criteria are clearly determinable quantities or descriptions that define which level should apply to each hazard
3. **Index**—The index is the hazard's score in each category, based on the assigned level
4. **Weight**—The weighting is a multiplier applied to each hazard's numeric value in each category, to represent the relative importance of the category (the higher the weighting, the more important the category)

Table 17-1 identifies the risk assessment categories, the criteria and associated risk level indices used to quantify their risk, and the weighting factor (weight value) applied to each category.

17.1.2 Total Ranking Score

To calculate the RF value for a given hazard, the assigned risk index value for each category is multiplied by the weighting factor to give a category score. The RF value is the sum of all category scores, as per the equation below:

Risk Factor Methodology Equation

$$\text{RF Value} = [(\text{Probability} \times 0.3) + (\text{Impact} \times 0.3) + (\text{Spatial Extent} \times 0.2) + (\text{Warning Time} \times 0.1) + (\text{Duration} \times 0.1)]$$

Hazards identified as high-risk have RFs greater than or equal to 2.5. RFs ranging from 2.0 to 2.4 are considered moderate-risk hazards. Hazards with RFs less than 2.0 are considered low risk hazards. The threat posed to life and property for moderate-risk and high-risk hazards is considered significant enough to warrant hazard-specific mitigation actions.



Table 17-1. Summary of Risk Factor Approach

Level	Criteria	Index	Weight
Category: Probability—What is the likelihood of a hazard event occurring in a given year?			
Unlikely	Annual Probability < 1%	1	30%
Possible	Annual Probability 1 – 49.9%	2	
Likely	Annual Probability 50 – 90%	3	
Highly Likely	Annual Probability > 90%	4	
Category: Impact—In terms of injuries, damage, or death, what level of impacts are anticipated for a significant hazard event?			
Minor	Very few injuries if any. Only minor property damage. Minimal disruption to quality of life. Temporary shutdown of critical facilities.	1	30%
Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	
Critical	Multiple deaths or injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one week.	3	
Catastrophic	High number of deaths or injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Category: Spatial Extent—How large of an area could be impacted by a hazard event? Are impacts localized or regional?			
Negligible	<1% of area affected	1	20%
Small	1 – 10.9% of area affected	2	
Moderate	11 – 25% of area affected	3	
Large	>25% of area affected	4	
Category: Warning Time—Is there usually some lead time associated with the hazard event? Have warning measures been implemented? <i>Note: Warning time criteria may be adjusted based on hazard addressed</i>			
Extended	> 24 hours	1	10%
Limited	12 – 24 hours	2	
Short	6 – 12 hours	3	
Very Short	< 6 hours	4	
Category: Duration—How long does the hazard event usually last? <i>Note: Warning time criteria may be adjusted based on hazard addressed</i>			
Very Short	< 6 hours	1	10%
Short	< 24 hours	2	
Long	< 1 week	3	
Extended	> 1 week	4	

17.2 HAZARD RANKING RESULTS

Using the methodology described above, the hazard ranking for the identified hazards of concern was determined for the County. Table 17-2 shows the preliminary index values for the five risk assessment categories for each hazard, along with the resulting RF rating. A risk assessment result for the entire County does not mean that each jurisdiction is at the same amount of risk to each hazard. The finalized hazard ranking for each jurisdiction can be found in the jurisdictional annexes in Volume II; the County's final hazard ranking is also presented in Table 17-3.



Mitigation actions were developed for all high-ranked hazards as presented in the jurisdictional annexes. For jurisdictions that do not have two or more high rankings, medium rankings that have associated actions can be considered as hazards of concern. Mitigation actions developed are presented in the jurisdictional annexes in Volume II.

Table 17-2. Preliminary Hazard Ranking for Putnam County

Hazards	Index Value					Risk Factor
	Probability	Impact	Spatial Extent	Warning Time	Duration	
High-Risk Hazards						
Severe Storm	4	2	3	2	2	2.8
Severe Winter Storm	4	2	3	2	2	2.8
Drought	3	1	4	1	4	2.5
Wildfire	3	2	2	3	3	2.5
Medium-Risk Hazards						
Extreme Temperature	3	2	3	1	2	2.4
Harmful Algal Bloom	4	1	2	2	3	2.4
Disease Outbreak	1	3	3	1	4	2.3
Low-Risk Hazards						
Flood	2	1	3	2	2	1.9
Earthquake	1	1	3	4	1	1.7
Dam Failure	1	2	1	2	1	1.4
Terrorism	1	1	1	4	1	1.3

Table 17-3. Final Hazard Ranking for Putnam County

Hazards	Index Value					Risk Factor
	Probability	Impact	Spatial Extent	Warning Time	Duration	
High-Risk Hazards						
Severe Storm	4	2	3	2	2	2.8
Severe Winter Storm	4	2	3	2	2	2.8
Drought	3	1	4	1	4	2.5
Medium-Risk Hazards						
Extreme Temperature	3	2	3	1	2	2.4
Wildfire	2	2	2	4	3	2.3
Disease Outbreak	1	3	3	1	4	2.3
Flood	3	1	3	2	2	2.2
Low-Risk Hazards						
Harmful Algal Bloom	3	1	2	1	2	1.9
Earthquake	1	1	3	4	1	1.7
Dam Failure	1	2	1	2	1	1.4
Terrorism	1	1	1	4	1	1.3

PART 3:

CAPABILITY

ASSESSMENT





18. CAPABILITY ASSESSMENT

A capability assessment is an inventory of a community's missions, programs, and policies and an analysis of its capacity to carry them out (FEMA 2003). This integral part of the planning process analyzes current governmental programs, policies, regulations, and funding that could either facilitate or hinder mitigation. Through assessing its capabilities, a jurisdiction learns whether it can implement certain mitigation actions by determining the following:

- The range of local and/or state administrative, programmatic, regulatory, financial, and technical resources available to assist in implementing mitigation actions
- Types of mitigation actions that may be technically, legally, administratively, politically, or fiscally challenging or infeasible because they are outside of current capabilities
- Opportunities to enhance local capabilities to support long-term mitigation and risk reduction

This chapter summarizes existing capabilities at all levels of government (federal, state, county, local) for supporting hazard mitigation within the planning area. These capabilities are presented in the following categories:

- Planning and regulatory capabilities
- Administrative and technical capabilities
- Fiscal capabilities

Each Planning Partner's annex in Volume II also includes a capability assessment specific to those jurisdictions. In addition to the above categories, the annexes review capabilities in the more localized categories of adaptive capacity and education and outreach. Participating jurisdictions evaluated the effectiveness of their capabilities for supporting hazard mitigation and identified opportunities to enhance those capabilities. Each jurisdiction identified how it has integrated hazard mitigation into its existing planning, regulatory, and operational/administrative framework and how it intends to promote ongoing integration.

18.1 PLANNING AND REGULATORY CAPABILITIES

Planning and regulatory capabilities are based on ordinances, policies, local laws, state statutes, plans, and programs that relate to managing growth and development. Planning and regulatory capabilities refer not only to current plans and regulations, but also to the jurisdiction's ability to change and improve those plans and regulations as needed. This section summarizes planning and regulatory capabilities for Putnam County. Further information is provided in the jurisdictional annexes in Volume II.

18.1.1 Federal

Biggert Waters National Flood Insurance Reform Act of 2012

The Biggert-Waters National Flood Insurance Reform Act of 2012 increased National Flood Insurance Program rates to more accurately reflect the flood risk to buildings in flood hazard areas. It encouraged property owners to consider long-term insurance costs when undertaking reconstruction or elevation of damaged buildings. An investment to reconstruct the lowest floor of a building at a higher elevation could result in significant future flood insurance savings. This Act was modified by the Homeowner's Flood Insurance Affordability Act of 2014 as described in a later section of this chapter.



Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004

The Flood Insurance Reform Act of 2004 established a program for mitigation of severe repetitive loss properties and gave FEMA the authority to fund mitigation activities for individual repetitive loss claims properties. The Act provided additional coverage for compliance with land use and control measures.

Disaster Mitigation Act of 2000

The Disaster Mitigation Act of 2000 (DMA) is the current federal legislation addressing hazard mitigation planning. The DMA emphasizes the need for state, tribal, and local entities to closely coordinate mitigation planning and implementation efforts. It specifically addresses planning at the local level. Communities with approved hazard mitigation plans are eligible to apply for federal funds for mitigation of hazards. HMPs that meet DMA requirements are eligible for FEMA Hazard Mitigation Assistance funds.

Disaster Recovery Reform Act

The Disaster Recovery Reform Act permits the use of technical and financial assistance through the Pre-Disaster Hazard Mitigation Grant Program to implement codes, specifications, and standards that incorporate the latest hazard-resistant designs. The Act called for the creation of a National Public Infrastructure Pre-Disaster Mitigation Fund and authorized the President's contribution to the cost of hazard mitigation measures to be used to increase resilience in any area affected by a major disaster.

Emergency Support Function #14, Long-Term Recovery Planning

FEMA's Emergency Support Function (ESF) #14 (Long-Term Community Recovery) provides a mechanism for coordinating federal support to state, tribal, regional, and local governments, nongovernmental organizations (NGOs), and the private sector to enable community recovery from the long-term consequences of extraordinary disasters. ESF #14 accomplishes this by identifying and facilitating availability and use of sources of recovery funding, and providing technical assistance for community recovery and recovery planning support. ESF #14 may be activated for incidents that require a coordinated federal response to address significant long-term impacts (e.g., impacts on housing, government operations, agriculture, businesses, employment, community infrastructure, the environment, human health, and social services) to foster sustainable recovery. Actions coordinated under ESF #14 include pre-incident planning and coordination, immediately prior to the incident, post-event planning, and operations (FEMA 2008).

Homeowner's Flood Insurance Affordability Act

The Homeowner's Flood Insurance Affordability Act modified the Biggert-Waters Flood Insurance Reform Act to lower rate increases on some NFIP policies, prevent some future rate increases, and implement a surcharge on all policyholders. The Act authorized resources for the National Academy of Sciences to complete an affordability study. It authorized private insurers and other stakeholders to work together to implement its reforms and to work toward helping families maintain affordable flood insurance, ensuring the financial stability of the NFIP, and reducing the risks and consequences of flooding nationwide.

Local Hazard Mitigation Plan Regulations

FEMA has prepared policies and procedures for FEMA's review and approval of local hazard mitigation plans (44 CFR Part 201.6). The rules provide detailed guidance on what communities must include in a plan.



National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a federal program enabling property owners in participating communities to purchase insurance against flood losses in exchange for state and community floodplain management regulations that reduce future flood damage. Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods. Flood damage in the U.S. is reduced by nearly \$1 billion each year through communities implementing sound floodplain management requirements and property owners purchasing flood insurance. Additionally, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance (FEMA 2007a).

Community participation in the NFIP is voluntary. Communities participate by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. States and municipalities may adopt higher regulatory standards than required by the NFIP, specifically related to the following:

- **Base Flood Elevation**—The elevation of surface water due to flooding that has a 1 percent chance of being equaled or exceeded in any given year. The NFIP requires that, when there is a base flood elevation available, the lowest floor, including any basement, must be at or above the base flood elevation. Community floodplain management ordinances are permitted to require even higher lowest-floor elevations.
- **Cumulative Substantial Improvement/Damage**—The NFIP allows improvements valued at up to 50 percent of the building's pre-improvement value to be permitted without meeting flood protection requirements. Over the years, a community may issue a succession of permits for different repairs or improvement to the same structures. This can greatly increase the overall flood damage potential for structures within a community. The community may wish to deem "substantial improvement" cumulatively so that once a threshold of improvement within a certain length of time is reached, the structure is considered to be substantially improved and must meet flood protection requirements.

Additional information on the NFIP program and its implementation throughout Sullivan County may be found in the flood hazard profile (see Section 11.2.2). Municipal compliance with the NFIP is described in the jurisdictional annexes in Volume II. Several municipalities propose actions in their mitigation strategies to update their flood damage prevention ordinance or to ensure that their floodplain administrators complete training on floodplain management and the NFIP. This information is also included in the annexes.

NFIP Community Rating System

FEMA's Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. NFIP flood insurance premiums are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance.

As of May 2026, none of the communities in Putnam County participate in the CRS program. Putnam County is exploring CRS program requirements through technical expertise and assistance to guide interested municipalities through the application process.



Presidential Policy Directive 8

Presidential Policy Directive 8 (PPD-8) requires that a threat hazard identification and risk assessment (THIRA) be developed for a state to remain eligible for Homeland Security Grant Program (HSGP) and Emergency Management Program Grant funding.

Risk Mapping, Assessment, and Planning

FEMA works with federal, state, tribal, and local partners across the nation to identify flood risk and promote informed planning and development practices to help reduce that risk through the Risk Mapping, Assessment, and Planning (Risk MAP) program. Risk MAP provides high-quality flood maps and information, tools to better assess the risk from flooding, and planning and outreach support to communities to help them take action to reduce (or mitigate) flood risk. Each Risk MAP flood risk project is tailored to the needs of each community and may involve different products and services.

According to the Risk MAP Progress interactive map available online at the time of this HMP update, there are numerous active Risk MAP projects taking place throughout New York (FEMA n.d.-a). FEMA coordinates and works directly with municipal floodplain managers during the Risk MAP project process. The State NFIP Coordinator is kept apprised of project activities and consults as needed.

Risk Rating 2.0: Equity in Action

FEMA introduced Risk Rating 2.0: Equity in Action to provide more individualized and equitable flood insurance rates. The rating methodology considers frequency of flooding, flood types, proximity to flood sources, and building characteristics such as first floor heights and costs to rebuilt (FEMA 2022c). Continued shifts in flood insurance costs, coverage, impacts on mitigation of flood prone properties, and potential updates to Risk Rating 2.0 will be monitored by Putnam County throughout the period of performance of the 2025 HMP.

Robert T. Stafford Disaster Relief and Emergency Assistance Act

The Robert T. Stafford Disaster Relief and Emergency Assistance Act provides federal government assistance to state and local governments to alleviate the impacts of disasters. The Act provides for the following:

- Revising and broadening the scope of existing disaster relief programs
- Encouraging the development of comprehensive disaster preparedness and assistance plans, programs, capabilities, and organizations by state and local governments
- Achieving greater coordination and responsiveness of disaster preparedness and relief programs
- Encouraging individuals and state and local governments to protect themselves by obtaining insurance coverage to supplement or replace governmental assistance
- Encouraging hazard mitigation measures to reduce losses from disasters, including development of land-use and construction regulations
- Providing federal assistance programs for both public and private losses sustained in disasters

U.S. Army Corps of Engineers Permitting

Under Section 404(e) of the Clean Water Act, the U.S. Army Corps of Engineers (USACE) can issue general permits to authorize activities that have only minimal individual and cumulative adverse environmental effects. There are three types of USACE permits:



- A nationwide permit is a general permit that authorizes activities across the country unless a district or division commander revokes the nationwide permit in a state or other geographic region. There are 59 nationwide permits, and they authorize a wide variety of activities, including linear transportation projects, bank stabilization activities, residential development, commercial and industrial developments, aids to navigation, and certain maintenance activities (USACE 2021).
- Standard permits are individual permits that involve full public interest review of an individual permit application and include the issuance of a public notice for any project that does not meet the terms and conditions of a nationwide permit or a Letter of Permission.
- Regional general permits are for small, specialized projects. In New York State, there are six regional general permit categories (USACE Buffalo District n.d.).

18.1.2 State

Community Risk and Resiliency Act

New York State's Community Risk and Resiliency Act (CRRRA) ensures that certain state monies, facility-siting regulations, and permits include consideration of the effects of climate risk and extreme weather. CRRRA includes five major provisions (NYSDEC 2020):

1. **Official Sea-Level Rise Projections**—CRRRA requires the NYSDEC to adopt science-based sea-level rise projections into regulation.
2. **Consideration of Sea-Level Rise, Storm Surge and Flooding**—CRRRA requires applicants for permits or funding in a number of specified programs to demonstrate that future physical climate risk due to sea-level rise, storm surge, and flooding have been considered. It requires NYSDEC to consider incorporating these factors into certain facility-siting regulations.
3. **Smart-Growth Public Infrastructure Policy Act Criteria**—CRRRA adds mitigation of risk due to sea-level rise, storm surge, and flooding to the list of smart-growth criteria to be considered by state public infrastructure agencies.
4. **Guidance on Natural Resiliency Measures**—CRRRA requires NYSDEC, in consultation with the New York Department of State, to develop guidance on the use of natural resources and natural processes to enhance community resilience.
5. **Model Local Laws Concerning Climate Risk**—CRRRA requires the Department of State, in cooperation with NYSDEC, to develop model local laws that include consideration of future risk due to sea-level rise, storm surge and/or flooding. These model local laws must be based on available data predicting the likelihood of extreme weather events, including hazard risk analysis.

CRRRA requires NYSDEC, in consultation with the Department of State, to prepare guidance on implementation of the statute. To achieve this, NYSDEC created *New York State Flood Risk Management Guidance for Implementation of the Community Risk and Resiliency Act*. This document provides guidance to state agencies as they develop program-specific guidance requiring applicants to demonstrate consideration of sea-level rise, storm surge, and flooding, as permitted by program-authorizing statutes and operating regulations. The guidance document incorporates possible future conditions, including the greater risks of coastal flooding presented by sea-level rise and enhanced storm surge and inland flooding expected to result from increasingly frequent extreme precipitation events (NYSDEC 2020).



Comprehensive Planning

Comprehensive planning is a process for achieving community goals and aspirations through community development. The outcome of this process is a comprehensive plan that directs public policy in terms of transportation, utilities, land use, recreation, and housing. New York State statutes require that all land use laws in a municipality be consistent with a comprehensive plan. Towns are authorized to develop and adopt a comprehensive plan by New York State Town Law Section 272-a. Villages can do the same per Section 7-722 of the Village Law.

Local Waterfront Revitalization Program

New York State's Waterfront Revitalization of Coastal Areas and Inland Waterways Act offers local governments the opportunity to participate in the State's Coastal Management Program (CMP) on a voluntary basis by preparing and adopting a Local Waterfront Revitalization Program (LWRP), providing detailed implementation of the CMP through use of such existing broad powers as zoning and site plan review. Any village, town, or city located along the state's coast or designated inland waterway can prepare a new or amend an existing LWRP. Municipalities are encouraged to use the LWRP to address local revitalization issues in a broader context, aligned with regional economic development strategies and regional resource protection and management programs (NYDOS n.d.).

An LWRP is a planning document prepared by a community and the program established to implement the plan. It may be comprehensive and address all issues that affect a community's entire waterfront, or it may address the most critical issues facing a significant portion of its waterfront. State rules and regulations outline required content of an LWRP, the processes of review and approval of an LWRP, and LWRP amendments (NYDOS n.d.).

An approved LWRP reflects community consensus and provides a clear direction for appropriate future development. It establishes a long-term partnership among local government, community-based organizations, and the State of New York. When an LWRP is approved by the New York State Secretary of State, state agency actions are required to be consistent with the approved LWRP to the maximum extent practicable. When the federal government concurs with the incorporation of an LWRP into the CMP, federal agency actions must be consistent with the approved addition to the CMP. This consistency provision is a strong tool that helps ensure all government levels work in unison to build a stronger economy and a healthier environment (NYDOS n.d.).

New York State Division of Homeland Security and Emergency Services

The NYS DHSES is the lead agency that reviews, submits, and administers federal funding to programs that mitigate hazards. These programs help find projects that are cost beneficial to help reduce damages from hazards. Through ESF #14 (Long-Term Recovery Planning), DHSES works to have a plan for long-term planning and recovery prior to a disaster or emergency. One of the areas of planning includes mitigation. This coordination allows for another statewide plan to incorporate mitigation principles and planning. The NYS DHSES also is the lead agency in preparing the State's THIRA.

New York Power Authority

The New York Power Authority (NYPA) operates 16 generating facilities and more than 1,400 circuit-miles of transmission lines. State and federal regulations shape NYPA's diverse customer base, which includes large and small businesses, not-for-profit organizations, community-owned electric systems, rural electric cooperatives, and government entities. NYPA provides the lowest-cost electricity in New York State and is the only statewide electricity supplier.



NYSDEC Floodplain Management Elevation Requirements

New York State law requires that, when there is a base flood elevation available, the lowest floor, including any basement, must be at or above the base flood elevation (plus 2 feet). Elevation may be by means of properly compacted fill, a solid slab foundation, or a “crawl space” foundation, which contains permanent openings to let flood waters in and out. Non-residential structures may be flood-proofed in lieu of elevation. Where a local floodplain administrator has information to estimate a base flood elevation, such as historical flood records or a hydraulic study, that elevation must be used. If the development consists of more than 5 acres or more than 50 lots, the permit applicant must develop a base flood elevation and build accordingly (NYSDEC n.d.-c). Communities may go beyond this requirement, providing for additional freeboard. In most New York communities, new structures must have the lowest floor 3 feet or more above the highest adjacent grade.

Stormwater Management Planning

The goal of stormwater management is to ensure that the quantity and quality of stormwater runoff from a site that is undergoing construction, or development should not be substantially altered from its pre-development conditions. The federal law commonly known as Stormwater Phase II requires permits for stormwater discharges from Municipal Separate Storm Sewer Systems in urbanized areas and those designated by the NYSDEC. Owners or operators of such systems must be authorized in accordance with the State Pollutant Discharge Elimination System General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems. The permit requires development of a Stormwater Management Program (NYSDEC 2023e).

18.1.3 County, Local, and Regional

An Agricultural and Farmland Protection Plan for Putnam County

The Putnam County Agriculture & Farmland Protection Board prepared a plan in 2004 that outlined the county’s agricultural opportunities and challenges at that time (Putnam County Ag Board 2004). The Plan established five major goals to fulfill the vision for agriculture and farmland in Putnam County:

- Goal 1: Economic Opportunities—Preserve agriculture as an important industry in the county and promote further agricultural economic development.
- Goal 2: Community Support—Increase community support of agriculture and cultivate an enhanced appreciation of agriculture and the many roles it plays in Putnam County.
- Goal 3: Supportive Policies and Programs—Promote regional, county, and local policies and programs that encourage and sustain farming.
- Goal 4: Education—Promote policies and programs that enhance farm viability and profitability.
- Goal 5: Open Space and Natural Resources—Preserve agriculture as working open space and promote farm practices that protect natural resources.

Flood Preparedness and Response: A Guide for Municipalities

The Lower Hudson Coalition of Conservation Districts published a guide in 2014 that encourages municipalities to take steps to reduce flooding risks by planning emergency response procedures and addressing the causes of flooding. *Flood Preparedness and Response: A Guide for Municipalities* outlines procedures and chains of command during any disaster, including flooding, to allow effective, efficient response. The purpose of this guide is specifically to address the flooding of streams and creeks that affect bridges, roadways and other public



infrastructure. Municipalities can work with county agencies, local fire departments, school districts and other entities to develop a plan (LHCCD 2014).

Hudson Valley Regional Council Comprehensive Economic Development Strategy

The Hudson Valley Regional Council (HVRC) was established in 1977 as an organization of the Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, and Westchester county governments. It is one of 650 such councils in the United States that provide a regional perspective, offer planning, education and outreach, and advocate for the communities they serve. Partially funded by the U.S. Department of Commerce, Economic Development Administration, HVRC can assist local projects with federal funding opportunities.

Currently, HVRC is preparing an updated Comprehensive Economic Development Strategy (CEDS) for the region, a five-year regional plan to guide economic growth, resilience, and opportunity across the Hudson Valley. The annual CEDS report provides a snapshot of the region's economic status and identifies key economic development initiatives.

As noted in previous updates of the CEDS, the largest constraint facing Putnam County is that 40 percent of its land is owned by the New York City Department of Environmental Protection as part of the New York City water supply system, and 96 percent of the County is located in the City's watershed. Nonetheless, the County reports making significant strides in improving its overall economic competitiveness. Putnam County has a plethora of tourism and other forms of targeted economic development that impact the County and its jurisdictions.

Mid-Hudson Regional Sustainability Plan

The *Mid-Hudson Regional Sustainability Plan*, published in 2013 by the Mid-Hudson Planning Consortium, set out a vision for sustainable development that builds on the region's social, cultural, and natural history, with the goal of promoting economic development and environmental sustainability, and enhancing quality of life for the region's more than 2 million residents (Mid-Hudson Planning Consortium 2013).

Moving Forward 2055

Putnam County is part of the planning area for the New York Metropolitan Transportation Council's regional transportation plan *Moving Forward 2055: Connecting Communities, Creating Opportunities* (NYMTC 2025). The Plan covers all modes of surface transportation from a regional perspective including highways, streets, public transportation, bicycle and pedestrian facilities, goods movement, and special needs transportation. In addition, it addresses key transportation activities such as operations and management of the transportation system, safety, security, and regional finances.

Municipal Land Use Planning and Regulatory Authority

Municipalities have various land use planning mechanisms that can be leveraged to mitigate flooding and support hazard risk reduction. Specific local planning and regulatory capabilities are identified in the jurisdictional annexes in Volume II. These include comprehensive plans, flood damage prevention ordinances, local codes and regulations, stormwater regulations, and municipal level plans. A list of plans reviewed for this HMP is also provided in each annex.

Section 239 of New York State General Municipal Law requires the referral of certain local planning actions to the county planning commission for the examination of possible intermunicipal impacts. The Putnam County Division of Planning, Community Development and Environmental Management operates under this state law to advise local boards on the potential intermunicipal or countywide impact of local land use decisions. The County uses the



Comprehensive Plan to direct recommendations on municipal land use referrals and to review proposed County capital improvement projects.

Putnam County Climate Change Adaptation & Resilience Plan

Putnam County is increasingly vulnerable to flooding, extreme heat, and severe storms—hazards that can pose a threat to communities, health, property, and local businesses. To proactively address and plan for these challenges, the County is partnering with the HVRC and New York State to develop *Putnam County: Climate Change Adaptation & Resilience Plan* (Putnam County et al. 2026). This county-wide plan will encompass a climate vulnerability assessment and adaptation plan, integrating data analysis, community input, and strategic recommendations. Once complete (public review is underway as of mid-2026), the plan will provide a framework for action to support the County in creating a safer, healthier, and more resilient future.

Putnam County Complete Street Study

The 2024 *Putnam County Complete Street Study* evaluated six intersections and roadways throughout Putnam County in order to assess existing transportation network conditions and develop conceptual recommendations to enhance roadway safety and improve the active transportation (walking, biking, etc.) environment (Putnam County 2024).

Putnam County Comprehensive Emergency Management Plan

The *Putnam County Comprehensive Emergency Management Plan* was prepared by county officials working cooperatively with state, federal, and private agencies in a planning effort coordinated by NYS DHSES. The plan was designed to reduce or prevent emergency/disaster situations that the county is predisposed to and to enhance the adeptness of response and recovery operations.

Putnam County Groundwater Protection and Utilization Plan

The *Putnam County Groundwater Protection and Utilization Plan* addresses the protection, conservation, and responsible utilization of groundwater, which is a critical water source for the county. It aligns with the Putnam County Soil and Water Conservation District's mission to provide technical assistance and programs for residents, landowners, and local governments on soil and water resource management.

Putnam County Public Transit System Study

In January 2026, the Putnam County Department of Planning, Development and Public Transportation began a study of the County's public transit system. The study will begin with an in-depth demographic survey of current ridership and major stakeholders in order to better understand the transit needs of the County. The study will also include a system-wide analysis of current services, including the fixed-route network (PART), ADA paratransit service, and demand-response Microtransit Pilot Program (Putnam On-demand). This analysis will review current alignments, bus route frequencies, service spans, stop locations and on-call options and their various strengths and weaknesses.

The study will also develop a set of recommendations for potential service changes, including adjustments to route alignment, frequency, and service span. More substantial changes—such as route elimination, consolidation, separation into additional routes, or replacement with alternative service models like demand-response microtransit—may also be considered. These recommendations will aim to increase ridership and maximize coordination among services. The study will also examine areas of the County not presently served by public transit and include an analysis of potential service expansions.



Finally, the study will examine ways to improve service through enhanced rider amenities, such as bus shelters and signage. It will also explore opportunities to increase Putnam County's use of current and emerging transit technologies, including enhanced trip planning tools, live bus tracking, and contactless/cashless fare payment.

Vision 2010

While not a true Comprehensive Plan, the Vision 2010 Plan provides a foundation for a continuing dialogue among community leaders and local residents as to the direction Putnam County should aim for. Recommendations of the Plan include the following:

- Cultivating expanded partnerships among the County, New York City Department of Environmental Protection, municipalities, and state and federal agencies to maximize financial and technical assistance for protecting water quality and quantity
- Completing and implementing the Groundwater Protection and Utilization Plan
- Facilitating the requirements of the U.S. Environmental Protection Agency and the New York State Department of Environmental Conservation's Phase II Stormwater Management Program, as required by the Clean Water Act
- Supporting Putnam's agricultural economy by providing enhanced technical assistance in areas of environmental best management practices, farm business management assistance, and improved access to local and regional markets
- Creating harmony between the built and non-built environment through innovative land use policies
- Inventorying streams to identify stream channel erosion and begin remediation activities.

18.2 ADMINISTRATIVE AND TECHNICAL CAPABILITIES

This section summarizes administrative and technical capabilities in Putnam County. Further information is provided in the jurisdictional annexes in Volume II.

18.2.1 Federal

FEMA Community Assistance Visits and Community Assistance Contacts

FEMA evaluates NFIP compliance through audits known as Community Assistance Visits (CAVs) or Community Assistance Contacts (CACs). CAVs and CACs are performed at entry into the CRS and to maintain ongoing CRS participation. FEMA may conduct these with Region 2 staff, with NYSDEC staff under the Compliance Assistance Program—State Support Services Element grant, or with private contractors. CAVs are generally more rigorous than CACs. FEMA evaluates the following key areas in a compliance audit:

- The community's flood damage prevention ordinance
- Mapping products and other ordinances used to regulate floodplain development
- Floodplain development permitting procedures
- Floodplain permit applications and other forms/records, including substantial damage and improvement determinations
- Floodplain development review and performance standards
- Floodplain development permits issued to applicants



Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with federal and state agencies to ensure and promote dam safety for dams associated with hydropower. Every five years, an independent consulting engineer, approved by the FERC, must inspect and evaluate projects with dams higher than 32.8 feet (10 meters) or with a total storage capacity of more than 2,000 acre-feet.

HURREVAC

HURREVAC is the decision support tool of the National Hurricane Program used for tracking hurricanes. Administered by FEMA, USACE, and the National Hurricane Center, HURREVAC permits governmental agencies to coordinate notification, communication, activations, public warning, and evacuation and sheltering efforts (HURREVAC n.d.).

National Weather Service (NWS)

Monitoring and Forecasting

The NWS monitors weather and delivers weather forecasting. New York State is serviced by five weather forecast offices: Albany, Binghamton, Buffalo, New York, and Burlington (VT). Putnam County is covered by the office located in Binghamton. NYS DHSES uses conference calling with the NWS and county emergency management offices to share specific information and needs when severe storms are forecasted (NWS 2023).

StormReady Program

The NWS StormReady program provides local emergency managers with guidelines on how to improve hazardous weather operations. To participate, a community must establish a 24-hour warning point and emergency operations center; have more than one way to receive severe weather warnings and forecasts and to alert the public; create a system that monitors weather conditions locally; promote public readiness through community seminars; and develop a hazardous weather plan that includes training severe weather spotters and holding emergency exercises (NWS 2026). Putnam County is not a StormReady community.

U.S. Army Corps of Engineers

New York State is serviced by the Buffalo, Pittsburgh, and New York districts of USACE, which have programs that support hazard mitigation measures, including the following:

- **Silver Jackets**—Silver Jackets is the state-level implementation program for the National Flood Risk Management Program. The program leverages resources from federal, state, and local agencies to improve flood risk management, improve public risk communication through a united effort, and implement initiatives beneficial to local communities.
- **Climate Preparedness and Resilience Community of Practice**—This practice develops and implements practical, nationally consistent, and cost-effective approaches to reduce vulnerabilities of the nation's water infrastructure.
- **Planning Assistance to States Program**—USACE assists states, local governments, Native American Tribes, and other non-federal entities in the preparation of comprehensive plans for the development and conservation of water and related land resources. Types of work that can be done include water quality studies, wetland evaluation studies, floodplain management studies, coastal zone



management/protection studies, harbor/port studies, and other water resource planning investigations. The non-federal sponsors determine the planning assistance needed.

- **Floodplain Management Services Program**—USACE provides assistance and guidance on all aspects of floodplain management planning. This program develops or interprets site-specific data on obstructions to flood flows, flood formation, and the timing, extent, duration, and frequency of flooding. Services are provided without charge to state, regional, and local governments, Native American tribes, and other non-federal public agencies.
- **Inspection of Completed Works Program**—Civil works structures whose failure could endanger public safety or cause substantial property damage are periodically inspected to ensure their structural stability, safety, and operational adequacy. For those structures constructed by USACE and turned over to others for operation and maintenance, the operating entity is responsible for the inspections. USACE may conduct the inspection on behalf of the project sponsor if reimbursement is made or participate in the inspection with the operating entity at the government's expense.
- **Rehabilitation and Inspection Program**—This USACE program provides for inspection of flood control projects, the rehabilitation of damaged flood control projects, and the rehabilitation of federally authorized and constructed hurricane or shore protection projects.
- **Dam Safety Program**—USACE is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams and has surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams. USACE has also developed guidelines for inspection and evaluation of dam safety.

U.S. Geological Survey

U.S. Geological Survey (USGS) maintains a network of gauges across New York that continuously measure lake, reservoir table, stream, and tidal levels. These data sets are transmitted to the USGS and made available over the internet. As project needs and funding levels change, gauges may be added or deactivated, and deactivated gauges may be reactivated (USGS 2023b). USGS provides data to the state for drought determinations. USGS also recovers high water marks post-coastal flooding (USGS 2018).

18.2.2 State

New York State Department of Environmental Conservation

The NYSDEC's mission is "To conserve, improve and protect New York's natural resources and environment and to prevent, abate and control water, land and air pollution, in order to enhance the health, safety and welfare of the people of the state and their overall economic and social well-being." NYSDEC's goal is to achieve this mission through the simultaneous pursuit of environmental quality, public health, economic prosperity, and social well-being, including environmental justice and the empowerment of individuals to participate in environmental decisions that affect their lives (NYSDEC 2023a). NYSDEC staff are responsible for natural resource management and environmental quality protection in New York (NYSDEC 2023b). NYSDEC Region 3 in southern New York includes Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, and Westchester counties.

NFIP Coordination

NYSDEC serves as the NFIP State Coordinating Agency and, in this capacity, is the liaison between FEMA and New York communities that elect to participate in the NFIP.



Bureau of Dam Safety, Coastal and Flood Protection

Within the NYSDEC Division of Water, the Bureau of Dam Safety, Coastal and Flood Protection cooperates with federal, state, regional, and local partners to protect lives and property from floods, coastal erosion and dam failures through floodplain management and both structural and nonstructural means; and provides support for information technology needs in the division (NYSDEC n.d.-a). The NYSDEC Division of Water flood protection section provides a wide range of technical assistance related to hazard mitigation (NYSDEC n.d.-b):

- **Dam Safety**—NYSDEC reviews repairs and modifications to dams and ensures that dam owners operate and maintain dams in a safe condition through inspections, technical reviews, enforcement, and emergency planning.
- **Coastal Erosion and Flooding**—NYSDEC works to reduce coastal erosion and storm damage to protect lives, natural resources, and properties through structural and nonstructural means.
- **Flood Protection and Flood Management**—NYSDEC is responsible for reducing flood risk to life and property through management of activities such as development in flood hazard areas and through construction, operation, and maintenance of flood control facilities. NYSDEC also reviews and develops revised flood maps.

New York State Department of State Division of Building Standards and Codes

The New York State Department of State's Division of Building Standards and Codes (DBSC) provides services related to the development, administration, and enforcement of the Uniform Fire Prevention and Building Code (Uniform Code) and Energy Conservation Construction Code (Energy Code). The statutory responsibility for maintaining the Uniform Code and the Energy Code is vested in the State Fire Prevention and Building Code Council (Code Council). The Code Development Unit evaluates proposed changes to the codes.

Executive Law §379 authorizes the legislative body of a local government to enact or adopt local laws and ordinances that impose standards for construction that are more restrictive than the corresponding standards imposed by the Uniform Code. Energy Law §11-109 allows counties, cities, towns, villages, school districts, or district corporations to promulgate local energy conservation construction codes that are more stringent than the state Energy Code. The Code Development Unit reviews the technical aspects of these local laws and ordinances and reports its findings to the Code Council. The Code Council is empowered to approve these more restrictive standards and codes when they comply with Executive Law §379 and Energy Law §11-109.

The DBSC's Code Enforcement Disaster Assistance Response program provides communities with post-disaster assistance. The program's initial disaster response focuses on performing rapid evaluation safety assessments of damaged structures in affected communities for use in the application process to request federal disaster assistance through FEMA. The program's long-term disaster response provides a unified method for communities to access the range of resources available within and beyond the Department of State.

Technical Bulletins for the 2020 Codes of New York State

The DBSC has published technical bulletins with guidance related to flood hazard areas: *Electrical Systems and Equipment in Flood-damaged Structures and Accessory Structures*; and *Flood Venting in Foundations and Enclosures Below Design Flood Elevation* (October 31, 2017). The latter publication provides clarification on the requirements for flood vents in foundations and enclosures located below the design flood elevation and in flood hazard areas.



Forms and Publications

The DBSC, in conjunction with the DHSES Office of Fire Prevention and Control, has implemented a joint outreach program to provide code users with concise, easily digestible information on the following:

- New topics that code users must be aware of
- Frequently overlooked or misunderstood code requirements
- Concerns relating to the administration and enforcement of the Uniform Code and Energy Code

The program will foster professional growth, support the efforts of the code enforcement community, and provide helpful guidance to all code users. The Code Outreach Program publications are to be distributed at the beginning of every month.

The DBSC posts model reporting forms and related publications on its web page. The Building Permit Application requests the applicant to indicate whether the site is or is not in a floodplain and advises checking with town clerks or NYSDEC. The General Residential Code Plan Review form includes a reminder to add 2 feet pf freeboard. Sample Flood Hazard Area Review Forms, including plan review checklists and inspection checklists for Zone A and Zone V, are based on the forms in *Reducing Flood Losses* through the series published by the International Code Council and FEMA.

New York State Department of Transportation

The New York State Department of Transportation (NYS DOT) offers grant, education, and training opportunities; has several environmental initiatives and programs; issues permits for traffic signals, driveways, advertisements, and other permitting needs; provides statistical roadway information; and provides information on community resources, such as scenic highways and fishing access sites. Putnam County is served by the Southern Tier, Region 9 NYS DOT office, which is based in Poughkeepsie, NY.

New York State Division of Homeland Security and Emergency Services

NYS DHSES is responsible for coordinating the activities of all state agencies to protect New York's communities, economic well-being, and the environment from natural and human-caused disasters and emergencies. NYS DHSES assists local governments, voluntary organizations, and private industry with emergency management programs, including hazard identification, loss prevention, planning, training, operational response to emergencies, technical support, and disaster recovery.

NYS DHSES administers the FEMA mitigation grant programs in the state and supports local mitigation planning in addition to developing and routinely updating the state hazard mitigation plan. The current state HMP, approved by FEMA in 2023, keeps New York eligible for recovery assistance in Public Assistance (Categories A through G) and Hazard Mitigation Assistance in each of the Unified Hazard Mitigation Assistance Program's five grant programs. The 2023 New York State HMP was used as guidance in updating the Putnam County HMP (NYS DHSES 2024).

New York State Office of Planning, Development and Community Infrastructure

The New York State Office of Planning, Development and Community Infrastructure works with communities to increase their resilience to changing conditions. The Office employs key resilience principles that help communities understand their vulnerabilities, advance resilience measures that reduce risk, including using natural infrastructure and natural processes, and avoid investments that are not highly adapted to a changing climate.



Northeast Regional Climate Center

The Northeast Regional Climate Center (NRCC) develops products for use by municipal officials, researchers, planners, highway departments, and other decision-makers who need to take future storm events into account. The NRCC's "Extreme Precipitation in New York & New England" website is an interactive tool for extreme precipitation analysis. The site includes estimates of extreme rainfall for various durations (5 minutes to 10 days) and recurrence intervals (1 year to 500 years). Regional extreme rainfall maps and graphic products are available. This tool can be used by municipalities to assist them in the design and feasibility assessment of future projects and allow them to see the future intensity and frequency of rain events (NRCC 2022). NRCC also partnered with the New York State Energy Research and Development Authority (NYSERDA) to compare methods of creating extreme precipitation projections to be used in adaptation planning for New York State (NRCC 2014).

Resilient NY

Resilient NY is a state-provided web site to help New Yorkers adapt to changes from extreme weather events. This website provides a centralized platform with quick links and tools to help plan and implement measures to reduce risk and adapt to climate change. Guidance, best practices, funding opportunities, and resources are provided to help local governments, businesses, and residents plan and act with confidence (New York State n.d.).

18.2.3 County, Local, and Regional

Child Advocacy Center of Putnam County

The Child Advocacy Center of Putnam County is a child- and family-focused facility providing comprehensive, multidisciplinary services to children suspected of being abused. This group provides community education relating to first responder training and prevention and outreach relating to child abuse.

Putnam County Agriculture and Farmland Protection Board

The Putnam County Agriculture & Farmland Protection Board is housed under the Department of Public Works. The Board's mission is to support and promote the economic viability of agriculture while protecting the environment. The Board was formed in 1997 to advise the County Legislature on actions that impact farms in Putnam County and to review applications to join the Agricultural District submitted during the annual enrollment period of April 1 – 30. The Board consists of active farmers, county representatives, and local food system coordinators and is a resource for farmers, landowners, and municipalities within Putnam County.

Putnam County Bureau of Emergency Services

The Bureau of Emergency Services maintains a county-wide communications organization and is responsible for operation and maintenance of the Enhanced 911 system. The Bureau's directorate plans for response, remediation, mitigation and recovery from natural and manmade disasters, including those resulting from biological, nuclear, incendiary, chemical and explosive causes.

Putnam County Department of Health

The mission of the Putnam County Department of Health is to improve and protect the health of the community by preventing the spread of disease, protecting against environmental hazards, promoting healthy lifestyles, ensuring access to quality health services, and responding to disasters.



Putnam County Department of Planning, Development, and Public Transportation

The Department of Planning, Development, and Public Transportation is focused on enhancing the lives of Putnam County residents through comprehensive land use, environmental, and transportation planning services. The Department provides essential support in land use reviews, public transit operations, and climate-smart initiatives. The Department's mission encompasses securing state and federal grants, conducting regional studies, and offering educational training to empower local planning and zoning boards. The Department aims to foster sustainable development and improve community connectivity, ensuring that its initiatives meet current needs and preserve the environment for future generations.

Putnam County Department of Public Works

The Department of Public Works is responsible for the administrative duties to ensure that all highway, facility, and park operations are conducted in a responsive and efficient manner. It includes the following divisions:

- **Automotive Division**—The Automotive Division maintains a fleet of over 300 vehicles, as well as vehicle attachments and small engine tools and mowers. Its mechanics weld, do bodywork, paint, diagnose and repair the fleet. The vehicles in the fleet include the Sheriff Department's unmarked and marked patrol units, Department of Social Services Office for the Aging buses, Health Department vehicles, and the Highway Department's heavy equipment. Along with doing major repairs, the Division performs regular preventative maintenance on these vehicles. Certified inspectors on staff ensure that the vehicles meet the state safety standards.
- **Facilities Division**—The Facilities Division is responsible for the planning, design, operation, maintenance, construction, and general administration of the County's 39 buildings and various properties. The Division performs a variety of maintenance and repair tasks. The Division is responsible for 5 park and rides, 9 radio towers, 27 standby generators with remote monitoring, and building management systems.
- **Fiscal Division**—The Fiscal Division is involved with all funding issues that relate to highways and facilities. The Division prepares annual operating and ongoing capital project budgets. Highway Department road, bridge and facility construction projects require that the Division work with law, audit, finance, purchasing and personnel offices at the County level and the Department of Transportation & Emergency Management, at the state level.
- **Division of Planning and Design**—The Division of Planning and Design provides engineering, planning and technical support services for the Department of Public Works. These services include engineering and architectural design, land surveying, generation of contract and bid documents (including drafting of plans), construction support and inspection, and contract administration. Additional duties include administering the County's highway work permit program, pavement and bridge management systems, and traffic count program.
- **Construction and Maintenance Division**—The Construction and Maintenance Division is comprised of workers ranging from laborers to heavy equipment operators. This Division is responsible for over 200 miles of roads from the Hudson River to the Connecticut border. In conjunction with snow and ice removal, these workers maintain the roadways by installing drainage pipes and basins, repairing guide rails, cutting and trimming roadside vegetation, and many other projects.
- **Putnam County Parks Division**—The Parks Division provides safe, passive recreational opportunities to the residents of Putnam County while preserving open space, protecting environmentally sensitive areas, and promoting smart stewardship of County-owned lands. The Division maintains and offers a wide selection of passive recreational opportunities for residents and tourists, including park areas, bike routes and trail routes.



Putnam County Department of Social Services and Mental Health

The mission of the Putnam County Department of Social Services and Mental Health is to provide financial and social services to eligible residents of Putnam County—in accordance with applicable federal, state, and county laws—toward enhancing family functioning, increasing resilience, supporting protective factors and maintaining adults and children in the community when possible. This Department contains adult and child protective services, substance use services, and disability services.

Putnam County Soil and Water Conservation District

The Soil and Water Conservation District is housed under the Department of Public Works and was developed in 1967 to administer programs related to soil, water, and natural resource conservation and provide technical assistance and programs to residents, landowners, and various units of government.

18.3 FISCAL CAPABILITIES

This section summarizes fiscal capabilities in Putnam County. Further information is provided in the jurisdictional annexes in Volume II. The State Capabilities section of the 2023 New York State HMP features a section on mitigation-related funding.

18.3.1 Federal

FEMA Hazard Mitigation Funding Opportunities

FEMA administers programs that provide funding for eligible mitigation planning and projects that reduces disaster losses and protect life and property from future disaster damage (FEMA n.d.-c). The Hazard Mitigation Grant Program (HMGP) assists in implementing long-term hazard mitigation planning and projects following a presidential major disaster declaration. Flood Mitigation Assistance (FMA) provides funds for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis. Pre-Disaster Mitigation (PDM) provides funds for hazard mitigation planning and projects on an annual basis (FEMA 2023c).

Federal mitigation grant funding is available to all communities with a current HMP (this plan). The grants require a local share in the range of 10 to 25 percent of the total project cost. Table 18-1 provides an overview of program funding eligibility and cost share.

Hazard Mitigation Grant Program

The HMGP is a post-disaster mitigation program that is made available to states by FEMA after a federal disaster declaration. The HMGP can provide up to 75 percent funding for hazard mitigation measures. It can be used to fund projects that will protect public or private property in an area covered by a federal disaster declaration or that will reduce damage from future disasters. Examples of projects include acquisition and demolition of structures in hazard-prone areas, flood-proofing or elevation to reduce future damage, minor structural improvements, and development of state or local standards. Projects must fit into an overall mitigation strategy for the area identified as part of a local planning effort.

**Table 18-1. FEMA Hazard Mitigation Grant Cost Share Requirements**

Programs	Cost Share (Percent of Federal/Non-Federal Share)
Hazard Mitigation Grant Program (HMGP) ^a	75/25
HMGP Post-Fire	75/25
Flood Mitigation Assistance (FMA) (community flood mitigation, project scoping, individual mitigation of insured properties, and planning grants)	75/25
FMA—repetitive loss property ^b	90/10
FMA—severe repetitive loss property ^b	100/0
Pre-Disaster Mitigation (PDM)	75/25
PDM—small and impoverished community	Up to 90/10

Source: FEMA 2023; FEMA 2023

- Subapplicants should consult their state hazard mitigation officer for the percentage of HMGP subrecipient management cost funding their state has determined to be passed through subrecipients.
- To be eligible for an increased federal cost share, a FEMA-approved state or tribal (standard or enhanced) mitigation plan that addressed repetitive loss properties must be in effect at the time of award, and the property is being submitted for consideration must be a repetitive loss property.

Applicants who are eligible for the HMGP are state and local governments, nonprofit organizations or institutions that perform essential government services, and Native American tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf (FEMA 2023c). Applications are submitted to NYS DHSES and placed in rank order for available funding and submitted to FEMA for final approval. Eligible projects not selected for funding are placed in an inactive status and may be considered as additional HMGP funding becomes available.

HMGP funding is generally 15 percent of the total amount of federal assistance provided to a state, territory, or federally recognized tribe following a major disaster declaration.

Flood Mitigation Assistance Program

The FMA program provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA is funded annually; no federal disaster declaration is required. Only NFIP insured homes and businesses are eligible for mitigation in this program.

Funding for FMA is limited and, as with the HMGP, individuals cannot apply directly for the program. Applications must come from local governments or other eligible organizations. The federal cost share for an FMA project is at least 75 percent. At most, 25 percent of the total eligible costs must be provided by a non-federal source. Of this 25 percent, no more than half can be provided as in-kind contributions from third parties. At minimum, a FEMA-approved local flood mitigation plan is required before a project can be approved. The FMA funds are distributed from FEMA to the state. The NYS DHSES serves as the grantee and program administrator for the FMA program.

Pre-Disaster Mitigation Grant Program

The PDM grant program makes federal funds available to state, local, tribal, and territorial governments to plan for and implement sustainable cost-effective measures designed to reduce the risk to individuals and property from



future natural hazards, while also reducing reliance on federal funding from future disasters. The program is authorized by Section 203 of the Stafford Act.

The Further Consolidated Appropriations Act, 2024 authorizes funding for 110 projects for states, tribes, territories and local communities for FEMA's Hazard Mitigation Assistance PDM grant program.

These funds allow governments to plan for and implement sustainable cost-effective measures designed to reduce the risk to individuals and property from future natural hazards, while also reducing reliance on federal funding from future disasters.

Extraordinary Circumstances

For HMGP and FMA, an exception may be made to the requirement that applicants have a current approved HMP if extraordinary circumstances are declared. This can occur when a determination is made by the applicant and FEMA that the proposed project is consistent with the priorities and strategies identified in the state hazard mitigation plan and that the jurisdiction meets at least one of the following criteria:

- The jurisdiction meets the small, impoverished community criteria.
- The jurisdiction has been determined to have had insufficient capacity due to lack of available funding, staffing, or other necessary expertise to satisfy the mitigation planning requirement prior to the current disaster or application deadline.
- The jurisdiction has been determined to have been at low risk from hazards because of low frequency of occurrence or minimal damage from previous occurrences as a result of sparse development.
- The jurisdiction experienced significant disruption from a declared disaster or another event that impacts its ability to complete the mitigation planning process prior to award or final approval of a project award.
- The jurisdiction does not have a mitigation plan for reasons beyond the control of the state, federally recognized tribe, or local community, such as Disaster Relief Fund restrictions that delay FEMA from granting a subaward prior to the expiration of an existing hazard mitigation plan.

If the jurisdiction does not meet at least one of these criteria, the FEMA region must coordinate with FEMA headquarters for HMGP. For FMA, the FEMA region must coordinate and seek concurrence prior to granting an exception. For HMGP and FMA, the applicant must provide written justification that identifies the specific criteria or circumstance listed above, explains why there is no longer an impediment to satisfying the mitigation planning requirement, and identifies the specific actions or circumstances that eliminated the deficiency.

When an HMGP project funding is awarded under extraordinary circumstances, the recipient must acknowledge in writing to FEMA that a plan will be completed within 12 months of the award. The recipient must provide a work plan for completing the hazard mitigation plan, including milestones and a timetable, to ensure that the jurisdiction will complete the HMP in the required time. This requirement must be incorporated into the award.

Rehabilitation of High Hazard Potential Dams Program

The Rehabilitation of High Hazard Potential Dams grant program provides technical, planning, design, and construction assistance for the following activities to reduce dam risk and increase community preparedness:

- Repair
- Removal
- Structural or nonstructural rehabilitation of eligible dams



Assistance to Firefighters Grant Program

Assistance to Firefighters Grants are direct financial assistance to fire departments, nonaffiliated emergency medical services organizations, and state fire training academies to enhance the safety of the public and firefighters with respect to fire-related hazards. This funding is for resources to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience.

Emergency Management Performance Grants Program

The Emergency Management Performance Grant provides state, local, tribal, and territorial emergency management agencies with resources to implement the National Preparedness System. The program supports efforts to build and sustain core capabilities across the prevention, protection, mitigation, response, and recovery mission areas.

Homeland Security Grant Program

The Homeland Security Grant Program (HSGP) supports the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient nation. The program supports efforts to build and sustain core capabilities across the prevention, protection, mitigation, response, and recovery mission areas. This includes building and sustaining law enforcement and terrorism prevention capabilities, and enhancing state and major urban area fusion centers. HSGP is composed of three grant programs: the State Homeland Security Program, Urban Areas Security Initiative, and Operation Stonegarden. These programs fund preparedness activities including planning, organization, equipment purchase, training, exercises, management, and administration.

Disaster and Recovery Assistance Programs

The sections below describe the general types of federal assistance that may be provided should the president declare an event to be a major disaster.

FEMA Public Assistance

Public Assistance provides cost reimbursement aid to local governments (state, county, local, municipal authorities, and school districts) and certain nonprofit agencies that were involved in disaster response and recovery programs or that suffered loss or damage to facilities or property used to deliver government-like services. This program is largely funded by FEMA with both local and state matching contributions required.

Small Business Administration Loans (Individual Assistance)

The Small Business Administration provides low-interest disaster loans (Individual Assistance) to homeowners, renters, business, and most private nonprofit organizations. The disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets. Available funding is as follows:

- Renters are eligible for loans to cover personal property losses. They may borrow up to \$40,000 to replace or repair personal property (such as clothing, furniture, cars, and appliances) damaged or destroyed in a disaster.
- Homeowners may apply for up to \$200,000 to replace or repair their primary residence. Individuals may borrow up to \$200,000 to repair or replace real estate, \$40,000 to cover losses to personal property, and an additional 20 percent for mitigation.



- Physical disaster loans of up to \$2 million are available to qualified businesses and most private nonprofit organizations. For businesses, loans may be made to repair or replace disaster damage to property owned by the business, including real estate, machinery and equipment, inventory, and supplies. Businesses of any size are eligible. Nonprofit organizations such as charities, churches, private universities, etc. are also eligible.

Economic Injury Disaster Loan

An Economic Injury Disaster Loan provides necessary working capital until normal operations resume after a physical disaster. These loans are restricted, by law, to small businesses only.

National Park Service Land and Water Conservation Fund

The Land and Water Conservation Fund was established to safeguard natural areas, water resources, and cultural heritage, and to provide recreation opportunities. Using no taxpayer dollars, the fund invests earnings from offshore oil and gas leasing to help strengthen communities, preserve history, and protect the national endowment of lands and waters. The program is divided into the “State Side,” which provides grants to state and local governments, and the “Federal Side,” which is used to acquire lands, waters, and interests therein necessary to achieve the natural, cultural, wildlife, and recreation management objectives of federal land management agencies.

Restore America’s Estuaries Coastal Watersheds Grant Program

Restore America’s Estuaries, in coordination with the U.S. EPA, administers the National Estuary Program Coastal Watersheds Grant Program. This program supports measures to address the following:

- Loss of key habitats resulting in significant impacts on fisheries and water quality such as seagrass, mangroves, tidal and freshwater wetlands, forested wetlands, kelp beds, shellfish beds, and coral reefs
- Recurring harmful algae blooms
- Unusual or unexplained marine mammal mortalities
- Proliferation or invasion of species that limit recreational uses, threaten wastewater systems, or cause other ecosystem damage
- Flooding and coastal erosion that may be related to sea-level rise, changing precipitation, or salt marsh, seagrass, or wetland degradation or loss
- Impacts of nutrients and warmer water temperatures on aquatic life and coastal ecosystems, including low dissolved oxygen conditions in estuarine waters
- Contaminants of emerging concern found in coastal and estuarine waters such as pharmaceuticals, personal care products, and microplastics

U.S. Department of Agriculture

Community Facilities Direct Loan and Grant Program

This program provides funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area and does not include private, commercial, or business undertakings. Funds can be used to purchase, construct, and/or improve essential community facilities, purchase equipment, and pay related project expenses. Rural areas including cities, villages, townships, towns, and federally recognized tribal lands, with no more than 20,000 residents according to the latest U.S. Census, are eligible for this program.



Emergency Loan Program

The Emergency Loan Program is triggered when a natural disaster is designated by the secretary of agriculture, or a natural disaster or emergency is declared by the president under the Stafford Act. These loans help producers who suffer qualifying farm-related losses directly caused by the disaster in a county declared or designated as a primary disaster or quarantine area. Farmers in counties that are contiguous to the declared, designated, or quarantined area also may qualify for emergency loans. For production losses, a 30 percent reduction in a primary crop in a designated or contiguous county is required. Losses to quality, such as receiving a 30 percent reduced price for flood-damaged crops, may be eligible for assistance, too.

Emergency Watershed Protection Program

The Emergency Watershed Protection (EWP) Program offers financial and technical assistance for various activities, including the following:

- Remove debris from stream channels, road culverts, and bridges
- Reshape and protect eroded streambanks
- Correct damaged or destroyed drainage facilities
- Establish vegetative cover on critically eroding lands
- Repair levees and structures
- Repair certain conservation practices
- Buyouts

EWP does not require a disaster declaration by federal or state government officials for program assistance to begin. The Natural Resources Conservation Service (NRCS) state conservationist can declare a local watershed emergency and initiate EWP program assistance in cooperation with an eligible sponsor. The sponsor must sign a cooperative agreement with NRCS. The EWP program

EWP–Recovery

The EWP–Recovery program is aimed at relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. Public and private landowners are eligible for assistance but must be represented by a project sponsor that is a legal subdivision of the state, such as a city, county, township, or conservation district, and Native American tribal governments. NRCS will pay up to 75 percent of the construction cost of emergency measures. The remaining 25 percent must come from local sources and can be in the form of cash or in-kind services.

EWP–Recovery is for the installation of recovery measures to safeguard lives and property as a result of a natural disaster. NRCS completes a damage survey report, which provides a case-by-case investigation of the work necessary to repair or protect a site. Watershed impairments that the program addresses are debris-clogged stream channels, undermined and unstable streambanks, jeopardized water control structures and public infrastructures, wind-borne debris removal, and damaged upland sites stripped of protective vegetation by fire or drought.

EWP–Floodplain Easement

the EWP–Floodplain Easement program funds projects to restore easements to the natural environment to the extent practicable. Work can include both structural and nonstructural practices to restore flood storage and flow,



control erosion, and improve the practical management of the easement. Privately owned lands or lands owned by local and state governments may be eligible for participation if they meet one of the following criteria:

- Lands that have been damaged by flooding at least once within the previous calendar year or have been subject to flood damage at least twice within the previous 10 years
- Other lands within the floodplain that would contribute to the restoration of flood storage and flow, provide for control of erosion, or improve the practical management of the floodplain easement
- Lands that would be inundated or adversely impacted as a result of a dam breach

Structures, including buildings, within the floodplain easement must be demolished and removed or relocated outside the 100-year floodplain or dam breach inundation area.

Regional Conservation Partnership Program

The Regional Conservation Partnership Program promotes coordination of NRCS conservation activities with partners that offer value-added contributions to expand the collective ability to address on-farm, watershed, and regional natural resource concerns. Through this program, NRCS seeks to co-invest with partners to implement projects that demonstrate innovative solutions to conservation challenges and provide measurable improvements and outcomes tied to the resource concerns they seek to address.

U.S. Department of Health and Human Services Social Services Block Grant Program

The Social Services Block Grant is a flexible funding source that allows states and territories to tailor social service programming to their population's needs. Through this program, states provide essential social services that help to reduce dependency and promote self-sufficiency; protect children and adults from neglect, abuse, and exploitation; and help individuals who are unable to take care of themselves to stay in their homes or find the best institutional arrangements.

U.S. Department of Housing and Urban Development

Community Development Block Grants

Community Development Block Grants (CDBG) are federal funds intended to provide low and moderate-income households with viable communities, including decent housing, a suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, planning, and administration. Public improvements may include flood and drainage improvements.

In limited instances, and during times of urgent need as defined by the CDBG National Objectives (e.g., post-disaster), CDBG funding may be used to acquire a property in a floodplain that was severely damaged by a recent flood, demolish a structure severely damaged by an earthquake, or repair a public facility severely damaged by a hazard event.

Community Development Block Grant Disaster Recovery (CDBG-DR) grant funds are appropriated by Congress and allocated by the Department of Housing and Urban Development to rebuild disaster-impacted areas and provide crucial seed money to start the long-term recovery process. These flexible grants help cities, counties, Native American tribes, and states recover from presidentially declared disasters, especially in low-income areas. CDBG-DR assistance can help communities and neighborhoods that otherwise might not recover due to limited resources.



Disaster Housing Assistance Program

The Disaster Housing Assistance Program provides emergency assistance for housing, including minor repairs of the home to establish livable conditions, mortgage, and rental assistance.

Home Investment Partnerships Program

The Home Investment Partnerships Program (HOME) provides grants to states and localities—often in partnership with local nonprofit groups—to fund building, buying, and/or rehabilitating affordable housing for rent or homeownership or providing direct rental assistance to low-income people. HOME is the largest federal block grant to state and local governments designed exclusively to create affordable housing for low-income households. HOME funds are awarded annually as grants to participating jurisdictions. The program's flexibility allows states and local governments to use HOME funds for grants, direct loans, loan guarantees or other forms of credit enhancements, or rental assistance or security deposits. The program's requirement that participating jurisdictions match 25 cents of every dollar in program funds mobilizes community resources in support of affordable housing.

Section 108 Loan Guarantee Program

The Section 108 Loan Guarantee Program provides communities with a source of low-cost, long-term financing for economic and community development projects. Section 108 financing provides an avenue for communities to undertake larger, more costly projects, where they may have limited resources to invest upfront. Section 108 can fund economic development, housing, public facilities, infrastructure, and other physical development projects, including improvements to increase resilience against natural disasters. Section 108 assistance can be deployed in two ways:

- Directly by the community or its governmental or non-profit partner to carry out an eligible project
- Indirectly with a community or its partner re-lending (or, in limited circumstances, granting) the funds to a developer or business to undertake an eligible project

U.S. Department of Transportation

Federal Highway Administration Emergency Relief

Federal Highway Administration (FHWA) Emergency Relief is a grant program that can be used for the repair or reconstruction of federal-aid highways and roads on federal lands that have suffered serious damage as a result of a disaster. New York State serves as the liaison between local municipalities and FHWA, making the municipalities sub-applicants of New York State. The program is appropriated \$100 million annually.

Federal Transit Administration Emergency Relief

Federal Transit Authority Emergency Relief is a grant program that funds capital projects to protect, repair, reconstruct, or replace equipment and facilities of public transportation systems. Administered by the Federal Transit Authority and directly allocated to mass transit and port authorities, this transportation-specific fund was created as an alternative to FEMA's Public Assistance.

Federal Highway Administration Recreational Trails

The FHWA Recreational Trails Program provides funds to states to develop and maintain recreational trails and trail-related facilities for both nonmotorized and motorized recreational trail uses. The program requires that states use 30 percent of funds for non-motorized recreation, 30 percent for motorized recreation, and 40 percent for



diverse recreational trail use. In New York State, the Recreational Trails Program is administered by the Office of Parks, Recreation, and Historic Preservation.

Rebuilding American Infrastructure with Sustainability and Equity Grant Program

The U.S. Department of Transportation (USDOT) Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant program supports road, rail, transit, and port projects that promise to achieve national objectives. Project sponsors at the state and local levels can obtain funding for multi-modal, multi-jurisdictional projects that are more difficult to support through traditional USDOT programs. RAISE can provide funding directly to any public entity, including municipalities, counties, port authorities, tribal governments, or others, in contrast to traditional federal programs that provide funding to very specific groups of applicants (mostly state departments of transportation and transit agencies). This flexibility allows RAISE and USDOT partners at the state and local levels to work directly with a host of entities that own, operate, and maintain much of that nation's transportation infrastructure but otherwise cannot turn to the federal government for support.

U.S. Economic Development Administration

The U.S. Economic Development Administration (USEDA) is an agency of the U.S. Department of Commerce that supports regional economic development in communities around the country. It provides funding to support comprehensive planning and makes strategic investments that foster employment creation and attract private investment in economically distressed areas of the United States.

Public Works Program

Through its Public Works Program, USEDA invests in key public infrastructure, such as traditional public works projects, including water and sewer system improvements, expansion of port and harbor facilities, brownfields, multitenant manufacturing and other facilities, business and industrial parks, business incubator facilities, redevelopment technology-based facilities, telecommunications facilities, and development facilities.

Economic Adjustment Program

Through its Economic Adjustment Program, USEDA administers its Revolving Loan Fund Program, which supplies small businesses and entrepreneurs with the gap financing needed to start or expand their business in areas that have experienced or are under threat of serious structural damage to the underlying economic base.

U.S. Environmental Protection Agency

Smart Growth Implementation Assistance Program

The Smart Growth Implementation Assistance program focuses on complex issues such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, and green building. Applicants can submit proposals under four categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design, or medical and social service facilities siting.

Clean Water Act Section 604(b) Water Quality Planning Grants

Water Quality Planning Grants provide funding to implement regional comprehensive water quality management planning activities as described in Section 604(b) of the federal Clean Water Act. Funds are to be used for water



quality management planning activities, including tasks to determine the nature, extent, and causes of point and nonpoint source water pollution problems, and to develop plans to resolve these problems.

U.S. Fish and Wildlife Service Partners for Fish and Wildlife

The Partners for Fish and Wildlife Program provides free technical and financial assistance to landowners, managers, tribes, corporations, schools, and nonprofits interested in improving wildlife habitat on their land. These projects range in size from a wetland of a few acres to a grassland restoration covering several hundred thousand acres. Efforts are focused on areas of conservation concern, such as upland forests, wetlands, native prairies, marshes, rivers, and streams. Many Partners for Fish and Wildlife projects take place on working landscapes such as forests, farms, and ranches. Projects are designed to benefit federal trust species including migratory birds and endangered, threatened, or at-risk species.

18.3.2 State

Empire State Development

Empire State Development offers a wide range of financing, grants, and incentives to promote business and employment growth and real estate development throughout the state. Several programs address infrastructure construction associated with project development, acquisition and demolition and brownfield remediation and redevelopment (NYS ESD 2023).

Funding for Local Waterfront Revitalization Programs

Funding for the preparation and implementation of LWRPs (as described in Section 18.1.2) may be requested through New York State's Environmental Protection Fund under Title 11, Local Waterfront Revitalization Program. Other state agencies with funding programs that may support LWRP implementation projects include the Office of Parks, Recreation and Historic Preservation, NYSDEC, and Empire State Development. Grant applications for these state programs are administered through the NYS Consolidated Funding Application (NYDOS 2024).

New York State Department of Archives Local Government Records Management Improvement Fund

The Local Government Records Management Improvement Fund provides grants to assist local governments in establishing records management programs or developing new program components. Funds come from fees collected by county clerks and the New York City Office of the City Register. These fees are collected during the recording of certain documents and when county clerks assign index numbers for certain court cases. The amount of grant funding available each year depends on the number of documents recorded and index numbers assigned that year. Project categories include the following:

- Disaster management
- Document conversion and access
- Files management
- Historical records
- Inactive records

Application types include:

- Individual (up to \$75,000)



- Shared services (up to \$150,000)
- New York City Department of Records

New York State Department of Environmental Conservation

Clean Water State Revolving Fund

The Clean Water State Revolving Fund (CWSRF) provides interest-free or low-interest rate financing for wastewater and sewer infrastructure projects to municipalities throughout New York State. Projects eligible for financing include construction or restoration of sewers and wastewater treatment facilities, stormwater management, landfill closures, and habitat restoration and protection projects. The New York State Environmental Facilities Corporation provides both short- and long-term financing—interest-free or low-interest—to accommodate municipalities of all population sizes with varying financial needs. When communities repay their financings, it allows the Environmental Facilities Corporation to finance new projects, so that the funds revolve over time.

Climate Smart Communities Grant Program

Climate Smart Community (CSC) grants support mitigation and adaptation projects to reduce greenhouse gas emissions and prepare for changing conditions. The CSC program enables high-performing registered communities to achieve recognition for their leadership. Designed around 10 pledge elements, the certification program recognizes communities achieving any of over 130 total possible actions through a rating system leading to four levels of award: Certified, Bronze, Silver, and Gold. Recertification of completed actions is required every five years.

Competitive grants ranging from \$25,000 to \$100,000 provide support for local governments to become certified CSCs. All counties, cities, towns, and villages of New York State are eligible to receive funding. The CSC grant program will provide 50/50 matching grants for eligible projects. It offers free technical support on energy and climate and guidance tailored to New York State communities. Funding is available for the following:

- Implementation projects that advance climate adaptation and mitigation actions, including the following:
 - Construction of natural resilience measures
 - Relocation or retrofit of vulnerable facilities
 - Conservation or restoration of riparian areas and tidal marsh migration areas
 - Reduction of flood risk
 - Clean transportation
 - Reduction or recycling of food waste
- Certification projects that advance actions aligned with CSC certification requirements, including the following:
 - Right-sizing government fleets
 - Developing natural resource inventories
 - Conducting vulnerability assessments
 - Developing climate adaptation strategies
 - Updating hazard mitigation plans to address changing conditions and reduce climate vulnerability



Environmental Protection Fund

New York State's Environmental Protection Fund (EPF) is a source of funding for capital projects that protect the environment and enhance communities. Capital projects are usually large projects that purchase land or construct facilities. Most projects that receive grants of EPF money combine it with other funding sources that require matching funds. The EPF also supports the stewardship of public lands, including state parks and millions of acres of public lands throughout the state. Through partnerships with volunteer organizations, state agencies use stewardship funding to manage trails and lands, protect natural resources, preserve wildlife habitats, make critical capital improvements at parks and campgrounds, educate students about conservation, and provide access to persons with disabilities.

Grants for High Hazard Potential Dams

Grant funding is available to assist eligible dam owners with infrastructure repair costs. Funding is provided through the FEMA's High Hazard Potential Dam grant program. NYSDEC accepts applications for grants to assist with technical, planning, design, and other pre-construction activities associated with the rehabilitation of eligible dams classified as High Hazard dams.

Volunteer Fire Assistance Grants

This 50/50 matching fund program makes funds available to rural fire companies for the purchase of wildland firefighting equipment such as portable backpack pumps, Nomex protective clothing, hand tools, hard hats, hoses, portable radios, and dry hydrants.

Wastewater Infrastructure Engineering Planning Grant

The Wastewater Infrastructure Engineering Planning Grant assists municipalities with the engineering and planning costs of CWSRF-eligible water quality projects. Eligibility for municipalities is based on median household income:

- Median household income of \$65,000 or less in the Regional Economic Development Council regions of Capital District, Southern Tier, North Country, Mohawk Valley, Central New York, Finger Lakes, or Western New York (Putnam County is located in the Southern Tier region)
- Median household income of \$85,000 or less in Regional Economic Development Council regions of Long Island, New York City, or Mid-Hudson

Grants with a 20 percent required local match could finance activities to produce an engineering report, including engineering and consultant fees. Funding priorities go to projects that have one of the following qualities:

- Required by an executed order on consent
- Required by a draft or final State Pollutant Discharge Elimination System permit
- Upgrading or replacing an existing wastewater system
- Constructing a wastewater treatment and/or collection system for an area with failing onsite septic systems
- Identified in a total maximum daily load implementation plan

The goal of the Engineering Planning Grant program is to advance water quality projects to construction, so successful applicants can use the engineering report funded by the grant to seek financing through the CWSRF program, Water Quality Improvement Project program, or other funding entities to further pursue the identified solution.



Water Quality Improvement Project Program

The Water Quality Improvement Project program is a competitive reimbursement grant program that funds projects that directly address documented water quality impairments. The competitive, statewide grant program is open to local governments and not-for-profit corporations. Grant recipients may receive up to 75 percent of the project costs for high priority wastewater treatment improvement, non-agricultural nonpoint source abatement and control, land acquisition for source water protection, aquatic habitat restoration, and municipal separate storm sewer system projects; up to 50 percent for salt storage projects; and up to 40 percent for general wastewater infrastructure improvement projects. Eligible activities include (NYSDEC n.d.-f):

- Wastewater treatment improvement
- Non-agricultural nonpoint source abatement and control
- Land acquisition for source water protection
- Salt storage
- Aquatic habitat restoration
- Municipal separate storm sewer systems

New York State Department of Transportation BRIDGE NY Program

The BRIDGE NY program, administered by the NYS DOT, is open to all municipal owners of bridges and culverts. Projects are awarded through a competitive process and support all phases of project development. Projects selected for funding under BRIDGE NY are evaluated based on the resilience of the structure, including such factors as hydraulic vulnerability and structural resilience; the significance and importance of the bridge, including traffic volumes, detour considerations, number and types of businesses served and impacts on commerce; and the current bridge and culvert structural conditions.

New York State Emergency Services Revolving Loan

The New York State Emergency Services Revolving Loan Account makes loans to cities, villages, fire districts, counties, towns, and not-for-profit fire/ambulance corporations at an annual fixed interest rate of 2.5 percent. The loan supports the repair of firefighting apparatus, ambulances, or rescue vehicles and the renovation, rehabilitation, or repair of facilities that house firefighting equipment, ambulances, rescue vehicles, and related equipment. Principal and interest payments made by recipients are deposited in the revolving loan account and loaned again to new applicants. Therefore, funding levels in the account vary throughout the year depending upon the amount of repayment money, interest accrued, and number of new loans made.

18.3.3 County and Local

Putnam County and individual jurisdictions are legally authorized to fund mitigation projects through existing local budgets, local appropriations (including referendums and bonding), and a variety of federal and state loan and grant programs. Many jurisdictions noted throughout the planning process that they are faced with increasing fiscal constraints, including decreasing revenues, budget constraints, and tax caps. In an effort to overcome these fiscal challenges, jurisdictions have continued to leverage the sharing of resources and combining available funding with grants and other sources and note that plans and interjurisdictional cooperation are beneficial in obtaining grants.



18.4 EDUCATION AND OUTREACH CAPABILITIES

This section summarizes education and outreach capabilities in Putnam County. Further information is provided in the jurisdictional annexes in Volume II.

18.4.1 Federal

Through the Emergency Management Institute, FEMA offers self-paced courses designed for people who have emergency management responsibilities and the general public. All are offered free-of-charge to those who qualify for enrollment. There are several courses available that relate to hazard mitigation:

- IS-30.b – Mitigation eGrants System for the Subgrant Applicant
- IS-31.b – Mitigation eGrants for the Grant Applicant
- IS-212.b – Introduction to Unified Hazard Mitigation Assistance (HMA)
- IS-273 – How to Read a Flood Insurance Rate Map (FIRM)
- IS-274 – How to Use a Flood Insurance Study (FIS)
- IS-318.b – Local Mitigation Planning Training
- IS-328.a – Plan Review for Local Mitigation Plans
- IS-393.b – Introduction to Hazard Mitigation
- IS-2700 – National Mitigation Framework, an Introduction

18.4.2 State

The DHSES Training and Exercise Program is for emergency responders, managers, and other support staff who work to protect life, property, and environment in New York State. The program provides realistic training conditions that can be adapted to almost any emergency participants may face. The program's course catalog can be found on its website.

18.4.3 County and Local

Local Activities

Jurisdictional annexes in Volume II identify methods of performing education and outreach. Jurisdictions were asked to indicate whether the following methods are utilized by their jurisdiction:

- | | |
|--|--|
| • Community newsletter | • Organizations that conduct outreach to socially vulnerable populations and underserved populations |
| • Hazard awareness campaigns | • Public information officer or communications office |
| • Hazard mitigation information available on its website | • Social media for hazard mitigation education and outreach |
| • Local news | • Warning systems for hazard events |
| • Natural disaster/safety programs in place for schools | |



PREADY

PREADY is an effort by Putnam County to inform the public how to be prepared and ready for an emergency. The program provides a checklist, encourages the use of alerts and warnings, and provides guidance on how to prepare before a disaster happens.

Putnam County Bureau of Emergency Services

The Bureau of Emergency Services offers training in the areas of emergency medical service, firefighting, and emergency management. The Training and Operations (TOPS) building hosts a variety of emergency management training courses, planning workshops and informational events aimed at enhancing citizen preparedness and community resilience. Local residents, elected officials, community leaders and non-governmental organizations gain useful knowledge and training that can make them more resilient during emergencies and help them to identify capabilities for undertaking recovery efforts.

PART 4: MITIGATION STRATEGY





19. MITIGATION STRATEGY

A mitigation strategy is a long-term blueprint for reducing the potential for hazard-related losses. The core of a mitigation strategy is a set of mitigation actions, which are projects, plans, or other activities that address a range of potential hazard impacts on the population, property, economy, and environment of a community. Communities use mitigation actions to achieve defined mitigation goals.

This chapter describes the process used to identify mitigation goals and actions and create mitigation strategies for each jurisdiction participating in the HMP. Planning Partners reviewed the risk assessment and capability assessment to develop their mitigation strategies.

19.1 MITIGATION GOALS

This section describes the process of updating hazard mitigation goals for reducing or avoiding long-term vulnerabilities to identified hazards. For the purposes of this plan, goals are defined as general guidelines that explain what is to be achieved. They are broad, long-term, policy-type statements that represent global visions. Goals help define the benefits that the HMP is trying to achieve. The success of the plan, once implemented, should be measured by the degree to which its goals have been met (that is, by the actual benefits in terms of hazard mitigation).

The Steering Committee reviewed the 2021 goals and made revisions for the 2027 update based on the following considerations:

- Hazard events and losses since the 2021 plan
- The updated hazard profiles and risk assessment
- The goals and objectives established in the New York State 2023 HMP
- The Planning Partnership's interests in integrating this HMP with other planning mechanisms, including Putnam County and local risk management plans
- Direct input from the Steering Committee, stakeholders, and the public on how the County and jurisdictions need to move forward to best manage their hazard risk
- Discussions and research on existing authorities, policies, programs, resources
- Support for mitigation through the protection of natural systems

As a result of this review process, the 2027 HMP goals for were updated to the following:

- Goal 1—Protect life and property.
- Goal 2—Increase public awareness, education, and outreach efforts among all stakeholders to foster resilience, preparedness and mitigation opportunities in the public and private spheres.
- Goal 3—Protect natural systems and encourage their use to mitigate natural hazards.
- Goal 4—Enhance or develop programs to build regional, county, and local mitigation and related emergency management capabilities.
- Goal 5—Promote resilient and sustainable land development practices to improve the ability to recover and bounce back faster from impacts of natural hazard events.
- Goal 6—Address long-term vulnerabilities from high-hazard and other vulnerable dams.



19.2 MITIGATION STRATEGY DEVELOPMENT

Beginning in April 2026, members of the Steering Committee and contract consultants worked directly with each jurisdiction (by phone, email, or virtual meetings) to update their annex with mitigation strategies that focus on well-defined, implementable projects that meet the definition or characteristics of mitigation. Mitigation actions were selected with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).

19.2.1 Mitigation Strategy Meetings and Workshops

Two in-person annex support meetings were held for Planning Partners to assist in the development of additional actions, foster collaboration between neighboring jurisdictions for mitigation actions, discuss actions that involve cooperation between the County and municipalities, and identify steps to complete the jurisdictional annexes. These meetings were held at the Putnam County Bureau of Emergency Service facility (112 Old Route 6, Carmel, NY 10512), on July 22 – 23, 2026. Additional virtual annex support meetings were held throughout from April through August 2026 (see Appendix D).

The mitigation strategy workshop was conducted in tandem with the in-person annex meetings on July 22 – 23, 2026 to support the development of focused problem statements based on the impacts of natural hazards in the County and their communities. These problem statements provide a detailed description of a problem area, including its impacts on the jurisdiction; past damage; loss of service; etc. An effort was made to include a street address for each problem location, lists of adjacent streets, water bodies, and well-known structures, and a brief description of existing conditions (topography, terrain, hydrology) at the site. These problem statements form a bridge between the hazard risk assessment, which quantifies impacts on each community, and the development of actionable mitigation strategies.

19.2.2 Review of Previous Actions

To evaluate progress on local mitigation actions, each Planning Partner completed a Mitigation Action Plan Review Worksheet that listed all actions identified for their jurisdiction in the prior (2021) plan. The Planning Partners indicated the status of each action (“In Progress,” “Ongoing Capability,” “No Progress,” or “Complete”) and provided comments to quantify the extent of progress and provide reasons for the level of progress. This information is included in the jurisdictional annexes in Volume II. At the kickoff and during subsequent local level planning meetings, all participating jurisdictions were further surveyed to identify completed mitigation actions, in progress actions, or ongoing capabilities.

Mitigation actions identified as “Complete” have been removed from the Planning Partners’ updated mitigation strategies. Actions identified as “No Progress” or “In Progress” have been carried forward for inclusion in the updated local mitigation strategies or discontinued for specific reasons. Updated action descriptions provide new details on these actions if needed to better define the projects, identify benefits and costs, and improve implementation.

Actions from the previous plan identified as “Ongoing Capability” represent programs that are now fully integrated into the normal operational and administrative framework of the community. These are removed from the updated mitigation strategy (marked as “Discontinued”) and included in the capabilities assessment of each annex.



19.2.3 Identification of New Actions

Communities were made aware of potential new mitigation actions as such actions became evident during the HMP update process. Throughout the course of the HMP update process, additional regional and County-level mitigation actions were identified by the following processes:

- Review of the results and findings of the updated risk assessment
- Review of available regional and County plans, reports, and studies
- Direct input from County departments and other regional agencies, including:
 - Putnam County Bureau of Emergency Services
 - Putnam County Department of Planning, Development, and Public Transportation
 - Putnam County Soil and Water Conservation District
 - Putnam County Economic Development Corporation
 - Putnam County Department of Health
 - Putnam County Department of Public Works
 - Putnam County Climate Smart
 - Putnam County Tourism Department
 - Putnam County Parks and Recreation Department
 - Putnam County Department of Social Services and Mental Health
- Input received through the public and stakeholder outreach process

The sections below describe the focus of the process followed to identify new mitigation actions.

Addressing Known Vulnerabilities

To help support the selection of an appropriate risk-based mitigation strategy, each annex includes a summary of hazard vulnerabilities. These were identified during the HMP update process by Planning Partner representatives, through review of available plans and reports, or through the hazard profiling and risk assessment process.

Protecting Critical Facilities

Mitigation actions that address vulnerable critical facilities have been proposed in consideration of protection against worst-case scenarios. For projects funded through federal mitigation programs, the level of protection may be influenced by cost-effectiveness as determined through a formal benefit-cost analysis. For locally self-funded projects, local guidance will determine appropriate levels of protection. It is recognized that the County and jurisdictions have limited authority with regard to mitigation at any level of protection over privately owned critical facilities.

Accounting for Climate Change

As discussed in the hazard profiles in this HMP, the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards (e.g., flood, severe storm, severe winter storm, and wildfire). Communities are working to evaluate and recognize these long-term implications and to incorporate their mitigation strategies into planning and capital improvement updates.



Incorporating a Range of Action Types

Concerted efforts were made to ensure that Planning Partners develop updated mitigation strategies that cover the range of mitigation action types described in recent FEMA planning guidance (FEMA 2021b):

- **Education Outreach**—Sustained programs to educate residents and community leaders about risks, vulnerabilities, and mitigation opportunities
- **Natural Systems Protection**—Actions that minimize damage and losses through preservation or restoration of natural systems
- **Planning and Regulations**—Policies or codes that influence the way land is developed and buildings are constructed
- **Structure and Infrastructure**—Actions modifying existing structures or infrastructure to remove them from a vulnerable area, or construction of new structures to protect existing development

Efforts were also made to develop mitigation strategies that cover the range of mitigation action types described in recent CRS guidance (FEMA 2017):

- **Preventive Activities**—Activities to keep flood problems from getting worse. The use and development of flood-prone areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices. Examples include planning and zoning, local floodplain laws, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection**—Activities undertaken by property owners on a building-by-building or parcel basis. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.
- **Natural Resource Protection**—Activities to preserve or restore natural areas or the natural functions of floodplain and watershed areas. They are implemented by a variety of agencies, primarily parks, recreation, or conservation agencies or organizations. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- **Emergency Services**—Measures taken during an emergency to minimize its impact. These measures are usually the responsibility of city or county emergency management staff and the owners or operators of major critical facilities. Services include warning systems, emergency response services, and the protection of essential facilities.
- **Structural Projects**—Projects to keep flood waters away from an area with a levee, reservoir, or other flood control measure. They are usually designed by engineers and managed or maintained by public works staff. Such structures include dams, setback levees, floodwalls, retaining walls, and safe rooms.
- **Public Information**—Activities to advise property owners, potential property owners, and visitors about hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of local floodplains. They are usually implemented by a public information office. Such actions include outreach projects, real estate disclosure, hazard information centers, and educational programs for school-age children and adults.

Considering Mitigation Best Practices

Catalogs of hazard mitigation best practices were developed that present a broad range of alternatives to be considered for use in the mitigation strategies, in compliance with 44 CFR Section 201.6(c)(3)(ii). One catalog was



developed for each hazard of concern evaluated in this plan. The catalogs present alternatives that are categorized based on the following considerations:

- Who would have responsibility for implementation:
 - Individuals—personal scale
 - Businesses—corporate scale
 - Government—government scale
- What the alternatives would do:
 - Manipulate the hazard
 - Reduce vulnerability to the hazard
 - Reduce impacts from the hazard
 - Build local capacity to respond to or be prepared for the hazard

The alternatives presented include actions that will mitigate current risk from hazards and actions that will help reduce risk from changes in the impacts of these hazards resulting from climate change. The catalogs provide a baseline of mitigation alternatives that are backed by a planning process, are consistent with the established goals and objectives, and are within the capabilities of the Planning Partners to implement. Some of these actions may not be feasible based on the selection criteria identified for this plan. The purpose of the catalogs was to provide a list of what could be considered to reduce risk from natural hazards within the planning area. Appropriate hazard mitigation actions were selected from among the alternatives in the catalogs for inclusion in the mitigation strategies. Actions in the catalog that are not included for the partnership's mitigation strategy were not selected for one or more of the following reasons:

- The action is not feasible
- The action is already being implemented
- There is an apparently more cost-effective alternative
- The action does not have public or political support.

The catalogs are included in Appendix B.

19.3 MITIGATION STRATEGY EVALUATION

19.3.1 Prioritization

Section 201.c.3.iii of 44 CFR establishes how mitigation strategies are to be prioritized, implemented, and administered by local jurisdictions. For this HMP update, each mitigation strategy was prioritized using criteria suitable for evaluating hazard mitigation strategies. This method provided a systematic approach that considered the opportunities and constraints of implementing each mitigation action. The Steering Committee chose the following evaluation criteria for this process:

- Life Safety—How effective will the action be at protecting lives and preventing injuries? Will the proposed action adversely affect one segment of the population?
- Property Protection—How significant will the action be at eliminating or reducing damage to structures and infrastructure? For example: development in the floodplain or high-risk areas?
- Cost-Effectiveness—Are the costs to implement the action commensurate with the benefits achieved?



- Political—Is there overall public support for the action? Is there the political will to support it? Is the action at odds with development pressures?
- Legal—Does the jurisdiction have the authority to implement the action?
- Fiscal—Can the action be funded under existing program budgets (i.e., is this action currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
- Environmental—What are the potential environmental impacts of the action? Will it comply with environmental regulations? Are there co-benefits of this action?
- Social Vulnerability—Does the action benefit socially vulnerable populations and underserved communities? Additional considerations can include appropriate numerical measures of social vulnerability.
- Administrative—Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary? Does the scale and scope of the action align with the jurisdiction's capabilities?
- Hazards of Concern—Does the action address one or more of the jurisdiction's high-ranked hazards?
- Climate Change—Does the action incorporate climate change projections? Is the action designed to withstand/address long-term conditions?
- Timeline—Can the action be completed in less than five years?
- Community Lifelines—Does this action benefit community lifelines?
- Other Local Objectives—Does the action advance other local objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of other plans and programs?

Participating jurisdictions were asked to use these criteria to prioritize their identified mitigation actions. For each mitigation action, the jurisdictions assigned a numeric score for each of the 14 evaluation criteria:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Jurisdictions were asked to provide a brief summary of the rationale behind the numeric rankings assigned. The numerical results were totaled and then used by each jurisdiction to help prioritize the action or strategy as *low*, *medium*, or *high*. Actions that had a numerical value between 0 and 6 were categorized as *low priority*; actions with numerical values between 7 and 10 were categorized as *medium priority*; and actions with numerical values between 11 and 14 were categorized as *high priority*. While this provided a consistent, systematic methodology to support the evaluation and prioritization of mitigation actions, jurisdictions may have additional considerations that could influence their overall prioritization of mitigation actions.

It is noted that jurisdictions may be carrying forward mitigation actions from prior mitigation strategies that were prioritized using a different, but not inherently contrary, approach. At their discretion, jurisdictions carrying forward prior actions were encouraged to re-evaluate their priority, particularly if conditions that would affect the prioritization criteria had changed.

For the HMP update there has been an effort to develop more clearly defined and action-oriented mitigation strategies. These local strategies include actions that are seen by the community as the most effective approaches to advance their local mitigation goals and objectives within their capabilities. In addition, each Planning Partner was asked to develop problem statements. With active support from NYS DHSES planning staff, the partners were able to develop action-oriented and achievable mitigation strategies. For that reason, many of the actions in the



updated mitigation strategy were ranked as *high* or *medium* priority, as reflective of the community's clear intent to implement them, available resources notwithstanding. In general, actions that would have had *low* priority rankings were appropriately screened out during the local action evaluation process.

19.3.2 Benefit/Cost Review

Section 201.6.c.3iii of 44 CFR requires the prioritization of the mitigation strategy to emphasize a benefit/cost comparison of the proposed actions. For all actions identified in the local strategies, jurisdictions identified the associated costs and benefits as follows:

- **Costs** presented include the total project estimation. This can include administrative, construction (engineering, design, and permitting), and maintenance costs.
- **Benefits** are the savings from losses avoided through project implementation. These can include life safety, structure and infrastructure damage, loss of service or function, and economic and environmental damage and losses.

When possible, jurisdictions were asked to identify the actual or estimated dollar costs and associated benefits. Where estimates of costs and benefits were available, the ratings were defined follows:

Low $\leq$ \$10,000

Medium = \$10,000 to \$100,000

High $\geq$ \$100,000

Where numerical costs or benefits could not be quantified, jurisdictions were asked to evaluate project cost-effectiveness using qualitative *high*, *medium*, and *low* ratings based on the following definitions:

- **Costs**
 - High—Existing funding levels are not adequate to cover the costs of the proposed project, and implementation would require an increase in revenue through an alternative source (e.g., bonds, grants, and fee increases).
 - Medium—The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
 - Low—The project could be funded under the existing budget. The project is part of or can be part of an existing, ongoing program.
- **Benefits**
 - High—Project will have an immediate impact on the reduction of risk exposure to life and property.
 - Medium—Project will have a long-term impact on the reduction of risk exposure to life and property or will provide an immediate reduction in the risk exposure to property.
 - Low—Long-term benefits of the project are difficult to quantify in the short-term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-effective.

For some of the actions identified, the Planning Partnership may seek financial assistance under FEMA's Hazard Mitigation Assistance (HMA) programs. These programs require detailed benefit/cost analysis as part of the application process. The benefit/cost review for the prioritization of actions in this update did not include the level of detail required by FEMA for project grant eligibility under HMA grant programs. These analyses will be performed when funding applications are prepared, using FEMA's Benefit-Cost Analysis model.



The Planning Partnership is committed to implementing mitigation strategies with benefits that exceed costs. For projects not seeking financial assistance from grant programs that require this sort of analysis, the Planning Partnership reserves the right to define benefits according to parameters that meet its needs and the goals and objectives of this plan.

PART 5:

PLAN

MAINTENANCE





20. PLAN MAINTENANCE AND IMPLEMENTATION

This chapter details the formal process that will ensure that the hazard mitigation plan remains an active and relevant document and that the Planning Partnership maintains its eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the HMP annually and producing an updated plan every five years. In addition, this chapter describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this HMP update will be incorporated into existing planning mechanisms and programs, such as comprehensive land use planning processes, capital improvement planning, and building code enforcement and implementation.

20.1 HMP COORDINATOR AND PLANNING PARTNER POINTS OF CONTACT

The HMP Coordinator is assigned to manage the maintenance and update of the HMP during its approval period (the five-year period between FEMA's approval of the HMP and its expiration), with the following responsibilities:

- Convene the Planning Partnership
- Be the prime point of contact for questions regarding the HMP and its implementation
- Coordinate the incorporation of additional information into the plan
- Manage the monitoring, evaluation, and updating responsibilities identified in this section

Currently, the Putnam County HMP Coordinator is designated as:

Matthew W. Nadolny, Director
Office of Emergency Management
Putnam County Bureau of Emergency Services
112 Old Route 6
Carmel, NY 10512
(845) 808-4000 ext. 41120
Email: Matthew.Nadolny@putnamcountyny.gov

Primary and secondary Planning Partner points of contact as of the date of this HMP are identified in each jurisdictional annex in Volume II. It will be the responsibility of each Planning Partner to inform the HMP Coordinator of any changes in representation.

20.2 MAINTENANCE AND IMPLEMENTATION TASKS

The procedures for maintaining and implementing the HMP are detailed in the sections below and summarized in Table 20-1.



Table 20-1. Plan Maintenance Matrix

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring	Planning Partners to recommend update of mitigation strategies, progress toward implementation of actions, identification of new actions, and update of information on funding opportunities.	Each June or after the occurrence of a federally declared disaster	Planning Partner points of contact identified in Volume II	Local jurisdiction implementation lead identified in Volume II
Integrating	Distribute the safe growth worksheet (see Table 20-2) for annual review and update by all participating jurisdictions.	June each year with interim email reminders to address integration in county and municipal activities	HMP Coordinator and Planning Partner points of contact identified in Volume II	Alternate Planning Partner points of contact
Evaluating	Review the status of previous actions, as submitted by the monitoring task lead, and assess the effectiveness of the plan; compile and finalize update of mitigation strategy.	Updated progress report completed by September 30 of each year	Planning Partner points of contact identified in Volume II	Alternate Planning Partner points of contact
Updating	Reconvene the Planning Partners to guide a comprehensive update to review and revise the plan.	Every 5 years or upon major update to Comprehensive Plan or after the occurrence of a major disaster	HMP Coordinator	Planning Partner points of contact identified in Volume II
Grant Monitoring	Notify lead agencies about grant opportunities, maintain a list of eligible jurisdiction-specific projects for funding consideration, and notify lead agencies of fiscal year mitigation priorities.	Continuously and as grant opportunities are identified	HMP Coordinator	Planning Partner points of contact identified in Volume II
Public Involvement	Maintain the HMP, inform the public of hazard events via social media outlets, promote educational workshops on hazard topics, and track and file public comments received regarding the HMP.	Continuously	HMP Coordinator and Planning Partner points of contact identified in Volume II	Alternate Planning Partner points of contact

20.2.1 Monitoring

The Planning Partnership will be responsible for monitoring and documenting annual progress on the plan. Each year, beginning one year after plan development, Planning Partnership representatives will collect and process information from the persons responsible for initiating or overseeing the mitigation projects in each department, agency, and organization involved in implementing mitigation actions identified in their jurisdictional annexes. In the first year of the approval period, this will be accomplished using an online performance progress reporting system, which will enable each Planning Partner to do the following:

- Directly access mitigation actions
- Easily update the status of each project
- Document successes or obstacles to implementation
- Add or delete projects to maintain mitigation strategy implementation

The reporting system will prompt Planning Partners to update progress on a quarterly basis, encouraging them to refresh their mitigation strategies and to continue implementation of actions. This system facilitates the sorting and



prioritization of projects and will support the submittal of an increased number of project grant fund applications. Planning Partnership representatives will be expected to document the following:

- Progress on the implementation of mitigation actions
- Obstacles or impediments to implementation of actions
- Any grant applications filed on behalf of any of the participating jurisdictions
- Hazard events and losses occurring in their jurisdiction
- Additional mitigation actions believed to be appropriate and feasible
- Public and stakeholder input.

Plan monitoring for years 2 through 4 of the approval period will be addressed via the online performance progress reporting system or manually.

20.2.2 Integrating the HMP into Municipal Planning Mechanisms

Hazard mitigation is sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. Integrating hazard mitigation into a community's existing plans, policies, codes, and programs leads to development patterns or redevelopment that reduce risk from known hazards. The jurisdictional annexes in Volume II describe how hazard mitigation is being integrated into existing planning mechanisms for each planning partner. Many partners have recognized the importance and benefits of incorporating hazard mitigation into future local planning and regulatory processes.

Effective mitigation is achieved when hazard awareness and risk management approaches and strategies become an integral part of public activities and decision-making. Within the County, there are many existing plans and programs that support hazard risk management, and it is critical that this HMP integrate and coordinate with and complement those existing plans and programs.

The capability assessment (Chapter 18) provides a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, and local) that support hazard mitigation within the County. In the jurisdictional annexes in Volume II, each Planning Partner identified how it has integrated hazard risk management into its existing planning, regulatory, and administrative framework ("existing integration") and how they intend to promote this integration further ("opportunities for future integration").

It is the intention of Planning Partners to incorporate mitigation planning as an integral component of daily government operations. Planning Partnership representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. The sample adoption resolution (Appendix A – Adoption Resolution) includes an item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Partnership anticipates the following:

- Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts.
- The HMP, comprehensive plans, emergency management plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of county residents.

Other planning processes and programs to be coordinated with the recommendations of the HMP include the following:



- Emergency response plans
- Training and exercise of emergency response plans
- Debris management plans
- Recovery plans
- Capital improvement programs
- Municipal codes
- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments
- Community wildfire protection plans
- Comprehensive flood hazard management plans
- Resilience plans
- Community Development Block Grant Disaster Recovery action plans
- Public information and improved public participation
- Educational programs
- Continued interagency coordination

During the HMP annual review process, participating jurisdictions will be asked to document how they are utilizing and incorporating the HMP into their day-to-day operations and planning and regulatory processes. Each municipality will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the annual HMP progress report. The checklist in Table 20-2 will help a community analyze how hazard mitigation is integrated into local plans, ordinances, regulations, and policies. Completing the checklist will help jurisdictions identify areas that currently integrate hazard mitigation and where to make improvements and reduce vulnerability to future development.



Table 20-2. Safe Growth Check List

Planning Mechanisms	Yes	No	How is it being done or how will this be utilized in the future?
Operating, Municipal, and Capital Improvement Program Budgets			
When constructing upcoming budgets, are hazard mitigation actions funded as budget allows?			
Are construction projects evaluated to see if they meet the hazard mitigation goals?			
Does the municipality review mitigation actions when allocating funding during annual budget adoption processes?			
Do budgets limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?			
Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?			
Do budgets provide funding for hazard mitigation projects identified in the HMP?			
Human Resource Manual			
Do any job descriptions specifically include identifying and/or implementing mitigation projects/actions or other efforts to reduce natural hazard risk?			
Building and Zoning Ordinances			
Prior to zoning changes or development permitting, does the municipality review the HMP and other hazard analyses to ensure consistent and compatible land use?			
Does the zoning ordinance discourage development or redevelopment within natural areas, including wetlands, floodways, and floodplains?			
Does the zoning ordinance contain natural overlay zones that set conditions?			
Does the zoning ordinance require developers to take additional actions to mitigate natural hazard risk?			
Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?			
Does the zoning ordinance prohibit development within or filling of wetlands, floodways, and floodplains?			



Planning Mechanisms	Yes	No	How is it being done or how will this be utilized in the future?
Subdivision Regulations			
Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?			
Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources?			
Do the regulations allow density transfers where hazard areas exist?			
Comprehensive Plan			
Are the goals and policies of the plan related to those of the HMP?			
Does the future land use map clearly identify natural hazard areas?			
Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			
Land Use			
Does the future land use map clearly identify natural hazard areas?			
Do the land use policies discourage development or redevelopment in natural hazard areas?			
Transportation Plan			
Does the transportation plan limit access to hazard areas?			
Is transportation policy used to guide growth to safe locations?			
Are transportation systems designed to function under disaster conditions (e.g., evacuation)?			
Environmental Management			
Are environmental systems that protect development from hazards identified and mapped?			
Do environmental policies maintain and restore protective ecosystems?			
Do environmental policies provide incentives to development located outside protective ecosystems?			
Grant Applications			
Are data and maps used as supporting documentation in grant applications?			
Municipal Ordinances			
Is hazard mitigation a priority when updating municipal ordinances?			
Economic Development			
Does the local economic development group take into account information regarding identified hazard areas when assisting new businesses in finding a location?			
Public Education and Outreach			
Does the municipality have any public outreach mechanisms/ programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events?			



20.2.3 Evaluating

Evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, whether the HMP goals are being achieved, and whether changes are needed. The HMP Coordinator will consult with the Planning Partnership members to evaluate the effectiveness of the plan implementation and to reflect changes that could affect mitigation priorities or available funding.

The status of the HMP will be discussed and documented at an annual plan review meeting of the Planning Partnership to be held in person or via teleconference approximately one year from the date of local adoption of this update and successively thereafter. The HMP Coordinator will be responsible for calling participants and coordinating the annual plan review meeting and soliciting input regarding progress toward meeting plan goals and objectives. At least two weeks before the annual plan review meeting, the HMP Coordinator will advise Planning Partnership members of the meeting date, agenda, and expectations of the members. These evaluations will assess whether:

- Goals and objectives address current and expected conditions
- The nature or magnitude of the risks has changed
- Current resources are appropriate for implementing the HMP and if different or additional resources are now available
- Actions were cost effective
- Schedules and budgets are feasible
- Implementation problems are present, such as technical, political, legal, or coordination issues with other agencies
- Outcomes have occurred as expected
- Changes in local resources impacted plan implementation (e.g., funding, personnel, and equipment)
- New agencies, departments, and staff are included, involving other local governments as defined under 44 CFR 201.6.

Specifically, the Planning Partnership will review the mitigation goals, objectives, and activities using performance-based indicators, including:

- New agencies/departments
- Project completion
- Underspending/overspending
- Achievement of the goals and objectives
- Resource allocation
- Timeframes
- Budgets
- Lead/support agency commitment
- Resources
- Feasibility



The Planning Partnership will evaluate how other programs and policies have conflicted with or augmented planned or implemented mitigation actions and will identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions. Other programs and policies can include those that address:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and safety
- Recreation
- Land use and zoning
- Public education and outreach
- Transportation

The Planning Partnership should refer to evaluation forms in the FEMA 386-4 guidance document to assist in the evaluation process (Worksheets #2 and #4; see Appendix F – Plan Review Tools). Further, the Planning Partnership should refer to any process and plan review deliverables developed by the County or participating jurisdictions as a part of the review processes established for prior or existing local HMPs within the county.

The HMP Coordinator will be responsible for preparing an annual HMP progress report for each year of the approval period based on the information provided by the Planning Partners and other information as appropriate. These annual reports will provide data for the five-year update of this HMP and will assist in pinpointing any implementation challenges. By monitoring the implementation of the HMP, the Planning Partnership will be able to assess which actions are completed, which are no longer feasible, and which require additional funding.

Following any major disasters, the HMP will be evaluated and revised to determine if the recommended actions remain relevant and appropriate. The risk assessment will also be revisited to see if any changes are necessary based on the pattern of disaster damage or if data listed in the hazard profiles of this HMP has been collected to facilitate the risk assessment. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

20.2.4 Updating

Local hazard mitigation plans must be reviewed, revised as appropriate, and resubmitted for approval to remain eligible for benefits awarded under DMA 2000 (44 CFR 201.6.d.3). It is the intent of the Putnam County HMP Planning Partnership to update this HMP on a five-year cycle from the date of initial plan adoption.

To facilitate the update process, the HMP Coordinator, with support of the Planning Partnership, will use the second annual Planning Partnership meeting to develop and commence the implementation of a detailed plan update program. Prior to the five-year update, the HMP Coordinator will invite representatives from the New York State Division of Homeland Security and Emergency Services to provide guidance on plan update procedures. At a minimum, this will establish who will be responsible for managing and completing the HMP update effort, items that need to be included in the updated plan, and a detailed timeline with milestones to ensure that the update is completed according to regulatory requirements. At this meeting, the project team will determine what resources will be needed to complete the update and seek to secure these resources.



Following each 5-year update of the HMP, the updated plan will be distributed for public comment. After all comments are addressed, the HMP will be revised and distributed to all Planning Partners.

20.2.5 Grant Monitoring and Coordination

Putnam County intends to be a resource to the Planning Partnership in the support of project grant writing and development. The degree of this support will depend on the level of assistance requested by the Planning Partners during openings for grant applications. As part of grant monitoring and coordination, Putnam County intends to provide the following:

- Notification to Planning Partners about impending grant opportunities
- A current list of eligible, jurisdiction-specific projects for funding pursuit consideration
- Notification about mitigation priorities for the fiscal year to assist the Planning Partners in the selection of appropriate projects.

20.2.6 Continued Public Involvement

The Planning Partners are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will continue to be posted online at the following website: <https://www.putnamcountyny.gov/pcbcs>.

In addition, public outreach and dissemination of the HMP will include the following:

- Links to the HMP on local websites of each jurisdiction with capability
- Continued utilization of existing social media outlets (Facebook, X, etc.) to inform the public of natural hazard events, such as floods and severe storms; the public can be educated via the jurisdictional websites on how these applications can be used in an emergency situation
- Promotion of articles or workshops on hazards to educate the public and keep them aware of the dangers of hazards

The HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. The public will have an opportunity to comment on the HMP via the hazard mitigation website at any time. The HMP Coordinator will ensure that:

- Public and stakeholder comments and input on the plan, and hazard mitigation in general, are collected, recorded, and addressed as appropriate.
- The Putnam County HMP website is maintained and updated as appropriate.
- Copies of the latest approved plan are available for review at appropriate county facilities, along with instructions to facilitate public input and comment on the plan.
- Public notices, including media releases, are made (as appropriate) to inform the public of the availability of the plan, particularly during plan update cycles.



REFERENCES

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ACRONYMS AND ABBREVIATIONS

ACS —American Community Survey	DHS —Department of Homeland Security
ADA —Americans with Disabilities Act	DHSES —Division of Homeland Security and Emergency Services
AE —A FEMA-define flood zone	DMA —Disaster Mitigation Act
AH —A FEMA-define flood zone	DMV —Department of Motor Vehicles
AO —A FEMA-define flood zone	DOH —Department of Health
APA —Approval Pending Adoption	DR —Major Disaster Declaration (FEMA)
AR —A FEMA-define flood zone	DSS-WISE —Decision Support System for Water Infrastructure Security
CCAHA —Conservation Center of Art and Historic Artifacts	EAP —Emergency Action Plan
CDBG —Community Development Block Grant	EF —Enhanced Fujita Scale
CDC —Centers for Disease Control	EM —Emergency Declaration (FEMA)
CEDS —Comprehensive Economic Development Strategy	EMI —Emergency Management Institute
CERCLIS —Comprehensive Environmental Response, Compensation and Liability Information System	EMPG —Emergency Management Program Grant
CFR —Code of Federal Regulations	EMS —Emergency Medical Services
CMP —Coastal Management Program	EPA —Environmental Protection Agency
COPD —Chronic Obstructive Pulmonary Disease	EPF —Environmental Protection Fund
COVID —Corona Virus Disease	ESF —Emergency Support Function
CRRA —Community Risk and Resiliency Act	EWP —Emergency Watershed Protection
CRS —Community Rating System	FBI —Federal Bureau of Investigation
CSC —Climate Smart Communities	FDRA —Fire Danger Rating Areas
CWSRF —Clean Water State Revolving Fund	FEMA —Federal Emergency Management Agency
DBSC —Division of Building Standards and Codes	FERC —Federal Energy Regulatory Commission
DFIRM —Digital Flood Insurance Rate Map	FHWA —Federal Highway Administration
	FIRM —Flood Insurance Rate Map



FL—Florida

FMA—Flood Mitigation Assistance

FPI—Fire Potential index

GIS—Geographic Information System

HAB—Harmful Algal Bloom

HIFLD—Homeland Infrastructure Foundation-Level Data

HMA—Hazard Mitigation Assistance

HMGP—Hazard Mitigation Grant Program

HMP—Hazard Mitigation Plan

HOME—Home Investment Partnerships Program

HSGP—Homeland Security Grant Program

HVAC—Heating, Ventilation, and Air Conditioning

HVRC—Hudson Valley Regional Council

IT—Information Technology

KBDI—Keetch-Bryam Drought Index

LAL—Lightning Activity Level Guide

LWRP—Local Waterfront Revitalization Program

MMI—Modified Mercalli Intensity

MRP—Mean Return Period

MTA—Metropolitan Transportation Authority

NASA—National Aeronautics and Space Administration

NCEI—National Centers for Environmental Information

NDMC—National Drought Mitigation Center

NEHRP—National Earthquake Hazard Reductions Program

NFIP—National Flood Insurance Program

NHC—National Hurricane Center

NIDIS—National Integrated Drought Information System

NIJ—National Institute of Justice

NLCD—National Land Cover Database

NOAA—National Oceanic and Atmospheric Administration

NPS—National Park Service

NRCC—Northeast Regional Climate Center

NRCS—Natural Resources Conservation Service

NSIDC—National Snow and Ice Data Center

NSSL—National Severe Storms Library

NWS—National Weather Service

NYC—New York City

NYCEM—New York City Emergency Management

NYDOS—New York State Department of State

NYMTC—New York Metropolitan Transportation Council

NY—New York

NYPA—New York Power Authority

NYS ITS—New York State Office of Information Technology Services

NYSDEC—New York State Department of Environmental Conservation

NYS DOH—New York State Department of Health

NYS DOL—New York State Department of Labor

NYS DOT—New York State Department of Transportation



NYSEG—New York State Electric and Gas

NYSERDA—New York State Energy Research and Development Authority

NYS—New York State

PART—Putnam Area Rapid Transit

PDM—Pre-Disaster Mitigation Program

PDSI—Palmer Drought Severity Index

PGA—Peak Ground Acceleration

RAISE—Rebuilding American Infrastructure with Sustainability and Equity

RCV—Replacement Cost Value

RF—Risk Factor

RL—Repetitive Loss

RSI—Regional Snowfall Index

SARS—Severe Acute Respiratory Syndrome

SDI—State drought index

SFHA—Special Flood Hazard Area

SPC—Storm Prediction Center

SPEI—Standardized Precipitation Evapotranspiration Index

TBD—To Be Determined

THIRA—Threat Hazard Identification and Risk Assessment

TOPS—Training and Operations

USACE—U.S. Army Corps of Engineers

USBR—U.S. Bureau of Reclamation

USDA—U.S. Department of Agriculture

USDM—U.S. Drought Monitor

USDOT—U.S. Department of Transportation

USEDA—U.S. Economic Development Administration

USFS—U.S. Forest Service

USGS—U.S. Geological Survey

USSD—U.S. Society on Dams

VE—A FEMA-defined flood zone

VT—Vermont

WestCOG—Western Connecticut Council of Governments

WFAS—Wildland Fire Assessment System

WHO—World Health Organization

WNV—West Nile Virus

WUI—Wildland/Urban Interface