Monroe County Hazard Mitigation Plan 2023 Update

Volume I

March 2023

TETRA TECH

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Section 1. Introduction

1.1 BACKGROUND

Communities, residents, and businesses have been faced with continually increasing costs associated with both natural and man-made hazards. Hazard mitigation is the first step in reducing risk and is the most effective way to reduce costs associated with hazards. Monroe County and 30 participating jurisdictions located therein, have developed this Monroe County Hazard Mitigation Plan (MCHMP, also referred herein as the "Hazard Mitigation Plan" or the "plan"), which is a multi-jurisdictional, multi-hazard mitigation plan. The MCHMP includes countywide analysis and assessment of hazards, risk and capabilities and represents an update of the 2017 "Monroe County Hazard Mitigation Plan." The plan has been prepared following the requirements of the federal Disaster Mitigation Act of 2000 (DMA 2000). DMA 2000 amends the Stafford Act and is designed to improve planning for, response to, and recovery from, disasters by requiring state and local entities to implement pre-disaster mitigation planning and develop HMPs. The Federal Emergency Management Agency (FEMA) has issued guidelines for the development of multi-jurisdictional hazard mitigation plans, and the New York State Division of Homeland Security and Emergency Services (DHSES) also supports plan development for jurisdictions in New York State.

Hazard Mitigation is any sustained action taken to reduce or eliminate the long-term risk and effects that can result from specific hazards.

FEMA defines a ***Hazard Mitigation Plan*** as the documentation of a state or local government evaluation of natural hazards and the strategies to mitigate such hazards.

Specifically, DMA 2000 requires that states, with support from local governmental agencies, update HMPs on a 5-year basis to prepare for and reduce the potential impacts of natural hazards. DMA 2000 is intended to facilitate cooperation between state and local authorities, prompting them to work together. This enhanced planning process will better enable local and state governments to articulate accurate needs for mitigation, resulting in faster allocation of funding and more effective risk reduction projects.

Monroe County has been included in 21 FEMA (major and emergency) declarations since 1954.

1.1.1 DMA 2000 Origins -The Robert T. Stafford Disaster Relief and Emergency Assistance Act

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.

In the early 1990s, a new federal policy regarding disasters began to evolve. Rather than simply reacting whenever disasters strike communities, the federal government began encouraging communities to first assess their vulnerability to various disasters and proceed to take actions to reduce or eliminate potential risks. The policy is based on the logic that a disaster-resistant community can rebound from a natural disaster with less loss of property or human injury, at much lower cost and, consequently, more quickly. Moreover, other costs associated with disasters are minimized, such as the time lost from productive activity by business and industries.

DMA 2000 provides an opportunity for states, tribes, and local governments to take a new and revitalized approach to mitigation planning. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous mitigation planning provisions (Section 409) and replacing them with a new set of requirements (Section 322). Section 322 sets forth the requirements that communities evaluate natural hazards within their respective jurisdictions and develop an appropriate plan of action to mitigate those hazards, while emphasizing the need for state, tribal, and local governments to closely coordinate mitigation planning and implementation efforts.

The amended Stafford Act requires that each local jurisdiction identify potential natural hazards to the health, safety, and well-being of its residents, and identify and prioritize actions that can be taken by the community to mitigate those hazards before disaster strikes. For communities to remain eligible for hazard mitigation assistance from the federal government, they must first prepare, and then maintain and update an HMP.

Responsibility for fulfilling the requirements of Section 322 of the Stafford Act and administering the FEMA Hazard Mitigation Program has been delegated to the State of New York, specifically to NYS DHSES. FEMA also provides support through guidance, resources, and plan reviews.

1.1.2 Benefits of Mitigation Planning

Effective mitigation planning will help prepare citizens and government agencies to better prepare for and respond when disasters occur. Also, mitigation planning allows Monroe County as a whole, including the participating Monroe County city, towns, and villages, to remain eligible for mitigation grant funding for mitigation projects that will reduce the impact of future disaster events. The long-term benefits of mitigation planning and implementation include:

National Benefit-Cost Ratio (BCR) Per Peril *BCR numbers in this study have been rounded	Beyond Code Requirements	Federally Funded
Overall Hazard Benefit-Cost Ratio	$4:1	$6:1
Riverine Flood	$5:1	$7:1
Hurricane Surge	$7:1	Too few grants
Wind	$5:1	$5:1
Earthquake	$4:1	$3:1
Wildland-Urban Interface Fire	$4:1	$3:1

Source: FEMA 2018; Federal Insurance Mitigation Administration 2018
Note: Natural hazard mitigation saves $6 on average for every $1 spent on federal mitigation grants.

- An increased understanding of hazards faced by Monroe County 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 damages to human health and structures
- Reduced costs associated with response and recovery efforts, including repairs

1.1.3 Organizations Involved in the Mitigation Planning Effort

Monroe County and the participating jurisdictions have prepared this hazard mitigation plan with full coordination and participation of county and local government, relevant organizations and groups, as well as state and federal agencies and the general public. Coordination helps to ensure that stakeholders have established communication channels and relationships necessary to support mitigation planning and mitigation actions included in Section 6 and in the jurisdictional annexes in Section 9. Including Monroe County, all 30 of the municipal governments in the County have participated in the planning process as indicated in Table 1-1 below.

Table 1-1. Participating Jurisdictions in Monroe County

Jurisdictions		
Monroe County	Town of Henrietta	Town of Riga

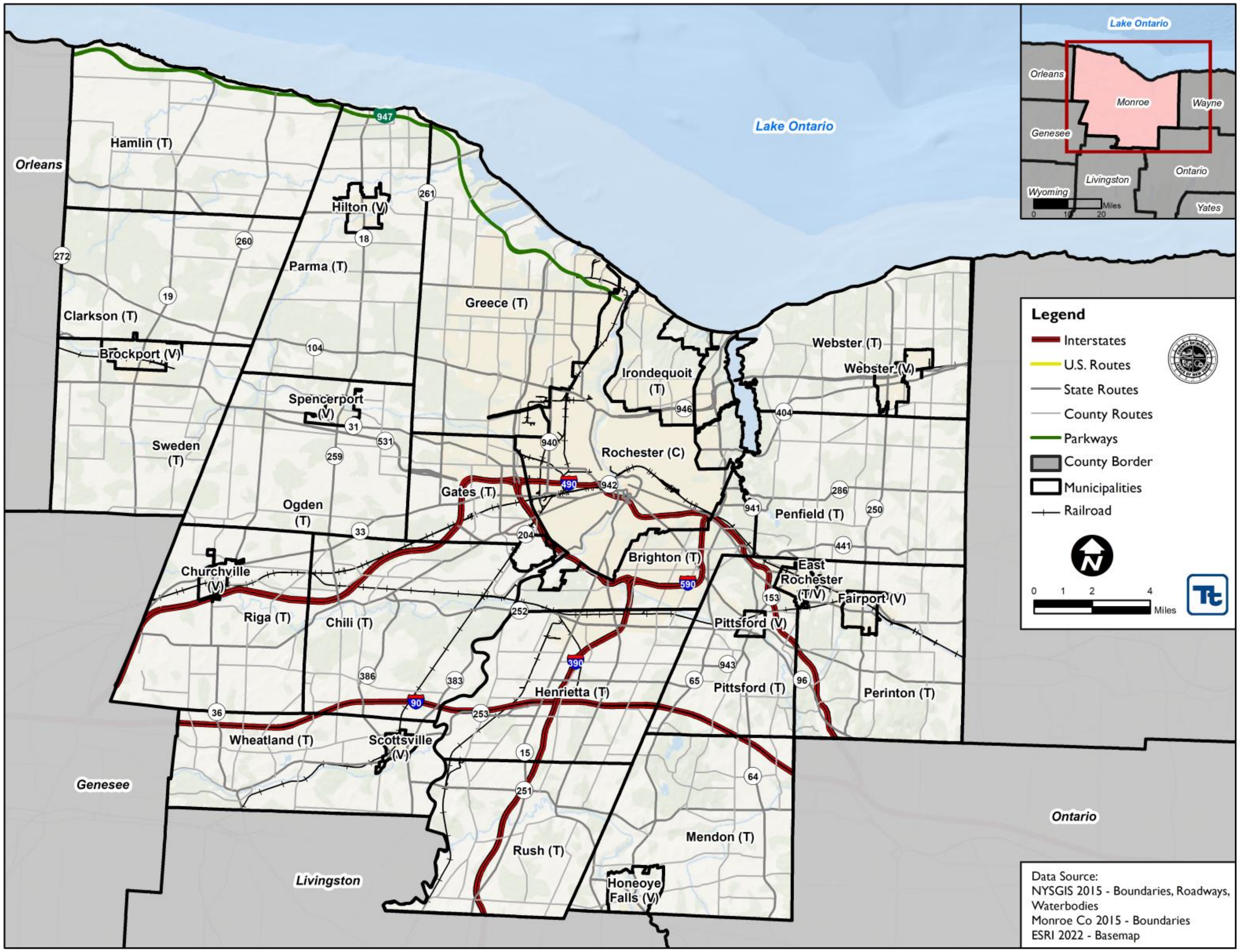
Jurisdictions		
Town of Brighton	Village of Hilton	City of Rochester
Village of Brockport	Village of Honeoye Falls	Town of Rush
Town of Chili	Town of Irondequoit	Village of Scottsville
Village of Churchville	Town of Mendon	Village of Spencerport
Town of Clarkson	Town of Ogden	Town of Sweden
Town/Village of East Rochester	Town of Parma	Town of Webster
Village of Fairport	Town of Penfield	Village of Webster
Town of Gates	Town of Perinton	Town of Wheatland
Town of Greece	Town of Pittsford	-
Town of Hamlin	Village of Pittsford	-

Multiple Agency Support for Hazard Mitigation

Primary responsibility for the development and implementation of mitigation strategies and policies lies with local governments. However, local governments are not alone; various partners and resources at the regional, state, and federal levels are available to assist communities in the development and implementation of mitigation strategies. Within New York State, NYS DHSES is the lead agency providing hazard mitigation planning assistance to local jurisdictions. In addition, FEMA provides grants, tools, guidance, and training to support mitigation planning.

Additional input and support for this planning effort was obtained from a wide range of agencies as well as through public involvement (as discussed in Section 3). Under the project management of the Monroe County Office of Emergency Management (OEM), the Monroe County Hazard Mitigation Steering Committee provided oversight for the preparation of this plan. Details regarding the roles and responsibilities of the Steering Committee and Planning Committee are further discussed in Section 3. The Steering Committee includes representatives from the Monroe County Office of Emergency Management, Department of Environmental Services, Geographic Information System Services, Rochester-Genesee Regional Transportation Authority (RGTA), Monroe County Soil & Water Conservation District, Monroe County School Superintendents, Monroe Community College, University of Rochester, City of Rochester, and Town of Irondequoit. The 30 participating municipalities provided significant input into the preparation of the plan, in particular the preparation of the annexes included in Section 9 for each municipality. Details regarding the roles and responsibilities of the various committees and other participants are further discussed in Section 3.

Figure 1-1. Monroe County, New York, Mitigation Plan Area



This hazard mitigation plan was prepared in accordance with the following regulations and guidance:

- FEMA *Local Mitigation Planning Policy Guide*, April 19, 2022.
- FEMA *Local Mitigation Planning Handbook*, March 2013.
- FEMA *Integrating Hazard Mitigation into Local Planning*, March 1, 2013.
- FEMA *Plan Integration: Linking Local Planning Efforts*, July 2015.
- *Local Mitigation Plan Review Guide*, October 1, 2011.
- DMA 2000 (Public Law 106-390, October 30, 2000).
- 44 Code of Federal Regulations (CFR) Parts 201 and 206 (including: Feb. 26, 2002, Oct. 1, 2002, Oct. 28, 2003, and Sept. 13, 2004 Interim Final Rules).
- FEMA *How-To Guide for Using HAZUS-MH for Risk Assessment* FEMA Document No. 433, February 2004.
- FEMA *Mitigation Planning How-to Series* (FEMA 386-1 through 4, 2002), available at: http://www.fema.gov/fima/planhowto.shtm
- FEMA *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, January 2013.
- NYS DHSES *Hazard Mitigation Planning Standard*, 2017.
- NYS DHSES Hazard Mitigation Plan

Table 1-2 summarizes the requirements outlined in the DMA 2000 Interim Final Rule and where each of these requirements is addressed in this hazard mitigation plan.

Table 1-2. FEMA Local Mitigation Plan Review Crosswalk

Plan Criteria	Primary Location in Plan
Prerequisites	
Adoption by the Local Governing Body: §201.6(c)(5)	Section 2.0; Appendix A
Planning Process	
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Section 3.0
Risk Assessment	
Identifying Hazards: §201.6(c)(2)(i)	Sections 5.2
Profiling Hazards: §201.6(c)(2)(i)	Section 5.4
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)	Section 5.4
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)	Section 4.0 Section 5.4
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)	Section 5.4
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)	Section 4.0; Section 9 Annexes
Mitigation Strategy	
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Section 6.0; Section 9 Annexes
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)	Section 6.0; Section 9 Annexes
Implementation of Mitigation Actions: §201.6(c)(3)(iii)	Section 6.0; Section 9 Annexes
Multi-Jurisdictional Mitigation Actions: : §201.6(c)(3)(iv)	Section 6.0; Section 9 Annexes
Plan Maintenance Process	
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)	Section 7.0
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Section 7.0; Section 9 Annexes
Continued Public Involvement: §201.6(c)(4)(iii)	Section 7.0

Organization

The Monroe County Hazard Mitigation Plan has been organized into a two-volume plan to facilitate use of this plan as a resource for each participant. The plan provides a detailed review and analysis of each hazard of concern, resources, and relevant statistical information for Monroe County and participating municipalities.

Volume I is intended for use as a resource for on-going mitigation analysis. It includes a description of the county and local municipalities as well as information on mitigation planning and how the risk assessment and capability analysis was performed. Volume II consists of an annex dedicated to each participating jurisdiction. Each annex summarizes the jurisdiction's legal, regulatory, and fiscal capabilities; evaluates vulnerabilities to natural hazards; describes the status of past mitigation actions; and provides specific mitigation strategies. The annexes are intended to provide an expedient resource for each jurisdiction for implementation of mitigation projects and maximizing future grant opportunities.

Hazard Mitigation Plan Goals and Objectives

According to CFR 201.6(c)(3)(i): "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards." The mitigation goals have been developed based on the risk assessment results, discussions, research, and input from amongst the committee, existing authorities, polices, programs, resources, stakeholders, and the public.

The Monroe County Hazard Mitigation Plan planning process included a review and update of the prior mitigation goals and objectives as a basis for the planning process and to guide the selection of appropriate mitigation actions addressing all hazards of concern. Further, the goal development process considered the mitigation goals expressed in the New York State HMP, as well as other relevant county and local planning documents, as discussed in Section 6 (Mitigation Strategy).

2023 Monroe County Hazard Mitigation Plan Goals

Goal 1: Coordinate hazard mitigation programs and other planning efforts that affect the County.

Goal 2: Prevent hazards from negatively impacting new development.

Goal 3: Protect life, property, and the environment from current and future hazard impacts.

Goal 4: Increase public awareness of current and future hazards, their impacts, and ways to reduce vulnerability through education and outreach.

Goal 5: Protect, preserve, and restore the functions of natural systems.

Hazards of Concern

Monroe County and participating jurisdictions reviewed the natural hazards that caused measurable impacts based on events, losses, and information available since the development of the current Monroe County HMP (2017). Monroe County and participating jurisdictions evaluated the risk and vulnerability due to each of the hazards of concern on the assets of each participating jurisdiction. Although the resulting hazard risk rankings varied for each jurisdiction, the summary risk rankings corresponded with that of Monroe County and are indicated in each jurisdictional annex. The hazard risk ranks were used to focus and prioritize individual jurisdictional mitigation strategies.

Monroe County HMP Hazards of Concern

Disease Outbreak
Drought
Earthquake
Extreme Temperature
Flood
Hazardous Materials
Infestation and Invasive Species
Severe Storm
Severe Winter Storm
Wildfire

Plan Integration into Other Planning Mechanisms

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 thus it is critical that this hazard mitigation plan integrate, complement, and reference those plans and programs to the extent practical in order to be a comprehensive resource for hazard mitigation.

The “Capability Assessment” section of Chapter 6 (Mitigation Strategy) 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. Within each jurisdictional annex in Chapter 9, the County and each participating jurisdiction have identified how they have integrated hazard risk management into their existing planning, regulatory and operational/administrative framework, and how they intend to continue to promote this integration. A further summary of these continued efforts to develop and promote a comprehensive and holistic approach to hazard risk management and mitigation is presented in Section 7.

1.1.4 Implementation of the 2017 Plan

The status of the mitigation projects identified in prior or existing local HMPS are provided in Section 6 (Mitigation Strategy) and Section 9 (Jurisdictional Annexes) of the plan. Numerous projects and programs have been implemented that have reduced hazard vulnerability to assets in the planning area. Those projects not completed have been revaluated, modified as necessary and incorporated into this plan. The County and municipal annexes describe these mitigation activities in more detail, and plan maintenance procedures (Section 7) have been developed to encourage thorough integration with local decisions and processes and regular review of implementation progress.

1.1.5 Implementation of the Planning Process

To support the planning process in developing this plan, Monroe County and the participating jurisdictions have accomplished the following:

- Developed a Steering Committee and countywide Planning Partnership with municipalities and stakeholders.
- Reviewed the 2017 Monroe County Hazard Mitigation Plan
- Identified and reviewed hazards of greatest concern to the community (hazards of concern) to be included in the update
- Profiled 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 2017 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 plan update process
- Developed mitigation plan maintenance procedures to be executed after obtaining approval of the plan from NYS DHSES and FEMA

As required by DMA 2000, Monroe County and participating jurisdictions have informed the public and provided opportunities for public comment and input. In addition, numerous agencies and stakeholders have participated as core or support members, providing input and expertise throughout the planning process.

This HMP Update documents the process and outcomes of the mitigation efforts of Monroe County and its jurisdictions. Additional information on the plan update process is included in Section 3, Planning Process. Documentation that the prerequisites for plan approval have been met is included in Section 2, Plan Adoption.

1.1.6 Organization of This Mitigation Plan

The planning effort followed the four-phase planning process recommended by FEMA and summarized in Figure 1-2.

Figure 1-2. Monroe County Hazard Mitigation Planning Process

Phase 1: Organize Resources

The planning partnership is developed; resources are identified and obtained; public involvement is initiated. Technical, regulatory, and planning experts are identified to support the planning process.

Phase 2: Assess Risks

The planning partnership, with appropriate input, identifies potential hazards, collects data, and evaluates the characteristics and potential consequences of natural and man-made hazards on the community.

HAZUS-MH was applied to help Monroe County:

- Identify Hazards (Phase 2)
- Profile Hazards (Phase 2)
- Perform a Vulnerability Assessment (Phase 2) including:
  - Inventory Assets
  - Estimate Losses
  - Evaluate Development Trends
  - Present Results of Risk Assessment

These results provide an input to Phase 3.

Phase 3: Develop a Mitigation Plan

The planning partnership uses the risk assessment process and stakeholder input to understand the risks posed by all hazards, determine what its mitigation priorities should be, and identify options to avoid or minimize undesired effects. The results are a hazard mitigation plan update, including updated mitigation strategies and a plan for implementation.

Phase 4: Implement the Plan and Monitor Progress

The planning partnership brings the plan to life in a variety of ways including: implementing specific mitigation projects; changing the day-to-day operation of Monroe County and jurisdictions, as necessary, to support mitigation goals; monitoring mitigation action progress; and updating the plan over time.

This plan was organized in accordance with FEMA and NYS DHSES guidance, organized into two volumes: Volume I includes all information that applies to the entire planning area (Monroe County); and Volume II includes specific information for the County as a jurisdiction as well as each participating jurisdiction.

More specifically, Volume I of this plan includes the following sections:

Section 1: Introduction: Overview of participants and planning process

Section 2: Plan Adoption: Information regarding the adoption of the plan by Monroe County and each participating jurisdiction.

Section 3: Planning Process: A description of the plan methodology and development process, committee and stakeholder roles and activities, and how the plan will be incorporated into existing programs.

Section 4: County Profile: An overview of Monroe County, including: (1) general information and physical conditions, (2) economy, (3) land use patterns and trends, (4) population and demographics, (5) general building stock inventory and (6) critical facilities.

Section 5: Risk Assessment: Documentation of the hazard identification and hazard risk ranking process, hazard profiles, and findings of the vulnerability assessment (estimates of the impact of hazard events on life, safety, and health; general building stock; critical facilities and the economy). Description of the status of local data and planned steps to improve local data to support mitigation planning.

Section 6: Mitigation Strategies: Information regarding the mitigation goals and objectives identified by the Steering Committee in response to priority hazards of concern, and the process by which County and local mitigation strategies have been developed or updated.

Section 7: Plan Maintenance Procedures: A system to continue to monitor, evaluate, maintain, and update the plan.

Volume II of this plan includes the following sections:

Section 8: Planning Partnership: Description of the planning partnership and jurisdictional annexes.

Section 9: Jurisdictional Annexes: A jurisdiction-specific annex for Monroe County and each participating jurisdiction containing their hazards of concern, hazard risk ranking, capability assessments, mitigation actions, action prioritization specific only to Monroe County or that jurisdiction, progress on prior mitigation activities (as applicable), and a discussion of prior local hazard mitigation plan integration into local planning processes.

Appendices include:

Appendix A: Sample Resolution of Plan Adoption: Documentation that supports the plan approval signatures included in Section 2 of this plan.

Appendix B: Meeting Documentation: Agendas, attendance sheets, minutes, and other documentation (as available and applicable) of planning meetings convened during the development of the plan.

Appendix C: Public and Stakeholder Outreach Documentation: Documentation of the public and stakeholder outreach effort including webpages, informational materials, public and stakeholder meetings and presentations, surveys, and other methods used to receive and incorporate public and stakeholder comment and input to the plan update process.

Appendix D: Participation Matrix

Appendix E: Action Worksheet Template and Instructions

Appendix F: Plan Maintenance Tools: Examples of plan review templates available to support annual plan review and example FEMA Guidance Worksheets (FEMA 386-4).

Appendix G: Critical Facility Inventory

Appendix H: Risk Assessment Supplementary Data: Details regarding past hazard events since those documented in the 2023 plan.

Appendix I: NYS DHSES Planning Standards: Includes planning standards and guidelines for hazard mitigation planning.

Appendix J: Linkage Procedures

Appendix K: Dam Supplement: This appendix contains information on high hazard dams within Monroe County. Due to the sensitive nature of this information, details of the facilities have been redacted for the public document.

SECTION 2. PLAN ADOPTION

2.1 OVERVIEW

This section contains information regarding adoption of the plan by Monroe County and each participating jurisdiction.

2.1.1 Plan Adoption by Local Governing Bodies

Adoption by the local governing bodies such as the County Legislature, City Council, or Town/Village Board demonstrates the commitment of Monroe County and each participating jurisdiction to fulfill the mitigation goals and strategies outlined in the plan. Adoption of the plan via a municipal resolution legitimizes the Hazard Mitigation Plan (HMP) and authorizes responsible agencies to execute their responsibilities.

The County and all participating jurisdictions will proceed with formal adoption proceedings when the Federal Emergency Management Agency (FEMA) has completed review of the plan and provides conditional approval of this HMP update, known as Approval Pending Adoption (APA).

Following adoption or formal action on the plan, the jurisdiction must submit a copy of the resolution or other legal instrument showing formal adoption (acceptance) of the plan to the Monroe County Hazard Mitigation Coordinator in the Monroe County Office of Emergency Management. Monroe County will forward the executed resolutions to the New York State Division of Homeland Security & Emergency Services (NYS DHSES), after which they will be forwarded to FEMA for the record. The jurisdictions understand that FEMA will transmit acknowledgement of verification of formal plan adoption and the official approval of the plan to the Monroe County Hazard Mitigation Plan Coordinator.

The resolutions issued by each jurisdiction to support adoption of the plan will be included in Appendix A.

In addition to being required by DMA 2000, adoption of the plan is necessary because:

- 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 the program and grant administrators that the plan's recommendations have been properly considered and approved by the governing authority and jurisdictions' 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.

Source: FEMA. 2003. H*ow to Series: Bringing the Plan to Life* (FEMA 386-4).

SECTION 3. PLANNING PROCESS

3.1 Introduction

This section includes a description of the planning process used to update the Monroe County Hazard Mitigation Plan (also referred herein as the "Hazard Mitigation Plan" or the "plan"), including how it was prepared, who was involved in the process, and how the public was involved.

To ensure that the plan both met the requirements of the DMA 2000, as well as to support the long-term goal of having all jurisdictions in the County covered under a comprehensive and cohesive county-wide DMA 2000 plan, an approach to the planning process and plan documentation was developed to achieve the following:

- The plan will be multi-jurisdictional, with the intention of including all municipalities in the County. Monroe County invited all jurisdictions in the county to join with them in the planning process. To date, all of the 30 local municipal governments in the County have participated in the 2023 plan update process as indicated in Table 3-1 below. The format of this plan is such that other entities can readily join in the regulatory 5-year plan update process, as identified in Section 7 (Plan Maintenance).

Table 3-1. Participating Monroe County Jurisdictions

Jurisdictions		
Monroe County	Town of Henrietta	Town of Riga
Town of Brighton	Village of Hilton	City of Rochester
Village of Brockport	Village of Honeoye Falls	Town of Rush
Town of Chili	Town of Irondequoit	Village of Scottsville
Village of Churchville	Town of Mendon	Village of Spencerport
Town of Clarkson	Town of Ogden	Town of Sweden
Town/Village of East Rochester	Town of Parma	Town of Webster
Village of Fairport	Town of Penfield	Village of Webster
Town of Gates	Town of Perinton	Town of Wheatland
Town of Greece	Town of Pittsford	-
Town of Hamlin	Village of Pittsford	-

- The plan considers all-natural hazards facing the area, thereby satisfying the natural hazards mitigation planning requirements specified in DMA 2000. In addition, non-natural hazards that pose significant risk were considered as well.
- The plan was developed following the process outlined by DMA 2000, FEMA regulations, and prevailing FEMA and NYS DHSES guidance. Following this process ensures that all the requirements are met and support Plan review. In addition, this plan will meet criteria for the National Flood Insurance Program (NFIP) Community Rating System (CRS) and the Flood Mitigation Assistance (FMA) programs.

The Monroe County HMP update was written using the best available information obtained from a wide variety of sources. Throughout the HMP update process, a concerted effort was made to gather information from municipal and regional agencies and staff as well as stakeholders, federal and state agencies, and the residents of the county. The HMP Steering Committee solicited information from local agencies and individuals with specific knowledge of certain natural hazards and past historical events. In addition, the Steering Committee and Planning Partnership took into consideration planning and zoning codes, ordinances, and recent land use planning decisions. The hazard mitigation strategies identified in this HMP have been developed through an extensive planning process involving local, county and regional agencies, residents, and stakeholders.

This section of the plan describes the mitigation planning process, including (1) Organization of Planning Process; (2) Planning Activities; (3) Stakeholder Outreach and Involvement; (4) Public Outreach and Involvement; (4) Integration of Existing Data, Plans, and Information; (5) Integration with Existing Planning Mechanisms and Programs; and (6) Continued Public Outreach.

3.2 Organization of Planning Process

This section of the plan identifies how the planning process was organized with the many planning partners involved and outlines the major activities that were conducted in the development of this HMP.

3.2.1 Organization of Planning Partnership

Monroe County applied for and was awarded a multi-jurisdictional planning grant under the Building Resilient Infrastructure and Communities (BRIC) grant program (EMN-2020-BR-063-0007), which has supported the development of this HMP.

Project management and grant administration has been the responsibility of the Monroe County Department of Public Safety – Office of Emergency Management. A contract planning consultant (Tetra Tech) was tasked with:

- Assisting with the organization of a Steering Committee and municipal Planning Partnership;
- Assisting with the development and implementation of a public and stakeholder outreach program;
- Data collection;
- Facilitation and attendance at meetings (Steering Committee, municipal, stakeholder, public and other);
- Review and update of the hazards of concern, and hazard profiling and risk assessment;
- Assistance with the review and update of mitigation planning goals and objectives;
- Assistance with the review of past mitigation strategies progress;
- Assistance with the screening of mitigation actions and the identification of appropriate actions;
- Assistance with the prioritization of mitigation actions; and
- Authoring of the draft and final plan documents.

In July 2022, the County notified all municipalities within the County of the pending planning process and invited them to formally participate. Jurisdictions were asked to formally notify the county of their intent to participate (via a Letter of Intent) and to identify planning points of contact to facilitate municipal participation and represent the interests of their respective communities.

To facilitate plan development, Monroe County developed a Steering Committee to provide guidance and direction to the HMP update effort, and to ensure the resulting document will be embraced both politically and by the constituency within the planning area. Specifically, the Steering Committee was charged with:

- 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,
  - Assuring that the data and information used in the plan update process is the best available
  - Reviewing and updating the hazard mitigation goals,
  - Identification and screening of appropriate mitigation strategies and activities; and

- Reviewing and commenting on plan documents prior to submission to NYS DHSES and FEMA.

The Steering Committee provided guidance and leadership, oversight of the planning process, and acted as the point of contact for all participating jurisdictions and the various interest groups in the planning area. Table 3-2 presents the members of the Steering Committee.

Table 3-2. Monroe County Hazard Mitigation Steering Committee Members

Affiliation	Name	Title
Monroe County Department of Public Safety	Matthew Jarrett	Office of Emergency Management
Monroe County Department of Public Safety	Elisabeth Clower	Office of Emergency Management
Monroe County Department of Environmental Services	Clement Chung	Deputy Director
Monroe County Department of Planning and Development	Rochelle Bell	Senior Associate Planner
Monroe County Geographic Information System (GIS) Services Division	Scott McCarty	Operations Manager
Rochester-Genesee Regional Transportation Authority (RGRTA)	Bill J. Carpenter	Chief Executive Officer
Monroe County Soil & Water Conservation District	Kelly Emerick	Executive Director
Monroe County School Superintendents	Dr. Casey Kosiorek	Hilton Superintendent
Monroe Community College in Brighton	Chuck DiSalvo	Public Safety - Coordinator, Strategic Planning
University of Rochester	Dr. John Kessler	Earth and Environmental Sciences, Chair
City of Rochester Fire Department	Jamie Renner	City of Rochester Fire Department, Captain
City of Rochester Emergency Management Office	Karen St. Aubin	City of Rochester Emergency Management
Town of Irondequoit	Erin Magee	Deputy Commissioner of Public Works
Town of Henrietta	Steve Schultz	Town Supervisor

All municipalities in the County were invited to participate in the planning process. It is noted that the Steering Committee members also are part of the overall project Planning Partnership, fulfilling these responsibilities on behalf of Monroe County. This Planning Partnership was 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, engineering, code enforcement, police and emergency services, public works)
- Assisting in gathering information for inclusion in the HMP update, including the use of previously developed reports and data
- Supporting and promoting the public involvement process
- Reporting on progress of mitigation actions identified in prior or existing HMPs, as applicable
- Identifying, developing, and prioritizing appropriate mitigation initiatives
- Reporting on progress of integration of prior or existing HMPs into other planning processes and municipal operations
- Supporting and developing a jurisdictional annex
- Reviewing, amending, and approving all sections of the plan update
- Adopting, implementing, and maintaining the plan update

Table 3-3 shows the current members of the Planning Partnership as of the time of publication of this plan update.

Table 3-3. Monroe County Hazard Mitigation Planning Partnership Members

Jurisdiction	Primary Point of Contact	Title	Alternate Point of Contact	Title
Monroe County	Matthew Jarrett	Office of Emergency Management	Elisabeth Clower	Office of Emergency Management
Town of Brighton	Michael Guyon	Commissioner of Public Works	Chad Roscoe	Junior Engineer
Village of Brockport	Erica Linden	Manager	Dan Verace	Superintendent of Public Works
Town of Chili	Dawn Forte	Secretary to Town Supervisor	David Lindsey	Commissioner of Public Works
Village of Churchville	John Hartman	Mayor	Stacy Stanton	Clerk/Treasurer
Town of Clarkson	Kevin Moore	Building Inspector/ Code Enforcement Officer	Christa Filipowicz	Supervisor
Town/Village of East Rochester	Martin D' Ambrose	Village Administrator	William Marr	Public Works
Village of Fairport	Bryan White	Village Manager's Office	Jill Wiedrick	Planner
Town of Gates	Cosmo A. Giunta	Town Supervisor	Kurt Rappazzo	Director of Public Works and Highways
Town of Greece	Kirk Morris	DPW Commissioner	Matthew Trau	Junior Engineer
Town of Hamlin	Bernard Maier	Fire Marshall	Cheryl Pacelli	Building Inspector
Town of Henrietta	Tim Lessing	Superintendent of Highways	Steve Schultz	Supervisor
Village of Hilton	Mark Mazzucco	Code Enforcement Officer	Jeff Pearce	DPW Superintendent
Village of Honeoye Falls	Richard Milne	Mayor	Brian Anderson	Village Administrator
Town of Irondequoit	Erin Magee	PW Commissioner	Thomas Alber	Emergency Manager
Town of Mendon	John Moffitt	Supervisor	Corey Gates	Building Inspector/Code Enforcement
Town of Ogden	Mike Zale	Town Supervisor	Sue Duggan	Assistant Building Inspector
Town of Parma	Mark Lenzi	Building Inspector	Allen Reitz	Fire Marshal
Town of Penfield	Jeff David	Fire Marshal/Building Department	Mark Valentine	Town Engineer
Town of Perinton	Eric Williams	Assistant to the Commissioner of Public Works	Greg Seigfred	Director of Building and Codes/Department of Public Works
Town of Pittsford	Salvatore Tantalo	Emergency Manager / Fire Marshal	Paul Schenkel	Commissioner of Public Works
Village of Pittsford	Steven Lauth	Building Inspector/CEO/Fire Marshall	Zack Bleier	DPW Superintendent
Town of Riga	Debbie Campanella	Town Councilperson	Brad O'Brocta	Town Supervisor
City of Rochester	Mark Hudson	Deputy Fire Chief	Captain Jamie Renner	Rochester Fire Department, Special Operations Unit
Town of Rush	Gerald Kusse	Town Supervisor	Doug Scarson	Code Enforcement Officer
Village of Scottsville	Maggie Ridge	Mayor	Anne Hartman	Village Clerk
Village of Spencerport	Gary Pender	Mayor	Jackier Sullivan	Village Clerk
Town of Sweden	Kevin Johnson	Supervisor	Patricia Hayles	Deputy Supervisor
Town of Webster	Andrew Vorndran	Fire Marshal/Community Development	Mary Herington	Town Engineer

Jurisdiction	Primary Point of Contact	Title	Alternate Point of Contact	Title
Village of Webster	Jake Swingly	Superintendent of Public Works	Darrell Byerts	Mayor
Town of Wheatland	Jay Coates	Fire Marshal	Linda Dobson	Town Supervisor

The various jurisdictions in Monroe County have differing levels of capabilities and resources available to apply to the plan update process, and further, have differing exposure and vulnerability to the natural hazard risks being considered in this plan. It was Monroe County's intent to encourage participation by all-inclusive jurisdictions, and to accommodate their specific needs and limitations while still meeting the intents and purpose of plan update participation. Such accommodations have included the establishment of a Steering Committee, engaging a contract consultant to assume certain elements of the plan update process on behalf of the jurisdictions, and the provision of additional and alternative mechanisms to meet the purposes and intent of mitigation planning.

Ultimately, jurisdictional participation is evidenced by a completed annex of the HMP wherein jurisdictions have individually identified their planning points of contact, evaluated their risk to the hazards of concern, identified their capabilities to effect mitigation in their community, and identified and prioritized an appropriate suite of mitigation initiatives, actions, and projects to mitigate their hazard risk; and eventually, by the adoption of the updated plan via resolution. Refer to Section 9 of this HMP.

Appendix D (Participation Matrix) identifies those individuals who represented the municipalities during this planning effort and indicates how they contributed to the planning process.

It is noted that all municipalities in the County actively participate in the National Flood Insurance Program and have a designated NFIP Floodplain Administrator (FPA). All FPAs have been informed of the planning process, reviewed the plan documents, and provided direct input to the plan update. Local FPAs are identified as part of the Hazard Mitigation Planning Team presented within each of the jurisdictional annexes in Section 9, as well as in Appendix D (Participation Matrix).

3.2.2 Planning Activities

Members of the Planning Partnership (individually and as a whole), as well as key stakeholders, convened and/or communicated on an as-needed basis to share information and participate in workshops to identify hazards; assess risks; review existing inventories of and identify new critical facilities; assist in updating and developing new mitigation goals and strategies; and provide continuity through the process to ensure that natural hazards vulnerability information and appropriate mitigation strategies were incorporated. 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.

A summary of Planning Partnership activities, including meetings held during the development of the plan, is included in Table 3-3. This summary table identifies only the formal meetings and milestone events held during the plan update process and does not reflect the larger universe of planning activities conducted by individuals and groups throughout the planning process. In addition to these meetings, there was a great deal of communication between Planning Partnership members and the consultant through individual local meetings, phone and email.

After completion of the plan, implementation and ongoing maintenance will become a function of the Planning Partnership as described in Section 7 (Plan Maintenance). The Planning Partnership is responsible for reviewing the draft plan and soliciting public comment as part of an annual review and as part of the five-year mitigation plan updates.

Table 3-4 presents a summary of planning activities and general project planning efforts conducted during the plan development process. It also identifies which DMA 2000 requirements the activities satisfy. Documentation of meetings (agendas, sign-in sheets, minutes, etc.) may be found in Appendix C (Public and Stakeholder Outreach).

Table 3-4. Summary of Mitigation Planning Activities / Efforts

Date	DMA 2000 Requirement	Description of Activity	Participants
June 24 and June 29, 2022	-	Meetings with NYS DHSES to discuss planning process timeline, NYS and FEMA requirements	Monroe County Office of Emergency Management, NYS DHSES, Tetra Tech
June 5, 2022	2	Project Start Up Meeting: Discuss proposed planning process and scope of work including documenting participation, schedule, and public and stakeholder outreach and involvement.	Monroe County Office of Emergency Management, Tetra Tech
July 2022	2	All municipalities invited to participate in the planning process.	-
July 15, 2022	2, 3c	GIS data collection meeting	Monroe County Office of Emergency Management, Monroe County GIS Operations, Tetra Tech
Bi-Weekly	-	Weekly project status meeting to discuss action items in support of the expedited planning process	Monroe County Office of Emergency Management, Tetra Tech
	1c, 2	Interested jurisdictions submit Letters of Intent to Participate in this planning process, acknowledging municipal participation requirements and identifying planning point(s) of contact.	See Appendix D
August 1, 2022	-	Meeting with Monroe County Communications Department to discuss communication strategy	Monroe County Office of Emergency Management, Monroe County Communications Department, Tetra Tech
August 9, 2022	1b, 2, 3a, 3b, 3c, 4a, 5c	SC Kickoff Meeting: Review project schedule; review municipal participation, discuss municipal Kick Off meeting and local data collection; review and discuss sources and availability of County and regional data; discuss public and stakeholder outreach efforts.	See Appendix D
August 10, 2022	1b, 2, 3a, 3b, 3c, 4a	Municipal Kick-Off Meeting: Complete overview of planning process, plan participant expectations, review of hazards and hazards of concern identification, discussion of data needs and data collection process explaining all provided worksheets, discussion of public and stakeholder outreach efforts	County and municipal representatives and stakeholders. See Appendix D
August 18, 2022	1b	Monroe County Stormwater Coalition Meeting: Presented HMP update process to Coalition and requested input and support. Encouraged municipal representatives to participate in planning process.	Monroe County Stormwater Coalition
August 2022	2	Public project website developed: https://www.monroecountynyhmp.com/	Core Planning Team, Contract Planner
September 2022	2	Online Public Hazard Preparedness and Mitigation survey developed and deployed	Core Planning Team, Contract Planner

Date	DMA 2000 Requirement	Description of Activity	Participants
September 2022	2	Online Stakeholder Hazard Mitigation surveys developed and deployed	Core Planning Team, Contract Planner
September 2022	2	Online Neighboring County Mitigation survey developed and deployed	Core Planning Team, Contract Planner
October 6, 2022	2	Public Information Meetings on planning process held	Core Planning Team, NYS DHSES, Public
October 13, 2022	1a, 3a, 3b, 3c, 3d	Steering Committee Risk Assessment Meeting	See Appendix D
October 13, 2022	1a, 3a, 3b, 3c, 3d	Planning Partnership Risk Assessment Meeting	See Appendix D
October 17, 2022	1a, 2, 4a, 4b, 4c	Mitigation Strategy Workshop	See Appendix D
November 1, 2022	1a, 2, 4a, 4b, 4c	Lakeshore Communities Annex Development Meeting	Town of Brighton, Town of Webster, Town of Parma, City of Rochester, Town of Clarkson, Town of Gates, Village of Hilton, Village of Webster, Town of Greece, Tetra Tech
November 1, 2022	1a, 2, 4a, 4b, 4c	Southeast Communities Annex Development Meeting	Town of Henrietta, Town of Penfield, Town of Rush, Monroe County, Village of Fairport, Village of Honeoye Falls, Town of Perinton, Tetra Tech
November 3, 2022	1a, 2, 4a, 4b, 4c	Southwest Communities Annex Development Meeting	Town of Hamlin, Village of Chile, Town of Wheatland, Town/Village of East Rochester, Village of Churchville, Town of Ogden, Village of Brockport, Village of Scottsville, Town of Riga, Town of Sweden
November 21, 2022	1b, 2, 3, 4, 5	Steering Committee Meeting- Plan Maintenance, Draft Plan Review	Steering Committee; Contract Planner See Appendix D
November 23, 2022	2	Draft Plan posted to public project website	Public and Stakeholders
November 29, 2022	1b	FEMA Flood Risk Insurance Open House. Information on the HMP planning process was made available to attendees. Attendees were encouraged to review the Draft Plan.	Public and Stakeholders
December 23, 2022	1b, 2	Public and stakeholder comments to Draft Plan received and incorporated into Final Plan.	Public and Stakeholders
December 23, 2022	All requirements	Final plan submitted to NYS DHSES and FEMA Region II	NYS DHSES, FEMA Region II
Upon plan approval by FEMA	1a	Plan adoption by resolution by the governing bodies of all participating municipalities	All plan participants

Note: TBD = to be determined.
Each number in column 2 identifies specific DMA 2000 requirements, as follows:
1a – Prerequisite – Adoption by the Local Governing Body
1b – Public Participation
2 – Planning Process – Documentation of the Planning Process
3a – Risk Assessment – Identifying Hazards
3b – Risk Assessment – Profiling Hazard Events
3c – Risk Assessment – Assessing Vulnerability: Identifying Assets
3d – Risk Assessment – Assessing Vulnerability: Estimating Potential Losses
3e – Risk Assessment – Assessing Vulnerability: Analyzing Development Trends
4a – Mitigation Strategy – Local Hazard Mitigation Goals
4b – Mitigation Strategy – Identification and Analysis of Mitigation Measures
4c – Mitigation Strategy – Implementation of Mitigation Measures
5a – Plan Maintenance Procedures – Monitoring, Evaluating, and Updating the Plan
5b – Plan Maintenance Procedures – Implementation through Existing Programs
5c – Plan Maintenance Procedures – Continued Public Involvement

3.3 Stakeholder Outreach and Involvement

This section details the outreach to, and involvement of, the many agencies, departments, organizations, non-profits, districts, authorities, and other entities that have a stake in managing hazard risk and mitigation, commonly referred to as stakeholders.

Diligent efforts were made to assure broad regional, county, and local representation in this planning process. To that end, a comprehensive list of stakeholders was developed with the support of the Steering and Planning Partnerships. Stakeholder outreach was performed early and throughout the planning process. In addition to "mass media" notification efforts, identified stakeholders were invited to attend the Planning Partnership risk assessment meeting, while key stakeholders were requested to participate on the Steering and/or Planning Partnerships. Information and input provided by these stakeholders has been included throughout this plan where appropriate, as identified in the references.

The following is a list of the various stakeholders that were invited to participate in the development of this plan, along with a summary of how these stakeholders participated and contributed to the plan. This summary listing cannot represent the sum total of stakeholders that were aware of and/or contributed to this plan since formal and informal outreach efforts were utilized throughout the process by the many planning partners involved in the overall effort. Complete documentation of such broad-based and often locally focused efforts is impossible. Instead, this summary is intended to demonstrate the scope and breadth of the stakeholder outreach efforts made during the planning process.

3.3.1 Federal Agencies

FEMA Region II: Provided updated planning guidance; provided summary and detailed NFIP data for planning area; presented preliminary regulatory flood products to municipalities and the public; attended meetings; participated in a Mitigation Strategy Workshop; conducted plan review.

Information regarding hazard identification and the risk assessment for this HMP update was requested and received or incorporated by reference from the following agencies and organizations:

- 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

3.3.2 State Agencies

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 Mitigation Strategy Workshop, 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.

3.3.3 County and Regional Agencies, Commissions and Non-Profits

The following county/regional agencies, commissions, and non-profits were invited to participate during the planning process. The table below describes how each participated.

Table 3-5. County and Regional Agencies, Commissions, and Non-Profits

County and Regional Agencies, Commissions and Non-Profits	Participation
Monroe County Department of Environmental Services	Served on steering committee, attended meetings, completed hazard of concern exercise and goals and objectives exercise and reviewed draft plan.
Monroe County Department of Planning and Development	Served on steering committee, provided input, and reviewed draft plan.
Monroe County Geographic Information System (GIS) Services Division	Served on steering committee, attended meetings, and provided input and reviewed draft plan.
Monroe County Office of Emergency Management	Served on steering committee, attended meetings and reviewed draft plan.
Rochester-Genesee Regional Transportation Authority (RGRTA)	Served on steering committee, attended meetings, completed hazards of concern exercise and goals and objectives exercise and reviewed draft plan.
Monroe County Soil & Water Conservation District	Served on steering committee, attended meetings, completed hazards of concern exercise and goals and objectives exercise and reviewed draft plan.
Monroe County School Superintendents	Served on steering committee, attended meetings, completed hazards of concern exercise and goals and objectives exercise and reviewed draft plan.
Monroe Community College in Brighton	Served on steering committee, attended meetings, completed hazards of concern exercise and goals and objectives exercise and reviewed draft plan.
University of Rochester	Served on the steering committee, provided input, and reviewed draft plan .
City of Rochester Fire Department	Served on the steering committee, provided input, and reviewed draft plan.
City of Rochester Bureau of Operations	Served on steering committee, attended meetings, completed hazards of concern exercise and goals and objectives exercise, and reviewed draft plan.
Town of Irondequoit	Served on steering committee, attended meetings, provided input and reviewed draft plan.
Town of Henrietta	Served on steering committee, attended meetings, completed hazards of concern exercise and goals and objectives exercise and reviewed draft plan.
Monroe County Department of Transportation (MCDOT)	Provided input and reviewed draft plan.
Irondequoit Bay State Marine Park	Provided input and reviewed draft plan.
Monroe County Department of Public Health	Provided input and reviewed draft plan.
Rochester Water Bureau	Provided input and reviewed draft plan.
YMCA of Greater Rochester	Provided input and reviewed draft plan.
YWCA of Rochester& Monroe County	Provided input and reviewed draft plan.
Spiritus Christi Prison Outreach/ Jennifer House	Invited to take the stakeholder survey and review the draft plan.
Rochester Area Community Foundation (Aging Alliance member)	Invited to take the stakeholder survey and review the draft plan.
Mt. Hope Family Center	Invited to take the stakeholder survey and review the draft plan.
Open Door Mission	Invited to take the stakeholder survey and review the draft plan.
Partners Ending Homelessness	Invited to take the stakeholder survey and review the draft plan.
Pencostal Power of Delivery	Invited to take the stakeholder survey and review the draft plan.
Person Centered Housing Options (PCHO)	Invited to take the stakeholder survey and review the draft plan.
Holy Apostles Church	Invited to take the stakeholder survey and review the draft plan.
Holy Childhood	Invited to take the stakeholder survey and review the draft plan.
Hope Initiatives	Invited to take the stakeholder survey and review the draft plan.
House of Mercy	Invited to take the stakeholder survey and review the draft plan.

County and Regional Agencies, Commissions and Non-Profits	Participation
Jewish Family Services	Invited to take the stakeholder survey and review the draft plan.
Baden Street Settlement	Invited to take the stakeholder survey and review the draft plan.
Bethany House	Invited to take the stakeholder survey and review the draft plan.
Beyond the Sanctuary	Invited to take the stakeholder survey and review the draft plan.
Big Brothers Big Sisters of GR	Invited to take the stakeholder survey and review the draft plan.
Bishop Sheen Ecumenical Housing Foundation, Inc.	Invited to take the stakeholder survey and review the draft plan.
Bivona Child Advocacy Center	Invited to take the stakeholder survey and review the draft plan.
Booth Haven & Safe Haven	Invited to take the stakeholder survey and review the draft plan.
Boys & Girls Clubs of Rochester	Invited to take the stakeholder survey and review the draft plan.
Catholic Charities (CCCS)	Invited to take the stakeholder survey and review the draft plan.
Catholic Charities (CFC)	Invited to take the stakeholder survey and review the draft plan.
CCFCS	Invited to take the stakeholder survey and review the draft plan.
490 Farmers	Invited to take the stakeholder survey and review the draft plan.
Action for a Better Community, Inc.	Invited to take the stakeholder survey and review the draft plan.
Agape Haven of Abundance	Invited to take the stakeholder survey and review the draft plan.
Asbury Day Care Center	Invited to take the stakeholder survey and review the draft plan.
Center for Community Alternatives	Invited to take the stakeholder survey and review the draft plan.
Center for Employment Opportunities	Invited to take the stakeholder survey and review the draft plan.
Charles Settlement House	Invited to take the stakeholder survey and review the draft plan.
Coffee Connection	Invited to take the stakeholder survey and review the draft plan.
Community Place of Greater Rochester	Invited to take the stakeholder survey and review the draft plan.
Compeer Rochester	Invited to take the stakeholder survey and review the draft plan.
CP Rochester	Invited to take the stakeholder survey and review the draft plan.
Crossroads of Caring, Inc.	Invited to take the stakeholder survey and review the draft plan.
Daystar Kids	Invited to take the stakeholder survey and review the draft plan.
Deaf Refugee Advocacy	Invited to take the stakeholder survey and review the draft plan.
Depaul Hopelink	Invited to take the stakeholder survey and review the draft plan.
Eagle Star Housing	Invited to take the stakeholder survey and review the draft plan.
Empire Justice Center	Invited to take the stakeholder survey and review the draft plan.
Episcopal Diocese of Rochester	Invited to take the stakeholder survey and review the draft plan.
Family Promise of Greater Rochester	Invited to take the stakeholder survey and review the draft plan.
Girl Scouts of Western New York	Invited to take the stakeholder survey and review the draft plan.
Healers Village/ Ubntu Village Works	Invited to take the stakeholder survey and review the draft plan.
Heritage Christian Services	Invited to take the stakeholder survey and review the draft plan.
Hillside	Invited to take the stakeholder survey and review the draft plan.
JustCause	Invited to take the stakeholder survey and review the draft plan.
Landmark Society of Western NY	Invited to take the stakeholder survey and review the draft plan.
Legal Aid Society of Rochester, NY Inc.	Invited to take the stakeholder survey and review the draft plan.
Legal Assistance of Western New York, Inc.	Invited to take the stakeholder survey and review the draft plan.
Lifespan	Invited to take the stakeholder survey and review the draft plan.

County and Regional Agencies, Commissions and Non-Profits	Participation
Living Word COGIC Outreach	Invited to take the stakeholder survey and review the draft plan.
Loop Ministries	Invited to take the stakeholder survey and review the draft plan.
The Center for Youth Services	Invited to take the stakeholder survey and review the draft plan.
TRU-Impact Inc.	Invited to take the stakeholder survey and review the draft plan.
Urban League of Rochester	Invited to take the stakeholder survey and review the draft plan.
Webster Comfort Care House	Invited to take the stakeholder survey and review the draft plan.
Willow DV Center	Invited to take the stakeholder survey and review the draft plan.
Depaul	Invited to take the stakeholder survey and review the draft plan.
Save Rochester Inc.	Invited to take the stakeholder survey and review the draft plan.
Seneca Waterways Council, BSA	Invited to take the stakeholder survey and review the draft plan.
Sisters of St. Joseph	Invited to take the stakeholder survey and review the draft plan.
SportNet, Division of CP Rochester	Invited to take the stakeholder survey and review the draft plan.

U.S. Geological Survey (USGS): Provided data and information.

Academia (School districts and other academic institutions): Many municipalities directly involved school district representatives in the planning process, as identified in Table 3-3. Municipalities were asked to invite representatives of their local schools to complete a stakeholder survey. Additionally, the following school districts, colleges, and academic organizations in the county were invited to complete a stakeholder survey and review the draft plan:

- Bryant and Stratton College in Greece and Henrietta
- Colgate Rochester Crozer Divinity School
- Monroe Community College in Brighton with a campus in the city
- Nazareth College in Pittsford
- Roberts Wesleyan College in Chili
- Rochester Institute of Technology in Henrietta
- St. Bernard's School of Theology and Ministry in Pittsford
- State University of New York at Brockport
- University of Rochester
- Rochester City School District
- Brockport Central School District
- Churchville-Chili Central School District
- Fairport Central School District
- Gates Chili Central School District
- Penfield Central School District
- Pittsford Central School District
- Allendale Columbia School
- Rochester School for the Deaf
- New York Sea Grant
- Mary Cariola Center
- ROCmusic Collaborative
- EnCompass: Resources for Learning
- Hochstein School

Law Enforcement: Many municipalities directly involved police and other law enforcement representatives in the planning process, as identified in Table 3-3. Municipalities were asked to invite their law enforcement agencies to complete a stakeholder survey. Further, the following police departments and law enforcement agencies in the County were invited to complete a stakeholder survey and review the draft plan:

- Fairport Police
- Brighton Police
- Irondequoit Police
- New York State Police

- Monroe County Sheriff
- Brockport Police
- Gates Police
- Rochester Police
- East Rochester Police
- Webster Police
- Ogden Police
- Greece Police

Fire Districts and Fire Departments: Many municipalities directly involved fire district/department, haz-mat teams, and rescue team representatives in the planning process, as identified in Table 3-3. Municipalities were asked to invite their fire departments to complete a stakeholder survey. In addition, the following fire district/department, haz-mat teams, and rescue team representatives in the County were invited to complete a stakeholder survey and review the draft plan:

- NY State Fire
- Town of Hamlin Fire Marshal
- Village of Honeoye Falls Fire Chief
- Town of Parma Fire Marshal
- Town of Penfield Fire Marshal
- Town of Pittsford Fire Marshal
- City of Rochester Deputy Fire Chief
- Town of Webster Fire Marshal
- Town of Wheatland Fire Marshal

Hospitals and Health-Care Facilities: The following hospitals and health-care facilities in the County were invited to complete a stakeholder survey and review the draft plan:

- Monroe Community Hospital (MCH)
- Strong Memorial Hospital (Strong)
- Highland Hospital
- Rochester General Hospital
- Unity Hospital
- Common Ground Health
- Center for Community Health and Prevention
- National Technical Institute for the Deaf
- Healthi Kids Coalition
- African American Health Coalition
- National Center for Deaf Health Research
- City of Rochester Bureau of Youth Services
- Rochester Monroe Anti-Poverty Initiative
- Culver Medical Group
- Mental Health Association of Rochester/Monroe County, Inc.
- Rochester Mental Health Center
- Manhattan Square Family Medicine
- Rochester Rehab
- Golisano Autism Center
- Spiritus Christi Mental Health Center
- Huther Doyle
- MC Collaborative
- AutismUp

Ambulance/Emergency Medical Services: Municipalities were asked to invite their ambulance and emergency medical service providers to complete a stakeholder survey. In addition, the following ambulance and emergency medical service providers in the County were also invited to complete a stakeholder survey and review the draft plan:

- City of Rochester Emergency Communications
- Monroe County Emergency Medical Services

Utilities: In addition to municipal utilities, the following utility companies in the County were invited to complete a stakeholder survey and review the draft plan:

- Monroe County Water Authority
- Rochester Water Bureau

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

- Genesee & Wyoming Railroad Services Inc.
- Medical Motor Service

3.3.4 Adjacent Jurisdictions

The County has made an effort to keep surrounding jurisdictions appraised of the project and allowed the opportunity to provide input to this planning process via a stakeholder survey and a request to review the draft plan. Specifically, the following adjoining county and state representatives were contacted in September 2022 to inform them about the availability of the project website, draft plan documents and surveys, and invited to provide input to the planning process:

- Orleans County (NY)
    - Division of Emergency Management
    - Planning Department
    - Orleans County Planning Commission
- Genesee County (NY)
    - Office of Emergency Management
    - Genesee County Planning Commission
    - Genesee County Planning Department
- Livingston County (NY)
    - Office of Emergency Management
    - Planning Department
    - Livingston County Planning Commission
- Ontario County (NY)
    - Office of Emergency Management
    - Planning Department
- Wayne County (NY)
    - Office of Emergency Management
    - Planning Department

Input from neighboring counties which responded to the survey is summarized in the section below.

3.3.5 Stakeholder and Neighboring County Survey Summaries

The following provides a summary of the results and feedback received by stakeholders who completed the survey. Feedback was reviewed by the Steering Committee and integrated where appropriate in the plan.

Stakeholder Survey

The stakeholder survey was designed to help identify general needs for hazard mitigation and resiliency within Monroe 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 the various county and municipal departments and agencies in the County. As of November 7, 2022, 27 stakeholders completed the survey, with respondents coming from the academic/research sector, business/commerce sector, emergency services sector, and public works. Over 50 percent of respondents identified as being from some other sector. The majority of respondents represented groups that either served the City of Rochester (42.1 percent) or Monroe County as a whole (47.4 percent).

When asked if the organization maintains or manages anything within their designated service area, 63.2 percent said no they do not manage any facilities. For those that did answer, they indicated the following facilities: buildings, stormwater infrastructure, roads, or water/sewer plants. The remaining respondents noted a variety of work including human services, sheltering programs, and spiritual health.

73.7 percent of respondents noted that they work with socially vulnerable populations. Examples of this work included:

- Work with the local and national Deaf communities
- Support for individuals with disabilities
- Support for refugees, the economically disadvantaged, developmentally disabled, and those diagnosed with HIV/AIDS
- Housing and services to the homeless population
- Drug and alcohol addiction services
- Services and support for individuals with autism
- Youth and young adult support including sheltering, crisis nurseries, and transitional living
- Reentry programs for prison release
- Support for those with mental health challenges
- Food distribution

Hazard and Damage Identification

29.4 percent of respondents indicated that buildings, facilities, or structures their organization is involved with have been impacted by a natural hazard. Of these, respondents noted wind damage to buildings and utilities, mild flooding, and snow/ice storms.

In addition to asking about whether or not their facilities were damaged, stakeholders were also asked what areas they believe to be the most vulnerable to natural hazards, and the problems they face. The respondents provided hazards and impacts:

- Flooding causing water damage and blocking roads
- Flash floods causing the sanitary sewer main to be overwhelmed
- Damage to overhead electric lines
- Tree damage and fall, especially impacting transportation and power supply
- Communication interruptions, heightened by a lack of cell coverage
- Sanitary sewer main gets overwhelmed during flash flooding events
- Power outages causing a halt in internet services

41.2 percent of respondents indicated they did not know if their facilities are prepared for withstanding natural disasters and 17.7 percent said their facilities are not adequately prepared for withstanding natural disasters. 35.3 percent did feel their facility was prepared. Less than half of respondents believed the transportation infrastructure serving their facilities is designed and equipped to withstand closures and damage due to natural hazards and are able to provide long-term support for your community's needs.

Only 11.8 percent feel their utility infrastructure is equipped to withstand natural hazards and provide uninterrupted service during a hazard event.

Community Preparedness

43.8 percent of respondents noted they are aware of the location and number of socially vulnerable populations in their community/operating area. Only 13.3 percent felt that education and outreach programs regarding hazards in Monroe County are effective in informing these vulnerable populations on what they should do to prepare for and reduce personal risk to natural disasters.

The majority of respondents were either unsure (40.0 percent) or did not believe (40.0 percent) the public, particularly vulnerable populations are aware of, understand, or take advantage of emergency warning and notification systems and services.

Just under half (46.7 percent) of respondents felt that local government understands, supports, and possesses adequate resources for hazard risk reduction efforts in their community. Over half (53.3 percent) of respondents believe that private businesses play a direct critical role in their organization's operation and daily function.

76.9 percent of total respondents being part of an Emergency Operations Plan, 40.0 percent being part of a Continuity of Operations/Government Plan, and 40.0 percent being part of an Evacuation Plan. More than half (66.7 percent) of participants also indicated their organization is resilient with respect to a natural disaster.

Project Identification

Respondents identified the following projects or programs that could reduce their organization's vulnerability to damages, including operation of service:

- Free and easily accessible training for hazard events.
- Upgrades for communication infrastructure, particularly internet connectivity.

Neighboring County Survey

The neighboring county survey was sent to the surrounding counties of Monroe due to their proximity to the county and because the effects of hazard events that impact Monroe County would be similar to that of their neighbors. As of Thursday, October 10th, 2022, two counties submitted the survey (Orleans County and Livingston County).

The Neighboring County Survey was broken down into 5 sections: Emergency Operations and Continuity of Operations Planning, Risk and Vulnerability, Evacuation and Sheltering, Information Sharing, and Projects, Grants, Education and Outreach, each detailed below.

Emergency Operations and Continuity of Operations Planning

No respondents answered survey questions regarding if any shared service or mutual aid agreements are in place between their county and Monroe County. However, Orleans County noted that Monroe County is involved in their county's emergency operations planning through mutual aid response. Each respondent noted that Monroe County is not involved in their Continuity of Operations Planning. One responded noted that communication improvements are needed regarding emergency operations and disaster response.

Risk and Vulnerability

Livingston County noted that they share risk and vulnerability assessments regarding the Mount Morris Dam with Monroe County.

Evacuation and Sheltering

None of the respondents indicated if there is collaboration with Monroe County on establishing evacuation routes or alternative evacuation routes. However, Orleans County noted they would consult with Monroe County before making evacuation decisions if the need arose. Livingston County noted that evacuation routes may not be maintained to the same level of protection across county lines.

Orleans County noted they would consult with Monroe County if making sheltering decisions would impact Monroe. No shared spaces for temporary housing were identified.

Information Sharing

Both respondents noted they have access to Monroe County's emergency operations centers at the county and local levels.

Projects, Grants, Education, and Outreach

Orleans County noted that flooding along the lakeshore is a concern they share with Monroe. Livingston County noted concerns with vulnerabilities associated with Mount Morris Dam. Orleans County shares information on potential shared mitigation projects during Emergency Management Association meetings and would set up follow up meetings as necessary.

Respondents did not identify any projects as requiring cross-collaboration between county boundaries. However, Orleans and Livingston County both noted they collaborate on grant applications through the Hazmat Consortium. Livingston County noted that DMNA and the Red Cross conduct hazard mitigation related outreach in both Livingston and Monroe Counties.

3.3.6 Public Outreach

In order to facilitate better coordination and communication between the Planning Partnership and citizens and to involve the public in the planning process, it was determined that draft documents will be made available to the public through a variety of venues including printed and online format. This effort is intended to increase the likelihood of hazard mitigation becoming one of the standard considerations in the evolution and growth of Monroe County.

The Steering and Planning Partnerships have made the following efforts toward public participation in the development and review of the Plan:

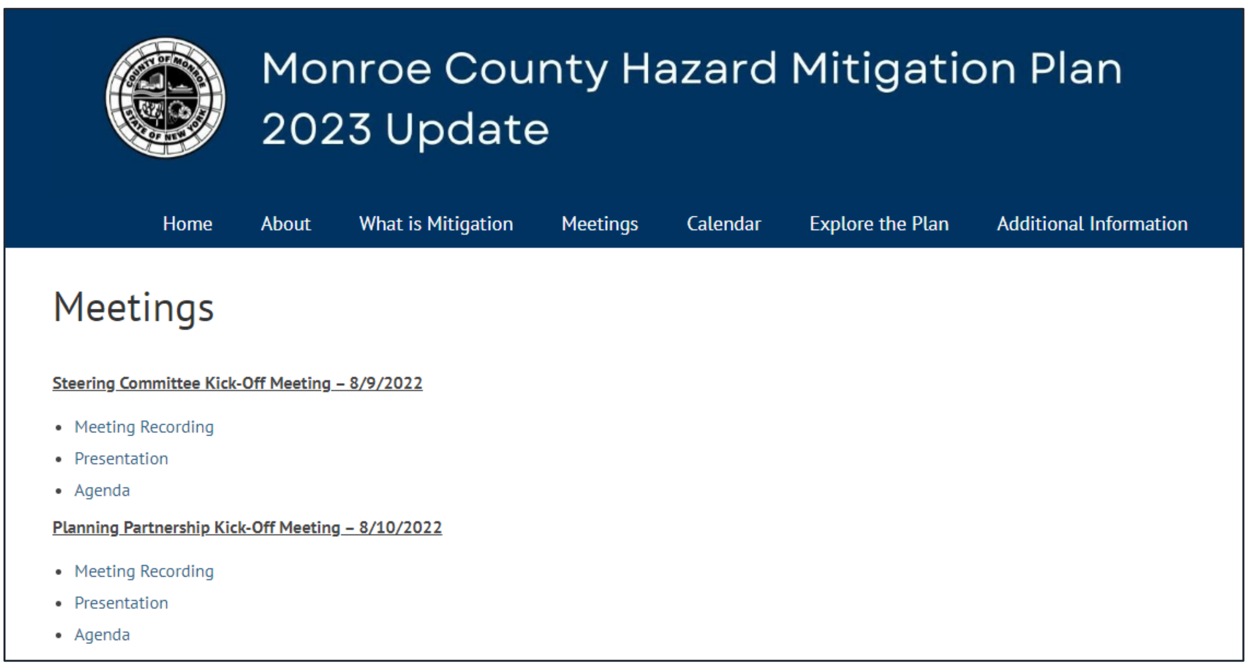
- The public was informed of the hazard mitigation planning effort commencement at the kick-off meeting and through press releases, news articles, and public service announcements released throughout the planning process. Copies of these announcements may be found in Appendix C.
- Media Release to local news sources.
- To inform the public and County agencies of the ongoing plan update effort, updates regarding the mitigation planning process have been made at county-wide meetings including those of the Monroe County Stormwater Coalition
- A public website is being maintained as another way to facilitate communication between the Steering Committee, planning partnership, public and stakeholders (www.Monroecountynyhmp.com). The

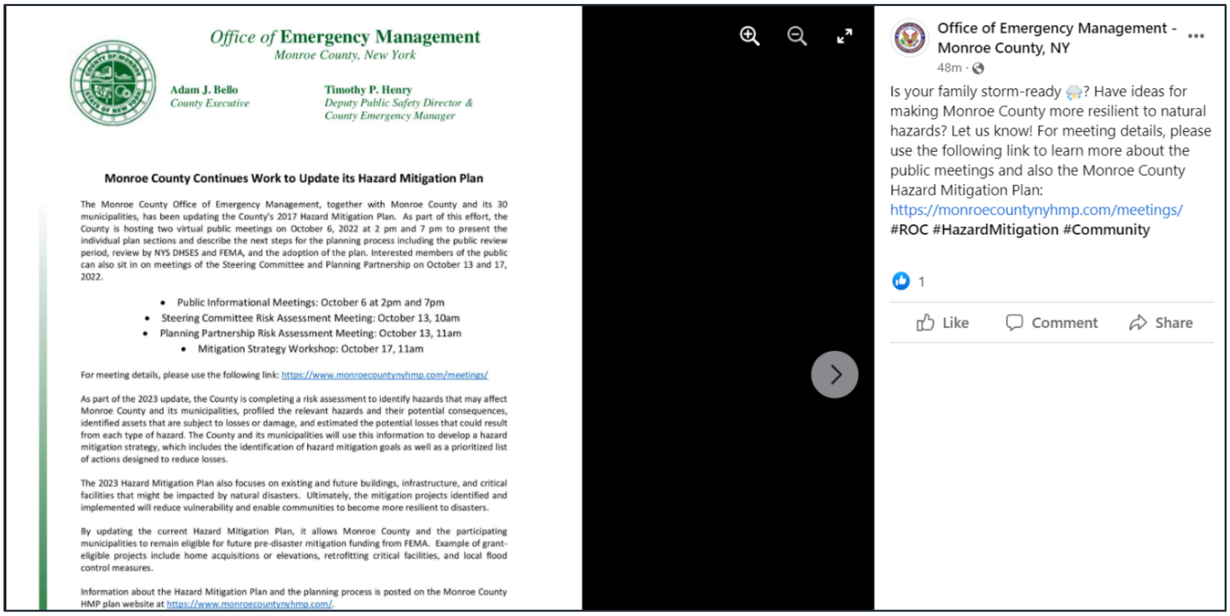
public website contains a project overview, County and local contact information, access to the citizens survey and various stakeholder surveys, and sections of the HMP for public review and comment.

- All participating municipalities have been encouraged to distribute press releases on the project, including links to the project webpage and citizen and stakeholder surveys. Municipalities posting information and supporting online outreach include:
    - Town of Chili
    - Town of Ogden
    - Town of Parma
    - Town of Penfield
    - Town of Perinton
    - Town of Webster
    - Village of Fairport
    - Village of Spencerport
    - Village of Webster
- In order to facilitate coordination and communication between the Planning Partnership and citizens and involve the public in the planning process, the Plan Update will be available to the public through a variety of venues. A printed version of the Plan will be maintained at the Monroe County Office of Emergency Management, and Monroe County Department of Planning.
- An on-line natural hazards preparedness citizen survey was developed to gauge household preparedness that may impact Monroe County and to assess the level of knowledge of tools and techniques to assist in reducing risk and loss of those hazards. The questionnaire asks quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs. The questionnaire also asks several demographic questions to help analyze trends.
- The questionnaire was posted on the County website on September 14, 2022, and was available through November 7th for public input. All participating municipalities have been requested to advertise the availability of the survey via local homepage links, and other available public announcement methods (e.g., Facebook, Twitter, email blasts, etc.). Roughly 100 responses have been collected. A summary of survey results is provided later in this Section with full results provided in Appendix C of this plan.
- Directed response surveys were distributed to Academia, Fire Departments, EMS, Hospitals and Healthcare Organizations, Business and Commercial interests, Utilities and Law Enforcement stakeholders as detailed in the Stakeholder outreach subsection of this chapter. A summary of survey results is provided later in this Section with full results provided in Appendix C of this plan. In addition, an example of the directed stakeholder surveys is presented in Appendix C.
- Public Information meetings on the HMP update process with both virtual and in-person options were held on October 6, 2022. A recording of one meeting was posted on the HMP webpage.
- The Draft Plan was posted to the public website as of November 23, 2022, for public review and comment. All public comments were directed to the Monroe County Office of Emergency Management for collection and review by the Steering Committee. All public comments received were forwarded to the appropriate jurisdiction and/or agency and incorporated into the final plan as appropriate.
- Information on the draft HMP was made available at a FEMA Flood Risk and Insurance Open House that was hosted by Monroe County and took place during the public review period.
- Once submitted to NYS DHSES/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 following as identified in Section 7, “Plan Maintenance”.

Examples of virtual outreach via websites and social media completed by the County and municipalities are provided below.

Figure 3-1. Monroe County HMP Webpage and Local On-Line Outreach




Office of Emergency Management
Monroe County, New York

Adam J. Bello
County Executive

Timothy P. Henry
Deputy Public Safety Director &
County Emergency Manager

Monroe County Continues Work to Update its Hazard Mitigation Plan

The Monroe County Office of Emergency Management, together with Monroe County and its 30 municipalities, has been updating the County's 2017 Hazard Mitigation Plan. As part of this effort, the County is hosting two virtual public meetings on October 6, 2022 at 2 pm and 7 pm to present the individual plan sections and describe the next steps for the planning process including the public review period, review by NYS DHSES and FEMA, and the adoption of the plan. Interested members of the public can also sit in on meetings of the Steering Committee and Planning Partnership on October 13 and 17, 2022.

- Public Informational Meetings: October 6 at 2pm and 7pm
- Steering Committee Risk Assessment Meeting: October 13, 10am
- Planning Partnership Risk Assessment Meeting: October 13, 11am
- Mitigation Strategy Workshop: October 17, 11am

For meeting details, please use the following link: https://www.monroecountynyhmp.com/meetings/

As part of the 2023 update, the County is completing a risk assessment to identify hazards that may affect Monroe County and its municipalities, profiled the relevant hazards and their potential consequences, identified assets that are subject to losses or damage, and estimated the potential losses that could result from each type of hazard. The County and its municipalities will use this information to develop a hazard mitigation strategy, which includes the identification of hazard mitigation goals as well as a prioritized list of actions designed to reduce losses.

The 2023 Hazard Mitigation Plan also focuses on existing and future buildings, infrastructure, and critical facilities that might be impacted by natural disasters. Ultimately, the mitigation projects identified and implemented will reduce vulnerability and enable communities to become more resilient to disasters.

By updating the current Hazard Mitigation Plan, it allows Monroe County and the participating municipalities to remain eligible for future pre-disaster mitigation funding from FEMA. Example of grant-eligible projects include home acquisitions or elevations, retrofitting critical facilities, and local flood control measures.

Information about the Hazard Mitigation Plan and the planning process is posted on the Monroe County HMP plan website at https://www.monroecountynyhmp.com/.


Monroe County Hazard Mitigation Plan - Public Survey

1. Introduction

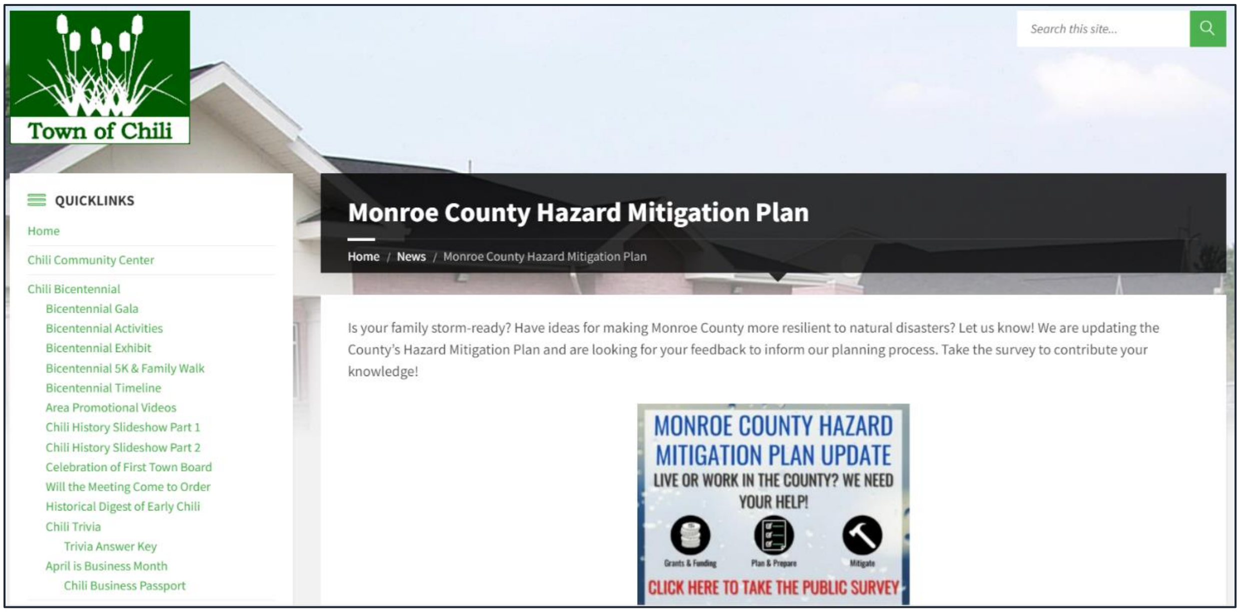
Monroe County Residents,

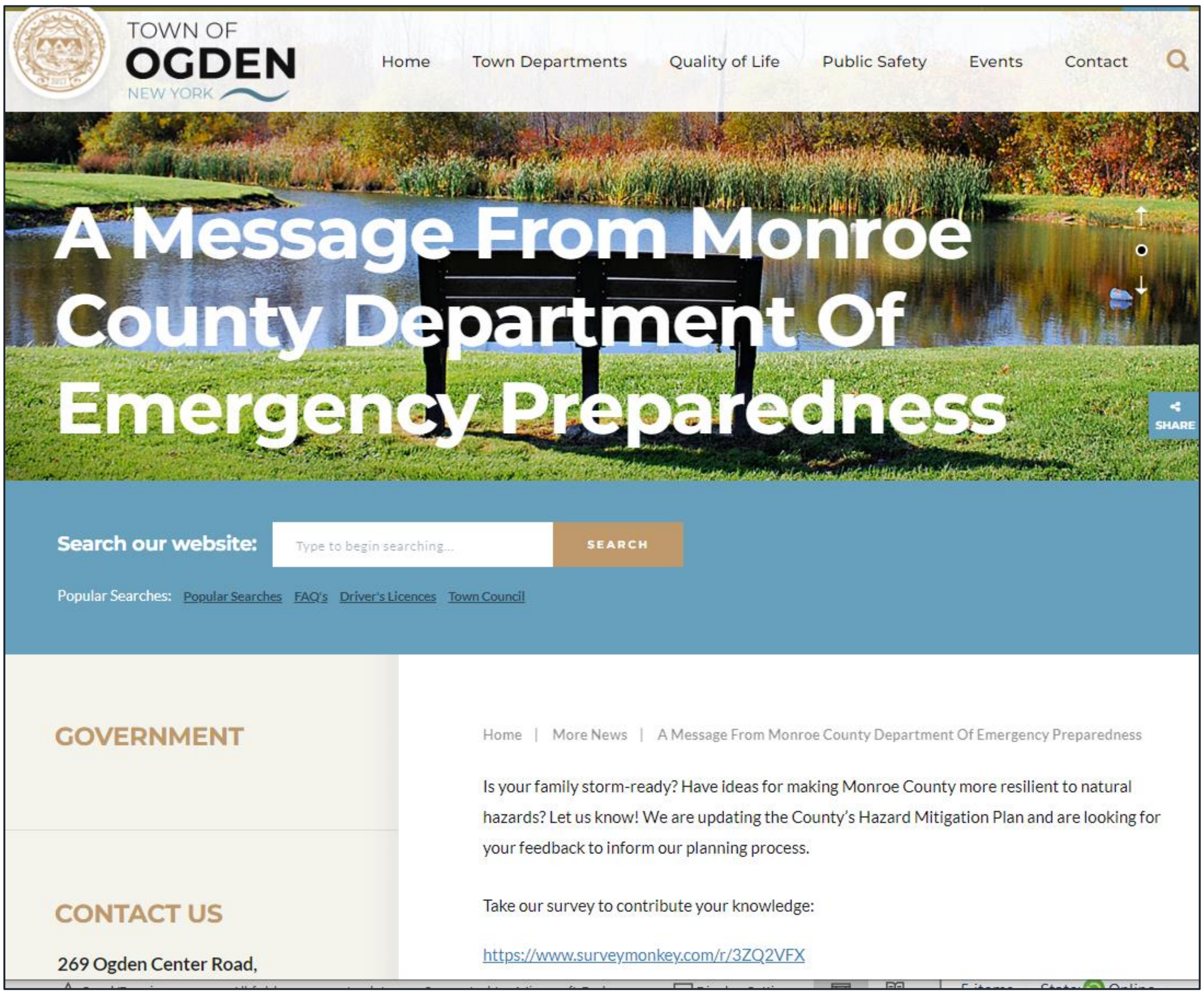
Monroe County has assembled a team to update our hazard mitigation plan which addresses hazards that may impact our county and municipalities. Please help us plan for future disaster by completing this survey regarding hazards in the county.

This survey is designed to help us gather information from around Monroe County to help us better coordinate activities and reduce the risk of injury or property damage. These questions are for information-gathering only and do not necessarily reflect any intent or future priorities of any governing body. This information will be shared with municipal, state, federal, and county entities for planning purposes only.

You will be asked if you live in a floodplain. If you do not know, or are not sure, please check the FEMA website: https://msc.fema.gov/portal/home.

The Monroe County Hazard Mitigation Planning Partnership thanks you in advance for your cooperation and participation.


Town of Chili
Search this site...
QUICKLINKS
Home
Chili Community Center
Chili Bicentennial
Bicentennial Gala
Bicentennial Activities
Bicentennial Exhibit
Bicentennial 5K & Family Walk
Bicentennial Timeline
Area Promotional Videos
Chili History Slideshow Part 1
Chili History Slideshow Part 2
Celebration of First Town Board
Will the Meeting Come to Order
Historical Digest of Early Chili
Chili Trivia
Trivia Answer Key
April is Business Month
Chili Business Passport
Monroe County Hazard Mitigation Plan
Home / News / Monroe County Hazard Mitigation Plan
Is your family storm-ready? Have ideas for making Monroe County more resilient to natural disasters? Let us know! We are updating the County's Hazard Mitigation Plan and are looking for your feedback to inform our planning process. Take the survey to contribute your knowledge!
MONROE COUNTY HAZARD MITIGATION PLAN UPDATE
LIVE OR WORK IN THE COUNTY? WE NEED YOUR HELP!
CLICK HERE TO TAKE THE PUBLIC SURVEY


TOWN OF
OGDEN
NEW YORK
Home
Town Departments
Quality of Life
Public Safety
Events
Contact
A Message From Monroe County Department Of Emergency Preparedness
SHARE
Search our website:
Type to begin searching...
SEARCH
Popular Searches: Popular Searches FAQ's Driver's Licences Town Council
GOVERNMENT
CONTACT US
269 Ogden Center Road,
Home | More News | A Message From Monroe County Department Of Emergency Preparedness
Is your family storm-ready? Have ideas for making Monroe County more resilient to natural hazards? Let us know! We are updating the County's Hazard Mitigation Plan and are looking for your feedback to inform our planning process.
Take our survey to contribute your knowledge:
https://www.surveymonkey.com/r/3ZQ2VFX

Public Survey Summary

Those that live and work in Monroe County were given the opportunity to be involved in the planning process. One opportunity was the public survey. As stated above, the survey was developed to assess the level of knowledge of tools and techniques to assist in reducing risk and loss of those hazards. It asked quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs. The County advertised the survey on their website and social media accounts. As of November 2022, the survey received 94 responses.

Most residents receive information concerning natural hazards through the internet (77.5%) or social media (67.6%).

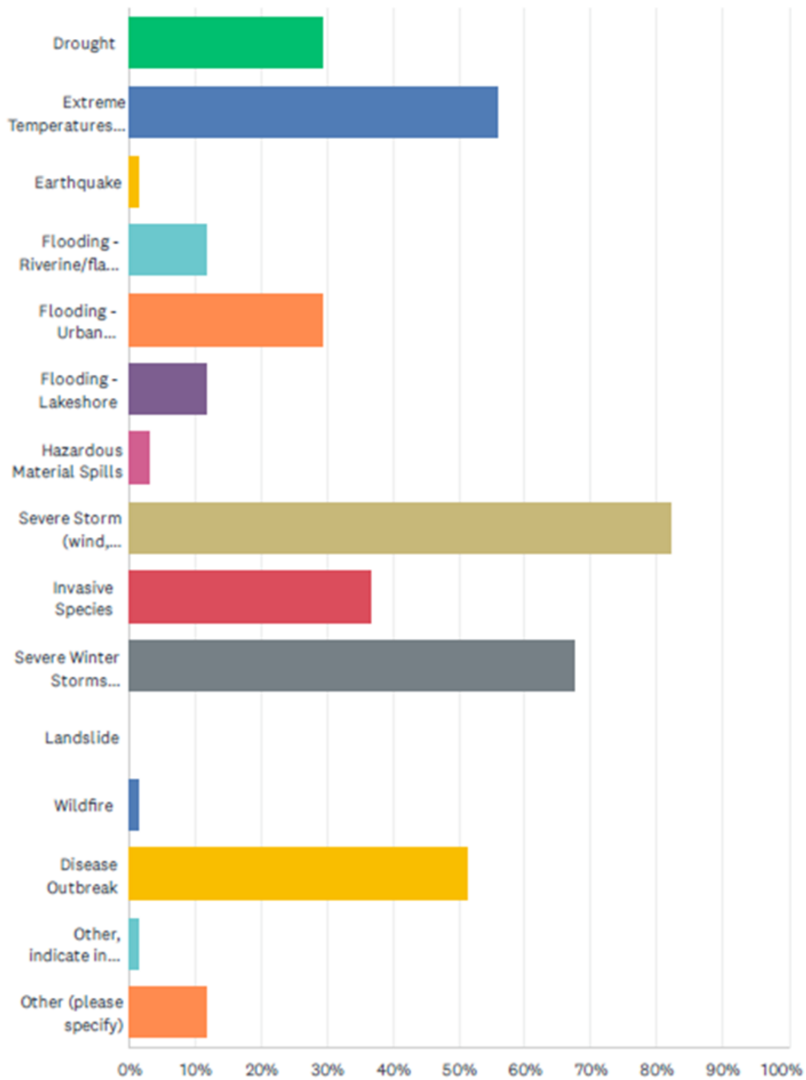
Demographically, survey respondents were from 22 municipalities within Monroe County, with 51 percent having lived in the County for 20 years or more. The most common (31.9 percent) age of respondents was over the age of 60. The majority (77.5 percent) of residents receive information concerning a natural hazard through the internet. Over half (67.6 percent) receive information through TV news or radio news (57.8 percent).

Survey respondents identified the following as the top 5 most frequently occurring natural hazard events within Monroe County in the past 10 years, as shown in Figure 3-2:

- Severe storms – wind, lightning, hail (82.4 percent)
- Severe winter storms – blizzard, heavy snow, ice (67.7 percent)
- Extreme temperature – heat and cold (55.9 percent
- Disease outbreak (51.5 percent)
- Invasive species (36.8 percent)

The highest hazards of concern (respondents reporting somewhat concerned, very concerned, or extremely concerned) include Extreme Temperatures, Severe Winter Storms, and Disease Outbreak.

Figure 3-2. Most frequently experienced natural hazard events in Monroe County



Respondents identified the following as desired projects to implement to reduce the damages due to natural hazards:

- Work on improving the damage resistance of utilities (electricity, communications, water/wastewater facilities etc.) (80.0 percent)
- Improve and strengthen infrastructure, such as elevating roadways and improving drainage systems (70.8 percent)

- Replace inadequate or vulnerable bridges and causeways (46.2 percent)
- Provide better information about hazard risks and high-hazard areas (33.9 percent)
- Assist vulnerable property owners with securing funding to mitigate their properties (30.8 percent)

Respondents were then given the opportunity to propose their own projects they would like to see implemented in Monroe County. Suggestions included assisting lakeshore property owners with flood protection, stormwater infrastructure upgrades, and electrical utility improvements.

Respondents were asked how much money they would be willing to spend on their current home to help protect it from the impacts of potential future natural disasters. 23.0 percent of respondents indicated they would spend between $5,000 and $9,999, while 24.6 percent of respondents do not know how much they would be willing to spend. However, 18 respondents provided the amount of money they have already spent on hazard mitigation, ranging from $500 to over $56,000, for items such as stormwater systems, window replacements, and shoreline fortification. 43 respondents indicated they would be incentivized by grants, tax breaks, funding assistance, insurance discounts, low interest rate loans, waivers, and/or lower insurance rates to protect their home from natural hazard impacts.

Please list any additional types of projects you believe local, county, state or federal government agencies could be doing in order to reduce the damage and disruption of natural disasters in Monroe County.

"Help Ontario lakeside property owners with flood protection."

"Storm drains repair and increased drainage for roads and parks."

"Convert overhead power lines to underground"

Respondents were also asked about their property's location within the floodplain, and if they have flood insurance. Of the 71 respondents who answered this question, only 5 (78.9 percent) indicated that their property is located in a designated floodplain. However, 7 residents (9.9 percent) indicated their home is covered by flood insurance.

The most self-selected jurisdictions respondents indicated that they live in, include the Town of Perinton, the City of Rochester, the Town/Village of East Rochester, and the Town of Chili.

Municipality-specific responses can be found in Section 9 (Jurisdictional Annexes).

Refer to Appendix D (Public and Stakeholder Outreach) for the full list of survey questions and responses.

3.4 Incorporation of Existing Plans, Studies, Reports and Technical Information

The Monroe County Hazard Mitigation Plan strives to use the best available technical information, plans, studies and reports throughout the planning process to support hazard profiling; risk and vulnerability assessment; review and evaluation of mitigation capabilities; and the identification, development and prioritization of County and local mitigation strategies.

The asset and inventory data used for the risk and vulnerability assessments is presented in the County Profile (Section 4). Details of the source of this data, along with technical information on how the data was used to develop the risk and vulnerability assessment, is presented in the Hazard Profiling and Risk Assessment Section (Section 5), specifically within Section 5.3 (Data and Methodology), as well as throughout the hazard profiles in Section 5.4. Further, the source of technical data and information used may be found within the References section.

Plans, reports and other technical information were identified and accessed online or provided directly by the County, participating jurisdictions and numerous stakeholders involved in the planning effort, as well as through independent research by the planning consultant. The County and participating jurisdictions were tasked with updating the inventory of their Planning and Regulatory capabilities (see Capability Assessment section of each jurisdictional annex in Section 9) and providing relevant planning and regulatory documents as applicable. Relevant documents, including plans, reports, and ordinances were reviewed to identify:

- Existing municipal capabilities;
- Needs and opportunities to develop or enhance capabilities, which may be identified within the County or local mitigation strategies;
- Mitigation-related goals or objectives, considered in the review and update of the overall Goals and Objectives (see Section 6);
- Proposed, in-progress, or potential mitigation projects, actions and initiatives to be incorporated into the updated County and local mitigation strategies.

The following local regulations, codes, ordinances and plans were reviewed during this process in an effort to develop mitigation planning goals and objectives and mitigation strategies that are consistent across local and regional planning and regulatory mechanisms; and thus, develop complementary and mutually supportive strategies, including:

- Comprehensive/Master Plans
- Building Codes
- Zoning and Subdivision Ordinances
- NFIP Flood Damage Prevention Ordinances
- Site Plan Requirements
- Local Waterfront Revitalization Plans
- Stormwater Management Plans
- Emergency Management and Response Plans
- Land Use and Open Space Plans
- Capital Plans
- Climate Smart Community Program
- Community Rating System
- New York State Standard Multi-Hazard Mitigation Plan, 2019

During the course of this planning process, a concerted effort was made to review all relevant plans contributing to the capability of the County and each municipality to integrate effective mitigation efforts into the daily activities of the county and municipalities. Documentation of this extensive review is reflected in the capability assessment table in each of the municipal annexes wherein the plan types, names, and dates are indicated in the table as well as a summary of how the plan supports mitigation and resilience.

3.5 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. Within the County there are many existing plans and programs that support hazard risk management, and thus it is critical that this hazard mitigation plan integrate and coordinate with, and complement, those existing plans and programs.

The "Capability Assessment" section of Chapter 6 (Mitigation Strategy) 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. Within each jurisdictional annex in Chapter 9, the County and each participating jurisdiction have identified how they have integrated hazard risk management into their existing planning, regulatory and operational/administrative framework ("integration capabilities") and how they intend to promote this integration ("integration actions").

A further summary of these continued efforts to develop and promote a comprehensive and holistic approach to hazard risk management and mitigation is presented in Section 7.

3.6 Continued Public Involvement

Monroe County and participating jurisdictions are committed to the continued involvement of the public in the hazard mitigation process. This Plan update will be posted on-line (currently at https://www.monroecountynyhmp.com/), and municipalities will be encouraged to maintain links to the plan website. Further, the County will make hard copies of the Plan available for review at public locations as identified on the public plan website.

A notice regarding annual updates of the plan and the location of plan copies will be publicized annually after the Planning Partnership's annual evaluation and posted on the public website (currently at https://www.monroecountynyhmp.com/).

Each jurisdiction's governing body shall be responsible for receiving, tracking, and filing public comments regarding this plan.

The public will have an opportunity to comment on the plan as a part of the annual mitigation planning evaluation process and the next five-year mitigation plan update. The HMP Coordinator (currently Mr. Timothy Henry of the Monroe County Office of Emergency Management) 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.

Further details regarding continued public involvement are provided in Section 7.

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 plan 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 plan 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. Timothy Henry of the Monroe County Office of Emergency Management has been identified as the ongoing County All-Hazard Mitigation Plan Coordinator (see Section 7), and is responsible for receiving, tracking, and filing public comments regarding this Plan Update. Contact information is:

Mailing Address: Monroe County Public Safety Department
Office of Emergency Management
1190 Scottsville Road, Suite 200
Rochester, NY 14624

Contact Name: Mr. Timothy Henry

Email Address: timhenry@monroecounty.gov

Telephone: (585) 753-3816

Section 4. County Profile

This profile describes the general information of the County (physical setting, population and demographics, general building stock, and land use and population trends) and critical facilities located within Monroe County. In Section 5, specific profile information is presented and analyzed to develop an understanding of the County, including the economic, structural, and population assets at risk and the concerns that may be present related to hazards analyzed (for example, a high percentage of vulnerable persons in an area).

4.1 General Information

4.1.1 History

Formerly a portion of Genesee and Ontario Counties, Monroe County officially became its own county on February 23, 1821, a namesake of President James Monroe. Following the Revolutionary War, people from New England, Maryland, and Pennsylvania came to settle the Genesee River Valley, bringing their knowledge of agriculture and methods of raising cattle and sheep. The settlers built flour and grist mills on the numerous small streams and along the Genesee River.

Prior to American settlement, the Algonquin, Seneca, and Iroquois tribes inhabited the land that is currently Monroe County. The Seneca, who joined the League of the Iroquois, controlled the major east-west and north-south trade routes in that region and were thus known as the “Keepers of the Western Door.” Ownership of the land was taken from both tribes in the Phelps and Gorham Purchase in 1788 and the Treaty of Big Tree in 1797. The former was when the Iroquois sold all rights to their land between Seneca Lake and the Genesee River to Oliver Phelps and Nathaniel Gorham, both of Massachusetts, who later defaulted on the purchase. The latter agreement, the Treaty of Big Tree, was formed between the Seneca Nation and the United States, in which the Seneca signed over rights to all territory west of the Genesee River, excluding 12 small tracts of land, for the price of $100,000 (SUNY Oswego, Date Unknown).

Early European settlement in the County was divided by the Genesee River, with settlements in the east becoming part of the Town of Northfield and those to the west becoming the Town of Northampton. Rapid population growth in the ensuing years altered both towns. On the eastern side of the river, Northfield became Boyle, which split in 1810 to form Penfield, then Perinton in 1812, both Brighton and Pittsford in 1814, and then Henrietta in 1818. Mendon was formed from Bloomfield in 1812 and Rush was created out of Avon in 1818. Irondequoit was formed in 1839 and Webster in 1840. Similar divisions took place on the west side of the river as Northampton split to form Parma and Riga in 1808, Gates in 1812, Sweden in 1813, Ogden in 1817, Clarkson in 1819, and Greece and Chili in 1822. Wheatland was formed in 1821 by a split from Southampton. Union was formed in 1853, and later became Hamlin in 1861.

Before 1821, the towns on both sides of the river were all part of either Ontario or Genesee counties, requiring all transactions to be recorded in the County seats, far from their homes and businesses. The City of Rochester (at that time, known as the Village of Rochesterville) was already a booming mill town, the focal point of settlements and economies in the surrounding towns and villages. At the time of the County’s founding, the Village of Rochesterville became the County seat and a Board of Supervisors was elected by the original 14 towns of the new county.

The year 1823 saw the birth of the City of Rochester and was also the year that the first 800-foot (244 m) Erie Canal aqueduct was constructed over the Genesee River, linking north-south trade along the Hudson River in eastern New York State to the potential of larger east-west trade through the Great Lakes and beyond. The completion of the Erie Canal in 1825 created unprecedented economic opportunity for Monroe County farmers and mills in the City of Rochester. The importance of wheat farming grew as the Erie Canal facilitated the shipment of products to the Port of New York, allowing goods and commodities to be shipped by water almost anywhere in the world. Monroe County's canal system is 42.8 miles long, and has supported many industries in the County's history, from flour, lumber, and nursery flowers to the modern industries of technology, recreation, and innovation.

Soon after the Erie Canal east to the Hudson River was opened in 1825, the County's economy boomed around the burgeoning industries in the Rochester area, and the population soared accordingly. By 1830, the population of the City of Rochester hit 9,200, and the city gained national recognition as "The Young Lion of the West." The prosperous economy soon led to another nickname for the city, the Flour City, based on the numerous flour mills lining the Genesee River within its borders. Less than a decade after the opening of the Erie Canal, roughly 20 mills were producing 44,000 tons of flour annually; the population of Rochester reached 13,500; and the city area expanded to 4,000 acres (16 km^2). By the mid-19th Century, Rochester was the 21st largest city in the United States. Westward expansion had shifted the focus of farming out of New York State and Monroe County's importance as the center for flour milling had deteriorated. However, a nursery and seed industry (started decades earlier by William A. Reynolds in Rochester) began to flourish, and several Rochester seed companies had grown to some of the largest in the world, the largest of which was the Ellwanger & Barry Nursery Co. As a result, the City of Rochester took yet another nickname, and was thereafter known as the Flower City.

Monroe County played an important history in the American abolition movement, and in the Civil War. In 1847, former slave and abolitionist leader Fredrick Douglass began publishing a newspaper "The North Star" out of Rochester. Douglass gave some of his most famous anti-slavery speeches while in Rochester, as did other renowned abolitionists including Susan. B. Anthony and William Lloyd Garrison. Elsewhere in the County in those years leading up to the Civil War, citizens were opening up their homes and places of business to shelter fugitive slaves as part of the Underground Railroad. Along with the City of Rochester, such safe houses were reportedly located in the Towns of Brighton, Pittsford, Mendon, Webster, and Chili (Coles 2005). Rochester had emerged as a center for culture, society, and education, and the University of Rochester was founded in 1850.

Later in the 19th century, another form of railroad made its mark on the County. Five freight and passenger railroads passed through Rochester by the middle of the 1890s, expanding on the County's already convenient systems of canals and roadways connecting Monroe County residents and businesses to cities and markets throughout the eastern United States. Inter-urban electric railroads came to Monroe County in the first decade of the 20th century, which included the Rochester, Lockport and Buffalo Railroad, and the Rochester, Syracuse and Eastern Rapid Railroad.

Modern-day Monroe County has come a long way from its early agricultural and milling start, and now prides itself on high-technology industries, manufacturing, and educational institutions. Both the Eastman Kodak and Bausch & Lomb Corporations have their world headquarters in the County, as do manufacturing facilities such as General Motors, Xerox, and ITT Automotive. Furthermore, the University of Rochester, the Rochester Institute of Technology, the National Institute for the Deaf, and five other institutions of higher learning are located in Monroe County.

Today, the County is comprised of 31 municipalities – one city, 20 towns, and ten villages (one of which, East Rochester, is conterminous with the town). The towns and villages of Monroe County are presented in Table 4-1.

Table 4-1. Monroe County Political Jurisdictions

City	Village	
City of Rochester	Village of Brockport Village of Churchville Village of Fairport Village of Hilton Village of Honeoye Falls	Village of Pittsford Village of Scottsville Village of Spencerport Village of Webster
Towns		
Town of Brighton Town of Chili Town of Clarkson Town/Village of East Rochester Town of Gates Town of Greece Town of Hamlin	Town of Henrietta Town of Irondequoit Town of Mendon Town of Ogden Town of Parma Town of Penfield Town of Perinton	Town of Pittsford Town of Riga Town of Rush Town of Sweden Town of Webster Town of Wheatland

4.1.2 Physical Setting

This section presents the physical setting of Monroe County, including its location, topography, hydrography and hydrology, climate, and land use and land cover.

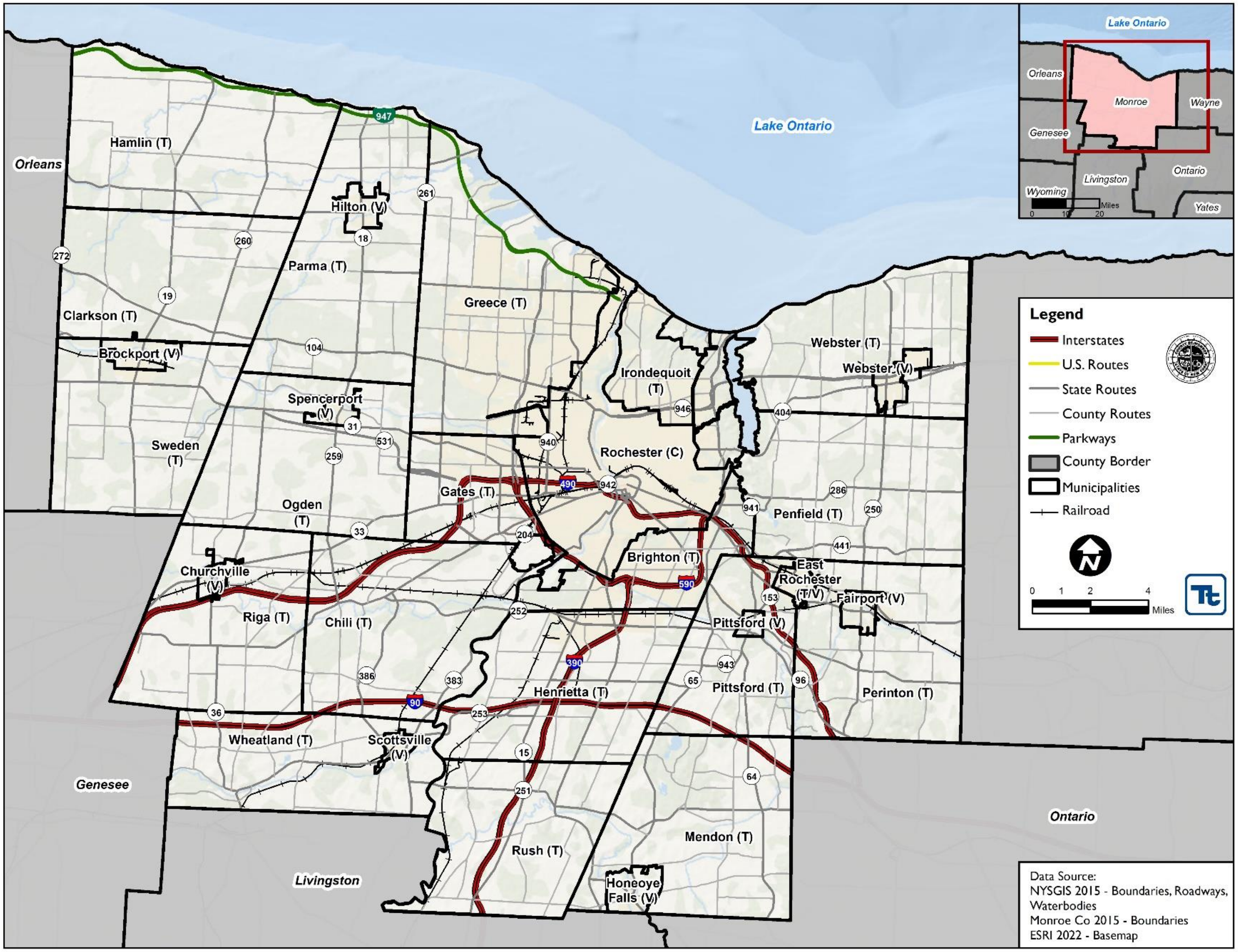
Location

Monroe County lies in the north-central portion of western New York, northeast of Buffalo and northwest of Syracuse, sharing its northern border with the United States border marked by Lake Ontario. Orleans and Genesee Counties form its western boundary, Livingston County marks the southern border with Ontario County to the southeast, and Wayne County shares a border to the east. Figure 4-1 displays Monroe County and its municipalities.

Lake Ontario, one of the Great Lakes, is a predominant feature in Monroe County, as it forms the northern border of the City of Rochester and the Towns of Hamlin, Parma, Greece, Irondequoit, and Webster; and is an important aesthetic, economic, environmental, and cultural resource for the County. The Genesee River is also significant, as it bisects the County into eastern and western sections, running directly through the heart of the City of Rochester and draining to Lake Ontario in the Town of Irondequoit. Topography ranges from gentle rolling hills in the northern parts of the County to steeper slopes and moderately rolling hills in the southern sections.

Monroe County itself is 1,367 square miles with 4,648 miles of road that wind across the County. Interstates (I)-90, I-390, I-490, and I-590 are the primary routes of travel through Monroe County. I-90, built in Monroe County as part of the New York State Thruway in the 1950s, traverses the County from the east to the west through the southern section, passing through the Towns of Wheatland, Chili, Henrietta, Pittsford, and Mendon. In the Town of Henrietta, I-90 intersects with I-390, major north-south route carrying traffic up from Livingston County and other points south and bisecting Monroe County, skirting the City of Rochester to the west and ending near the shores of Lake Ontario where the road continues as the Lake Ontario State Parkway. I-490 is the third major route option for travelers in Monroe County, an auxiliary highway offering a direct route into the City of Rochester from where it splits from I-90 on both the southeastern and southwestern corners of the County. I-490 was constructed in the 1950s along the original path of the Erie Canal through the City of Rochester. Its route serves the Villages of Churchville and Pittsford, among others. It connects with I-390 and New York State Route 390 (NY 390) just west of the City of Rochester and I-590 and NY 590 to the east of the City. Together, these roads comprise the southernmost portion of the Inner Loop Beltway, which circles around the interior of Rochester. State Route 531 connects I-490 to western suburbs including the Towns of Ogden and Gates, and the Villages of Brockport and Spencerport.

Figure 4-1. Monroe County, New York Mitigation Plan Area



Additionally, State Routes 104, 33, 31, and 36 connect the County to its eastern western, and southern neighbors. SR 104 and SR 31 run east west through the northern and central section of the County, respectively. SR 36 begins at the terminus of SR 531 in the Town of Ogden and runs south through the Town of Riga and Wheatland before connecting with Livingston County. SR 33 connects SR 31 in the City of Rochester directly to the City of Buffalo to the west. Often paralleling I-490 along its segments in Monroe County, SR 33 is mostly a rural highway serving local traffic.

Hydrography and Hydrology

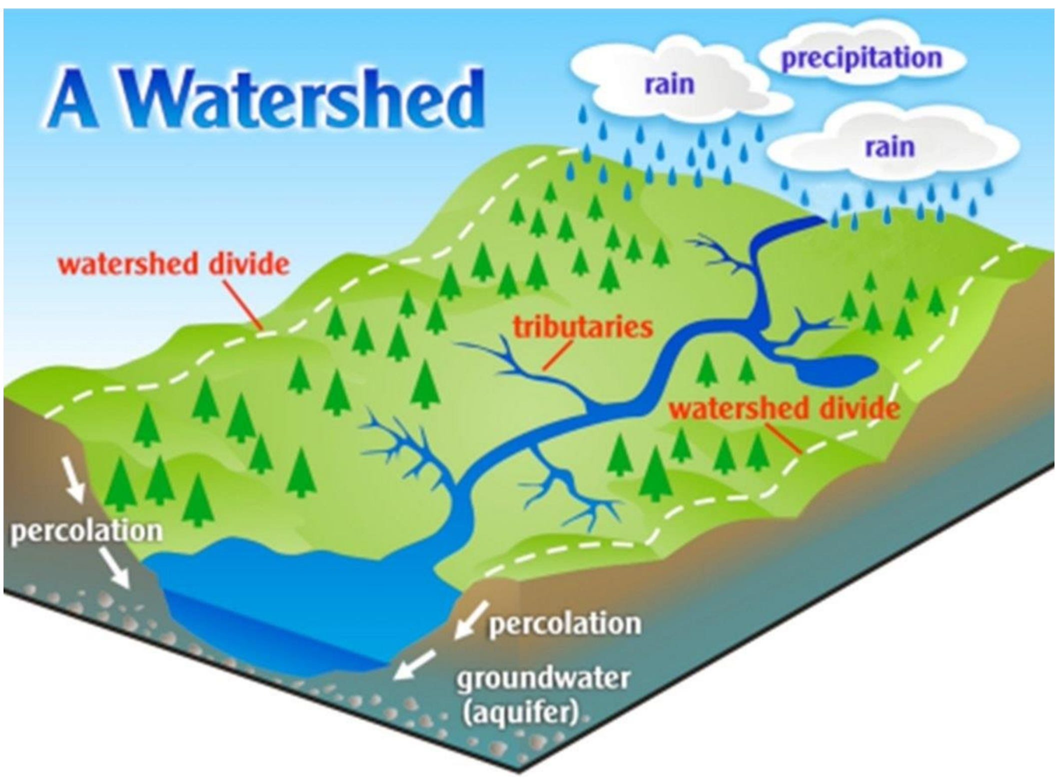
Major waterways in Monroe County include the Genesee River, Black Creek, Honeoye Creek, Irondequoit Creek, Oatka Creek, and Shipbuilders Cree. In addition to many creeks and ponds, Lake Ontario provides the northern border of the County. Irondequoit Bay is fed by Irondequoit Creek, between the towns of Irondequoit and Webster.

Watersheds

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 in the area such as hills or slopes. It includes not only the waterway itself but also the entire land area that drains to it. For example, the watershed of a lake would include not only the streams entering the lake but also the land area that drains into those streams and eventually the lake. Drainage basins generally refer to large watersheds that encompass the watersheds of many smaller rivers and streams. Figure 4-2 depicts the hydrologic system of a watershed (NYCDEP 2015).

Watersheds come in all shapes and sizes and can cross municipal and county boundaries. New York State's waters (lakes, rivers, and streams) fall within one of 17 major watersheds (or drainage basins).

Figure 4-2. Watershed



Source: Riverside-Corona Resource Conservation District 2022

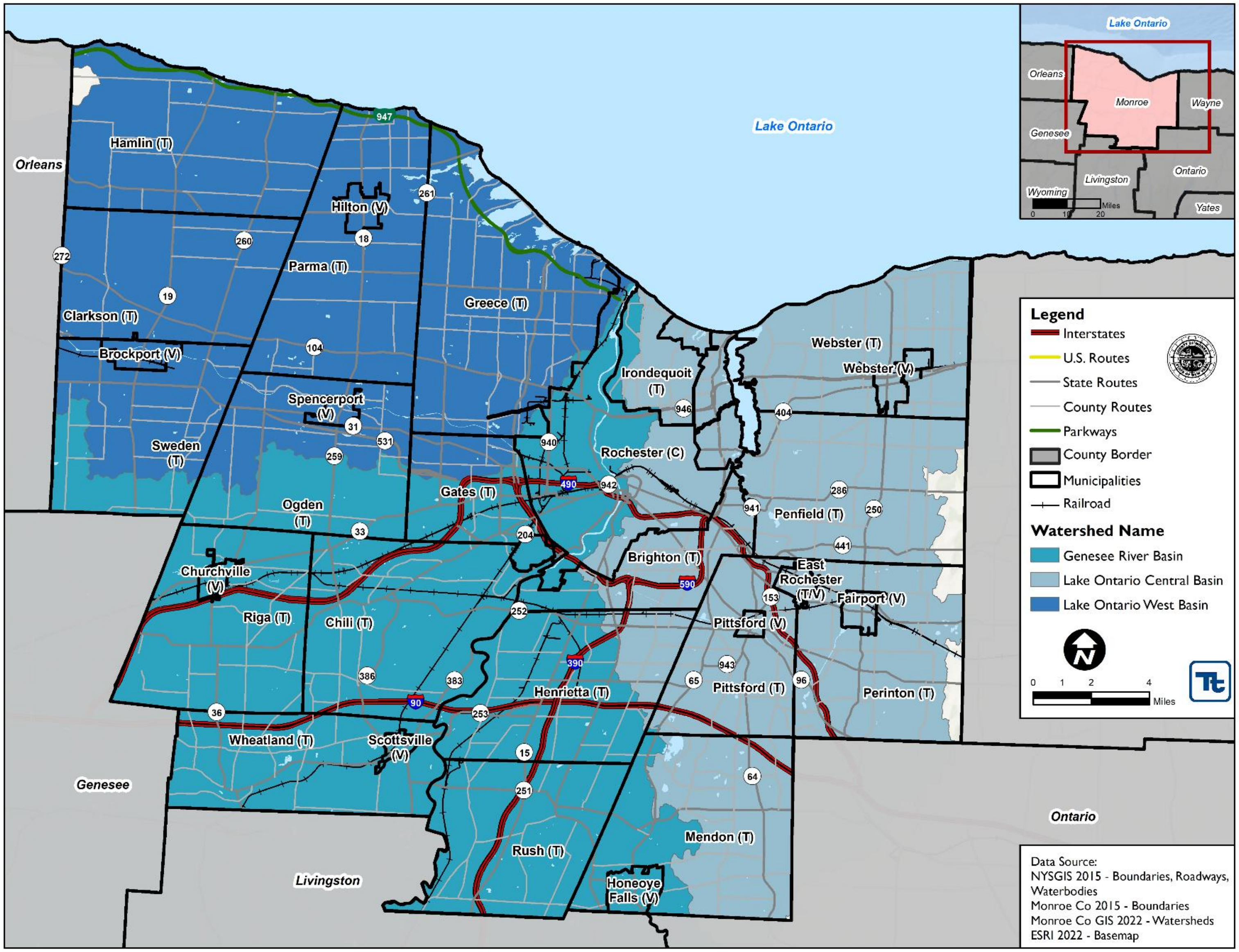
Monroe County creates the landward boundary of the Rochester Embayment of Lake Ontario, a 35-square-mile portion of Lake Ontario between Nine Mile Point in the Town of Webster and Bogus Point in the Town of Parma. At the mouth of the Genesee River, this bay drains approximately 3,000 square miles of upland, including all or parts of ten counties (nine in New York and one in Pennsylvania) including Monroe County. Monroe County drainage into the Rochester Embayment comes from three major sub-basins: The Genesee River Sub-Basin, the Lake Ontario Central Sub-Basin, and the Lake Ontario West Sub-Basin.

Figure 4-4 and Figure 4-3 show the location of watershed and sub watersheds in Monroe County.

Figure 4-3. Sub Watersheds in Monroe County

Source: Monroe County GIS 2015

Figure 4-4. Watersheds in Monroe County



Topography and Geology

Consistent with the rest of western New York, the geography and topography of the land that encompasses Monroe County owes its formation to the thawing of glaciers during the last Ice Age. The region is marked by rolling and rounded hills, often elongated with steeper slopes towards the north and more gradual, gentle slopes towards the south. Elevation ranges from 928 feet above sea level at Baker Hill on the Ontario County line in Perinton Township to 246 feet above sea level along the shores of Lake Ontario and Irondequoit Bay, and the lower course of the Genesee River Soil Survey of Monroe (Crabb 1910).

Most of the geology in the County is the result of glacial debris and sediment left behind after the Ice Age. Bedrock in the area is layered by shale, dolomite, and sandstone, and is overlain by soils of sandy loam, silt loam, and gravelly loam. There is a sharp boundary between soils and bedrock in Monroe County, which is evidence of the glacial activity that characterized the region, as soils were transported to their present location rather than created by gradual weathering of rock over time. Soils in Monroe County originated from glacial rivers, flowing terraces, and alluvial fans. Many boulders found in the region are foreign to the area, transported to Monroe County by the massive glaciers that covered the region. As glaciers receded, streams formed from the melting water and cut through the loose soils creating terraces that can be seen in the valleys of streams around the City of Rochester (Wishart n.d.). As a result of more than a century of agricultural and foresting activity, very little of the original, native vegetation remains in the region.

Climate

The climate of Monroe County is fairly humid, and strongly influenced by its proximity to Lake Ontario and the other Great Lakes. Precipitation is regularly distributed across all seasons in terms of quantity, although the frequency of storms is much greater in the winter months when heavy snowfall events occur at highly irregular intervals over varied distances.

Average yearly temperature is about 48.4° Fahrenheit (F). Lake temperatures stabilize the climate through the spring months, resulting in a relatively dry period, although soils remain wet from winter precipitation. Monroe County's summers are typically warm and sunny, with average temperatures between 70 and 72° F and some rain every third or fourth day. Temperatures at any one place in the County normally exceed 90°F roughly nine times each summer. It is uncommon for air temperatures to reach triple digits; however, higher temperatures combined with humidity may lead to days that feel much hotter (National Weather Service, Buffalo Office 2015).

The stabilizing effect of lake waters again leads to mild and dry autumns, but cold weather moves in by late October bringing clouds and early frosts. Monroe County winters are generally cold, cloudy, and snowy. Cold temperatures prevail whenever arctic air masses, under high barometric pressure, flow southward from central Canada or from Hudson Bay (Cornell University College of Agriculture and Life Sciences 2011), and about half of the region's snowfall comes from the "lake effect" process, which creates localized, variable conditions. Lake effect snowfall impacts the eastern portion of the County the most, due to wind patterns coming off Lake Ontario. Total season snowfall ranges from 70 inches in the southern portions of the County to about 90 inches in the City of Rochester, and over 120 inches along the shores of Lake Ontario in the northeastern part of the County. Monroe County's average annual low temperature is 39.5°F (U.S. Climate Data 2015). On average, temperatures fall below 0°F six nights each winter, and temperatures below -10°F are uncommon (National Weather Service, Buffalo Office 2015).

Land Use and Land Cover

The original primeval forest in Monroe County was a mix of several different forest communities. In general, oak dominated on dry slopes while beech was most prevalent in wetter flatland sites. Other common species included shagbark hickory, tulip tree, red maple, and black cherry. Current vegetation consists of agriculture, deciduous hardwood forests such as sugar maple, beech, yellow birch, ash, red maple, and white oak (Ramsey Lab 2015).

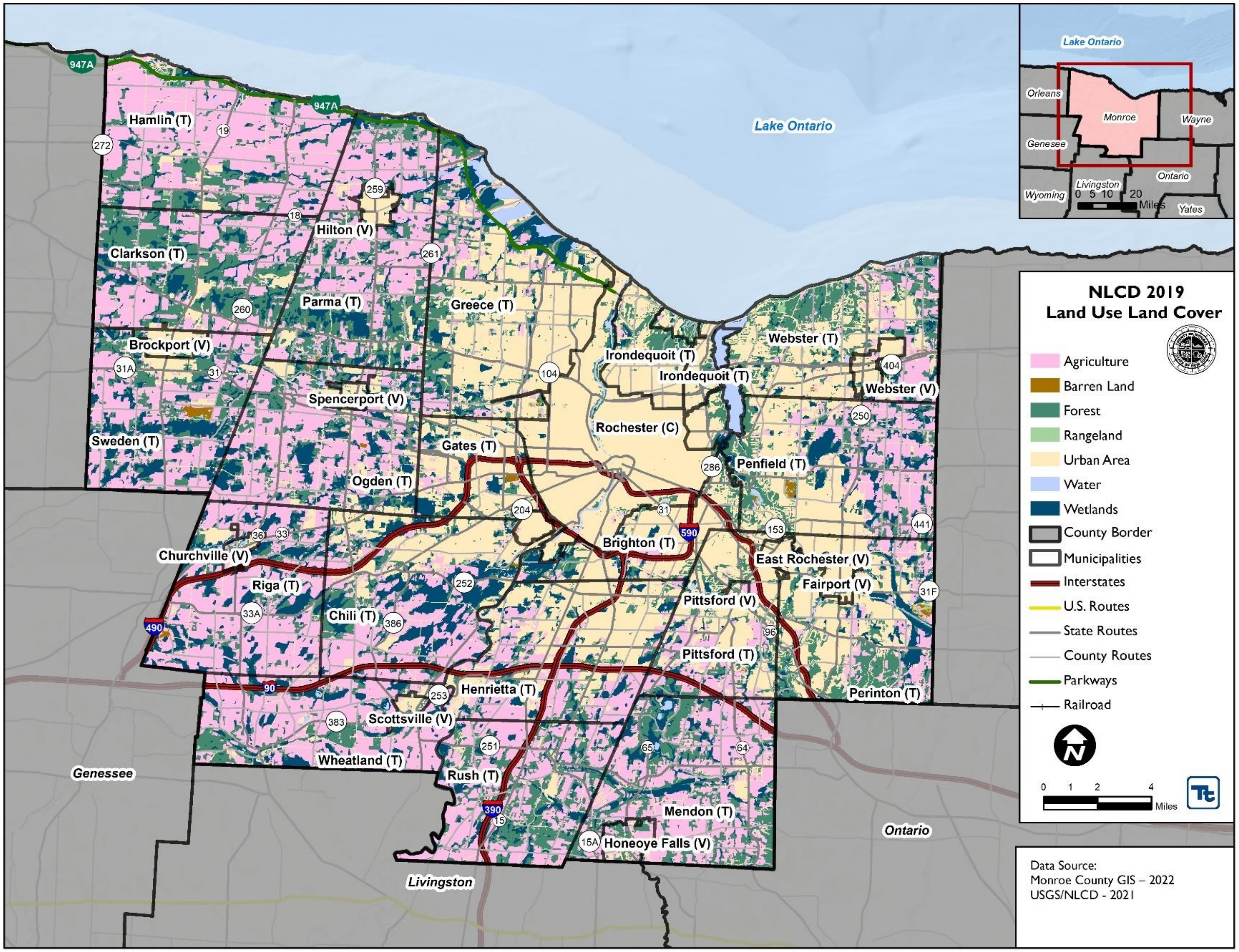
According to the 2020 Monroe Land Use Report published by the Monroe County Department of Planning and Development (MCDPD) Planning Division, the greatest share of land use in Monroe County is residential, with 40.15 percent of all land cover categorized as one of many residential land use categories (in terms of acreage). The next largest shares are agricultural with 21.35 percent, followed by vacant land and commercial, with 15.95 percent and 5.26 percent, respectively. Table 4.2 summarizes the land use categories by the total number of parcels, or properties, in each category. Ranked by number of properties, the top three land uses are Residential with 86.35 percent, Vacant Land with 6.26 percent, and Commercial with 4.67 percent (Monroe County Department of Planning of Development 2022).

Table 4-2. Monroe County 2020 Land Use Classification Table

Property Code	Category Description	Property Count	Count %	Property Acreage	Acreage %
100	Agricultural	1,565	0.59%	83,337.36	21.35%
200	Residential	229,825	86.35%	156,667.47	40.15%
300	Vacant land	16,665	6.26%	62,253.25	15.95%
400	Commercial	12,442	4.67%	20,514.24	5.26%
500	Recreation and entertainment	670	0.25%	11,197.22	2.87%
600	Community services	2,016	0.76%	20,191.98	5.17%
700	Industrial	866	0.33%	7,064.13	1.81%
800	Public services	893	0.34%	8,055.80	2.06%
900	Wild, forested, conservation lands and public parks	360	0.14%	17,695.86	4.53%
No Data	-	845	0.32%	3,267.67	0.84%
Total	**-**	**266,147**	**100%**	**390,254.98**	**100%**

Source: Monroe County Department of Planning of Development 2020

Figure 4-5. Monroe County Land Use and Land Cover



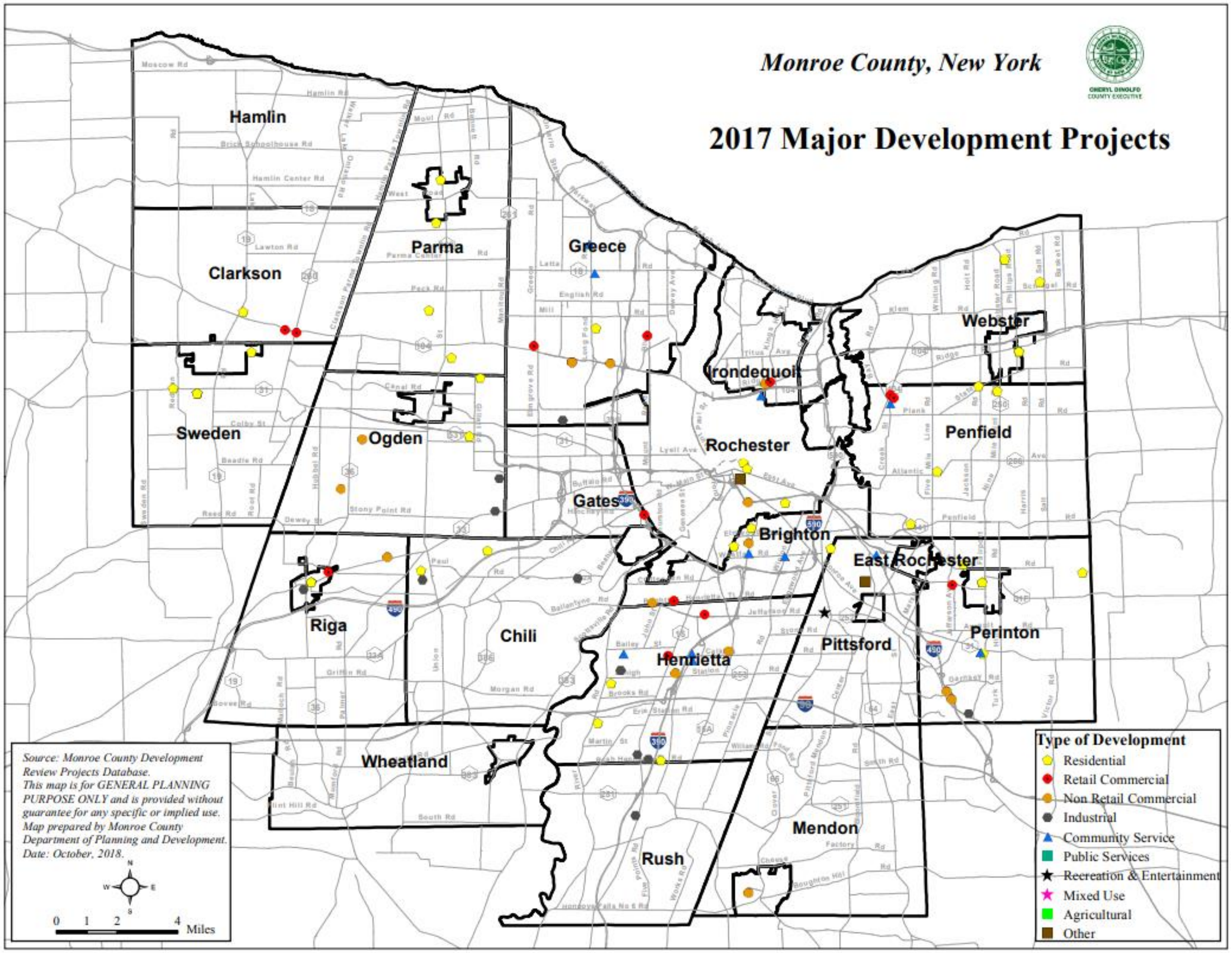
New Development

For new development, the County uses best available data to avoid potential hazard exposure where possible. Additionally, the County intends to (1) discourage development within vulnerable areas, areas with high population density, and the Special Flood Hazard Area (SFHA); and (2) encourage higher regulatory standards at the local level.

In 2020, Monroe County municipalities issued 711 new residential permits compared to 591 in 2019. There were 97 major projects proposed throughout the County in 2020, 2 of which were applications for rezoning (often indicating future development activity). Residential development made up 35 projects, proposing a total of 1,538 residential units. Four of these submitted residential developments were senior housing projects, proposing a total of 224 senior housing units. The Town of Henrietta was the host of the most projects, with 12, followed by the Towns of Greece and Irondequoit with 10 each, City of Rochester with 7, and Gates with 6.

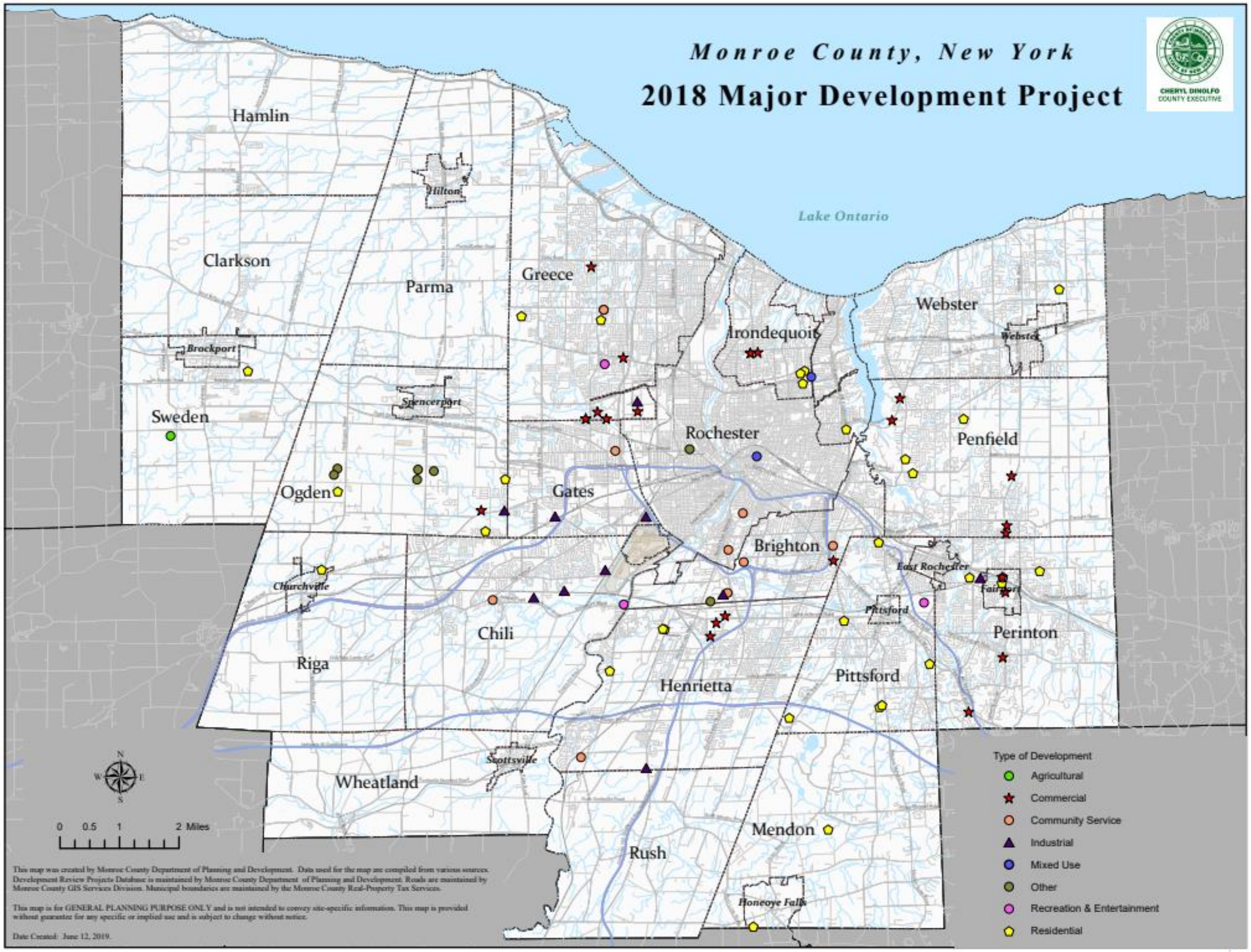
Figure 4 6 through Figure 4 9 show the major development projects in 2017, 2018, 2019, and 2020 (Monroe County Department of Planning of Development 2022). Individual development projects are detailed in Section 9 under each appropriate jurisdictional annex.

Figure 4-6. Monroe County 2017 Major Development Projects



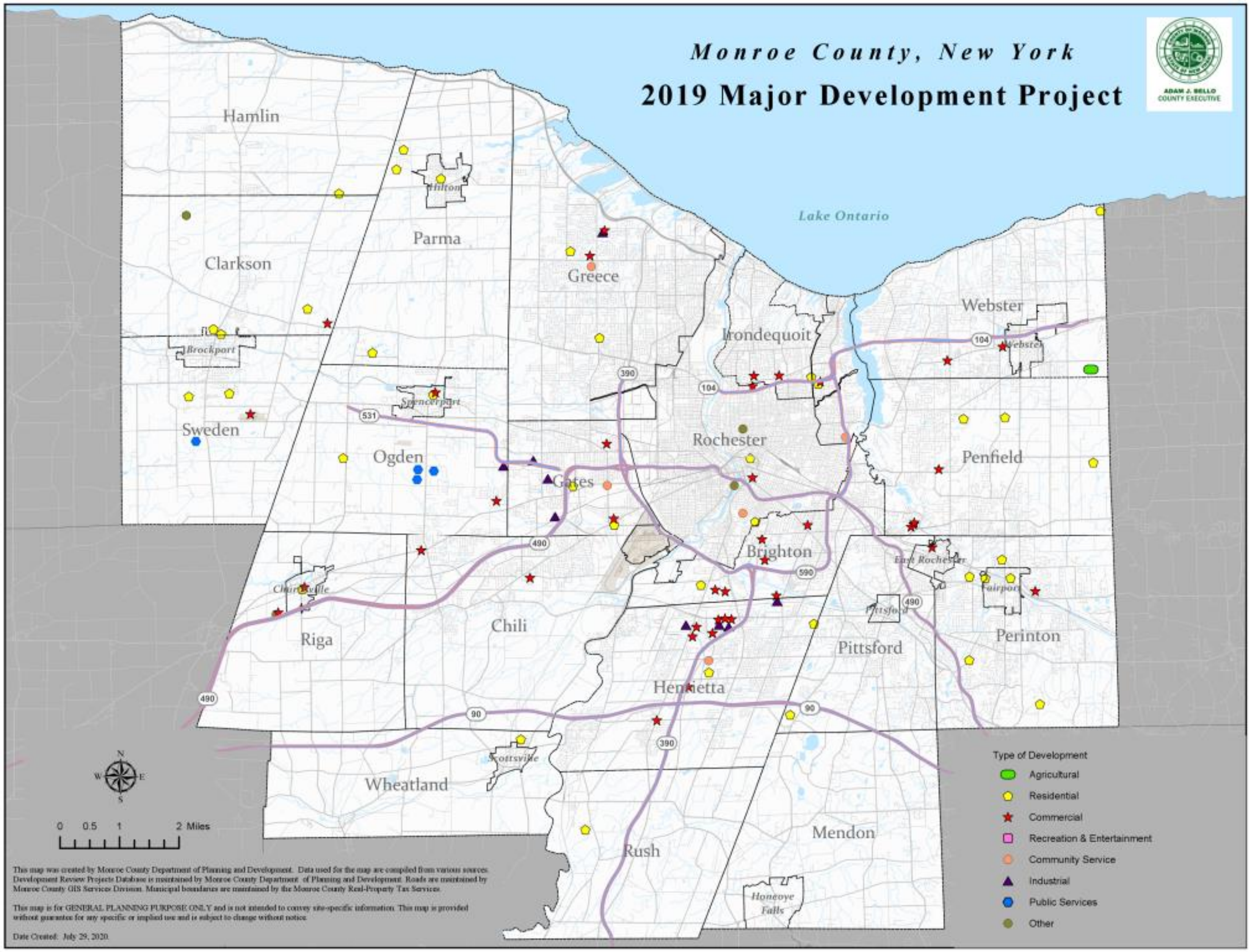
Source: Monroe County Department of Planning of Development 2022

Figure 4-7. Monroe County 2018 Major Development Projects



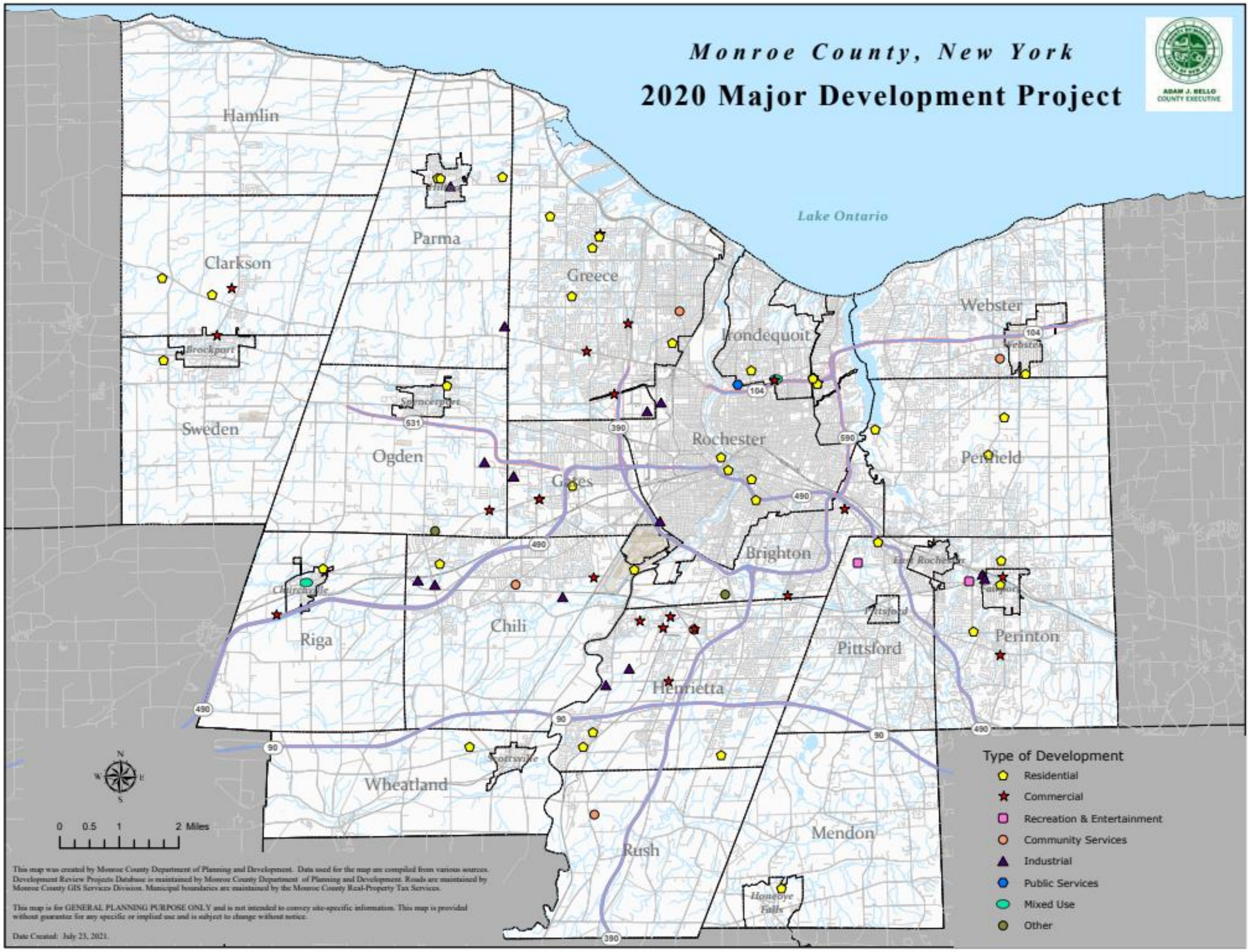
Source: Monroe County Department of Planning of Development 2022

Figure 4-8. Monroe County 2019 Major Development Projects



Source: *Monroe County Department of Planning of Development 2022*

Figure 4-9. Monroe County 2020 Major Development Projects



Source: Monroe County Department of Planning of Development 2022

4.2 Population and Demographics

According to the 2020 U.S. Census, Monroe County has a population of 753,109 people. Approximately 28.1 percent of that population resides in the City of Rochester. While the overall population of Monroe County has increased by approximately 1.02 percent since 2010, this growth is not geographically uniform throughout the County, with some areas having experienced a decline in population. However, the 2020 U.S. Census data for Hazards-U.S. Multi-Hazard (HAZUS-MH) are believed to be sufficient and appropriate to support the risk assessment and mitigation planning efforts of this project.

The Federal Emergency Management Agency's (FEMA) Disaster Mitigation Act of 2000 (DMA 2000) requires that hazard mitigation plans (HMP) consider socially vulnerable populations. These populations can be more susceptible to hazard events based on a number of factors including their physical and financial ability to react or respond during a hazard, and the location and construction quality of their housing. This HMP considers several socially vulnerable population groups: the elderly (persons over the age of 65), the young (persons under the age of 5), non-English speaking households, those with disabilities, and those living below the poverty level (as defined by the U.S. Census Bureau). Table 4-3 and Table 4-4 present the population statistics for each municipality in the County based on the 2010 and 2020 Census data.

Table 4-3. Monroe County Population and Demographic Statistics, 2010 Census

Municipality	U.S. Census 2010				
	Total	Pop. 65+	% Pop. 65+	Below Poverty Level	% Below Poverty Level
Brighton (T)	36,609	6,421	18%	2,162	6%
Brockport (V)	8,366	686	8%	661	8%
Chili (T)	28,625	4,229	15%	960	3%
Churchville (V)	1,961	287	15%	96	5%
Clarkson (T)	6,588	851	13%	382	6%
East Rochester (T/V)	6,587	800	12%	544	8%
Fairport (V)	5,353	811	15%	344	6%
Gates (T)	28,400	5,327	19%	1,790	6%
Greece (T)	96,095	16,011	17%	5,208	5%
Hamlin (T)	9,045	929	10%	459	5%
Henrietta (T)	42,581	4,964	12%	2,509	6%
Hilton (V)	5,886	789	13%	164	3%
Honeoye Falls (V)	2,674	406	15%	191	7%
Irondequoit (T)	51,692	9,802	19%	3,706	7%
Mendon (T)	6,478	754	12%	18	0%
Ogden (T)	16,255	1,971	12%	331	2%
Parma (T)	9,747	1,360	14%	314	3%
Penfield (T)	36,242	6,342	18%	1,094	3%
Perinton (T)	41,109	6,940	17%	1,415	3%
Pittsford (T)	28,050	4,909	18%	616	2%
Pittsford (V)	1,355	231	17%	31	2%
Riga (T)	3,629	434	12%	176	5%
Rochester City	210,565	18,955	9%	29,978	14%
Rush (T)	3,478	588	17%	110	3%
Scottsville (V)	2,001	287	14%	68	3%
Spencerport (V)	3,601	497	14%	215	6%
Sweden (T)	5,957	765	13%	376	6%
Webster (T)	37,242	6,028	16%	1,424	4%
Webster (V)	5,399	842	16%	342	6%
Wheatland (T)	2,774	378	14%	154	6%
Monroe County	**744,344**	**103,594**	**14%**	**55838**	**8%**

Source: HAZUS-MH 2.2; U.S. Census Bureau, Census 2010; U.S. Census Bureau, Census 2020

Table 4-4. Monroe County Population and Demographic Statistics 2020 Census, American Community Survey 5-Year Estimates

Municipality	U.S. Census 2020*									
	Total	Over 65	Percent of Jurisdiction Total	Under 5	Percent of Jurisdiction Total	Non-English-Speaking Households	Percent of Jurisdiction Total	Disability	Percent of Jurisdiction Total	Poverty Level	Percent of Jurisdiction Total
Brighton (T)	37,137	7,492	20.2%	1,294	3.5%	498	1.3%	3,740	10.1%	3,605	9.7%
Brockport (V)	7,104	1,091	15.4%	120	1.7%	7	0.1%	0	0.0%	1,029	14.5%
Chili (T)	29,123	5,566	19.1%	1,580	5.4%	214	0.7%	3,441	11.8%	1,710	5.9%
Churchville (V)	2,091	423	20.2%	127	6.1%	0	0.0%	316	15.1%	101	4.8%
Clarkson (T)	6,904	1,314	19.0%	379	5.5%	34	0.5%	955	13.8%	783	11.3%
East Rochester (T/V)	6,334	1,135	17.9%	380	6.0%	19	0.3%	960	15.2%	581	9.2%
Fairport (V)	5,501	1,104	20.1%	113	2.1%	15	0.3%	871	15.8%	759	13.8%
Gates (T)	29,167	5,954	20.4%	1,611	5.5%	402	1.4%	4,318	14.8%	2,125	7.3%
Greece (T)	96,926	18,651	19.2%	4,677	4.8%	1,159	1.2%	14,305	14.8%	8,908	9.2%
Hamlin (T)	8,725	1,537	17.6%	710	8.1%	25	0.3%	1,296	14.9%	670	7.7%
Henrietta (T)	47,096	6,295	13.4%	2,197	4.7%	516	1.1%	5,239	11.1%	5,222	11.1%
Hilton (V)	6,027	782	13.0%	483	8.0%	0	0.0%	675	11.2%	661	11.0%
Honeoye Falls (V)	2,706	549	20.3%	93	3.4%	0	0.0%	281	10.4%	239	8.8%
Irondequoit (T)	51,043	11,605	22.7%	2,231	4.4%	530	1.0%	7,105	13.9%	3,966	7.8%
Mendon (T)	6,389	958	15.0%	536	8.4%	0	0.0%	345	5.4%	181	2.8%
Ogden (T)	16,585	2,664	16.1%	725	4.4%	50	0.3%	1,946	11.7%	1,185	7.1%
Parma (T)	10,190	1,811	17.8%	379	3.7%	20	0.2%	905	8.9%	562	5.5%
Penfield (T)	39,438	7,583	19.2%	2,187	5.5%	231	0.6%	3,588	9.1%	1,598	4.1%
Perinton (T)	39,128	8,731	22.3%	2,364	6.0%	222	0.6%	3,743	9.6%	1,661	4.2%
Pittsford (T)	25,714	4,857	18.9%	1,267	4.9%	101	0.4%	1,761	6.8%	473	1.8%
Pittsford (V)	1,419	246	17.3%	92	6.5%	0	0.0%	40	2.8%	23	1.6%
Riga (T)	3,495	506	14.5%	286	8.2%	0	0.0%	315	9.0%	253	7.2%
Rochester City	211,328	23,947	11.3%	13,203	6.2%	5,737	2.7%	37,911	17.9%	60,015	28.4%
Rush (T)	3,490	894	25.6%	113	3.2%	0	0.0%	374	10.7%	151	4.3%
Scottsville (V)	2,009	368	18.3%	178	8.9%	7	0.3%	250	12.4%	320	15.9%
Spencerport (V)	3,685	643	17.4%	201	5.5%	0	0.0%	322	8.7%	193	5.2%
Sweden (T)	6,140	1,059	17.2%	478	7.8%	58	0.9%	1,672	27.2%	942	15.3%
Webster (T)	39,676	8,368	21.1%	2,112	5.3%	292	0.7%	4,599	11.6%	1,521	3.8%
Webster (V)	5,651	1,059	18.7%	109	1.9%	211	3.7%	859	15.2%	701	12.4%
Wheatland (T)	2,888	396	13.7%	226	7.8%	0	0.0%	367	12.7%	346	12.0%
Monroe County	**753,109**	**127,588**	**16.9%**	**40,451**	**5.4%**	**10,348**	**1.4%**	**102,499**	**13.6%**	**100,484**	**13.3%**

Source: HAZUS-MH 2.2; U.S. Census Bureau, Census 2020
*Notes: * 2020 data includes estimates of population percentages based on the 2020 American Community Survey 5-year Estimates*

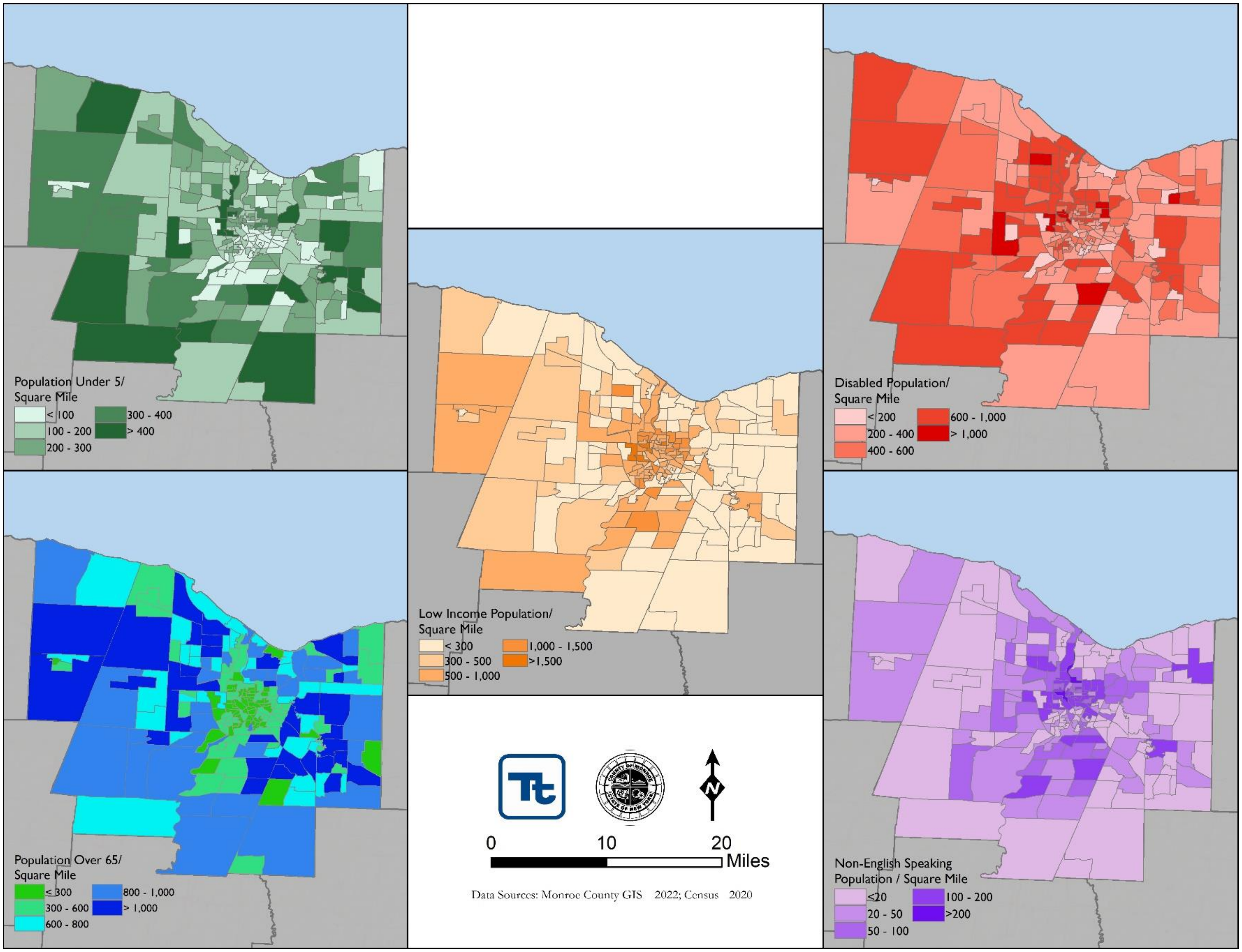
4.2.1 Socially Vulnerable Populations

The Federal Emergency Management Agency's (FEMA) Disaster Mitigation Act of 2000 (DMA 2000) requires that hazard mitigation plans (HMP) consider socially vulnerable populations. These populations can be more susceptible to hazard events based on a number of factors including their physical and financial ability to react or respond during a hazard, and the location and construction quality of their housing. This HMP considers several socially vulnerable population groups: the elderly (persons over the age of 65), the young (persons under the age of 5), non-English speaking households, those with disabilities, and those living below the poverty level (as defined by the U.S. Census Bureau). Refer to Table 4-3 and Table 4-4 for population statistics for these socially vulnerable populations, for each municipality in the County based on the 2010 and 2020 Census data.

16.9 percent of the Monroe County population is over the age of 65. 5.4 percent of the population in the County is under the age of 5. The 2020 U.S. Census data indicate a total of 13.9 percent of all persons living in households fall below the poverty level (Census 2020).

Figure 4-10 shows the distribution of the general population density (persons per square mile) for persons under 5 years of age, persons over 65 years of age, low-income population, the disabled population, and the non-English speaking population.

Figure 4-10. Distribution of Socially Vulnerable Population by Census Block for Monroe County



1.4 percent of the County's residents live in non-English speaking households (Census 2020). Monroe County averages 8.5 percent of its population characterized as "foreign born." The City of Rochester is a sanctuary city and welcomes refuges from Somalia, Cuba, Bhutan, Iraq, Congo, and Burma primarily (Monroe County Department of Health 2019).

The City of Rochester has a large population of Deaf sign language users and many older adults with hearing loss. Rochester Institute of Technology (RIT) estimates that in the Rochester area there are 42,674 people who are deaf or have serious difficulty hearing, including 19,438 persons younger than 65 years old (National Technical Institute for the Deaf 2012). The Rochester School for the Deaf works with deaf and hard-of-hearing children and their families. The National Technical Institute for the Deaf D is the largest technical college for deaf and hard-of-hearing students in the country, with approximately 1,400 students. The critical mass of Deaf people influences the local Rochester economy, and many local companies hire qualified Deaf people for blue-collar and white-collar jobs, and local service industries, such as restaurants, are comfortable with Deaf customers. University of Rochester research and clinical training programs include Deaf graduate students, medical students, and fellows. Deaf people migrate to Rochester, attracted by the economic, social, and educational opportunities (Monroe County Department of Health 2019).

4.3 General Building Stock

According to 2020 Census data, 305,210 households are located in Monroe County. A household includes all the people who occupy a housing unit as their usual residence. The Census data identified 338,052 housing units in the county. A housing unit is a house, apartment, mobile home or trailer, a group of rooms, or a single room occupied as separate living quarters (or if vacant, intended for occupancy as separate living quarters). According to the 2020 Census, there are 19,301 vacant housing units in the County (U.S. Census 2020).

For this update, the default general building stock in HAZUS-MH was updated and replaced with a custom building inventory for Monroe County both at the aggregate and structure level. The building stock update was performed using the most current parcel and the New York State Department of Taxation and Finance tax assessment data provided by Monroe County. The tax assessment data was joined to the spatial layer of structure footprints also provided by the County. The replacement cost value was calculated using the square footage value of each building and RS Means 2022 data.

For the purposes of this plan, approximately 312,018 structures were identified by the tax data and spatial data available. These structures account for a replacement cost value of approximately $173 billion. Estimated content value was calculated by using 50 percent of the residential replacement cost value, and 100 percent of the non-residential replacement values. Using this methodology, approximately $141 billion in contents exist within these properties. Approximately 79.1 percent of the total buildings in the County are residential, which make up approximately 58.0 percent of the total building stock value. Table 4-5 presents building stock statistics by occupancy class for Monroe County.

Table 4-5. Building Stock Count and Replacement Cost Value (RCV) by Occupancy Class

Jurisdiction	All Occupancies				Residential		Commercial	
	Count	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value (Structure + Contents)	Count	Total Replacement Cost Value (Structure + Contents)	Count	Total Replacement Cost Value (Structure + Contents)
Brighton (T)	11,693	$8,018,612,066	$6,425,273,936	$14,443,886,002	10,270	$5,580,375,863	1,259	$6,093,196,671
Brockport (V)	2,224	$2,528,139,646	$2,630,649,947	$5,158,789,593	1,610	$640,479,602	491	$2,747,646,434
Chili (T)	11,534	$5,143,090,968	$4,063,752,918	$9,206,843,886	10,013	$3,993,957,118	1,182	$3,348,362,080
Churchville (V)	1,112	$524,841,659	$413,322,418	$938,164,078	853	$284,144,029	236	$503,302,995
Clarkson (T)	3,411	$1,092,033,825	$795,358,205	$1,887,392,030	2,262	$902,262,571	1,063	$855,123,448
East Rochester (T/V)	2,924	$1,867,574,316	$1,572,596,811	$3,440,171,127	2,428	$708,559,999	441	$2,030,617,679
Fairport (V)	2,394	$1,241,155,279	$1,040,300,797	$2,281,456,076	2,018	$758,398,775	341	$1,010,519,831
Gates (T)	11,801	$6,360,259,250	$5,860,340,035	$12,220,599,285	10,541	$3,786,446,019	1,019	$3,814,022,542
Greece (T)	36,414	$15,353,982,024	$11,600,396,660	$26,954,378,684	33,432	$13,272,805,288	2,643	$8,303,870,789
Hamlin (T)	5,539	$1,326,520,319	$992,257,708	$2,318,778,027	3,699	$1,076,615,019	1,728	$946,838,486
Henrietta (T)	15,982	$12,207,689,238	$11,252,877,084	$23,460,566,322	13,249	$6,095,727,279	2,288	$9,335,995,519
Hilton (V)	2,143	$1,217,915,013	$902,372,975	$2,120,287,988	1,912	$708,654,462	189	$814,073,823
Honeoye Falls (V)	1,155	$958,640,006	$854,540,685	$1,813,180,690	873	$407,093,838	247	$844,128,446
Irondequoit (T)	21,885	$7,952,286,403	$5,474,720,437	$13,427,006,840	19,659	$7,041,068,033	2,108	$5,061,073,578
Mendon (T)	3,835	$1,621,833,177	$1,230,322,737	$2,852,155,914	2,327	$1,186,886,439	1,350	$1,458,365,989
Ogden (T)	7,407	$3,085,558,975	$2,472,528,465	$5,558,087,440	5,604	$2,296,291,456	1,546	$1,723,419,525
Parma (T)	5,509	$1,928,899,846	$1,444,512,728	$3,373,412,574	4,007	$1,529,775,633	1,397	$1,541,642,328
Penfield (T)	15,882	$6,562,442,642	$4,556,791,349	$11,119,233,991	14,128	$6,241,168,186	1,461	$3,108,343,726
Perinton (T)	16,817	$7,627,088,739	$5,498,326,668	$13,125,415,407	14,983	$6,715,410,339	1,569	$4,730,871,596
Pittsford (T)	10,590	$6,033,826,086	$4,652,947,915	$10,686,774,001	9,400	$4,923,430,830	919	$3,049,673,012
Pittsford (V)	804	$930,437,470	$846,397,041	$1,776,834,511	565	$258,437,114	218	$1,307,795,943
Riga (T)	2,356	$848,605,349	$690,887,496	$1,539,492,845	1,365	$472,009,443	888	$650,102,259
Rochester (C)	89,392	$64,962,663,964	$54,980,707,092	$119,943,371,056	59,563	$21,959,576,383	28,315	$75,946,717,760
Rush (T)	2,808	$995,725,102	$820,720,252	$1,816,445,354	1,405	$560,863,090	1,204	$818,170,658
Scottsville (V)	1,069	$490,385,148	$418,331,605	$908,716,753	726	$248,077,070	308	$394,234,885
Spencerport (V)	1,654	$890,802,851	$690,041,845	$1,580,844,696	1,257	$479,394,702	376	$943,979,928
Sweden (T)	3,465	$1,858,369,017	$1,543,889,219	$3,402,258,236	2,060	$938,121,236	1,334	$1,893,041,495
Webster (T)	16,660	$6,717,594,859	$4,792,596,311	$11,510,191,170	14,331	$6,253,561,105	2,108	$3,215,679,437
Webster (V)	1,633	$1,779,482,826	$1,854,583,456	$3,634,066,282	1,344	$810,221,962	210	$766,075,242
Wheatland (T)	1,926	$1,332,809,855	$1,176,267,185	$2,509,077,040	1,011	$555,019,265	676	$867,892,661
Monroe County (Total)	**312,018**	**$173,459,265,918**	**$141,548,611,980**	**$315,007,877,898**	**246,895**	**$100,684,832,147**	**59,114**	**$148,124,778,765**

Source: Monroe County GIS - 2022; RS Means - 2022
Notes: C: City T: Town V: Village

The 2020 Economic Surveys Business Patterns data identified 17,383 business establishments employing approximately 354,169 people in Monroe County. The retail trade industry has the greatest number of establishments in the County, with 2,219. This is followed by the professional, scientific, and technical services industry with 1,943 establishments, and the health care and social assistance industry with 1,931 establishments (Census 2020).

Figure 4-11 through Figure 4-13 show the distribution and exposure density of residential, commercial, and industrial buildings in Monroe County based on the New York State Department of Taxation and Finance Property Class Code. Exposure density is the dollar value of structures per unit area, including building content value. The densities are shown in units of $1,000 ($K) per square mile. Viewing exposure distribution maps, such as those used for Figure 4-11 through Figure 4-13, can assist communities in visualizing areas of high exposure and in evaluating aspects of the study area in relation to the specific hazard risks.

Figure 4-11. Distribution of Residential Building Stock and Value Density in Monroe County

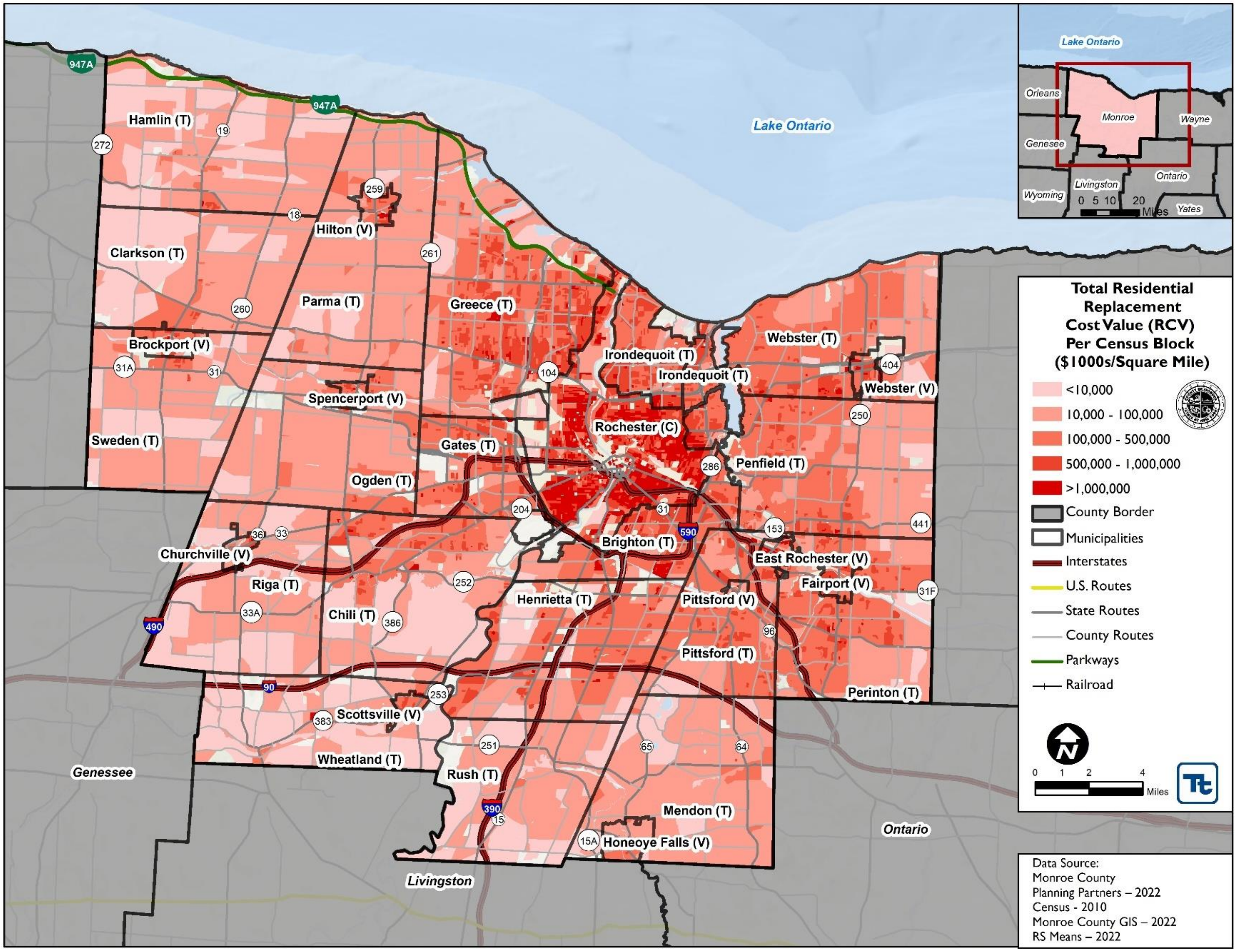


Figure 4-12. Distribution of Commercial Building Stock and Value Density in Monroe County

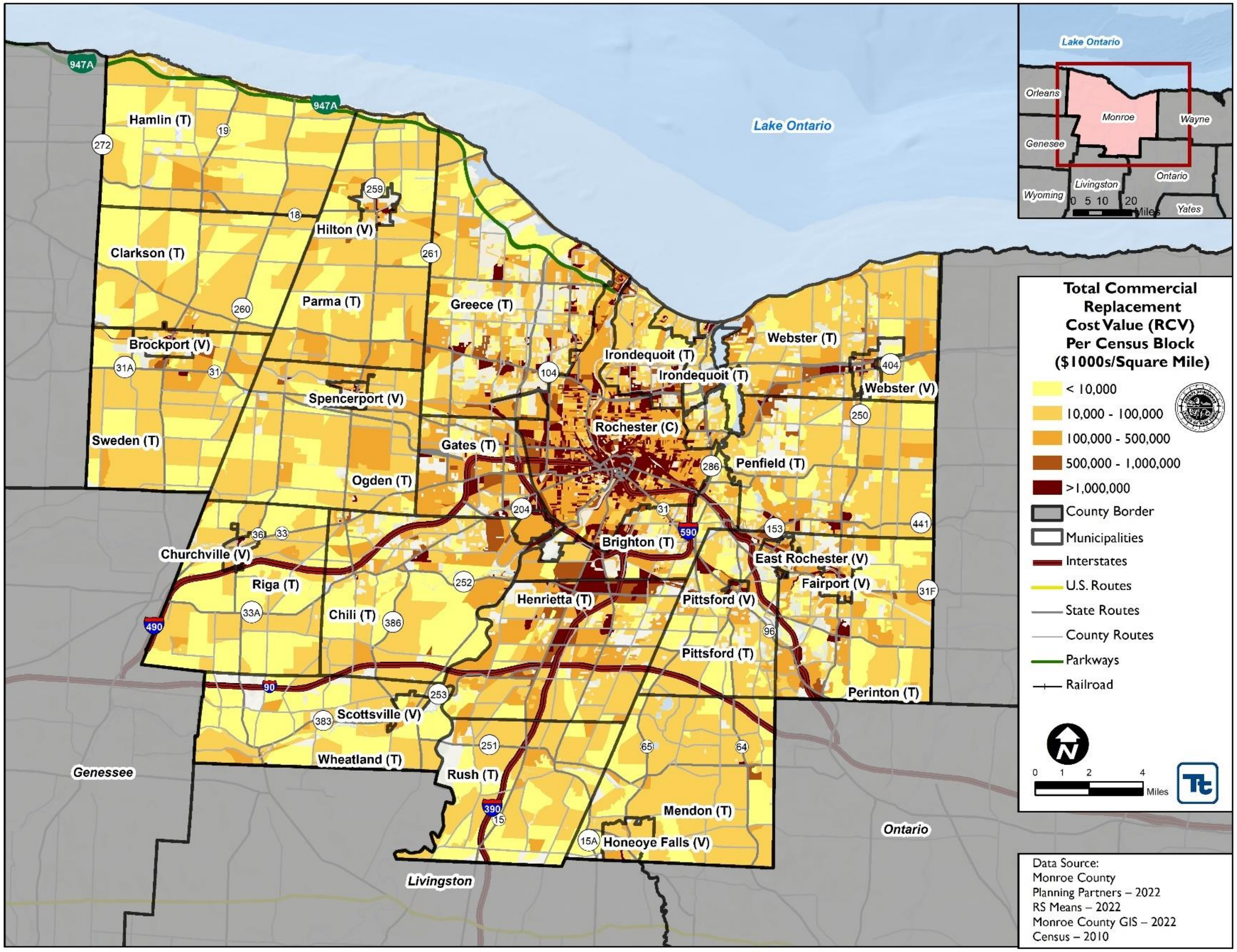
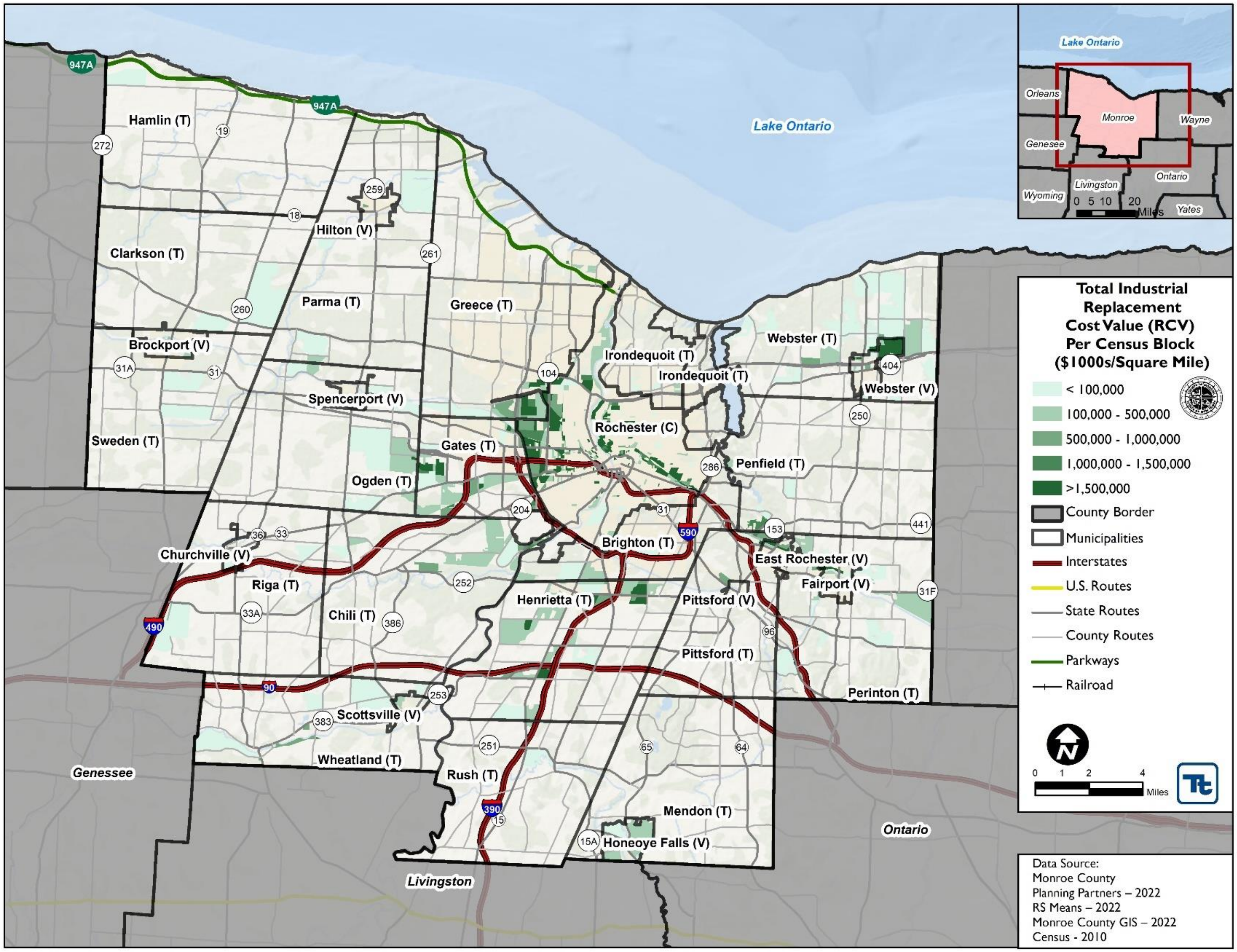


Figure 4-13. Distribution of Industrial Building Stock and Value Density in Monroe County



4.4 Land Use and Population Trends

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. DMA 2000 requires that communities consider land use trends, which can impact the need for, and priority of, mitigation options over time. Land use trends can also significantly impact exposure and vulnerability to various hazards. For example, significant development in a hazard area increases the building stock and population exposed to that hazard.

This section provides a general overview of land use and population trends, and types of development occurring within the County. An understanding of these development trends can assist in planning for further development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect human health and community infrastructure.

4.4.1 Land Use Trends

Monroe County is an urbanizing County, and the most populated County in the nine-county Genesee/Finger Lakes region. Monroe County contains major employers, human services providers, schools and colleges, retail and service businesses, recreational sites, and tourist attractions. Most County and state facilities, as well as regional and national retailers, are located in and around the City of Rochester. The County is home to two Fortune 500 companies – Kodak and Xerox – both of which have significant holdings and operations in the County. The headquarters of both Kodak and Bausch & Lomb, widely known for high quality optical equipment, are located in the City of Rochester. Agriculture is also a major business in Monroe County.

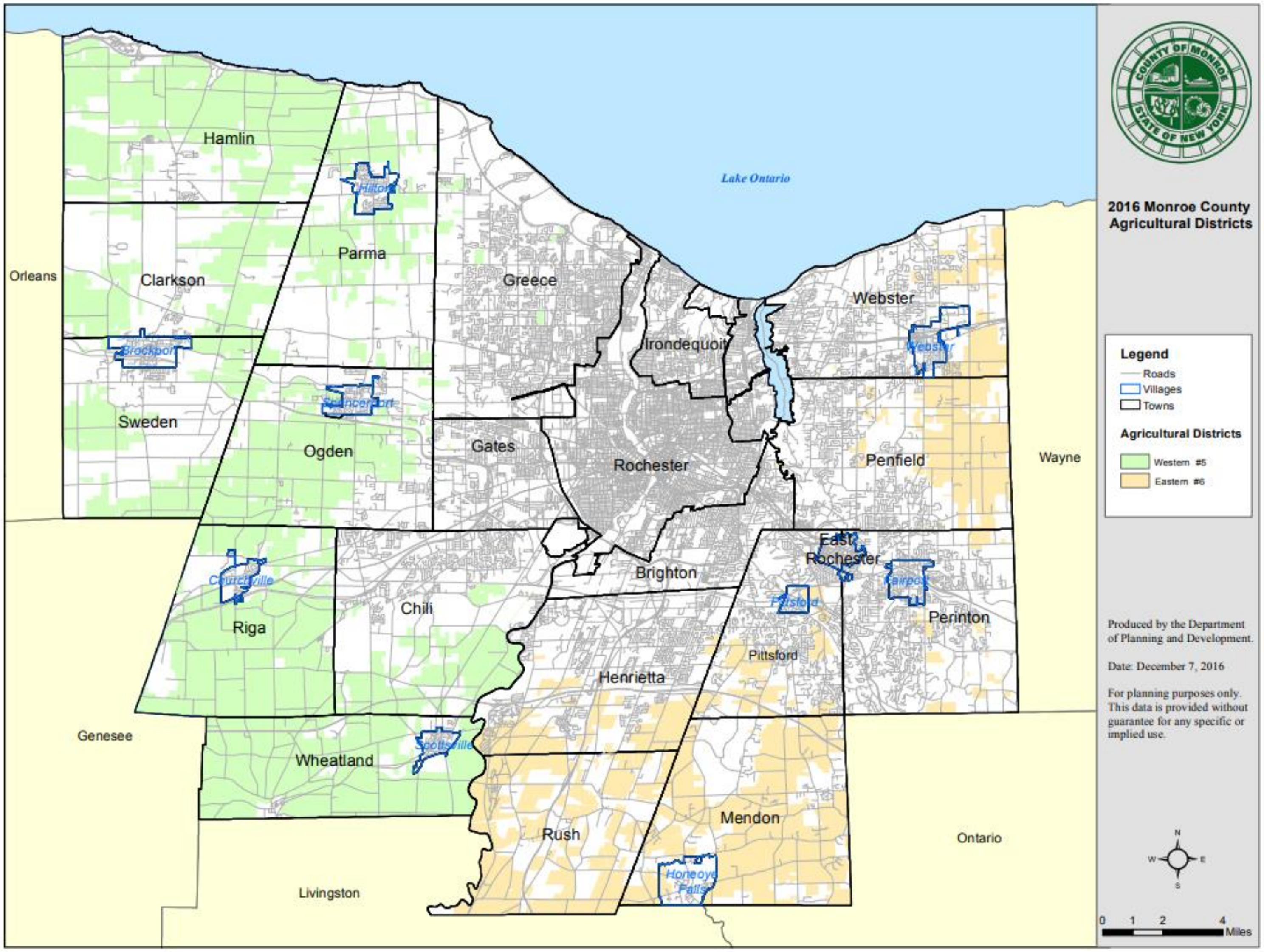
Agriculture

Agriculture in Monroe County has undergone significant changes in recent decades as expanding non-farm development put pressure on landowners for farmland conversion, profitability of certain agricultural markets decreased, and more. According to the 2017 Census of Agriculture, the number of farms in Monroe County has increased 11 percent, total farmland is up 8 percent, and the average size of each farm is down 2 percent since 2012. Between 2012 and 2017, the number of farms increased from 475 to 527, for a total reduction of land in farms of 8,102 acres. However, the market value of products sold in the Monroe County agricultural economies decreased by 15 percent between 2012 and 2017. Combined with an increased number of farms operating, this marked a 24 percent decrease in average market value of products sold per farm (USDA 2017).

The County has a well-developed vegetables, melons, potatoes, and sweet potatoes sector, and is ranked sixth in the state on value of sales by this commodity group. Additionally, Monroe County ranks eighth in the state, and 98th in the nation, for the value of its cut Christmas trees and short rotation woody crops sales (USDA 2017).

Article 25AA of the New York State Agriculture and Markets Law, titled Agricultural Districts, provides counties with the opportunity to create agricultural districts for the purpose of protecting and promoting the agriculture industry. Once created, the law requires that each district must be reviewed on an eight-, ten-, or twelve-year basis to see if it is still achieving its intended purpose. In Monroe County, districts are reviewed every eight years. Monroe County has two agricultural districts. The Western Agricultural District (#5) consists of the Towns of Chili, Clarkson, Gates, Greece, Hamlin, Ogden, Parma, Riga, Sweden, and Wheatland and has a total acreage of 94,077 acres. The Eastern Agricultural District (#6) consists of the Towns of Henrietta, Mendon, Perinton, Penfield, Pittsford, Rush, and Webster and has a total acreage of 47,673 acres (Monroe County 2022).

Figure 4-14. Monroe County Agricultural Districts



Source: Monroe County Department of Planning and Development 2016

Economy

Monroe County's economy is developing into a more diverse economy focused on high-technology industry, education, health care, and a growing small and mid-sized business sector. This transformation reflects the national trend from manufacturing. Locally, significant losses in manufacturing have been offset by gains in other sectors, particularly education and financial activities (ACT Rochester 2022).

The Educational Services and Financial Activities in the region grew between 2001 and 2020 (37 percent and 29 percent), while jobs in the Manufacturing and Information sectors declined (39 percent and 51 percent respectively). The Trade, Transportation, and Utilities sector provided the most jobs in the region at 16 percent of the total in 2020, followed by Health Care and Social Assistance and Professional and Business Services sectors making up 14 percent and 13 percent of the total (ACT Rochester 2022).

The average salary in 2020 in the region of $55,100 was below the state ($83,100) and national ($64,000) figures. All sectors have wages below state figures, and the rate of increase in average salary has consistently lagged in comparison since 2004 (ACT Rochester 2022).

4.4.2 Population Trends

This section discusses population trend information used to estimate future shifts that could significantly change the character of the area. Population trends can provide a basis for making decisions on the type of mitigation approaches to consider and the locations in which these approaches should be applied. This information can also be used to support planning decisions regarding future development in vulnerable areas.

As seen in Table 4-6, Monroe County's population has increased over most decades since 1960. However, the population projections for Monroe County from Cornell University for the next two decades anticipate a peak in population around 2030, followed by a slight drop in population as seen in Table 4-7.

Table 4-6. Population Growth in Monroe County

Population and Projections	Historical						
	1960	1970	1980	1990	2000	2010	2020
Monroe County	586,387	711,917	702,238	713,968	735,343	744,344	753,109
Town of Brighton	27,849	35,065	35,776	34,455	35,588	36,609	37,137
Town of Chili	11,237	19,609	23,676	25,178	27,638	28,625	29,123
Town of Clarkson	2,339	3,642	4,016	4,417	5,928	6,588	6,904
Village of Brockport	5,256	7,878	9,776	8,849	8,103	8,366	7,104
T/V of East Rochester	8,152	8,347	7,596	6,932	6,650	6,587	6,334
Town of Gates	13,755	26,442	29,756	28,583	29,275	28,400	29,167
Town of Greece	48,670	75,136	81,367	90,106	94,141	96,095	96,926
Town of Hamlin	2,755	4,167	7,675	9,203	9,355	9,045	8,725
Town of Henrietta	11,598	33,017	36,134	36,376	39,028	42,581	47,096
Town of Irondequoit	55,337	63,675	57,648	52,377	52,354	51,692	51,043
Town of Mendon	1,759	2,293	3,024	4,505	5,775	6,478	6,389
Village of Honeoye Falls	2,143	2,248	2,410	2,340	2,595	2,674	2,706
Town of Ogden	4,801	8,807	11,269	13,306	14,933	16,255	16,585
Village of Spencerport	2,461	2,929	3,424	3,606	3,559	3,601	3,685
Town of Parma	4,943	8,308	8,434	8,657	8,966	9,747	10,190
Village of Hilton	1,334	2,440	4,151	5,216	5,856	5,886	6,027
Town of Penfield	12,601	23,782	27,201	30,219	34,645	36,242	39,438
Town of Perinton	7,593	21,609	32,359	37,072	40,350	41,109	39,128
Village of Fairport	5,507	6,474	5,970	5,943	5,740	5,353	5,501
Town of Pittsford	8,469	18,441	21,052	23,009	25,801	28,050	25,714
Village of Pittsford	1,749	1,755	1,568	1,488	1,418	1,355	1,419
Town of Riga	1,797	2,681	2,910	3,383	3,550	3,629	3,495
Village of Churchville	1,003	1,065	1,399	1,731	1,887	1,961	2,091
City of Rochester	318,611	296,233	241,741	231,636	219,773	210,565	211,328
Town of Rush	2,555	3,287	3,001	3,217	3,603	3,478	3,490

Population and Projections	Historical 1960	1970	1980	1990	2000	2010	2020
Town of Sweden	1,968	3,583	5,083	5,432	5,757	5,957	6,140
Town of Webster	13,374	19,702	23,426	26,175	32,710	37,242	39,676
Village of Webster	3,060	5,037	5,499	5,464	5,216	5,399	5,651
Town of Wheatland	1,848	2,298	3,108	3,181	3,021	2,774	2,888

Source: Genesee/Finger Lakes Regional Planning Council 2013; US Census 2020

Table 4-7. Population Growth in Monroe County

Population and Projections	Historical							Projected	
	1960	1970	1980	1990	2000	2010	2020	2030	2040
Monroe County	586,387	711,917	702,238	713,968	735,343	744,344	753,109	758,536	751,581

Source: Genesee/Finger Lakes Regional Planning Council 2013; US Census 2020; Cornell PAD projections 2018

4.5 Lifelines and Critical Facilities

Critical infrastructure and facilities are those that are essential to the health and welfare of the population. These facilities are especially important after any hazard event. Critical facilities are those that maintain essential and emergency functions and are typically defined to include police and fire stations, schools, and emergency operations centers. Critical infrastructure can include the roads and bridges that provide ingress and egress and allow emergency vehicles access to those in need and the utilities that provide water, electricity, and communication services to the community. Also included are Tier II facilities (hazardous materials) and rail yards; rail lines hold or carry significant amounts of hazardous materials with a potential to impact public health and welfare in a hazard event (FEMA 1997).

Critical Facilities are those facilities considered critical to the health and welfare of the population and that are especially important following a hazard. As defined for this HMP, critical facilities include transportation systems, lifeline utility systems, high-potential loss facilities, and hazardous material facilities, and essential facilities

Essential facilities are a subset of critical facilities that include those facilities that are important to ensure a full recovery following the occurrence of a hazard event. For the county risk assessment, this category was defined to include police, fire, EMS, schools/colleges, shelters, senior facilities, and medical facilities.

Lifelines enable the continuous operation of critical business and government functions and are essential to human health and safety or economic security.

Beginning in 2017, FEMA developed a new construct to increase effectiveness for disaster operations and position response to catastrophic incidents. This construct, known as “community lifelines”, represents the most fundamental services in the community that, when stabilized, enable all other aspects of society. Following a disaster event, intervention is required to stabilize community lifelines. Lifelines are divided into seven categories which include:

- Safety and Security
- Food, Water, Shelter
- Health and Medical
- Energy (Power and Fuel)
- Communications
- Transportation
- Hazardous Materials

To facilitate consistency with the National Response Framework, FEMA Strategic Plan, and guidance for the Building Resilient Infrastructure and Communities grant program, critical facilities in Monroe County are discussed in terms of lifelines.

A comprehensive inventory of critical facilities and lifelines in Monroe County was developed from various sources including input from the Steering Committee and Planning Partnership. The inventory of critical facilities presented in this section represents the current state of this effort at the time of publication of the HMP and was used for the risk assessment in Section 5 (Risk Assessment).

4.5.1 Safety and Security

This section provides information on Safety and Security lifelines. Components of this lifeline category include law enforcement/security, fire services, search and rescue services, government services, and community safety (e.g., dams) (Figure 4-15).

Emergency Facilities

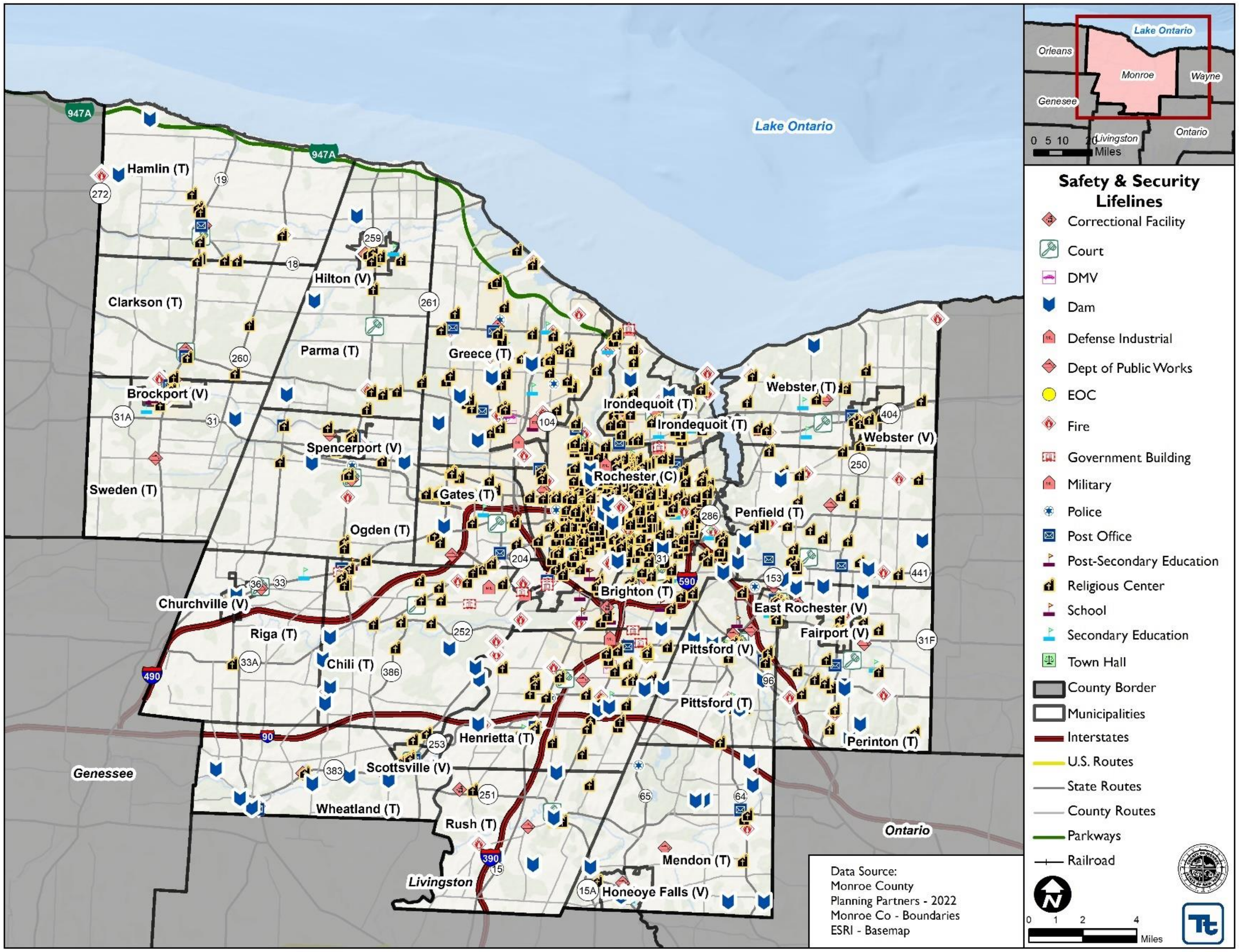
The Monroe County Office of Emergency Management (OEM) is organized into four main tiers: Operations, Planning, Logistics, and Administrative/Financial. The operations tier includes all emergency operations including police, fire/EMS, public works, transportation, and sheltering. The OEM is responsible for aiding communities in emergency planning and response, as well as providing the training and equipment for the county's first responders and volunteers. OEM operates an Emergency Operations Center in the City of Rochester, which is a specially designed facility where public organizations and private-sector agencies meet to decide and coordinate emergency response to community-wide disasters. Additionally, the OEM funds a 24-hour 9-1-1 Center and oversees the operation of the Emergency Communications Department (ECD), operated by the City of Rochester under contract with the County.

The OEM develops, maintains, and executes Monroe County's Comprehensive Emergency Management Plan for disaster relief before, during, and after any type of natural or man-made disaster (or a war-time situation). The OEM also assists towns and villages in the preparation of their emergency response plans. With guidance from FEMA, OEM develops and continually reviews the Monroe County Radiological Emergency Preparedness Plan (MCREPP) in case of an incident at the Ginna nuclear power plant, and conducts multiple exercises annually to test its REPP.

There are 90 fire department facilities in Monroe County serving the County's municipalities. Police enforcement and public safety is maintained by the New York State Police Department, Monroe County Police, and local departments. The Monroe County Sheriff's Office operates two jails and six stations; it also has three boats. The Sheriff's Office patrols towns within Monroe County that do not have their own police patrols and is responsible for primary police patrols at the Greater Rochester International Airport as well as the many parks throughout the County.

Figure 4-15 displays the location of emergency facilities in Monroe County.

Figure 4-15. Safety and Security Facilities In Monroe County



Hospitals and Medical Facilities

The County has multiple hospitals and health care facilities ranging in size and primary function to include smaller community health centers and the larger, regional Strong Memorial Hospital. Hospitals in Monroe County consist of three "systems" – University of Rochester Medical Center, including Strong Memorial Hospital and Highland Hospital; Rochester General Health System, including Rochester General Hospital; and Unity Health System, including Unity Hospital (former Park Ridge Hospital) and the Genesee Street campus (formerly St. Mary's Hospital). All three systems have associated nursing homes, health centers or clinics, and hospital-sponsored medical practices (Monroe County 2017).

Monroe County is also served by a network of federally qualified Community Health Centers (FQHCs) – Jordan, (sites at Holland Street, Woodward, and Brown Square) and Oak Orchard. Inner-city Rochester FQHCs include Clinton Family Health Center, Genesee Health Center, Northeast Health Services, Orchard Street Community Health Center, and Unity Family Medicine Center. St. Joseph's Neighborhood Center and the Mercy Outreach Center, also in the city, are free clinics primarily serving individuals who are uninsured (Monroe County 2017).

For non-emergency health care needs, a number of "urgent care centers" are located throughout the County. Some of these clinics are open 24 hours per day, and most have evening and weekend hours. There are 21 urgent care facilities in the County. The County also has 33 alcohol/drug treatment facilities.

Figure 4-16 displays the location of hospitals and medical facilities in Monroe County.

Schools

There are 255 public and private primary educational facilities (elementary, middle, and high schools) and 17 secondary educational facilities (colleges and universities) located in Monroe County. In times of need, schools can function as shelters and are an important resource to the community. For information regarding shelters, see the Shelters subsection of this document below.

Senior Care and Living Facilities

The County has an extensive system of programs and services for the senior population, including 41 adult care, 33 nursing homes, and 69 Home Care Providers (New York State n.d.). These facilities are highly vulnerable to potential impacts from disasters and knowing the location and numbers of these types of facilities will be effective in managing a response plan pre- and post-disaster. Figure 4-16 displays the location of senior care and living facilities in Monroe County.

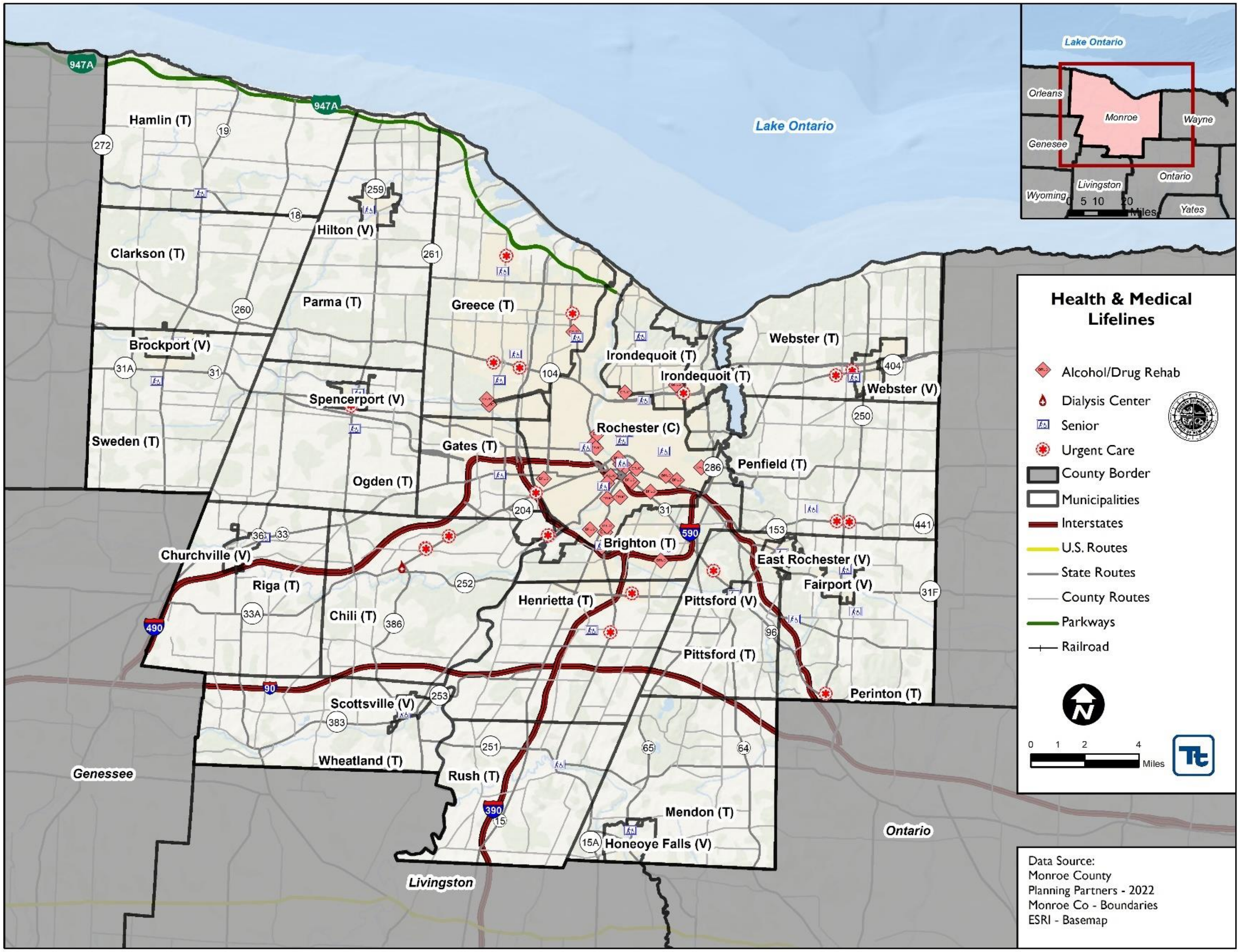
Shelters

With support and cooperation of the American Red Cross and local jurisdictions, the county references an inventory of suitable shelter locations and can assist with the coordination and communication of shelter availability as necessitated by the execution of local municipal emergency operation plans. County-wide sheltering policies and procedures are documented in the following plans, which are maintained by the Monroe County OEM:

- Monroe County Comprehensive Emergency Management Plan
- Monroe County Comprehensive Emergency Management Plan, Mass Sheltering Plan Annex
- Monroe County Radiological Emergency Preparedness Plan (MCREPP)

The County also has 15 homeless shelters facilities.

Figure 4-16. Health and Medical Lifelines in Monroe County



Evacuation Routes

The County has identified evacuation zones for severe weather, maintains specific evacuation plans for radiological emergencies associated with the Ginna Nuclear Power Plant, and can assist with the coordination and communication of evacuation routing as necessitated by the execution of local municipal emergency operation plans.

4.5.2 Transportation Systems

Monroe County's location and extensive transportation network offer residents and employees' various options for transportation throughout the county and the region. The transportation system includes an extensive network of roads, access to national and commuter rail, countywide bus service, an airport providing domestic and international flights, and a commercial shipping port. Major transportation routes through Monroe County include Interstate Routes 90, 490, 590, 390, and 531 and navigable waterways including the Erie Canal and Lake Ontario.

There are 4,648 miles of roadway in Monroe County. The County Department of Transportation is responsible for roughly 1,500 miles of county-owned highways, 180 bridges, and 275 major culverts, and 805 traffic signal and flasher devices as part of the Monroe County highway system (Monroe County 2022).

Interstates (I)-90, I-390, I-490 and I-590 are the primary routes of travel through Monroe County. I-90 traverses the County from the east to the west through the southern section, passing through the Towns of Wheatland, Chili, Henrietta, Pittsford, and Mendon. In the Town of Henrietta, I-90 intersects with I-390, which is a major north-south route carrying traffic up from Livingston County and other points south. I-390 bisects Monroe County, skirting the City of Rochester to the west and ending near the shores of Lake Ontario where the road continues as the Lake Ontario State Parkway. I-490 is the third major route option and is an auxiliary highway offering a direct route into the City of Rochester from where it splits from I-90 on both the southeastern and southwestern corners of the County. I-490 runs along the original path of the Eire Canal through the City of Rochester; it also serves the Villages of Churchville and Pittsford, among others. I-490 connects with I-390 and New York State Route 390/NY 390 just west of the City of Rochester, and with I-590/NY 590 to the east of Rochester. Together, these roads comprise the southernmost portion of the Inner Loop Beltway, which circles around the interior of Rochester. State Route 531 connects I-490 to western suburbs including the Towns of Ogden and Gates, and the Villages of Brockport and Spencerport.

Additionally, State Routes 104, 33, 31, and 36 connect the County to its eastern western, and southern neighbors. SR 104 and SR 31 run east west through the northern and central section of the County, respectively. SR 36 begins at the terminus of SR 531 in the Town of Ogden and runs south through the Town of Riga and Wheatland before connecting with Livingston County. SR 33 connects SR 31 in the City of Rochester directly to the City of Buffalo to the west. SR 33 is mostly a rural highway serving local traffic and it often parallels I-490. Figure 4-17 displays the location of transportation lifelines in Monroe County.

Bus and Other Transit Facilities

Residents of Monroe County have the option of using public transportation through the Regional Transit Service (RTS), the largest subsidiary of the Rochester Genesee Regional Transportation Authority (RGRTA), which includes 216 buses and 41 fixed routes serving a population of nearly 750,000 throughout Monroe County and the surrounding region. RTS provides affordable public transportation to urban, suburban, and rural areas, as well as complimentary paratransit service throughout the region, and currently serves a ridership of over 14 million (RGRTA 2020).

Railroad Facilities

There are two types of rail systems in Monroe County: freight and passenger. There are a total of 10 junctions or freight stations throughout the Rochester area, including Charlotte Yard in the north, Goodman St. Yard in the east, West Ave. Yard near the city center, and Brooks Ave. Yard along the city's southwestern border. These stations and yards serve a number of transportation and freight companies, including CSX Transportation, Inc. (CSXT); CSXT Amtrak; Livonia, Avon & Lakeville Railroad Corp (LAL); and Rochester & Southern Railroad (RSR). As these lines spread out from Rochester, they provide passenger and freight rail at points in Webster (Ontario Midland Railroad Corp [OMID]), Fairport (CSXT Amtrak), Henrietta (LAL), and Chili (CSXT Amtrak and CSXT) (NYS DOT 2019).

Amtrak provides passenger service from Chicago to Washington DC, and also connects through the City of Rochester. The Rochester station is located along Amtrak's Empire Service and provides regional service to New York City, Albany, Syracuse, Buffalo, and Niagara Falls (Amtrak 2022).

The Rochester & Southern Railroad (RSR), owned and operated by Genesee & Wyoming (G&W), is a 58-mile short line freight railroad that interchanges with the Buffalo & Pittsburgh Railroad; Canadian National; Canadian Pacific; CSX Transportation; Livonia, Avon & Lakeville Railroad; and Norfolk Southern. RSR tracks originate in the City of Rochester, sending one line to Buffalo where it connects with a larger network of G&W trains to points south and west; and another to a terminus in Dansville, south of Rochester. Commodities transported by rail include aggregates, brick and cement, chemicals, coal, food and feed products, forest products, and steel and scrap (GWRR 2015).

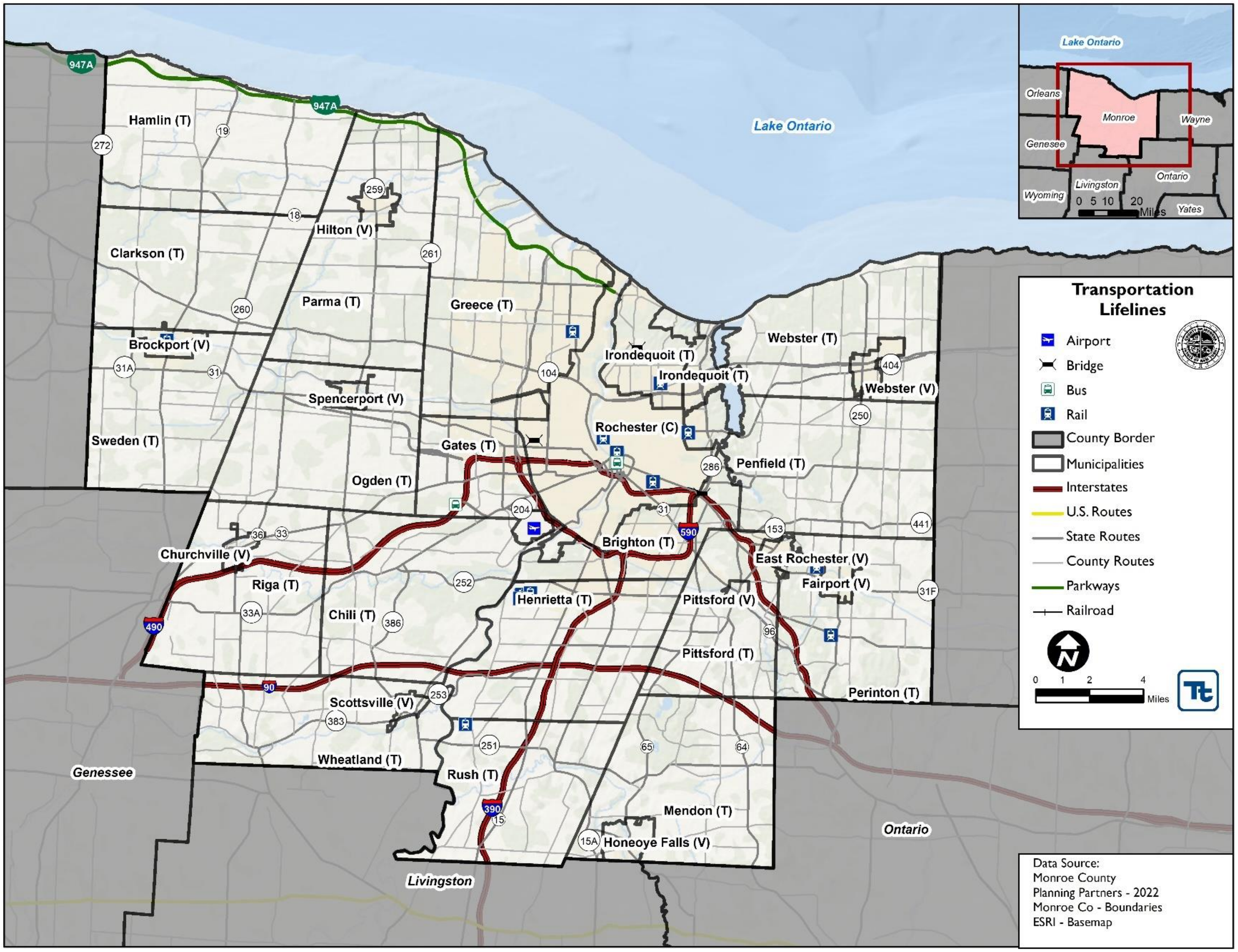
Airports

The Greater Rochester International Airport (ROC) is located 4 miles southwest of downtown Rochester and 12 miles south of Lake Ontario. The airport is the fifth busiest airport in the state of New York and is home to the 642nd Aviation Support Battalion, part of the 42nd Infantry Division. The airport contains a 380,000-square-foot terminal with 22 passenger gates. The airport serviced over 1.5 million passengers in 2021 (US DOT n.d.).

Ferry Service and Ports

The Rochester-Monroe County Port Authority operates a small deep draft commercial harbor at the Genesee River's confluence with Lake Ontario, serving commercial shipping traffic at depths up to 24 feet across a 2.7-mile stretch that includes the Lake Ontario approach, harbor entrance, and Genesee River federal channels. Major partners and operators at port include the Port of Rochester, U.S. Coast Guard, Essroc Cement Corporation and Shellet-Genesee Shipping Group. The Rochester Harbor enables transportation of important commodities and supports $26.8 Million in business revenue, 142 jobs, and $7.4 Million in labor income (USACE 2021).

Figure 4-17. Transportation Lifelines in Monroe County



4.5.3 Lifeline Utility Systems

This section presents data and information on potable water, wastewater, energy resource, and communication utility systems. Due to heightened security concerns, local utility lifeline data sufficient to complete the analysis have only partially been obtained.

Potable Water

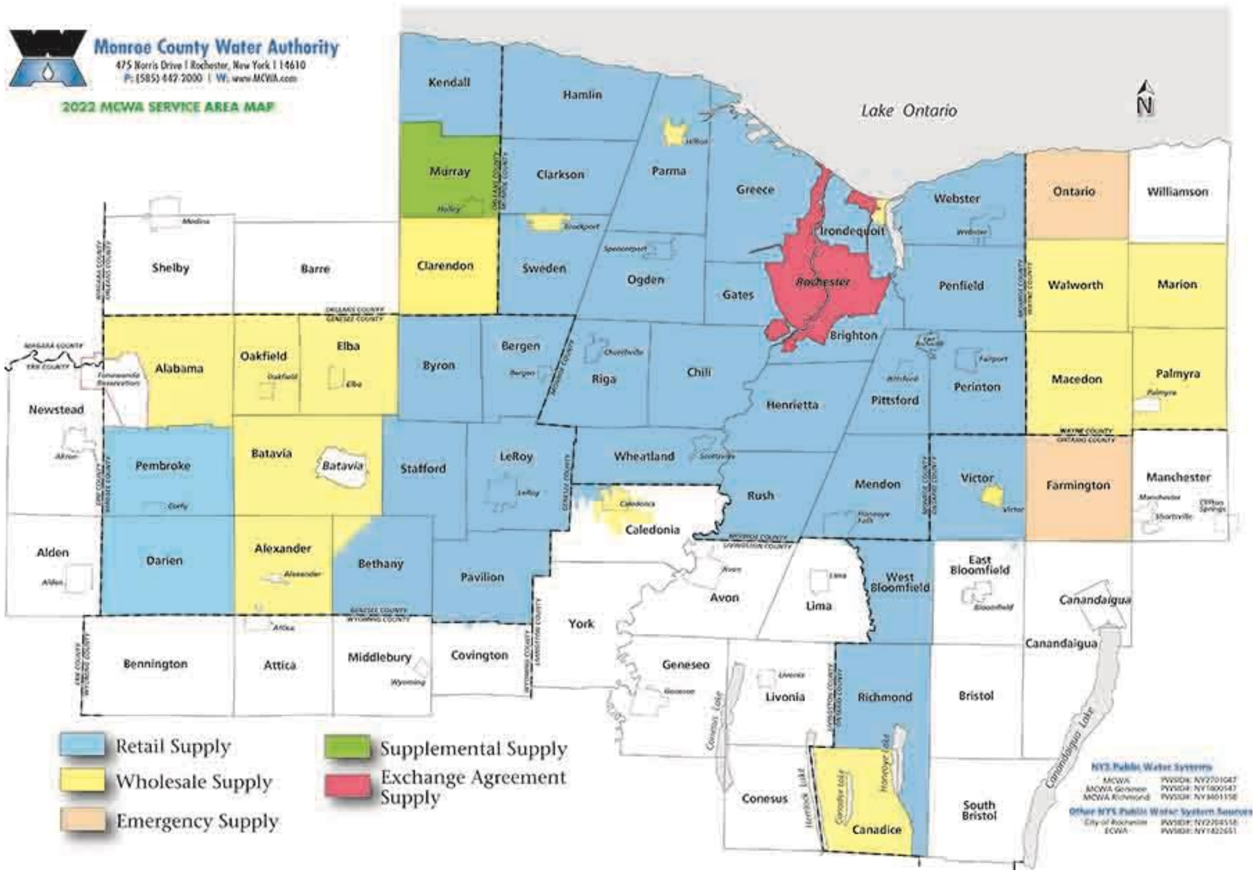
In Monroe County, water is provided from various facilities as a public service or through private supplies, such as wells. Community water suppliers serve most of the county's population while a small portion of the population relies on on-site wells. Figure 4-19 shows the location of water treatment and distribution facilities in Monroe County.

Monroe County's public water supply comes from Lake Ontario, two of the Finger Lakes (Hemlock Lake and Canadice Lake), and from private wells (Monroe County Department of Health 2019). There are two producers of public drinking water within Monroe County: Monroe County Water Authority (MCWA) and City of Rochester Bureau of Water and Lighting. The MCWA is the third largest water supplier in New York State and produces and delivers an average of 20 billion gallons of drinking water every year (MCWA 2021). The Villages of Brockport and Hilton, as well as the Seabreeze Water District community in the Town of Irondequoit, purchase water from MCWA for re-sale to their customers.

Water treatment facilities and distribution systems are not identified for security purposes. Many of the rural areas are dependent on private wells. Several large industries have their own supply source and treatment facilities. Many fire departments have an alternate water source for firefighting. For instance, the City of Rochester has a parallel supply for fire suppression within the downtown area called the "Holley System," and many suburban and rural departments have standpipes on natural waterways.

Water from Lake Ontario, its primary source, is treated at MWCA's Shoremont plant in the Town of Greece and another plant in the Town of Webster. MCWA also operates the Corfu plant, which is a small well supply in the Village of Corfu in Genesee County, and purchases water from the City of Rochester and the Erie County Water Authority (ECWA) (MCWA 2021).

Figure 4-18. Monroe County Water Authority Service Area



Source: *MCWA 2022*
Note: *Monroe County is indicated with the dashed black line.*

Wastewater Facilities

The Monroe County Division of Pure Waters was established by the County's legislature to implement the 1969 Pure Waters Master Plan to reduce the levels of pollution in Irondequoit Bay, the Genesee River, areas of Lake Ontario, and other waters of Monroe County to safe and healthy levels. Today, the County's four sewer districts contain several miles of major interceptor tunnel, two wastewater treatment facilities, pump stations and the sewer collection systems for the Rochester and Gates-Chili-Ogden districts (Monroe County Pure Waters 2022).

The sewer system operated by Monroe County is spread over four sewer districts (Northwest, Gates Chili Ogden, Rochester, and Irondequoit Bay) and serves a population of over 500,000 people. Collection sewers in other districts are operated, maintained, and funded by local municipalities. The districts obtain the majority of their revenue from user charges. In Monroe County, wastewater is collected by a system of underground pipes, or sewers, which carry it to wastewater treatment facilities (WWTF).

Monroe County contains five treatment facilities, most of which are located near bodies of water into which the treated wastewater is discharged. Other wastewater treatment plants that discharge into the Genesee River include those from the Village of Honeoye Falls and Kodak's King's Landing. The County's VanLare and Northwest Quadrant plants are located on the south shore of Lake Ontario. The VanLare plant, first opened in 1916, is the largest WWTF in the County with a permitted flow of 135 million gallons per day (mgd). The

VanLare plant is capable of handling 660 mgd during storm events. The Northwest Quadrant facility is located in the Town of Hilton and has an operating permit for flow of 22 mgd and handles 14 mgd of primarily residential wastewater (Rochester Subway 2022). Figure 4-19 shows the location of wastewater facilities in Monroe County.

Energy Resources

Gas and electric power in Monroe County are transmitted and distributed by three companies: Rochester Gas and Electric Corporation (RG&E), New York State Gas and Electric Corporation (both Avangrid companies), and National Grid. Homes in the County are heated by many different sources, with a majority using utility gas or fuel oil. In addition, there are three municipal electric providers and one municipal natural gas provider. Some areas are dependent on residential propane tanks for gas service. Figure 4-20 displays the location of energy lifelines in Monroe County.

Communications

Monroe County is served by a variety of communications systems, including traditional land line, fiber optic, and cellular service provided by multiple companies, such as Verizon, Direct TV, and Time Warner and Frontier Communications. Each carrier has individual plans for emergency situations during hazard events and post-disaster recovery efforts. In addition to land line, fiber optic and cellular communications systems, Monroe 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 61 communication facilities in Monroe County identified as critical facilities. Figure 4-21 displays the location of these facilities.

Figure 4-19. Food, Water, and Shelter Lifelines in Monroe County

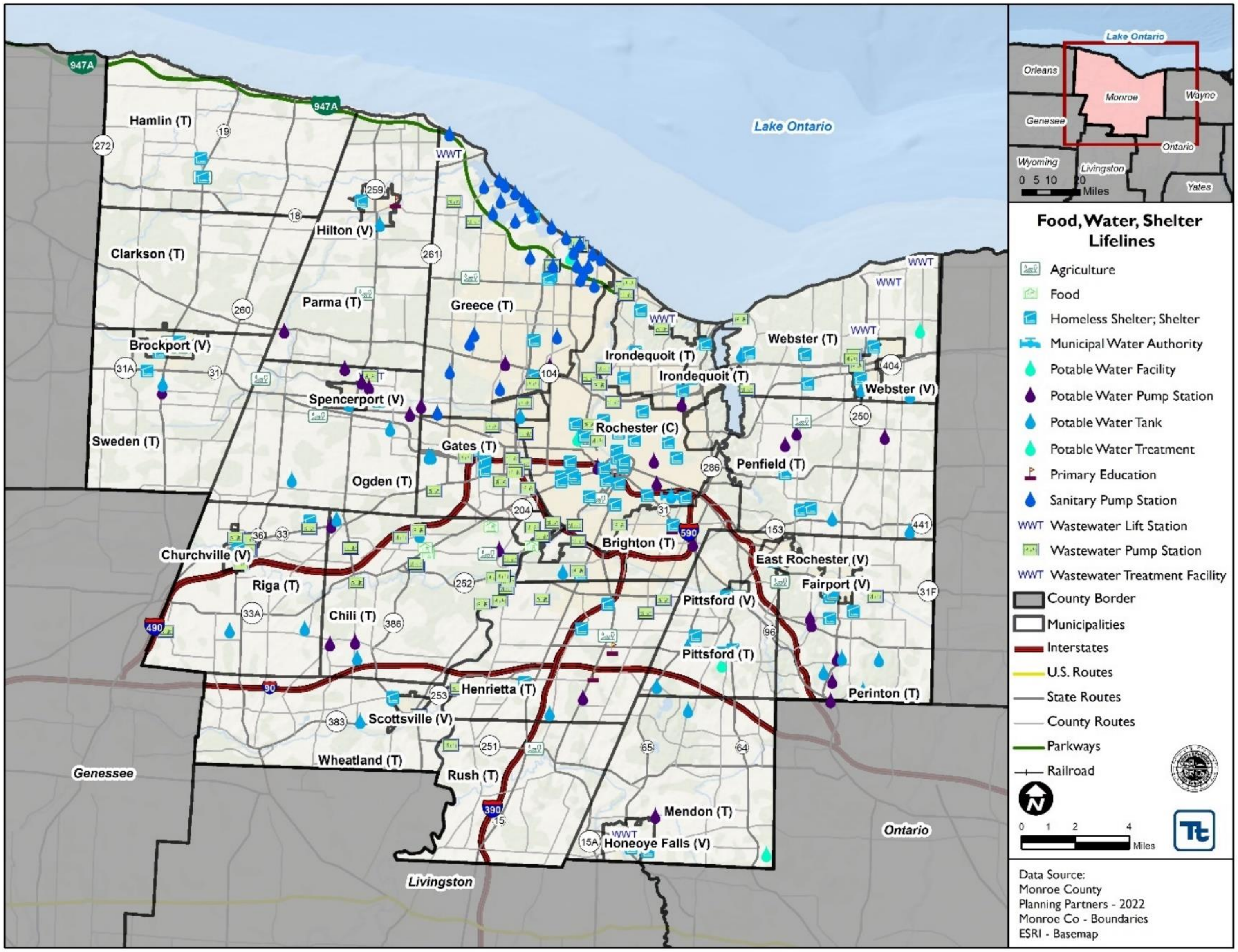


Figure 4-20. Energy Lifelines in Monroe County

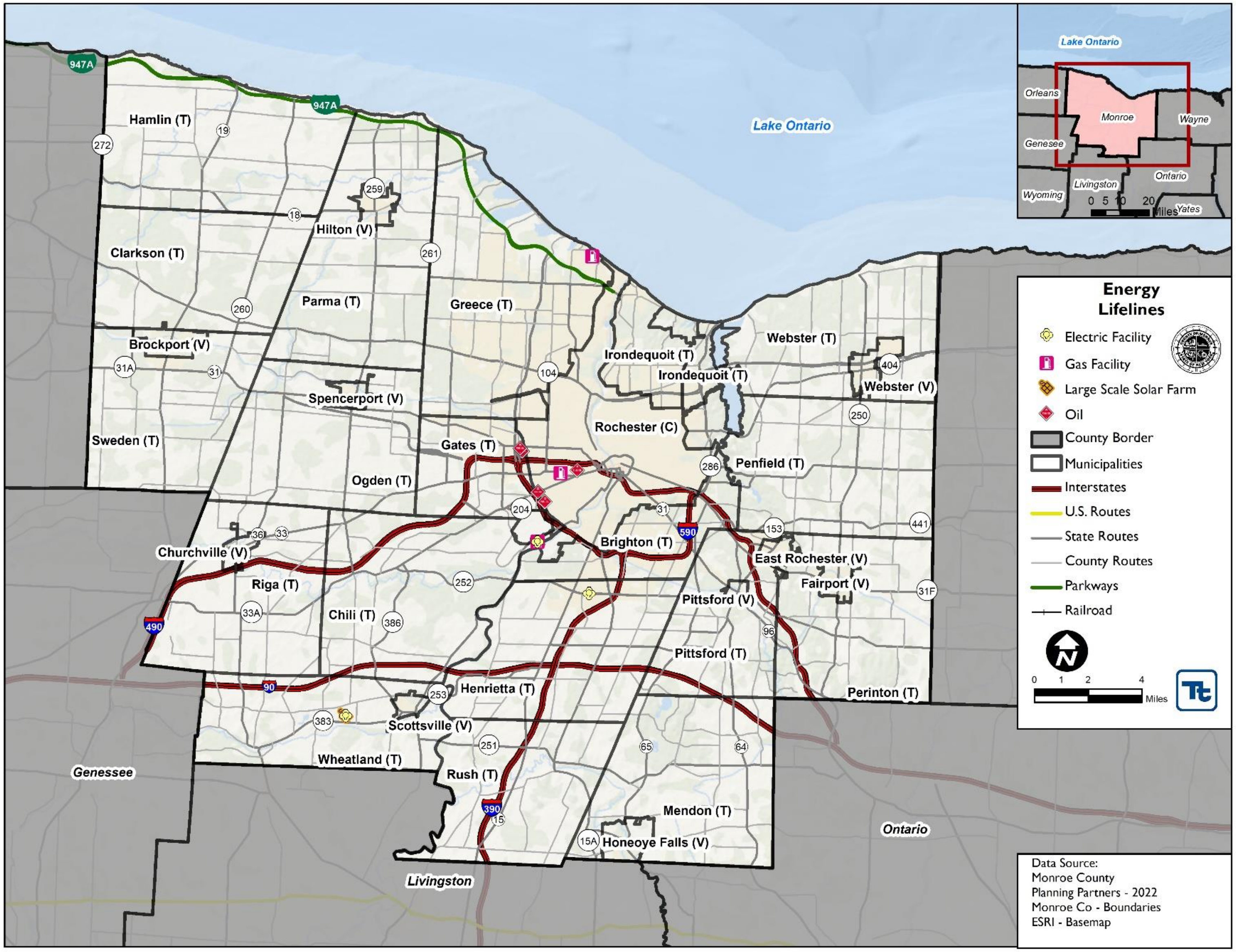
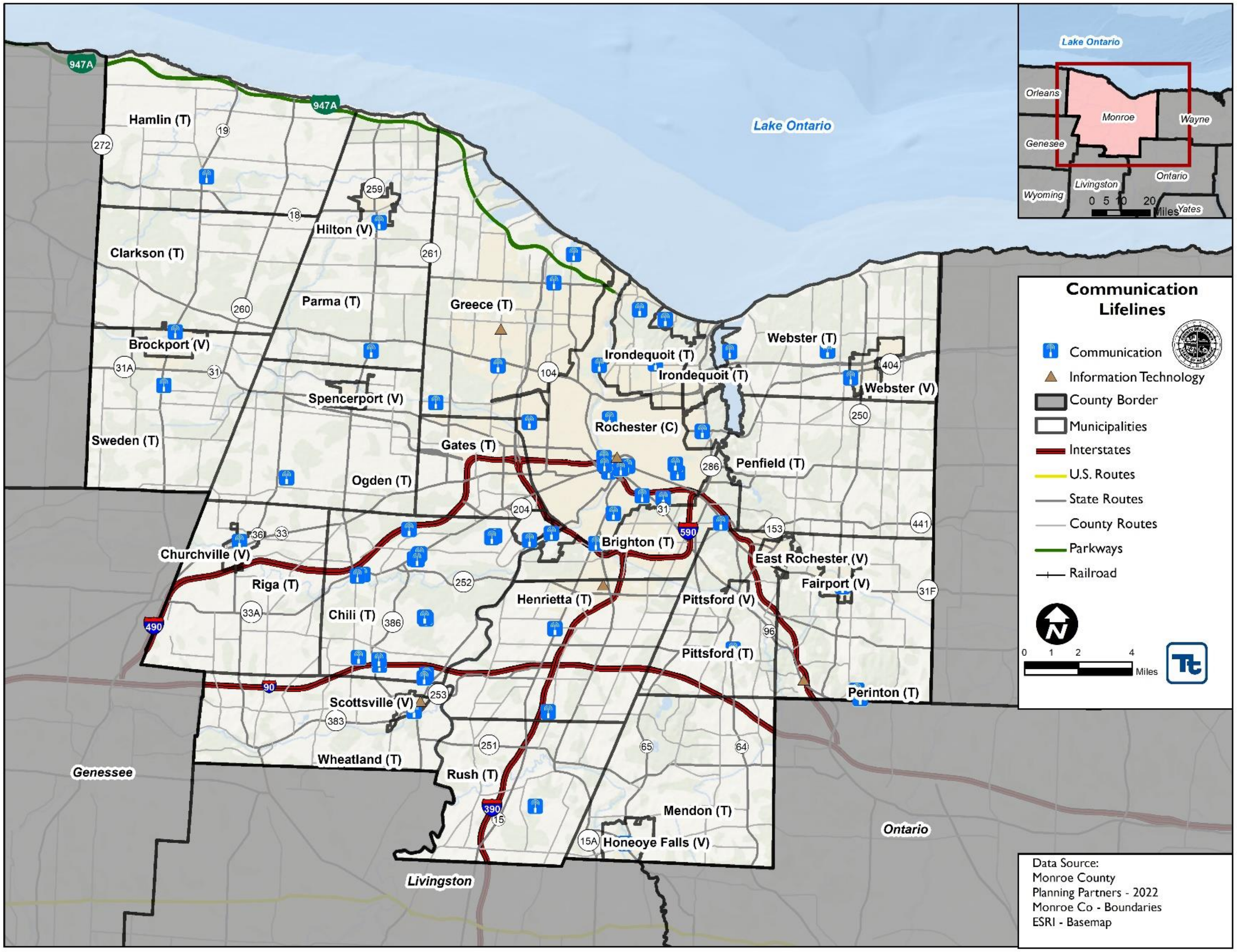


Figure 4-21. Communications Lifelines in Monroe County



4.5.4 High-Potential Loss Facilities

High-potential loss facilities include dams, levees, hazardous materials (HAZMAT) facilities, nuclear power plants, and military installations. The Ginna Nuclear Power Station is located in Wayne County near the northeastern border of Monroe County. Dams are also discussed below.

Military Installations

The 42nd Infantry Division and 53rd Troop Command of the National Guard have guardsmen that report to locations throughout the county. The only other noteworthy military installation in the County is a U.S. Coast Guard station near Lake Ontario and the Genesee River.

HAZMAT Facilities

The U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) (Superfund) Public Access Database (CPAD) reports that there are currently no Superfund sites in Monroe County. Superfund sites are polluted locations requiring a long-term response to clean up hazardous material contaminations.

Abandoned hazardous waste sites placed on the federal National Priorities List (NPL) 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 2022, Monroe County has no inactive hazardous sites in the federal Superfund Program that are listed on the NPL (CERCLIS 2021).

In addition to the hazardous waste sites, there are numerous hazardous facilities in Monroe County cataloged by the NYS DEC’s Bulk Storage Program Database. The Bulk Storage Program includes three types of facilities: Petroleum Bulk Storage (PBS), Major Oil Storage Facilities (MOSF), and Chemical Bulk Storage (CBS). Registration with NYS DEC is mandatory for all PBS facilities with a total storage capacity of 1,100 gallons or more; all CBS underground tanks and all stationary aboveground tanks with a capacity of 185 gallons or more; and all MOSF sites storing more than 400,000 gallons of petroleum products. As of August 2022, there are roughly 2,100 sites in the DEC’s Bulk Storage Program Database in Monroe County, NY (NYS DEC 2022).

Dams and Levees

According to the NYSDEC Division of Water Bureau and Flood Protection and Dam Safety, there are three hazard classifications of dams in New York State. The dams are classified in terms of potential for downstream damage if the dam were to fail. The hazard classifications are as follows:

- *Low Hazard (Class A)* is a dam located 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 mis-operation would result in no probable loss of human life. Losses are principally limited to the owner's property
- *Intermediate Hazard (Class B)* is a dam located in an area where failure may damage isolated homes, main highways, and minor railroads; interrupt the use of relatively important public utilities; and will cause significant economic loss or serious environmental damage. Failure or mis-operation would result in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Class B 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)* is a dam located 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 will cause extensive economic loss. This is a downstream hazard classification for dams

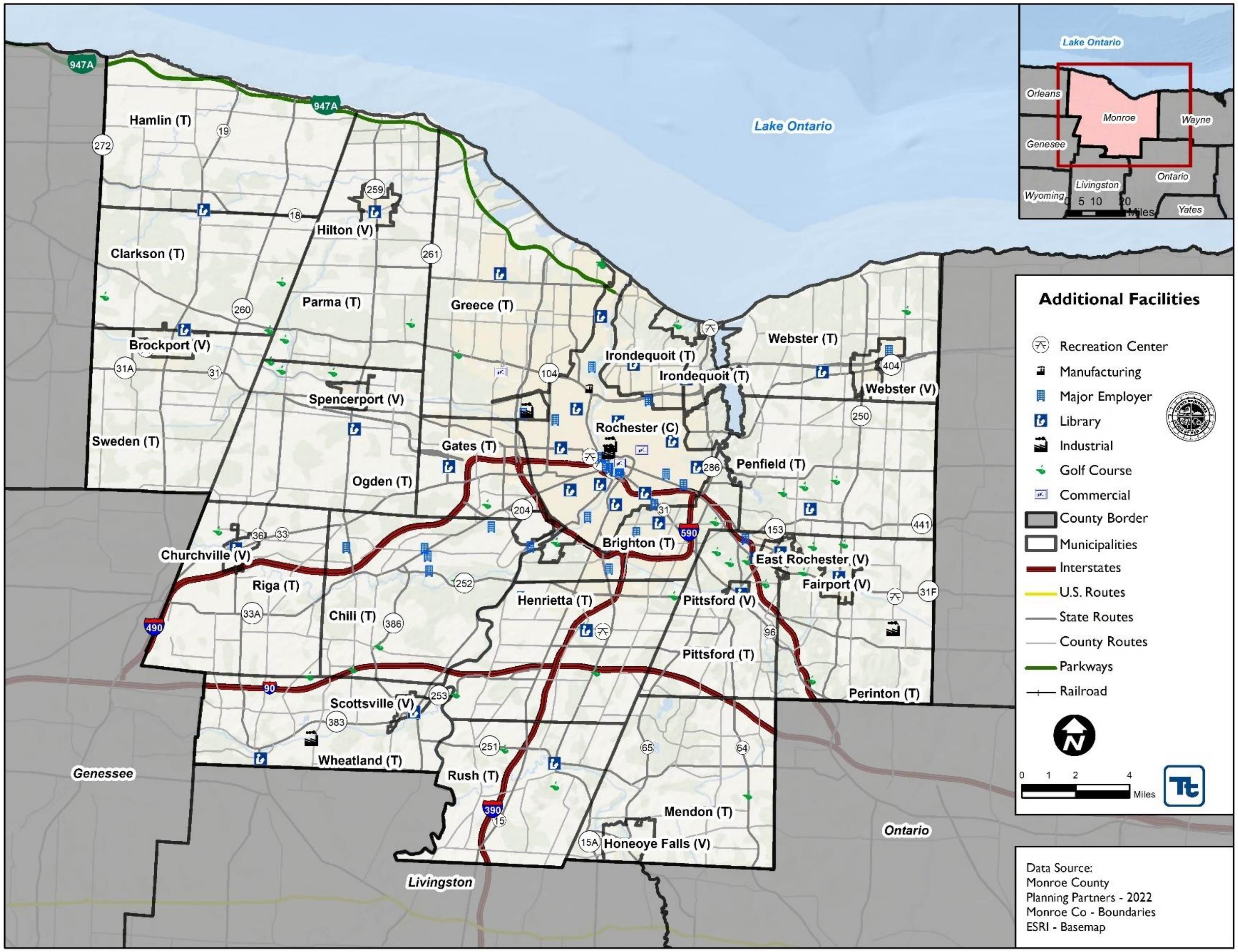
in which excessive economic loss (urban area including extensive community, industry, agriculture, or outstanding natural resources) would occur as a direct result of dam failure (NYS DEC n.d.).

According to the USACE National Inventory of Dams (NID), there are 31 dams located within Monroe County with 14 listed as high hazard, 9 listed as significant hazard, and 8 listed as low hazard (USACE n.d.). For the purpose of this plan, the NYSDEC data from the New York State GIS Clearinghouse will be used. According to the GIS data, there are 81 dams located in Monroe County (9 high hazard, 6 intermediate hazard, 43 low hazard, and 23 negligible or no hazard dams). According to the National Levee Database maintained by USACE, there are no levees in Monroe County (USACE n.d.). Refer to Appendix H for the names and locations of the dams found in the County.

4.5.5 Other Facilities

The Planning Partnership also identified additional critical facilities including municipal buildings, government facilities, major employers, and more. These facilities were included in the risk assessment conducted for the County. Figure 4-22 shows the locations of these facilities in the County.

Figure 4-22. Other Facilities in Monroe County



SECTION 5 . RISK ASSESSMENT

A risk assessment is the process of measuring the potential loss of life, personal injury, and economic and property damage resulting 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 to a specified hazard. Past, present, and future conditions must be evaluated to most accurately assess risk for the county and each jurisdiction. The process focuses on the following elements:

- **Hazard identification**—Use all available information to determine what types of hazards may affect a jurisdiction.
- **Profile each hazard**—Understand each hazard in terms of:
    - Extent—Severity of each hazard.
    - Location—Geographic area most affected by the hazard.
    - Previous occurrences and losses
    - Impacts of Climate Change
    - Probability of Future Hazard Events
- **Assess Vulnerability**
    - Exposure identification—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.
    - Vulnerability identification and loss estimation—Assess the impact of hazard events on the people, property, economy, and lands of the region, including estimates of the cost of potential damage or cost that can be avoided by mitigation.
    - Future changes that may impact vulnerability—Analyze how demographic changes, projected development and climate change impacts can alter current exposure and vulnerability.

This section presents the Monroe County risk assessment and is outlined as follows:

- Methodology and tools used to conduct the risk assessment
- Identification of hazards of concern that impact Monroe County
- Hazards of concern profiles and vulnerability assessment
- Hazard ranking

5.1 METHODOLOGY AND TOOLS

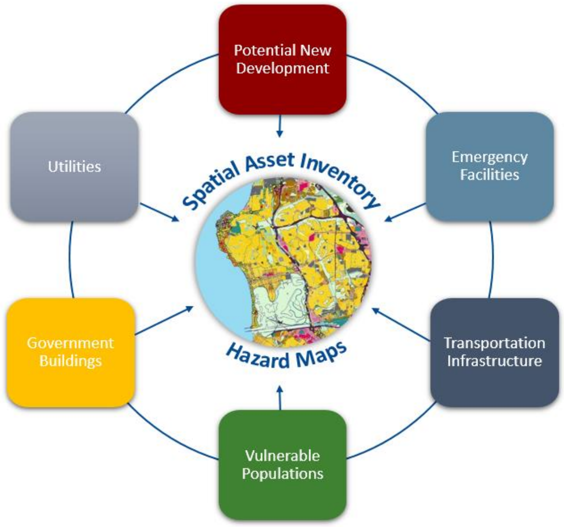
The Monroe County risk assessment was updated using the following best-available information:

- A new building stock inventory was generated using 2022 building footprints, tax assessor and parcel data provided by Monroe County GIS; and 2022 RSMeans cost adjustment values.
- 2020 Decennial Census Population data and 2016-2020 American Community Survey 5-year Population Estimates were utilized.
- Critical facilities were updated and reviewed by the Planning Partnership and county jurisdictions.
- Lifelines were identified in the critical facility inventory to align with Federal Emergency Management Agency's (FEMA) lifeline definition.
- Hazards-U.S. (Hazus) was used to estimate potential impacts to the flood, wind, and seismic hazards.
- Best-available hazard data were used, as described in this section.

The following sections summarize the asset inventories, methodology and tools used to support the risk assessment process.

5.1.1 Asset Inventories

Monroe County assets were identified to assess potential exposure and loss associated with the hazards of concern. For the HMP update, Monroe County assessed exposure and vulnerability of the following types of assets: population, buildings, critical facilities, lifelines, infrastructure, new development, and the environment. Some assets may be more vulnerable because of their physical characteristics or socio-economic uses. To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual personal or public properties. Each asset type is described below.



The risk assessment included the collection and use of an expanded and enhanced asset inventory to estimate hazard exposure and vulnerability.

Population

Total population statistics from the 2020 Decennial Census Population estimate and 2016-2020 American Community Survey (ACS) 5-year estimate were used to estimate the exposure and potential impacts to the county's population in place of the 2010 U.S. Census block estimates. To determine population statistics for village and towns, village population totals were subtracted from the total town population. 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 respective town. Population counts at the jurisdictional level were averaged among the residential structures in the county to estimate the population at the structure level. This estimate provides a more precise distribution of population across the county compared to only using the Census block or Census tract boundaries. Limitations of these analyses are recognized, and thus the results are used only to provide a general estimate for planning purposes.

FEMA's Hazus program was used to model estimated potential losses to flood, seismic and wind hazards; as discussed further later in this section. Hazus still contains 2010 U.S. Census data and was used to estimate sheltering and injuries as part of the hazard analysis.

As discussed in Section 4, County Profile, research has shown that some populations are at greater risk from hazard events because of decreased resources or physical abilities. Vulnerable populations in Monroe County included in the risk assessment are children, elderly, population below the poverty level, non-English speaking individuals, and persons institutionalized with a disability.

Buildings

A custom general building stock was created countywide. The general building stock was updated countywide with a custom-building inventory using 2022 building stock footprints provided by Monroe County GIS. The building inventory attributes were updated using 2022 parcel tax assessor information provided by Monroe County GIS. Attributes provided in the associated files were used to further define each structure, such as year built, number of stories, basement type, occupancy class, and square footage. The centroid of each building footprint was used to estimate the building location. Structural and content replacement cost values (RCV) were calculated for each building using the available assessor data, the building footprint, and RSMeans 2022 values. The analysis used a location factor associated by location zip-code, which produced location factors of 1.00 and

1.00 for residential and non-residential occupancy classes, respectively. RCV is the current cost of returning an asset to its pre-damaged condition using present-day cost of labor and materials. Total RCV consists of both the structural cost to replace a building and the estimate value of contents of a building. The occupancy classes available in Hazus were condensed into the categories of residential, commercial, industrial, agricultural, religious, governmental, and educational to facilitate analysis and presentation of results. Residential loss estimates addressed both multi-family and single-family dwellings.

Critical Facilities and Lifelines

*A **lifeline** provides indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security (FEMA).*

A critical facility inventory, which includes essential facilities, utilities, transportation features and user-defined facilities, was created by the Planning Partnership and county jurisdictions. 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 in accordance with FEMA's definition (refer to Appendix G, Critical Facilities). To protect individual privacy and the security of assets, information is presented in aggregate, without details about specific individual properties or facilities.

Environment and Land Use Area

National land use land cover data created by the U.S. Geological Survey (USGS) in 2021 was used to assess land use characteristics of the county. This dataset was converted from a raster to a vector polygon, which informed spatial areas of built and natural land use areas. The built land use areas were defined as urban areas and include developed open space, low, medium, and high intensity locations. Non-urban areas were extracted into agricultural, barren land, forest, rangeland, water, and wetlands land use categories.

New Development

In addition to assessing the vulnerability of the built environment, Monroe County examined recent development over the last 5 years and anticipated new development in 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.

New development was identified as (1) anticipated in the next 5 years and (2) recently developed over the last 5 years. An exposure analysis was conducted in geographic information system (GIS) to determine hazard exposure to these development sites. Projects built on multiple parcels were assessed as one unit. If one parcel identified within the project boundary intersected a spatial hazard layer, the entire project was considered "exposed" to the hazard area of concern.

Identifying these changes and integrating new development into the risk assessment provides communities information to consider when developing the mitigation strategy to reduce these vulnerabilities in the future (one tool in the Mitigation Toolbox discussed in Section 6, Mitigation Strategy. The new development is listed in Section 4, County Profile, and hazard exposure analysis results are presented in Section 9, Jurisdictional Annexes, as a table in each annex.

5.1.2 Methodology

To address the requirements of the DMA 2000 and to better understand potential vulnerability and losses associated with hazards of concern, Monroe County used standardized tools, combined with local, state, and federal data and expertise to conduct the risk assessment. Three different levels of analysis were used depending upon the data available for each hazard as described below. Table 5.1-1 summarizes the type of analysis conducted by hazard of concern.

1. **Historic Occurrences and Qualitative Analysis** – This analysis includes an examination of historic impacts to understand potential impacts of future events of similar size. In addition, potential impacts and losses are discussed qualitatively using best-available data and professional judgement.
2. **Exposure Assessment** – This analysis involves overlaying available spatial hazard layers, or hazards with defined extent and locations, with assets in GIS to determine which assets are located in the impact area of the hazard. The analysis highlights which assets are located in the hazard area and may incur future impacts.
3. **Loss Estimation** — The FEMA Hazus modeling software was used to estimate potential losses for the following hazards: flood, earthquake, and hurricane. In addition, an examination of historic impacts and an exposure assessment was conducted for these spatially-delineated hazards.

Table 5.1-1. Summary of Risk Assessment Analyses

Hazard	Population	General Building Stock	Critical Facilities	New Development
Disease Outbreak	Q	Q	Q	Q
Drought	Q	Q	Q	Q
Earthquake	E, H	E, H	E, H	E
Extreme Temperature	Q	Q	Q	Q
Flood	E, H	E, H	E, H	E, H
Hazardous Materials	Q	Q	Q	Q
Infestation and Invasive Species	Q	Q	Q	Q
Landslide	E	E	E	E
Severe Storm	H	H	H	H
Severe Winter Storm	Q	Q	Q	Q
Wildfire	E	E	E	E

Notes: E = Exposure analysis; H = Hazus analysis; Q = Qualitative analysis

Hazards U.S. – Multi-Hazard (Hazus-MH)

In 1997, FEMA developed a standardized model for estimating losses caused by earthquakes, known as Hazards U.S. or Hazus. Hazus was developed in response to the need for more effective national-, state-, and community-level planning and the need to identify areas that face the highest risk and potential for loss. Hazus was expanded into a multi-hazard methodology, Hazus with new models for estimating potential losses from wind (hurricanes) and flood (riverine) hazards. Hazus is a GIS-based software tool that applies engineering and scientific risk calculations, which have been developed by hazard and information technology experts, to provide defensible damage and loss estimates. These methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards. The GIS framework also supports the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

Hazus uses GIS technology to produce detailed maps and analytical reports that estimate a community's direct physical damage to building stock, critical facilities, transportation systems and utility systems. To generate this information, Hazus uses default data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. Damage reports can include induced damage (inundation, fire, threats posed by hazardous materials and debris) and direct economic and social losses (casualties, shelter requirements, and economic impact) depending on the hazard and available local data. Hazus' open data architecture can be used to manage community GIS data in a central location. The use of this software also promotes consistency of data output now and in the future and standardization of data collection and storage. More information on Hazus is available at http://www.fema.gov/hazus.

In general, modeled losses were estimated in the program using depth grids for the flood analysis and probabilistic analyses were performed to develop expected or estimated distribution of losses (mean return period losses) for hurricane wind and seismic hazards. The probabilistic model generates estimated damages and losses for specified return periods (e.g., 100- and 500-year). Table 5.1-2 displays the various levels of analyses that can be conducted using the Hazus software.

Table 5.1-2. Summary of Hazus Analysis Levels

Hazus Analysis Levels	
Level 1	Hazus provides hazard and inventory data with minimal outside data collection or mapping.
Level 2	Analysis involves augmenting the Hazus provided hazard and inventory data with more recent or detailed data for the study region, referred to as "local data"
Level 3	Analysis involves adjusting the built-in loss estimation models used for the hazard loss analyses. This Level is typical done in conjunction with the use of local data.

Disease Outbreak

All of Monroe County is at risk to impacts from disease outbreaks. Refer to Section 5.4.1 for the qualitative analysis summarizing the county's vulnerability to this hazard of concern.

Drought

All of Monroe County is at risk to impacts from drought events. Refer to Section 5.4.2 for the qualitative analysis summarizing the county's vulnerability to this hazard of concern.

Earthquake

A probabilistic assessment was conducted for Monroe County for the 100-year and 500-year mean return period (MRPs) events through a Level 2 analysis in Hazus to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information from historic earthquakes and inferred faults, locations, and magnitudes, and computes the probable ground shaking levels that may be experienced during a recurrence period by Census tract.

As noted in the Hazus Earthquake User Manual, "*Although the software offers users the opportunity to prepare comprehensive loss estimates, it should be recognized that uncertainties are inherent in any estimation methodology, even with state-of-the-art techniques. Any region or city studied will have an enormous variety of buildings and facilities of different sizes, shapes, and structural systems that have been constructed over a range of years under diverse seismic design codes. There are a variety of components that contribute to transportation and utility system damage estimations. These components can have differing seismic resistance*" (FEMA 2020). However, Hazus' potential loss estimates are acceptable for the purposes of this HMP.

Ground shaking is the primary cause of earthquake damage to man-made structures and soft soils amplify ground shaking. One contributor to the site amplification is the velocity at which the rock or soil transmits shear waves (S-waves). The National Earthquake Hazard Reductions Program (NEHRP) has developed five soil classifications defined by their shear-wave velocity that impact the severity of an earthquake. The soil classification system ranges from A to E, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Class D and E NEHRP soils are the two classes most susceptible to amplified ground motion during an earthquake.

An exposure 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 exposure analysis focused on soil types that would experience amplified ground motion during an earthquake (i.e., Class D and E). Assets with their centroid in the hazard areas were totaled to estimate the numbers and values vulnerable to these soil types.

Data from New York State were 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 damages are 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 are calculated for losses to buildings (structural and non-structural) and contents; structural losses include load carrying components of the structure, and non-structural losses include those to architectural, mechanical, and electrical components of the structure, such as nonbearing walls, veneer and finishes, HVAC systems, boils, etc.

Extreme Temperature

All of Monroe County is at risk to impacts from extreme temperature events. Refer to Section 5.4.4 for the qualitative analysis summarizing the county's vulnerability to this hazard of concern.

Flood

The 1- and 0.2-percent annual chance flood events were examined to evaluate the county's risk from the flood hazard. These flood events are generally those considered by planners and evaluated under federal programs such as NFIP.

The following data were used to evaluate exposure and determine potential future losses for this plan update:

- The Monroe County FEMA Effective Digital Flood Insurance Rate Map (DFIRM) dated August 28, 2008
- A depth grid was created by use of base-flood elevation and cross section data from the 2008 effective FEMA Digital Flood Insurance Rate Map (DFIRM) and the 1/3 arc-second Digital Elevation Map (DEM) model provided by the U.S. Geological Survey (USGS); for areas without elevation data from FEMA, those data were generated by use of the HAZUS-MH Enhanced Quick Look tool.

The effective Monroe County FEMA DFIRM published in 2008 was used to evaluate exposure and determine potential future losses. The depth grid generated using the DFIRM and 1/3 arc-second DEM was integrated into the Hazus riverine flood model and used to estimate potential losses for the 1-percent annual chance flood event.

To estimate exposure 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). Centroids that intersected the flood boundaries were totaled to estimate the building RCV and population vulnerable to the flood inundation areas. A Level 2 Hazus riverine flood analysis was performed. Both the critical facility and building inventories were formatted to be compatible with Hazus and its Comprehensive Data Management System (CDMS). Once updated with the inventories, the Hazus riverine flood model was run to estimate potential losses in Monroe County for the 1-percent annual chance flood events. A user-defined analysis was also performed for the building stock. Buildings located within the floodplain were imported as user-defined facilities to estimate potential losses to the building stock at the structural level. Hazus calculated the estimated potential losses to the population (default 2010 U.S. Census data across dasymetric blocks), potential damages to the general building stock, and potential damages to critical facility inventories based on the depth grids generated and the default Hazus damage functions in the flood model.

Hazardous Materials

All of Monroe County is at risk to impacts from hazardous materials. Refer to Section 5.4.6 for the qualitative analysis summarizing the county's vulnerability to this hazard of concern.

Infestation and Invasive Species

All of Monroe County is at risk to impacts from infestation and invasive species. Refer to Section 5.4.7 for the qualitative analysis summarizing the county's vulnerability to this hazard of concern.

Landslide

An exposure assessment was conducted using landslide incidence and landslide susceptibility data from the United States Geological Survey (USGS) to determine the county's risk to the landslide hazard. The county's assets (population, buildings, critical facilities, and new development) were examined to determine if they are built in areas of the low incidence landslide hazard area, moderate incidence landslide hazard area, or moderate susceptibility landslide hazard area. Assets with their centroid located in the hazard area were totaled to estimate the totals and values at risk to impacts from landslides.

Severe Storm

A Hazus probabilistic analysis was performed to analyze the wind hazard losses for Monroe County for the 100- and 500-year MRP events. The probabilistic Hazus hurricane model activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated with Monroe County. Hazus contains data on historic hurricane events and wind speeds. It also includes surface roughness and vegetation (tree coverage) maps for the area. Surface roughness and vegetation data 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 damages are 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, a density analysis was used to extract the percent of building structures that fall within 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 Monroe County is exposed and vulnerable to the winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. Refer to Section 5.4.10 for the qualitative analysis summarizing the county's vulnerability to this hazard of concern.

Wildfire

The Wildland-Urban Interface (Interface and Intermix) obtained through the SILVIS Laboratory, Department of Forest Ecology and Management, University of Wisconsin – Madison, was referenced to delineate wildfire hazard areas. The University of Wisconsin – Madison wildland fire hazard areas are based on the 2010 Census and 2006 National Land Cover Dataset and the Protected Areas Database. For this risk assessment, the high-, medium-, and low-density interface areas were combined and used as the "Interface" hazard area, and the high-, medium-, and low-density intermix areas were combined and used as the "Intermix" hazard areas.

To determine what assets are exposed to wildfire, available and appropriate GIS data were overlaid with the hazard area. Assets with their centroid located in the hazard area were totaled to estimate the totals and values at risk to impacts from a wildfire event.

Considerations for Mitigation and Next Steps

The following items are to be discussed for considerations for the next plan update to enhance the vulnerability 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.
- 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 exposure analysis and generate a more detailed flood depth grid that can be integrated into the current Hazus version.
- Landslide
  - A pilot study conducted in Schenectady County, NY (Landslide Susceptibility – A Pilot Study of Schenectady County, NY) provided a detailed methodology for delineating high-risk landslide areas. This study looked at a variety of environmental characteristics including slope and soil conditions to determine areas at risk to landslide. To coincide with the methodology of that study, the generated slopes were categorized into five classes: 0 to 2 percent; 3 to 7 percent; 8 to 15 percent; 16 to 25 percent; Greater than 25 percent. Should the county determine the need for a more detailed assessment of risk, it could determine steep slope by other percent categorizations. Additional environmental and soil characteristics used in the Schenectady County plan can be collected and used to follow the methodology used to further delineate the county's most at-risk areas.
- 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

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

5.1.3 Data Source Summary

Table 5.1-3 summarizes the data sources used for the risk assessment for this plan.

Table 5.1-3. Risk Assessment Data Documentation

Data	Source	Date	Format
Population data	U.S. Census Bureau; American Community Survey 5-Year Estimates	2020	Digital (GIS) format
Building Inventory	Monroe County GIS, Tetra Tech	2022	Digital (GIS) format
Wildfire Hazard Data	University of Wisconsin - Madison	2010	Digital (GIS) format
Critical Facilities and Lifelines	Monroe County Planning Partnership and County Jurisdictions	2022	Digital (GIS) format
Digitized Effective FIRM maps	FEMA	2008	Digital (GIS) format
1-Meter Digital Elevation Model	USGS	2015	TIFF
Landslide Hazard Data	USGS	n.d.	Digital (GIS) format
NEHRP Soil	NYS	n.d.	Digital (GIS) format
Rail Network	NYS DOT	2013	Digital (GIS) format
Road Network	NYS GIS	2020	Digital (GIS) format
New Development Data	Monroe County Planning Partnership and County Jurisdictions	2022	Digital (GIS) Format

Notes: DOT = Department of Transportation
FEMA = Federal Emergency Management Agency
NRCS = Natural Resources Conservation Service
USDA = U.S. Department of Agriculture
USGS = U.S. Geological Survey

Limitations

Loss estimates, exposure assessments, and hazard-specific vulnerability 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:

1) Approximations and simplifications necessary to conduct such a study
2) Incomplete or dated inventory, demographic, or economic parameter data
3) The unique nature, geographic extent, and severity of each hazard
4) Mitigation measures already employed by the participating municipalities
5) The amount of advance notice residents have to prepare for a specific hazard event
6) 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 exposure and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, Monroe 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.

5.2 IDENTIFICATION OF HAZARDS OF CONCERN

To provide a strong foundation for mitigation actions considered in Section 6 (Mitigation Strategy) and Section 9 (Jurisdictional Annexes), Monroe County focused on considering a full range of hazards that could impact the area and then identified and ranked those hazards that presented the greatest concern. The hazard of concern identification process incorporated input from the County and participating jurisdictions; review of the New York State Hazard Mitigation Plan (NYS HMP 2019); review of the 2017 Monroe County HMP (2017 Monroe County Hazard Mitigation Plan); research and local, state, and federal information on the frequency, magnitude, and costs associated with the various hazards that have previously or could feasibly impact the region; and qualitative or anecdotal information regarding natural (not man-made) hazards and the perceived vulnerability of the study area's assets to them. Table 5.2-1 documents the process of identifying the natural hazards of concern for further profiling and evaluation. Specific hazards not identified as a hazard of concern for Monroe County will not be further discussed in detail.

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

Natural Hazards are those hazards that are a source of harm or difficultly created by a meteorological, environmental, or geological event.

5.2.1 Changes from 2017 Hazard Mitigation Plan

The 2017 Monroe County Hazard Mitigation Plan did not identify Pandemic as a hazard of concern. Members of the Steering Committee and Planning Partnership identified this hazard as hazards of concern for the 2023 Hazard Mitigation Plan Update.

The Steering Committee re-evaluated the inclusion of Civil Unrest and Terrorism as stand-alone hazards as per the 2017 plan. However, based on the inherent random aspect civil unrest and terrorism, the alignment with preparedness rather than mitigation planning, and the inclusion of these hazards in preparedness plans, it was determined to not include these hazards in the 2023 plan. The Steering Committee also reevaluated Utility Failure as a stand-alone hazard. The Steering Committee determined that utility failure is a cascading hazard associated with severe weather and therefore, has been included by reference in the Extreme Temperature, Flood, Severe Storm, and Severe Winter Storm hazards.

The 2023 Monroe County Hazard Mitigation Plan includes best available data throughout the plan to present an updated understanding of Monroe County's risk.

5.2.2 Hazard Groupings

The Steering Committee approved use of the following hazard event groupings which are the same as those provided by the Federal Emergency Management Agency (FEMA) guidance documents (*FEMA 386-2 Understanding Your Risks, Identifying Hazards and Estimating Losses*; *Multi-Hazard Identification and Risk Assessment – The Cornerstone of the National Mitigation Strategy*; *Local Mitigation Planning Handbook*), and with consideration of hazard grouping in the NYS HMP.

A *Drought* is a period characterized by long durations of below normal precipitation. Drought is a temporary irregularity that can affect agriculture, water supply, aquatic ecology, wildlife, and plant life.

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 man-made explosion.

The *Extreme Temperature* hazard includes both heat and cold events, which can have a significant impact to 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. The 2022 HMP considers the heat island effect that occurs within developed areas.

The *Flood* hazard includes riverine flooding, lakeshore, flash flooding, shallow flooding, ice jam flooding, urban drainage flooding, and dam failure flooding. Inclusion of the various forms of flooding under a general *Flood* hazard is consistent with that used in FEMA's *Multi-Hazard Identification and Risk Assessment* guidance and the NYS HMP.

The *Hazardous Materials* profile includes materials and wastes that are considered severely harmful to human health and the environment, as defined by the U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (also known as Superfund). Many hazardous materials are commonly used substances, which are harmless in their normal uses but are quite dangerous if released.

The *Infestation and Invasive Species* profile includes infestations of native species and invasive species. An infestation is the presence of pest organisms within an area or field, on the surface of a host, or in soil at numbers or quantities large enough to harm, threaten, or otherwise negatively affect native plants, animals, and humans. Invasive species are non-native species that can harm the environment, the economy, or human health.

The *Landslide* hazard includes rock falls, rock topples, rotational slump, transitional slide, earth flows, creep, block slides, debris avalanche, and debris flows.

The *Pandemic* 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. An aggregation of cases in a given area over a particular period, regardless of the number of cases, is called a cluster. In an outbreak or epidemic, it is presumed that the cases are related to one another or that they have a common cause.

The *Severe Storm* hazard includes windstorms that often entail a variety of other influencing weather conditions, including thunderstorms, hail, lightning, and tornadoes. Tropical disturbances (hurricanes, tropical storms, and tropical depressions) are often identified as a type of severe storm. For this HMP update, *Severe Storm* includes thunderstorms, hail, lightning, tornadoes, hurricanes, and tropical storms.

The *Severe Winter Storm* hazard includes blizzards, ice storms, snowstorms, sleet, and freezing rain.

The *Wildfire* hazard can be defined as any non-structural fire that occurs in the wildland. Three distinct types of wildland fires have been defined and include naturally occurring wildfire, human-caused wildfire, and prescribed fire. They may be highly destructive and become difficult to control. Wildfires result in the disturbance of forest and brush and destruction of real estate and personal property and have secondary impacts on other hazards, such as flooding, by removing vegetation and disturbing watersheds.

Table 5.2-1. Identification of Natural Hazards of Concern for Monroe County

Hazard	Is this a hazard that may occur in Monroe County?	If yes, does this hazard pose a significant threat to Monroe County?	Why was this determination made?	Source(s)
Avalanche	No	No	• The 2019 New York State Hazard Mitigation Plan (NYS HMP) identifies avalanche as a hazard of concern. • The topography and climate of Monroe County does not support the occurrence of an avalanche. • New York State, in general, has a very low occurrence of avalanche events based on statistics provided by National Avalanche Center – American Avalanche Association (NAC-AAA) between 1998 and 2018. • Avalanche was identified as a hazard in the NYS HMP, and there have been occurrences in the state; however, there were no occurrences in Monroe County. The Steering Committee and Planning Partnership do not consider the hazard to be a significant concern.	• NYS DHSES • NAC-AAA
Civil Unrest	Yes	No	• The 2019 NYS HMP does not identify civil unrest as a hazard of concern for New York State. • Monroe County has a history of civil unrest. • The Steering Committee and Planning Partnership do not consider terrorism to be a hazard of concern for Monroe County as is addressed in other preparedness plans.	• Input from Steering Committee and Planning Partnership • Monroe County OEM
Coastal Erosion	Yes	Yes	• The NYS HMP identifies coastal erosion as a hazard of concern for New York State. Erosion can impact all of 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 waterbodies, bays, harbors, shallows, and wetlands. • Although Monroe County has a coastline along Lake Ontario, coastal erosion was not identified as a significant concern by the Planning Committee. • Coastal erosion is briefly discussed in the "Flood" profile. • 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
Dam Failure	Yes	No	• The 2019 NYS 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 NYS DEC, there are 81 dams within Monroe County, as shown in Section 4. Of these 81 dams in Monroe County: 43 low hazard, 6 intermediate hazard, 9 high hazard, and 23 negligible or no hazard classification code (NYSDEC 2022).	• NYS DHSES • Input from Steering Committee and

Table 5.2-1. Identification of Natural Hazards of Concern for Monroe County

Hazard	Is this a hazard that may occur in Monroe County?	If yes, does this hazard pose a significant threat to Monroe County?	Why was this determination made?	Source(s)
			• Dam failure is included in the flood profile.	Planning Partnership • NYSDEC • NYS GIS
Pandemic	Yes	Yes	• The 2019 NYS HMP does not identify pandemic as a hazard of concern for New York State. • The County has been impacted by various diseases (influenza, COVID-19). • The Steering Committee and Planning Partnership has identified pandemic as a hazard of concern for Monroe County.	• NYS DHSES • NYS DEC • Input from Steering Committee and Planning Partnership
Drought	Yes	Yes	• The NYS HMP identifies drought as a hazard of concern for the state. Monroe County has been impacted by several drought events that have occurred in New York State. • Agriculture is a substantial industry in Monroe County. Drought conditions would severely impact the county's economy. • New York State was included in one FEMA drought-related disaster declaration, which did not include Monroe County. • Monroe County was included in 3 recent drought-related U.S. Department of Agriculture (USDA) disaster declarations: ○ S4023 - 2016 Drought ○ S4031 - 2016 Drought ○ S4037 - 2016 Drought • The Steering Committee and Planning Partnership has identified drought as a hazard of concern for Monroe County.	• NYS DHSES • FEMA • USDA • Input from Steering Committee and Planning Partnership • NOAA-NCEI • NRCC

Table 5.2-1. Identification of Natural Hazards of Concern for Monroe County

Hazard	Is this a hazard that may occur in Monroe County?	If yes, does this hazard pose a significant threat to Monroe County?	Why was this determination made?	Source(s)
Earthquake	Yes	Yes	• The NYS HMP identified earthquake as a hazard of concern for the state. • A 500-year earthquake event could result in a moderate level peak ground acceleration (PGA) of 3.9-5.2%g • New York State was included in one FEMA earthquake-related disaster declaration (DR-1415); Monroe County was not included in this declaration. • From 2015 to 2022, there have been no significant earthquakes epicentered in Monroe County. • Based on input from the Steering Committee and Planning Partnership, earthquake has been identified as a hazard of concern for Monroe County.	• NYS DHSES • Input from Steering Committee and Planning Partnership • U.S. Geological Survey (USGS) – Earthquake Hazards Program, Review of USGS Seismic Maps
Expansive Soils	Yes	Yes	• The NYS HMP does not identify expansive soils as a hazard of concern for New York State. • USGS indicated that Monroe County does not have the type of soils (swelling clay) that would result in expansive or swelling soils; therefore, Monroe County has little to no swelling potential. • 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 • Review of USGS 1989 Swelling Clays Map of the Conterminous United States
Extreme Temperature	Yes	Yes	• The NYS HMP identifies Coldwaves and Heatwaves as hazards of concern for New York State. • Monroe County was included in six recent USDA disaster declarations related to extreme temperature events: ○ S4023 - 2015 Heat, Excessive Heat ○ S4031 - 2015 Heat Excessive Heat ○ S4037 - 2015 Heat, Excessive Heat ○ S4052 - 2015 Frost, Freeze	• NYS DHSES • Input from Steering Committee and Planning Partnership • NOAA-NCEI • USDA

Table 5.2-1. Identification of Natural Hazards of Concern for Monroe County

Hazard	Is this a hazard that may occur in Monroe County?	If yes, does this hazard pose a significant threat to Monroe County?	Why was this determination made?	Source(s)
			○ S4903 - 2020 Frost, Freeze ○ S4904 - 2020 Frost, Freeze • The Steering Committee and Planning Partnership identified extreme temperature as a hazard of concern for Monroe County.	
Flood (riverine, lakeshore, ice jam, dam failure, urban flooding, and flash flooding)	Yes	Yes	• The NYS HMP identifies flooding as a hazard of concern for New York State. • Between 1956 and 2022, Monroe County was included in 4 FEMA flood-related declarations. ○ FEMA DR-338; June 23, 1972; New York Tropical Storm Agnes ○ FEMA DR-367; March 21, 1973; New York High Winds, Wave Action, Flooding ○ FEMA EM-3004; November 2, 1974; New York Flooding ○ FEMA DR-4348; May 2, 2017 - August 6, 2017; New York Flooding • Based on the history of flooding and its impacts on Monroe County and input from the Steering Committee and Planning Partnership, flooding has been identified as a hazard of concern for the County.	• NYS DHSES • Input from Steering Committee and Planning Partnership • FEMA • NOAA-NCEI • USACE CRREL Ice Jam Database
Hailstorm	Yes	Yes	Please see Severe Storm Profile	
Hurricane (tropical cyclones, including tropical storms and tropical depressions)	Yes	Yes	Please see Severe Storm Profile	
Ice Jams	Yes	Yes	Please see Flood Profile	
Ice Storm	Yes	Yes	Please see Severe Winter Storm Profile	
Invasive Species/Infestation	Yes	Yes	• The 2019 NYS HMP does not identify invasive species as a hazard of concern for New York State. • The Planning Committee considers infestation and invasive species to be a potential hazard to agriculture and recreation in the County. • New York State has been affected by various instances of invasive species. • The stinkbug infestation of 2010 destroyed over $46,000 worth of the crops in the County. • The county has also experienced infestations from West Nile virus, Armyworm, Emerald ash borers, and Dutch elm disease. • Based on input from the Steering Committee and Planning Partnership, invasive species/infestation has been identified as a hazard of concern for Monroe County.	• NYS DEC • Input from Steering Committee and Planning Partnership

Table 5.2-1. Identification of Natural Hazards of Concern for Monroe County

Hazard	Is this a hazard that may occur in Monroe County?	If yes, does this hazard pose a significant threat to Monroe County?	Why was this determination made?	Source(s)
Land Subsidence	No	o	• NYS HMP indicates New York State is vulnerable to land subsidence; however, this hazard is "extremely localized" and poses a "very low risk to population and property", according to the 2019 NYS HMP. • NYS HMP does not identify Monroe County as a community that has experienced land subsidence in the past. In general, moderate to low land subsidence susceptibility exists for New York State; however, the NYS HMP states that this hazard has a very low risk to population or property. • The Steering Committee and Planning Partnership did not identify land subsidence as a hazard of concern for Monroe County.	• NYS DHSES • Input from Steering Committee and Planning Partnership • USGS
Landslide	Yes	Yes	• The 2019 NYS HMP includes landslide as a hazard of concern for New York State. • Between 1954 and 2022, New York State has included in one landslide-related disaster declaration, which did not include Monroe County. • USGS indicates within the National Atlas Map Maker program that Monroe County is identified as having low landslide incidence, with pockets of moderate incidence. • Based on previous occurrences and input from the Steering Committee and Planning Partnership, the landslide hazard was identified as a hazard of concern for Monroe County.	• NYS DHSES • Input from Steering Committee and Planning Partnership • FEMA
Nor'Easters (extra-tropical cyclones, including severe winter low-pressure systems)	No	No	• Monroe County is located in the western part of New York State and is therefore not highly susceptible to Nor'Easter systems that come up the eastern seaboard. • This hazard is briefly mentioned in the "Severe Storms" profile.	• NYS DHSES • FEMA • NOAA-NCEI

Severe Storm (windstorms, thunderstorms, hail, and tornadoes)	Yes	Yes	• The NYS 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 lightning, hail, tornadoes, high winds, and hurricanes/tropical storms. For the Monroe County HMP, the hazards were combined into one profile.
			• Between 1954 and 2022, Monroe County was included in four FEMA severe storm-related declarations.
			  ○ FEMA DR-1244; September 7, 1998; New York Severe Weather
			  ○ FEMA DR-1233; June 25 – July 10, 1998; New York Severe Storms and Flooding
			  ○ FEMA DR-1534; May 13 – June 17, 2004; New York Severe Storms and Flooding
			  ○ FEMA DR-1564; August 13 – September 16, 2004; New York Severe Storms and Flooding
			• Monroe County was included in two recent severe storm-related U.S. Department of Agriculture (USDA) disaster declarations:
			  ○ S3885 - 2015 Excessive Rain, High Winds, Hail, Lightning, and Tornado
				• NYS DHSES
				• FEMA
				• NOAA-NCEI
				• SPC
				• Input from Steering Committee and Planning Partnership

Table 5.2-1. Identification of Natural Hazards of Concern for Monroe County

Hazard	Is this a hazard that may occur in Monroe County?	If yes, does this hazard pose a significant threat to Monroe County?	Why was this determination made?	Source(s)
			◦ S4595 - 2019 Hail • Based on previous occurrences and input from the Steering Committee and Planning Partnership, severe storms are identified as a hazard of concern for Monroe County.	
Severe Winter Storm (heavy snow, blizzards, ice storms)	Yes	Yes	• The NYS HMP identifies ice storms and snowstorms as hazards of concern for New York State. According to the 2019 NYS HMP, Monroe County has an annualized count of 2 snowstorm events and annualized snowstorm losses of $212 thousand. According to the 2019 NYS HMP, Monroe County has an annualized count of 4 ice storm events and annualized ice storm losses of $563 thousand. • FEMA included Monroe County in 4 snowstorm and 2 ice storm-related disaster declarations: ◦ FEMA DR-494; March 19, 1976; New York Ice Storm, Severe Storms; Flooding ◦ FEMA DR-898; March 3-4, 1990; New York Severe Storm, Winter Storm ◦ FEMA EM-3107; March 13-17; New York Severe Blizzard ◦ FEMA DR-1196; January 5-17, 1998; New York Severe Winter Storms ◦ FEMA EM-3138; March 3-6, 1999; New York Winter Storm ◦ FEMA DR-1467; April 3-5, 2003; New York Ice Storm • Based on previous occurrences and input from the Steering Committee and Planning Partnership, severe winter storms are identified as a hazard of concern for Monroe County.	• NYS DHSES • FEMA • NOAA-NCEI • Input from Steering Committee and Planning Partnership
Terrorism	Yes	No	• Monroe County has a history of terrorism and has proximity to an international border. • The Steering Committee and Planning Partnership do not consider terrorism to be a hazard of concern for Monroe County as is addressed in other preparedness plans.	• Input from Planning Committee • Monroe County OEM
Tornado	Yes	Yes	Please see Severe Storm	
Tsunami	No	No	• Tsunami is identified as a hazard of concern in the NYS HMP. • The Steering Committee and Planning Partnership do not consider tsunami to be a hazard of concern for Monroe County.	• NYS DHSES • Input from Steering Committee and Planning Partnership
Utility Failure	Yes	Yes	• Monroe 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.	• NYS DHSES • NOAA NCEI

Table 5.2-1. Identification of Natural Hazards of Concern for Monroe County

Hazard	Is this a hazard that may occur in Monroe County?	If yes, does this hazard pose a significant threat to Monroe County?	Why was this determination made?	Source(s)
			• The Steering Committee and Planning Partnership consider utility failure a cascading impact of severe storm, severe winter storm, and flooding events and included discussion of utility failure in those hazard profiles.	• Input from Steering Committee and Planning Partnership
Volcano	No	No	• The NYS HMP identifies volcano as a hazard of concern for New York State. However, the Steering Committee and Planning Partnership do not consider volcano to be a hazard of concern for Monroe County.	• NYS DHSES • Input from Steering Committee and Planning Partnership
Wildfire	Yes	Yes	• The NYS HMP identifies wildfire as a hazard of concern for New York State. • Monroe County was not included in any FEMA wildfire-related disaster declarations. • Wildfires have occurred within Monroe County. • The county's agriculture industry could be severely impacted by a large wildfire. • Based on available data and the nature of the county, the Steering Committee and Planning Partnership identified Wildfire as a hazard of concern.	• NYS DHSES • Input from Steering Committee and Planning Partnership • FEMA
Windstorm	Yes	Yes	Please see Severe Storm	

CRREL	*Cold Regions Research and Engineering Laboratory*
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*
NYS DEC	*New York State Department of Environmental Conservation*
NYS DHSES	*New York State Division of Homeland Security and Emergency Services*
NYS HMP	*New York State Hazard Mitigation Plan*
PGA	*Peak ground acceleration*
SPC	*Storm Prediction Center*
USDA	*U.S. Department of Agriculture*
USGS	*United States Geologic Survey*

5.2.3 Summary of Hazards of Concern

In summary, a total of 11 hazards of concern were identified as significant hazards affecting the entire County, to be addressed at the County level in this plan (shown here in alphabetical order):

- Drought
- Earthquake
- Extreme Temperature
- Flood
- Hazardous Materials
- Infestation and Invasive Species
- Landslide
- Pandemic
- Severe Storm
- Severe Winter Storm
- Wildfire

Other natural and technological hazards of concern have occurred within Monroe 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 will not be further addressed within this version of the Plan. However, if deemed necessary by the County, these hazards may be considered in future versions of the Plan.

5.3 HAZARD RANKING

A comprehensive range of hazards that pose a significant risk to Monroe County were selected and considered during the development of this plan; see Section 5.2 (Identification of Hazards of Concern). However, each community has differing levels of exposure and vulnerability to each of these hazards. It is important for each community participating in this plan to recognize those hazards that pose the greatest risk to their community and direct their attention and resources accordingly to most effectively and efficiently manage risk and reduce losses. The hazard ranking for the County and each participating jurisdiction can be found in their jurisdictional annexes in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

To this end, a hazard risk ranking process was conducted for Monroe County and its municipalities using the method described below. This method includes four risk assessment categories—probability of occurrence, impact (population, property and economy), adaptive capacity, and changing future conditions (i.e., climate change). Each was assigned a weighting factor to calculate an overall ranking value for each hazard of concern. Depending on the calculation, each hazard was assigned a high, medium, or low ranking. Details regarding each of these categories is described below.

5.3.1 Hazard Ranking Methodology

Estimates of hazard risk for the County were developed using methodologies promoted by FEMA's hazard mitigation planning guidance, generated by FEMA's Hazus risk assessment tool, and input from Monroe County and participating jurisdictions.

As described in Section 5.1 (Methodology and Tools), three different levels of analysis were used to estimate potential impacts: 1) historic loss/qualitative analysis; 2) exposure analysis; and 3) loss estimation. All three levels of analysis are suitable for planning purposes; however, with any risk analysis, there is underlying uncertainty resulting from assumptions used to describe and assess vulnerability and the methodologies available to model impacts. Impacts from any hazard event within the County will vary from the analysis presented here based on the factors described for each hazard of concern; namely location, extent, warning time, and mitigation measures in place at the time of an event.

The hazard ranking methodology for some hazards of concern is based on a scenario event, while others are based on their potential risk to the County as a whole. In order to account for these differences, the quantitative hazard ranking methodology was adjusted using professional judgement and subject-matter input; assumptions are included, as appropriate, in the following subsections. The limitations of this analysis are recognized given the scenarios do not have the same likelihood of occurrence; nonetheless, there is value in summarizing and comparing the hazards using a standardized approach to evaluate relative risk. The following categories were considered when evaluating the relative risk of the hazards of concern.

- **Probability of Occurrence -** The probability of occurrence of the scenario evaluated was estimated by examining the historic record and/or calculating the likelihood of annual occurrence. When no scenario was assessed, an examination of the historic record and judgement was used to estimate the probability of occurrence of an event that will impact the County.
- **Impact**—The following three hazard impact subcategories were considered: impact to people; impact to buildings; and impact to the economy. The results of the updated risk assessment and/or professional judgement were used to assign the numeric values for these three impact subcategories. A factor was applied to each subcategory, giving impact on population the greatest weight.
    - Population—Numeric value x 3
    - Buildings—Numeric value x 2

- Economy—Numeric value x 1

- **Adaptive Capacity -** Adaptive capacity describes a jurisdiction's current ability to protect from or withstand a hazard event. This includes capabilities and capacity in the following areas: administrative, technical, planning/regulatory and financial. Mitigation measures already in place increases a jurisdiction's capacity to withstand and rebound from events (e.g. codes/ordinances with higher standards to withstand hazards due to design or location; deployable resources; or plans and procedures in place to respond to an event). In other words, assigning 'weak' for adaptive capacity means the jurisdiction does not have the capability to effectively respond, which increases vulnerability; whereas 'strong' adaptive capacity means the jurisdiction does have the capability to effectively respond, which decreases vulnerability. These ratings were assigned using the results of the core capability assessment with subject-matter input from each jurisdiction.
- **Climate Change (Changing Future Conditions) -** Current climate change projections were considered as part of the hazard ranking to ensure the potential for an increase in severity/frequency of the hazard was included. This was important to Monroe County to include because the hazard ranking helps guide and prioritize the mitigation strategy development, which should have a long-term future vision to mitigate the hazards of concern. The potential impacts climate change may have on each hazard of concern is discussed in Sections 5.4.1 through 5.4.11. The benchmark values in the methodology are similar to confidence levels outlined in the National Climate Assessment 2017.

Example Risk Ranking Equation

Risk Ranking = [(Impact on Population x 3) + (Impact on Property x 2) + (Impact on Economy x 1) x 0.3] + [Capability x 0.3] + [Climate Impact x 0.1] + [Probability of Occurrence x 0.3]

Table 5.3-1 summarizes the categories, benchmark values, and weights used to calculate the risk factor for each hazard. Using the weighting applied, the highest possible risk factor value is 6.9. The higher the number, the greater the relative risk. Based on the total for each hazard, a priority ranking is assigned to each hazard of concern (high, medium, or low). The rankings were categorized as follows: Low = Values less than 3.9; Medium = Values between 3.9 and 4.9; High = Values greater than 4.9.

Table 5.3-1. Summary of Hazard Ranking Approach

Category		Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
Probability of Occurrence		Unlikely	A hazard event is not likely to occur or is unlikely to occur with less than a 1 percent annual chance probability.	0	30%
		Rare	Between 1 and 10 percent annual probability of a hazard event occurring.	1	
		Occasional	Between 10 and 100 percent annual probability of a hazard event occurring.	2	
		Frequent	100 percent annual probability; a hazard event may occur multiple times per year.	3	
Impact (Sum of all 3)	Population (Numeric Value x 3)	Low	14 percent or less of population is exposed to a hazard with potential for measurable life-safety impact due to its extent and location.	1	30%
		Medium	15 to 29 percent of population is exposed to a hazard with potential for measurable life-safety impact due to its extent and location.	2	
		High	30 percent or more of population is exposed to a hazard with potential for measurable life-safety impact, due to its extent and location.	3	
	Property (Numeric Value x 2)	Low	Property exposure is 14 percent or less of the total number of structures for your community.	1	
		Medium	Property exposure is 15 to 29 percent of the total number of structures for the community.	2	

Category		Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
		High	Property exposure is 30 percent or more of the total number of structures for the community.	3	
	Economy (Numeric Value x 1)	Low	Loss estimate is 9 percent or less of the total replacement cost for the community.	1	
		Medium	Loss estimate is 10 to 19 percent of the total replacement cost for the community.	2	
		High	Loss estimate is 20 percent or more of the total replacement cost for the community.	3	
Adaptive Capacity		Weak	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	1	30%
		Moderate	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; county/jurisdiction can recover but needs outside resources; moderate county/Jurisdiction capabilities.	0	
		Strong	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available, and capabilities are high.	-1	
Climate Change		Low	No local data are available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	1	10%
		Medium	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).	2	
		High	Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very high confidence level (strong evidence, well documented, and acceptable methods).	3	

Note: A numerical value of zero is assigned if there is no impact.
**For the purposes of this exercise, "impacted" means exposed for population and property and estimated loss for economy. For non-natural hazards, although they may occur anywhere in the County, an event will not likely cause countywide impacts; therefore, impact to population was scored using an event-specific scenario.*

In an attempt to summarize the confidence level regarding the input utilized to populate the hazard ranking, a gradient of certainty was developed. A certainty factor of high, medium or low was selected and assigned to each hazard to provide a level of transparency and increased understanding of the data utilized to support the resulting ranking. The following scale was used to assign a certainty factor to each hazard:

- High—Defined scenario/event to evaluate; probability calculated; evidenced-based/quantitative assessment to estimate potential impacts through hazard modeling.
- Moderate—Defined scenario/event or only a hazard area to evaluate; estimated probability; combination of quantitative (exposure analysis, no hazard modeling) and qualitative data to estimate potential impacts.
- Low—Scenario or hazard area is undefined; there is a degree of uncertainty regarding event probability; majority of potential impacts are qualitative.

5.3.2 Hazard Ranking Results

Using the process described above, the risk ranking for the identified hazards of concern was determined for Monroe County. The hazard ranking for Monroe County is detailed in the subsequent tables that present the step-wise process for the ranking. The countywide risk ranking includes the entire planning area and may not reflect the highest risk indicated for any of the participating jurisdictions. The resulting ranks of each municipality indicate the differing degrees of risk exposure and vulnerability. The results support the appropriate selection and prioritization of initiatives to reduce the highest levels of risk for each municipality. Both the county and the participating jurisdictions have applied the same methodology to develop the countywide risk and local rankings to ensure consistency in the overall ranking of risk; jurisdictions had the ability to alter rankings based on local knowledge and experience in handling each hazard.

This hazard ranking exercise serves four purposes: (1) to describe the probability of occurrence for each hazard; (2) to describe the impact each would have on the people, property, and economy; (3) to evaluate the capabilities a community has with regards to natural hazards; and (4) to consider changing future conditions (i.e., climate change) in Monroe County. Estimates of risk for Monroe County were developed using methodologies promoted by FEMA's hazard mitigation planning guidance, generated by FEMA's HAZUS-MH risk assessment tool and input from the county and participating municipalities.

Table 5.3-2 shows the probability ranking assigned for the likelihood of occurrence for each hazard.

Table 5.3-2. Probability of Occurrence Ranking for Hazards of Concern for Monroe County

Hazard of Concern	Probability	Numeric Value
Disease Outbreak	Occasional	2
Drought	Occasional	2
Earthquake	Unlikely	0
Extreme Temperature	Occasional	2
Flood	Occasional	2
Hazardous Materials	Rare	1
Invasive Species	Occasional	2
Landslide	Unlikely	0
Severe Storm	Frequent	3
Severe Winter Storm	Frequent	3
Wildfire	Occasional	2

Table 5.3-3 shows the impact evaluation results for each hazard of concern, including impact on property, structures, and the economy on the County level. The weighting factor results and a total impact for each hazard also are summarized. It is noted that several hazards that have a high impact on the local jurisdictional level can have a lower impact when analyzed countywide.

Table 5.3-3. Impact Ranking for Hazards of Concern for Monroe County

Hazard of Concern	Population			Property			Economy			Total Impact Rating (Population + Property + Economy)
	Impact	Numeric Value	Multiplied by Weighing Factor (3)	Impact	Numeric Value	Multiplied by Weighing Factor (2)	Impact	Numeric Value	Multiplied by Weighing Factor (1)	
Disease Outbreak	Medium	2	6	Low	1	2	Low	1	1	9
Drought	Medium	2	6	Low	1	2	Medium	2	2	10
Earthquake	Medium	2	6	Medium	2	4	Medium	2	2	12
Extreme Temperature	Medium	2	6	Low	1	2	Medium	2	2	10
Flood	Medium	2	6	High	3	6	Low	1	1	13
Hazardous Materials	Medium	2	6	Low	1	2	Medium	2	2	10
Invasive Species	Low	1	3	Low	1	2	Medium	2	2	7
Landslide	Medium	2	6	Medium	2	4	Medium	2	2	12
Severe Storm	High	3	9	Medium	2	4	Low	1	1	14

Hazard of Concern	Population			Property			Economy			Total Impact Rating (Population + Property + Economy)
	Impact	Numeric Value	Multiplied by Weighing Factor (3)	Impact	Numeric Value	Multiplied by Weighing Factor (2)	Impact	Numeric Value	Multiplied by Weighing Factor (1)	
Severe Winter Storm	High	3	9	Medium	2	4	Medium	2	2	15
Wildfire	Low	1	3	Low	1	2	Low	1	1	6

Table 5.3-4 shows the additional impact rankings for the hazards of concern. This includes the overall capabilities of the County and municipalities and the consideration of changing future conditions, such as climate change.

Table 5.3-4. Additional Impact Ranking for Hazards of Concern for Monroe County

Hazard of Concern	Capabilities	Numeric Value	Climate Change	Numeric Value
Disease Outbreak	Medium	0	Medium	2
Drought	Medium	0	High	3
Earthquake	Medium	0	Low	1
Extreme Temperature	Medium	0	High	3
Flood	Medium	0	High	3
Hazardous Materials	Medium	0	Low	1
Invasive Species	Low	1	High	3
Landslide	Medium	0	Medium	2
Severe Storm	High	-1	High	3
Severe Winter Storm	High	-1	Medium	2
Wildfire	Medium	0	Medium	2

Table 5.3-5 presents the total calculations for each hazard ranking value for the hazards of concern. The rankings were categorized and assigned a color as follows: Low = values less than or equal to 3.8 (green); Medium = values between 3.9 and 4.9 (yellow); High = values greater than or equal to 5.0 (red).

Table 5.3-5. Total Hazard Ranking Values for the Hazards of Concern for Monroe County

Hazard of Concern	Probability x 30%	Total Impact x 30%	Adaptive Capacity x 30%	Changing Future Conditions x 10%	Total Risk Ranking Value
Disease Outbreak	0.6	2.7	0	0.2	3.5
Drought	0.6	3	0	0.3	3.9
Earthquake	0	3.6	0	0.1	3.7
Extreme Temperature	0.6	3	0	0.3	3.9
Flood	0.9	3.9	0	0.3	5.1
Hazardous Materials	0.3	3	0	0.1	3.4
Invasive Species	0.6	2.1	0.3	0.3	2.7
Landslide	0	3.6	0	0.2	3.8
Severe Storm	0.9	4.2	-0.3	0.3	5.1
Severe Winter Storm	0.9	4.5	-0.3	0.2	5.3
Wildfire	0.6	1.8	0	0.2	2.6

Notes: Low = Values less than 3.9; Medium = Values between 3.9 and 4.9; High = Values greater than 4.9

Table 5.3-6 presents the jurisdictional hazard ranking for each hazard. An evaluation of the total risk ranking score determined ranking categories that were grouped into three categories: low, medium, and high. It also includes input by the municipalities.

These rankings have been used as one of the bases for identifying the jurisdictional hazard mitigation strategies included in this plan in Section 9, Jurisdictional Annexes. The summary rankings for the county reflect the results of the vulnerability analysis for each hazard of concern and vary from the specific results of each jurisdiction. For example, the severe storm hazard may be ranked low in one jurisdiction, but due to the exposure and impact countywide, it is ranked as a high hazard and is addressed in the County mitigation strategy accordingly. Jurisdictional ranking results are presented in each ocal annex in this plan in Section 9, Jurisdictional Annexes.

Table 5.3-6. Summary of Overall Ranking of Hazards by Jurisdiction

Monroe County Municipalities	Disease Outbreak	Drought	Earthquake	Extreme Temperature	Flood	Hazardous Material	Invasive Species	Landslide	Severe Storm	Severe Winter Storm	Wildfire
Town of Brighton	Low	Medium	Low	Medium	High	Low	Low	Low	High	High	Low
Village of Brockport	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	High
Town of Chili	Low	Medium	Low	Medium	High	Low	Low	Low	High	High	Medium
Village of Churchville	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Town of Clarkson	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	High
Town/Village of East Rochester	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Village of Fairport	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Town of Gates	Low	Medium	Low	Medium	High	Low	Low	Low	High	High	Low
Town of Greece	Low	Medium	Low	Medium	High	Low	Low	Low	High	High	Medium
Town of Hamlin	Low	Medium	Low	Medium	High	Low	Low	Low	High	High	Low
Town of Henrietta	Low	Medium	Low	Medium	High	Low	Low	Low	High	High	Low
Village of Hilton	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Village of Honeoye Falls	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Town of Irondequoit	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Town of Mendon	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Town of Ogden	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Town of Parma	Low	Medium	Low	Medium	High	Low	Low	Low	High	High	Medium
Town of Penfield	Low	Medium	Low	Medium	High	Low	Low	Low	High	High	Low
Town of Perinton	Low	Medium	Low	Medium	High	Low	Low	Low	High	High	Low
Town of Pittsford	Low	Medium	Low	Medium	High	Low	Low	Low	High	High	Low
Village of Pittsford	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Town of Riga	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Medium
City of Rochester	Low	Medium	Low	High	High	Low	Low	Low	High	High	Low
Town of Rush	Low	Medium	Low	Medium	High	Low	Low	Low	High	High	Low
Village of Scottsville	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Village of Spencerport	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Town of Sweden	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Town of Webster	Low	Medium	Low	Medium	High	Low	Low	Low	High	High	Low
Village of Webster	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Town of Wheatland	Low	Medium	Low	Medium	Low	Low	Low	Low	High	High	Low
Monroe County	**Low**	**Medium**	**Low**	**Medium**	**High**	**Low**	**Low**	**Low**	**High**	**High**	**Low**

5.4.1 Disease Outbreak

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the disease outbreak hazard in Monroe County.

5.4.1.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections, and the probability of future occurrences for the disease outbreak hazard. For this HMP update, the disease outbreak hazard will primarily focus on disease outbreak events caused by influenza, West Nile Virus, Lyme disease, and coronavirus.

Hazard Description

An outbreak or an epidemic 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 a disease occurring over a wide geographic area and affecting a high proportion of the population. A pandemic can cause sudden, pervasive illness in all age groups on a local or global scale. A pandemic is a novel virus to which humans have no natural immunity that spreads from person to person. A pandemic will cause both widespread and sustained effects and is likely to stress the resources of both the State and Federal government (NJOEM 2019)

Most disease outbreaks occur due to respiratory viruses. A respiratory virus with pandemic potential is a highly contagious respiratory virus that spreads easily from person to person and for which there is little human immunity. This hazard includes pandemic influenza. This hazard strains the healthcare system, requires school closures, causes high rates of illness and absenteeism that undermine critical infrastructure across the city, and decreases community trust due to social distancing measures interfering with personal movement and being perceived as being ineffectual. Previous events that exemplify this hazard include the 1918 ("Spanish flu") and 2009 ("Swine flu") influenza pandemics and the 2003 SARS outbreak, which had pandemic potential (NYC Emergency Management 2019).

In addition to respiratory viruses, diseases with new or emerging features can challenge control. 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 (NYC Emergency Management 2019).

Of particular concern in Monroe County are respiratory illnesses such as influenza, also known as the 'flu'. While flu symptoms are typically mild, vulnerable populations; older adults, younger children, pregnant persons, and people with pre-existing conditions are more likely to experience flu-related complications. Seasonal flu epidemics occur yearly, typically beginning at the end of October and continuing through the colder months (NYS DOH 2022).

West Nile Virus (WNV) disease is spread by the bite of a mosquito infected with the virus. Mosquitos become infected when they feed on infected birds (NYS DOH 2017). The West Nile Virus cases will increase in portions of the state during the late summer and early fall seasons.

Tick-borne diseases are bacterial illnesses that spread to humans through infected ticks. These types of diseases rely on ticks for transmission. Ticks become infected by micro-organisms when feeding on small, infected mammals (mice and voles). Different tick-borne diseases are caused by different micro-organisms, and it is possible to be infected with more than one tick-borne disease at a time. Anyone who is bitten by an infected tick may get a tick-borne disease. People who spend a lot of time outdoors have a greater risk of becoming infected. 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).

The Novel-Coronavirus, also known as 'Covid-19' is an infection disease caused by the SARS-CoV-2 virus. The virus can spread from an infected person's mouth or nose in small liquid particles through coughing, sneezing, speaking, singing, or breathing (World Health Organization 2022).

For the purposes of this hazard mitigation plan update, the following infectious diseases will be discussed in further detail: Influenza, West Nile Virus (WNV), Lyme Disease, and Coronavirus.

Influenza

Influenza (the flu) 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).

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.

Pandemic influenza differs from seasonal influenza (or 'the flu') because outbreaks of seasonal flu are caused by viruses already living amongst people. 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 (Center for Disease Control and Prevention 2020). Additionally, the seasonal flu happens annually and usually peaks between December and February.

West Nile Virus

West Nile Virus (WNV) is the leading cause of mosquito-borne disease in the United States. West Nile Virus is most commonly spread to people who are bitten by an infected mosquito. WNV is usually diagnosed during mosquito season, starting in the summer months and continuing through the fall (CDC 2021). WNV was first found in New York State in 1999. Since 2000, 490 human cases and 37 deaths of WNV have been reported statewide (the data range is 2000-2017) (NYS DOH 2017). The symptoms of severe infection (West Nile encephalitis or meningitis) can include headache, high fever, neck stiffness, muscle weakness, stupor, disorientation, tremors, seizures, paralysis, and coma. WNV can cause serious illness, and in some cases, death. Usually, symptoms occur from 3 to 14 days after being bitten by an infected mosquito (NYS DOH 2017).

Lyme Disease

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 2021). In New York, the commonly infected tick is the deer tick. Immature ticks become infected by feeding on infected white-footed mice and other small mammals. Deer ticks can also spread other tick-borne diseases. Anyone who is bitten by a tick carrying the bacteria can become infected (NYS DOH 2019).

Coronavirus

Coronavirus disease (COVID-19) is an infectious disease first identified in 2019. The virus rapidly spread into a global pandemic by spring of 2020. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illnesses (World Health Organization 2022). With the virus being relatively new, information regarding transmission and symptoms of the virus is still new. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes.

Reported illnesses have ranged from mild symptoms to severe illness and death. Reported 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 2-14 days after exposure to the virus (based on the incubation period of MERS-CoV viruses) (CDC 2021).

As of November 16, 2022, Monroe County has reported 183,834 positive cases of COVID-19 and 1,762 deaths (New York Times 2022).

Extent

The extent and location of disease outbreaks depend on the preferred habitat of the species, as well as the species' ease of movement and establishment. The magnitude of disease outbreaks species ranges from nuisance to widespread. The threat is typically intensified when the ecosystem or host species is already stressed, such as during periods of drought. The already weakened state of the ecosystem causes it to more easily be impacted by an infestation. The presence of disease-carrying mosquitoes and ticks has been reported throughout most of New York State and Monroe County.

The exact size and extent of an infected population depend 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 will depend on the mode of transmission of a given illness.

Influenza and Coronavirus

As noted above, the exact size and extent of an infected population depend 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 will depend on the mode of transmission of a given illness. The severity and length of the next pandemic cannot be predicted; however, experts expect that its effect on the United States could be severe.

Between 2018 and 2021, there were 17,058 confirmed cases of influenza in Monroe County (NYS DOH 2022). Those most vulnerable to influenza include young children and the elderly, although anyone can become infected.

In 1999, The World Health Organization (WHO) published guidance for pandemic influenza and defined the six phases of a pandemic. The updated guidance was published in 2005 to redefine these phases, and in 2009 WHO published the *Pandemic Influenza Preparedness and Response*, this guidance significantly updates and replaces the guidance published in 2005 (World Health Organization 2009). The revised guidance retains the six-phase approach to facilitate the incorporation of new recommendations. Phases 1-3 and 5-6 have been grouped to include common action points. The WHO pandemic phases are outlined in Table 5.4.1 1 below.

Table 5.4.1-1. WHO Global Pandemic Phases

Phase	Description
Preparedness and Response– Global, Regional, National, Sub-National Level	
Phase 1	No animal influenza virus circulating among animals has been reported to cause infection in humans.
Phase 2	An animal influenza virus circulating in domesticated or wild animals is known to have caused infection in humans and is therefore considered a potential pandemic threat.
Phase 3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.
Containment	
Phase 4	Human-to-human transmission (H2H) of an animal or human-animal influenza reassortant virus able to sustain community-level outbreaks has been verified.
Response – Global Level	
Phase 5	The same identified virus has caused sustained community-level outbreaks in two or more countries in one WHO region.
Phase 6	In addition to the criteria defined in Phase 5, the same virus has caused sustained community-level outbreaks in at least one other country in another WHO region.
Post-Pandemic	
Post-Peak Period	Levels of pandemic influenza in most countries with adequate surveillance have dropped below peak levels.
Possible New Wave	Level of pandemic influenza activity in most countries with adequate surveillance rising again.
Post-Pandemic Period	Levels of influenza activity have returned to the levels seen for seasonal influenza in most countries with adequate surveillance

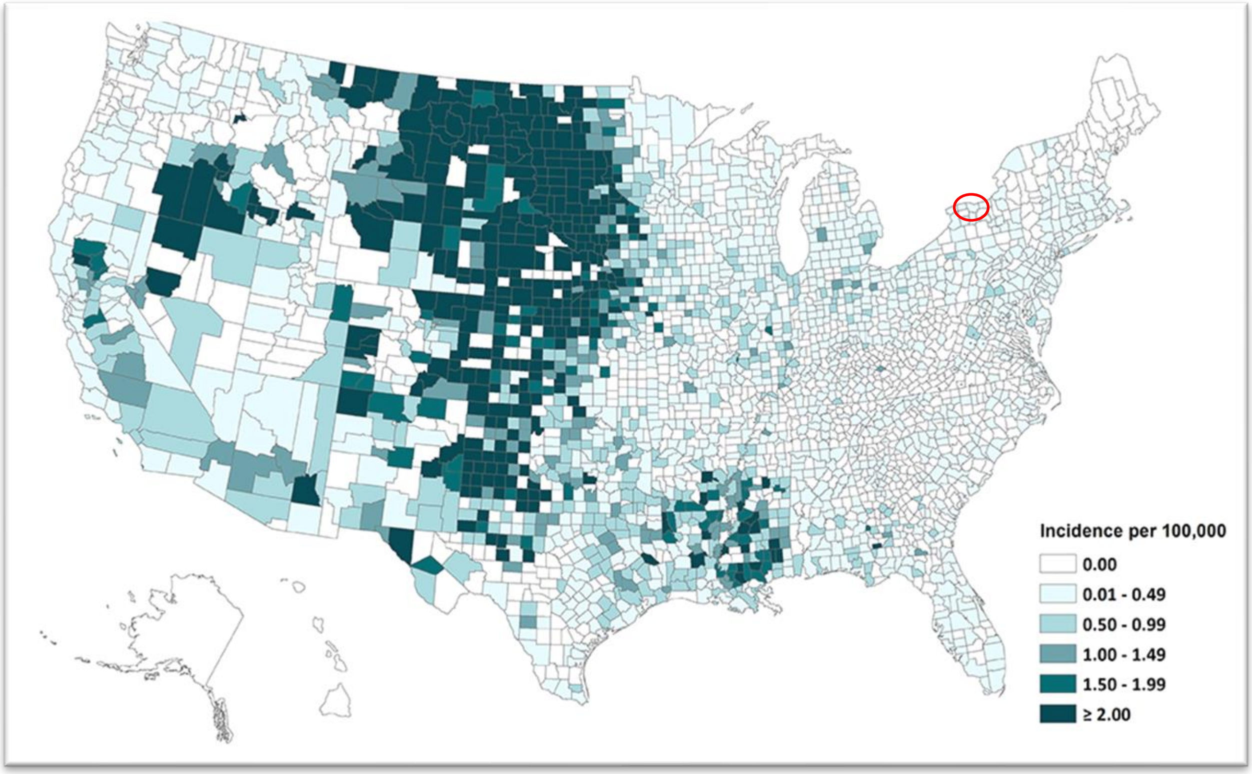
Source: WHO 2009

In New York State, activities to be undertaken during the pandemic period, use the World Health Organization's classification system. The Pandemic Influenza Preparedness and Response document provides guidance to government agencies, individuals, families and communities, and the health sectors at the local and global levels.

West Nile Virus

West Nile Virus (WNV) is the leading cause of mosquito-borne diseases in the continental United States. There are no vaccines to prevent or medications to treat WNV in people, and those infected rarely experience sickness or symptoms. About 1 in 5 infected people will develop a fever and other symptoms, and 1 in 150 infected people will develop a serious, sometimes fatal, illness (CDC 2022). Figure 5.4.1-1 shows the annual average WNV incidences in the United States. The figure shows that Monroe County had between 0.01 and 0.49 incidents per 100,000 people.

Figure 5.4.1-1. Average Annual Incidence of West Nile Virus Neuroinvasive Disease Reported to CDC by County, 1999-2020

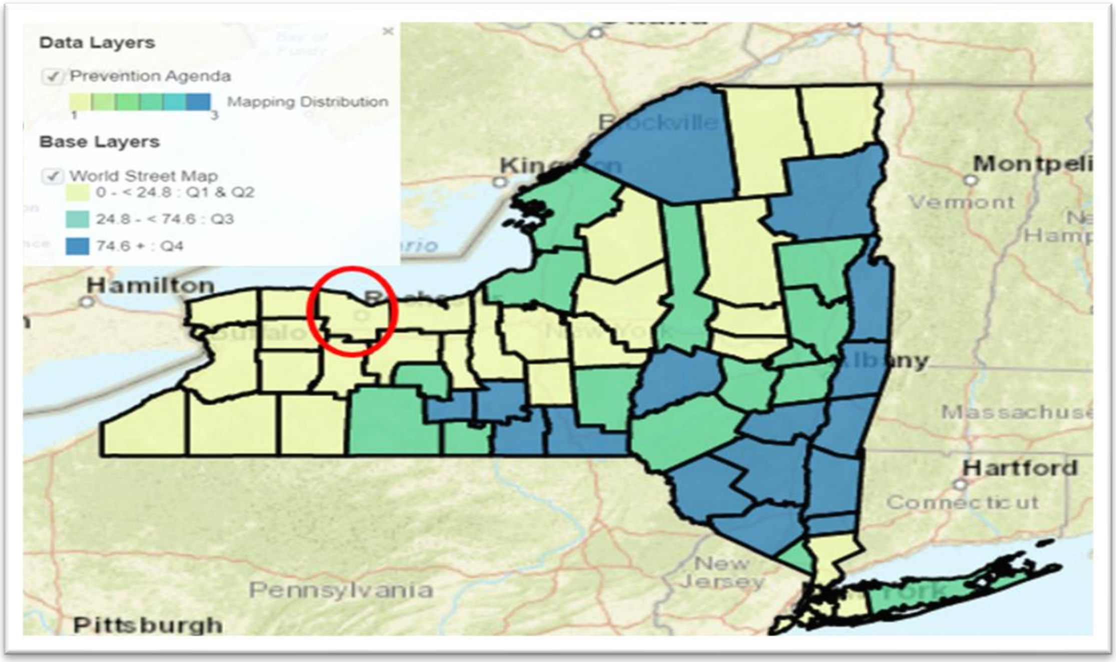


Source: CDC 2022
Note: The red circle shows the approximate location of Monroe County

Lyme Disease

Lyme disease is the most reported vector borne illness in the U.S. Between 2000 and 2018, there was a total of 527 confirmed cases in Lyme disease in Monroe County, including 89 cases in 2013, the highest number of reported cases of a given year (TickCheck 2022). The CDC only reports confirmed cases, due to this the true number of cases is estimated at 5,270. Figure 5.4.1-2 below shows New York State and Monroe County related Lyme disease incidents.

Figure 5.4.1-2. Lyme disease Incidences Rate per 100,000 people,



Source: *Health Data NY*
Note: *The red circle indicates the approximate location of Monroe County*

Location

Monroe County's geographic and demographic characteristics make it particularly vulnerable to importation and spread of infectious diseases. In terms of pandemic influenza, all counties may experience pandemic influenza outbreak caused by factors such as population density and the nature of public meeting areas. Densely populated areas will spread diseases quicker than less densely populated areas. There are some densely populated municipalities in the County, leading to the spread of influenza and coronavirus more quickly than less densely populated communities.

Previous Occurrences and Losses

Historical information regarding previous occurrences and losses associated with disease outbreak events throughout New York State and areas within Monroe County was obtained from many sources. Given so many sources reviewed for the purpose of this HMP, loss and impact information regarding many events could vary depending on the source.

FEMA Major Disaster and Emergency Declarations

New York State has included three disease outbreak-related declarations; one disaster declaration (DR) for Covid-19 and two emergency declarations (EM) for West Nile virus and Covid-19. Generally, these disaster declarations cover a wide range of the State and impact many counties. Monroe County was included in each of these Statewide disaster declarations.

Table 5.4.1-2. FEMA DR and EM Declarations for Disease Outbreak Events in Monroe County, 2000 to 2020

FEMA Declaration Number	Date(s) Of Event	Event Type	Details
EM-3155	May 22, 2000 – November 1, 2000	Other	West Nile Virus
DR-4480	January 20, 2020 – Ongoing	Biological	COVID-19 Pandemic
EM-3434	January 20, 2020 – Ongoing	Biological	COVID-19 Pandemic

Source: FEMA 2022

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was not included in any USDA-designated agricultural disasters that included disease outbreak events.

Previous Events

Table 5.4.1-3 identifies the known flood events that impacted Monroe County between 2015 and 2022. For events before 2015, refer to Appendix H (Risk Assessment Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Table 5.4.1-3. Major Disease Outbreak Events in Monroe County, 2015 to 2022

Dates of Event	Disease Type	FEMA Declaration Number (if applicable)	Monroe County Designated?	Description
2015	Influenza	N/A	N/A	2,616 confirmed cases of influenza in Monroe County
2015	Lyme Disease	N/A	N/A	123 confirmed cases of Lyme disease in Monroe County
2015	West Nile Virus	N/A	N/A	One confirmed case of West Nile Virus in Monroe County
2016	Influenza	N/A	N/A	2,824 confirmed cases of influenza in Monroe County
2016	Lyme Disease	N/A	N/A	109 confirmed cases of Lyme disease in Monroe County
2016	West Nile Virus	N/A	N/A	One confirmed case of West Nile Virus in Monroe County
2017	Influenza	N/A	N/A	3,701 confirmed cases of influenza in Monroe County
2017	Lyme Disease	N/A	N/A	184 confirmed cases of Lyme disease in Monroe County
2018	Influenza	N/A	N/A	6,902 confirmed cases of influenza in Monroe County
2018	Lyme Disease	N/A	N/A	101 confirmed cases of Lyme disease in Monroe County
2018	West Nile Virus	N/A	N/A	Five confirmed cases of West Nile Virus in Monroe County
2020-2021	Coronavirus	DR-4480, EM-3434	Yes	Monroe County received Public Assistance: Emergency protective measures (Category B). As of November 16, 2022, Monroe County has reported 183,834 positive cases of COVID-19 and 1,762 deaths.

Source: FEMA 2022; NYSDOH 2021; USA Facts 2022
Note: 2019 to present reports were not available for influenza, Lyme disease, and West Nile Virus.

Climate Change Impacts

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to increase. The impacts related to increasing temperatures and sea level rise are already causing complications in the state. *ClimAID: The Integrated Assessment for Effective Climate Change in New York State (ClimAID)* was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011/2014).

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across New York State by 2–3.4 °F by the 2020s, 4.1–6.8 °F by the 2050s, and 5.3–10.1 °F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the state (NYSERDA 2011/2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Monroe County is part of Region 1 (Western New York and the Great Lake Plains), where temperatures are estimated to increase by 4.3 to 6.3ºF by the 2050s and 5.7 to 9.6ºF by the 2080s (baseline of 47.7ºF, middle range projection). Precipitation totals are estimated to increase between four to ten percent by the 2050s and four to thirteen percent by the 2080s (baseline of 34.0 inches, middle-range projection). Table 5.4.1-4. 4 displays the projected seasonal precipitation change for the region (NYSERDA 2011/2014).

Table 5.4.1-4. Projected Seasonal Precipitation Change in Region 2, 2050s (% change)

Winter	Spring	Summer	Fall
+5 to +15	0 to +15	-10 to +10	-5 to +10

Source: NYSERDA 2014

Warmer temperatures and changing rainfall patterns provide an environment where mosquitos can remain active longer, greatly increasing the risk for animals and humans. Lyme disease could also expand throughout the United States as temperatures warm, allowing ticks to move into new areas of the country. The climate changes can also allow tropical and subtropical insects to move from regions where diseases thrive into new places (Natural Resource Defense Council 2015).

An increase in temperature and humidity may also lead to a larger number of influenza outbreaks. Studies have shown that warmer winters led to an increase in influenza cases. During warm winters, fewer people contract influenza which causes a large number in population to remain vulnerable into the next season. This causes an early and strong occurrence of the virus (Towers, et al. 2013).

Probability of Future Occurrences

It is difficult to predict when the next disease outbreak will occur and how severe it will be because viruses are always changing. The United States and other countries are constantly preparing to respond to pandemics. The Department of Health and Human Services and others are developing supplies of vaccines and medicines. In addition, the United States has been working with the WHO and other countries to strengthen the detection of disease and response to outbreaks. Preparedness efforts are ongoing via the New York State Department of Health, and local health departments through community preparedness programs to empower local health departments and their community partners to promote local readiness, foster community resilience, and to ensure comprehensive, coordinated, and effective responses

In Monroe County, the probability for a future disease outbreak event is dependent on several factors. One factor that influences the spread of disease is population density. Populations that live close to one another are more likely to spread diseases. As population density increases in the County, so too will the probability of a disease outbreak event to occur. When there is a significant change in a circulating strain of a virus, more of the population is susceptible and the strain could rapidly spread from person to person (NYC Emergency Management 2019).

As for mosquito-borne and tick-borne diseases, as long as mosquitoes and ticks are found in Monroe County, the risk of contracting WNV, Lyme disease, or other diseases carried by these insects 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 Monroe County and the threat of Lyme disease and other tick-borne diseases will continue. Similar to mosquitoes, there are eradication efforts in place to control the tick population and new methods of control are being developed (Steere, Coburn and Glickstein 2004). Therefore, based on all available information and available data regarding mosquito and tick populations, it is anticipated that mosquito- and tick-borne diseases will continue to be a threat to Monroe County.

Based on historical records and input from the Steering Committee, the probability of occurrence for disease outbreak events in the County is considered "occasional" (between 10 and 100 percent annual probability of a hazard event occurring as presented in Table 5.3-2). Disease outbreak was not previously ranked as a hazard of concern for the County. With the emergence of the COVID-19 pandemic, disease outbreak has been identified as a new hazard of concern for many counties throughout the State.

5.4.1.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. The following discusses Monroe County's vulnerability, in a qualitative nature, to the disease outbreak hazard.

Impact on Life, Health, and Safety

The entire population of Monroe County (753,109) is vulnerable to the disease outbreak hazard. Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this 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 also have an increased risk of exposure or transmission of disease to the closer proximity of the population to potentially infected people.

Most recently with COVID-19, the Centers for Disease Control and Prevention have indicated that persons over 65 years and older, persons living in a nursing home or long-term care facility, and persons with underlying medical conditions such as diabetes, severe obesity, serious heart conditions, etc. are at a higher risk of getting severely ill (CDC 2021). According to the 2020 American Community Survey 5-year Estimates, there are 128,588 persons over 65 years old in Monroe County (16.9 percent of the County population). This age group would be considered at risk for getting severely ill from the COVID-19 virus.

Impact on General Building Stock

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

Impact on Critical Facilities

No critical facilities are anticipated to be affected by disease outbreaks. Hospitals and medical facilities will likely see an increase in patients which may cause an interruption of services, but it is unlikely that there will be damage to the facilities. Large rates of infection may increase the rate of hospitalization which may overwhelm hospitals and medical facilities and lead to decreased services for those seeking medical attention. The recent coronavirus pandemic has led to overwhelmed hospitals in numerous locations across New York State, including Monroe County.

Impact on Economy

The impact disease outbreaks have on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with the activities and programs implemented to conduct surveillance and address disease outbreaks have not been quantified in the available documentation. Instead, activities and programs implemented by the County to address this hazard are described below, all of which could impact the local economy.

COVID-19 has had a significant impact on employment levels in the Finger Lakes Region. At its peak decline in April, the Rochester Metropolitan Statistical Area (RMSA) had 101,500 fewer non-farm jobs than a year earlier, including nearly 87,000 in the private sector. May through July brought partial recovery, with the July year-over-year decline totaling 69,500 overall jobs (including 59,400 in the private sector) (Finger Lakes Regional Economic Development Council 2020). Tourism, hospitality, and retail trade sectors accounted for nearly a third of job losses as of July 2020.

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

Impact on the Environment

Disease outbreaks may have an impact on the environment if the outbreaks are caused by invasive species. Invasive species tend to be competitive with native species and their habitat and can be the major transmitters of disease like Zika, dengue, and yellow fever (Placer Mosquito and Vector Control District 2019). Secondary impacts from mitigating disease outbreaks could also have an impact on the environment. Pesticides used to control disease carrying insects like mosquitos have been reviewed by the EPA and the New York Department of Environmental Conservation. If these sprays are applied in large concentrations, they could potentially leach into waterways and harm nearby terrestrial species. As a result, pesticides must be registered before they can be sold, distributed, or used in the state (New York Department of Environmental Conservation 2020).

Cascading Impacts on Other Hazards

There are no known cascading impacts that disease outbreaks can cause to other hazards of concern for Monroe County.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the county can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The county considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development

- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

As discussed in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the disease outbreak hazard because the entire planning area is exposed and vulnerable. Additional development of structures in areas with high population density are at an increased risk. Please refer to the specific areas of development indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). Changes in the density of population 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. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

As discussed earlier in this section, the relationship between climate change and increase in infectious diseases is difficult to predict with certainty, however there may be linkages between the two. Changes in the environment may create a more livable habitat for vectors carrying disease as suggested by the Centers for Disease Control and Prevention (CDC 2021). Localized changes in climate and human interaction may also be a factor in the spread of disease.

Change of Vulnerability Since 2017 HMP

Disease outbreak was not identified as a hazard of concern in the 2017 HMP. Tick-borne diseases including Lyme and West Nile Virus as well as coronavirus are included in this section. Updated data regarding the extent of these diseases are included to provide a better understanding of the potential impacts caused by the disease outbreak hazard.

5.4.2 DROUGHT

This section provides a profile and vulnerability assessment of the drought hazard for Monroe County.

5.4.2.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections, and the probability of future occurrences of the drought hazard.

Hazard Description

Drought is a period characterized by long durations of below-normal precipitation. Drought is a temporary irregularity and differs from aridity since the latter is restricted to low-rainfall regions and is a permanent feature of climate. 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.

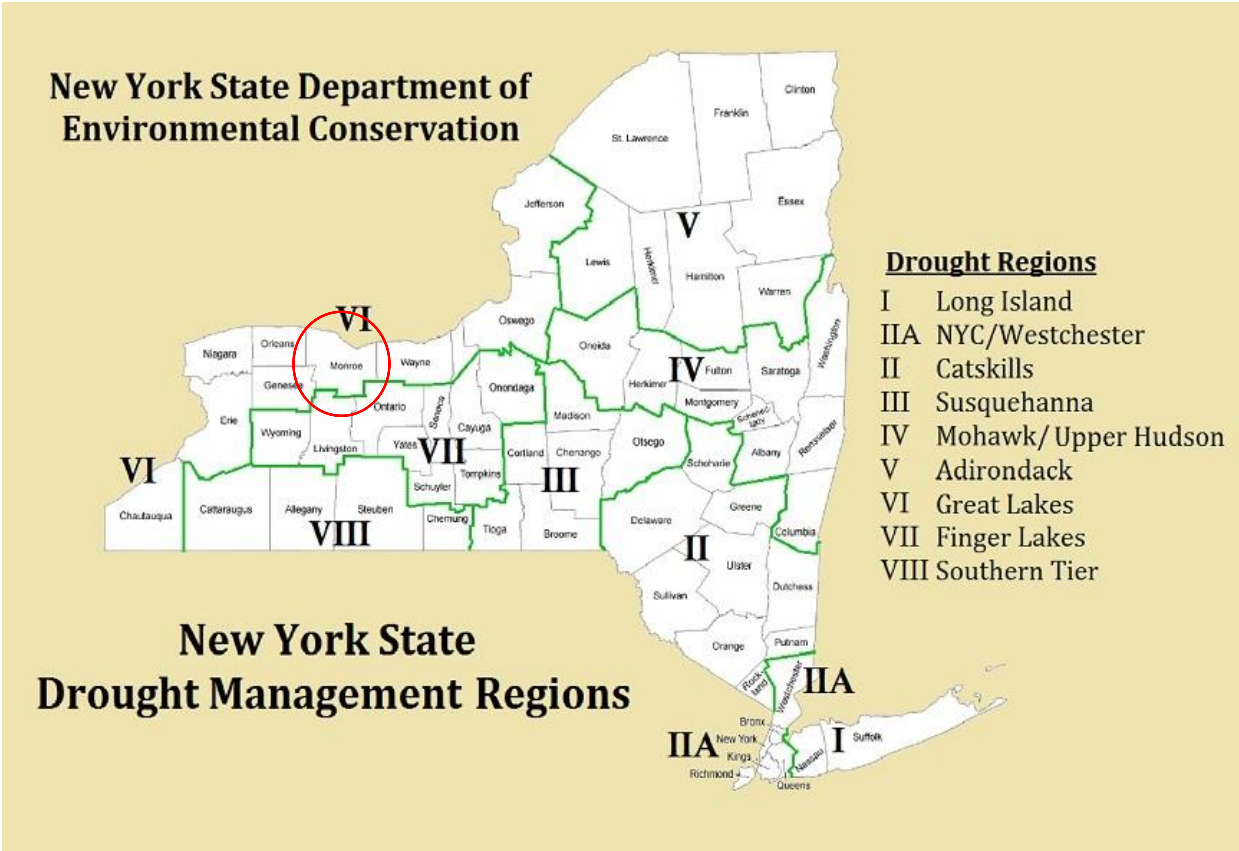
There are four different ways that drought can be defined or grouped:

- ***Meteorological*** drought is a measure of the 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 links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced groundwater or reservoir levels, and other parameters. It occurs when there is not enough water available for a particular crop to grow at a particular time. Agricultural drought is defined in terms of soil moisture deficiencies relative to water demands of plant life, primarily crops.
- ***Hydrological*** drought is associated with the effects of periods of precipitation shortfalls (including snowfall) on surface or subsurface water supply. It occurs when these water supplies are below normal. It is related to the effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
- ***Socioeconomic*** drought is associated with the supply and demand of an economic good with elements of meteorological, hydrological, and agricultural drought. This differs from the aforementioned types of drought because its occurrence depends on the time and space processes of supply and demand to identify or classify droughts. The supply of many economic goods depends on the weather (for example water, forage, food grains, fish, and hydroelectric power). 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 (NDMC 2013).

Location

New York State is divided into nine drought management regions based roughly on drainage basins and county lines. NYSDEC monitors precipitation, lake and reservoir levels, stream flow, and groundwater levels every month within each region, and more frequently during periods of drought. NYSDEC uses these data to assess the condition within each region, which can range from "normal" to "drought disaster" (NYSDEC 2022). Monroe County is identified as NYSDEC Drought Management Region 6, the Great Lakes Drought Region (Figure 5.4.2-1).

Figure 5.4.2-1. NYSDEC Drought Management Regions of New York State



Source: NYSDEC 2022
Note: The red circle indicates the approximate location of Monroe County.

When a drought occurs, the agricultural industry is most at risk in terms of economic impact and damage. According to the 2017 Census of Agriculture, Monroe County is home to 527 farms, covering 106,778 acres. Only 1 percent of that land is irrigated (USDA 2017). Some farms have access to Monroe County Water Authority for tank loads during emergencies. Many dairy operations on the west side of Monroe County are on well water, while many horse operations in the County are on public water service. In cases of emergency, tank loads can be dumped into wells or on-site water tanks can be delivered. A minority of crop farmers in Monroe County have irrigation and access to an emergency water source.

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 (NOAA 2022). The NYSDEC and the New York State Drought Management Task Force identify droughts in the following four stages:

- ***Normal*** is considered the standard moisture soil levels found throughout New York State
- ***Drought Watch*** is the first stage of drought. This stage is declared by the NYSDEC and is 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*** is the second stage of drought. This stage is also declared by the NYSDEC and 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 the third stage of drought. This stage is declared by the NYSDHSES, based upon the recommendation of the Task Force. It is a notice of existing severe and persistent drought conditions. An emergency declaration is a notice for 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 likely are unable to respond adequately (NYSDEC n.d.).

New York State applies two methodologies to identify the different drought stages. The most commonly used indicator is the Palmer Drought Severity Index (PDSI), which is primarily based on soil conditions. Soil with decreased moisture content is the first indicator of an overall moisture deficit. The second methodology applied in New York State, created by the NYSDEC, is known as the State Drought Index (SDI) (NYSDEC n.d.).

Table 5.4.2-1 lists the Palmer Drought Severity Index (PDSI) classifications. According to the National Integrated Drought Information System (NIDIS), the PDSI was developed in 1965, and indicates prolonged and abnormal moisture deficiency or excess. It uses temperature and precipitation data to calculate water supply and demand, incorporates soil moisture, and is considered most effective for assessing moisture conditions in unirrigated cropland. The PDSI primarily indicates long-term drought and has been used extensively as a signal to initiate drought relief (NIDIS 2015).

Table 5.4.2-1. PDSI Classifications

Palmer Classifications	
4.0 or more	Extremely wet
3.0 to 3.99	Very wet
2.0 to 2.99	Moderately wet
1.0 to 1.99	Slightly wet
0.5 to 0.99	Incipient wet spell
0.49 to -0.49	Near normal
-0.5 to -0.99	Incipient dry spell
-1.0 to -1.99	Mild drought
-2.0 to -2.99	Moderate drought
-3.0 to -3.99	Severe drought
-4.0 or less	Extreme drought

Source: NDMC 2013

The SDI evaluates drought conditions more comprehensively by determining whether numerous indicators reach dire thresholds. It compares the following four parameters to historical or "normal" values to evaluate drought conditions: stream flows, precipitation, lake and reservoir storage levels, and groundwater levels. The State's Drought Management Task Force uses those factors along with water use, duration of the dry period, and season to assess drought within different areas of the State. The data acquired are compared to critical threshold values to indicate a normal or changeable drought condition. The indicators are weighted regionally to reflect the different circumstances within each drought management region (NYS DHSES 2014; NYSDEC 2022). Table 5.4.2-2 lists the SDI index range within the Normal stage and the three drought stages.

Table 5.4.2-2. State Drought Index Range of Values

Drought Stage	Drought Index Range
Normal	100 to 150
Watch	75 to 100
Warning	50 to 70
Emergency	0 to 50

Source: NYS DHSES 2014

Previous Occurrences and Losses

Many sources provide historical information regarding previous occurrences and losses associated with drought events throughout New York State and Monroe County. Information about loss and impact resulting from each of many events can vary depending on the source. Notably, monetary amounts cited in this section on drought derive solely from information obtained during the research for this HMP.

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, FEMA declared that New York State underwent one drought-related disaster (DR) or emergency (EM) classified as a water shortage. Generally, drought-related disasters affect a wide region of the State and thus may have impacted many counties. However, Monroe County was not included in the disaster declaration.

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was included in the following USDA-designated agricultural disasters that included or may have included losses due to drought:

- S4023 - 2016 Drought
- S4031 - 2016 Drought
- S4037 - 2016 Drought

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are low the following years as well. USDA records indicate that Monroe County has experienced crop losses from severe storm events in the years when USDA disasters were declared. Table 5.4.2-3 provides details regarding crop losses in Monroe County according to USDA records.

Table 5.4.2-3. USDA Crop Losses from Drought in Monroe County

Year	Crop Type	Cause of Loss	Losses
2016	Wheat	Drought	$2,697.00
2016	Corn	Drought	$1,183,280.10
2016	Sweet Corn	Drought	$134,788.80
2016	Fresh Market Sweet Corn	Drought	$49,309.00
2016	Processing Beans	Drought	$84,969.50
2016	Dry Beans	Drought	$73,666.00
2016	Apples	Drought	$30,050.22

Year	Crop Type	Cause of Loss	Losses
2016	Green Peas	Drought	$89,502.00
2016	Cabbage	Drought	$80,389.00
2016	Soybeans	Drought	$367,032.80

Source: USDA 2022

Previous Events

Table 5.4.2-4 identifies the known drought events that impacted Monroe County between 2015 and 2022. For events prior to 2015, refer to Appendix H (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Table 5.4.2-4. Drought Events in Monroe County between 2015 and 2022.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
January – July 2015	Drought	N/A	No	According to the U.S. Drought Monitor, D0 conditions in Monroe County lasted from January through July 2015.
December 2015 – February 2016	Drought	N/A	No	According to the U.S. Drought Monitor, D0 conditions lasted from December 2015 to February 2016.
May 2016 – March 2017	Drought	N/A	No	According to the U.S. Drought Monitor, conditions varied between D0 – D3 drought in Monroe County from summer 2016 to the spring of 2017. NOAA – NCEI described a weather pattern supporting dry conditions were prevalent across New York resulting in below-normal precipitation. In addition, below-normal snowpack from a mild winter left conditions drier than normal going into spring. These were the primary factors that led to the drought conditions. The USGS groundwater level network showed that numerous wells are in the driest 10th percentile.
June – September 2018	Drought	N/A	No	According to the U.S. Drought Monitor, conditions varied from D0-D1 drought conditions in Monroe County from June to September 2018.
September – October 2019	Drought	N/A	No	Monroe County briefly experienced D0 drought conditions from September to October 2019 according to the U.S. Drought Monitor.
July 2022	Drought Watch	N/A	No	Monroe County is one of 21 counties placed under drought watch by the New York State Department of Environmental Conservation.

Sources: NOAA-NCEI 2022; USDA 2022; U.S. Drought Monitor 2022; (Rochester First 2022); The Democrat and Chronicle Various Articles; NWS Buffalo 2007; The Times Union 2007.

FEMA Federal Emergency Management Agency
N/A Not applicable
NRCC Northeast Regional Climate Center
NWS National Weather Service
USDA U.S. Department of Agriculture

Climate Change Impacts

According to the 2019 New York State HMP update, rising summer temperatures, along with little change in summer rainfall, are projected to increase frequency of short-term droughts. This scenario will lead to impacts on the natural and managed ecosystems across New York State. Water management and hydrology are also affected (NYS DHSES 2019).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Monroe County is part of Region 1, Western New York, Great Lakes Plain. In Region 1, it is estimated that temperatures will increase by 3.0 ºF to 5.5 ºF by the 2050s and 4.5 ºF to 8.5 ºF by the 2080s (baseline of 48.0 ºF, mid-range projection). Precipitation totals will increase between 0 and 10 percent by the 2050s and 0 to 15 percent by the 2080s (baseline of 37.0 inches, mid-range projection). Table 5.4.2-5 displays the projected seasonal precipitation change for the Region 1 (NYSERDA 2011).

Table 5.4.2-5. Projected Seasonal Precipitation Change in Region 1, 2050s (% change)

Winter	Spring	Summer	Fall
5 to +15	0 to +15	-10 to +10	-5 to +10

Source: NYSERDA 2011

With the increase in temperatures, heat waves will become more frequent and intense as shown in Table 5.4.2-6 below. Heat waves, defined as three or more consecutive days with maximum temperatures at or above 90 ˚F. Summer droughts are projected to increase under these conditions, affecting water supply, agriculture, ecosystems, and energy projects (NYSERDA 2014).

Table 5.4.2-6. Extreme Event Projections for Region 1

Middle Range (25th to 75th Percentile)	2020s	2050s	2080's
Days over 90 °F (8 days)	14 to 17	22 to 34	27 to 57
# of Heat Waves (0.7 heat waves)	2 to 2	3 to 4	3 to 8
Duration of Heat Waves (4 days)	4 to 4	4 to 5	5 to 6
Days below 32 °F (133 days)	103 to 111	84 to 96	68 to 88
Days over 1" Rainfall (5 days)	5 to 5	5 to 5	5 to 6
Days over 2" Rainfall (0.6 days)	0.6 to 0.7	0.6 to 0.8	0.6 to 0.9

Source: NYSERDA 2014

By the end of the 21st century, the number of droughts is likely to increase, as the effect of higher temperatures on evaporation is likely to outweigh the increase in precipitation. Droughts in the northeast U.S. have been associated with local and remote modes of multi-year ocean-atmosphere variability that are unpredictable and may change with climate change. Changes in distribution of precipitation throughout the year and in timing of snowmelt could increase frequency of droughts (NYSERDA 2011).

Probability of Future Occurrences

Based upon risk factors for and past occurrences, it is likely that droughts will occur across New York State and Monroe County in the future. In addition, as temperatures increase (see climate change impacts), the probability for future droughts will likely increase as well. Therefore, it is likely that droughts will occur in the State and County of varied severity in the future.

It is estimated that Monroe County will continue to experience direct and indirect impacts of drought and its impacts on occasion, with the secondary effects causing potential disruption or damage to agricultural activities and creating shortages in water supply within communities.

In Section 5.3, the identified hazards of concern for Monroe County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee, the probability of occurrence for drought in the County is considered 'occasional' (between 10 and 100 percent annual probability of a hazard event occurring, as presented in Table 5.3-2).

5.4.2.2 Vulnerability Assessment

Drought is a significant concern to Monroe County, mainly due to its impact on public health, natural resources, and agriculture. Estimated losses are difficult to quantify; however, drought events can impact Monroe County's population and economy. Assets at particular risk would include areas used for agricultural purposes (farms and cropland). In the past, drought in other counties and regions affected Monroe County, including the 2007 persistent shortage of rainfall along the Mohawk Valley and in Western New York. This dry period reduced the amount of water available to maintain sufficient navigational depth in some sections of the NYS Canal System, which was forced to close commercial traffic one week early that October, impacting local food supply and trade markets. That closure also impacted water-based recreational markets, affecting the local economy. Year-round recreation and tourism in Monroe County from snow skiing to boating and other activities rely on water.

In addition, water supply resources could be impacted by extended periods of below average rain. The County's public water supply is lake fed, but rural populations are served by private wells and are significantly affected by periods of diminished groundwater resources. Particularly susceptible to the drought hazard and cascading impacts are populations vulnerable because of age, health conditions, limited ability to mobilize to shelter, and limited accessibility to cooling and medical resources.

Potential drought impacts are agricultural, hydrologic, and socioeconomic. The sequence of these impacts highlights the differences among them. When a drought begins, the agricultural sector is typically the first to be affected due to its heavy dependence on stored soil water. During dry periods, soil water can deplete quickly. If precipitation deficiencies continue, people who depend on other sources of water will begin to feel impacts of the shortage. Those who rely on surface water (for example, reservoirs and lakes) and subsurface water (for example, groundwater) are usually the last to be affected. A short-term drought that persists for 3 to 6 months may have little impact on these sectors, depending on characteristics of the hydrologic system and intensity of water use (NYS DHSES 2014).

Because agriculture and related sectors, including forestry, fisheries, and water activities, rely on surface and subsurface water supplies, they are vulnerable to numerous economic impacts. Droughts often result in loss of crop yields and livestock production, increased issues with insect infestations, increased forest diseases, and reduced growth. Forest and grass fires also increase substantially during extended drought periods, posing higher levels of risk to human and wildlife populations, as well as to property (NYS DHSES 2014)

Loss of income is another factor in assessment of impacts of drought. Examples of income loss include reduced income for farmers, and for retailers and others who provide goods and services to farmers. The recreation and tourism industries may also undergo a loss of income because of increased costs of food, energy, and other products as supplies decrease. Some local shortages of certain goods trigger the need to import goods from outside the affected region. Reduced water supply affects use of rivers and other water bodies. Hydropower production may also be impacted by drought (NYS DHSES 2014)

Environmental losses from drought include damages to plant and animal species, wildfire habitat, and air and water quality; forest and grass fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some impacts may be short-term, and others may linger for longer periods of time. If changes in climate intensify, environmental impacts and losses may become more significant. Wildfire habitat may be degraded through loss of wetlands, lakes, and vegetation. Increased soil erosion can lead to a more permanent loss of biological productivity of landscapes. However, quantifying environmental losses is difficult (NYS DHSES 2014).

Social impacts primarily involve public safety, health, conflicts among water users, reduced quality of life, and inequities in distribution of impacts and disaster relief. Many economic and environmental effects induce social impacts as well (NYS DHSES 2014).

To understand risk, a community must evaluate what assets are exposed or vulnerable within the identified hazard area. Regarding the drought hazard, all of Monroe County has been identified as the hazard area. Therefore, all assets within the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 4), are vulnerable to a drought. The following factors are addressed in subsequent text that evaluates and estimates potential impacts of the drought hazard on the County:

- Impact on: (1) life, health, and safety of residents; (2) general building stock; (3) critical facilities; (4) economy; and (5) environment
- Cascading Impacts on Other Hazards
- Future changes that may impact vulnerability
- Change of vulnerability since the 2017 HMP

Impact on Life, Health, and Safety

The entire population of Monroe County is vulnerable to drought events. According to the 2020 U.S. Census, the county had a population of 753,109. 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 2013). 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 2012).

As previously stated, drought conditions can cause shortages of water for human consumption. Droughts can also lead to reduced local firefighting capabilities. The drought hazard is a concern for Monroe County because rural populations within the County rely upon private water supply from local groundwater resources.

Impact on 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). Therefore, all assets within and adjacent to the WUI zone—including population, structures, critical facilities, lifelines, and businesses—are considered vulnerable to wildfire. Refer to Section 5.4.11 for more information on wildfire risk.

Impact on Critical Facilities

Water supply facilities may be affected by short supplies of water. As mentioned, drought events generally do not impact buildings; however, droughts can impact agriculture-related facilities and critical facilities associated with potable water supplies. Also, those critical facilities in and adjacent to the WUI zone are considered vulnerable to wildfire. Refer to Section 5.4.11 for more information on wildfire risk.

Impact on Economy

Drought causes many economic impacts on agriculture and related sectors (forestry, fisheries, and waterborne activities). In addition to losses in yields in crop and livestock production, drought is associated with increased insect infestations, plant diseases, and wind erosion. Drought can lead to other losses because so many sectors are affected—losses that include reduced income for farmers and reduced business for retailers and others who provide goods and services to farmers. This leads to unemployment, increased credit risk for financial institutions, capital shortfalls, and loss of tax revenue. Prices for food, energy, and other products may also increase as supplies decrease (NYS DHSES 2014). As noted in the 2019 New York State HMP, economic impacts that could occur from drought include the following:

- Decreased land prices
- Loss to industries directly dependent on agricultural production (e.g., machinery and
- Fertilizer manufacturers, food processors, dairies, etc.)
- Unemployment from drought-related declines in production
- Strain on financial institutions (foreclosures, more credit risk, capital shortfalls)
- Revenue losses to Federal, State, and Local governments (from reduced tax base)
- Reduction of economic development
- Fewer agricultural producers (due to bankruptcies, new occupations)
- Rural population loss.

When a drought occurs, the agricultural industry is most at risk for economic impact and damage. During droughts, crops do not mature, which results in smaller crop yield, undernourishment of wildlife and livestock, decreases in land values, and ultimately financial loss to the farmer (FEMA 1997).

Based on the 2017 Census of Agriculture, 527 farms were present in Monroe County, encompassing 106,778 acres of total farmland. The average farm size was 203 acres. Monroe County farms had a total market value of products sold of $76.64 million, averaging $145,433 per farm (USDA 2017). Table 5.4.2-7 lists the acreage of agricultural land exposed to the drought hazard.

Table 5.4.2-7. Agricultural Land in Monroe County in 2017

Number of Farms	Land in Farms (acres)	Total Cropland (acres)	Total Pastureland (acres)	Acres Irrigated
527	106,778	85,422	4,271	639

Source: USDA 2017

In 2017, the top three agricultural products sold in Monroe County were grains, oilseeds, dry beans, and dry peas at $26 million; vegetables, melons, potatoes, and sweet potatoes at $19.7 million; and nursery, greenhouse, floriculture, and sod at $11.9 million. Monroe County was the eighth-highest-ranked County in the State for its sales of cut Christmas trees and short rotation woody crops, and sixth highest ranked for its total acreage of crop items for all harvested vegetables (USDA 2017).

If the average production (dollar value) per crop type could be identified on a per acre basis, loss estimates could be developed based on assumed percent damage that could result from a drought. If a drought impacted 40 percent of the agricultural products sold from Monroe County farms, based on 2017 market values, this would be a loss of $30.6 million. This figure does not include how the tourism industry and local jobs are impacted.

Impact on the Environment

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 periods because they are dependent on steady water levels and soil moisture availability to sustain growth. As a result, these types of habitats can be negatively impacted after long periods of dryness.

Cascading Impacts On Other Hazards

Drought may trigger wildfires in the County. As discussed in earlier sections, drought can lead to increasing temperatures and evaporation of moisture, which are ideal dry conditions for wildfire events to occur. Dry, hot, and windy weather combined with dry vegetation is more susceptible to sparking wildfires when met with a spark created by humans or natural events, such as lightning (National Integrated Drought Information System 2020). Refer to Section 5.4.11 for more information on wildfire risk.

Drought may also increase the spread of certain insect infestations. For more information on invasive species, refer to Section 5.4.7.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the county can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The county considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in the population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

Section 4 identifies areas targeted for future growth and development across the County. Any areas of growth located in the County could be susceptible to drought. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Projected Changes in the Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). Changes in the density of the population can impact the number of persons exposed to drought and the draw upon water resources.

Climate Change

As discussed above, most studies project that the State of New York and Monroe County will see an increase in average annual temperatures. Additionally, the State is projected to experience more frequent droughts.

Droughts can cause deficits in surface and groundwater used for drinking water. The New York State Water Resources Institute at Cornell University conducted a vulnerability assessment of drinking water supplies and climate change. To assess water supplies in New York State, it was assumed that long-term average supply will remain the same, but the duration and/or frequency of dry periods may increase. Both types of water supplies, surface water and groundwater, were divided into three categories: sensitive to short droughts (two to three months), sensitive to moderate and longer droughts (greater than six months), and relatively sensitive to any droughts. Major reservoir systems are presumed to have moderate sensitivity to drought because there is a likelihood of decreases in summer and fall water availability (NYSERDA 2011). The greatest likelihood of future water shortages is likely to occur on small water systems.

Change of Vulnerability Since 2017 HMP

Monroe County continues to be vulnerable to the drought hazard. Updated population and building stock statistics were used in the current risk assessment. Further, exposure for both the population and critical facilities was analyzed. These updated datasets provide a more accurate exposure analysis to the drought hazard.

5.4.3 EARTHQUAKE

This section provides a profile and vulnerability assessment of the earthquake hazard for Monroe County.

5.4.3.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections and the probability of future occurrences for the earthquake hazard.

Hazard Description

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 by a manmade explosion (FEMA 2013). Most earthquakes occur at the boundaries where the Earth's tectonic plates meet (faults); however, less than 10 percent of earthquakes occur within plate interiors. New York State is in an area where plate interior-related earthquakes occur. As plates continue to move and plate boundaries change over geologic time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust (Shedlock and Pakiser 1997).

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter (Shedlock and Pakiser 1997). Earthquakes usually occur without warning and their effects can impact areas of great distance from the epicenter.

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 (FEMA 2001). This includes surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, tsunamis, and seiches. A description of each of these is provided below.

- *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 20 kilometers.
- *Ground motion (shaking):* The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
- *Landslide*: A movement of surface material down a slope.
- *Liquefaction*: A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.
- *Tectonic Deformation*: A change in the original shape of a material due to stress and strain.
- *Tsunami*: A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands.
- *Seiche*: The sloshing of a closed body of water from earthquake shaking (USGS 2012).

Location

As noted in the 2019 NYS HMP, the importance of the earthquake hazard in New York State is often underestimated because other natural hazards (for example, hurricanes and floods) occur more frequently and because major hurricanes and floods have occurred more recently than a major earthquake event (NYS DHSES

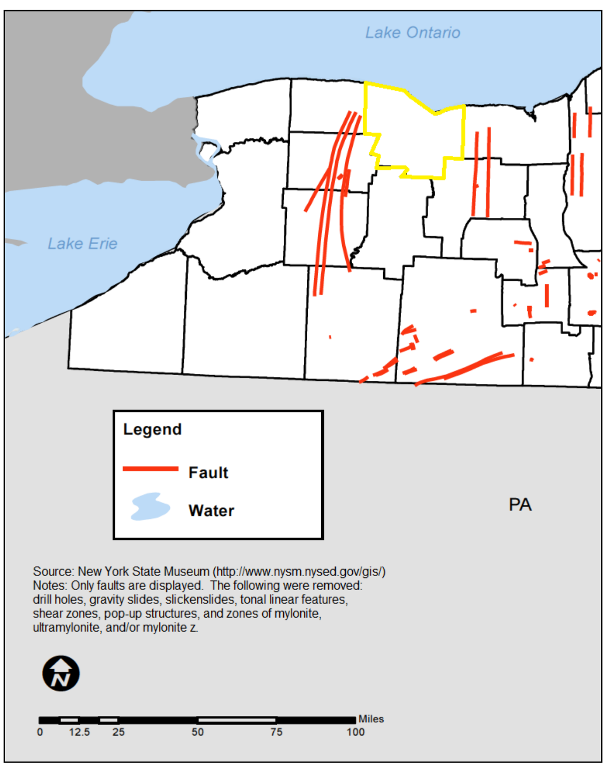
2019). However, the potential for earthquakes exists across all of New York State and the entire northeastern United States. The New York City Area Consortium for Earthquake Loss Mitigation (NYCEM) ranks New York State as having the third highest earthquake activity level east of the Mississippi River (Tantala 2003)

Three general regions in New York State have a higher seismic risk than other parts of the state. These regions are: (1) the north and northeast third of the state, which includes the North Country/Adirondack region and a portion of the greater Albany-Saratoga region; (2) the southeast corner, which includes the greater New York City area and western Long Island; and (3) the northwest corner, which includes Buffalo and its surrounding area. Overall, these three regions are the most seismically active areas of the state, with the north-northeast portion having the higher seismic risk, and the northwest corner of the state having the lower seismic risk (NYS DHSES 2014).

Fractures or fracture zones along with rocks on adjacent sides have broken and moved upward, downward, or horizontally are known as faults (Volkert and Witte 2015). Movement can take place at faults and cause an earthquake. There are numerous faults throughout New York State, and Figure 5.4.3-1 illustrates the faults relative to Monroe County (New York State Museum 2012).

The closest plate boundary to the East Coast is the Mid-Atlantic Ridge, which is approximately 2,000 miles east of Pennsylvania. Over 200 million years ago, when the continent Pangaea rifted apart forming the Atlantic Ocean, the northeast coast of America was a plate boundary. Being at the plate boundary, many faults were formed in the region. Although these faults are geologically old and are contained in a passive margin, they act as pre-existing planes of weakness and concentrated strain. When a strain exceeds the strength of the ancient fault, it ruptures causing an earthquake (PA DCNR 2007).

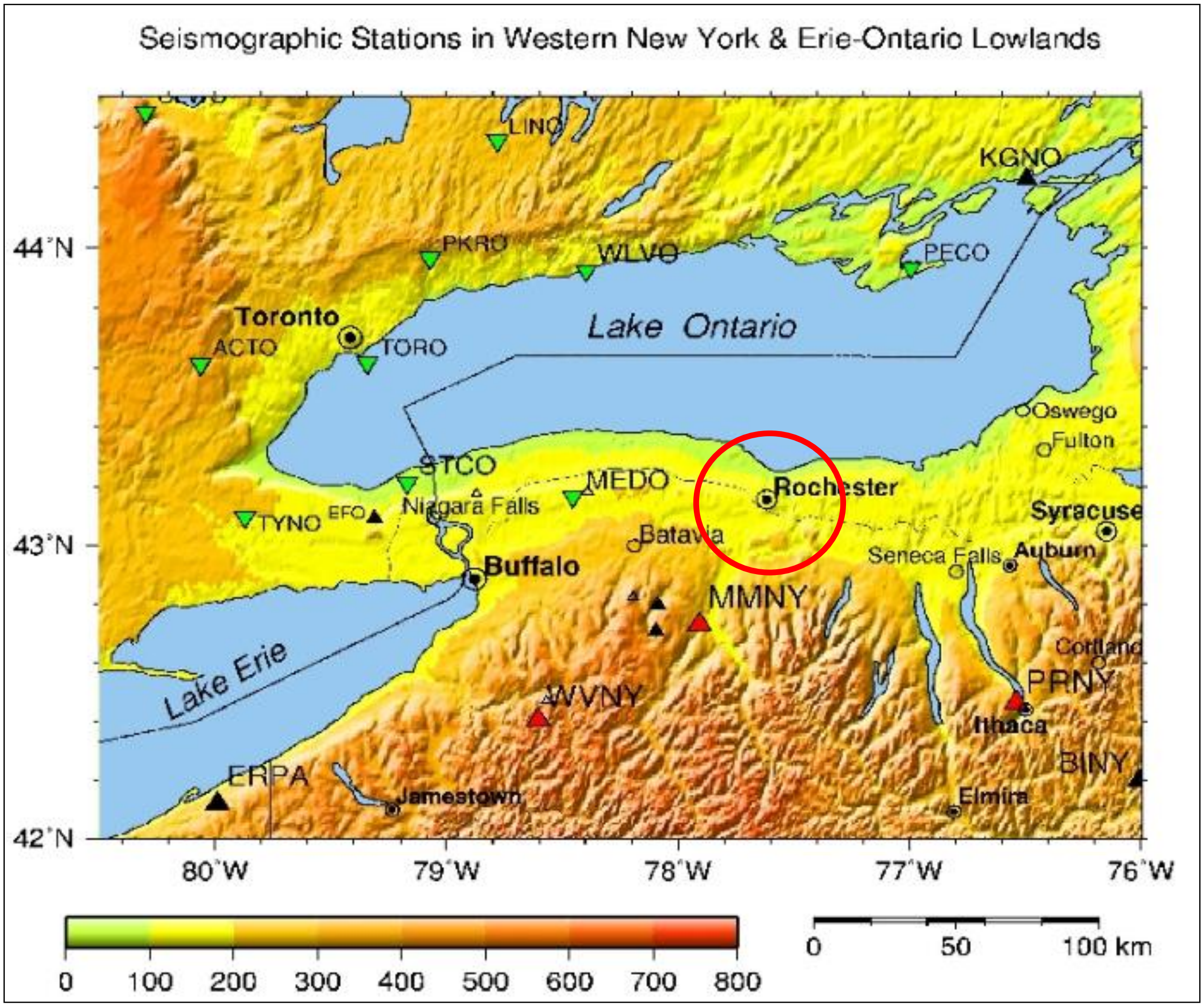
Figure 5.4.3-1. Faults in New York State



Source: New York State Museum 2012
Note: Monroe County is outlined in yellow.

The Lamont-Doherty Cooperative Seismographic Network (LCSN) monitors earthquakes that occur primarily in the northeastern United States. The goals of the monitoring project are to compile a complete earthquake catalog for this region, to assess the earthquake hazards, and to study the causes of the earthquakes in the region. The LCSN operates 40 seismographic stations in the following seven states: Connecticut, Delaware, Maryland, New Jersey, New York, Pennsylvania, and Vermont. No seismographic stations are located in Monroe County; however, there are several within the vicinity of the County. Figure 5.4.3-2 shows the location of these stations in the western New York State area (LCSN 2014).

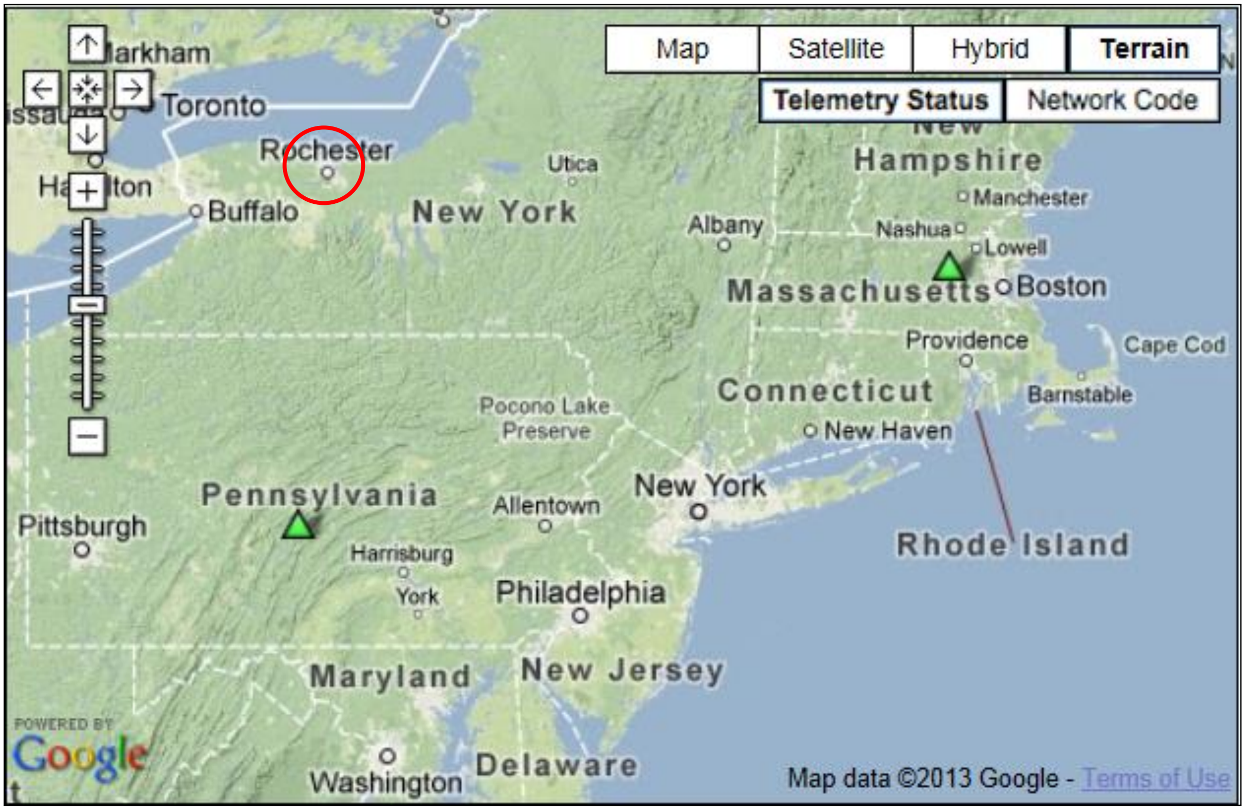
Figure 5.4.3-2. Lamont-Doherty Seismic Station Locations in the Western New York State Area



Source: LCSN 2012
Note: The red circle indicates the approximate location of Monroe County.

In addition to the Lamont-Doherty Seismic Stations, the USGS operates a global network of seismic stations to monitor seismic activity. While no seismic stations are located in New York State, nearby stations are positioned in State College, Pennsylvania, and Oak Ridge, Massachusetts. Figure 5.4.3-3 shows the locations of USGS seismic stations near New York State.

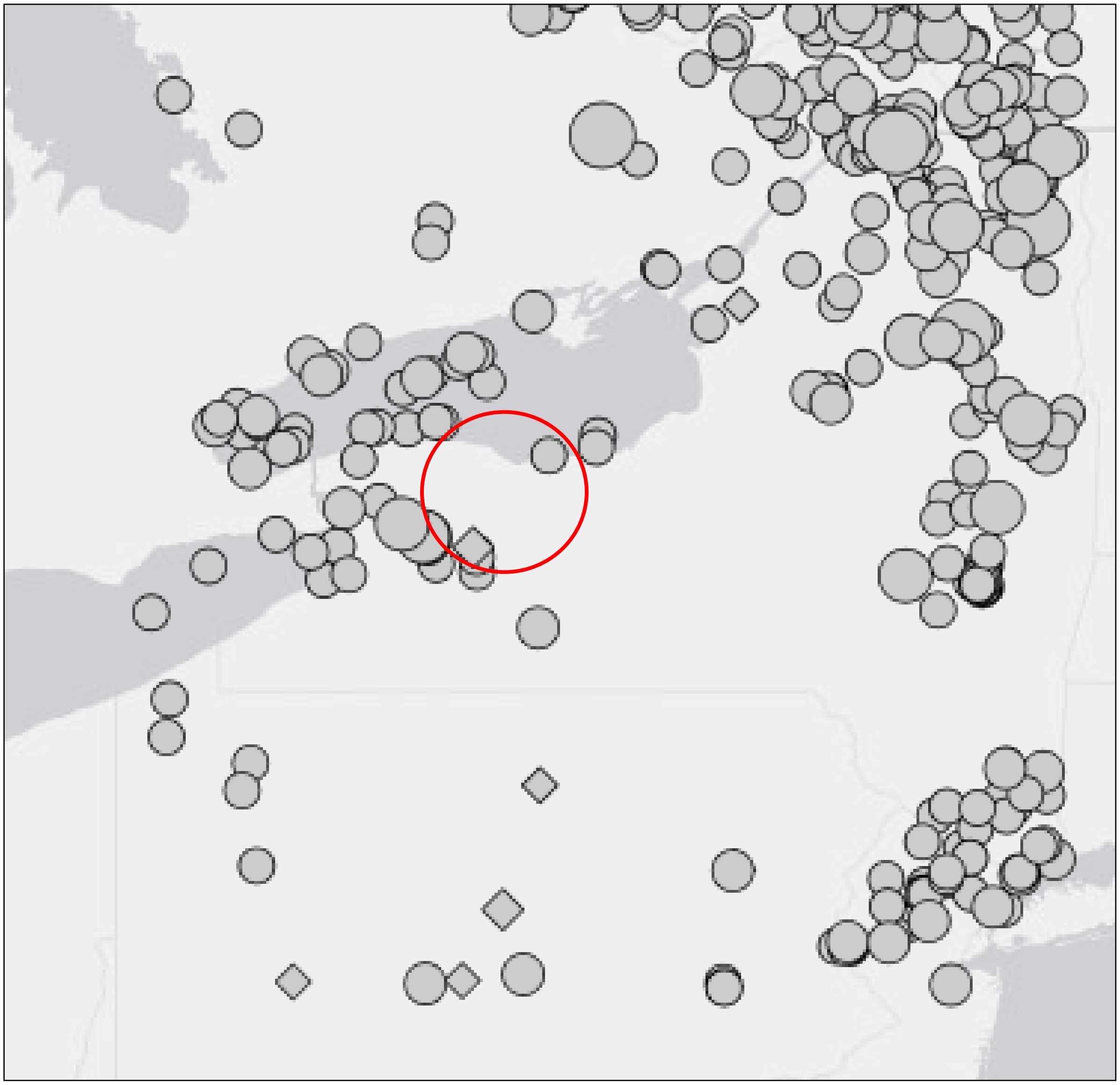
Figure 5.4.3-3. USGS Seismic Stations near New York State



Source: USGS 2015
Note: The red circle indicates the approximate location of Monroe County.

Figure 5.4.3-4 illustrates historic earthquake epicenters across the northeast United States and in New York State between 1914 and 2022. There have been multiple earthquakes originating outside New York's borders that have been felt within the state. These quakes have come from Quebec, Canada; and Massachusetts. According to the NYS HMP, such events are considered significant for hazard mitigation planning because they could produce damage within the state in certain situations.

Figure 5.4.3-4. Earthquake Epicenters in the Northeast U.S., 1914 to 2022



Source: USGS 2022
Note: The red circle indicates the approximate location of Monroe County.

Extent

An earthquake's magnitude and intensity are used to describe the severity and size of the event. intensity describes the overall felt severity of shaking during the event and magnitude describes the size at the focus of an earthquake. The earthquake's magnitude is a measure of the energy released at the source of the earthquake. Magnitude was formerly expressed by ratings on the Richter scale. It is now most commonly expressed using the moment magnitude (Mw) scale. This scale is based on the total moment release of the earthquake (the product of the distance a fault moved, and the force required to move it). The scale is as follows:

- Great Mw > 8
- Major Mw = 7.0 – 7.9
- Strong Mw = 6.0 – 6.9

- Moderate Mw = 5.0 – 5.9
- Light Mw = 4.0 – 4.9
- Minor Mw = 3.0 – 3.9
- Micro Mw = 3.0 – 3.9

The most commonly used intensity scale is the modified Mercalli intensity scale. Ratings of the scale, as well as the perceived shaking and damage potential for structures, are shown in Table 5.4.3-1. The modified Mercalli intensity scale is generally represented visually using shake maps, which show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region. This shaking depends on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust. A USGS shake map shows the variation of ground shaking in a region immediately following significant earthquakes. Table 5.4.3-2 displays the MMI scale and its relationship to the areas peak ground acceleration.

Table 5.4.3-1. Modified Mercalli Intensity Scale

Mercalli Intensity	Shaking	Description
I	Not Felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing automobiles may rock slightly. Vibrations are similar to the passing of a truck. Duration estimated.
IV	Light	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 automobiles rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very Strong	Felt by all. 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	Felt by all. 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	Felt by all. 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	Felt by all. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: USGS 2014

Table 5.4.3-2. Modified Mercalli Intensity (MMI) and PGA Equivalents

Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	< .17	Not Felt	None
II	.17 – 1.4	Weak	None
III	.17 – 1.4	Weak	None
IV	1.4 – 3.9	Light	None
V	3.9 – 9.2	Moderate	Very Light
VI	9.2 – 18	Strong	Light
VII	18 – 34	Very Strong	Moderate

Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
VIII	34 – 65	Severe	Moderate to Heavy
IX	65-124	Violent	Heavy
X	>124	Extreme	Very Heavy

Source: Freeman et al. (Purdue University) 2004
Note: PGA Peak Ground Acceleration

The ground experiences acceleration as it shakes during an earthquake. The peak ground acceleration (PGA) is a measure of how hard the earth shakes in a given geographic area. It is expressed as a percentage of the acceleration due to gravity (percent g). Horizontal and vertical PGA varies with soil or rock type. Earthquake hazard assessment involves estimating the annual probability that certain ground accelerations will be exceeded, and then summing the annual probabilities over a period of interest. Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Figure 5.4.3-2 through Figure 5.4.3-4.

PGA expresses the severity of an earthquake and is a measure of how hard the earth shakes, or accelerates, in a given geographic area. PGA is expressed as a percent acceleration force of gravity (%g). For example, 1.0%g PGA in an earthquake (an extremely strong ground motion) means that objects accelerate sideways at the same rate as if they had been dropped from the ceiling. 10%g PGA means that the ground acceleration is 10% that of gravity (NJOEM 2013). Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Table 5.4.3-3.

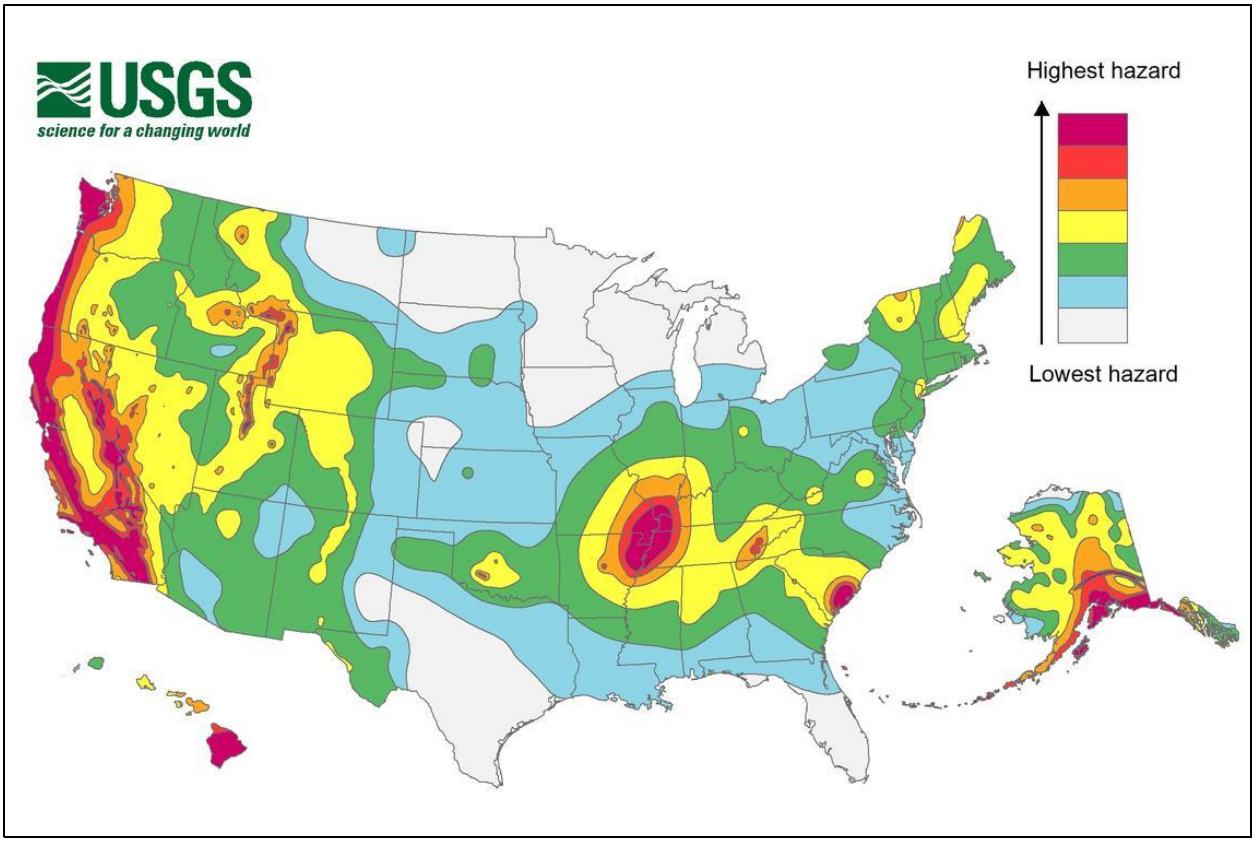
Table 5.4.3-3. Damage Levels Experienced in Earthquakes

Ground Motion Percentage	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.
Below 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: NJOEM 2011
Note: %g Peak Ground Acceleration

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 2018. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps. The 2018 map represents the best available data, as determined by the USGS.

Figure 5.4.3-5. 2018 Long-Term National Seismic Hazard Map



Source: USGS 2018

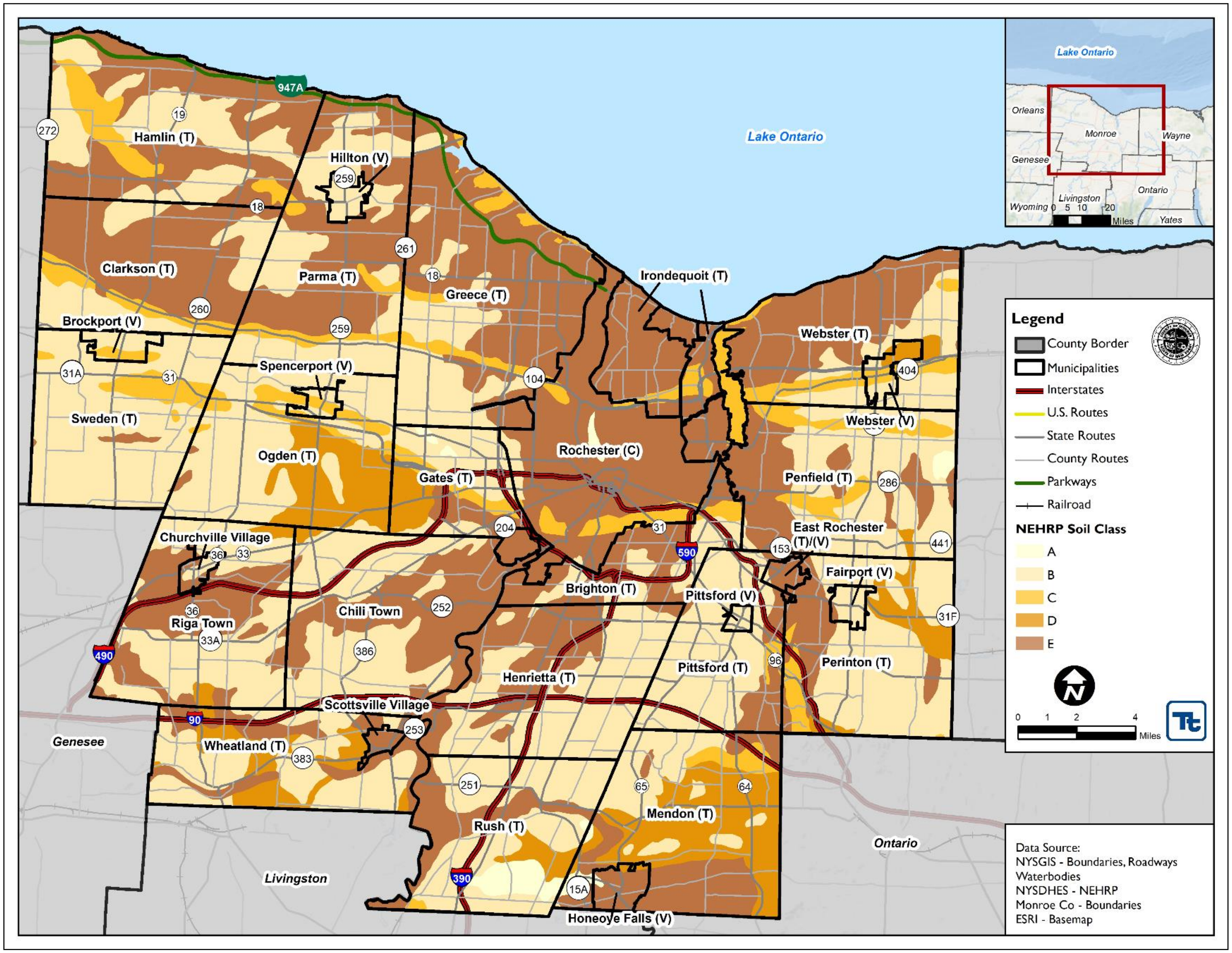
The New York State Geological Survey conducted seismic shear-wave tests of the state's surficial geology (glacial deposits). Based on these test results, the surficial geologic materials of New York State were categorized according to the National Earthquake Hazard Reduction Program's (NEHRP) Soil Site Classifications (Table 5.4.3-4). The NEHRP developed five soil classifications defined by their shear-wave velocity that impact the severity of an earthquake. The soil classification system ranges from Class A to Class E, as noted in Table 5.4.3-4, where Class A represents hard rock that reduces ground motions from an earthquake and Class E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Class E soils include water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type. Seismic waves travel faster through hard rock than through softer rock and sediments. As the waves pass from harder to softer rocks, the waves slow down, and their amplitude increases. Shaking tends to be stronger at locations with softer surface layers where seismic waves move more slowly. Ground motion above an unconsolidated landfill or soft soils can be more than 10 times stronger than at neighboring locations on rock for small ground motions (FEMA 2013).

Table 5.4.3-4. 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 2013

Figure 5.4.3-6. NEHRP Soils in Monroe County



As illustrated in Figure 5.4.3-6, Monroe County is primarily comprised of NEHRP Soil Classes B, D, and E with the majority of the County comprised of Soil Classes B (rock) and E (soft soils).

A probabilistic assessment was conducted for the 100- and 500-year mean return periods (MRP) through a Level 2 analysis using the HAZUS-MH, Version 2.2 (HAZUS-MH) probabilistic model to analyze the earthquake hazard for Monroe County. The Level 2 HAZUS analysis evaluates the statistical likelihood that a specific event will occur and what consequences will occur. A 100-year MRP event is an earthquake with a 1 percent chance that the mapped ground motion levels (PGA) will be exceeded in any given year. For a 500-year MRP, there is a 0.2 percent chance the mapped PGA will be exceeded in any given year.

Figure 5.4.3-7 and Figure 5.4.3-8 illustrate the geographic distribution of PGA (*g*) across Monroe County for 100- and 500-year MRP events at the census tract level.

Figure 5.4.3-7. Peak Ground Acceleration Modified Mercalli Scale for a 100-Year MRP Earthquake Event

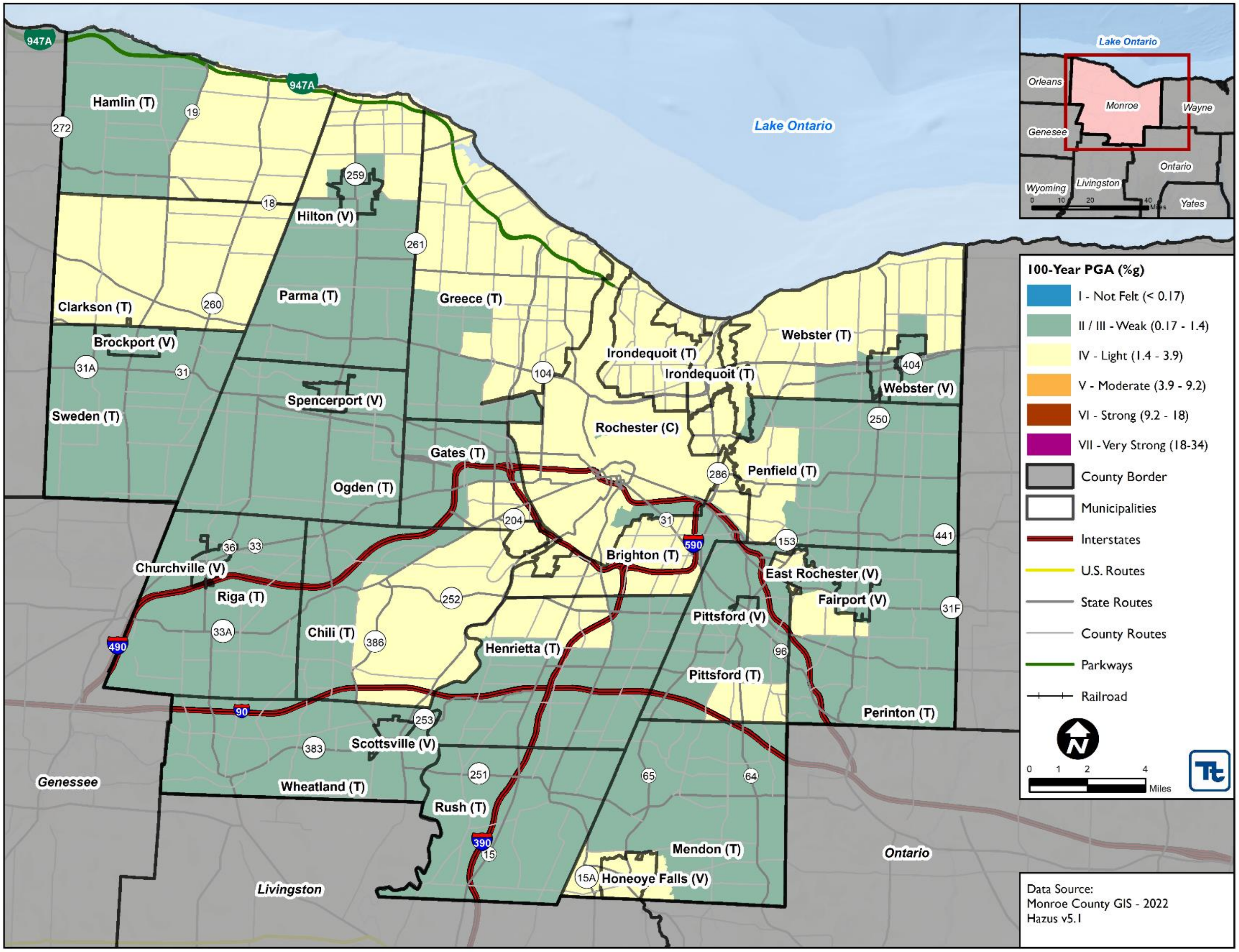
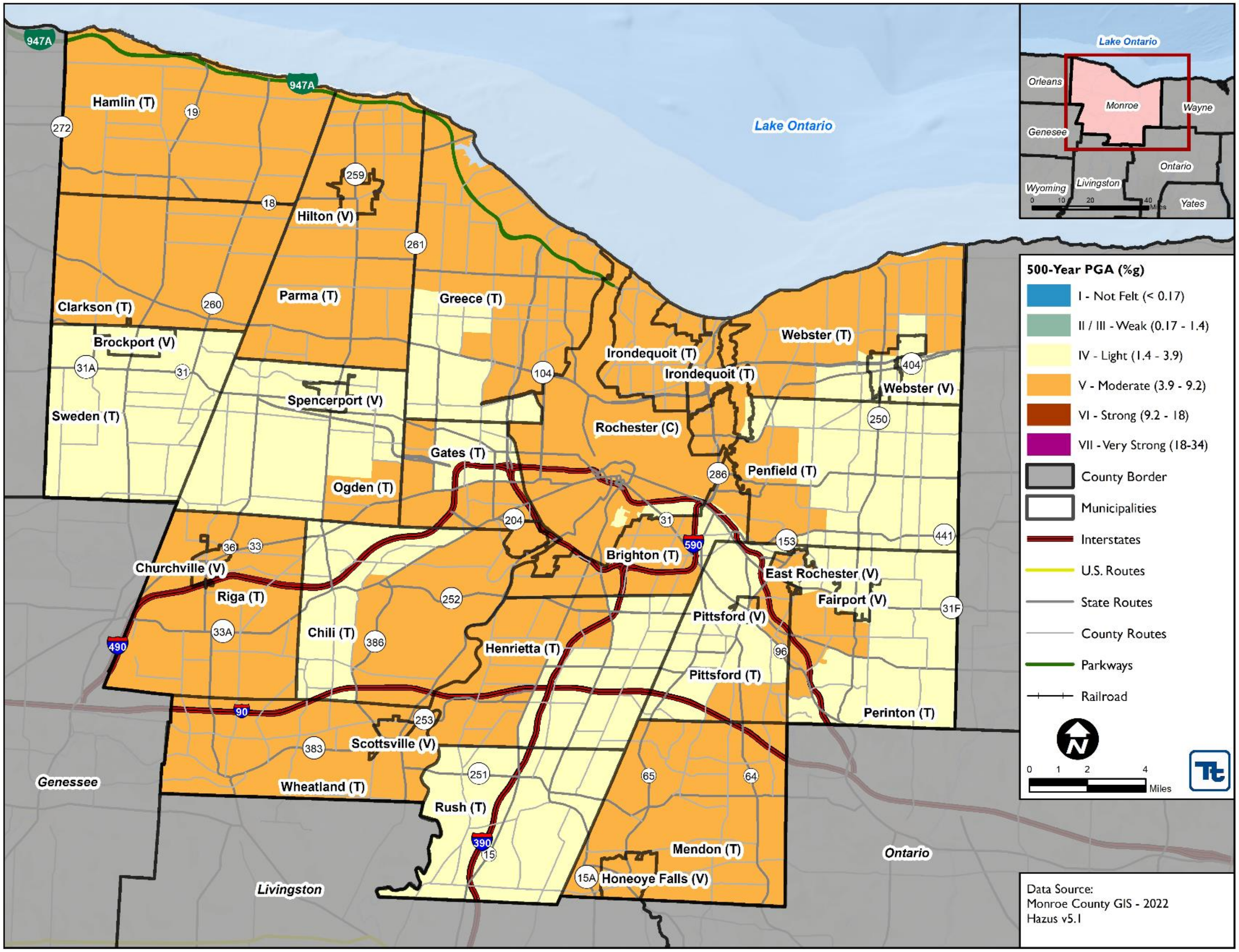


Figure 5.4.3-8. Peak Ground Acceleration Modified Mercalli Scale for a 500-Year MRP Earthquake Event



Previous Occurrences and Losses

Many sources provided historical information on previous occurrences and losses associated with earthquakes throughout New York State. Therefore, with so many sources reviewed for the purpose of this HMP update, loss and impact information for many events could vary depending on the source.

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, New York State was included in one earthquake-related major disaster (DR) or emergency (EM) declaration. Generally, these disasters cover a wide region of the state; therefore, they may have impacted many counties. However, not all counties were included in the disaster declaration. Monroe County has not been included in any DRs or EMs (FEMA 2022).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was not included in any USDA declarations involving earthquake events.

Previous Events

Table 5.4.3-5 identifies known earthquake events that impacted Monroe County between 2015 and 2022. For events prior to 2015, refer to Appendix H (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Table 5.4.3-5. Earthquake Events in Monroe County, 2015 to 2022

Dates of Event	Magnitude (Richter Scale)	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
August 15, 2022	Magnitude 1.2	3.7 miles west northwest of Le Roy, New York	N/A	No	A 1.2-magnitude earthquake near Le Roy, New York struck around 6:37 a.m. according to the U.S. Geological Survey. The quake was weakly felt in Monroe County.
March 15, 2022	Magnitude 2.6	3.1 miles south southwest of Warsaw, New York	N/A	No	A 2.6-magnitude earthquake near Warsaw, New York struck around 3:11 p.m. according to the U.S. Geological Survey. The quake was weakly felt in Monroe County.
February 9, 2021	Magnitude 1.9	3.7 miles west of Bergen, New York	N/A	No	A 1.9-magnitude earthquake near Bergen, New York struck around 3:43 a.m. according to the U.S. Geological Survey. The quake was weakly felt in Monroe County.
March 29, 2020	Magnitude 2.6	6.8 miles north of Lyndonville, New York	N/A	No	A 2.6-magnitude earthquake near Lyndonville, New York struck around 5:04 p.m. according to the U.S. Geological Survey. The quake was weakly felt in Monroe County.
December 18, 2019	Magnitude 2.1	8 miles north northeast of Sodus Point, New York	N/A	No	A 2.1-magnitude earthquake near Sodus Point, New York struck around 7:40 a.m. according to the U.S. Geological Survey. The quake was weakly felt in Monroe County.
February 13, 2019	Magnitude 2.0	14.2 miles northwest of Hamlin, New York	N/A	No	A 2.0-magnitude earthquake near Hamlin, New York struck around 7:29 p.m. according to the U.S. Geological Survey. The quake was weakly felt in Monroe County.
June 12, 2018	Magnitude 1.1	4.9 miles north northwest of Ontario, New York	N/A	No	A 1.1-magnitude earthquake near Ontario, New York struck around 2:07 p.m. according to the U.S. Geological Survey. The quake was weakly felt in Monroe County.
May 8, 2018	Magnitude 3.0	8.7 miles Southeast of Ajax, Canada	N/A	No	A 3.0-magnitude earthquake near Ajax, Canada struck around 9:27 p.m. according to the U.S. Geological Survey. The quake was weakly felt in Monroe County.
November 30, 2017	Magnitude 4.1	1.8 miles north northeast of Little Creek, Delaware	N/A	No	A 4.1 magnitude earthquake near Little Creek, Delaware struck around 9:47 p.m. according to the U.S. Geological Survey. The quake was weakly felt in Monroe County.
July 11, 2017	Magnitude 2.5	6.8 miles north northwest of Barker, New York	N/A	No	A 2.5-magnitude earthquake struck near Barker, New York at 6:27 a.m. according to the U.S. Geological Survey. The quake was weakly felt in Monroe County.

Source: USGS 2022; FEMA 2022
Note: All magnitudes referenced refer to the Richter Scale, unless otherwise specified.
USGS United States Geological Survey

Climate Change Impacts

The impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity according to research into prehistoric earthquakes and volcanic activity. NASA and USGS scientists found that retreating glaciers in southern Alaska may be opening the way for future earthquakes (NASA 2004).

Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms could experience liquefaction during seismic activity due to the increased saturation. Dams storing increased volumes of water due to changes in the hydrograph could fail during seismic events. There are currently no models available to estimate these impacts.

Probability of Future Occurrences

Earthquake hazard maps illustrate the distribution of earthquake shaking levels that have a certain probability of occurring over a given time period. According to the USGS, in 2017 (the date of the most recent analysis), Monroe County had a PGA of 0.06g to 0.1g for earthquakes with a 10 percent probability of an occurrence within 50 years.

The NYSDPC indicates that the earthquake hazard in New York State is often understated because other natural hazards occur more frequently (such as hurricanes, tornadoes, and flooding) and are much more visible. However, the potential for earthquakes does exist across the entire northeastern United States, including New York State and Monroe County (NYS DHSES 2019).

Based on historical records and input from the Steering Committee, the probability of occurrence for earthquakes in the County is considered "unlikely" (not likely to occur or less than one percent annual chance of occurring as presented in Table 5.3-2). It is anticipated that the County will experience some direct and indirect impacts from earthquakes that may affect the general building stock and local economy, and may induce secondary hazards such as igniting fires and causing utility failure.

5.4.3.2 Vulnerability Assessment

A probabilistic assessment was conducted for the 100-year, 500-year, and 2,500-year Mean Return Period (MRP) events through a Level 2 analysis in Hazus to analyze the earthquake hazard and provide a range of loss estimates. Refer to Section 5.1 (Methodology and Tools) for additional details on the methodology used to assess earthquake risk.

Impact on Life, Health and Safety

While the entire population of Monroe County can experience impacts from the earthquake hazard, those living in more vulnerable areas are more susceptible. An exposure analysis was performed using the NEHRP soils data and the 2020 Census population data. The sum of the population by census block within the NEHRP Class D and E soil types were calculated and summarized in Table 5.4.3-6 below. Overall, approximately 59.4 percent of the County's population is located on NEHRP Class D and E soils.

The impact of an earthquake on life, health, and safety is dependent upon the severity of the event. Risk to public safety and loss of life from an earthquake in the County is minimal. However, a higher risk would occur in for those inside buildings, due to structural damage, or people walking below building ornamentation and chimneys that may be loose and fall as a result of the earthquake.

Populations considered most vulnerable are located in the built environment, particularly near unreinforced masonry construction. In addition, the vulnerable population includes the elderly (persons over the age of 65, 16.9 percent of the County population) and individuals living below the census poverty threshold (13.3 percent of the County population (U.S. Census 2020). These socially vulnerable populations are most susceptible, based on a number of factors including their physical and financial ability to react or respond during a hazard, and the location and construction quality of their housing.

Table 5.4.3-6. Approximate Population within NEHRP 'D' and 'E' Soils

Municipality	Total Population (2020 Census)	Population NEHRP Class "D" and "E" Soils	
		Total Population Exposed	% of Population Exposed
Brighton (T)	37,137	21,031	56.6%
Brockport (V)	7,104	0	0.0%
Chili (T)	29,123	10,735	36.9%
Churchville (V)	2,091	507	24.3%
Clarkson (T)	6,904	3,254	47.1%
East Rochester (V/T)	6,334	5,854	92.4%
Fairport (V)	5,501	521	9.5%
Gates (T)	29,167	6,541	22.4%
Greece (T)	96,926	67,479	69.6%
Hamlin (T)	8,725	3,894	44.6%
Henrietta (T)	47,096	16,078	34.1%
Hilton (V)	6,027	290	4.8%
Honeoye Falls (V)	2,706	2,684	99.2%
Irondequoit (T)	51,043	47,525	93.1%
Mendon (T)	6,389	5,035	78.8%
Ogden (T)	16,585	5,809	35.0%
Parma (T)	10,190	3,934	38.6%
Penfield (T)	39,438	13,103	33.2%
Perinton (T)	39,128	12,355	31.6%
Pittsford (T)	25,714	5,786	22.5%
Pittsford (V)	1,419	0	0.0%
Riga (T)	3,495	1,198	34.3%
Rochester (C)	211,328	183,892	87.0%
Rush (T)	3,490	817	23.4%
Scottsville (V)	2,009	1,890	94.1%
Spencerport (V)	3,685	0	0.0%
Sweden (T)	6,140	18	0.3%
Webster (T)	39,676	25,282	63.7%
Webster (V)	5,651	63	1.1%
Wheatland (T)	2,888	1,634	56.6%
Monroe County (Total)	753,109	447,211	59.4%

Source: NYS DHSES 2022; U.S. Census 2020
Notes: C City
T Town
V Village

Residents may be displaced or require temporary to long-term sheltering. 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 following a disaster event. Table 5.4.3-7 and Table 5.4.3-8 estimate the number of households displaced, and population that may require short-term sheltering as a result of the 100- and 500- MRP earthquake events.

Table 5.4.3-7. Summary of Estimated Sheltering Needs for Monroe County

Scenario	Displaced Households	Persons Seeking Short-Term Shelter
100-Year Earthquake	0	0
500-Year Earthquake	1	1

Source: HAZUS v5.1

Table 5.4.3-8. Estimated Displaced Households and Population Seeking Short-Term Shelter from the 100- and 500-year MRP Events per Municipality

Municipality	100-Year MRP Event		500-Year MRP Event	
	Displaced Households	Persons Seeking Short-Term Sheltering	Displaced Households	Persons Seeking Short-Term Sheltering
Brighton (T)	0	0	0	0
Brockport (V)	0	0	0	0
Chili (T)	0	0	0	0
Churchville (V)	0	0	0	0
Clarkson (T)	0	0	0	0
East Rochester (T/V)	0	0	0	0
Fairport (V)	0	0	0	0
Gates (T)	0	0	0	0
Greece (T)	0	0	0	0
Hamlin (T)	0	0	0	0
Henrietta (T)	0	0	0	0
Hilton (V)	0	0	0	0
Honeoye Falls (V)	0	0	0	0
Irondequoit (T)	0	0	0	0
Mendon (T)	0	0	0	0
Ogden (T)	0	0	0	0
Parma (T)	0	0	0	0
Penfield (T)	0	0	0	0
Perinton (T)	0	0	0	0
Pittsford (T)	0	0	0	0
Pittsford (V)	0	0	0	0
Riga (T)	0	0	0	0
Rochester (C)	0	0	1	1
Rush (T)	0	0	0	0
Scottsville (V)	0	0	0	0
Spencerport (V)	0	0	0	0
Sweden (T)	0	0	0	0
Webster (T)	0	0	0	0
Webster (V)	0	0	0	0
Wheatland (T)	0	0	0	0
Monroe County (Total)	**0**	**0**	**1**	**1**

Source: HAZUS v5.1
Notes:
C City
T Town
V Village

According to the 1999-2003 NYCEM Summary Report (*Earthquake Risks and Mitigation in the New York / New Jersey / Connecticut Region*), a strong correlation exists between structural building damage and the number of injuries and casualties from an earthquake event. Further, the time of day also exposes different sectors of the community to the hazard. For example, Hazus considers the residential occupancy at its maximum at 2:00 a.m., where the educational, commercial and industrial sectors are at their maximum at 2:00 p.m., and peak commute time is at 5:00 p.m. Whether directly impacted or indirectly impacted, the entire population will be affected to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of utilities could impact populations that suffered no direct damage from an event itself.

Table 5.4.3-9 and Table 5.4.3-10 summarize the County-wide injuries and casualties estimated for the 500- and 2,500-year MRP earthquake events, respectively.

Table 5.4.3-9. Estimated Number of Injuries and Casualties from the 100-Year MRP Earthquake Event

Level of Severity	Time of Day		
	2:00 AM	2:00 PM	5:00 PM
Injuries	0	2	0
Hospitalization	0	0	0
Casualties	0	0	0

Source: HAZUS-MH 2.2

Table 5.4.3-10. Estimated Number of Injuries and Casualties from the 500-Year MRP Earthquake Event

Level of Severity	Time of Day		
	2:00 AM	2:00 PM	5:00 PM
Injuries	7	44	17
Hospitalization	0	6	2
Casualties	0	1	0

Source: HAZUS-MH 2.2

Impact on General Building Stock

The entire County's general building stock is considered at risk and exposed to this hazard. As stated earlier, soft soils (NEHRP Soil Classes D and E) can amplify ground shaking to damaging levels even in a moderate earthquake (Tantala 2003). Therefore, buildings located on NEHRP Soil Classes D and E have an increased risk of damages from an earthquake. Table 5.4.3-11 summarizes the number and replacement cost value of buildings in Monroe County on the approximately located NEHRP Soil Classes D and E.

Table 5.4.3-11. Number and Replacement Cost Value of Buildings Located in NEHRP 'D' and 'E' Soils

Municipality	Total Number of Buildings	Total RCV (Structure and Contents)	Buildings NEHRP Class "D" and "E" Soils			
			Number Exposed	% of Total Number	RCV Exposed	% of Total RCV
Brighton (T)	11,693	$14,443,886,002	6,745	57.7%	$9,120,976,752	63.1%
Brockport (V)	2,224	$5,158,789,593	0	0.0%	$0	0.0%
Chili (T)	11,534	$9,206,843,886	4,371	37.9%	$4,829,957,133	52.5%
Churchville (V)	1,112	$938,164,078	323	29.0%	$361,991,364	38.6%

Municipality	Total Number of Buildings	Total RCV (Structure and Contents)	Buildings NEHRP Class "D" and "E" Soils			
			Number Exposed	% of Total Number	RCV Exposed	% of Total RCV
Clarkson (T)	3,411	$1,887,392,030	1,662	48.7%	$778,414,759	41.2%
East Rochester (V/T)	2,924	$3,440,171,127	2,721	93.1%	$3,371,749,070	98.0%
Fairport (V)	3,411	$2,281,456,076	1,662	48.7%	$778,414,759	34.1%
Gates (T)	11,801	$12,220,599,285	2,768	23.5%	$6,348,222,672	51.9%
Greece (T)	36,414	$26,954,378,684	25,312	69.5%	$18,439,665,019	68.4%
Hamlin (T)	5,539	$2,318,778,027	2,680	48.4%	$1,261,583,152	54.4%
Henrietta (T)	15,982	$23,460,566,322	5,718	35.8%	$12,975,583,549	55.3%
Hilton (V)	2,143	$2,120,287,988	92	4.3%	$30,238,461	1.4%
Honeoye Falls (V)	1,155	$1,813,180,690	1,146	99.2%	$1,809,236,064	99.8%
Irondequoit (T)	21,885	$13,427,006,840	20,235	92.5%	$10,732,745,572	79.9%
Mendon (T)	3,835	$2,852,155,914	2,974	77.5%	$2,233,498,663	78.3%
Ogden (T)	7,407	$5,558,087,440	2,613	35.3%	$2,007,919,269	36.1%
Parma (T)	5,509	$3,373,412,574	2,233	40.5%	$1,166,956,414	34.6%
Penfield (T)	15,882	$11,119,233,991	5,249	33.0%	$4,079,557,147	36.7%
Perinton (T)	16,817	$13,125,415,407	5,328	31.7%	$4,494,111,306	34.2%
Pittsford (T)	10,590	$10,686,774,001	2,417	22.8%	$1,654,747,882	15.5%
Pittsford (V)	804	$1,776,834,511	0	0.0%	$0	0.0%
Riga (T)	2,356	$1,539,492,845	878	37.3%	$588,372,873	38.2%
Rochester (C)	89,392	$119,943,371,056	77,734	87.0%	$108,639,791,200	90.6%
Rush (T)	2,808	$1,816,445,354	683	24.3%	$482,651,643	26.6%
Scottsville (V)	1,069	$908,716,753	1,001	93.6%	$897,233,362	98.74%
Spencerport (V)	1,654	$1,580,844,696	0	0.0%	$0	0.00%
Sweden (T)	3,465	$3,402,258,236	9	0.3%	$3,296,699	0.10%
Webster (T)	16,660	$11,510,191,170	10,229	61.4%	$5,840,470,418	50.74%
Webster (V)	1,633	$3,634,066,282	76	4.7%	$1,769,948,381	48.70%
Wheatland (T)	1,926	$2,509,077,040	991	51.5%	$1,361,442,516	54.26%
Monroe County (Total)	312,018	$315,007,877,898	186,384	59.7%	$206,058,776,099	65.41%

Sources: NYS DHSES 2020, U.S. Census 2020; Monroe County GIS 2022
Note: RCV is the estimated replacement cost value of both structure and contents.
C City
T Town
V Village

According to NYCEM, where earthquake risks and mitigation were evaluated in the New York, New Jersey, and Connecticut region, most damage and loss caused by an earthquake is directly or indirectly the result of ground shaking (Tantala 2003). There is a strong correlation between PGA and damage a building might undergo (NYCEM 2003). The Hazus model is based on best available earthquake science and aligns with these statements. The Hazus probabilistic earthquake model was applied to analyze effects from the earthquake hazard on general building stock in Erie County. See Figure 5.4.3-7 and Figure 5.4.3-8 illustrating the geographic distribution of PGA (%g) across the County for 100- and 500-year MRP events at the census-tract level.

A building's construction determines how well it can withstand the force of an earthquake. The NYCEM report indicates that unreinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward, whereas steel and wood buildings absorb more of the earthquake's energy. Additional attributes that affect a building's capability to withstand an earthquake's force include its age, number of stories, and quality of construction. Hazus considers building construction and age of building as part of the analysis. Because a custom general building stock was used for this analysis, the building ages and building types from the inventory were incorporated into the Hazus model.

Potential building damage was evaluated by Hazus across the following damage categories (none, slight, moderate, extensive, and complete). Table 5.4.3-12 provides definitions of these five categories of damage for a light wood-framed building; definitions for other building types are included in Hazus technical manual documentation.

Table 5.4.3-12. Example of Structural Damage State Definitions for a Light Wood-Framed Building

Damage Category	Description
Slight	Small plaster or gypsum-board cracks at corners of door and window openings and wall-ceiling intersections; small cracks in masonry chimneys and masonry veneer.
Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.
Extensive	Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates and/or slippage of structure over foundations; partial collapse of room-over-garage or other soft-story configurations.
Complete	Structure may have large permanent lateral displacement, may collapse, or be in imminent danger of collapse due to cripple wall failure or the failure of the lateral load resisting system; some structures may slip and fall off the foundations; large foundation cracks.

Source: HAZUS Technical Manual

Building damage as a result of the 500-year MRP earthquake events was estimated using Hazus. Damage loss estimates include structural and non-structural damage to the building and loss of contents. Table 5.4.3-13 and Table 5.4.3-14 summarize the damage estimated for the 100- and 500-year MRP earthquake events. Damage loss estimates include structural and non-structural damage to the building and loss of contents. Hazus estimates that 23 structures in the County will face extensive damage from a 500-year earthquake event.

Table 5.4.3-13. Estimated Buildings Damaged by General Occupancy for 100-year MRP Earthquake Events

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 100-Year	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	246,803	None	246,742	100.0%
		Slight	61	0.0%
		Moderate	0	0.0%
		Extensive	0	0.0%
		Complete Destruction	0	0.0%
Commercial Buildings	59,100	None	59,042	99.9%
		Slight	50	0.1%
		Moderate	7	0.0%
		Extensive	0	0.0%

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 100-Year	
			Building Count	Percent Buildings in Occupancy Class
		Complete Destruction	0	0.0%
Industrial Buildings	1,511	None	1,502	99.4%
		Slight	6	0.4%
		Moderate	2	0.1%
		Extensive	0	0.0%
		Complete Destruction	0	0.0%
Government, Religion, Agricultural, and Education Buildings	4,498	None	4,492	99.9%
		Slight	5	0.1%
		Moderate	1	0.0%
		Extensive	0	0.0%
		Complete Destruction	0	0.0%

Source: HAZUS v5.1
Notes: Due to the differences in the boundaries of Census Tracts used in the Hazus model, the number of structures assessed in the Hazus model may underestimate the number of structures located in the County.

Table 5.4.3-14. Estimated Buildings Damaged by General Occupancy for 500-year MRP Earthquake Events

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 500-Year	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	246,803	None	243,475	98.7%
		Slight	3,015	1.2%
		Moderate	312	0.1%
		Extensive	1	0.0%
		Complete Destruction	0	0.0%
Commercial Buildings	59,100	None	57,099	96.6%
		Slight	1,524	2.6%
		Moderate	458	0.8%
		Extensive	17	0.0%
		Complete Destruction	2	0.0%
Industrial Buildings	1,511	None	1,387	91.8%
		Slight	83	5.5%
		Moderate	35	2.3%
		Extensive	6	0.4%
		Complete Destruction	1	0.0%
Government, Religion, Agricultural, and Education Buildings	4,498	None	4,349	96.7%
		Slight	113	2.5%
		Moderate	31	0.7%
		Extensive	4	0.1%
		Complete Destruction	0	0.0%

Source: HAZUS v5.1
Notes: Due to the differences in the boundaries of Census Tracts used in the Hazus model, the number of structures assessed in the Hazus model may underestimate the number of structures located in the County.

Table 5.4.3-15 and Table 5.4.3-16 also break down estimated damages by the structural general occupancy class for each jurisdiction.

Table 5.4.3-15. Estimated Replacement Cost Value (Building and Contents) Damaged by the 100-Year MRP Earthquake Event

Jurisdiction	Total Replacement Cost Value (RCV)	100-Year MRP				
		Estimated Total Damage	Percent of Total Building and Contents Replacement Cost Value	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damages for All Other Occupancies
Brighton (T)	$14,443,886,002	$701	<0.1%	$37	$155	$509
Brockport (V)	$5,158,789,593	$0	0.0%	$0	$0	$0
Chili (T)	$9,206,843,886	$13,374	<0.1%	$593	$10,671	$2,111
Churchville (V)	$938,164,078	$0	0.0%	$0	$0	$0
Clarkson (T)	$1,887,392,030	$0	0.0%	$0	$0	$0
East Rochester (T/V)	$3,440,171,127	$45,189	<0.1%	$6,798	$21,069	$17,322
Fairport (V)	$2,281,456,076	$0	0.0%	$0	$0	$0
Gates (T)	$12,220,599,285	$3,715	<0.1%	$165	$2,964	$586
Greece (T)	$26,954,378,684	$308,231	<0.1%	$86,937	$76,055	$145,240
Hamlin (T)	$2,318,778,027	$0	0.0%	$0	$0	$0
Henrietta (T)	$23,460,566,322	$0	0.0%	$0	$0	$0
Hilton (V)	$2,120,287,988	$0	0.0%	$0	$0	$0
Honeoye Falls (V)	$1,813,180,690	$0	0.0%	$0	$0	$0
Irondequoit (T)	$13,427,006,840	$269,664	<0.1%	$80,714	$63,084	$125,866
Mendon (T)	$2,852,155,914	$0	0.0%	$0	$0	$0
Ogden (T)	$5,558,087,440	$0	0.0%	$0	$0	$0
Parma (T)	$3,373,412,574	$0	0.0%	$0	$0	$0
Penfield (T)	$11,119,233,991	$37,206	<0.1%	$21,144	$6,216	$9,847
Perinton (T)	$13,125,415,407	$314	<0.1%	$47	$146	$120
Pittsford (T)	$10,686,774,001	$79	<0.1%	$12	$37	$30
Pittsford (V)	$1,776,834,511	$0	0.0%	$0	$0	$0
Riga (T)	$1,539,492,845	$0	0.0%	$0	$0	$0
Rochester (C)	$119,943,371,056	$4,448,286	<0.1%	$339,450	$2,749,942	$1,358,893
Rush (T)	$1,816,445,354	$0	0.0%	$0	$0	$0
Scottsville (V)	$908,716,753	$0	0.0%	$0	$0	$0
Spencerport (V)	$1,580,844,696	$0	0.0%	$0	$0	$0
Sweden (T)	$3,402,258,236	$0	0.0%	$0	$0	$0
Webster (T)	$11,510,191,170	$0	0.0%	$0	$0	$0
Webster (V)	$3,634,066,282	$0	0.0%	$0	$0	$0
Wheatland (T)	$2,509,077,040	$0	0.0%	$0	$0	$0
Monroe County (Total)	**$315,007,877,898**	**$5,126,759**	**0.0%**	**$535,896**	**$2,930,339**	**$1,660,524**

Source: Hazus v5.1; RS Means - 2022; Monroe County GIS - 2022

Notes:
C City
T Town
V Village

Table 5.4.3-16. Estimated Replacement Cost Value (Building and Contents) Damaged by the 500-Year MRP Earthquake Event

Jurisdiction	Total Replacement Cost Value (RCV)	500-Year MRP				
		Estimated Total Damage	Percent of Total Building and Contents Replacement Cost Value	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damages for All Other Occupancies
Brighton (T)	$14,443,886,002	$8,987,671	0.1%	$2,439,997	$3,313,859	$3,233,815
Brockport (V)	$5,158,789,593	$337,136	<0.1%	$20,469	$64,161	$252,506
Chili (T)	$9,206,843,886	$3,449,473	<0.1%	$796,050	$1,590,039	$1,063,384
Churchville (V)	$938,164,078	$336,416	<0.1%	$56,634	$131,134	$148,647
Clarkson (T)	$1,887,392,030	$1,156,231	0.1%	$372,922	$724,399	$58,910
East Rochester (T/V)	$3,440,171,127	$4,753,707	0.1%	$559,357	$2,817,302	$1,377,047
Fairport (V)	$2,281,456,076	$209,646	<0.1%	$37,042	$68,314	$104,290
Gates (T)	$12,220,599,285	$3,723,900	<0.1%	$481,079	$1,130,772	$2,112,049
Greece (T)	$26,954,378,684	$17,822,176	0.1%	$7,435,348	$5,537,634	$4,849,195
Hamlin (T)	$2,318,778,027	$1,031,236	<0.1%	$406,420	$501,396	$123,419
Henrietta (T)	$23,460,566,322	$16,038,585	0.1%	$1,573,017	$6,171,230	$8,294,338
Hilton (V)	$2,120,287,988	$827,004	<0.1%	$155,765	$322,844	$348,395
Honeoye Falls (V)	$1,813,180,690	$1,898,599	0.1%	$229,302	$803,481	$865,816
Irondequoit (T)	$13,427,006,840	$13,507,035	0.1%	$5,327,547	$5,435,445	$2,744,042
Mendon (T)	$2,852,155,914	$1,073,045	<0.1%	$313,601	$570,767	$188,677
Ogden (T)	$5,558,087,440	$774,269	<0.1%	$250,399	$196,643	$327,227
Parma (T)	$3,373,412,574	$1,282,299	<0.1%	$432,785	$661,917	$187,596
Penfield (T)	$11,119,233,991	$4,219,072	<0.1%	$1,864,065	$1,148,635	$1,206,371
Perinton (T)	$13,125,415,407	$3,026,973	<0.1%	$1,159,961	$801,826	$1,065,186
Pittsford (T)	$10,686,774,001	$1,650,582	<0.1%	$521,209	$252,816	$876,558
Pittsford (V)	$1,776,834,511	$82,435	<0.1%	$19,419	$35,029	$27,986
Riga (T)	$1,539,492,845	$711,812	<0.1%	$119,855	$277,302	$314,655
Rochester (C)	$119,943,371,056	$171,981,069	0.1%	$17,858,065	$114,240,481	$39,882,522
Rush (T)	$1,816,445,354	$278,622	<0.1%	$59,291	$125,892	$93,439
Scottsville (V)	$908,716,753	$329,720	<0.1%	$51,577	$108,887	$169,257
Spencerport (V)	$1,580,844,696	$255,023	<0.1%	$33,921	$55,487	$165,615
Sweden (T)	$3,402,258,236	$357,665	<0.1%	$34,588	$76,072	$247,006
Webster (T)	$11,510,191,170	$6,309,481	0.1%	$2,688,727	$1,448,070	$2,172,683
Webster (V)	$3,634,066,282	$377,655	<0.1%	$63,403	$61,345	$252,908
Wheatland (T)	$2,509,077,040	$593,157	<0.1%	$92,787	$195,934	$304,435
Monroe County (Total)	**$315,007,877,898**	**$267,381,692**	**0.1%**	**$45,454,604**	**$148,869,114**	**$73,057,974**

Source: Hazus v5.1; RS Means - 2022; Monroe County GIS - 2022

Notes:
C City
T Town
V Village

Hazus estimated approximately $267 million in damage as a result of the 500-year earthquake event. This includes structural damage, non-structural damage, and loss of contents, representing 0.1-percent of the total replacement value for general building stock in Monroe County. Commercial buildings account for most of the damage for earthquake event.

Impact on Critical Facilities

After considering the general building stock exposed to, and damaged by, 100- and 500-year MRP earthquake events, critical facilities were evaluated. All critical facilities (essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities, and user-defined facilities) in Monroe County are considered exposed and vulnerable to the earthquake hazard. Refer to subsection "Critical Facilities" in Section 4 (County Profile) of this plan for a complete inventory of critical facilities in Monroe County. Table 5.4.3-17 summarizes the number of critical facilities by type located on NEHRP soil classes D and E.

Table 5.4.3-17. Number of Critical Facilities Located Exposed to NEHRP D & E Soils

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Earthquake (NEHRP Soil D & E)			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Brighton (T)	69	65	43	62.3%	41	63.1%
Brockport (V)	29	28	0	0.0%	0	0.0%
Chili (T)	111	102	58	52.3%	53	52.0%
Churchville (V)	24	23	8	33.3%	8	34.8%
Clarkson (T)	14	10	1	7.1%	1	10.0%
East Rochester (T/V)	31	29	31	100.0%	29	100.0%
Fairport (V)	17	16	0	0.0%	0	0.0%
Gates (T)	58	54	15	25.9%	11	20.4%
Greece (T)	165	158	119	72.1%	113	71.5%
Hamlin (T)	23	22	8	34.8%	8	36.4%
Henrietta (T)	111	103	33	29.7%	29	28.2%
Hilton (V)	21	20	0	0.0%	0	0.0%
Honeoye Falls (V)	17	16	17	100.0%	16	100.0%
Irondequoit (T)	103	100	90	87.4%	88	88.0%
Mendon (T)	21	20	14	66.7%	13	65.0%
Ogden (T)	42	38	11	26.2%	10	26.3%
Parma (T)	18	16	4	22.2%	4	25.0%
Penfield (T)	73	68	19	26.0%	18	26.5%
Perinton (T)	64	57	16	25.0%	14	24.6%
Pittsford (T)	45	39	5	11.1%	5	12.8%
Pittsford (V)	14	13	0	0.0%	0	0.0%
Riga (T)	20	18	4	20.0%	4	22.2%
Rochester (C)	639	605	565	88.4%	534	88.3%
Rush (T)	29	26	13	44.8%	12	46.2%
Scottsville (V)	14	13	14	100.0%	13	100.0%
Spencerport (V)	13	13	0	0.0%	0	0.0%
Sweden (T)	11	11	0	0.0%	0	0.0%
Webster (T)	55	53	31	56.4%	31	58.5%
Webster (V)	16	15	2	12.5%	1	6.7%
Wheatland (T)	23	21	15	65.2%	13	61.9%
Monroe County (Total)	**1,890**	**1,773**	**1,136**	**60.1%**	**1,069**	**60.3%**

Source: Monroe County GIS – 2022; NYSDHSES 2022

Table 5.4.3-18 separates the critical facilities exposed to NEHRP soil by the lifeline category. A majority of the exposed lifelines fall under the transportation category.

Table 5.4.3-18. Number of Lifelines Exposed to NEHRP D Soils

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Exposed to Class D and E NEHRP Soils
Communications	68	41

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Exposed to Class D and E NEHRP Soils
Energy	14	9
Food, Water, Shelter	286	148
Hazardous Material	1	1
Health and Medical	93	61
Safety and Security	1,274	797
Transportation	36	12
Monroe County (Total)	**1,772**	**1,069**

Source: Monroe County GIS – 2022; NYSDHSES 2022

Hazus estimates the probability that critical facilities may sustain damage as a result of the 100- and 500-year MRP earthquake events. Additionally, Hazus estimates percent functionality for each facility days after the event. As a result of a 500-Year MRP event, Hazus estimates that emergency facilities (EOC, medical facilities, police, fire, EMS and schools) and highway bridges identified by Monroe County as critical will be nearly 93 percent functional. Table 5.4.3-19 and Table 5.4.3-20 list the percent probability of critical facilities sustaining the damage category as defined by the column heading and percent functionality after the event for the 500- and 2,500-year MRP earthquake events.

Table 5.4.3-19. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities for the 100-Year MRP Earthquake Event

Name	Percent Probability of Sustaining Damage					Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Critical Facilities									
EOC	99.3%	0.6%	0.1%	<0.1%	0.0%	99.2%	99.8%	99.9%	99.9%
Medical Facilities	99.9%	0% - 0.1%	0.0%	0.0%	0.0%	99.8% - 99.9%	99.9%	99.9%	99.9%
Police Stations	99.2% - 99.9%	<0.1% - 0.6%	0.0% - 0.1%	0.0% - <0.1%	0.0%	99.1% - 99.9%	99.8% - 99.9%	99.9%	99.9%
Fire Stations/EMS	99.2% - 99.9%	<0.1% - 0.7%	0.0% - 0.2%	0.0% - <0.1%	0.0%	99.0% - 99.9%	99.8% - 99.9%	99.9%	99.9%
Schools	99.2% - 99.9%	<0.1% - 0.7%	0.0% - 0.2%	0.0% - <0.1%	0.0%	99.0% - 99.9%	99.8% - 99.9%	99.9%	99.9%
Transportation									
Highway Bridges	1.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0 %

Source: Hazus v5.1; Monroe County GIS - 2022
Notes: No results were available for Military, Utilities, Airports, or Bus Facilities.
C City
T Town
V Village

Table 5.4.3-20. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities for the 500-Year MRP Earthquake Event

Name	Percent Probability of Sustaining Damage					Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Critical Facilities									
EOC	92.7%	5.2%	2.0%	0.2%	<0.1%	92.6%	97.7%	99.7%	99.8%
Medical Facilities	97.6% - 99.9%	0.1% - 2.0%	0.0% - <0.1%	0.0%	0.0%	97.5% - 99.8%	99.8% - 99.9%	99.9%	99.9%
Police Stations	92.6% - 99.2%	0.6% - 5.3%	0.1% - 2.0%	<0.1% - 0.2%	0.0% - <0.1%	92.5% - 99.1%	97.6% - 99.8%	99.6% - 99.9%	99.8% - 99.9%

Name	Percent Probability of Sustaining Damage					Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Fire Stations/EMS	92.4% - 99.2%	0.6% - 5.4%	0.1% - 2.0%	<0.1% - 0.3%	0.0% - <0.1%	92.4% - 99.1%	97.5% - 99.8%	99.6% - 99.9%	99.8% - 99.9%
Schools	92.4% - 99.6%	0.4% - 5.4%	<0.1% - 2.0%	0.0% - 0.3%	0.0% - <0.1%	92.4% - 99.5%	97.5% - 99.8%	99.6% - 99.9%	99.8% - 99.9%
Transportation									
Highway Bridges		0.9% - 1.0%	0.0%	0.0%	0.0%	99.9% - 100.0 %	99.9% - 100.0 %	99.9% - 100.0 %	99.9% - 100.0 %

Source: Hazus v5.1; Monroe County GIS - 2022
Notes: No results were available for Military, Utilities, Airports, or Bus Facilities.
C City
T Town
V Village

Impact on Economy

Earthquakes also impact the economy, including loss of business function, damage to inventory (buildings, transportation, and utility systems), relocation costs, wage loss, and rental loss due to repair and replacement of buildings. Hazus estimates building-related economic losses, including income losses (wage, rental, relocation, and capital-related losses) and capital stock losses (structural, non-structural, content, and inventory losses). Economic losses estimated by Hazus are summarized in Table 5.4.3-21.

Table 5.4.3-21. Building-Related Economic Losses from 100- and 500-Year MRP Earthquake Events

Mean Return Period (MRP)	Inventory Loss	Relocation Loss	Building and Content Losses	Wages Losses	Rental Losses	Capital-Related Loss
100-Year MRP	$6,500	$424,500	$5,125,800	$185,400	$279,500	$100,000
500-year MRP	$1,040,100	$17,075,700	$267,381,100	$5,710,500	$9,096,400	$3,256,600

Source: NYS GIS n.d.; Hazus v4.2

Although the Hazus analysis did not compute damage estimates for individual roadway segments and railroad tracks, assumedly these features would undergo damage due to ground failure resulting in interruptions of regional transportation and of distribution of materials. Losses to the community that would result from damage to lifelines could exceed costs of repair (FEMA 2012). Earthquake events can significantly affect road bridges, many of which provide the only access to certain neighborhoods. Because softer soils generally follow floodplain boundaries, bridges that cross watercourses should be considered vulnerable. Another key factor in degree of vulnerability is age of facilities and infrastructure, which correlates with standards in place at time of construction.

Additionally, Hazus estimates volume of debris that may be generated as a result of an earthquake event to enable the study region to prepare for and rapidly and efficiently manage debris removal and disposal. Debris estimates were divided into two categories: (1) reinforced concrete and steel that require special equipment to break up before transport can occur, and (2) brick, wood, and other debris that can be loaded directly onto trucks by use of bulldozers (Hazus Earthquake User's Manual).

For the 100-year MRP event, Hazus estimates over 18,000 tons of brick and wood debris and approximately 660 tons of concrete and steel debris will be generated. For the 500-year MRP event, Hazus v5.1 estimates 44,761 tons of brick and wood debris and 30,185tons of concrete and steel debris will be generated.

Table 5.4.3-22. Estimated Debris Generated by the 100- and 500-Year MRP Earthquake Events

Municipality	100-Year		500-Year	
	Brick/Wood (tons)	Concrete/Steel (tons)	Brick/Wood (tons)	Concrete/Steel (tons)
Brighton (T)	1	0	1,686	369
Brockport (V)	0	0	237	32
Chili (T)	2	0	775	156
Churchville (V)	0	0	104	25
Clarkson (T)	0	0	78	29
East Rochester (T/V)	14	4	836	515
Fairport (V)	0	0	116	16
Gates (T)	1	0	1,845	329
Greece (T)	121	16	3,832	851
Hamlin (T)	0	0	97	36
Henrietta (T)	0	0	3,294	831
Hilton (V)	0	0	174	67
Honeoye Falls (V)	0	0	440	143
Irondequoit (T)	85	14	1,474	746
Mendon (T)	0	0	124	36
Ogden (T)	0	0	310	47
Parma (T)	0	0	125	42
Penfield (T)	14	1	809	169
Perinton (T)	0	0	698	118
Pittsford (T)	0	0	618	85
Pittsford (V)	0	0	29	4
Riga (T)	0	0	221	53
Rochester (C)	1,571	624	24,085	25,033
Rush (T)	0	0	68	12
Scottsville (V)	0	0	109	20
Spencerport (V)	0	0	128	21
Sweden (T)	0	0	180	24
Webster (T)	0	0	1,699	289
Webster (V)	0	0	376	51
Wheatland (T)	0	0	195	36
Monroe County (Total)	**1,808**	**659**	**44,761**	**30,185**

Source: HAZUS v5.1
Notes: C City
T Town
V Village

Impact on the Environment

According to USGS, earthquakes can cause damage to the surface of the Earth in various forms depending on the magnitude and distribution of the event (USGS 2020). Surface faulting is one of the major seismic components to earthquakes that can create wide ruptures in the ground. Ruptures can have a direct impact on the landscape and natural environment because it can disconnect habitats for miles isolating animal species or tear apart plant roots.

Furthermore, ground failure as a result of soil liquefaction can have an impact on soil pores and retention of water resources (USGS 2020). The greater the seismic activity and liquefaction properties of the soil, the more likely 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.

Cascading Impacts On Other Hazards

The Global Geoengineering Research Group in USGS has been investigating the relationship earthquakes have with ground failure, and coastal erosion (USGS n.d.). As mentioned in earlier sections, soft and loose soils are more susceptible to earthquake events. Ground failure can become exacerbated due to earthquake events, causing land sliding and coastal erosion. Areas of steep slopes are at greater risk of ground failure and potential erosion during earthquakes (USGS n.d.). Further, residual impacts from earthquakes could alter the floodplain extent for the County if ground failure and erosion occur.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the county can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. It is anticipated that the human exposure and vulnerability to earthquake impacts in newly developed areas will be similar to those that currently exist within the County. Current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts than older, existing construction that may have been built using lower construction standards.

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). Changes in the density of population can impact the number of persons exposed to earthquake. Furthermore, County visitors and tourists will continue to drive potential growth in the County's communities and their amenities, exposing more persons to earthquake. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

Providing projections of future climate change for a specific region is challenging. Shorter-term projections are more closely tied to existing trends making longer-term projections even more challenging. The further out a prediction reaches, the more subject to changing dynamics it becomes. The potential impacts of global climate change on earthquake probability are unknown. Some scientists feel that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity according to research into prehistoric earthquakes and volcanic activity. NASA and USGS scientists found that retreating glaciers in southern Alaska might be opening the way for future earthquakes.

Secondary impacts of earthquakes could be magnified by future climate change. Soils saturated by repetitive storms could experience liquefaction during seismic activity because of increased saturation. Dams storing increased volumes of water from changes in the climate could fail during seismic events. There are currently no models available to estimate these impacts.

Change of Vulnerability Since 2017 HMP

Overall, the County's vulnerability to the earthquake hazard has remained the same since 2017. Since the 2017 HMP analysis, population statistics have been updated using the 2020 US Census. An updated general building stock was also established. Exposure to the earthquake hazard was determined by overlaying critical facilities and building centroids on New York State NEHRP soil layer.

Overall, this vulnerability assessment uses a more precise and thorough approach, which provides increased accuracy for estimated exposure and potential losses for Monroe County.

5.4.4 Extreme Temperatures

This section provides a profile and vulnerability assessment of the extreme temperatures hazard for Monroe County.

5.4.4.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections, and the probability of future occurrences for the extreme temperatures hazard.

Description

Extreme temperature includes both heat and cold events, which can have a significant impact to human health, commercial/agricultural businesses, and primary and secondary effects on infrastructure (such as burst pipes and power failure). What constitutes "extreme cold" or "extreme heat" can vary across different areas of the country, based on the population's experience.

Extreme Cold

Extreme cold events occur when temperatures drop well below normal in an area. For example, near-freezing temperatures are considered "extreme cold" in regions relatively unaccustomed to winter weather. Conversely, "extreme cold" might be used to describe temperatures below 0° F in regions that are subjected to temperatures below freezing on more of a regular basis. For the purposes of this HMP, extreme cold temperatures are characterized when the ambient air temperature drops to approximately 0 degrees Fahrenheit (ºF) or below (National Weather Service n.d.). Extensive exposure to extreme cold temperatures can cause frostbite or hypothermia and can become life-threatening. Extreme cold also can cause emergencies in susceptible populations, such as those without shelter, those who are stranded, or those who live in a home that is poorly insulated or without heat (such as mobile homes). Infants and the elderly are most susceptible to the effects of extreme changes in temperatures and are particularly at risk, but anyone can be affected (Center for Disease Control and Prevention [CDC] 2012).

In New York State, extreme cold days are defined to reflect the State's regional climate variations. Extreme cold days in the State are individual days with minimum temperatures at or below 32° F or individual days with minimum temperatures at or below 0°F (NYSERDA 2014).

Several health hazards are related to extreme cold temperatures and include wind chill, frostbite, and hypothermia.

- *Wind chill* is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature.
- *Frostbite* is damage to body tissue caused by extreme cold. A wind chill of -20°F will cause frostbite in just 30 minutes. Frostbite can cause a loss of feeling and a white or pale appearance in extremities.
- *Hypothermia* is a condition brought on when the body temperature drops to less than 95°F, and it can be deadly. Warning signs of hypothermia include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion

Extreme Heat

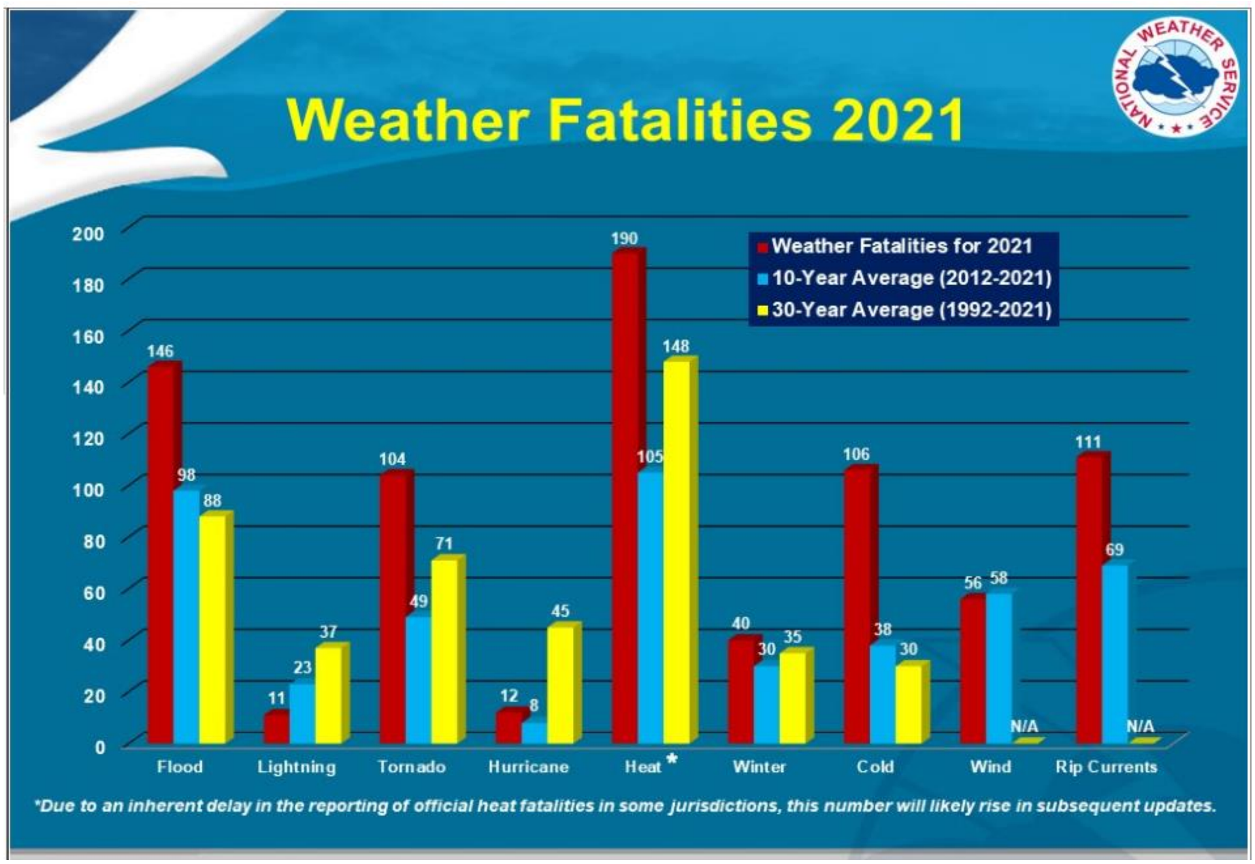
Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for a region and that last for several weeks (Center for Disease Control and Prevention [CDC] 2012). Humid or muggy conditions occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground. A heat wave is a period of abnormally and uncomfortably hot and unusually humid weather. A heat wave will typically last two or more days (NOAA 2009).

In New York State, high temperatures and heat waves are defined in several ways to reflect the diversity of conditions experienced across the State. Extreme hot days in New York State are defined as individual days with maximum temperatures at or above 90° F or 95°F. Heat waves are defined as three consecutive days with maximum temperatures above 90° F (NYSERDA 2014).

Depending on severity, duration, and location; extreme heat events can create or provoke secondary hazards including, but not limited to, dust storms, droughts, wildfires, water shortages, and power outages. These secondary hazards could result in a broad and far-reaching set of impacts throughout a local area or an entire region. Impacts could include significant loss of life and illness; economic costs in transportation, agriculture, production, energy, and infrastructure; and losses of ecosystems, wildlife habitats, and water resources (NYS DHSES 2019).

Extreme heat is the number one weather-related cause of death in the U.S. On average, nearly 150 people die each year in the United States from excessive heat (NWS 2021). Figure 5.4.4-1 shows the number of weather fatalities based on a 10-year average and a 30-year average. Heat caused the highest average of weather-related fatalities between 2012 and 2021.

Figure 5.4.4-1. Average Number of Weather-Related Fatalities in the U.S.



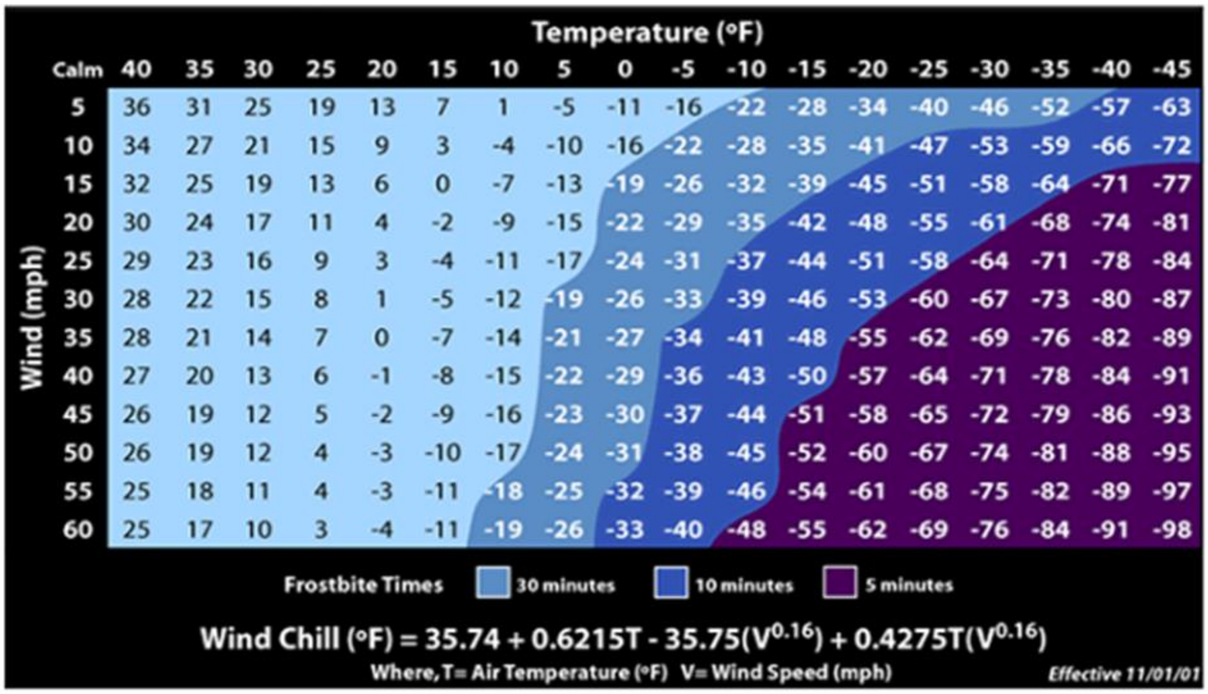
Source: NWS 2021

Extent

Extreme Cold

The extent (severity or magnitude) of extreme cold temperatures is generally measured through the Wind Chill Temperature (WCT) Index. The index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from wind chill. For details regarding the WCT, refer to: [Winter (weather.gov)](). The WCT is presented in Figure 5.4.4-2.

Figure 5.4.4-2. Wind Chill Index



Temperature (°F)

Wind (mph)	Calm 40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill } (°F) = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T = Air Temperature (°F) V = Wind Speed (mph)

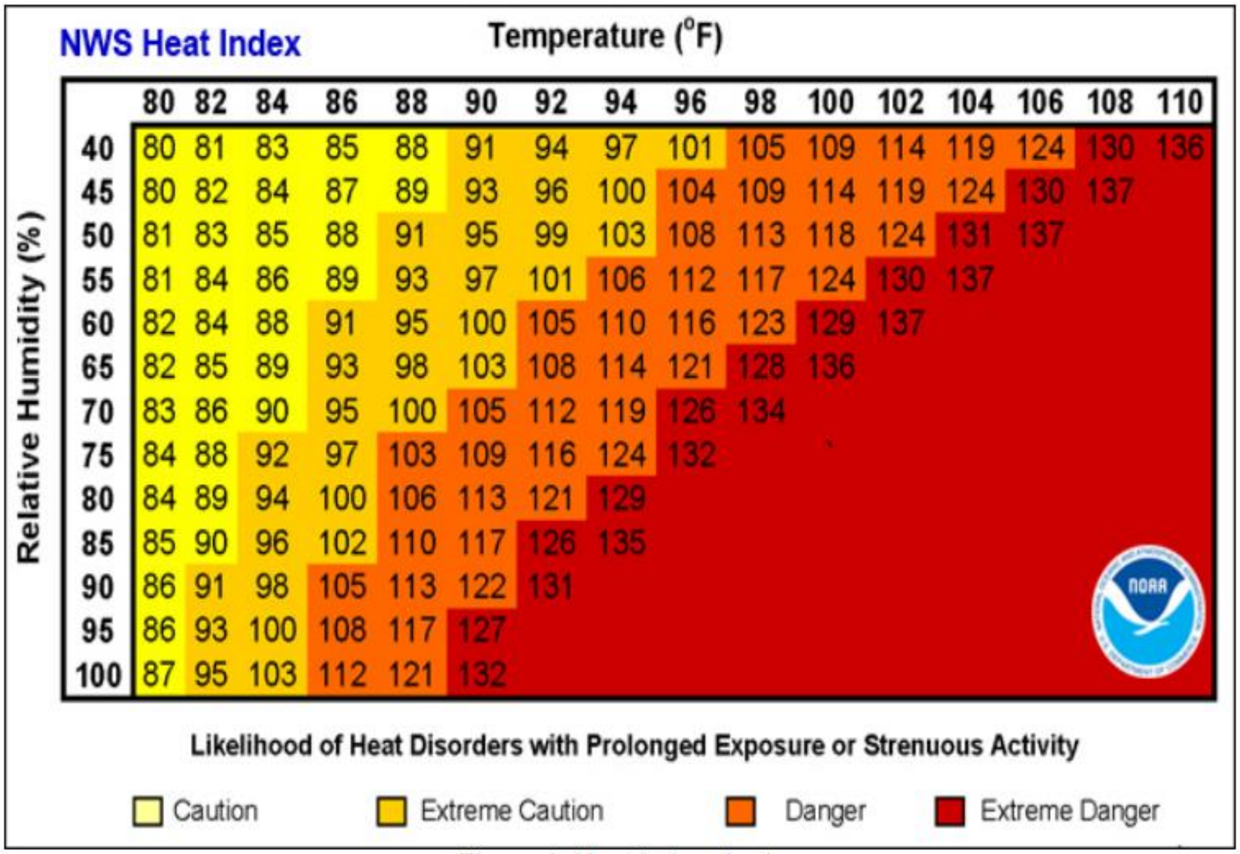
Effective 11/01/01

Source: NWS 2001

Extreme Heat

The extent of extreme heat temperatures is generally measured through the Heat Index, identified in Figure 5.4.4-3. Created by the NWS, the Heat Index is a chart that accurately measures apparent temperature of the air as it increases with the relative humidity. The temperature and relative humidity are needed to determine the Heat Index. Once both values have been identified, the Heat Index is the corresponding number of both values (as seen in Figure 5.4.4-3). This index provides a measure of how temperatures actually feel; however, the values are devised for shady, light wind conditions. Figure 5.4.4-3 shows the heat index value for shaded areas. Exposure to full sun can increase the index by up to 15 degrees (NYSDHSES n.d.).

Figure 5.4.4-3. NWS Heat Index Chart – Shaded Areas



Source: NWS

Table 5.4.4-1 describes the adverse effects of prolonged exposure to direct sunlight on an individual.

Table 5.4.4-1. Adverse Effects of Prolonged Exposure to Direct Sunlight

Category	Heat Index	Effects on the Body
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

Source: NWS

The National Weather Service (NWS) provides alerts when Heat Indices approach hazardous levels. Table 5.4.4-2 explains these alerts. In the event of an extreme heat advisory, the NWS does the following:

- Includes Heat Index values and city forecasts
- Issues special weather statements including who is most at risk, safety rules for reducing risk, and the extent of the hazard and Heat Index values

- Provides assistance to state and local health officials in preparing Civil Emergency Messages in severe heat waves (NYSDHSES n.d.).

Table 5.4.4-2. National Weather Service Alerts

Alert	Criteria
Heat Advisory	Issued 12 hours of the onset of the following conditions: maximum daytime heat index values are to reach between 100°F to 104°F for at least 2 consecutive hours
Excessive Heat Watch	Issued when conditions are favorable for excessive heat in the next 24 to 72 hours
Excessive Heat Warning	Issued within 12 hours of the onset of the following conditions: maximum heat index temperature is expected to be 105°F or higher for at least 2 days and nighttime air temperatures will not drop below 75°F

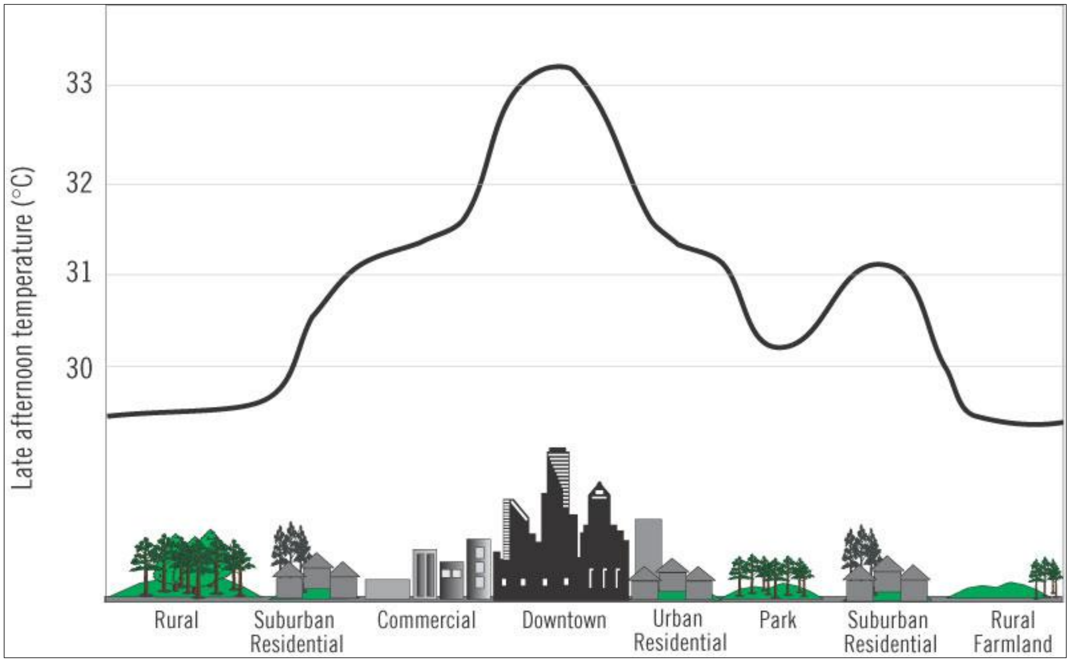
Source: NYSDHSES n.d.

Urbanized areas and urbanization create an exacerbated type of risk during an extreme heat event, compared to rural and suburban areas. As these urban areas develop and change, so does the landscape. Buildings, roads, and other infrastructure replace open land and vegetation. Surfaces that were once permeable and moist are now impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas. This forms an 'island' of higher temperatures (EPA 2022). The City of Rochester is the main urban area within Monroe County.

The term 'heat island' describes built-up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with more than 1 million people can be between 1.8 ºF and 5.4ºF warmer than its surrounding areas. In the evening, the difference in air temperatures can be as high as 22ºF. Heat islands occur on the surface and in the atmosphere. On a hot, sunny day, the sun can heat dry, exposed urban surfaces to temperatures 50ºF to 90ºF hotter than the air. Heat islands can affect communities by increasing peak energy demand during the summer; thereby escalating air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and death, and water quality degradation (EPA 2022).

Figure 5.4.4-4 below illustrates an urban heat island profile. The graphic demonstrates that heat islands are typically most intense over dense urban areas. Further, vegetation and parks within a downtown area may help reduce heat islands (U.S. EPA 2019).

Figure 5.4.4-4. Urban Heat Island Profile

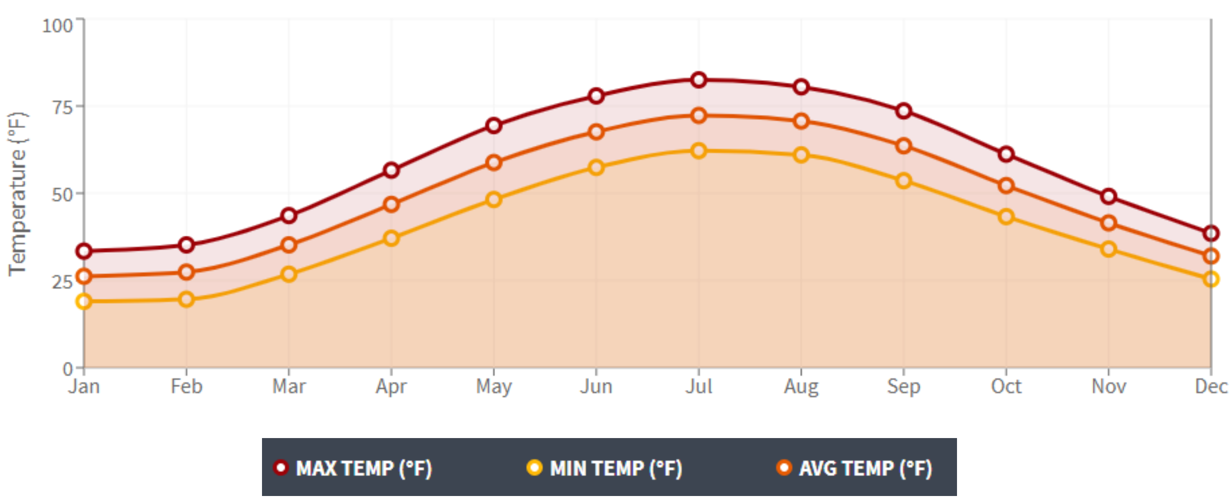


Source: EPA 2019
ºC degrees Celsius

Location

Varying land elevations, character of the landscape, and proximity to large bodies of water play a significant role in the state's temperatures. Monroe County is susceptible to both extreme cold and extreme heat temperature events. Figure 5.4.4-5 shows the average low and high temperatures each month at the Rochester International Airport station located in Monroe County.

Figure 5.4.4-5. Average Temperatures at Rochester International Airport



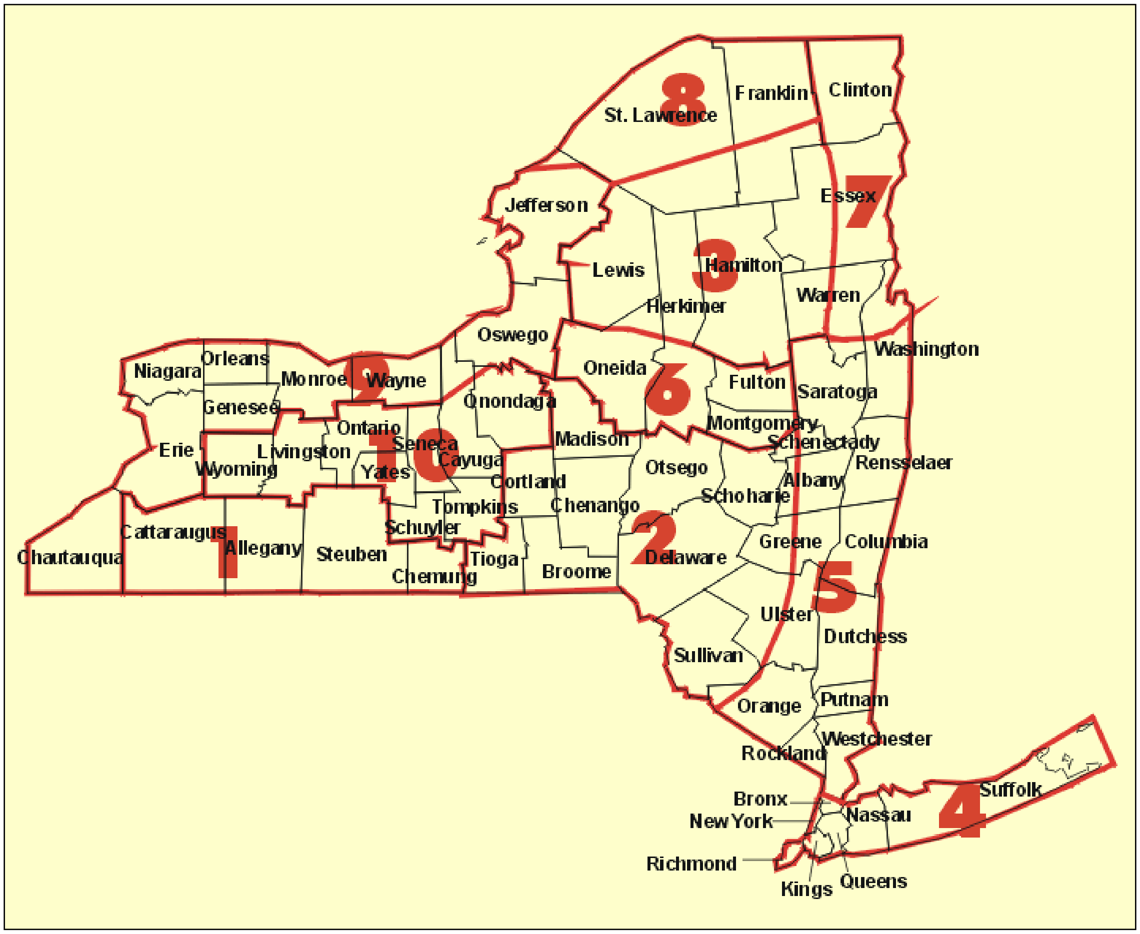
Source: NOAA NCEI 2020

Extensive periods of extreme cold temperatures are a result from movement of great high-pressure systems into and through the eastern United States. Under higher-than-normal atmospheric pressures when arctic air masses are present, extreme winter temperatures hover over New York. New York State's location in the northeast makes it highly susceptible to extreme cold that can cause impact to human life and property (NYS DHSES 2019). Extreme cold temperatures occur throughout most of the winter season and generally accompany most winter storm events throughout the state. The NYSC Office of Cornell University indicates that cold temperatures prevail over the state whenever arctic air masses, under high barometric pressure, flow southward from central Canada or from Hudson Bay (Cornell University n.d.).

Excessive heat can occur anywhere, and occurrences of excessive heat are generally widespread and will cover an entire county. However, there can be spot locations that are somewhat cooler (e.g., a shady park near a stream) or hotter (e.g., urban areas because of their built environment holds the heat) (NYS DHSES 2019). Extreme heat temperatures of varying degrees exist throughout the state for most of the summer season, except for areas with high altitudes (Cornell University n.d.).

New York State is divided into 10 climate divisions: Western Plateau, Eastern Plateau (Catskill Mountains), Northern Plateau (Adirondack Mountains), Coastal, Hudson Valley, Mohawk Valley, Champlain Valley, St. Lawrence Valley, Great Lakes, and Central Lakes. According to NCDC, "Climatic divisions are regions within each state that have been determined to be reasonably climatically homogeneous" (NOAA 2012). Monroe County is located within the Great Lakes Division (Division 9). Figure 5.4.4-6 depicts the climate divisions in New York State.

Figure 5.4.4-6. New York State Climate Divisions



Source: NOAA 2012
Notes: (1) Western Plateau; (2) Eastern Plateau (Catskill Mountains); (3) Northern Plateau (Adirondack Mountains); (4) Coastal; (5) Hudson Valley; (6) Mohawk Valley; (7) Champlain Valley; (8) St. Lawrence Valley; (9) Great Lakes; and (10) Central Lakes

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with extreme temperatures throughout New York State and Monroe County. With so many sources reviewed for this HMP, loss and impact information for many events could vary. Therefore, the accuracy of monetary figures discussed is based only on the available information in cited sources.

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, New York State and Monroe County were not included in any FEMA-declared extreme temperature specific disasters (DR) or emergency declarations (EM). However, Monroe County has been included in numerous declarations that involved severe winter storms. Refer to Section 5.4.10 (Severe Winter Storm) for more information on these declarations.

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was included in the following USDA-designated agricultural disasters that included or may have included losses due to extreme temperatures:

- S4023 - 2015 Heat, Excessive Heat
- S4031 - 2015 Heat Excessive Heat
- S4037 - 2015 Heat, Excessive Heat
- S4052 - 2015 Frost, Freeze
- S4903 - 2020 Frost, Freeze
- S4904 - 2020 Frost, Freeze

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are low the following years as well. USDA records indicate that Monroe County has experienced crop losses from extreme temperature events. Table 5.4.4-3. provides details regarding crop losses in Monroe County according to USDA records.

Table 5.4.4-3. USDA Crop Losses from Excess Moisture/Precipitation/Rain and/or Flooding in Monroe County (2015-2022)

Year	Crop Type	Cause of Loss	Losses
2020	Sweet Corn, Green Peas, Soybean	Heat	$98k
2020	Apples, Soybeans	Frost/Freeze	$180k

Source: USDA 2022
Note: Cold Wet Weather is not included in the values above.

Previous Events

Table 5.4.4-4. identifies the known extreme temperature events that impacted Monroe County between 2015 and 2022. For events prior to 2015, refer to Appendix E (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Table 5.4.4-4. Extreme Temperature Events in Monroe County, 2015 to 2022

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
October 17, 2018	Frost/Freeze	Monroe County	N/A	N/A	Widespread freezing temperatures occurred in most of the area to start the day. This resulted in a killing freeze or end of the growing season in most counties. This included 31° F in Spencerport.
January 1–31, 2019	Extreme Cold/Wind Chill	Monroe County	N/A	N/A	Behind the front that caused widespread blowing and drifting snow across the area with localized blizzard conditions in Buffalo and Watertown, temperatures dipped below zero in the entirety of the area. This combined with wind gusts of 35 to 50 mph dropped wind chills substantially below zero. One homeless man died of exposure in Williamsville during the cold outbreak that closed almost all area schools and churches. Some of the recorded lowest wind chills during the period were, -25° F in Irondequoit,.
May 5, 2020	Frost/Freeze	Monroe County	N/A	N/A	A very cold pattern persisted from April into the growing season across most of the northeastern United States. This allowed for widespread accumulating snows periodically along with unseasonable cold temperatures to persist through the first half of May. Widespread freezing temperatures were present overnight in much of the area on several nights as the first few weeks of the growing season started. Selected morning low temperatures included 29° F in Rochester
May 8–14, 2020	Frost/Freeze	Monroe County	N/A	N/A	A very cold pattern persisted from April into the growing season across most of the northeastern United States. This allowed for widespread accumulating snows periodically along with unseasonable cold temperatures to persist through the first half of May. Widespread freezing temperatures were present overnight in much of the area on several nights as the first few weeks of the growing season started.

Source: NOAA NCEI 2022; FEMA 2022

Climate Change Impacts

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and heavier precipitation are already being felt in the state. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change, Monroe County is part of Region 1 (Western New York and the Great Lakes Plain). In Region 1, it is estimated that temperatures will increase by 4.3ºF to 6.3ºF by the 2050s and 5.7ºF to 9.6ºF by the 2080s (baseline of 47.7ºF). Average annual temperatures are projected to increase across New York State by 2° F to 3.4° F by the 2020s, 4.1° F to 6.8° F by the 2050s, and 5.3° F to 10.1° F by the 2080s with an average rate of warming over the past century of 0.25° F per decade. By the end of the century, the greatest warming is projected to be in the northern section of the State.

Extreme events are also projected to increase, as illustrated in Table 5.4.4-5 below (NYSERDA 2014).

Table 5.4.4-5. Extreme Event Projections for Region 1

Event Type (2020s)	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
Days over 90 °F (8 days)	12	14 to 17	19
# Of Heat Waves (0.7 heat waves)	2	2 to 2	2
Duration of Heat Wave (4 days)	4	4 to 4	4
Days below 32 °F (133 days)	99	103 to 111	116
Days over 1" Rainfall (5 days)	4	5 to 5	6
Days over 2" Rainfall (0.6 days)	0.6	0.6 to 0.7	0.8

Source: NYSERDA 2014

Probability of Future Occurrences

Based on the historic and more recent extreme temperature events in Monroe County, and the future climate projections for this region, the County has a moderate probability of future extreme temperature events. It is anticipated that Monroe County will continue to experience direct and indirect impacts of extreme temperature events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, etc. Additionally, climate change is expected to increase the severity and frequency of extreme heat events in Monroe County. According to available record-keeping, Monroe County has a 100-percent annual chance of occurrence of extreme temperature events (heat or cold) in any given year.

Table 5.4.4-6. Probability of Future Occurrence of Extreme Temperature Events

Hazard Type	Number of Occurrences Between 1900 and 2022	% chance of occurrence in any given year
Extreme Heat (days with maximum temperature ≥ 95°F or greater)	98	76.6%
Extreme Cold (days with minimum temperatures ≤ 0°F	506	100%
TOTAL	**604**	**100%**

Source: Midwestern Regional Climate Center 2022; FEMA 2022

Note: Disaster occurrences include federally declared disasters and selected extreme temperature events between January 1, 1996, and January 1, 2022. Due to limitations in data, not all extreme temperature events occurring between 1996 and June 2022 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Section 5.3 ranks the identified hazards of concern for Monroe County. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee, the probability of occurrence of extreme temperature in the County is considered 'occasional' (between 10 and 100 percent annual probability of a hazard event occurring, as presented in Table 5.3-2.).

5.4.4.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the hazard area identified. The entire County has been identified as exposed for the extreme temperature events. Therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 4), are exposed and potentially vulnerable. The following text evaluates and estimates the potential impact of extreme temperatures on Monroe County, including:

- Impact on Life, Health, and Safety
- Impact on General Building Stock
- Impact on Critical Facilities
- Impact on Economy
- Impact on the Environment
- Cascading Impacts on Other Hazards
- Future Changes That May Impact Vulnerability
- Change of Vulnerability Since the 2017 HMP

Impact on Life, Health and Safety

> According to NOAA's 2001 Winter Storms The Deceptive Killers, approximately 50 percent of the deaths related to extreme cold temperatures happen to people over 60 years old, more than 75 percent of those deaths are male, and about 20 percent occur in the home (NYS DHSES 2014).

Extreme temperature events have potential health impacts including injury and death. According to the Centers for Disease Control and Prevention, populations most at risk to extreme cold and heat events include the following: (1) the elderly, who are less able to withstand temperatures extremes because of their age, health conditions, and limited mobility to access shelters; (2) infants and children up to 4 years of age; (3) individuals who are physically ill (such as with heart disease or high blood pressure), (4) low-income persons who cannot afford proper heating and cooling; and (5) members of the general public who may overexert during work or exercise during extreme heat events or experience hypothermia during extreme cold events (CDC 2006).

The entire population of Monroe County is exposed to extreme temperature events. According to the 2020 U.S. Census, the County had a population of 753,109. Refer to Section 4 (County Profile) for a summary of population statistics for the county.

Impact on General Building Stock

Extreme heat generally does not affect buildings; however, losses may be associated with overheating of heating, ventilation, and air conditioning (HVAC) systems. Extreme cold temperature events can damage buildings through freezing and bursting pipes and freeze/thaw cycles. Additionally, manufactured homes (mobile homes) and antiquated or poorly constructed facilities may have inadequate capabilities to withstand extreme temperatures.

All of the building stock in the County is exposed to the extreme temperature hazard; however, direct impacts are expected to be minimal. Refer to Section 4 (County Profile), which summarizes the building inventory in Monroe County.

Impact on Critical Facilities

Similar to the general building stock, all critical facilities in the County are exposed to the extreme temperature hazard; however, direct impacts are expected to be minimal. Impacts to critical facilities are the same as were described for general building stock. Additionally, it is essential that critical facilities remain operational during natural hazard events. Extreme heat events can sometimes cause short periods of utility failures, commonly referred to as "brown-outs," created by increased usage from air conditioners, appliances, and similar equipment. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can interrupt power as well. Backup power is recommended for critical facilities and infrastructure.

Impact on Economy

Extreme temperature events also have impacts on the economy, including loss of business function and damage and loss of inventory. Business owners may be faced with increased financial burdens due to unexpected repairs caused to the building (pipes bursting), higher than normal utility bills, or business interruption caused by power failure (loss of electricity and telecommunications).

The agricultural industry is most at risk in terms of economic impact and damage caused by extreme temperature events. Extreme heat events can result in drought and dry conditions and directly affect livestock and crop production.

Based on the 2017 Census of Agriculture, 527 farms were present in Monroe County, encompassing 106,778 acres of total farmland. The average farm size was 203 acres. Monroe County farms had a total market value of products sold of $76.64 million, averaging $145,433 per farm (USDA 2017). Table 5.4.4-7 lists the acreage of agricultural land exposed to extreme temperature hazards.

Table 5.4.4-7. Agricultural Land in Monroe County in 2017

Number of Farms	Land in Farms (acres)	Total Cropland (acres)	Total Pastureland (acres)	Acres Irrigated
527	106,778	85,422	4,271	639

Source: USDA 2017

In 2017, the top three agricultural products sold in Monroe County were grains, oilseeds, dry beans, and dry peas at $26 million; vegetables, melons, potatoes, and sweet potatoes at $19.7 million; and nursery, greenhouse, floriculture, and sod at $11.9 million. Monroe County was the eighth highest-ranked County in the State for its sales of cut Christmas trees and short rotation woody crops, and sixth highest ranked for its total acreage of crop items for all harvested vegetables (USDA 2017).

If an extreme temperature event impacted 40 percent of the agricultural products sold from Monroe County farms, based on 2017 market values, this would be a loss of $30.6 million. This figure does not include how the tourism industry and local jobs are impacted.

Impact on the Environment

Extreme temperature events can have a major impact on the environment. For example, 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.

Cascading Impacts On Other Hazards

Extreme heat temperature events can exacerbate the drought hazard, increase the potential risk of wildfires, and escalate severe storm and severe winter weather events for the County. For example, extreme heat events may accelerate evaporation rates, drying out the air and soils. Extreme heat can also dry out terrestrial 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 weather during freezing and thawing periods. Refer to Section 5.4.9 (Severe Storm), Section 5.4.10 (Severe Winter Storm), and Section 5.4.11 (Wildfire) for more information about these hazards of concern.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The county considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in the population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected 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. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). An increase in the population throughout Monroe County will increase the County's risk to extreme temperature events. Refer to section 4 (County Profile), which includes a more thorough discussion about population trends for the County.

Climate Change

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures and precipitation. As the climate warms, extreme cold events might decrease in frequency, while extreme heat events might increase in frequency; the shift in temperatures could also result in hotter extreme heat events. With increased temperatures, vulnerable populations could face increased vulnerability to extreme heat and its associated illnesses, such as heatstroke and cardiovascular and kidney disease. Additionally, as temperatures rise, more buildings, facilities, and infrastructure systems may exceed their ability to cope with the heat.

Change of Vulnerability Since 2017 HMP

Overall, the entire County remains vulnerable to extreme temperatures. As existing development and infrastructure continue to age, they can be at increased risk to failed utility systems (e.g., HVAC) if they are not properly maintained. Similarly, an increase in the elderly population remaining in the County increases the vulnerable population.

5.4.5 Flood

The following section and vulnerability assessment of the flood hazard for Monroe County.

5.4.5.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections and the probability of future occurrences for the flood hazard.

Hazard Description

Floods are one of the most common natural hazards in the U.S. They can develop slowly over a period of days or develop quickly, with disastrous effects that can be local (impacting a neighborhood or community) or regional (affecting entire river basins, coastlines and multiple counties or states) (FEMA 2007). As defined in the NYS HMP (NYS DHSES 2019), flooding is a general and temporary condition of partial or complete inundation on normally dry land as a result of the following:

- Riverine overbank flooding
- Flash floods
- Alluvial fan floods
- Mudflows or debris floods
- Dam-break floods
- Local draining or high groundwater levels
- Fluctuating lake levels
- Ice-jams
- Coastal flooding
- Urban flooding

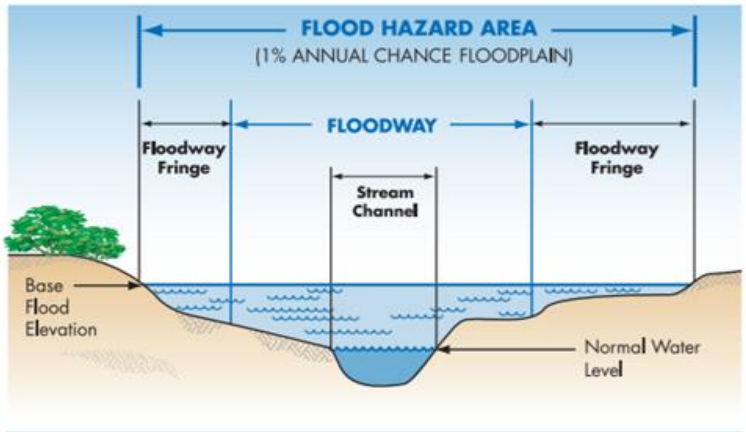
For the purpose of this HMP and as deemed appropriate by the Monroe County Steering Committee, the main flood types of concern discussed in this section include: riverine, flash, stormwater/urban, lakeshore, ice jam, and dam failure flooding. In addition, coastal erosion is considered as a cascading hazard in the coastal areas. These types of floods are further discussed below.

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 (Illinois Association for Floodplain and Stormwater Management 2006)

A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. In Monroe County, floodplains line the rivers and streams of the County and the lakeshore areas. The boundaries of the floodplains are altered as a result of 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 modeling techniques. Figure 5.4.5-1 depicts the flood hazard area, the flood fringe, and the floodway areas of a floodplain.

Figure 5.4.5-1. Illustration of a Floodplain



Source: NJDEP 2015

Flash Flooding

Flash floods are defined by the National Weather Service as "a flood caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Flash floods are usually characterized by raging torrents after heavy rains that rip through riverbeds, urban streets, or mountain canyons sweeping everything before them. They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed, or after a sudden release of water by a debris or ice jam." (National Weather Service 2009).

Stormwater/Urban Flooding

Stormwater/urban flooding described below is due to local drainage issues and high groundwater levels. Locally, heavy precipitation may produce flooding in areas other than delineated floodplains or along recognizable channels. If local conditions cannot accommodate intense precipitation through a combination of infiltration and surface runoff, water may accumulate and cause flooding problems. During winter and spring, frozen ground and snow accumulations may contribute to inadequate drainage and localized ponding. Flooding issues of this nature generally occur in areas with flat gradients and generally increase with urbanization which speeds the accumulation of floodwaters because of impervious areas. Shallow street flooding can occur unless channels have been improved to account for increased flows (FEMA 1997).

High groundwater levels can be a concern and cause problems even where there is no surface flooding. Basements are susceptible to high groundwater levels. Seasonally high groundwater is common in many areas, while elsewhere high groundwater occurs only after a long period of above-average precipitation (FEMA 1997).

Heavy rainfall that overwhelms a developed area's stormwater infrastructure causing flooding is commonly referred to as urban flooding. Urban flooding can be worsened by aging and 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). While riverine and lakeshore flooding is mapped and studied by FEMA, urban flooding is not.

NOAA defines urban flooding as the flooding of streets, underpasses, low lying areas, or storm drains (National Weather Service 2009). Urban drainage flooding is caused by increased water runoff due to urban development and inadequate drainage systems. Drainage systems are designed to remove surface water from developed areas as quickly as possible to prevent localized flooding on streets and other urban areas. The systems make use of a closed conveyance system that channels water away from an urban area to surrounding streams. 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)

Coastal/Lakeshore Flooding, Seiches, and Erosion

Great Lakes storms can occur any time of the year and at varying levels of severity. Natural protective features within coastal erosion hazard areas provide buffering and protection to shorelines from erosion. Dunes and bluffs are effective against storm-induced high water and related wave action (NYS DHSES 2019).

Wind and weather conditions on the Great Lakes may create a seiche, an oscillating wave which can be several feet high. In many of the Great Lakes, the time period between the "high" and "low" of a seiche may be between 4 and 7 hours. As this is similar to the 6-hour time period of the tides on the ocean, it is frequently mistaken for a tide.

Coastal/lakeshore flooding may cause beach erosion; loss or submergence of wetlands and other coastal ecosystems; high water tables; loss of coastal recreation areas, beaches, protective sand dunes, parks, and open space; and loss of coastal structures. Coastal structures can include sea walls, piers, bulkheads, bridges, or buildings (FEMA 2011).

There are several forces that occur with coastal/lakeshore flooding:

- ***Hydrostatic forces*** against a structure are created by standing or slowly moving water. Flooding can cause vertical hydrostatic forces, or flotation. These types of forces are one of the main causes of flood damage.
- ***Hydrodynamic forces*** on buildings are created when coastal floodwaters move at high velocities. These high-velocity flows are capable of destroying solid walls and dislodging buildings with inadequate foundations. High-velocity flows can also move large quantities of sediment and debris that can cause additional damage. In lakeshore areas, high-velocity flows are typically associated with one or more of the following:
    - Wave run-up flowing landward through breaks in sand dunes or across low-lying areas
    - Strong currents parallel to the shoreline, driven by waves produced from a storm
    - High-velocity flows

High-velocity flows can be created or exacerbated by the presence of manmade or natural obstructions along the shoreline and by weak points formed by roads and access paths that cross dunes, bridges or canals, channels, or drainage features.

- ***Waves*** can affect coastal buildings from breaking waves, wave run-up, wave reflection and deflection, and wave uplift. The most severe damage is caused by breaking waves. The force created by these types of waves breaking against a vertical surface is often at least 10 times higher than the force created by high winds during a storm.
- ***Flood-borne debris*** produced by coastal flooding events and storms typically includes decks, steps, ramps, breakaway wall panels, portions of or entire houses, heating oil and propane tanks, cars, boats, decks and pilings from piers, fences, erosion control structures, and many other types of smaller objects. Debris from floods are capable of destroying unreinforced masonry walls, light wood-frame construction, and small-diameter posts and piles (FEMA 2011).

As waves approach a shoreline, they crest and break, losing some initial energy. The remaining wave runs up the beach before pulling back down. Depending on the size of the wave, angle of wave "attack," and the wave period, waves can cause erosion or accretion of sediment. Seasonal high temperatures and seiches contribute to elevated lake levels allowing larger waves to reach the shoreline. Greater water depths near shore also result in less loss of wave energy from shoaling.

Elevated lake levels contribute to higher rates of coastal erosion. Higher lake levels will magnify the reach of currents and wave action. Unlike oceans which have tides, the Great Lakes are considered to be non-tidal and experience change in water levels primarily because of meteorological effects. Water levels in the Great Lakes have long-term, annual, and short-term variations. Long-term variations depend on precipitation and water storage over many years. Annual variations occur with the changing seasons with an annual high in the late spring and a low in the winter. These changes occur at a rate that can be measured in feet per month (NOAA 2020).

Ice Jam Flooding

An ice jam occurs when pieces of floating ice are carried with a stream's current and accumulate behind any obstruction to the stream flow. Obstructions may include river bends, mouths of tributaries, points where the river slope decreases, as well as dams and bridges. The water held back by this obstruction can cause flooding upstream, and if the obstruction suddenly breaks, flash flooding can occur as well (NOAA 2013). The formation of ice jams depends on the weather and physical condition of the river and stream channels. They are most likely to occur where the channel slope naturally decreases, in culverts, and along shallows where channels may freeze solid. Ice jams and resulting floods can occur during at different times of the year: fall freeze-up from the formation of frazil ice; mid-winter periods when stream channels freeze solid, forming anchor ice; and spring breakup when rising water levels from snowmelt or rainfall break existing ice cover into pieces that accumulate at bridges or other types of obstructions (NYS DHSES 2019).

Ice Jams At a Glance

- Freeze-up jams occur when floating ice may slow or stop due to a change in water slope as it reaches an obstruction to movement.
- Breakup jams occur during periods of thaw, generally in late winter and early spring.

Dam Failure Flooding

A dam is an artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material for the purpose of storage or control of water (FEMA 2007). Dams are man-made structures built across a stream or river that impound water and reduce the flow downstream (FEMA 2003). They are built for the purpose of power production, agriculture, water supply, recreation, and flood protection. Dam failure is any malfunction or abnormality outside of the design that adversely affects a dam's primary function of impounding water (FEMA 2007). Dams can fail for one or a combination of the following reasons:

- Overtopping caused by floods that exceed the capacity of the dam (inadequate spillway capacity due to uncontrolled release or exceedance of design);
- Prolonged periods of rainfall and flooding;
- Deliberate acts of sabotage (terrorism);
- Structural failure of materials used in dam construction;
- Movement and/or failure of the foundation supporting the dam;
- Settlement and cracking of concrete or embankment dams;
- Piping and internal erosion of soil in embankment dams;
- Inadequate or negligent operation, maintenance, and upkeep;
- Failure of upstream dams on the same waterway; or

- Earthquake (liquefaction / landslides) (FEMA 2007).

A break in a dam can produce extremely dangerous flood situations because of the high velocities and large volumes of water released by such a break. Sometimes they can occur with little to no warning. Breaching of dams often occurs within hours after the first visible sign of dam failure, leaving little or no time for evacuation (FEMA 2007).

Location

Flooding potential is influenced by climatology, meteorology, and topography (elevations, latitude, and water bodies and waterways). Flooding potential for each type of flooding that affects Monroe County is described in the subsections below.

Floodplains

A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. In Monroe County, floodplains line the rivers, streams, and lakeshores of the County. The boundaries of the floodplains are altered as a result of 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 modeling techniques (NJAFM 2015).

Flood hazard areas are identified as Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled to or exceeded in any given year. The 1-percent annual chance flood is also referred to as the base flood or 100-year flood. A 100-year floodplain is not a flood that will occur once every 100 years; the designation indicates a flood that has a 1-percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. Similarly, the moderate flood hazard area (500-year floodplain) will not occur every 500 years but is an event with a 0.2-percent chance of being equaled or exceeded each year (FEMA 2020). The 1-percent annual chance floodplain establishes the area that has flood insurance and floodplain management requirements.

Figure 5.4.5-2. Flood Map Terms

Flood Map Terms

- Flood hazard areas identified on the Flood Insurance Rate Map are identified as a Special Flood Hazard Area (SFHA).
- SFHA = the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year.
- 1-percent annual chance flood = the base flood or 100-year flood.
- SFHAs are 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 and are 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, are labeled

Source: FEMA 2018

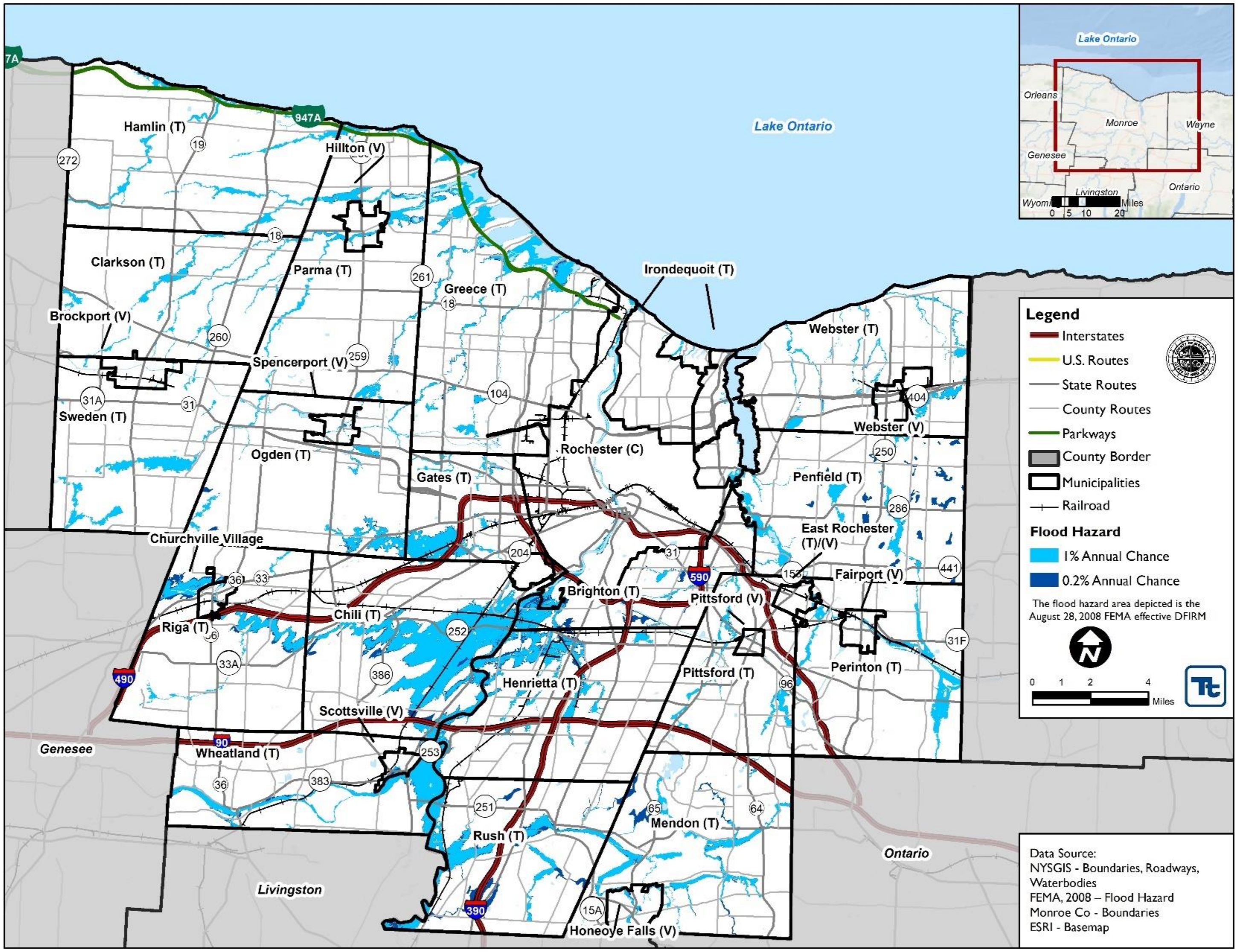
Locations of flood zones in Monroe County as depicted on the FEMA preliminary Digital Flood Insurance Rate Map (DFIRM) are illustrated in, Figure 5.4.5-3 and the total land area in the floodplain, inclusive of waterbodies, is summarized in Table 5.4.5-1. Refer to Section 9 for a map of each jurisdiction depicting the floodplains. Flood hazard zones occur throughout the County.

Table 5.4.5-1. Number of Acres Monroe County Is Exposed to 1-Percent and 0.2-Percent Annual Chance Flood

Jurisdiction	Total Acres of Land Area	Total Acres of Land Area (Excluding Waterbodies) Located in the Flood Hazard Areas			
		Total Acres Located in the 1-Percent Annual Chance Flood Event	Percent of Total	Total Acres Located in the 0.2-Percent Annual Chance Flood Event	Percent of Total
Brighton (T)	9,868	879	8.9%	1,402	14.2%
Brockport (V)	1,375	26	1.9%	26	1.9%
Chili (T)	25,234	5,967	23.6%	6,681	26.5%
Churchville (V)	743	57	7.6%	89	11.9%
Clarkson (T)	21,170	1,114	5.3%	1,130	5.3%
East Rochester (T/V)	837	28	3.3%	29	3.4%
Fairport (V)	1,002	66	6.5%	71	7.1%
Gates (T)	9,740	1,324	13.6%	1,434	14.7%
Greece (T)	30,096	2,714	9.0%	3,001	10.0%
Hamlin (T)	27,493	1,442	5.2%	1,443	5.2%
Henrietta (T)	22,578	2,250	10.0%	2,856	12.6%
Hilton (V)	1,119	78	6.9%	89	8.0%
Honeoye Falls (V)	1,621	147	9.0%	178	11.0%
Irondequoit (T)	9,626	204	2.1%	211	2.2%
Mendon (T)	23,684	1,672	7.1%	2,156	9.1%
Ogden (T)	22,551	1,164	5.2%	1,372	6.1%
Parma (T)	25,575	1,563	6.1%	1,727	6.8%
Penfield (T)	23,840	1,615	6.8%	2,292	9.6%
Perinton (T)	20,874	1,335	6.4%	1,352	6.5%
Pittsford (T)	14,399	798	5.5%	852	5.9%
Pittsford (V)	449	5	1.2%	5	1.2%
Riga (T)	21,706	1,204	5.5%	1,572	7.2%
Rochester (C)	22,860	565	2.5%	681	3.0%
Rush (T)	19,410	1,966	10.1%	2,804	14.4%
Scottsville (V)	615	45	7.3%	80	13.0%
Spencerport (V)	813	42	5.1%	52	6.4%
Sweden (T)	20,200	1,145	5.7%	1,146	5.7%
Webster (T)	20,270	1,327	6.5%	1,449	7.1%
Webster (V)	1,392	4	0.3%	7	0.5%
Wheatland (T)	18,892	2,124	11.2%	2,254	11.9%
Monroe County (Total)	**420,035**	**32,866**	**7.8%**	**38,442**	**9.2%**

Source: FEMA 2008; Monroe County GIS 2022
Note: C = City, T = Town, V = Village, % = Percent

Figure 5.4.5-3. FEMA Flood Hazard Areas in Monroe County



Flood Gages

The USGS National Water Information System (NWIS) collects surface water data from more than 850,000 stations across the country. The time-series data describes stream levels, streamflow (discharge), reservoir and lake levels, surface water quality, and rainfall. The data is collected by automatic recorders and manual field measurements at the gage locations. USGS uses stream gages to determine the severity of flood at different points along a body of water. There are numerous gages in Monroe County, in addition to others just outside of the County's boundary, that provide critical flood data for waterways affecting the County.

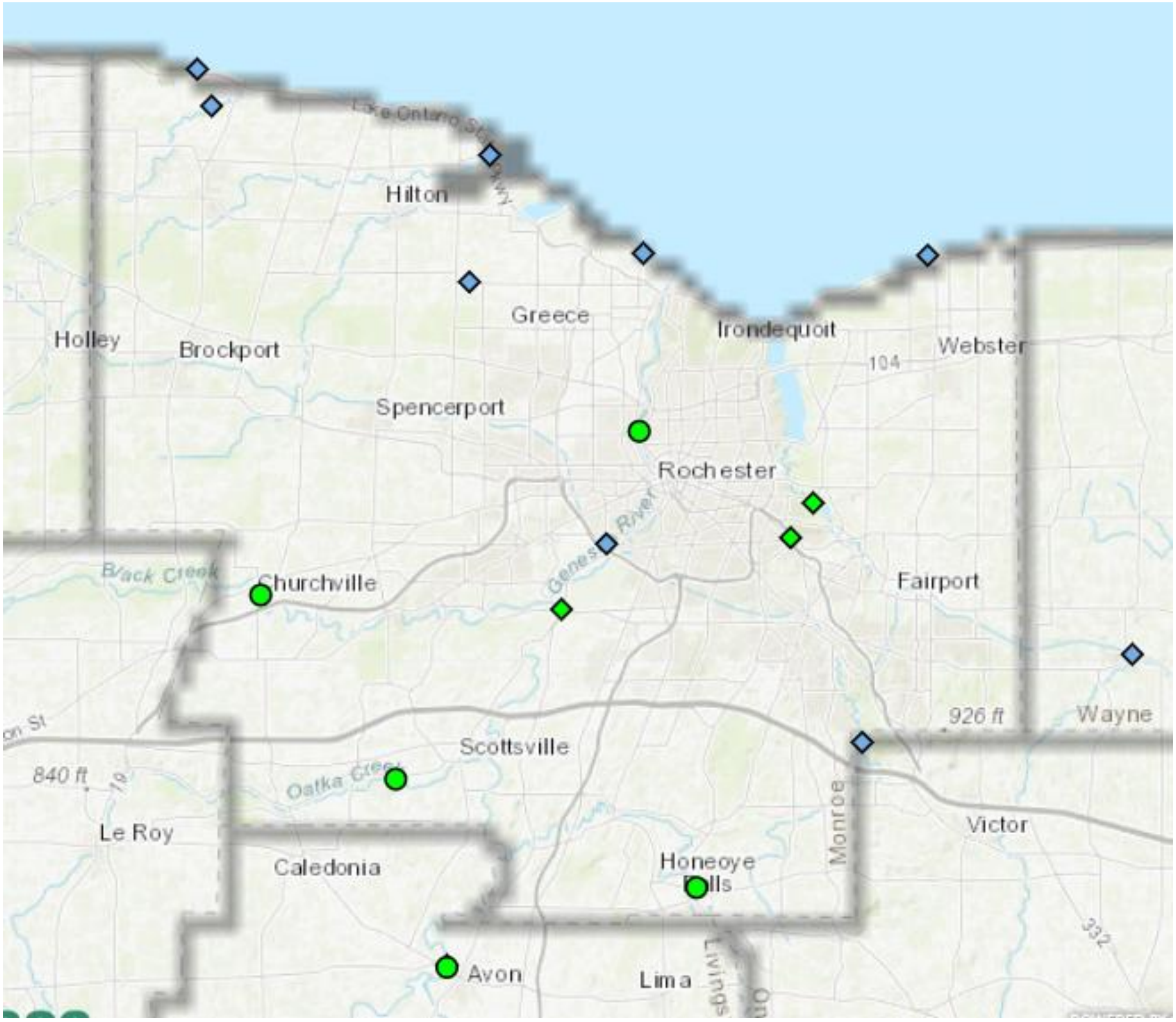
There are 10 stream gages in the County and 4 gages on Lake Ontario. Table 5.4.5-2 shows the stream gages in the County and details about each gage. The USGS website provides details about each of the gages (https://waterwatch.usgs.gov/index.php) and the gage heights of flooding events. The NWS provides the different flood stages for the gages (https://water.weather.gov/ahps/).

Table 5.4.5-2. Gages in Monroe County

Gage Site Number	Site Name	Flood Stage Height	Record Flood Height
04220223	Sandy Creek at North Hamlin	Unavailable	14.79
0422026250	Northrup Creek at North Greece	Unavailable	5.01
04232050	Allen Creek at Rochester	5	Unavailable
04231000	Black Creek at Churchville	6	9.44
04232040	Irondequoit Creek at Railroad Mills	8	Unavailable
04232042	Irondequoit Creek at Rochester	Unavailable	Unavailable
04228500	Genesee River at Rochester	15	24.50
04232000	Genesee River at South Rochester	17	Unavailable
04229500	Honeoye Creek at Honeoye Falls	6.5	8.42
04230500	Oatka Creek at Garbutt	6	8.64

Source: FEMA FIS 2022; NWS 2022; USGS 2022

Figure 5.4.5-4. Stream Gages in Monroe County



Source: NWS 2022

Riverine Flooding

Riverine flooding is most severe around major creeks and riverbeds, including Red Creek, Black Creek, Oatka Creek, Honeoye Creek, Irondequoit Creek, Allens Creek, and the Genesee River. According to the County's FIS, major floods can occur on Irondequoit Creek and lower Genesee River any time of year, although most result from heavy rainfall or snowmelt in the basin. Flood problems along the Genesee River are most visible in low-lying areas, and high water periodically will inundate primary residences and vacation homes. Tropical Storm Agnes caused the largest flood on the lower Genesee River since the Mount Morris Dam began operations in 1951 (FEMA 2008).

Additionally, the Lower Black Creek (from Churchville to the river) is a very large and wide floodplain, and the area floods often. According to Monroe County Department of Health, this vulnerability is detailed in a USACE report from the 1950s. Smaller magnitude flooding can occur in the Red Creek basin in Henrietta and Rush; the lack of relief in many of these areas hinders drainage so that it frequently backs up when large amounts of water hit. Ellison Park in Brighton undergoes routine flooding as well; however, that is due to its location in the floodplain.

Lastly, a spot on Irondequoit Creek, in Perinton, has been noted as problematic, and there is concern over canal maintenance operations. These maintenance operations open bottom manholes during the winter to facilitate repairs, creating additional discharges. The additional discharges, while relatively small (<20 cubic feet per second [cfs]) take up storage in stream channels that could be hit with melt off discharges (FEMA 2008).

Flash Flooding

Flash flooding can occur throughout any region of NYS; however, the distinctive flash flood event characterized by fast moving water and damaging impacts requires a steep topography. While Monroe County could undergo flash floods (and has, in the past), the County is at a lower risk than other parts of the State for this type of flood event (NYS DHSES 2019).

Stormwater/Urban Flooding

Stormwater/urban flooding is not mapped by the State or FEMA but is most likely to occur in highly developed areas with high percentages of impervious coverage that contribute to high rates of runoff. Locations that have undersized stormwater components or stormwater components that are prone to becoming clogged or failing often experience stormwater flooding.

Coastal/Lakeshore Flooding, Seiches, and Erosion

The south shore of Lake Ontario is the only major coastline in the County, and thus the County's only scene of notable lakeshore flooding. Monroe County contains 36.5 miles of Lake Ontario shoreline, which increases residential risk from erosion and wave action, threatens local infrastructure, compromises sensitive environmental features, and contributes to general flooding events. Moreover, the geography along Lake Ontario increases likelihood of training thunderstorms (i.e., thunderstorms repeatedly moving across the same area), particularly along Lake Breeze Fronts.

Water levels in the Great Lakes have long-term, annual, and short-term variations. Long-term variations depend on precipitation and water storage over many years. Annual variations occur with the changing seasons with an annual high in the late spring and a low in the winter. These changes occur at a rate that can be measured in feet per month (NOAA 2020). Most damaging floods from Lake Ontario occur when lake levels are high or during severe storms. Both scenarios create a temporary rise in the lake level and wave run-ups. Although these floods may occur throughout the year, they are most probable during spring (FEMA 2008).

Coastal Erosion Hazard Area

The coastline of Lake Monroe is designated by NYS DEC as an area at risk to coastal erosion from natural and human activities and is therefore regulated. NYS DEC has two programs focused on the protection of coastal erosion: Coastal Erosion Hazard Area (CEHA) permit program and the United States Army Corps of Engineers (USACE) Civil Works Program. The CEHA program regulates and issues permits for activities within a coastal erosion hazard area. NYS DEC works with USACE to study coastal erosion problems along coastlines and to develop coastal erosion solutions. These are usually large-scale projects that impact entire communities (NYS DEC n.d.)

Because of the consistent coastal erosion problems along the New York State coastline, the State Legislature passed the CEHA Act (Article 34 of the Environmental Conservation Law [ECL]), establishing the state's coastal policy in August 1981. Under this act:

- Areas prone to coastal erosion are identified.
- Activities in areas subject to coastal erosion are undertaken in such a way that damage to property is minimized, increases in coastal erosion are prevented, and natural features are protected. Public actions likely to encourage new development in CEHA should not be undertaken unless the areas are protected by structural or other erosion control projects, which could prevent erosion damage during the life of the proposed action.
- Erosion control projects are publicly financed only where needed to protect human life for existing or new development, which absolutely requires a location within a given hazard area.
- Public and private erosion control projects should minimize damage to other human-made property, natural protective features, and other natural resources.

Regulated CEHA communities have various actions that are restricted, prohibited, or require a permit (NYS DEC n.d.). The following municipalities are Certified CEHA communities in Monroe County:

- Town of Greece
- Town of Hamlin
- Town of Irondequoit
- Town of Parma
- Town of Penfield
- City of Rochester
- Town of Webster (NYS DEC n.d.)

NYS DEC has established a general permit (Great Lakes Erosion Control General Permit) for various shoreline stabilization and structural repair activities in state-regulated waters, wetlands, and coastal erosion hazard areas along Lake Monroe, Lake Ontario, Niagara River, and St. Lawrence River. The Great Lakes Erosion Control General Permit (GP-0-20-004) was issued on May 8, 2020 for a five-year term in response to recurring high-water events in these systems and the ongoing need for affected property owners to install shoreline stabilization measures and repair damaged property (NYS DEC n.d.).

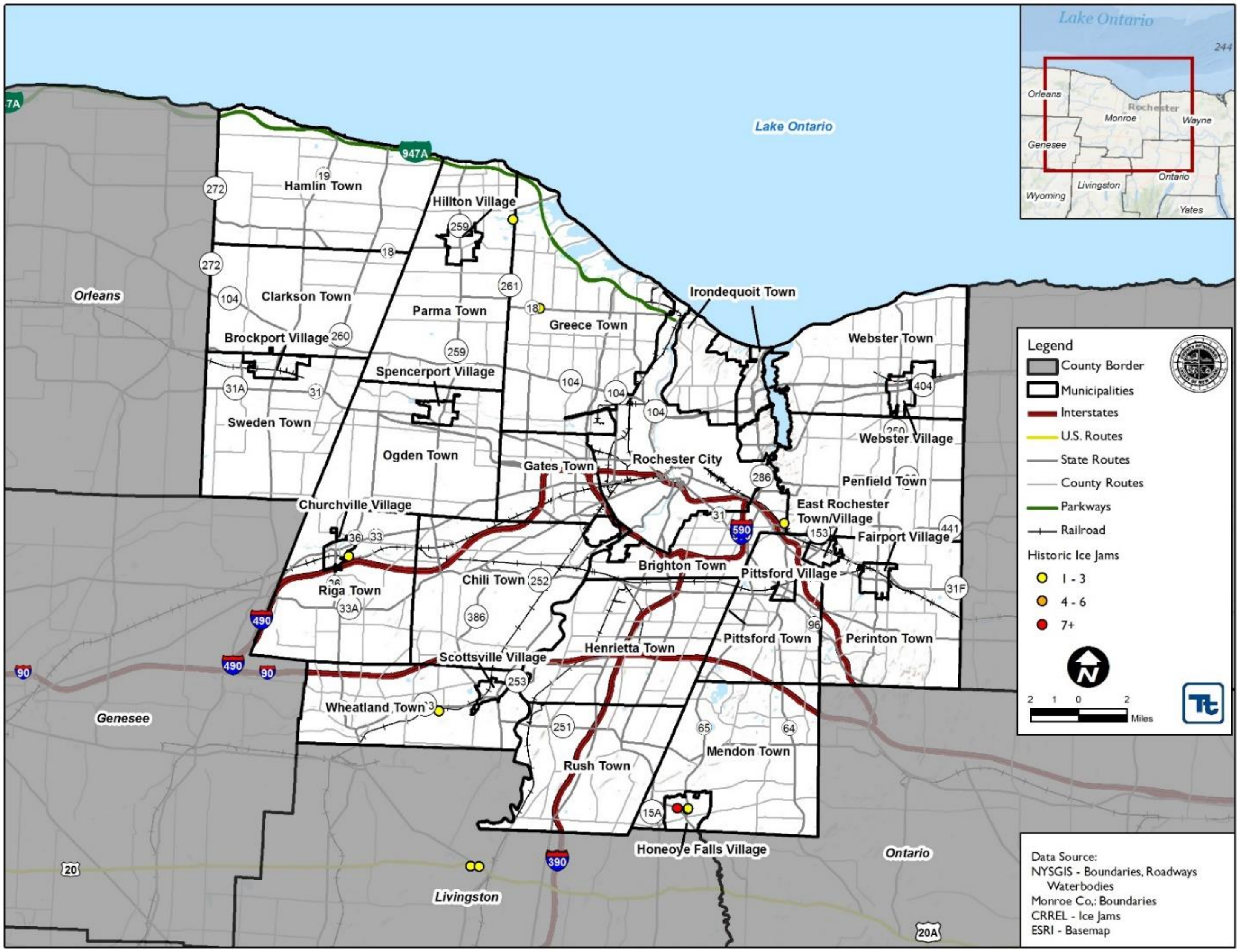
Ice Jam Flooding

Ice jams are common in the northeast United States, and NYS is not an exception. In fact, according to USACE, NYS ranks second in the United States for total number of ice jam events, with over 1,600 incidents documented between 1867 and 2015. Areas of NYS that include characteristics lending to ice jam flooding are the northern counties of the Finger Lakes region and far western New York, the Mohawk Valley of central and eastern NYS, and the North Country (NYS DHSES 2019).

The Ice Jam Database, maintained by the Ice Engineering Group at the USACE Cold Regions Research and Engineering Laboratory (CRREL), currently consists of over 19,000 records from across the United States. According to the USACE-CRREL, Monroe County underwent or may have been impacted by 74 historic ice jam incidents between 1780 and 2022, though no events have occurred in the last 25 years (USACE 2022). Ice Jams have formed along Oatka Creek, Honeoye Creek, Genesee River, Black Creek, Crystal Brook, Canandaigua Lake Outlet, Cayuga Inlet, Fall Creek, Flint Creek, Hemlock Creek, Ninemile Creek, Onondaga Creek, Owasco Outlet, Seneca River, Northrup Creek, West Creek, Sterling Creek, and Allen Creek.

Figure 5.4.5-5 shows the number of ice jam incidents in Monroe County from 1780 to 2022. Historical events are also cited in Appendix H.

Figure 5.4.5-5. Ice Jams in Monroe County, 1780 to 2022



Dam Failure

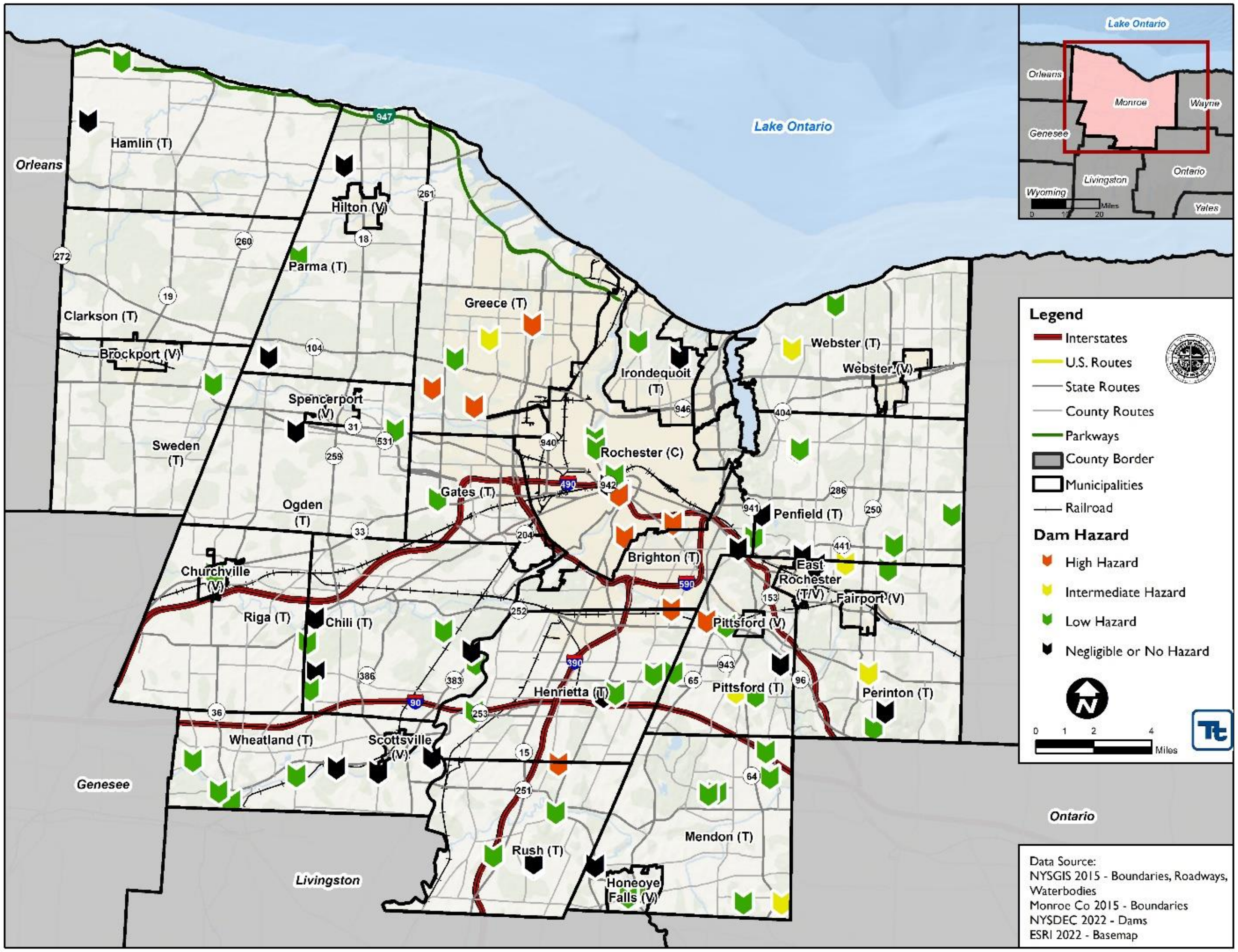
Locations of the dams in Monroe County are shown in Figure 5.4.5-6**.** The number of dams by classification per municipality is listed in Table 5.4.5-3. Dam failure can result in flooding of areas downstream of the failed dam. According to NYS DEC data, Monroe County has 23 dams with negligible or no hazard, 43 low hazard dams, 6 intermediate hazard dams, and nine high hazard dams (NYS DEC 2022). High hazard dams are required to develop emergency action plans.

Table 5.4.5-3. Dams by Hazard Classification per Jurisdiction in Monroe County

Jurisdiction	High Hazard Dams within Jurisdiction	Intermediate Hazard Dams within Jurisdiction	Low Hazard Dams within Jurisdiction	Negligible or No Hazard Dams within Jurisdiction
Brighton (T)	0	0	0	1
Brockport (V)	0	0	0	0
Chili (T)	0	0	4	3
Churchville (V)	0	0	1	0
Clarkson (T)	0	0	0	0
East Rochester (T/V)	0	0	0	0
Fairport (V)	0	0	0	0
Gates (T)	0	0	1	0
Greece (T)	3	1	1	0
Hamlin (T)	0	0	1	1
Henrietta (T)	1	0	3	1
Hilton (V)	0	0	0	0
Honeoye Falls (V)	0	0	2	0
Irondequoit (T)	0	0	1	1
Mendon (T)	0	1	5	1
Ogden (T)	0	0	1	1
Parma (T)	0	0	1	2
Penfield (T)	0	0	5	3
Perinton (T)	0	2	2	2
Pittsford (T)	1	1	3	1
Pittsford (V)	0	0	0	0
Riga (T)	0	0	0	0
Rochester (C)	3	0	3	2
Rush (T)	1	0	3	1
Scottsville (V)	0	0	0	0
Spencerport (V)	0	0	0	0
Sweden (T)	0	0	1	0
Webster (T)	0	1	1	0
Webster (V)	0	0	0	0
Wheatland (T)	0	0	4	3
Monroe County (Total)	**9**	**6**	**43**	**23**

Source: NYSDEC 2022

Figure 5.4.5-6. Dams in Monroe County



Flood Protection Structures

Monroe County has a variety of flood protection structures in place including the following dams and retention basins:

- Dams
  - Churchville Dam on Black Creek about 0.5 miles south of Village of Churchville – Town of Riga border
    - Provides some retention of storm waters with 1-percent annual chance recurrence but has negligible effects with larger storms.
  - Driving Park Dam on the Genesee River about 2.3 miles south of City of Rochester – Town of Irondequoit Border
    - Controlled during normal flows by the Rochester Gas and Electric Company. During flood flows, reverts from detention facilities to run-of-the river structures .
  - Central Avenue Dam on the Genesee River about 3.1 miles northeast of City of Rochester – Town of Chili border
    - Controlled during normal flows by the Rochester Gas and Electric Company. During flood flows, reverts from detention facilities to run-of-the river structures
  - Court Street Dam on the Genesee River about 2.7 miles northeast of City of Rochester – Town of Chili border
    - Operated by New York State. During flood flows, reverts from detention facilities to run-of-the river structures
  - Mount Morris Dam on the Genesee River about 25 miles south of the Chili – Wheatland border
    - Constructed by the USACE in 1951. Since operation began, significant damages to lower Genesee River Valley were averted during floods.
  - Honeoye Creek has several dams and one dike which provides protection to the Sewage treatment plant for a 500-year flood
- Retention Basins
  - East Branch Larkin Creek: Significantly reduce downstream peak flood flows and effectively reduce the width of the floodplain
  - Round Pond Creek: Significantly reduce downstream peak flood flows and effectively reduce the width of the floodplain (FEMA 2022)

Extent

The severity of a flood event is typically determined by a combination of several factors depending on the type of flooding event.

Riverine and Flash Flooding

The severity of riverine and flash flooding is determined by a combination of several factors including stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. Generally, floods are long-term events that may last for several days. Severity depends not only on the amount of water that accumulates in a period of time, but also on the land's ability to manage this water. One element is the size of rivers and streams in an area; but an equally important factor is the land's absorbency. When it rains, soil acts as a sponge. When the land is saturated or frozen, infiltration into the ground slows and any more water that accumulates must flow as runoff (Harris 2008).

The frequency and severity of riverine flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels.

In the case of riverine or flash flooding, once a river reaches flood stage, the flood extent or severity categories used by the NWS include minor flooding, moderate flooding, and major flooding. Each category has a definition based on property damage and public threat:

- ***Minor Flooding*** – minimal or no property damage, but possibly some public threat or inconvenience.
- ***Moderate Flooding*** – some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- ***Major Flooding*** – extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations (NWS 2011).

Stormwater/ Urban Flooding

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

Coastal/Lakeshore Flooding, Seiches, and Erosion

The extent of coastal flooding due to storms is determined by three factors: 1) the nature of the storm with respect to intensity, duration, and path; 2) astronomical tide conditions at the time the seiche or storm surge wave reaches the shore; and 3) the physical geometry and bathymetry of a particular area, which affects the time and passage of the seiche or surge wave.

Coastal erosion is measured as the rate of change in the position or horizontal displacement of a shoreline over a period of time. Geologists measure the severity of erosion in two ways, as a rate of linear retreat (feet of shoreline recession per year) and volumetric loss (cubic yards of eroded sediment per linear foot of shoreline frontage per year) (NYCEM 2019).

Ice Jam

Ice jam flooding events often occur suddenly and difficult to predict, allowing for little time to prepare for and warn of an event. The size of the snowpack and the rate of snowmelt controls the extent of an ice jam (Rokaya 2018).

Dam Failure

According to the NYSDEC Division of Water Bureau of Flood Protection and Dam Safety, the hazard classification of a dam is assigned according to the potential impacts of a dam failure pursuant to 6 New York Codes, Rules, and Regulations (NYCRR) Part 673.3 (NYSDEC 2009). Dams are classified in terms of potential for downstream damage if the dam were to fail. These hazard classifications are identified and defined below:

- *Low Hazard (Class A)* is a dam located 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 mis-operation would result in no probable loss of human life. Losses are principally limited to the owner's property
- *Intermediate Hazard (Class B)* is a dam located in an area where failure may damage isolated homes, main highways, minor railroads, interrupt the use of relatively important public utilities, and/or will cause significant economic loss or serious environmental damage. Failure or mis-operation would result in no probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification 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)* is a dam located 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) would occur as a direct result of dam failure.
- *Negligible or No Hazard (Class D)* is (1) a dam that has been breached or removed, or has failed or otherwise no longer materially impounds waters, or (2) a dam that was planned but never constructed. Class "D" dams are considered to be defunct dams posing negligible or no hazard. The department may retain pertinent records regarding such dams (NYSDEC 2009).

Previous Occurrences and Losses

Historical information regarding previous occurrences and losses associated with flooding events throughout NYS and areas within Monroe County was obtained from many sources. Given so many sources reviewed for the purpose of this HMP, loss and impact information regarding many events could vary depending on the source.

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, New York State was included in 25 FEMA declared flood specific disasters (DR) or emergency declarations (EM). Monroe County was included in four of these flood-related declarations (Table 5.4.5-4).

Table 5.4.5-4. FEMA DR and EM Declarations for Flood Events in Monroe County, 1954 to 2020

FEMA Declaration Number	Date(s) Of Event	Event Type	Details
DR-338	June 23, 1972	Flood	Tropical Storm Agnes
DR-367	March 21, 1973	Flood	High Winds, Wave Action & Flooding
EM-3004	November 2, 1974	Flood	Flooding (NYS Barge Canal)
4348	May 2, 2017 – August 6, 2017	Flood	Flooding

Source: FEMA 2022

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was included in the following USDA-designated agricultural disasters that included or may have included losses due to flood events:

- S3885 – 2015: Excessive Rain, High Winds, Hail, Lightning, and Tornado
- S4274- 2017: Flooding (USDA 2022)

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are low the following years as well. USDA records indicate that Monroe County has experienced crop losses from flood events in the years when USDA disasters were declared. Table 5.4.5-5 provides details regarding crop losses in Monroe County according to USDA records.

Table 5.4.5-5. Flood Related USDA Crop Losses from in Monroe County (2015-2022)

Year	Crop Type	Cause of Loss	Losses
2015	Wheat	Excessive Moisture/Precipitation/Rain	$383,497
2015	Corn	Excessive Moisture/Precipitation/Rain	$189,525
2015	Sweet Corn	Excessive Moisture/Precipitation/Rain	$44,445
2015	Processing Beans	Excessive Moisture/Precipitation/Rain	$17,125
2015	Dry Beans	Excessive Moisture/Precipitation/Rain	$185,704
2015	Green Beans	Excessive Moisture/Precipitation/Rain	$219,586
2015	Cabbage	Excessive Moisture/Precipitation/Rain	$193,576
2015	Soybeans	Excessive Moisture/Precipitation/Rain	$383,497
2017	Wheat	Excessive Moisture/Precipitation/Rain	$32,855
2017	Oats	Excessive Moisture/Precipitation/Rain	$400
2017	Corn	Excessive Moisture/Precipitation/Rain	$2,078,194
2017	Sweet Corn	Excessive Moisture/Precipitation/Rain	$82,456
2017	Processing Beans	Excessive Moisture/Precipitation/Rain	$69,108
2017	Dry Beans	Excessive Moisture/Precipitation/Rain	$148,863
2017	Green Peas	Excessive Moisture/Precipitation/Rain	$21,267
2017	Cabbage	Excessive Moisture/Precipitation/Rain	$291,050
2017	Soybeans	Excessive Moisture/Precipitation/Rain	$807,200

Source: USDA 2022

Previous Events

Table 5.4.5-6 identifies the known flood events that impacted Monroe County between 2015 and 2022. For events prior to 2015, refer to Appendix E (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Table 5.4.5-6. Flood Events in Monroe County, 2015 to 2022

Dates of Event	Event Type	FEMA Declaration Number	Monroe County Designated?	Location	Losses / Impacts
August 20, 2015	Flash Flood	N/A	N/A	Beechwood, Gates Center	A slow moving cold front brought heavy rain and thunderstorms to the Genesee Valley and Finger Lakes. In Monroe County, the thunderstorms produced rainfall measured at near two inches in about twenty minutes. The heavy rains overwhelmed many storm systems in the Rochester area. Numerous underpasses were flooded and some cars were inundated by water. The flood waters produced some damage at Highland Hospital in Rochester. $35,000 in property damage was reported at Beechwood. $100,000 in property damage was reported in Beechwood. $35,000 in property damage was reported in Gates Center.
April 6-8, 2017	Flood	N/A	N/A	Churchville	The month of April began on a wet note following a wet March. Several areas creeks reached flood stage. Irondequoit Creek in Monroe County peaked at 9.44 feet at 9:45 AM EST on the 7th. Flooding occurred at Ellison Park and along Blossom Road with additional flooding along Allen Creek. The Black River at Watertown crested at 10.48 feet on the 8th at 11:15 AM EST. Flood stage is 10 feet. Farmland flooding was reported in the Flats with some minor flooding to riverfront properties in Dexter. Black Creek at Churchville, in Monroe County, crested at 6.76 feet on the 8th at 8:30 AM EST. Churchville reported $20,000 in damage over the event.
May 1, 2017	Flood	N/A	N/A	Morton, Greece	A strong cold front moved across the region during the afternoon and evening hours. A line of thunderstorms just ahead of the front produced damaging winds that downed trees and wires across western New York through the Finger Lakes Region as well as areas east of Lake Ontario. A few falling trees caused minor structural damage. Wind gusts were measured to 60 mph. The line of storms also dropped heavy rainfall in a short period of time, with amounts of 0.75 to 1.5 inches common over a few hours. While not overly excessive rates, on top of very wet antecedent conditions, there were reports of road closures due to flooding mainly in flood prone areas such as low-lying land and underpasses. $8,000 in property damage was reported in Morton.
May 6-7, 2017	Flood	N/A	N/A	Brighton, Churchville	Soaking rains fell across the region. Combined with the antecedent wet conditions (the three month March through May period was the second wettest on record in Rochester) area creeks rain high and in some cases overflowed. Black Creek at Churchville crested at 6.21 feet at 6:30 AM EST on the 7th. Irondequoit Creek crested at 8.62 feet at 8:15 PM EST on the 6th. $10,000 in property damage was reported in Brighton. $15,000 in property damage was reported in Churchville.
June-November, 2017	Lakeshore Flooding	DR-4348	Yes	Town of Hamlin, Town of Parma, Town of Greece, City of Rochester, Town of Irondequoit, Town of Webster,	During the first six months of 2017, more than twice the normal amount of water accumulated on Lake Ontario while the Ottawa River saw the highest flows in more than 50 years, leading to widespread flooding across the Lake Ontario St. Lawrence River system. Inflows to Lake Ontario from Lake Monroe were above average from January through June. Lake Ontario saw two of the wettest months ever recorded in April and May of 2017. Water levels were impacted by precipitation falling directly onto the lake's surface and by runoff. Variable ice conditions in the St. Lawrence River from January through March along with high Ottawa River flows limited outflow from Lake Ontario. The lake reached a record level of 248.95 feet. Flooding began in early May and continued into early fall. Waves destroyed public and private breakwalls all along the lake shore. Thousands of homes and buildings were affected flood waters. Several homes dropped off bluffs. In some areas shoreline erosion of 50 to 100 feet deep occurred. Sanitary sewer systems in lakeside communities were affected. Beaches, marinas and state parks were closed all summer long

Dates of Event	Event Type	FEMA Declaration Number	Monroe County Designated?	Location	Losses / Impacts
				Town of Penfield.	with unknown economic losses to mainly seasonal businesses. In late May, the Governor imposed a 5 mph speed limit within 600 feet of the Lake Ontario and St. Lawrence River shore. The shoreline counties of Lake Ontario and the St. Lawrence River sustained enough damage to qualify for both a New York State and Federal Disaster Declaration. By summer's end, damage estimates included $3 Million in Monroe County.
November 6-8, 2017	Flood	N/A	N/A	Mumford, Scottsville, Churchville	After a warm front brought soaking rains to the region, a cold front brought additional rain. The heavy precipitation fell on already saturated ground resulting in both area and river flooding. Rainfall amounts of three to four inches were reported. Roads were flooded and closed in Akron, Rapids, Wolcottsville, Rochester, Athol Springs, Warsaw, Brighton, Cassadaga, and Macedon. Several area creeks and river exceeded flood stage. Black Creek at Churchville crested at 6.32 feet at 6:00 PM on the 7th (Flood Stage is 6 feet). $10,000 in property damages were reported in Scottsville. $10,000 were reported in Churchville.
August 14, 2018	Flash Flood	N/A	N/A	Railroad Mills, Bushnell Basin, Blackwatch Hills	A mid-level closed low, more typical of the cold season, passed slowly through PA and into eastern NY. Abundant moisture in the presence of this anomalous forcing produced heavy rain and flash flooding. The main corridors of heavy rain developed along fairly subtle deformation zones and subtle low level convergence zones in Oswego, Wayne, and Ontario counties, reaching eastern Monroe County by mid-morning.
May 17-31, 2019	Flood	N/A	N/A	Troutberg, Manitou Beach	Excessive runoff into the Ottawa River Basin in Canada restricted the outlet of Lake Ontario. This combined with above normal precipitation into the Lake Ontario Basin, record levels on the Great Lakes above Lake Ontario, and higher than normal flows into the lake from the Niagara River pushed the lake to well above normal levels. Over the course of May, the levels quickly approached those reached in 2017, surpassing 5 feet above low water datum on May 17. The levels continued to increase through the end of the month, rising to near 5.5 feet above low water datum by May 31. $2 million in property damage was reported in Troutberg.
June 1-30, 2019	Flood	N/A	N/A	Troutberg, Union Hill	Excessive runoff into the Ottawa River Basin in Canada restricted the outlet of Lake Ontario. This combined with above normal precipitation into the Lake Ontario Basin, record levels on the Great Lakes above Lake Ontario, and higher than normal flows into the lake from the Niagara River pushed the lake to well above normal levels. Over the course of June, new records were broken as the lake pushed to nearly 6 feet above low water datum and eclipsed the levels set in 2017. The lake peaked on June 10. $1,000 in property damage was reported in Troutberg.
June 20, 2019	Flash Flood	N/A	N/A	Mendon, Henrietta, Bushnell Basin, Rush	Though the primary west to east oriented frontal boundary with upper 60s to low 70s dewpoints streaming into it remained south across Ohio and Pennsylvania, a deepening low pressure system crossing New York State and a very moist air mass resulted in a dynamic moisture-laden system dropping heavy rain from the Southern Tier through Oswego County. The rainfall intensity was also enhanced by a mesolow that moved through simultaneously. Overall, multiple locations saw rainfall totals over 3 inches in less than 12 hours. Numerous road closures occurred during the event including both directions of the Thruway near Rochester. The flooding was so extensive that a State of Emergency was declared for the entire County on Thursday afternoon. Many flash flood and areal flood warnings were issued during this event and some of these persisted well into Friday

Dates of Event	Event Type	FEMA Declaration Number	Monroe County Designated?	Location	Losses / Impacts
					morning. $40,000 in property damages were reported in Mendon. $10,000 in property damages were reported in Henrietta.
July 1-31, 2019	Flood	N/A	N/A	Troutberg	Excessive runoff into the Ottawa River Basin in Canada restricted the outlet of Lake Ontario. This combined with above normal precipitation into the Lake Ontario Basin, record levels on the Great Lakes above Lake Ontario, and higher than normal flows into the lake from the Niagara River pushed the lake to well above normal levels. Over the course of July, water levels began to slowly recede, however after starting the month about 5.5 feet above low water datum, the lake only fell to just below 5 feet above low water datum over the entirety of the month. $500,000 in property damages were reported in Troutberg.
August 1-24, 2019	Flood	N/A	N/A	Troutberg, Forest Lawn	Excessive runoff into the Ottawa River Basin in Canada through the early half of the summer restricted the outlet of Lake Ontario. This combined with above normal precipitation into the Lake Ontario Basin, record levels on the Great Lakes above Lake Ontario, and higher than normal flows into the lake from the Niagara River pushed the lake to well above normal levels. Over the course of August, while ongoing precipitation gradually started to seasonally decrease, and outgoing flows through the Moses Saunders Dam increased, it took the majority of month before the lake finally decreased below 4 feet above low water datum and flooding along the lakeshore finally subsided. $50,000 in property damages were reported in Troutberg.
July 11, 2020	Flash Flood	N/A	N/A	Point Pleasant, Maplewood, West Webster	A sharp short wave trough embedded within a broad upper level trough over the northeastern U.S. supported a wave of convection that moved across the entire area. A precipitable water value of 1.65 inches was observed on the KBUF sounding, and models suggested over 2 inches in portions of the area. This combined with an incoming mesoscale convective vortex to drive slow-moving and heavy rain-producing thunderstorms. While shear was minimal in the environment, the MCV resulted in locally higher shear values, which enhanced wind damage across portions of the area.
July 8, 2021	Flash Flood	N/A	N/A	Point Pleasant	Showers and thunderstorms developed during the afternoon along a west-to-east oriented frontal boundary along the south shore of Lake Ontario. Thunderstorms developed first over the Niagara Peninsula, which then tracked into the Buffalo area. Another line of storms formed from Oswego to Onondaga counties. This line of storms expanded in coverage and severity while a north-south line of storms approached from Lake Ontario. These two lines merged over northern Oswego and southwest Jefferson counties, as velocity values increased near Sackets Harbor, where several trees were reported down. In Point Pleasant, Flooding was reported on Route 104 and 590. Deep water was reported on Titus Ave and Ridge Drive. Several water rescues were performed. $50,000 in property damages were reported.
August 7, 2021	Flash Flood	N/A	N/A	Scottsville	An upper level trough axis moved into western New York during the evening hours. This feature moved into a modestly unstable environment fairly unimpressive precipitable water values of only just slightly over one inch. Further, low level moisture transport was unimpressive. A cluster of storms congealed around northern Livingston and southern Monroe counties. Weak flow and some back-building allowed for torrential rain over the area. A few spots had three inches per hour rainfall rates that lasted up to 55 minutes. This resulted in roads closed with water flowing over them in Monroe County.

Dates of Event	Event Type	FEMA Declaration Number	Monroe County Designated?	Location	Losses / Impacts
October 26, 2021	Flood	N/A	N/A	Brighton Po, Northeast Henrietta	An upper level closed low meandered through the Great Lakes while slowly phasing with an Atlantic Nor'easter. Convergence along an inverted trough coincided with a strong push of Atlantic moisture to force periods of heavy rainfall south of Lake Ontario from Rochester eastward through the latter half of the day.
October 29-31, 2021	Flood	N/A	N/A	East Rochester, Brighton, Rigney Bluff	A broad occluded low advanced northeastward from the Ohio Valley. Easterly moisture feed off the Atlantic ahead of this system brought precipitable water values above 1 inch. A vast area of moderate and occasionally heavy rainfall resulted in areas of flooding.
December 11, 2021	Seiche	N/A	N/A	Monroe County	A strong cold front crossed the region. Selected peak wind gusts included 60 mph at Rochester Airport. Strong surface high pressure over the southern Plains amplified the pressure gradient such that a lake seiche did occur on Lake Monroe with a smaller one evident on Lake Ontario, as well.

Source: NOAA-NCEI 2022; FEMA 2022; USACE 2022

Climate Change Impacts

Climate change is affecting both people and resources in New York State, and these impacts are projected to continue growing. *ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID)* was undertaken to provide decision-makers with information on the State's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Monroe County is part of Region 1, Western New York and Great Lakes Plain. Attributes that will be affected by climate change include agricultural revenue, relatively low rainfall that may increase summer drought risk, high-value crops that may need irrigation, and projected improved conditions for grapes (NYSERDA 2011).

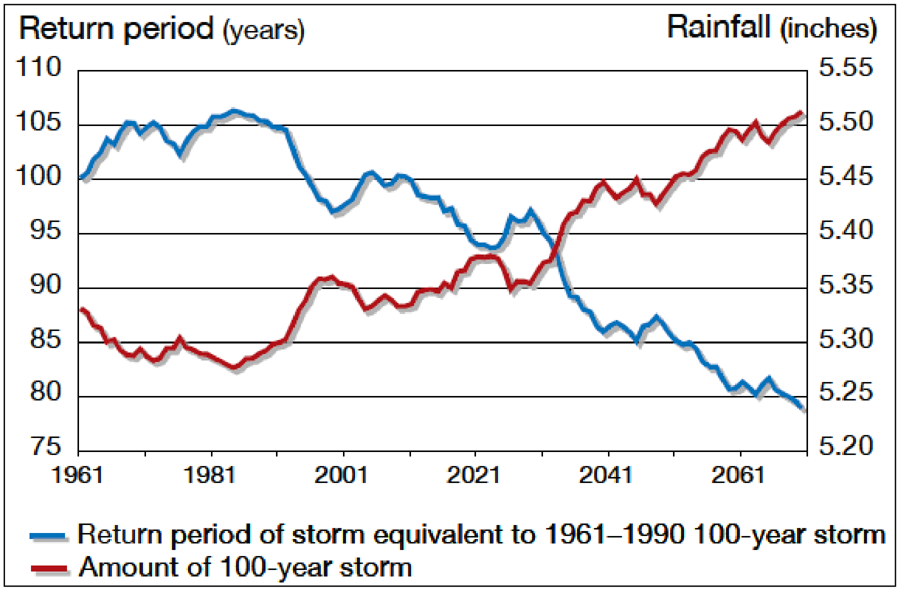
In Region 1, it is estimated that temperatures will increase by 3.7 ºF to 7.3 ºF by the 2050s and 4.2 ºF to 12.0 ºF by the 2080s (baseline of 47.7 ºF). Precipitation totals will increase between 2 to 12 percent by the 2050s and 1 to 17 percent by the 2080s (baseline of 34.0 inches) (NYSERDA 2014).

The projected increase in precipitation is expected to occur in heavy downpours and less in light rains. Downpours are very likely to increase in frequency and intensity (NYSERDA 2014). Heavy rainfall can result in flooding events.

Overall regional precipitation is the primary driver of average Great Lakes water levels. Increases in annual precipitation will impact the elevation of lakes. Projected increases in precipitation totals are likely to increase the elevation of Lake Ontario. Temperatures are predicted to increase in Monroe County, which may lead to an increase in intensity and frequency of severe storm events. This increase may lead to more weather patterns that cause flooding events.

Increasing air temperatures intensify the water cycle by increasing evaporation and precipitation. This can cause an increase in rain totals during events with longer dry periods in between those events. These changes can have a variety of effects on the State's water resources (NYSERDA 2011). Figure 5.4.5-7 displays the project rainfall and frequency of extreme storms in New York State. The amount of rain fall in a 100-year event is projected to increase, while the number of years between such storms (return period) is projected to decrease. Rainstorms will become more severe and more frequent (NYSERDA 2011).

Figure 5.4.5-7. Projected Rainfall and Frequency of Extreme Storms



Source: NYSERDA 2011

Assumptions about a river's flow behavior, expressed as hydrographs are influences for dam design. Changes in weather patterns can significantly affect the hydrograph used for the design of a dam. If the hygrograph changes, the dam conceivably could lose some or all of its designed margin of safety, also known as freeboard. Loss of designed margin of safety increases possibility that floodwaters would overtop the dam or create unintended loads, which could lead to a dam failure.

Probability of Future Occurrences

Based on the historic and more recent flood events in Monroe County, and the future climate projections for this region, the County has a moderate probability of future flooding. It is anticipated that Monroe County will continue to experience direct and indirect impacts of flooding events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents, and inconveniences. Additionally, climate change is expected to increase the severity and frequency of heavy rain events in Monroe County. This is likely to lead to an increase in flooding events. According to available record keeping, Monroe County has a 100% annual chance of occurrence of flood events in any given year.

Table 5.4.5-7. Probability of Future Occurrence of Flooding Events

Hazard Type	Number of Occurrences Between 1996 and 2022	% chance of occurrence in any given year
Coastal/Lakeshore Flood	8	30.77%
Dam Failure	0	0%
Flash Flood	31	100%
Flood	30	100%
Ice Jam	0	0%
Seiche	1	3.85%
TOTAL	**70**	**100%**

Source: NOAA-NCEI 2022; USACE 2022; NPDP 2022; FEMA 2022

Note: Disaster occurrences include federally declared disasters and selected flood events between January 1, 1996 and January 1, 2022. Due to limitations in data, not all flood events occurring between 1996 and June 2022 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Section 5.3 ranks the identified hazards of concern for Monroe County. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee, the probability of occurrence for flood in the County is considered 'frequent' (100 percent annual probability; a hazard event may occur multiple times per year. as noted in Table 5.3-2).

5.4.5.2 Vulnerability Assessment

To assess Monroe County's risk to the flood hazard, a spatial analysis was conducted using the FEMA Risk Map effective dated 2008. Preliminary products dated September 30, 2022 were received from FEMA at the completion of the risk assessment. Information from the Preliminary Flood Insurance Study was used to update the flood profile but the analysis used for the vulnerability assessment is based on the effective FIRM. The 1 and 0.2-percent annual chance flood events were examined to determine the assets located in the hazard areas and to estimate potential loss using the FEMA Hazus riverine flood model. These results are summarized below.

Impact on Life, Health and Safety

The impact of flooding on life, health, and safety is dependent upon several factors, including the severity of the event and whether or not adequate warning time is provided to residents. Exposure represents the population living in or near floodplain areas that could be impacted should a flood event occur. Additionally, exposure should not be limited to only those who reside in a defined hazard zone, but everyone who may be affected by the effects of a hazard event (e.g., people are at risk while traveling in flooded areas, or their access to emergency services is compromised during an event). The degree of that impact will vary and is not strictly measurable.

To estimate population exposure to the 1-percent and 0.2-percent annual chance flood events, the DFIRM flood boundaries were used. Based on the spatial analysis, there are an estimated 6,364 residents living in the 1-percent annual chance floodplain or 0.8 percent of the County's total population. There are an estimated 9,104 residents living in the 0.2-percent annual chance floodplain, or 1.2 percent of the County's total population. The Town of Gates has the greatest number of residents living in the floodplain, with approximately 2,059 residents living in the Special Flood Hazard Area (SFHA) and 2,261 people living in the 0.2-percent annual chance floodplain. Table 5.4.5-8. Estimated Population Exposed to the 1-percent and **0.2-percent Annual Chance Flood Event Hazard Area**

summarizes the population exposed to the flood hazard by jurisdiction.

Table 5.4.5-8. Estimated Population Exposed to the 1-percent and 0.2-percent Annual Chance Flood Event Hazard Area

Jurisdiction	Total Population (2020 Decennial Census)	Estimated Population Located in the Flood Hazard Areas			
		Number of Persons Located in the 1-percent Annual Chance Flood Event Hazard Area	Percent of Total	Number of Persons Located in the 0.2-percent Annual Chance Flood Event Hazard Area	Percent of Total
Brighton (T)	37,137	199	0.5%	546	1.5%
Brockport (V)	7,104	0	0.0%	0	0.0%
Chili (T)	29,123	721	2.5%	1,050	3.6%
Churchville (V)	2,091	7	0.4%	27	1.3%
Clarkson (T)	6,904	18	0.3%	21	0.3%
East Rochester (T/V)	6,334	0	0.0%	0	0.0%
Fairport (V)	5,501	33	0.6%	33	0.6%
Gates (T)	29,167	2,059	7.1%	2,261	7.8%
Greece (T)	96,926	351	0.4%	528	0.5%
Hamlin (T)	8,725	427	4.9%	427	4.9%

Jurisdiction	Total Population (2020 Decennial Census)	Estimated Population Located in the Flood Hazard Areas			
		Number of Persons Located in the 1-percent Annual Chance Flood Event Hazard Area	Percent of Total	Number of Persons Located in the 0.2-percent Annual Chance Flood Event Hazard Area	Percent of Total
Henrietta (T)	47,096	722	1.5%	1,265	2.7%
Hilton (V)	6,027	32	0.5%	63	1.0%
Honeoye Falls (V)	2,706	12	0.5%	84	3.1%
Irondequoit (T)	51,043	366	0.7%	621	1.2%
Mendon (T)	6,389	58	0.9%	93	1.5%
Ogden (T)	16,585	53	0.3%	133	0.8%
Parma (T)	10,190	460	4.5%	501	4.9%
Penfield (T)	39,438	167	0.4%	234	0.6%
Perinton (T)	39,128	91	0.2%	115	0.3%
Pittsford (T)	25,714	101	0.4%	202	0.8%
Pittsford (V)	1,419	0	0.0%	0	0.0%
Riga (T)	3,495	41	1.2%	77	2.2%
Rochester (C)	211,328	78	0.0%	177	0.1%
Rush (T)	3,490	12	0.4%	65	1.9%
Scottsville (V)	2,009	39	1.9%	160	8.0%
Spencerport (V)	3,685	18	0.5%	23	0.6%
Sweden (T)	6,140	12	0.2%	12	0.2%
Webster (T)	39,676	244	0.6%	296	0.7%
Webster (V)	5,651	0	0.0%	8	0.1%
Wheatland (T)	2,888	43	1.5%	80	2.8%
Monroe County (Total)	**753,109**	**6,364**	**0.8%**	**9,104**	**1.2%**

Source: FEMA 2008; US Census 2020
Notes: % = Percent; C = City; T = Town; V = Village

Research has shown that some populations, while they may not have more hazard exposure, may experience exacerbated impacts and prolonged recovery if/when impacted. This is due to many factors, including their physical and financial ability to react or respond during a hazard. Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Economically disadvantaged populations may be more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a flood event, and they may have more difficulty evacuating. Within Monroe County, there are approximately 127,588 people over the age of 65 (16.9 percent of the County population) and 100,484 people below the poverty level (13.3 percent of the County population (American Community Survey 2020).

The Centers for Disease Control and Prevention (CDC) 2016 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Monroe County's overall score is 0.5204, indicating that its communities have a moderate to high level of social vulnerability (CDC 2018). This score indicates that some County residents may not have enough resources to respond to flood events.

Using 2020 U.S. Census data, Hazus estimates the potential sheltering needs as a result of a 1-percent annual chance flood event. For the 1-percent flood event, Hazus estimates 15,752 individuals will be displaced, and 3,775 people will seek short-term sheltering. These statistics, by jurisdiction and by flood zone, are presented in Table 5.4.5-9.

Table 5.4.5-9. Estimated Population Displaced or Seeking Short-Term Shelter from the 1-percent Annual Chance Flood Event Hazard Area

Jurisdiction	Total Population (2020 Decennial Census)	1-Percent Annual Chance Flood Event	
		Displaced Population*	Persons Seeking Short-Term Sheltering
Brighton (T)	37,137	617	209
Brockport (V)	7,104	38	20
Chili (T)	29,123	1,354	153
Churchville (V)	2,091	41	14
Clarkson (T)	6,904	164	94
East Rochester (T/V)	6,334	40	3
Fairport (V)	5,501	136	23
Gates (T)	29,167	2,761	450
Greece (T)	96,926	1,384	478
Hamlin (T)	8,725	346	79
Henrietta (T)	47,096	3,170	455
Hilton (V)	6,027	251	53
Honeoye Falls (V)	2,706	151	37
Irondequoit (T)	51,043	351	99
Mendon (T)	6,389	244	71
Ogden (T)	16,585	410	138
Parma (T)	10,190	599	131
Penfield (T)	39,438	796	214
Perinton (T)	39,128	340	124
Pittsford (T)	25,714	823	263
Pittsford (V)	1,419	4	1
Riga (T)	3,495	141	26
Rochester (C)	211,328	308	131
Rush (T)	3,490	138	38
Scottsville (V)	2,009	85	16
Spencerport (V)	3,685	79	34
Sweden (T)	6,140	31	19
Webster (T)	39,676	812	373
Webster (V)	5,651	8	8
Wheatland (T)	2,888	130	21
Monroe County (Total)	**753,109**	**15,752**	**3,775**

Source: Hazus v5.1; Census 2020; FEMA 2008
Notes: C = City; T = Town; V = Village
**The number of displaced persons may overestimate the impacted population located in the 1-percent annual chance flood hazard area due to the limitations of the Hazus model using Census 2010 census block data*

The total number of injuries and casualties resulting from flooding is generally limited based on advance weather forecasting, blockades, and warnings. More likely, persons could become displaced from their homes or may seek shelter due to the impacts of a flood event. 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.

Dam failure can cause, in the most extreme case, loss of life and extensive property damage, or in the least extreme case, no loss of life or significant property damage. Dam failure can cause persons to become displaced if flooding of structures occurs. Dam failure may mimic flood events, depending on the size of the dam reservoir and breach. Dam failure inundation modeling estimates the potential impacts of a failure; however, this data is considered sensitive information and is not displayed or discussed further in the HMP.

Cascading impacts of flooding and dam failure inundation may also include exposure to pathogens such as mold. After flood events, excess moisture and standing water contribute to the growth of mold in buildings. Mold may present a health risk to building occupants, especially those with already compromised immune systems such as infants, children, the elderly, and pregnant women. The degree of impact will vary and is not strictly measurable. Mold spores can grow in as short a period as 24–48 hours in wet and damaged areas of buildings that have not been properly cleaned. Very small mold spores can easily be inhaled, creating the potential for allergic reactions, asthma episodes, and other respiratory problems. Buildings should be properly cleaned and dried out to safely prevent mold growth (CDC 2019).

Molds and mildews are not the only public health risk associated with flooding. Floodwaters can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. Common public health risks associated with flood events also include:

- Unsafe food
- Contaminated drinking and washing water and poor sanitation
- Mosquitos and animals
- Carbon monoxide poisoning
- Secondary hazards associated with re-entering/cleaning flooded structures
- Mental stress and fatigue

Current loss estimation models such as Hazus are not equipped to measure public health impacts. The best level of mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with these vulnerabilities in responding to flood events.

Impact on General Building Stock

Exposure to the flood hazard includes those buildings located in the flood zone or those that are built downstream in other flood inundation areas such as dam failure inundation areas. The potential damage is the modeled loss that could occur to the exposed inventory measured by the structural and content replacement cost value. There are an estimated 3,434 and 4,741 buildings located in the 1-percent and 0.2-percent annual chance flood event hazard area, respectively. This represents approximately 1.7 percent and 2.4 percent of the County's total general building stock inventory replacement cost value, respectively (approximately $315 billion). The Town of Amherst has the greatest number of its buildings located in the 1-percent annual chance floodplain (859 buildings or 7.3 percent of its total building stock). The Town of Gates also has the greatest number of its buildings located in the 0.2-percent annual chance floodplain (948 buildings or 8.0 percent of its total building stock). Refer to Table 5.4.5-10 and Table 5.4.5-11 for the estimated exposure of 1-percent and 0.2-percent flood events by jurisdiction. Refer to Table 5.4.5-12 for the Hazus estimated losses by jurisdiction, for residential, commercial, and other occupancy structures, respectively.

Table 5.4.5-10. Estimated General Building Stock Exposure to the 1-percent Annual Chance Flood Event

Jurisdiction	No. of Bldgs.	Total RCV	Estimated Building Stock Exposed to 1-percent Annual Chance Flood Total (All Flood Zones)			
			No. of Bldgs.	% of Bldgs.	RCV	% of RCV
Brighton (T)	11,693	$14,443,886,002	103	0.9%	$213,586,534	1.5%
Brockport (V)	2,224	$5,158,789,593	1	0.0%	$39,636	0.0%
Chili (T)	11,534	$9,206,843,885	393	3.4%	$482,297,684	5.2%
Churchville (V)	1,112	$938,164,078	8	0.7%	$24,672,941	2.6%
Clarkson (T)	3,411	$1,887,392,030	19	0.6%	$5,637,155	0.3%
East Rochester (T/V)	2,924	$3,440,171,127	10	0.3%	$12,439,986	0.4%
Fairport (V)	2,394	$2,281,456,075	24	1.0%	$111,099,188	4.9%
Gates (T)	11,801	$12,220,599,285	859	7.3%	$958,205,170	7.8%
Greece (T)	36,414	$26,954,378,684	177	0.5%	$201,638,152	0.7%
Hamlin (T)	5,539	$2,318,778,027	263	4.7%	$92,814,703	4.0%
Henrietta (T)	15,982	$23,460,566,322	298	1.9%	$752,071,581	3.2%
Hilton (V)	2,143	$2,120,287,988	26	1.2%	$29,214,194	1.4%
Honeoye Falls (V)	1,155	$1,813,180,690	10	0.9%	$62,440,877	3.4%
Irondequoit (T)	21,885	$13,427,006,840	167	0.8%	$200,796,580	1.5%
Mendon (T)	3,835	$2,852,155,915	66	1.7%	$26,404,916	0.9%
Ogden (T)	7,407	$5,558,087,440	37	0.5%	$16,130,704	0.3%
Parma (T)	5,509	$3,373,412,574	273	5.0%	$116,899,100	3.5%
Penfield (T)	15,882	$11,119,233,991	114	0.7%	$533,803,786	4.8%
Perinton (T)	16,817	$13,125,415,407	61	0.4%	$129,204,988	1.0%
Pittsford (T)	10,590	$10,686,774,000	67	0.6%	$79,733,209	0.7%
Pittsford (V)	804	$1,776,834,511	0	0.0%	$0	0.0%
Riga (T)	2,356	$1,539,492,845	43	1.8%	$14,096,853	0.9%
Rochester (C)	89,392	$119,943,371,056	92	0.1%	$630,278,220	0.5%
Rush (T)	2,808	$1,816,445,354	32	1.1%	$26,123,114	1.4%
Scottsville (V)	1,069	$908,716,753	27	2.5%	$52,390,410	5.8%
Spencerport (V)	1,654	$1,580,844,696	16	1.0%	$109,432,916	6.9%
Sweden (T)	3,465	$3,402,258,236	12	0.3%	$33,922,259	1.0%
Webster (T)	16,660	$11,510,191,170	186	1.1%	$298,781,447	2.6%
Webster (V)	1,633	$3,634,066,282	0	0.0%	$0	0.0%
Wheatland (T)	1,926	$2,509,077,040	50	2.6%	$149,490,023	6.0%
Monroe County (Total)	**312,018**	**$315,007,877,896**	**3,434**	**1.1%**	**$5,363,646,328**	**1.7%**

Source: FEMA 2008; Monroe County GIS - 2022
Notes C = City; T = Town; V = Village
No. = Number Bldgs. = Buildings RCV = Replacement Cost Value % = Percent

Table 5.4.5-11. Estimated General Building Stock Exposure to the 0.2-percent Annual Chance Flood Event

Jurisdiction	No. of Bldgs.	Total RCV	Estimated Building Stock Exposed to 0.2-percent Annual Chance Flood Total (All Flood Zones)			
			No. of Bldgs.	% of Bldgs.	RCV	% of RCV
Brighton (T)	11,693	$14,443,886,002	239	2.0%	$442,678,446	3.1%
Brockport (V)	2,224	$5,158,789,593	1	0.0%	$39,636	0.0%

Jurisdiction	No. of Bldgs.	Total RCV	Estimated Building Stock Exposed to 0.2-percent Annual Chance Flood Total (All Flood Zones)			
			No. of Bldgs.	% of Bldgs.	RCV	% of RCV
Chili (T)	11,534	$9,206,843,885	550	4.8%	$630,401,906	6.8%
Churchville (V)	1,112	$938,164,078	30	2.7%	$45,548,971	4.9%
Clarkson (T)	3,411	$1,887,392,030	20	0.6%	$6,117,188	0.3%
East Rochester (T/V)	2,924	$3,440,171,127	10	0.3%	$12,439,986	0.4%
Fairport (V)	2,394	$2,281,456,075	25	1.0%	$116,287,556	5.1%
Gates (T)	11,801	$12,220,599,285	948	8.0%	$1,087,132,130	8.9%
Greece (T)	36,414	$26,954,378,684	263	0.7%	$237,007,370	0.9%
Hamlin (T)	5,539	$2,318,778,027	263	4.7%	$92,814,703	4.0%
Henrietta (T)	15,982	$23,460,566,322	528	3.3%	$1,504,472,788	6.4%
Hilton (V)	2,143	$2,120,287,988	39	1.8%	$62,058,166	2.9%
Honeoye Falls (V)	1,155	$1,813,180,690	40	3.5%	$73,122,162	4.0%
Irondequoit (T)	21,885	$13,427,006,840	266	1.2%	$231,863,436	1.7%
Mendon (T)	3,835	$2,852,155,915	101	2.6%	$54,743,506	1.9%
Ogden (T)	7,407	$5,558,087,440	71	1.0%	$34,660,734	0.6%
Parma (T)	5,509	$3,373,412,574	293	5.3%	$155,829,272	4.6%
Penfield (T)	15,882	$11,119,233,991	147	0.9%	$578,866,676	5.2%
Perinton (T)	16,817	$13,125,415,407	72	0.4%	$134,944,860	1.0%
Pittsford (T)	10,590	$10,686,774,000	106	1.0%	$98,807,281	0.9%
Pittsford (V)	804	$1,776,834,511	0	0.0%	$0	0.0%
Riga (T)	2,356	$1,539,492,845	67	2.8%	$22,112,002	1.4%
Rochester (C)	89,392	$119,943,371,056	146	0.2%	$1,073,233,890	0.9%
Rush (T)	2,808	$1,816,445,354	77	2.7%	$117,508,300	6.5%
Scottsville (V)	1,069	$908,716,753	99	9.3%	$109,706,429	12.1%
Spencerport (V)	1,654	$1,580,844,696	24	1.5%	$151,780,270	9.6%
Sweden (T)	3,465	$3,402,258,236	12	0.3%	$33,922,259	1.0%
Webster (T)	16,660	$11,510,191,170	231	1.4%	$362,010,249	3.1%
Webster (V)	1,633	$3,634,066,282	4	0.2%	$3,498,418	0.1%
Wheatland (T)	1,926	$2,509,077,040	69	3.6%	$162,556,051	6.5%
Monroe County (Total)	**312,018**	**$315,007,877,896**	**4,741**	**1.5%**	**$7,636,164,640**	**2.4%**

Source: FEMA 2008; Monroe County GIS - 2022

Notes: C = City; T = Town; V = Village; No. = Number; Bldgs. = Buildings; RCV = Replacement Cost Value; % = Percent

Table 5.4.5-12. Estimated Building Stock Potential Loss by Occupancy to the 1-percent Annual Chance Flood Event

Jurisdiction	Total Replacement Cost Value (RCV)	All Occupancies		Residential		Commercial		Agricultural, Industrial, Religious, Education and Government	
		Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value
Brighton (T)	$14,443,886,002	$46,986,950	0.3%	$3,156,992	<0.1%	$43,829,959	0.3%	$0	0
Brockport (V)	$5,158,789,593	$16,321	<0.1%	$16,321	<0.1%	$0	0.0%	$0	0.0%
Chili (T)	$9,206,843,885	$89,948,027	1.0%	$14,294,304	0.2%	$71,643,615	0.8%	$4,010,108	0.0%
Churchville (V)	$938,164,078	$12,837,066	1.4%	$245,553	<0.1%	$12,591,513	1.3%	$0	0.0%
Clarkson (T)	$1,887,392,030	$1,320,813	0.1%	$494,101	<0.1%	$826,712	<0.1%	$0	0.0%
East Rochester (T/V)	$3,440,171,127	$7,048,982	0.2%	$0	0.0%	$7,048,982	0.2%	$0	0.0%
Fairport (V)	$2,281,456,075	$26,312,562	1.2%	$597,695	<0.1%	$16,298,446	0.7%	$9,416,420	0.4%
Gates (T)	$12,220,599,285	$161,774,175	1.3%	$64,828,565	0.5%	$24,908,268	0.2%	$72,037,342	0.6%
Greece (T)	$26,954,378,684	$44,027,928	0.2%	$3,763,943	<0.1%	$29,924,197	0.1%	$10,339,787	0.0%
Hamlin (T)	$2,318,778,027	$9,885,201	0.4%	$6,076,084	0.3%	$3,809,117	0.2%	$0	0.0%
Henrietta (T)	$23,460,566,322	$102,716,207	0.4%	$19,502,735	0.1%	$75,471,577	0.3%	$7,741,895	0.0%
Hilton (V)	$2,120,287,988	$13,740,978	0.6%	$5,473,538	0.3%	$3,699,699	0.2%	$4,567,741	0.2%
Honeoye Falls (V)	$1,813,180,690	$5,595,603	0.3%	$788,497	<0.1%	$4,807,106	0.3%	$0	0.0%
Irondequoit (T)	$13,427,006,840	$24,526,845	0.2%	$9,376,740	0.1%	$15,150,105	0.1%	$0	0.0%
Mendon (T)	$2,852,155,915	$4,254,529	0.1%	$1,364,496	<0.1%	$2,797,623	0.1%	$92,411	0.0%
Ogden (T)	$5,558,087,440	$7,749,493	0.1%	$1,283,128	<0.1%	$6,466,365	0.1%	$0	0.0%
Parma (T)	$3,373,412,574	$15,599,682	0.5%	$4,334,718	0.1%	$11,235,526	0.3%	$29,438	0.0%
Penfield (T)	$11,119,233,991	$180,269,903	1.6%	$3,635,455	<0.1%	$77,381,175	0.7%	$99,253,273	0.9%
Perinton (T)	$13,125,415,407	$31,658,359	0.2%	$1,158,016	<0.1%	$30,212,859	0.2%	$287,485	0.0%
Pittsford (T)	$10,686,774,000	$31,917,544	0.3%	$4,384,133	<0.1%	$27,027,912	0.3%	$505,498	0.0%
Pittsford (V)	$1,776,834,511	$0	0.0%	$0	0.0%	$0	0.0%	$0	0.0%
Riga (T)	$1,539,492,845	$4,657,675	0.3%	$1,800,825	0.1%	$2,856,851	0.2%	$0	0.0%
Rochester (C)	$119,943,371,056	$99,048,238	0.1%	$4,470,305	<0.1%	$94,554,734	0.1%	$23,199	0.0%
Rush (T)	$1,816,445,354	$6,468,363	0.4%	$1,911	<0.1%	$1,558,162	0.1%	$4,908,291	0.3%
Scottsville (V)	$908,716,753	$27,743,284	3.1%	$797,907	0.1%	$23,096,795	2.5%	$3,848,583	0.4%
Spencerport (V)	$1,580,844,696	$714,602	0.0%	$535,322	<0.1%	$179,280	<0.1%	$0	0.0%
Sweden (T)	$3,402,258,236	$12,072,993	0.4%	$13,171	<0.1%	$12,059,821	0.4%	$0	0.0%
Webster (T)	$11,510,191,170	$78,992,844	0.7%	$5,052,492	<0.1%	$71,274,252	0.6%	$2,666,101	0.0%

Jurisdiction	Total Replacement Cost Value (RCV)	All Occupancies		Residential		Commercial		Agricultural, Industrial, Religious, Education and Government	
		Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value
Webster (V)	$3,634,066,282	$0	0.0%	$0	0.0%	$0	0.0%	$0	0.0%
Wheatland (T)	$2,509,077,040	$33,260,790	1.3%	$774,805	<0.1%	$1,849,023	0.1%	$30,636,962	1.2%
Monroe County (Total)	**$315,007,877,896**	**$1,081,145,959**	**0.3%**	**$158,221,751**	**0.1%**	**$672,559,674**	**0.2%**	**$250,364,535**	**0.1%**

Source: *Hazus v5.1; Monroe County GIS 2022; FEMA 2008*
Notes: *C = City; T = Town; V = Village*

NFIP Statistics

In addition to total building stock modeling, individual data available on flood policies, claims, repetitive loss (RL) properties, and severe RL (SRL) properties were analyzed. FEMA Region 2 provided a list of residential properties with NFIP policies, past claims, and multiple claims (RLs). According to the metadata provided, "The (*sic* National Flood Insurance Program) NFIP Repetitive Loss File contains losses reported from individuals who have flood insurance through the Federal Government. A property is considered a repetitive loss property when there are two or more losses reported that were paid more than $1,000 for each loss. The two losses must be within 10 years of each other & be as least 10 days apart. Only losses from (*sic* since) January 1, 1978 that are closed are considered."

SRLs were then examined for Monroe County. According to Section 1361A of the National Flood Insurance Act, as amended (NFIA), 42 *United States Code* (U.S.C.) 4102a, an SRL property is defined as a residential property covered under an NFIP flood insurance policy, and satisfying either of conditions 1 and 2, as well as condition 3:

1. At least four NFIP claim payments for the property (including building and contents) over $5,000 each have occurred, and the cumulative amount of such claims payments exceeded $20,000.
2. At least two separate claims payments for the property (building payments only) have occurred, and the cumulative amount of the building portion of such claims exceeded the market value of the building.
3. For either of the above, at least two of the referenced claims must have occurred within any 10-year period, and must have occurred more than 10 days apart.

Table 5.4.5-13 through Table 5.4.5-15 summarizes NFIP policies, claims, and repetitive loss statistics for Monroe County as of December 2022. According to FEMA, Table 5.4.5-13 summarizes occupancy classes of RL properties in Monroe County. The majority of properties within the RL occupancy class are single-family residences (74.4 percent). Severe repetitive loss data was not available. This information is current as of December 2022.

Table 5.4.5-13. Occupancy Class of Repetitive Loss Structures in Monroe County

Occupancy Class	Total Number of Repetitive Loss Properties
Single Family	32
Condo	0
2-4 Family	1
Other Residential	7
Business-Non-Residential	2
Other Non-Residential	1
Monroe County	**43**

Source: FEMA Region 2 2022
Notes: Repetitive loss statistics provided by FEMA Region 2, and current as of December 2022.

Table 5.4.5-14. Occupancy Class of Repetitive Loss Structures in Monroe County by Municipality

Municipality	Repetitive Loss Properties					
	2-4 Family	Assumed Condo	Business-Non Residential	Other-Non Residential	Other Residential	Single Family
Brighton (T)	0	0	0	0	0	1
Brockport (V)	0	0	0	0	0	0

Municipality	Repetitive Loss Properties					
	2-4 Family	Assumed Condo	Business-Non Residential	Other-Non Residential	Other Residential	Single Family
Chili (T)	0	0	0	0	0	1
Churchville (V)	0	0	0	0	0	0
Clarkson (T)	0	0	0	0	0	0
East Rochester (V/T)	0	0	0	0	0	0
Fairport (V)	0	0	0	0	0	0
Gates (T)	0	0	0	0	0	1
Greece (T)	0	0	0	0	0	8
Hamlin (T)	0	0	0	0	0	5
Henrietta (T)	0	0	0	0	1	0
Hilton (V)	0	0	0	0	0	0
Honeoye Falls (V)	0	0	0	0	0	0
Irondequoit (T)	0	0	1	0	0	3
Mendon (T)	0	0	0	0	0	1
Ogden (T)	1	0	0	0	0	0
Parma (T)	0	0	0	0	1	1
Penfield (T)	0	0	0	0	5	0
Perinton (T)	0	0	0	0	0	4
Pittsford (T)	0	0	0	0	0	3
Pittsford (V)	0	0	0	0	0	0
Riga (T)	0	0	0	0	0	0
Rochester (C)	0	0	1	0	0	1
Rush (T)	0	0	0	0	0	0
Scottsville (V)	0	0	0	0	0	0
Spencerport (V)	0	0	0	1	0	0
Sweden (T)	0	0	0	0	0	0
Webster (T)	0	0	0	0	0	1
Webster (V)	0	0	0	0	0	0
Wheatland (T)	0	0	0	0	0	2
Monroe County (Total)	**1**	**0**	**2**	**1**	**7**	**32**

Source: FEMA Region 2 2022
Notes:
Policies, claims, repetitive loss and severe repetitive loss statistics provided by FEMA Region 2, and current as of December 2022.
Statistics summarized using the Community Name provided by FEMA Region 2. Severe repetitive loss properties data was unavailable.
C City
T Town
V Village

Table 5.4.5-15. NFIP Statistics in Monroe County

Municipality	# Policies (1)	# Claims (Losses) (1)	Total Loss Payments (1)	# Rep. Loss Prop. (2)	# Policies in the 1% Flood Boundary (1)
Brighton (T)	110	13	$50,901	1	35
Brockport (V)	3	1	$1,238	0	0
Chili (T)	181	24	$111,637	1	136
Churchville (V)	8	0	$0	0	4
Clarkson (T)	6	6	$9,711	0	3
East Rochester (V/T)	0	0	$0	0	0
Fairport (V)	7	1	$500	0	5
Gates (T)	336	18	$53,777	1	290
Greece (T)	192	63	$384,960	8	62
Hamlin (T)	81	23	$100,161	5	53
Henrietta (T)	180	26	$126,713	1	89
Hilton (V)	20	11	$435,822	0	10
Honeoye Falls (V)	18	2	$17,355	0	4
Irondequoit (T)	72	11	$28,451	4	35
Mendon (T)	23	3	$20,426	1	13
Ogden (T)	26	5	$152,841	1	11
Parma (T)	100	9	$46,158	2	77
Penfield (T)	62	21	$444,541	5	26
Perinton (T)	59	20	$229,926	4	24
Pittsford (T)	82	15	$116,032	3	26
Pittsford (V)	4	0	$0	0	2
Riga (T)	8	1	$1,476	0	6
Rochester (C)	90	17	$88,889	2	35
Rush (T)	10	3	$1,850	0	4
Scottsville (V)	18	2	$12,920	0	14
Spencerport (V)	13	10	$161,550	1	4
Sweden (T)	6	1	$1,515	0	3
Webster (T)	71	26	$95,931	1	43
Webster (V)	8	2	$101,403	0	0
Wheatland (T)	21	22	$599,758	2	4
Monroe County (Total)	**1,815**	**356**	**$3,396,444**	**43**	**1,108**

Source: FEMA Region 2 2022, 2015
Note (1): Policies, claims, provided by FEMA Region 2, and are current as of June 30, 2015.
Note (2): Repetitive loss count provided by FEMA Region 2, and current as of December 2022.
Note (3): Number of policies inside and outside of flood zones is based on latitude and longitude provided by FEMA Region 2 in the policy file as of June 30, 2015.
FEMA noted that for a property with more than one entry, more than one policy may have been in force or more than one Geographic Information System (GIS) specification was possible. Number of policies and claims, and claims total, exclude properties outside Monroe County boundary, based on provided latitude and longitude coordinates.
C City
T Town
V Village

Impact on Critical Facilities

It is important to determine the critical facilities and infrastructure within the County that may be at risk to flooding and who may be impacted should damage occur. Critical services during and after a flood event may not be available if critical facilities are directly damaged or transportation routes to access these critical facilities are impacted. 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. Utilities such as overhead power, cable, and phone lines could also be vulnerable due to utility poles damaged by standing water or the surge of water from a dam failure event. Loss of these utilities could create additional isolation issues for the inundation zones.

Major roadways that may be impacted by the 1-percent annual chance flood event include Interstates I-490, I-390, and I-590, and various state and County roads. There are several issues associated with transportation routes flooding, including isolation caused by bridges being washed out or blocked by floods or debris, health problems caused by water and sewer systems that are flooded or backed up, drinking water contamination caused by floodwaters carrying pollutants in water supplies, and localized urban flooding caused by culverts blocked with debris.

Critical facility exposure to the 1-percent and 0.2-percent annual chance flood hazard event boundary was examined. In addition, Hazus was used to estimate the flood loss potential to critical facilities located in the FEMA mapped floodplains. Table 5.4.5-16. and Table 5.4.5-17 summarize the number of critical facilities exposed to the 1-percent and 0.2-percent flood inundation areas by jurisdiction. Of the 59 critical facilities located in the 1-percent annual chance flood event boundary, all 59 are considered lifelines for the County. Out of the 71 critical facilities located in the 0.2-percent annual chance flood event boundary, 70 are considered lifelines for the County. Table 5.4.5-18. shows the number of lifeline facilities by category in the 1-percent and 0.2-percent annual chance flood event boundary. Refer to Section 4 (County Profile) for more information about the critical facilities and lifelines in Monroe County.

Table 5.4.5-16. Number of Critical Facilities Located in the 1-percent Annual Chance Flood Hazard Area

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Event Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Brighton (T)	69	65	4	5.8%	4	6.2%
Brockport (V)	29	28	0	0.0%	0	0.0%
Chili (T)	111	102	11	9.9%	11	10.8%
Churchville (V)	24	23	0	0.0%	0	0.0%
Clarkson (T)	14	10	0	0.0%	0	0.0%
East Rochester (T/V)	31	29	1	3.2%	1	3.4%
Fairport (V)	17	16	0	0.0%	0	0.0%
Gates (T)	58	54	2	3.4%	2	3.7%
Greece (T)	165	158	6	3.6%	6	3.8%
Hamlin (T)	23	22	0	0.0%	0	0.0%
Henrietta (T)	111	103	1	0.9%	1	1.0%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Event Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Hilton (V)	21	20	0	0.0%	0	0.0%
Honeoye Falls (V)	17	16	3	17.6%	3	18.8%
Irondequoit (T)	103	100	0	0.0%	0	0.0%
Mendon (T)	21	20	0	0.0%	0	0.0%
Ogden (T)	42	38	0	0.0%	0	0.0%
Parma (T)	18	16	0	0.0%	0	0.0%
Penfield (T)	73	68	3	4.1%	3	4.4%
Perinton (T)	64	57	2	3.1%	2	3.5%
Pittsford (T)	45	39	2	4.4%	2	5.1%
Pittsford (V)	14	13	0	0.0%	0	0.0%
Riga (T)	20	18	1	5.0%	1	5.6%
Rochester (C)	639	605	11	1.7%	11	1.8%
Rush (T)	29	26	3	10.3%	3	11.5%
Scottsville (V)	14	13	0	0.0%	0	0.0%
Spencerport (V)	13	13	0	0.0%	0	0.0%
Sweden (T)	11	11	1	9.1%	1	9.1%
Webster (T)	55	53	1	1.8%	1	1.9%
Webster (V)	16	15	0	0.0%	0	0.0%
Wheatland (T)	23	21	7	30.4%	7	33.3%
Monroe County (Total)	**1,890**	**1,773**	**59**	**3.1%**	**59**	**3.3%**

Source: FEMA 2008; Monroe County GIS 2022
Notes: C = City; T = Town; V = Village % = Percent

Table 5.4.5-17. Number of Critical Facilities Located in the 0.2-percent Annual Chance Flood Hazard Area

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the 0.2-Percent Annual Chance Flood Event Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Brighton (T)	69	65	4	5.8%	4	6.2%
Brockport (V)	29	28	0	0.0%	0	0.0%
Chili (T)	111	102	13	11.7%	13	12.7%
Churchville (V)	24	23	3	12.5%	3	13.0%
Clarkson (T)	14	10	0	0.0%	0	0.0%
East Rochester (T/V)	31	29	1	3.2%	1	3.4%
Fairport (V)	17	16	0	0.0%	0	0.0%
Gates (T)	58	54	3	5.2%	3	5.6%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the 0.2-Percent Annual Chance Flood Event Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Greece (T)	165	158	7	4.2%	7	4.4%
Hamlin (T)	23	22	0	0.0%	0	0.0%
Henrietta (T)	111	103	4	3.6%	3	2.9%
Hilton (V)	21	20	0	0.0%	0	0.0%
Honeoye Falls (V)	17	16	3	17.6%	3	18.8%
Irondequoit (T)	103	100	0	0.0%	0	0.0%
Mendon (T)	21	20	0	0.0%	0	0.0%
Ogden (T)	42	38	0	0.0%	0	0.0%
Parma (T)	18	16	0	0.0%	0	0.0%
Penfield (T)	73	68	4	5.5%	4	5.9%
Perinton (T)	64	57	2	3.1%	2	3.5%
Pittsford (T)	45	39	2	4.4%	2	5.1%
Pittsford (V)	14	13	0	0.0%	0	0.0%
Riga (T)	20	18	2	10.0%	2	11.1%
Rochester (C)	639	605	11	1.7%	11	1.8%
Rush (T)	29	26	3	10.3%	3	11.5%
Scottsville (V)	14	13	0	0.0%	0	0.0%
Spencerport (V)	13	13	0	0.0%	0	0.0%
Sweden (T)	11	11	1	9.1%	1	9.1%
Webster (T)	55	53	1	1.8%	1	1.9%
Webster (V)	16	15	0	0.0%	0	0.0%
Wheatland (T)	23	21	7	30.4%	7	33.3%
Monroe County (Total)	**1,890**	**1,773**	**71**	**3.8%**	**70**	**3.9%**

Source: FEMA 2008; Monroe County GIS 2022
Notes: C = City; T = Town; V = Village % = Percent

Table 5.4.5-18. Lifelines Exposed to the 1 and 0.2-percent Annual Chance Flood Event Boundary

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the 1-percent Annual Chance Flood Event Hazard Area	Number of Lifelines Located in the 0.2-percent Annual Chance Flood Event Hazard Area
Communications	68	2	2
Energy	14	0	0
Food, Water, Shelter	286	17	23
Hazardous Material	1	0	0
Health and Medical	93	1	2
Safety and Security	1,274	39	42
Transportation	36	0	1
Monroe County (Total)	**1,772**	**59**	**70**

Source: FEMA 2008; Monroe County GIS 2022

In cases where short-term functionality is impacted by a hazard, other facilities of neighboring municipalities may need to increase support response functions during a disaster event. Mitigation planning should consider means to reduce impact on critical facilities and ensure enough emergency and school services remain when a significant event occurs. Actions addressing shared services agreements are included in Section 9 (Jurisdictional Annexes) of this plan.

Impact on Economy

Flood events can significantly impact the local and regional economy. This includes but is not limited to general building stock damages and associated tax loss, impacts on utilities and infrastructure, business interruption, and impacts on tourism. In areas that are directly flooded, renovations of commercial and industrial buildings may be necessary, disrupting associated services. The Impact on General Building Stock subsection above discusses direct impacts on buildings in Monroe County.

Debris management may also be a large expense after a flood event. HAZUS estimates the amount of structural debris generated during a flood event. The model breaks down debris into three categories: (1) finishes (dry wall, insulation, etc.); (2) structural (wood, brick, etc.); and (3) foundations (concrete slab and block, rebar, etc.). These distinctions are necessary because of the different types of equipment needed to handle debris. Table 5.4.5-19. summarizes the Hazus v5.1 countywide debris estimates for the 1-percent annual chance flood event. This table only estimates structural debris generated by flooding and does not include non-structural debris or additional potential damage and debris possibly generated by wind that may be associated with a flood event or storm that causes flooding. Overall, Hazus estimates that there will be 46,819 tons of debris generated during the 1-percent annual chance flood event in Monroe County.

Table 5.4.5-19. Estimated Debris Generated from the 1-percent Annual Chance Flood Event

Jurisdiction	1-Percent Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Brighton (T)	2,767	1,599	647	521
Brockport (V)	920	748	89	83
Chili (T)	1,668	1,375	168	125
Churchville (V)	134	67	39	28
Clarkson (T)	245	187	30	27
East Rochester (T/V)	331	114	128	90
Fairport (V)	606	566	25	16
Gates (T)	3,087	2,973	70	44
Greece (T)	2,122	1,662	263	197
Hamlin (T)	1,332	1,173	93	66
Henrietta (T)	4,804	3,595	577	631
Hilton (V)	2,653	739	1,194	720
Honeoye Falls (V)	461	198	157	106
Irondequoit (T)	4,409	1,335	1,421	1,653
Mendon (T)	234	185	28	21
Ogden (T)	732	412	154	166
Parma (T)	1,424	1,017	231	176
Penfield (T)	4,747	1,754	1,567	1,426
Perinton (T)	1,167	906	153	108
Pittsford (T)	2,957	1,355	992	610
Pittsford (V)	76	59	10	7

Jurisdiction	1-Percent Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Riga (T)	148	129	12	7
Rochester (C)	2,121	496	963	662
Rush (T)	1,175	464	413	298
Scottsville (V)	546	221	199	125
Spencerport (V)	401	150	129	122
Sweden (T)	205	138	38	29
Webster (T)	4,168	2,066	1,122	981
Webster (V)	15	15	0	0
Wheatland (T)	1,163	641	289	233
Monroe County (Total)	**46,819**	**26,338**	**11,202**	**9,279**

Source: FEMA 2008; HAZUS v5.1
Notes: V = Village, T = Town, C = City

In addition to replacement costs and the cost of debris generated, estimated losses were generated through Hazus for losses of inventory, relocation, buildings, contents, wages, rentals, and income.

Table 5.4.5-20. Estimated Losses for the 1-percent Annual Chance Flood Event

Inventory Loss	Relocation Loss	Building Loss	Content Loss	Wage Loss	Rental Loss	Income Loss
$22,260,000	$232,910,000	$580,820,000	$1,051,390,000	$651,950,000	$133,780,000	$453,720,000

Source: FEMA 2008; HAZUS v5.1

Impact on the Environment

As Monroe County and its jurisdictions evolve with changes in population and density, flood events may increase in frequency and/or severity as land use changes, more structures are built, and impervious surfaces expand. Furthermore, flood extents for the 1-percent annual chance flood event will continue to evolve alongside natural occurrences such as climate change and/or severe weather events. These flood events will inevitably impact Monroe County's natural and local environment.

Furthermore, the environmental impacts of a dam failure can include significant water quality and debris-disposal issues. Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to flood waters. Hazardous materials may be released and distributed widely across the floodplain. Water supply and wastewater treatment facilities could be offline for weeks. After the flood waters subside, contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties. In addition, severe erosion is likely; such erosion can negatively impact local ecosystems.

Cascading Impacts On Other Hazards

Flood events can exacerbate the impacts of land sliding and utility failure. The New York City (NYC) 2019 Hazard Mitigation Plan suggests that flooding may cause a loss of stabilizing plant material caused by inundation and erosion (NYCEM 2019). Flooding of contaminated waters and flood water containing debris may also cause failure of utilities, particularly if the utilities are disrupted by debris clogging treatment systems or flood waters inundating power sources. More information about the landslide hazard of concern can be found in Section 5.4.8.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the county can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The county considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

Section 4 identifies areas targeted for future growth and development across the County. Any areas of growth located in the special flood hazard area could be potentially 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. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). Changes in the density of population can impact the number of persons exposed to erosion. As forests continue to be cleared for new development and run-off persists, the population in the County will remain exposed to this hazard. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

Climate is defined not simply as average temperature and precipitation but also by the type, frequency, and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of events that exacerbate coastal erosion. While predicting changes of coastal erosion under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (US EPA 2009). Warmer temperatures may lead to an increase in frequency of storms, thus leading to more weather events with potentially increased severity, that cause erosion.

Change of Vulnerability Since 2017 HMP

Monroe County continues to be vulnerable to the flood hazard. However, there are several differences between the exposure estimates of this plan update and the results reported in the 2017 HMP. Updated population statistics and building stock was used in the current risk assessment. Further, exposure for both the population and critical facilities was analyzed. These updated datasets provide a more accurate exposure analysis to the coastal erosion hazard.

5.4.6 HAZARDOUS MATERIALS

This section provides a profile and vulnerability assessment of the hazardous materials hazard for Monroe County.

5.4.6.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections and the probability of future occurrences for the hazardous materials (HazMat) hazard.

Hazard Description

HazMat are substances considered severely harmful to human health and the environment, as defined by the United States Environmental Protection Agency (US EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Superfund Law). This law created a tax on the chemical and petroleum industries and provided federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment (U.S. EPA 2022). There are about 800 CERCLA hazardous materials. Additionally, there are approximately 1,500 known radionuclides, approximately 760 of which are listed individually (U.S. EPA 2022).

Hazardous substance as defined by section 101(14) of CERCLA includes the following:

- Any substance designated pursuant to section 311(b)(2)(A) of the Federal Water Pollution Control Act (33 U.S.C 1215 et esq.) (U.S. EPA 2022);
- Any element, compound, mixture, solution, or substance designated as hazardous under section 102 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA);
- Any hazardous waste having the characteristics identified under or listed pursuant to section 3001 of the Solid Waste Disposal Act (42 U.S.C. 6801 et esq.) (but not including any waste the regulations of which under the Solid Waste Disposal Act has been suspended by Act of Congress) (U.S. EPA 2022).
- Any toxic pollutant listed under section 307(a) of the Federal Water Pollution Control Act (U.S. EPA 2022);
- Any hazardous air pollutant listed under section 112 of the Clean Air Act (42 U.S.C. 7401 *et seq.*); and
- Any imminently hazardous chemical substance or mixture with respect to which the Administrator of EPA (Administrator) has taken action pursuant to section 7 of the Toxic Substances Control Act (15 U.S.C. 2601 *et seq.*). The term does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under paragraphs (1) through (6) of this definition, and the term does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas) (U.S. EPA 2022).

Numerous facilities throughout Monroe County use and store HazMat as defined by US EPA. Many products containing HazMat are used and stored in homes, and these products are shipped daily on highways, railroads, waterways, and pipelines. If released or misused, HazMat can cause death, serious injury, long-lasting health effects, and damage to structures and other properties, as well as to the environment.

Transportation of HazMat on highways involves tanker trucks or trailers, which are responsible for the greatest number of hazardous substance release incidents. The Monroe County Department of Transportation is responsible for approximately 1,500 lane miles of county-owned highways, 180 bridges, and 275 major culverts (Monroe County 2022). These roads cross rivers and streams at many points; hazardous substance spills on roads could pollute watersheds that serve as domestic water supplies for areas within Monroe County and other parts of the State. Hazardous substance releases also could occur along rail lines, as collisions and derailments of train cars can result in large spills.

Pipelines transport hazardous liquids and flammable substances such as natural gas and petroleum. If these pipes are corroded, hazardous substances releases could occur when the pipes are damaged during excavation, incorrect operation, or by other forces. When HazMat are transported by aircraft or by watercraft, crashes, spills of materials, or fires on these vessels can pose hazards.

Nuclear power generating stations, research reactors, or other stationary sources of radioactivity present the threat of release of radiological material. This type of event could threaten a large, multi-jurisdictional area, and result in property damage, contamination of farm and water supplies, and economic damage.

Location

The following information pertains to locations of hazardous substances incidents.

Hazardous Materials Fixed Site

A fixed-site hazardous substance (materials and waste) incident is the uncontrolled release of materials from a fixed site, capable of posing a risk to health, safety, and property as determined by the Resource Conservation Recovery Act (RCRA). It is possible to identify and prepare for a fixed-site incident because federal and state laws require those facilities to notify state and local authorities about the materials being used or produced at the site. Hazardous materials at fixed sites are regulated by the EPA.

The EPA chooses to specifically list substances as hazardous and extremely hazardous, rather than providing objective definitions. Hazardous substances (as listed) are generally materials that, if released into the environment, tend to persist for long periods and pose long-term health hazards for living organisms. Extremely hazardous substances, while also generally toxic materials, represent acute health hazards that, when released, are immediately dangerous to the lives of humans and animals and cause serious damage to the environment. When facilities contain these materials in quantities at or above the threshold planning quantity (TPQ), they must submit “Tier II” information to appropriate state and/or local agencies to facilitate emergency planning.

More than 300 fixed facilities use or store HazMat in Monroe County. For security purposes, they are not mapped in this profile.

Superfund is a program administered by the US EPA to locate, investigate, and clean up the worst hazardous waste sites throughout the United States. Data from the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database indicates that no Superfund sites are present in Monroe County (U.S. EPA 2022).

Hazard Materials In-Transit

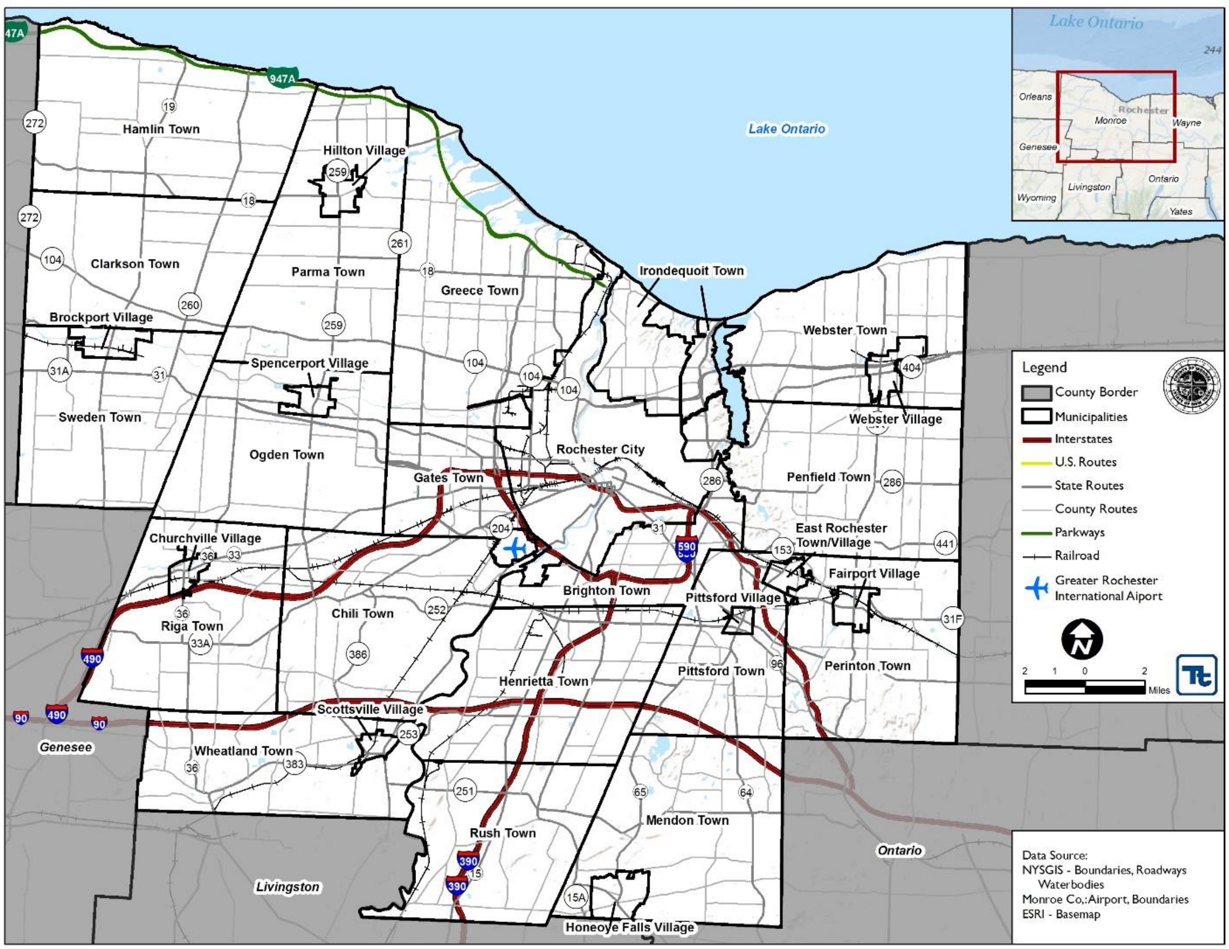
As defined in regulations by the U.S. Department of Transportation (DOT) Materials Transport, a hazardous materials transportation incident is any event resulting in an uncontrolled release of materials during transport that can pose a risk to health, safety, and property. Transportation incidents are difficult to prepare for because there is little, if any, notice about the types of materials involved should an accident happen.

Hazardous materials transportation incidents can occur anywhere within the United States. Transportation of hazardous materials on highways involves tanker trucks or trailers, and these are responsible for the greatest number of hazardous substance release incidents. Potential also exists for hazardous substance releases to occur along rail lines, as collisions and derailments of train cars can result in large spills. Hazardous materials in transit are regulated by DOT.

Incidents involving HazMat in transit can occur anywhere in Monroe County. Transportation corridors within Monroe County that carry HazMat include highways, railroads, air/flight paths, pipelines, and navigable waterways. Major highways are more likely to be settings for this type of hazard because of interstate and local commercial transport of HazMat. Transport vehicles do not typically travel through residential areas unless en route to destinations such as a gasoline service station or storage facility

Major transportation routes through Monroe County include Interstate Routes 90, 490, 590, 390, and 531 (see Figure 5.4.6-1 below); and navigable waterways including the Erie Canal and Lake Ontario. Potential for a spill also exists on routes used for industry/business purposes. Section 4 discusses roadways in the County.

Figure 5.4.6-1. Major Transportation Routes and Railways in Monroe County

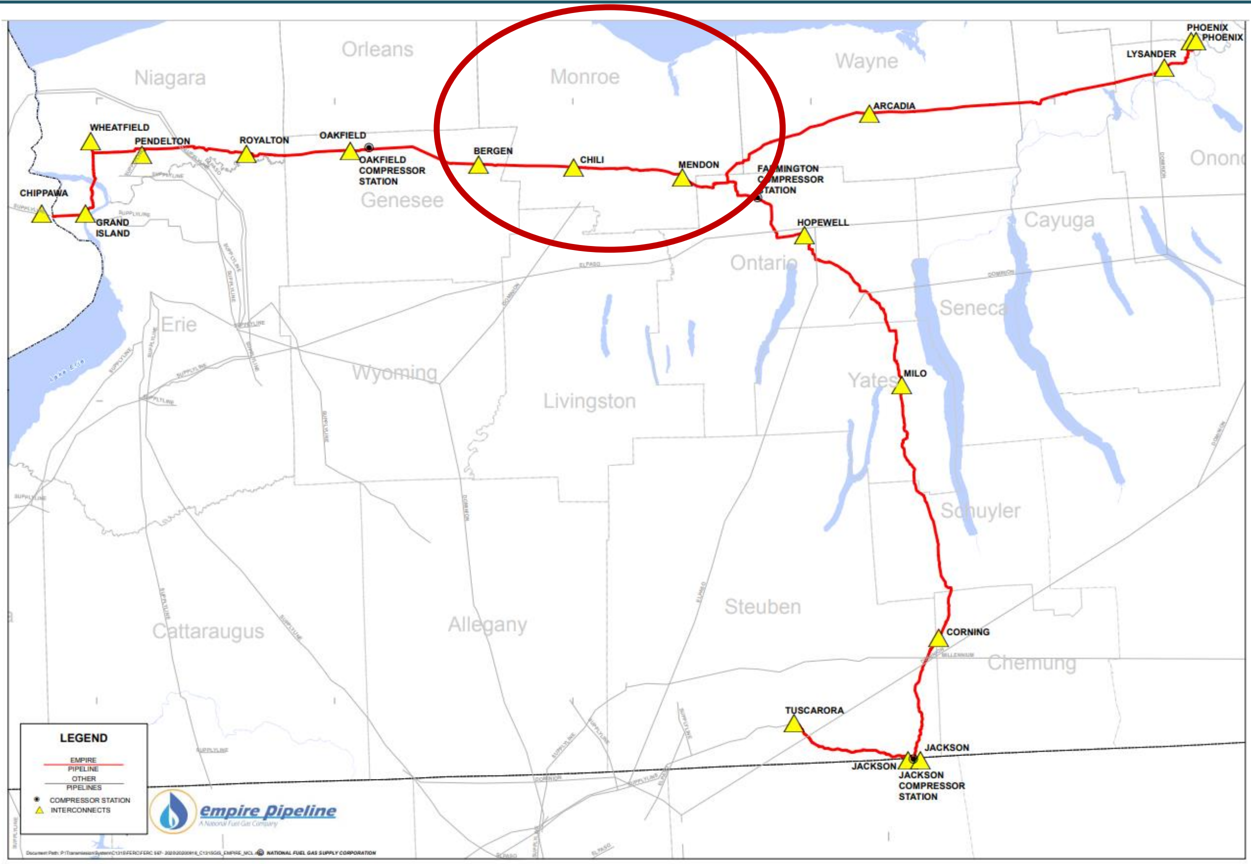


Source: Monroe County 2017 HMP

HazMat incidents may occur along railways in Monroe County. Rail lines that may carry HazMat include the CSX (railroad) east-west corridor, and Rochester & Southern (railroad) north-south corridor. The New York Department of Transportation (NYDOT) has a vital interest in preserving and improving the rail freight part of its transportation network. Rail shipments allow cost-effective movement of goods and thus decrease stress on the State's highway system. Major commodities shipped by rail include petrochemicals (including plastic pellets), construction materials, food products, raw materials, and finished goods for manufacturers. Rail cars carrying HazMat are of concern because an accident or release could pose a public safety hazard to the community.

HazMat can also be transported via underground petroleum and gas (natural and propane) pipelines across the State. New York has an extensive network of natural gas and petroleum pipelines, at least one of which passes through Monroe County. Figure 5.4.6-2 shows extent and location of pipelines throughout western New York state and Pennsylvania, with Monroe County's general area indicated by the red oval.

Figure 5.4.6-2. National Fuel Empire Pipeline Map



Source: National Fuel Gas Company 2020
Note: The red oval represents the approximate location of Monore County

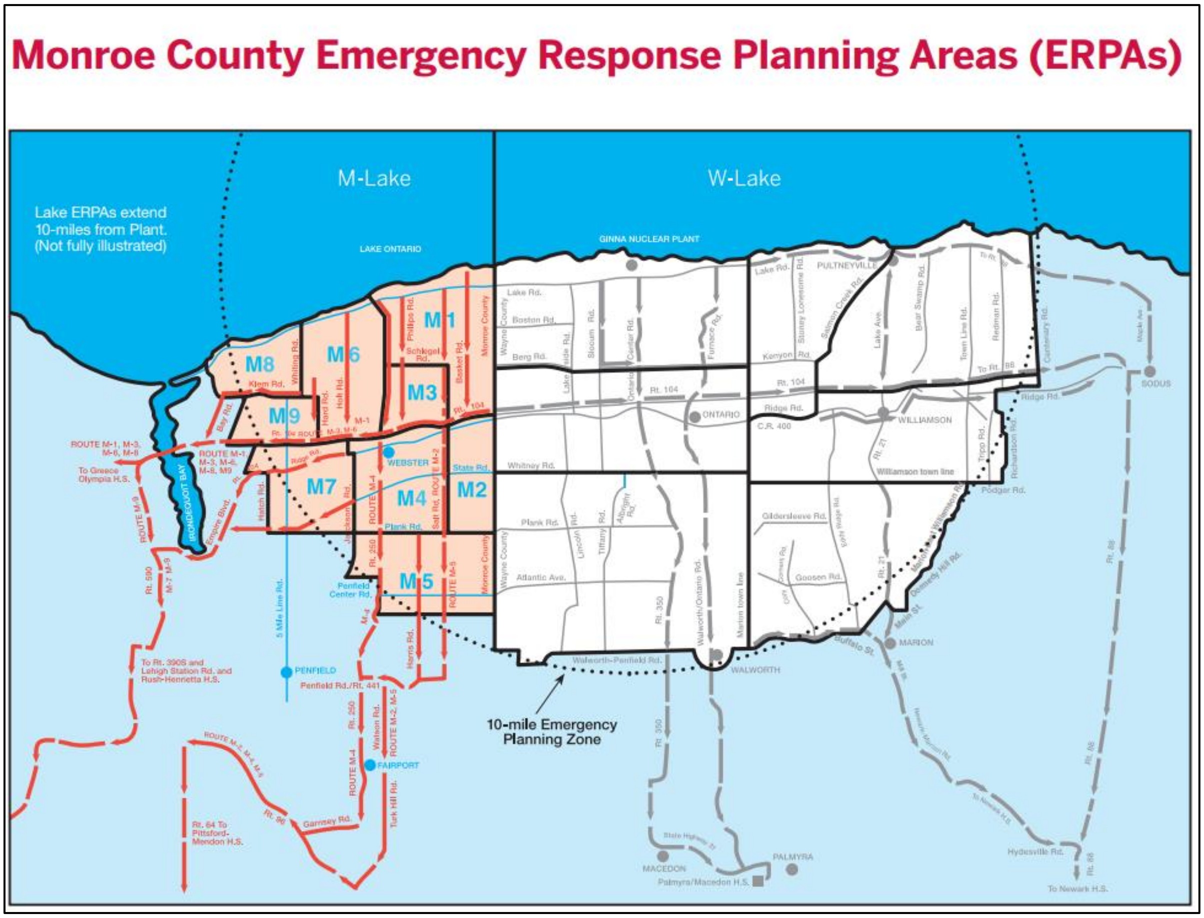
Radiological

The threat of a radiological event at a fixed facility is always a possibility because of proximity of the Ginna Nuclear Power Station in Wayne County to the northeastern border of Monroe County. For commercial reactors, areas of risk from exposure to radiation releases are designated as (1) within the Plume Exposure Emergency Planning Zone (EPZ) of such sites (within a 10-mile radius of a site) for direct exposure, or (2) within the Ingestion Pathway Emergency Planning Zone (within a 50-mile radius of a nuclear site) for exposure via the food chain. A credible worst-case event of a radioactive release from a fixed site could affect a large region around the nuclear power site.

The federal EPZ and its 10-mile radius overlay portions of the towns of Webster and Penfield, and the Village of Webster. The 10-mile EPZ is sectored into Emergency Response Planning Areas (ERPA) for Emergency Management purposes. In coordination with New York State, and as tested by the Federal Emergency Management Agency (FEMA), Monroe and Wayne County plans address public alerting and notification, emergency response, special need populations, evacuation routes, detection and monitoring, decontamination, and public health among other topics. The Monroe County Radiological Emergency Preparedness Plan and community Public Safety providers are annually tested on their readiness and response (Constellation Energy Corporation 2022).

Substantial safety features and security measures are in place at the Ginna Nuclear Power Station. Figure 5.4.6-3 below displays the Monroe County Emergency Response Planning Areas (ERPAs).

Figure 5.4.6-3. Monroe County Emergency Response Planning Areas (ERPAs)



Source: Constellation Energy Corporation 2022

Extent

The extent of a hazardous substance release depends on (1) whether the substance is released from a fixed or mobile source, (2) the size of the impacted area, (3) the toxicity and properties of the substance, (4) the duration of the release, and (5) environmental conditions (for example, wind and precipitation, terrain, etc.).

Hazardous substance releases can contaminate air, water, and soils, possibly resulting in death and/or injuries. Dispersion can occur rapidly when the hazardous substance is transported by water and wind. While often accidental, releases can occur because of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, these incidents are known as secondary events. HazMat can include toxic chemicals, radioactive substances, infectious substances, and hazardous wastes. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas.

Severity or impact of a hazardous substance release, whether accidental or intentional, depends on several potentially mitigating or exacerbating circumstances. Mitigation involves precautionary measures taken in advance to reduce the impact of a release on the surrounding environment. For example, primary and secondary containment or shielding by implementation of sheltering-in-place protects people and property from the harmful effects of a hazardous substance release. Exacerbating conditions, characteristics that can enhance or magnify the effects of a hazardous substance release, include the following:

- Weather conditions, which affect how the hazard occurs and develops
- Micro-meteorological effects of buildings and terrain, which alter dispersion of HazMat in compliance with applicable codes (such as building or fire codes)
- Maintenance failures (such as fire protection and containment features), which can substantially increase damage to a facility and to surrounding buildings.

The severity of an incident depends not only on the circumstances described above, but also on the type of substance released and the distance from the incident and related response time of emergency response teams. Areas closest to a release are generally at greatest risk; however, depending on the substance, a release can travel great distances or remain present in the environment for a long period of time (for example, centuries to millennia).

According to the 2022 Monroe County HazMat Response Plan, there are four main classifications of HazMat incidents:

- "Level 0" incident is not likely to adversely impact or threaten life, health, property, or the environment; control of the incident is within the capabilities of resources available to the local response jurisdictions.
- "Level 1" incident may adversely impact or threaten life, health, property or the environment within an area immediately surrounding the point of release or potential release; control of the incident is within the capabilities of the resources locally available to responders in Monroe County.
- "Level 2" incident may adversely impact or threaten life, health, property or the environment beyond the point of release; incident may be across municipal jurisdictions; control of the incident is within the capabilities of the resources based within Monroe County.
- "Level 3" incident is likely to adversely impact or threaten life, health, property, or the environment in a large geographic area. Additional resources are required to supplement those available within Monroe County (Office of Emergency Management 2022).

The occurrence of a hazardous materials incident can be sudden and without any warning, such an explosion, or may slowly develop, as in the case of a leaking container for example. Facilities that store extremely hazardous substances are required to notify local officials when an incident occurs. Local emergency responders and emergency management officials would determine whether they need to evacuate the public or to advise to shelter in place. Similar to on-site hazardous substances incidents, the amount of warning time for incidents associated with hazardous substances in transit varies based on the nature and scope of the incident. If an explosion did not occur immediately following an accident, officials may have time to warn adjacent neighborhoods and facilitate appropriate protective actions.

The north-central region of Monroe County is closest to the Ginna facility, and some areas fall within the prescribed 10-mile EPZ or evacuation area. Additionally, all Monroe County jurisdictions are within the 50-mile ingestion exposure pathway, and could receive deposits of radioactive particles on crops, bodies of water, and ground surfaces, rendering local agricultural harvest unusable for consumption by either humans or livestock.

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with hazardous material releases throughout New York State and Monroe County; therefore, the loss and impact information for many events varies depending on the source. The accuracy of monetary figures discussed is based on the available information in cited sources.

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, New York State was included in two FEMA declared hazardous material specific emergency declarations (EM). Typically, EMs cover a wide region of an included state, and therefore could impact many counties within that state. However, not all counties in New York State were included in the two EMs cited above. Importantly, Monroe County was not included in either EM.

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was not included in any USDA-designated agricultural disasters that included hazardous materials events.

Previous Events

Table 5.4.6-1 identifies the known hazardous materials events that impacted Monroe County between 2015 and 2022. For events prior to 2015, refer to Appendix H (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Table 5.4.6-1. Hazardous Material Releases in Monroe County, 2015 to 2022

Dates of Event	Event Type	FEMA Declaration Number	Monroe County Designated?	Location	Losses / Impacts
April 10, 2015	Chemical	N/A	N/A	Town of Henrietta	A combination of cleaning chemicals produced an odor and fog resulting in a HazMat situation at the Henrietta Holiday Inn.
July 24, 2016	Chemical	N/A	N/A	Village of East Rochester	Police responded to a Level 1 HazMat situation in the Village of East Rochester.
August 13, 2016	Fuel/Oil/Gas	N/A	N/A	City of Rochester	A gasoline leak from a vehicle in a lower-level maintenance shop was found causes the evacuation at Senior Home in the City of Rochester.
March 5, 2017	Fuel/Oil/Gas	N/A	N/A	City of Rochester	A car crashes into building in Culver Road and Norton Street area in the City of Rochester, resulting in the disconnection of a gas main that feeds into the building.
July 7, 2017	Fuel/Oil/Gas	N/A	N/A	Town of Perinton	A natural gas operated garbage truck was stuck underneath the Baird Road Bridge in the Town of Perinton. When the truck hit the bridge, it crushed the gas tanks, and caused the natural gas to leak.
September 26, 2017	Chemical	N/A	N/A	City of Rochester	Five gallons of an unknown chemical were poured down the drain of an unoccupied building at Emerson Street in the City of Rochester.
November 1, 2017	Fuel/Oil/Gas	N/A	N/A	Town of Perinton	A wrong-way driver caused a crash that closed I-490 overnight in the Town of Perinton. The crash resulted in thirty to forty gallons of gasoline to leak onto the I-490, deeming a Level 0 HazMat situation.
February 28, 2018	Fuel/Oil/Gas	N/A	N/A	Town of Chili	During construction a gas line was punctured, resulting in a gas leak and a closure of the adjacent plaza in the Town of Chili.
March 13, 2018	Fuel/Oil/Gas	N/A	N/A	City of Rochester	A tractor-trailer crash resulted in downed powerlines in the City of Rochester. The tractor-trailer began leaking diesel fuel in the roadway and firefighters need to apply suppression to the diesel fumes to clear crash site.
June 11, 2018	Fuel/Oil/Gas	N/A	N/A	Town of Wheatland	A collision occurred between a fuel tanker carrying 1,000 gallons of gas and 800 gallons of diesel fuel collided with a van in the Town of Wheatland. HazMat crews responded to the crash for necessary precautions.
December 12, 2018	Chemical	N/A	N/A	City of Rochester	A leak of chlorine gas outside a City of Rochester chemical plant sparked a fire and hazmat response.
August 29, 2019	Chemical	N/A	N/A	City of Rochester	A resident of a high rise building on Van Auker Street in the City of Rochester microwaved a hot pepper causing other residents trouble breathing. The hot pepper released the chemical capsaicin as a result of being microwaved.
May 3, 2020	Fuel/Oil/Gas	N/A	N/A	City of Rochester	Several buildings on East Main Street in the City of Rochester had to be evacuated due to a gas leak.

Source: NOAA-NCEI 2022; FEMA 2022; Global Incident Map 2022

Climate Change Impacts

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to increase. The impacts related to increasing temperatures and sea level rise are already causing complications in the state. *ClimAID: The Integrated Assessment for Effective Climate Change in New York State (ClimAID)* was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011/2014).

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across New York State by 2–3.4 °F by the 2020s, 4.1–6.8 °F by the 2050s, and 5.3–10.1 °F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the state (NYSERDA 2011/2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Monroe County is part of Region 1 (Western New York and the Great Lake Plains), where temperatures are estimated to increase by 4.3 to 6.3ºF by the 2050s and 5.7 to 9.6ºF by the 2080s (baseline of 47.7ºF, middle range projection). Precipitation totals are estimated to increase between four to ten percent by the 2050s and four to thirteen percent by the 2080s (baseline of 34.0 inches, middle range projection). Table 5.4.6-2. displays the projected seasonal precipitation change for the region (NYSERDA 2011/2014).

Table 5.4.6-2. Projected Seasonal Precipitation Change in Region 1, 2050s (% change)

Winter	Spring	Summer	Fall
+5 to +15	0 to +15	-10 to +10	-5 to +10

Source: NYSERDA 2014

Non-natural incidents such as hazardous substance incidents are not typically considered vulnerable to climate change; however, climate change may have some impact. Climate change and its impact on hazardous materials sites, particularly waste sites, is a growing concern. According to the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) State Climate Summaries for New York State, the mean annual temperature has increased approximately 2 ºF. This temperature change is likely to indirectly affect the County's vulnerability to hazmat incidents.

As temperatures change, excessive heat on aging structures and/or infrastructure may be adversely affected. Excessive heat on structures or containers containing hazardous materials may alter the material properties.

In addition, hazardous substances stored at fixed locations in the floodplain may experience an increase in flood events due to the projected changes in increased precipitation events, specifically related to magnitude and frequency. Hazardous waste sites near rivers are tentatively at highest risk because extreme storms and higher water levels could release pollution into the environment. Many of these sites were built in locations believed to be removed from potential contamination or exposure-increasing factors. However, development, floodplain boundary change, and an increase in extreme events from climate change are increasing the possibility that water may reach hazardous material and waste sites.

Probability of Future Occurrences

Predicting future hazardous substance incidents in Monroe County is difficult. These can occur at anytime and anywhere in the County. Incidents can occur suddenly without any warning or develop slowly. Small spills, both fixed site and in transit, occur throughout the year, and probability of occurrences of these events is high. Risk of a major incident within a given year is small.

In Section 5.3, the identified hazards of concern within Monroe County were ranked. Probability of occurrence, or likelihood of an event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee, probability of occurrence of HazMat spills within the County is considered "rare" (Between 1 and 10 percent annual probability of a hazard event occurring., as presented in Table 5.3-1).

The County is expected to continue to undergo direct and indirect impacts of hazardous substance incidents annually that may induce secondary hazards such as infrastructure deterioration or failure, potential decreases in water quality and supply, and transportation delays, accidents, and inconveniences.

5.4.6.2 Vulnerability Assessment

A qualitative assessment was conducted for hazardous material incidents in Monroe County. The following discusses the County's vulnerability to this hazard. Refer to Section 5.1 (Methodology and Tools) for additional details on the methodology used to assess the hazardous materials risk.

Impact on Life, Health and Safety

Hazardous material incidents have the potential to compromise the health and safety of those living and working in the area of the incident. Specific impacts vary according to the type of material released, the area affected, and the population within the affected area.

A chemical incident may also include an explosion, with additional injuries and deaths being caused by the pressure wave from the explosion. Biological incidents effects on the population depend on the nature of the agent involved, transmissibility, at-risk populations, incubation period, time before detection, and other factors. Biological agents may cause disease from which some individuals will recover while others will not. Radioactive materials can cause significant health effects in individuals, especially if the materials are taken into the body. Radiological incidents that result in the release of radioactive materials from a nuclear power plant can contaminate sources of potable water, livestock, and crops, leading to a dramatically reduced local food supply. Large chemical incidents, and radiological incidents that result in the release of radioactive materials can contaminate sources of potable water, crops, and livestock, leading to a reduced local food supply.

Depending on the type and quantity of chemicals released and weather conditions, an incident can affect larger areas that cross jurisdictional boundaries. When HazMat are released into the air or water, or on land, they may contaminate the environment and pose greater danger to human health. The general population may be exposed to a HazMat release through inhalation, ingestion, or dermal exposure. Exposure may be either acute or chronic, depending upon the nature of the substance and extent of release and contamination. HazMat incidents can lead to injury, illnesses, and/or death of involved persons and those living within the impacted areas.

Locations of these different HazMat and wastes sites in Monroe County render the entire County vulnerable to these hazards. Populations particularly vulnerable to effects of HazMat incidents are along major transportation routes, because significant quantities of chemicals are transported along these major thoroughfares.

Impact on General Building Stock

Potential losses of general building stock caused by a HazMat incident are difficult to quantify. Extent of damage to the general building stock depends on the scale of the incident. Potential losses may include inaccessibility, loss of service, contamination, and/or potential structural and content losses if an explosion occurs.

Impact on Critical Facilities

Potential losses of critical facilities caused by a HazMat incident are difficult to quantify. Potential losses may include inaccessibility, loss of service, contamination, and/or potential structural and content losses if an explosion occurs. If the operators at a critical piece of infrastructure, such as a power plant, were unavailable, there could be physical damages to the infrastructure itself. Refer to Section 4 (County Profile), which summarizes the number and type of critical facilities in Monroe County.

Impact on Economy

If a significant HazMat incident occurs, not only would life, safety, and building stock be at risk, but the economy of Monroe County would be affected as well. A significant incident within an urban area may force businesses to close for an extended period of time because of contamination or direct damage caused by an explosion, if one occurred. Exact impacts on the economy are difficult to predict, given the uncertainty of sizes and scopes of incidents.

HazMat incidents can lead to closures of major transportation routes in Monroe County. Closures of waterways, railroads, airports, and highways because of these incidents can hinder delivery of goods and services. Potential impacts may be local, regional, or statewide, depending on the magnitude of the event and the extent of disruptions to services.

Radiological contamination of agriculture, livestock, and production can lead to loss of commerce with other regions of the State, country, and even the world. Certain chemicals and hazardous materials can be toxic to plants and animals, damaging their habitats and food sources. Radioactive materials released into the environment could enter the food chain and ultimately contaminate the human food supply. Nuclear impacts on the environment are similar to that of radioactive materials; however, the extent of impacts can be larger due to the amount of miles it can impact (NYC 2019).

Impact on the Environment

Certain chemicals and hazardous materials can be toxic to plants and animals, damaging their habitats and food sources. Radioactive materials released into the environment could enter the food chain and ultimately contaminate the human food supply. Nuclear impacts on the environment are similar to that of radioactive materials; however, the extent of impacts can be larger due to the amount of miles it can impact (NYC 2019).

Wastes that get into waterways will be disruptive and sometimes deadly to aquatic species. Consequentially, wastes that get into waterways can also contaminate drinking water supplies. Hazardous wastes can also leach into soils and travel with wind, which not only impacts the local habitat, but can create issues for surrounding communities. Strict disposal regulations have been defined by organizations like EPA to ensure that the environment and community is protected from these types of events.

Cascading Impacts On Other Hazards

Hazardous material incidents can cause utility failure. If an explosion or contamination occurred, water quality and supply could stop or drastically decrease.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

Any areas of growth could be potentially impacted by the hazardous materials hazard. Development near the transit routes for hazardous materials and facilities will increase the County's overall risk. Therefore, the County should take precautions when determining the location of new development to consider the development's proximity to hazardous material facilities and transit routes. The County may also want to consider implementing designs into the new development that enable improved evacuation or protection from residual impacts from the hazardous materials. Section 4, County Profile, includes more information about the county's anticipated and recent new development plans.

Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). Any changes in the density of population can impact the number of persons living near hazardous materials facilities, transit routes, and pipelines. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

As temperatures change, excessive heat on hazardous materials containers may alter the properties of the material. In addition, fixed hazmat storage locations in the floodplain may experience an increase in flood events due to the projected changes in increased precipitation events, such as changes in magnitude and frequency.

Change of Vulnerability Since 2017 HMP

This vulnerability assessment uses updated data where applicable to provide a better understanding of the potential impacts caused by hazardous materials.

5.4.7 Infestation and Invasive Species

This section provides a profile and vulnerability assessment of the infestation and invasive species hazard for Monroe County.

5.4.7.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections and the probability of future occurrences for the infestation and invasive species hazard. Lyme disease and West Nile Virus caused by ticks and mosquitos are discussed in Section 5.4.1 – Disease Outbreak.

Hazard Description

An infestation is defined as an invasion or overrun by parasites that attack plants, animals, and humans. Insect, fungi, and parasitic infestations can result in destruction of various natural habitats and cropland, impact human health, and cause disease and death among native plants, wildlife, and livestock. An infestation is the presence of pest organisms within an area or field, on the surface of a host, or in soil at numbers or quantities large enough to harm, threaten, or otherwise negatively affect native plants, animals, and humans. Pests are any organisms (insects, mammals, birds, parasite/pathogen, fungi, non-native species) that threaten other living species within an environment. Pests compete for natural resources and can transmit diseases to humans, crops, and livestock. Human populations are generally affected by insect or animal infestations that can lead to epidemics or endemics.

Invasive species are non-native species that can harm the environment, the economy, or human health. They may come from anywhere in the world, and as international trade increases, so does the rate of invasive species introductions. Invasive species threaten nearly every aspect of the world and are one of the greatest threats to New York State's biodiversity (NYSDEC n.d.). They can cause or contribute to the following:

- Habitat degradation and loss
- Loss of native fish, wildlife, and tree species
- Loss of recreational opportunities and income
- Crop damage, and diseases in humans and livestock (NYSDEC n.d.)

Thousands of species have been introduced into the United States, posing serious threats to agriculture, human health, and the integrity of land and water. New York State and Monroe County are vulnerable to damage from these invasive species. The following are names of invasive species found in New York State; however, this list does not include all plant species that are invasive or potentially invasive within the state.

- Amur Cork Tree
- Amur Honeysuckle
- Autumn Olive
- Beach Vitex
- Black Locust
- Black Swallow-wort
- Border Privet
- Brazilian Waterweed
- Broad-leaf Pepper -grass
- Broadleaf Water – milfoil
- Canada Thistle
- Carolina Fanwort
- Chinese Lespedeza
- Chinese Sliver Grass Chinese Lespedeza
- Chinese Sliver Grass
- Chinese Yam
- Cogon Grass
- Common Buckthorn
- Common Frogbit
- Cup-plant
- Curly Pondweed
- Cut-leaf Teasel
- Cypress Spurge
- Eurasian Water -milfoil
- European Common Reed Grass
- Floating Primrose – Willow

- Garden Loosestrife
- Garlic Mustard
- Giant Hogweed
- Japanese Angelica
- Tree
- Japanese Barberry
- Japanese Honeysuckle
- Japanese Hops
- Japanese Knotweed
- Japanese Stilt Grass
- Japanese Virgin's - bower
- Kudzu
- Leafy Spurge
- Lesser Celandine
- Marsh Dewflower
- Mile-a-minute Weed
- Morrow's
- Honeysuckle
- Mugwort
- Multiflora Rose
- Narrowleaf Bittercress
- Norway Maple
- Oriental Bittersweet
- Pale Swallow-wort
- Parrot-feather
- Porcelain Berry
- Purple Loosestrife
- Reed Canary-grass
- Rock Snot (diatom)
- Rusty Willow
- Slender False Brome
- Small Carpgrass
- Smooth Buckthorn
- Spotted Knapweed
- Sycamore Maple
- Tall Glyceria
- Uruguayan Primrosewillow
- Water Chestnut
- Water thyme
- Wavyleaf Basketgrass
- Wild Chervil
- Wineberry
- Winged Euonymus
- Winter Creeper
- Yellow Floating Heart
- Yellow Iris

The Finger Lakes Partnership for Regional Invasive Species Management (PRISM) is a cooperative partnership of diverse stakeholders from throughout the central region of New York State, including Monroe County. According to the Finger Lakes PRISM agricultural working group, the priority invasive plant species of concern in the region include Autumn and Russian olive, Canada thistle, Field bindweed, Japanese knotweed, Johnson grass, Ragweed, Spotted knapweed, Swallow-wort, Velvet leaf, and Wild parsnip for plants; Basil downy mildew (*Peronospora belbahrii*), Grape crown gall (*Agrobacterium tumefaciens*), Late blight (*Phytophthora infestans*), Phytophthora blight (*Phytophthora capsici*), and Plum pox virus (Potyvirus) for diseases; and BMSB (*Halyomorpha halys*), Garlic bloat nematode (*Ditylenchus dipsaci*), Golden nematode (*Globodera rostochiensis* - not an insect but should be included), Spotted wing drosophila (*Drosophila suzukii*), and Swede Midge (Contarinia nasturtii) for insects. Aquatic species of concern include the macrophytes Hydrilla and *Trapa natans* (water chestnut); macroalgae *Nitellopsis obtuse* (starry stonewort); invertebrates *Corbicula fluminea* (Asian clam) and *hemimysis* (bloody red shrimp); and the fish *Neogobius melanostomus* (round goby) (New York Invasive Species (IS) Information 2022).

New York State has been impacted by various past and present infestations, including high populations of mosquitoes, which can cause West Nile Virus (WNV); deer ticks, which can cause Lyme disease; and Asian longhorned beetles and hemlock woolly adelgid, which destroy trees. Other infestations that have affected the state include Eastern Equine Encephalitis, La Crosse Encephalitis, Powassan Virus, St. Louis Encephalitis, Western Equine Encephalitis, Emerald Ash Borer, and Sirex Woodwasp. Not all of these infestations have occurred in Monroe County. The infestations listed below merit attention.

Black Swallow-Wort, also known as *Cynanchum louiseae*, is a weed in the shape of a V and resembles a swallow's tail. The invasive plant has been found in gardens and parks throughout Monroe County.

Brown Marmorated Stink Bug (BMSB) is an invasive species that is native to Eastern Asia and was first detected in Pennsylvania in October 2001. The insect has spread across a number of eastern U.S. states, and its presence has now been documented in Oregon and California as well. These insects can be an agricultural pest, threatening apples, pears, peaches, figs, mulberries, citrus, persimmons, and soybeans (Cornell Cooperative Experience 2019). Severe damage from these insects can render crops unusable for processed products.

Emerald Ash Borer (EAB) is an invasive beetle from Asia and kills North American ash species (*Fraxinus* sp.), all of New York's ash trees are susceptible to EAB. The first EAB infestation in New York State was discovered in Cattaraugus County 2009. As of the summer of 2022, the presence of EAB has been confirmed in all New York counties except; Essex, Hamilton, and Lewis (NYSDEC 2021). The EAB is a small and very destructive beetle. It has four stages: adult, egg, larva, and pupa. The adult beetle are roughly 3/8 to 5/8 inch long with metallic green wing covers and a coppery red or purple abdomen. They may be present from late May through early September but are most common in June and July. Signs of infection include tree canopy dieback, yellowing, and browning of leaves (NYSDEC 2021).

Hemlock Woolly Adelgid (*HWA)* came to the U.S. from southern Japan and has been present in New York State since the 1980s, where it most likely arrived on infested nursery stock that was sold and distributed near New York City and the Lower Hudson region, and in 2008 the HWA was first found in the Finger Lakes Region (Cornell Cooperative Experience 2019). The adelgid uses long mouth parts to extract sap and nutrients from hemlock foliage, preventing free growth and causing needles to discolor from deep green to grayish green and to drop prematurely. Loss of new shoots and needles seriously impairs tree health. Infestation is usually fatal to the tree after several years. Wind, birds, other wildlife, and movement of infested host material (wood) by humans are all factors in dispersion of the adelgid (NYSDEC 2018). Hemlock wood is commonly used in barns and on farm building projects. Groves of hemlock trees provide habitat and cover for deer, ruffled grouse, turkey, rabbit, and snowshoe hare. Loss of hemlock groves can result in loss of cool, damp, and shaded microclimate that supports terrestrial plant communities. Losses can also result in warmer stream temperatures for fish and other aquatic species, thus harming them.

Spotted Lanternfly is a planthopper native to China and Southeastern Asia. Spotted lanternfly is a significant economic and lifestyle pest for residents, businesses, tourism, forestry, and agriculture. The greatest agricultural concern falls on grapes, hops, apples, blueberries, and stone fruits. Its presence has led to crop loss, exporting issues, and increased management costs (New York State Integrated Pest Management 2022a).

True Armyworm, also known as the common armyworm, is primarily a pest of plants in the grass family: forage/ pasture/ grasses and lawns, small grains, and corn. However, under distress, armyworms will also attack legumes and other plants. Young larvae appear smooth, cylindrical, pale green to brownish, while mature larvae are smooth and marked with two orange, white-bordered strips on each side. Larvae range in size from 1/8 inch to 1 ½ inches long. The insect spends winters in the south and flies up to New York State in the spring (Cornell Cooperative Extension 2021).

Regulations

The Invasive Species Council (Council) is a statutory body that was created in 2008 by Title 17, Section 9 of the Environmental Conservation Law (ECL). The Council was created to coordinate among multiple State entities and partners in addressing the environmental and economic threats of invasive species. The legislation defines invasive species as "a species that is (a) non-native to the ecosystem under consideration; and (b) whose introduction causes or is likely to cause economic or environmental harm or harm to human health" (NYSDEC 2022).

The Council is co-led by the Department of Agriculture and Markets (AGM) and consist of nine members: the Commissioners of DEC, AGM, Transportation, Education, and Office of Parks Recreation and Historic Preservation (OPRHP), Secretary of State, the Chairperson of New York State Thruway Authority, the Director of the New York State Canal Corporation, and the Chairperson of the Adirondack Park Agency (APA) (NYSDEC 2022).

As of 2014, New York State has adopted regulations (6 New York Codes Rules and Regulations [NYCRR] Part 575) which identifies the regulations standards for selling and offering regulated species. Any persons who purchase a regulated invasive species is required to maintain all labels, signs and notices pertaining to invasive species in the given areas (New York Codes, Rules, and Regulations 2022).

Extent and Location

The extent and location of an infestation or invasive species depend on the preferred habitat of the species, as well as the species' ease of movement and establishment. Each threat can impact most areas of New York State, including Monroe County. Levels of threat from infestations and invasive species range from nuisance to widespread. The threat typically intensifies when the ecosystem or host species is already stressed, such as during periods of drought and increased periods of rainfall.

Black Swallow Wart

Black Swallow-Wort, also known as *Cynanchum louiseae*, is a weed in the shape of a V and resembles a swallow's tail. The invasive plant has been found in gardens and parks throughout Monroe County. In 2014, reports of black swallow-wart were found in all the parks located within the County (Democrat & Chronicle 2014).

Brown Marmorated Stink Bug

Figure 5.4.7-1 below shows the distribution of brown marmorated stink bugs in New York State as of 2022. The red circle identifies Monroe County, where over 500 cases have been reported.

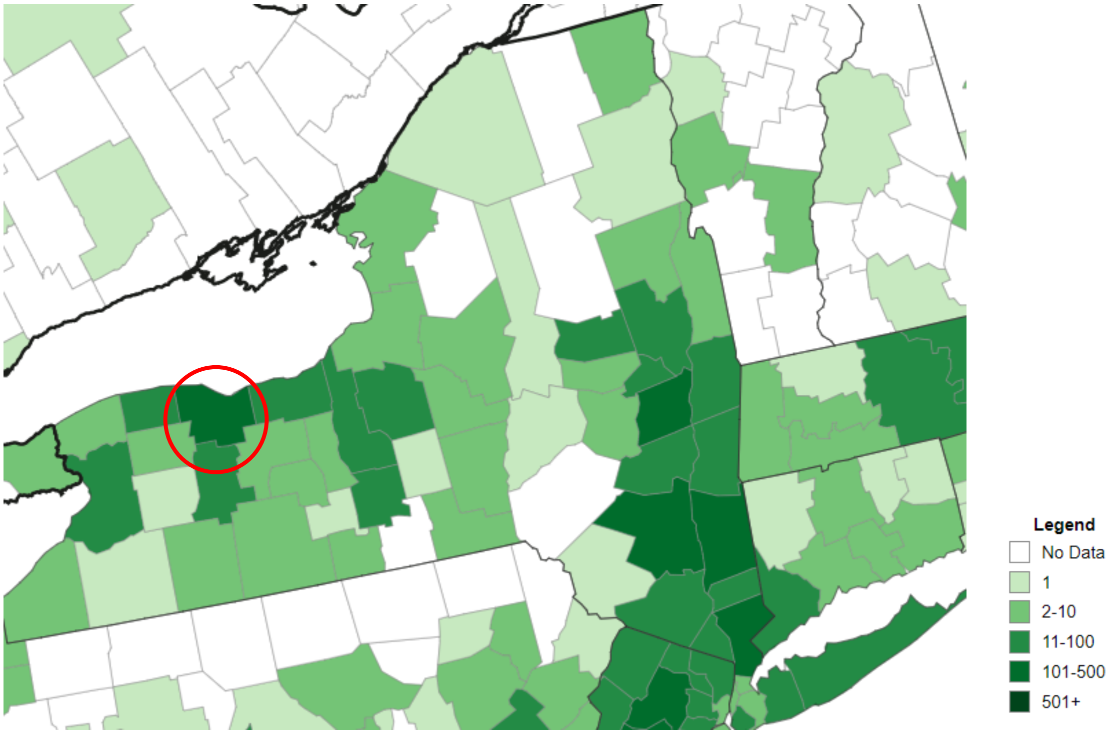
Emerald Ash Borer

The Emerald Ash Borer (EAB) is a very small but very destructive beetle, that has decimated North America's native ash tree population, and is responsible for putting all three of New York's ash species into serious decline (Monroe County Soil & Water Conservation District 2020). Signs of infestation in the tree canopy include dieback, yellowing, and browning of leaves. Monroe County is home to the highest density of ash trees in New York State, leaving a disproportionate impact on the County's parks, forests, and waterways (Monroe County Soil & Water Conservation District 2020). Ash frequently grows along streams, swamps, and lakes, and is key to reducing nutrient runoff and sediment erosion, the Monroe County Soil & Water Conservation District along with Monroe County and New York State Parks planted 21,240 new trees of different species along the waterways in the County where ash typically grew, in hopes to provide the same benefits to water quality, secure the economic and ecological health of water and waterways (Monroe County Soil & Water Conservation District 2020). This initiative was funded through the Great Lakes Restoration Initiative and was completed in 2020.

Hemlock Woolly Adelgid (HWA)

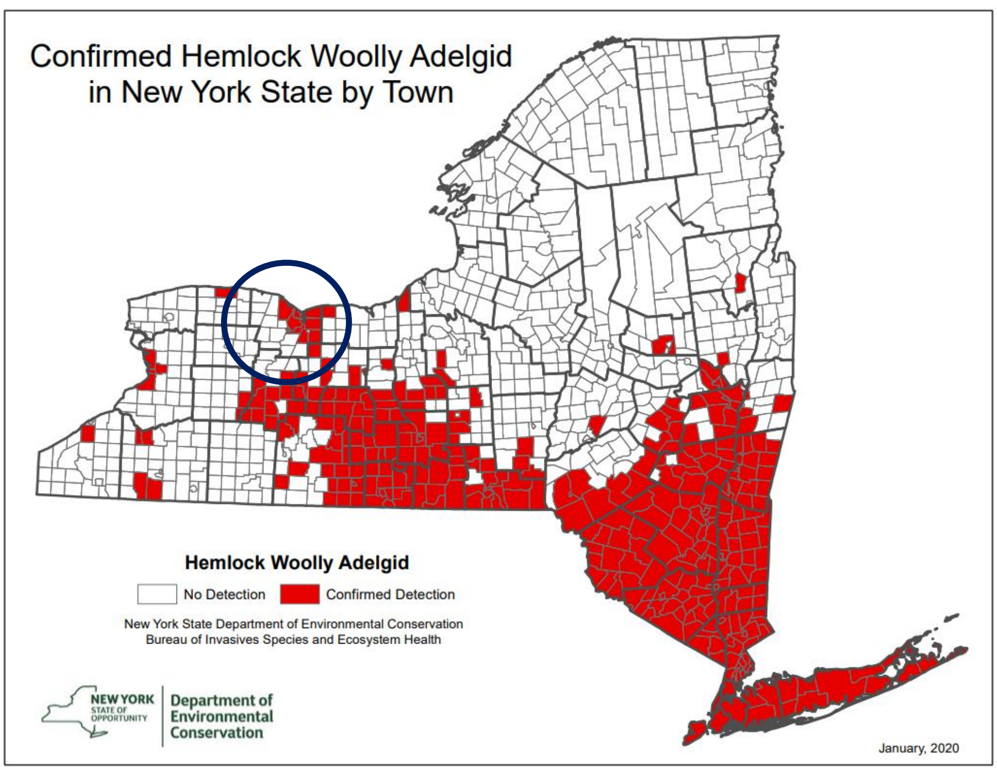
The Hemlock Woolly Adelgid (HWA) is an aphid like insect that threatens hemlock trees in eastern North America. HWA has been in North America for twenty years and has been spreading across New York State and to higher elevations at an alarming rate (Cornell Cooperative Extension 2018). Early detection is the key to successful management, HWA are recognized by white woolly masses produced on twigs in late winter. Figure 5.4.7-2 shows the distribution of HWA in New York State and Monroe County as of January 2020. The dark blue circle indicates Monroe County.

Figure 5.4.7-1 Brown Marmorated Stink Bug Distribution in New York State and Monroe County



Source: EDDMaps 2022
Note: The red circle indicates the position of Monroe County

Figure 5.4.7-2. Confirmed Hemlock Woolly Adelgid in New York State by Town



Source: NYSDEC 2020

Note: The black circle indicates the approximate position of Monroe County

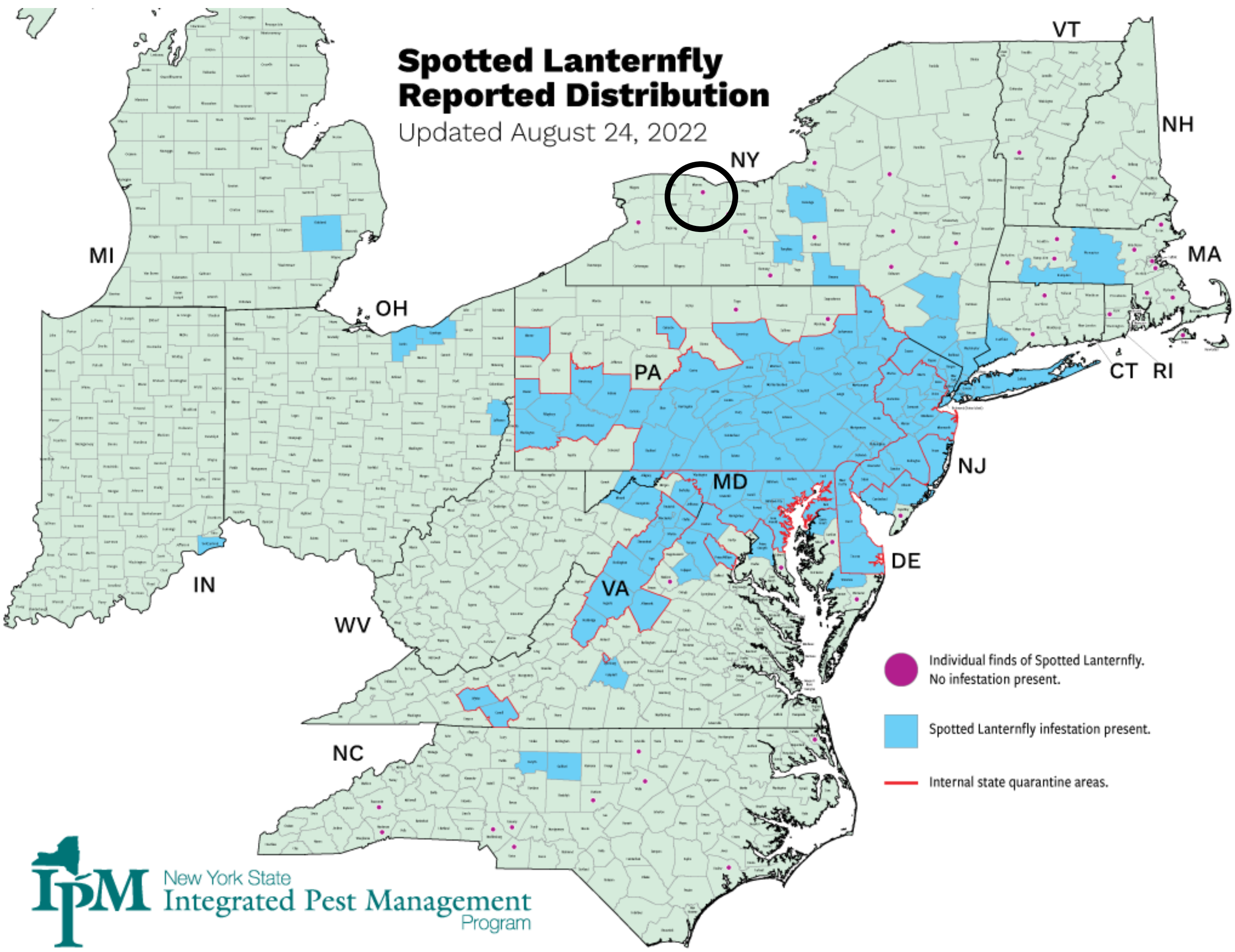
Based on the information presented in the above image, the northeast and southeast portions of Monroe County have the largest detection of HWA.

Spotted Lanternfly

The spotted lanternfly (*Lycorma deliculta*) is an Asian plant hopper. In the USA, spotted lanternfly is an invasive species that could be very devastating to some crops and hardwood trees. This insect was accidentally introduced into Pennsylvania and was confirmed in September 2014. Since this time, the insect has spread throughout the mid-Atlantic (New York State Integrated Pest Management 2022a)

The spotted lanternfly can feed on more than 70 plant species including cultivated grapes, fruit trees, and hardwood trees. Key tree hosts include black walnut; red maple; and agricultural crops such as grapes, hops, apples, and peaches. As of August 2022, spotted lanternfly has been found in Monroe County but has not reached infestation levels yet (New York State Integrated Pest Management 2022a).

Figure 5.4.7-3 Spotted Lanternfly Reported Distribution



Source: New York State Integrated Pest Management 2022a
Note: The black circle indicates the position of Monroe County

True Armyworm

The True Armyworms are primarily a pest of plants in the grass family: forage, pasture, grasses and lawns, small grain, and corn. This native species does not overwinter in New York but fly north from southern states in the spring. Under hunger stress armyworms will attack legumes, and other plants. Commercial field crops at risk for armyworms; grass or mostly grass hay fields, pastures, corn fields that were late planted into grass fields, no-till or reduced tillage fields, fields with crop residue, planted into small grain (especially rye grass) cover crop, corn fields with grassy weeds, quackgrass, crabgrass and bluegrass and other perennials, small grain fields (Cornell Cooperative Extension 2021).

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with infestations and invasive species throughout New York State and Monroe County; therefore, the loss and impact information for many events varies depending on the source. The accuracy of monetary figures discussed is based on the available information in cited sources.

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, New York State and Monroe County were not included in any FEMA declared infestation and invasive species disasters (DR) or emergency declarations (EM). However, Monroe County was included in a West Nile Virus outbreak in 2000. Section 5.4.1 (Disease Outbreak) includes more information on this declaration.

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was included in the following USDA-designated agricultural disasters that included or may have included losses due to infestation and invasive species:

- S4023 - 2016 Insects
- S4031 - 2016 Insects
- S4037 - 2016 Insects

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are low the following years as well. USDA records indicate that Monroe County has experienced crop losses from infestation and invasive species events. Table 5.4.7-1 provides details regarding crop losses in Monroe County according to USDA records.

Table 5.4.7-1. USDA Crop Losses from Infestation and Invasive Species in Monroe County (2015-2022)

Year	Crop Type	Cause of Loss	Losses
2015	Soybeans	Wildlife/Invasive Species/Infestation	$12 thousand
2016	Corn, Soybeans	Wildlife/Invasive Species/Infestation	$11 thousand
2017	Corn	Wildlife/Invasive Species/Infestation	$14 thousand
2018	Corn, Soybeans	Wildlife/Invasive Species/Infestation	$22 thousand
2019	Corn, Soybeans	Wildlife/Invasive Species/Infestation	$4 thousand

Year	Crop Type	Cause of Loss	Losses
2020	Corn, Soybeans	Wildlife/Invasive Species/Infestation	$6 thousand
2021	Soybeans	Wildlife/Invasive Species/Infestation	$2 thousand
2022	Soybeans	Wildlife/Invasive Species/Infestation	$1 thousand

Source: USDA 2022

Previous Events

No new invasive species have impacted Monroe County since 2015. No infestation events have been identified since 2015. For events prior to 2015, refer to Appendix H (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Climate Change Impacts

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to increase. The impacts related to increasing temperatures and sea level rise are already causing complications in the state. *ClimAID: The Integrated Assessment for Effective Climate Change in New York State (ClimAID)* was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011/2014).

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across New York State by 2–3.4 °F by the 2020s, 4.1–6.8 °F by the 2050s, and 5.3–10.1 °F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the state (NYSERDA 2011/2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Monroe County is part of Region 1 (Western New York and the Great Lake Plains), where temperatures are estimated to increase by 4.3 to 6.3ºF by the 2050s and 5.7 to 9.6ºF by the 2080s (baseline of 47.7ºF, middle range projection). Precipitation totals are estimated to increase between four to ten percent by the 2050s and four to thirteen percent by the 2080s (baseline of 34.0 inches, middle range projection). Table 5.4.7-2 displays the projected seasonal precipitation change for the region (NYSERDA 2011/2014).

Table 5.4.7-2. Projected Seasonal Precipitation Change in Region 1, 2050s (% change)

Winter	Spring	Summer	Fall
+5 to +15	0 to +15	-10 to +10	-5 to +10

Source: NYSERDA 2014

Temperature and rainfall increases due to climate change are anticipated, and evidence exists that climate change may be a factor in expansion of infestation and infectious diseases in the United States. Warmer temperatures and changing rainfall patterns provide an environment where insects can remain active longer, greatly increasing the risk for animals and humans. The changes in climate can also allow tropical and subtropical insects to move from regions where diseases thrive into new places (Natural Resource Defense Council 2015). Armyworms die in colder temperatures. Warmer spring and winter temperatures allow them to continue to reproduce—a factor contributing to the outbreak in 2012.

As temperatures increase and rainfall patterns change, these insects can remain active for longer seasons and within wider areas. The ability to predict the future distribution of invasive species in response to climate change is a difficult task due to the factors that influence local and short-term invasion patterns, and because invasive species and concurrent climate and land-use changes are dynamically linked (Finch, et al. 2021).

Probability of Future Occurrences

Based on historical documentation and given the overall impact of changing climate, New York State is expected to undergo increased incidences of infestation. Monroe County and all its jurisdictions will continue under threat of infestations that may induce secondary hazards and health threats to the County population if infestations are not prevented, controlled, or eradicated.

In Section 5.3, the identified hazards of concern within Monroe County were ranked. Probability of occurrence, or likelihood of an event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee, probability of occurrence of infestation and invasive species within the County is considered "occasional" (Between 10 and 100 percent annual probability of a hazard event occurring., as presented in Table 5.3-1).

5.4.7.2 Vulnerability Assessment

A qualitative assessment was conducted for infestations and invasive species in Monroe County. The following discusses the County's vulnerability to this hazard. Refer to Section 5.1 (Methodology and Tools) for additional details on the methodology used to assess the infestation and invasive species risk.

Impact on Life, Health and Safety

The entire population of Monroe County is vulnerable to infestation. According to the 2020 U.S. Census, Monroe County had a population of 759,443. As discussed earlier, infestations can have an impact on agricultural commodities. This destruction of crop may include consumable resources that are sold to persons in the County. Section 5.4.2 (Drought) discusses the number of farms that are operating in the County (i.e., 527 farms) (USDA 2017). It is reasonable to assume that the farms in Monroe County also experience losses in crops. This not only impacts the livelihood of the farmers; it also affects the community that relies on these crops for food or other commodities.

Impact on General Building Stock

Structures are not anticipated to be directly affected by infestation or invasive species; however, EAB may cause a catastrophic loss of ash trees throughout the County, which could result in stream bank instability, erosion, and increased sedimentation, impacting ground stabilization and possibly cause foundation issues for nearby structures. Additionally, with an increased number of dead trees, there is an increased risk of trees falling on roadways, power lines, and buildings.

Some invasive plants have been shown to destabilize soil due to high densities and shallow root systems, negatively impacting nearby buildings and septic systems. Other invasive plant species have been known to clog culverts and streams, increasing flooding risk.

Impact on Critical Facilities

Water treatment plants could be impacted by infestation and invasive species because of similar issues that the general building stock may experience. Water that becomes polluted due to increased sedimentation and erosion will require additional treatment. If the system becomes clogged with these pollutants, the ability of water treatment plants to operate may become impaired. Additionally, soil that becomes unstable due to decaying vegetation can impact critical facilities that are built on or around these soils.

Impact on Economy

Impacts of infestation and invasive species on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with activities and programs implemented to conduct surveillance and address infestation have not been quantified in available documentation. Crop losses from invasive species may be significant; during 2012, the County's crop was severely impacted by the armyworm. In 2017, there were 85,422 acres of cropland in Monroe County with $66,638,000 in crops sold (USDA 2017). Therefore, it is reasonable to believe that Monroe County farmers have experienced monetary losses from infestations.

EAB is the responsible for placing all three of New York's ash species in serious decline. Ash wood is the primary wood for baseball bats, the most common tree planted in parks and city streets, and has a long history of positive impact to several wildlife species (Monroe County Soil & Water Conservation District 2020). The cost of removal for ash trees can be upwards of $1 million depending on the number of trees for removal and their location.

Impact on the Environment

As previously discussed, Monroe County's parks, forests, landscaping, and agricultural areas are vulnerable to spotted lanternfly, HWA, and EAB. Species that cause eventual destabilization of soil, such as invasive insects that destroy plants or invasive plants that outcompete native vegetation but have less effective root systems, can increase runoff into waterbodies. Soil destabilization can also increase the likelihood of mudslides in areas with a steep slope.

Cascading Impacts On Other Hazards

Species that result in damage and death to trees can increase the risk of wildfire. For more information on wildfire, refer to Section 5.4.11. Soil destabilization can also increase the likelihood of mudslides in areas with a steep slope. For more information on landslides, refer to Section 5.4.8.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

Section 4 identifies areas targeted for future growth and development across the County. Any areas of growth located within Monroe County could be potentially impacted by invasive species and infestation. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). Changes in the density of population and the increased construction throughout the County could lead to increased infestation of homes and other structures. When building developments locate near wetlands, forested areas, or agricultural lands, it increases the possibility of infestation. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

Climate change and invasive species are two of the top four drivers of global biodiversity loss, affecting production landscapes, reducing crop yields, and the provision of ecosystem services (Masters and Norgrove 2010). Land use changes because of climate change creates an empty niche for invasive species to occur so together these drivers have a greater impact. Climate change can facilities invasive species and infestation such as new species that become invasive entering regions due to climate change, species hierarchy in ecosystems will begin to shift, leading to new dominants that may portrait invasive behaviors, and climate induced stress in the ecosystem will facilitate invasive ecosystems (Masters and Norgrove 2010). Alternatively, invasive species and infestations can facilitate climate stress by increasing the ecosystems susceptibility to climatic disturbance, through reducing the number of species and their functional types within an ecosystem.

Change of Vulnerability Since 2017 HMP

Overall, the County’s vulnerability has not changed since the 2017 HMP, and exposure and vulnerability to infestation and invasive species will continue throughout Monroe County.

5.4.8 LANDSLIDE

This section provides a profile and vulnerability assessment of the landslide hazard for Monroe County.

5.4.8.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections and the probability of future occurrences for the landslide hazard.

Hazard Description

A landslide is the process that results in the downward and outward movement of slope-forming materials (NYS Geological Survey n.d.). Landslide materials can consist of natural rock, soil, artificial fill, or any combination of these materials (NYS DHSES 2014). The materials move by falling, toppling, sliding, spreading, or flowing (NYS Geological Survey n.d.).

Landslides are caused by one or more of the following factors: change in slope of the terrain, increased load on the land, shocks and vibrations, change in water content, groundwater movement, frost action, weathering of rocks, and removing or changing the type of vegetation covering slopes. Landslide hazard areas exist where the land has characteristics that contribute to the risk of the downhill movement of material, such as the following:

- A slope greater than 33 percent
- A history of landslide activity or movement during the last 10,000 years
- Stream or wave activity that has caused erosion, undercut a bank, or cut into a bank to cause the surrounding land to be unstable
- The presence or potential for snow avalanches
- The presence of an alluvial fan, indicating vulnerability to the flow of debris or sediments
- The presence of impermeable soils, such as silt or clay, which are mixed with granular soils such as sand and gravel.

Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening of slopes caused by construction or erosion, earthquakes, and changes in groundwater levels. Areas that are generally prone to landslide hazards include previous landslide areas, the bases of steep slopes, the bases of drainage channels, developed hillsides, and areas recently burned by forest and brush fires (NYS DHSES 2014). Human activities that contribute to slope failure include altering the natural slope gradient, increasing soil water content, and removing vegetation cover. Warning signs for landslide activity include:

- Springs, seeps, or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavement, or sidewalk
- Soil moving away from foundations
- Ancillary structures, such as decks and patios, tilting and moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken water lines and other underground utilities
- Leaning telephone poles, trees, retaining walls, or fences
- Offset fence lines
- Sunken or down-dropped road beds
- Rapid increase in creek water levels, possibly accompanied by increased turbidity
- Sudden increase in creek water levels while rain is still failing or just recently ended
- Sticking doors and windows, and visible open spaces indicating jambs and frames out of plumb

- A faint rumbling sound that increases in volume as the landslide nears
- Unusual sounds, such as trees cracking or boulders knocking together (USGS 2013).

There are several different types of landslides including:

- *Rock Falls:* blocks of rock that fall away from a bedrock unit without a rotational component
- *Rock Topples:* blocks of rock that fall away from a bedrock unit with a rotational component
- *Rotational Slump:* blocks of fine grained sediment that rotate and move down slope
- *Transitional Slide:* sediments that move along a flat surface without a rotational component
- *Earth Flows:* fine-grained sediments that flow downhill and typically form a fan structure
- *Creep:* a slow moving landslide often only noticed through crooked trees and disturbed structures
- *Block Slides:* blocks of rock that slide along a slip plane as a unit down a slope
- *Debris Avalanche:* predominately gravel, cobble, boulder, and sediment portions, and trees that move quickly down slope
- *Debris Flows:* coarse sediments that flow downhill and spread out over relatively flat areas (NYS DHSES 2014)

Location

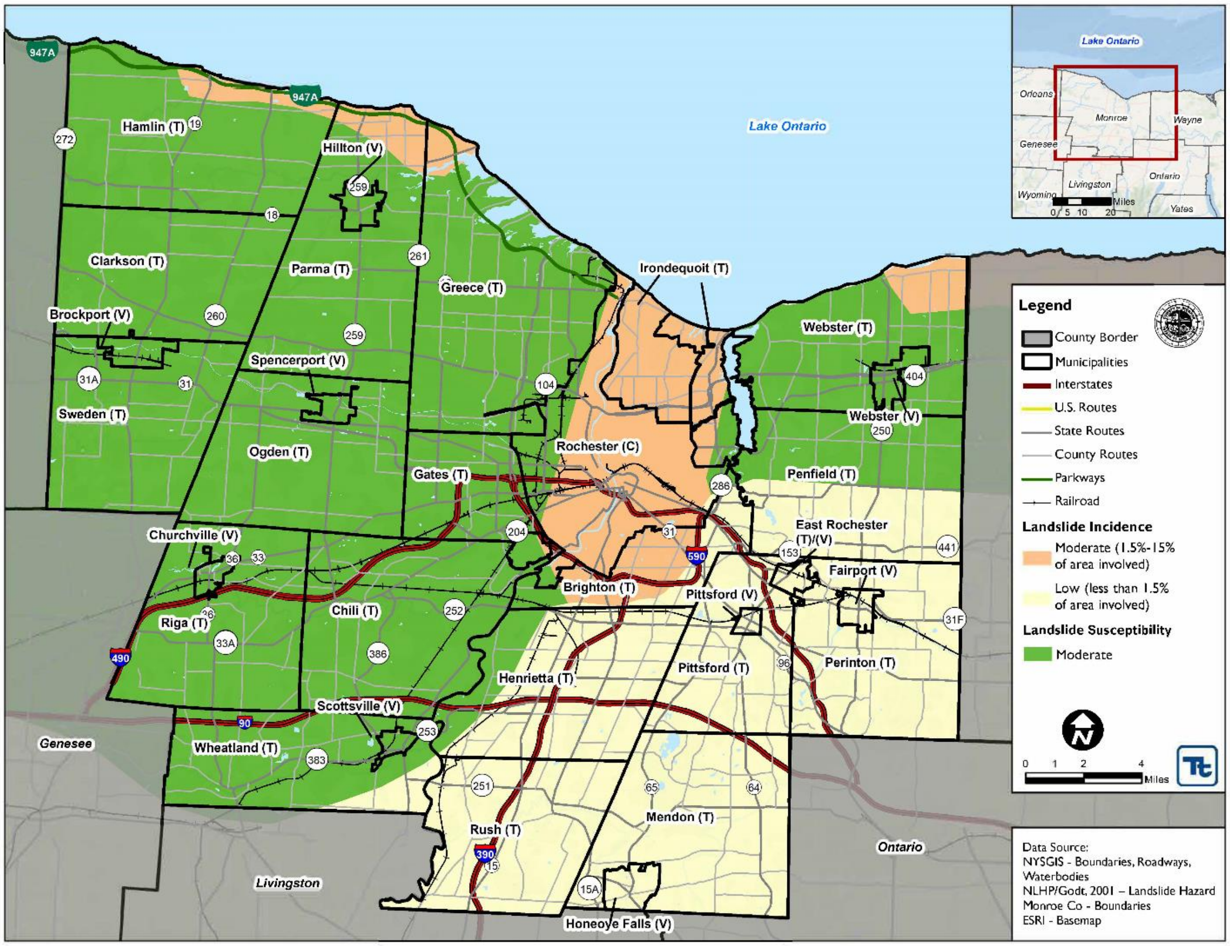
Landslides have occurred in several areas of Monroe County, often as a result of flooding and erosion along the Lake Ontario shoreline and bluffs. Landslides have also occurred in some of the large open gravel pits. Natural variables such as soil properties, topographic position, and slope contribute to determining the overall risk of the landslide hazard in a given area. Specific areas of the County which have historically been most susceptible include:

- The high-angle slope areas surrounding Irondequoit Bay and the south shore of Lake Ontario, including the houses and businesses and other nearby structures
- Specific areas within Monroe County parks
- Open mine pits.

The underlying cause of a landslide is another significant variable influencing the occurrence of an event. These causes, or triggers, can be natural or human-induced sources. The three most common landslide triggers are water saturation of the ground; loading, or increased weight at the top or high end of the slope; and taking away soil or removing mass from the bottom (NYS DHSES 2014).

256,266 persons in Monroe County live in a moderate incidence area and 323,263 persons live in a moderate susceptibility area (NYS DHSES 2014). Figure 5.4.8-1 shows the landslide incidence and susceptibility in Monroe County based on terrain slopes and soil type throughout the County (Monroe County 2022).

Figure 5.4.8-1. Landslide Incidence and Susceptibility in Monroe County



Source: *Monroe County 2022*

Extent

The extent of a landslide hazard is determined by identifying the affected areas and assessing the probability of a landslide occurring within a time period. Natural variables that contribute to the overall extent of potential landslide activity in any particular area include soil properties, topographic position and slope, and historical incidence. Predicting a landslide is difficult, even under ideal conditions. As a result, the landslide hazard is often represented by landslide incidence and susceptibility, as defined below.

- Landslide incidence is the number of landslides that have occurred in a given geographic area. High incidence means greater than 15 percent of a given area has been involved in landsliding; medium incidence means that 1.5 to 15 percent of an area has been involved; and low incidence means that less than 1.5 percent of an area has been involved (Radbruch-Hall 1982).

- Landslide susceptibility is defined as the probable degree of response of geologic formations to natural or artificial cutting, to loading of slopes, or to unusually high precipitation. It can be assumed that unusually high precipitation or changes in existing conditions can initiate landslide movement in areas where rocks and soils have experienced landslides in the past. Landslide susceptibility depends on slope angle and the geologic material underlying the slope. Landslide susceptibility only identifies areas potentially affected and does not imply a time frame when a landslide might occur. High, medium, and low susceptibility are delimited by the same percentages used for classifying the incidence of landsliding (Radbruch-Hall 1982).

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with landslides throughout New York State and Monroe County; therefore, the loss and impact information for many events varies depending on the source. The accuracy of monetary figures discussed is based on the available information in cited sources.

Landslides have occurred in several areas within Monroe County, however, none have caused personal injury. High water levels on Lake Ontario caused severe erosion in 1993, 1997, and 1998, and contributed to landslides. Cliffs along the shoreline in the Town of Webster, and along the Irondequoit Bay were eroded. In 1998, severe erosion exposed a sanitary sewage transmission main near Sea Breeze, in the Town of Irondequoit, prompting emergency measures for repair and a call for immediate protective relief from the International Joint Commission that regulates lake levels (NYS DHSES 2014). On April 2, 1997, a house on the west side of Irondequoit Bay slid off its foundation into the bay; however, the cause was unknown. In January, 1998, a basement wall on the uphill side of a home in Webster collapsed from the pressure of saturated soils and downhill drainage. On August 31, 2004, excessive rain saturated a hillside in the Town of Irondequoit and caused brush and dirt to slide 40 feet toward bayside houses known as German Village (more than ten were affected). According to the NYS HMP and other sources reviewed, there has only been one landslide since 2010, occurring in 2020 south of Oakdale (Lacrosse Tribune 2020).

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, FEMA issued one disaster declaration (DR) for landslides in New York State. Generally, these disasters cover a wide region of the state; therefore, they may have impacted many counties. However, not all counties were included in the disaster declaration; Monroe County was not included in this declaration (FEMA 2022).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was included in the following USDA-designated agricultural disasters that included or may have included losses due to landslides:

- S3885 - 2015 Excessive Rain, High Winds, Hail, Lightning, and Tornado
- S4274 - 2017 Excessive Rain and Related Flooding
- S4265 - 2017 Excessive Rain and Related Flooding, High Winds, and Hail
- S4479 - 2018 Excessive Rain
- S4622 - 2019 Excessive Rain, Moisture, Humidity

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are also low in the following years. USDA records indicate that Monroe County has not experienced crop losses from landslide events.

Previous Events

For this 2022 HMP Update, known landslide events that have impacted Monroe County between 2015 and 2022 are identified in Table 5.4.8-1. However, Table 5.4.8-1 may not include a complete record of all landslide events that have occurred within the County.

Table 5.4.8-1. Landslide Events between 2015 and 2022

Dates of Event	Event Type	FEMA Declaration Number	Location / County Designated?	Losses / Impacts
August 28, 2020	Landslide	N/A	No	A Monroe County home on Hope Road, south of Oakdale, was damaged by a landslide event.

Sources: Lacrosse Tribune 2020
FEMA Federal Emergency Management Agency
N/A Not applicable

Climate Change Impacts

Providing projections of future climate change for a specific region is challenging. Shorter-term projections are more closely tied to existing trends making longer-term projections even more challenging. The further out a prediction reaches, the more it is subject to change.

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Monroe County is part of Region 1, Western New York, Great Lakes Plain. In Region 1, it is estimated that temperatures will increase by 3.0 ºF to 5.5 ºF by the 2050s and 4.5 ºF to 8.5 ºF by the 2080s (baseline of 48.0 ºF, mid-range projection). Precipitation totals will increase between 0 and 10 percent by the 2050s and 0 to 15 percent by the 2080s (baseline of 37.0 inches, mid-range projection). Table 5.4.8-2 displays the projected seasonal precipitation change for ClimAID Region 1 (NYSERDA 2014).

Table 5.4.8-2. Projected Seasonal Precipitation Change in Region 1, 2050s (% change)

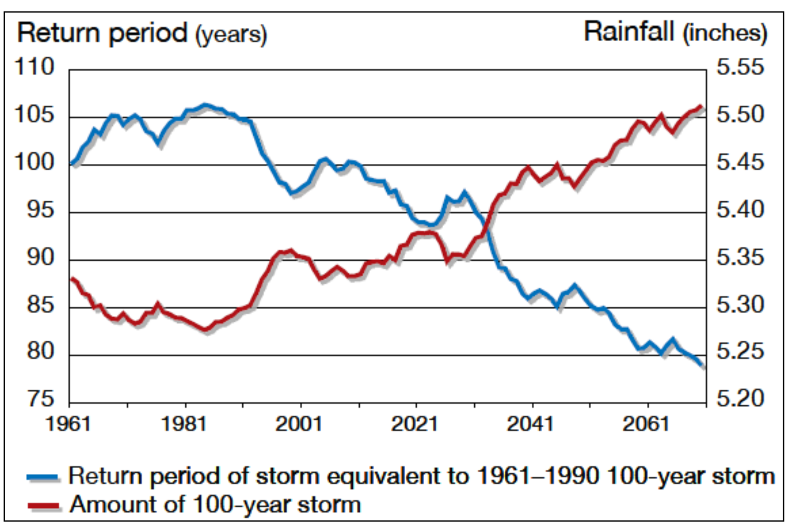
Winter	Spring	Summer	Fall
+5 to +15	0 to +10	-5 to +10	-5 to +10

Source: NYSERDA 2014

The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. Downpours are very likely to increase in frequency and intensity, a change which has the potential to affect drinking water; heighten the risk of riverine flooding; flood key rail lines, roadways, and transportation hubs; and increase delays and hazards related to extreme weather events (NYSERDA 2011). Less frequent rainfall during the summer months may impact the ability of water supply systems. Increasing water temperatures in rivers and streams will affect aquatic health and reduce the capacity of streams to assimilate effluent wastewater treatment plants (NYSERDA 2011).

Figure 5.4.8-2 displays the project rainfall and frequency of extreme storms in New York State. The amount of rainfall in a 100-year event is projected to increase, while the number of years between such storms (return period) is projected to decrease. Rainstorms will become more severe and more frequent (NYSERDA 2011). Heavy rainfall events are likely to loosen soils and could contribute to increased frequency and severity of landslides.

Figure 5.4.8-2. Projected Rainfall and Frequency of Extreme Storms



Source: NYSERDA 2011

Global temperature increase could affect the snowpack and its ability to hold and store water. Warming temperatures also could increase occurrence and duration of droughts, which could increase probability of wildfire and likely reduce the vegetation that helps support steep slopes. All these factors could increase the probability of landslide occurrence.

Probability of Future Occurrences

As indicated in the NYS HMP, and given the history of landslides in New York State, it is certain that future landslides will occur, but the severity of these landslides cannot be determined. Therefore, the probability of future landslides in New York State is considered high; however, since documentation on landslides in Monroe County is sparse, it is difficult to predict the extent of future landslides in the County.

The frequency of damaging landslides within Monroe County can be classified, relative to other higher risk areas, as low. However, the fact that high landslide susceptibility exists and landslides have occurred in the past suggests that the certain parts of the County's infrastructure, as well as people, are at risk from damaging landslide hazards in in the County.

In Section 5.3, the identified hazards of concern for Monroe County were ranked using various parameters. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee, the probability of occurrence for landslides in Monroe County is considered 'unlikely' (not likely to occur or is unlikely to occur with less than a 1 percent annual chance probability) in Table 5.3-2.

5.4.8.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For this analysis, the hazard area is defined as the moderate susceptibility and moderate incidence landslide zones.

Impact on Life, Health, and Safety

Table 5.4.8-3 summarizes the area within each hazard ranked area, specific to Monroe County municipalities. To estimate the population located within the landslide hazard areas, the approximate hazard area boundaries were overlaid upon the 2020 Census population data (U.S. Census 2020). The Census blocks having their center (centroid) within the boundary of the landslide incidence hazard areas were used to calculate the estimated population considered exposed to this hazard. In total, 256,266 (34%) of the County's population is exposed to the moderate incidence hazard area, and 323,263 (42.9%) of the County's population is exposed to the moderate susceptibility hazard area.

Table 5.4.8-3. Estimated Population Exposed to Landslides in Monroe County

Municipality	Total Population (U.S. Census 2020)	Landslide Incidence		Landslide Susceptibility	
		Moderate	% of Total	Moderate	% of Total
Brighton (T)	37,137	18,626	50.2%	749	2.0%
Brockport (V)	7,104	0	0.0%	7,104	100.0%
Chili (T)	29,123	0	0.0%	29,123	100.0%
Churchville (V)	2,091	0	0.0%	2,091	100.0%
Clarkson (T)	6,904	0	0.0%	6,904	100.0%
East Rochester (V/T)	6,334	0	0.0%	0	0.0%

Municipality	Total Population (U.S. Census 2020)	Landslide Incidence		Landslide Susceptibility	
		Moderate	% of Total	Moderate	% of Total
Fairport (V)	5,501	0	0.0%	0	0.0%
Gates (T)	29,167	3	0.0%	29,164	100.0%
Greece (T)	96,926	907	0.9%	94,586	97.6%
Hamlin (T)	8,725	915	10.5%	7,774	89.1%
Henrietta (T)	47,096	0	0.0%	8,787	18.7%
Hilton (V)	6,027	0	0.0%	6,027	100.0%
Honeoye Falls (V)	2,706	0	0.0%	0	0.0%
Irondequoit (T)	51,043	46,987	92.1%	3,687	7.2%
Mendon (T)	6,389	0	0.0%	0	0.0%
Ogden (T)	16,585	0	0.0%	16,585	100.0%
Parma (T)	10,190	1,294	12.7%	8,733	85.7%
Penfield (T)	39,438	0	0.0%	16,149	40.9%
Perinton (T)	39,128	0	0.0%	0	0.0%
Pittsford (T)	25,714	0	0.0%	0	0.0%
Pittsford (V)	1,419	0	0.0%	0	0.0%
Riga (T)	3,495	0	0.0%	3,495	100.0%
Rochester (C)	211,328	184,647	87.4%	25,478	12.1%
Rush (T)	3,490	0	0.0%	0	0.0%
Scottsville (V)	2,009	0	0.0%	2,009	100.0%
Spencerport (V)	3,685	0	0.0%	3,685	100.0%
Sweden (T)	6,140	0	0.0%	6,134	99.9%
Webster (T)	39,676	2,885	7.3%	36,625	92.3%
Webster (V)	5,651	0	0.0%	5,651	100.0%
Wheatland (T)	2,888	0	0.0%	2,722	94.3%
Monroe County (Total)	**753,109**	**256,266**	**34.0%**	**323,263**	**42.9%**

Source: Godt, 2001; U.S. Census 2020
Notes: C City
T Town
V Village

Impact on General Building Stock

In general, the building environment located in the high susceptibility zones and the population, structures, and infrastructure located downslope are vulnerable to this hazard. The Census blocks having their center (centroid) within the boundary of the landslide incidence hazard areas were used to calculate the estimated building stock exposed to this hazard. Table 5.4.8-4 lists the results of the general building stock exposed to this hazard.

Table 5.4.8-4. Number of Buildings located in the Landslide Hazard Area

Municipality	Total Number of Buildings	Landslide Incidence		Landslide Susceptibility	
		Moderate	% of Total	Moderate	% of Total
Brighton (T)	11,693	5,997	51.3%	298	2.5%
Brockport (V)	2,224	0	0.0%	2,224	100.0%
Chili (T)	11,534	20	0.2%	11,514	99.8%
Churchville (V)	1,112	0	0.0%	1,112	100.0%
Clarkson (T)	3,411	0	0.0%	3,411	100.0%
East Rochester (V/T)	2,924	0	0.0%	0	0.0%
Fairport (V)	2,394	0	0.0%	0	0.0%
Gates (T)	11,801	10	0.1%	11,791	99.9%
Greece (T)	36,414	409	1.1%	35,395	97.2%
Hamlin (T)	5,539	573	10.3%	4,944	89.3%
Henrietta (T)	15,982	0	0.0%	2,847	17.8%
Hilton (V)	2,143	0	0.0%	2,143	100.0%
Honeoye Falls (V)	1,155	0	0.0%	0	0.0%
Irondequoit (T)	21,885	20,236	92.5%	1,505	6.9%
Mendon (T)	3,835	0	0.0%	0	0.0%
Ogden (T)	7,407	0	0.0%	7,407	100.0%
Parma (T)	5,509	715	13.0%	4,723	85.7%
Penfield (T)	15,882	0	0.0%	6,619	41.7%
Perinton (T)	16,817	0	0.0%	0	0.0%
Pittsford (T)	10,590	0	0.0%	0	0.0%
Pittsford (V)	804	0	0.0%	0	0.0%
Riga (T)	2,356	0	0.0%	2,356	100.0%
Rochester (C)	89,392	76,911	86.0%	11,952	13.4%
Rush (T)	2,808	0	0.0%	0	0.0%
Scottsville (V)	1,069	0	0.0%	1,069	100.0%
Spencerport (V)	1,654	0	0.0%	1,654	100.0%
Sweden (T)	3,465	0	0.0%	3,460	99.9%
Webster (T)	16,660	1,438	8.6%	15,132	90.8%
Webster (V)	1,633	0	0.0%	1,633	100.0%
Wheatland (T)	1,926	0	0.0%	1,751	90.9%
Monroe County (Total)	**312,018**	**106,309**	**34.1%**	**134,940**	**43.2%**

Source: Godt 2001; Monroe County
Notes: C City
T Town
V Village

Impact on Critical Facilities

To estimate exposure, the approximate landslide hazard areas were overlaid upon the critical facilities and lifeline facilities. Table 5.4.8-5 and Table 5.4.8-6 list the critical facilities (e.g., police, fire, emergency operations centers [EOC], hospitals, and schools) that are located in the landslide susceptibility/ incidence hazard areas. In total, 744 critical facilities and 705 lifeline facilities are located in the moderate incidence landslide area, representing 39.4 and 39.8 percent of the County totals. 737 critical facilities and 693 lifeline facilities are located in the moderate susceptibility landslide area, representing 39.0 and 39.1 percent of the County totals.

Table 5.4.8-5. Number of Critical Facilities Located in the Moderate Incidence Landslide Hazard Area

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Moderate Incidence Landslide Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Brighton (T)	69	65	45	65.2%	42	64.6%
Brockport (V)	29	28	0	0.0%	0	0.0%
Chili (T)	111	102	3	2.7%	3	2.9%
Churchville (V)	24	23	0	0.0%	0	0.0%
Clarkson (T)	14	10	0	0.0%	0	0.0%
East Rochester (T/V)	31	29	0	0.0%	0	0.0%
Fairport (V)	17	16	0	0.0%	0	0.0%
Gates (T)	58	54	0	0.0%	0	0.0%
Greece (T)	165	158	2	1.2%	2	1.3%
Hamlin (T)	23	22	0	0.0%	0	0.0%
Henrietta (T)	111	103	0	0.0%	0	0.0%
Hilton (V)	21	20	0	0.0%	0	0.0%
Honeoye Falls (V)	17	16	0	0.0%	0	0.0%
Irondequoit (T)	103	100	97	94.2%	94	94.0%
Mendon (T)	21	20	0	0.0%	0	0.0%
Ogden (T)	42	38	0	0.0%	0	0.0%
Parma (T)	18	16	0	0.0%	0	0.0%
Penfield (T)	73	68	0	0.0%	0	0.0%
Perinton (T)	64	57	0	0.0%	0	0.0%
Pittsford (T)	45	39	0	0.0%	0	0.0%
Pittsford (V)	14	13	0	0.0%	0	0.0%
Riga (T)	20	18	0	0.0%	0	0.0%
Rochester (C)	639	605	594	93.0%	561	92.7%
Rush (T)	29	26	0	0.0%	0	0.0%
Scottsville (V)	14	13	0	0.0%	0	0.0%
Spencerport (V)	13	13	0	0.0%	0	0.0%
Sweden (T)	11	11	0	0.0%	0	0.0%
Webster (T)	55	53	3	5.5%	3	5.7%
Webster (V)	16	15	0	0.0%	0	0.0%
Wheatland (T)	23	21	0	0.0%	0	0.0%
Monroe County (Total)	**1,890**	**1,773**	**744**	**39.4%**	**705**	**39.8%**

Source: Godt 2001; Monroe County

Notes: C City
T Town
V Village

Table 5.4.8-6. Number of Critical Facilities Located in the Moderate Susceptibility Landslide Hazard Area

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Moderate Susceptibility Landslide Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Brighton (T)	69	65	2	2.9%	2	3.1%
Brockport (V)	29	28	29	100.0%	28	100.0%
Chili (T)	111	102	108	97.3%	99	97.1%
Churchville (V)	24	23	24	100.0%	23	100.0%
Clarkson (T)	14	10	14	100.0%	10	100.0%
East Rochester (T/V)	31	29	0	0.0%	0	0.0%
Fairport (V)	17	16	0	0.0%	0	0.0%
Gates (T)	58	54	58	100.0%	54	100.0%
Greece (T)	165	158	158	95.8%	151	95.6%
Hamlin (T)	23	22	23	100.0%	22	100.0%
Henrietta (T)	111	103	20	18.0%	18	17.5%
Hilton (V)	21	20	21	100.0%	20	100.0%
Honeoye Falls (V)	17	16	0	0.0%	0	0.0%
Irondequoit (T)	103	100	6	5.8%	6	6.0%
Mendon (T)	21	20	0	0.0%	0	0.0%
Ogden (T)	42	38	42	100.0%	38	100.0%
Parma (T)	18	16	18	100.0%	16	100.0%
Penfield (T)	73	68	23	31.5%	23	33.8%
Perinton (T)	64	57	0	0.0%	0	0.0%
Pittsford (T)	45	39	0	0.0%	0	0.0%
Pittsford (V)	14	13	0	0.0%	0	0.0%
Riga (T)	20	18	20	100.0%	18	100.0%
Rochester (C)	639	605	42	6.6%	41	6.8%
Rush (T)	29	26	0	0.0%	0	0.0%
Scottsville (V)	14	13	14	100.0%	13	100.0%
Spencerport (V)	13	13	13	100.0%	13	100.0%
Sweden (T)	11	11	11	100.0%	11	100.0%
Webster (T)	55	53	52	94.5%	50	94.3%
Webster (V)	16	15	16	100.0%	15	100.0%
Wheatland (T)	23	21	23	100.0%	21	100.0%
Monroe County (Total)	**1,890**	**1,773**	**737**	**39.0%**	**693**	**39.1%**

Source: *Godt 2001; Monroe County*
Notes: *C* *City*
T *Town*
V *Village*

Table 5.4.8-7 provides the number of lifelines in each FEMA lifeline category located in the landslide hazard areas.

Table 5.4.8-7. Number of Lifelines located in the Landslide Hazard Areas

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Moderate Incidence Landslide Hazard Area	Number of Lifelines Located in the Moderate Susceptibility Landslide Hazard Area
Communications	68	20	37
Energy	14	3	10
Food, Water, Shelter	286	67	162
Hazardous Material	1	1	0
Health and Medical	93	40	37
Safety and Security	1,274	564	424
Transportation	36	10	22
Monroe County (Total)	**1,772**	**705**	**692**

Source: Godt 2001; Monroe County
Notes: C City
T Town
V Village

Impact on Economy

The impact of a landslide on the economy and estimated dollar losses are difficult to measure. As stated earlier, landslides can impose direct and indirect impacts on society. Direct costs include the actual damage sustained by buildings, property, and infrastructure. Indirect costs, such as clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity are difficult to measure. Additionally, landslides threaten transportation corridors, fuel and energy conduits, and communication lines (USGS 2003). Estimated potential damage to general building stock can be quantified as discussed above. For the purposes of this analysis, damage to general building stock is discussed below.

Direct building losses are the estimated costs to repair or replace the damage caused to the building. There are zero buildings located in the high incidence and high/moderate susceptibility/incidence landslide hazard areas. A total risk exposure of approximately $129 billion or 41.2-percent of Monroe County's total inventory is estimated for the buildings located in the landslide moderate incidence area. A total risk exposure of approximately $115 billion or 36.7 percent of Monroe County's total inventory is estimated for the buildings located in the landslide moderate susceptibility area. Losses to Monroe County's total building inventory would impact Monroe County's tax base and the local economy.

Interstates 90, 390, 490, and 530 and the Lake Ontario State Parkway traverse the moderate incidence and moderate/susceptibility/low incidence hazard areas. Many of the County's state highways are also located within the hazard area. Refer to Figure 5.4.8-1 to see the location of major roadways in the County in relation to the hazard area.

Table 5.4.8-8. Estimated General Building Stock Replacement Cost Value in the Landslide Hazard Area

Municipality	Total GBS RCV	Landslide Incidence		Landslide Susceptibility	
		Moderate	% of Total	Moderate	% of Total
Brighton (T)	$14,443,886,002	$9,422,351,153	65.2%	$632,361,466	4.4%
Brockport (V)	$5,158,789,593	$0	0.0%	$5,158,789,593	100.0%

Table 5.4.8-8. Estimated General Building Stock Replacement Cost Value in the Landslide Hazard Area

Municipality	Total GBS RCV	Landslide Incidence		Landslide Susceptibility	
		Moderate	% of Total	Moderate	% of Total
Chili (T)	$9,206,843,885	$154,896,989	1.7%	$9,051,946,896	98.3%
Churchville (V)	$938,164,078	$0	0.0%	$938,164,078	100.0%
Clarkson (T)	$1,887,392,030	$0	0.0%	$1,887,392,030	100.0%
East Rochester (V/T)	$3,440,171,127	$0	0.0%	$0	0.0%
Fairport (V)	$2,281,456,075	$0	0.0%	$0	0.0%
Gates (T)	$12,220,599,285	$74,526,464	0.6%	$12,146,072,821	99.4%
Greece (T)	$26,954,378,684	$327,172,568	1.2%	$26,384,056,270	97.9%
Hamlin (T)	$2,318,778,027	$183,674,311	7.9%	$2,125,249,787	91.7%
Henrietta (T)	$23,460,566,322	$0	0.0%	$4,191,877,437	17.9%
Hilton (V)	$2,120,287,988	$0	0.0%	$2,120,287,988	100.0%
Honeoye Falls (V)	$1,813,180,690	$0	0.0%	$0	0.0%
Irondequoit (T)	$13,427,006,840	$12,715,554,454	94.7%	$674,110,440	5.0%
Mendon (T)	$2,852,155,915	$0	0.0%	$0	0.0%
Ogden (T)	$5,558,087,440	$0	0.0%	$5,558,087,440	100.0%
Parma (T)	$3,373,412,574	$251,788,057	7.5%	$3,095,325,391	91.8%
Penfield (T)	$11,119,233,991	$0	0.0%	$4,389,584,462	39.5%
Perinton (T)	$13,125,415,407	$0	0.0%	$0	0.0%
Pittsford (T)	$10,686,774,000	$0	0.0%	$0	0.0%
Pittsford (V)	$1,776,834,511	$0	0.0%	$0	0.0%
Riga (T)	$1,539,492,845	$0	0.0%	$1,539,492,845	100.0%
Rochester (C)	$119,943,371,056	$106,058,619,286	88.4%	$13,258,329,376	11.1%
Rush (T)	$1,816,445,354	$0	0.0%	$0	0.0%
Scottsville (V)	$908,716,753	$0	0.0%	$908,716,753	100.0%
Spencerport (V)	$1,580,844,696	$0	0.0%	$1,580,844,696	100.0%
Sweden (T)	$3,402,258,236	$0	0.0%	$3,344,197,382	98.3%
Webster (T)	$11,510,191,170	$735,955,114	6.4%	$10,730,075,460	93.2%
Webster (V)	$3,634,066,282	$0	0.0%	$3,634,066,282	100.0%
Wheatland (T)	$2,509,077,040	$0	0.0%	$2,247,363,308	89.6%
Monroe County (Total)	**$315,007,877,896**	**$129,924,538,398**	**41.2%**	**$115,596,392,202**	**36.7%**

Source: Godt 2001; Monroe County

Notes: GBS General Building Stock;
RCV Replacement Cost Value.
C City
T Town
V Village

Impact on the Environment

A landslide event alters the landscape. In addition to changes in topography, vegetation and wildlife habitats may be damaged or destroyed. Soil and sediment runoff will accumulate downslope, potentially blocking waterways and roadways and impacting quality of streams and other water bodies. Additional environmental impacts include loss of forest productivity.

Furthermore, soil and sediment runoff can accumulate downslope potentially blocking waterways and roadways and impacting quality of streams and other water bodies. Mudflows that erode into downstream waterways can threaten the life of freshwater species (USGS 2020). The impacts of eroded landscape can travel for miles downstream into adjacent waterways and create issues for surrounding watersheds.

Cascading Impacts On Other Hazards

Landslide events can have cascading impacts on utility failure in Monroe County. As discussed in earlier sections, landslides may disrupt the functionality of utilities if the debris falls, topples, or spreads over the utilities providing services to the County. For example, electric utilities may become disconnected if power lines are broken from displaced geologic material. Water utilities may become breached with excess debris and/or contaminants carried by landslide events.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The county considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

As discussed in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County. Any areas of growth located in areas with moderate landslide incidence or susceptibility could be potentially impacted by the landslide hazard. Please refer to the specific areas of development indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan.

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). Changes in the density of the population can impact the number of persons exposed to landslide. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

Climate is defined not simply as average temperature and precipitation, but also by the type, frequency, and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such as severe storms, including those that may bring intense and prolonged precipitation (EPA 2013). An increase in rainfall intensity and duration will saturate the soil and potentially erode the local landscape and impact slope stability. This may lead to an increase of landslide events in Monroe County.

While predicting changes in events under a varying climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (EPA 2013). The potential effects of climate change on Monroe County's vulnerability to landslide events shall need to be considered as a greater understanding of regional climate change impacts develop.

Change of Vulnerability Since 2017 HMP

For this HMP Update, the risk for the County's population, building stock, and critical facilities was assessed, and, overall, the County's landslide vulnerability has remained unchanged.

5.4.9 Severe Storm

This section provides a profile and vulnerability assessment of the severe storm hazard for Monroe County.

5.4.9.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections and the probability of future occurrences for the severe storm hazard.

Hazard Description

Severe storm events are a common occurrence in Monroe County. A variety of severe storm types, such as thunderstorms, lightning, hail, tornadoes, high winds, and tropical cyclones have damaged property and infrastructure, disrupt power, downing trees and power lines, and causing injuries and fatalities. The following section describes the different severe storm types that impact Monroe County.

Thunderstorms

Thunderstorms can lead to flooding, landslides, strong winds, and lightning. Roads could become impassable from flooding, downed trees or power lines, or a landslide. Downed utility poles can lead to utility losses, such as electricity, phone, and water (from loss of pumping and filtering capabilities).

A thunderstorm is a local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder (NWS, National Weather Service Glossary 2021). A thunderstorm forms from a combination of moisture, rapidly rising warm air, and a force capable of lifting air, such as a warm and cold front, a sea breeze, or a mountain. Thunderstorms form from the equator to as far north as Alaska. Although thunderstorms generally affect a small area when they occur, they have the potential to become dangerous due to their ability in generating tornadoes, hailstorms, strong winds, flash flooding, and lightning. The NWS considers a thunderstorm *severe* only if it produces damaging wind gusts of 58 mph or higher or large hail one inch (quarter size) in diameter or larger or tornadoes (NWS, National Weather Service Glossary 2021).

Lightning

Lighting 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. All thunderstorms produce lightning and are very dangerous. Lightning ranks as one of the top weather killers in the United States, killing approximately 50 people and injuring hundreds each year. Lightning can occur anywhere there is a thunderstorm. Lightning can be cloud to air, cloud to cloud, and cloud to ground.

Lightning can damage homes and injure people. In the United States, an average of 300 people are injured and 80 people are killed by lightning each year. Typical thunderstorms are 15 miles in diameter and last an average of 30 minutes. An estimated 100,000 thunderstorms occur each year in the United States, with approximately 10 percent of them classified as severe. During the warm season, thunderstorms are responsible for most of the rainfall.

Hailstorms

Hail forms inside a thunderstorm where there are strong updrafts of warm air and downdrafts of cold water. If a water droplet is picked up by the updrafts, it can be carried well above the freezing level. Water droplets freeze when temperatures reach 32 °F or colder. As the frozen droplet begins to fall, it might thaw as it moves into warmer air toward the bottom of the thunderstorm, or the droplet might 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. The frozen droplet, with many layers of ice, falls to the ground as hail (NSSL 2021).

High Winds

Wind begins with differences in air pressures. It is 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 by other severe weather events such as thunderstorms, tornadoes, hurricanes, and tropical storms (NWS, Air Pressure and Wind 2012).

Tornadoes

A tornado is a violently rotating column of air that extends from a thunderstorm to the ground with an average forward speed of 30 miles per hour (mph). Tornadoes typically develop from either a severe thunderstorm or hurricane as cool air rapidly overrides a layer of warm air. Tornadoes can occur at any time of the year, with peak seasons at different times for different states (NWS, Thunderstorms, Tornadoes, Lightning...Nature's Most Violent Storms 2010).

Tropical Cyclones

Tropical cyclones (hurricanes) are fueled by a different heat mechanism than other cyclonic windstorms such as nor'easters and polar lows. The characteristic that separates a tropical storm from another cyclonic system is that at any height in the atmosphere, the center of a tropical storm will be warmer than its surroundings, a phenomenon called "warm core" storm systems (NOAA 2011)Tropical cyclones strengthen when water evaporated from the ocean is released as the saturated air rises, resulting in condensation of water vapor contained in the moist air. Tropical cyclones begin as disturbed areas of weather, often referred to as tropical waves. As the storm organizes, it is designated as a tropical depression.

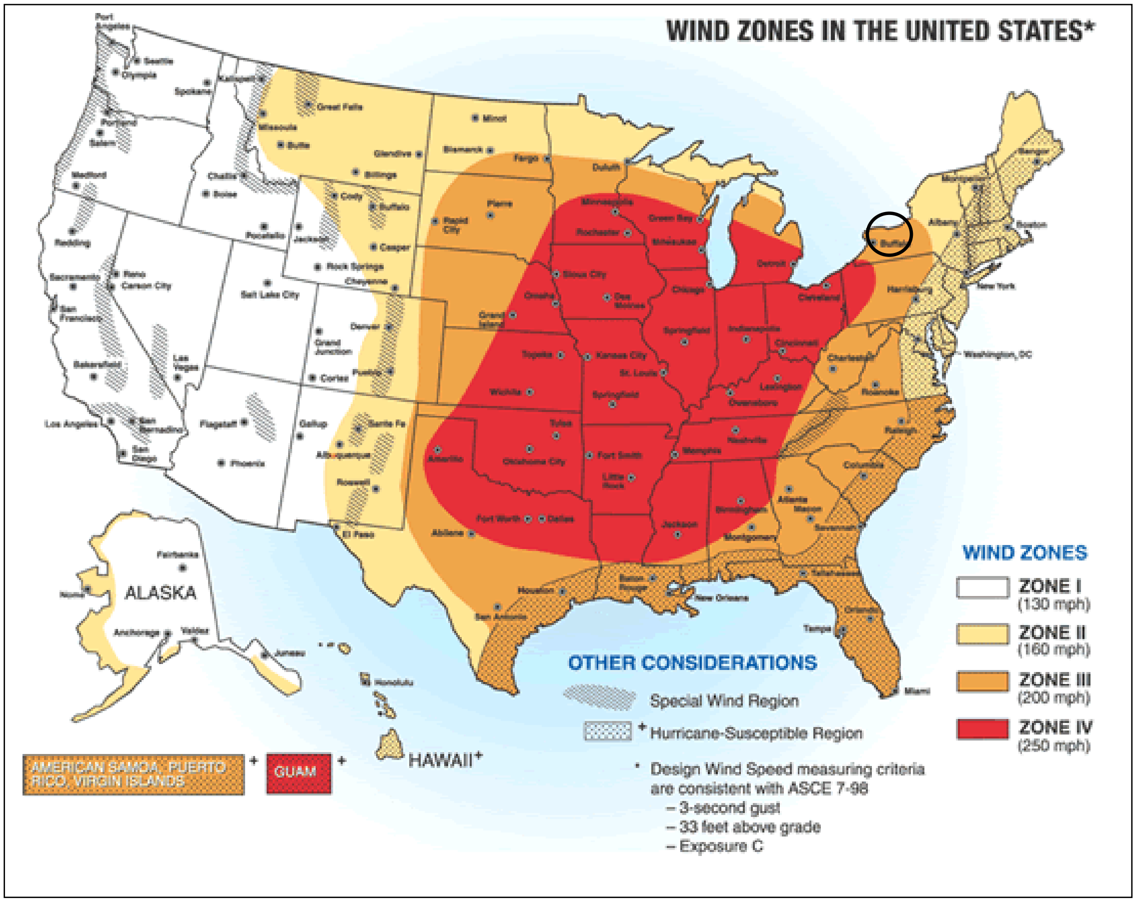
A tropical storm system is characterized by a low-pressure center and numerous thunderstorms that produce strong winds of 39 to 73 mph and heavy rain. A hurricane is a tropical storm that attains hurricane status when its wind speed reaches 74 mph or higher. Tropical systems may develop in the Atlantic between the Lesser Antilles and the African coast or may develop in the warm tropical waters of the Caribbean and Gulf of Mexico. These storms may move up the Atlantic coast of the United States and impact the eastern seaboard or move into the United States through the states along the Gulf Coast, bringing wind and rain as far north as New England before moving offshore and heading east.

Location

All of Monroe County is exposed to thunderstorms, lightning, hailstorms, high winds, tornadoes, and tropical cyclones. Monroe County is located in Western New York State; its entire northern border is Lake Ontario. Despite Monroe County's inland location, coastal storms, such as hurricanes and tropical storms, can impact the County. Hurricanes and tropical storms can impact Monroe County from June to November, the official eastern U.S. hurricane season; however, late July to early October is the most likely period for hurricanes and tropical storms to impact the County when North Atlantic Ocean waters are warmest (NYS DHSES 2019)Although one of the most severe impacts associated with hurricanes is storm surge, due to Monroe County's location, storm surge is not a concern for the County and has not been detailed in this profile.

According to the FEMA Winds Zones of the United States map, Monroe County is located within Wind Zone III where wind speeds can reach up to 200 mph. Figure 5.4.9-1 illustrates wind zones across the United States, which indicate the impacts of the strength and frequency of wind activity per region. The information on the figure is based on 40 years of tornado data and 100 years of hurricane data collected by FEMA.

Figure 5.4.9-1. Wind Zones in the United States



Source: *FEMA 2012*
Note: *The black oval indicates the approximate location of Monroe County.*

Extent

The extent (severity or magnitude) of a severe storm is largely dependent upon the most damaging aspects of each type of severe weather. This section describes the extent of thunderstorms, lighting, hail, windstorms, tornadoes, and tropical cyclones in Monroe County.

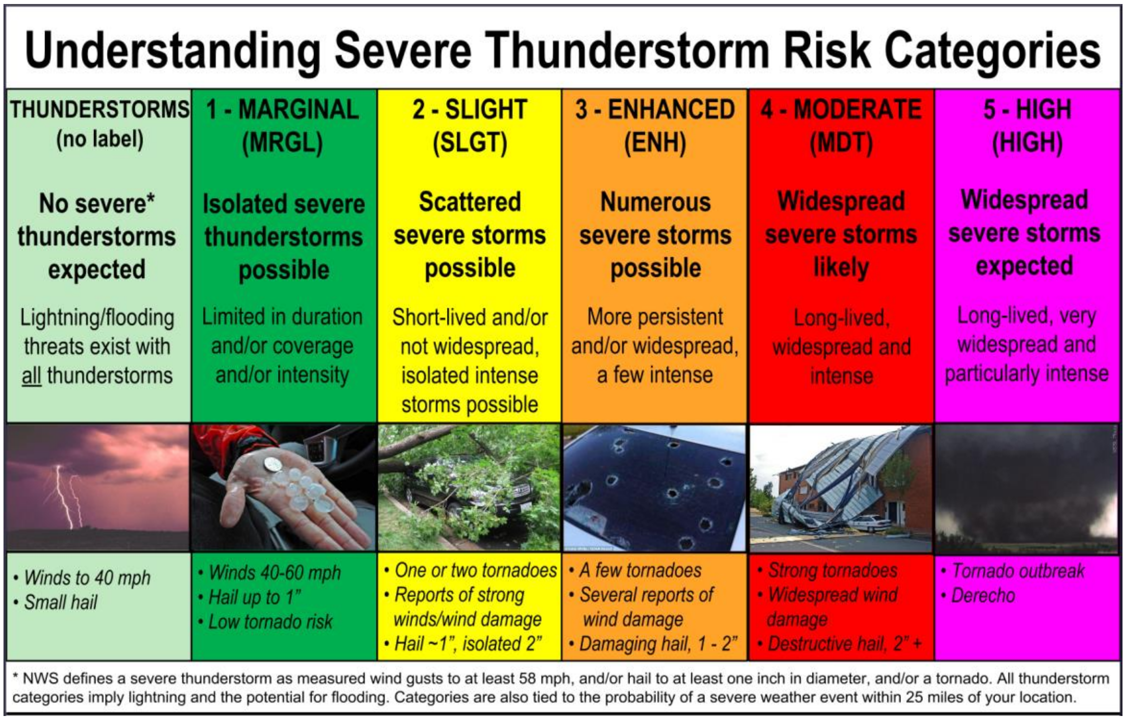
Thunderstorms

Severe thunderstorm watches and warnings are issued by the local NWS office and the Storm Prediction Center (SPC). The NWS and SPC will update the watches and warnings and notify the public when they are no longer in effect. NWS issues statements, watches, and warnings for thunderstorms:

- 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 40-58 mph or small hail <1 inch.
- 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 still 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 (NWS 2020)

Figure 5.4.9-2 presents the severe thunderstorm risk categories, as provided by the SPC.

Figure 5.4.9-2. Severe Thunderstorm Risk Categories



Source: NOAA SPC 2017

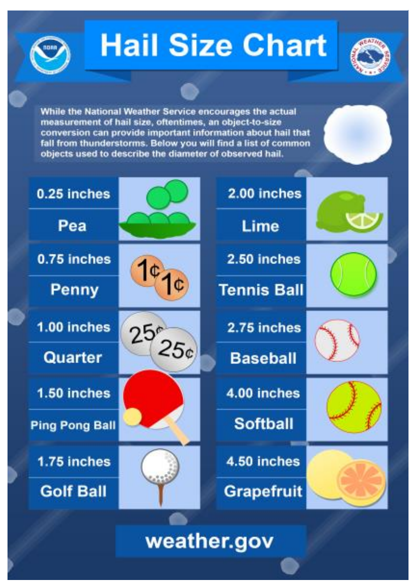
Lightning

Lightning is associated with moderate to severe thunderstorms. Lightning severity is determined by the frequency of lightning strikes during a storm. The New York City Office of Emergency Management notes that lightning strikes occur with moderate frequency in the State of New York, with 3.8 strikes occurring per square mile each year. Multiple devices are available to track and monitor the frequency of lightning (NYC Emergency Management 2020).

Hailstorms

The severity of hail is measured by duration, hail size, and geographic extent. Hail can exhibit a variety of sizes, though only the very largest hail stones pose serious risk to people, if exposed (DHSES 2019). The size of hail is estimated by comparing it to a known object. The Tornado and Storm Research Organization (TORRO) Hailstorm Intensity Scale (H0 to H10) relates typical damage and hail sizes. Refer to Appendix H (Supplementary Data) for a table that outlines the TORRO scale.

Figure 5.4.9-3. Hail Size Chart



High Winds

The following table provides the descriptions of winds and their associated sustained wind speed used by the NWS during wind-producing events. The Beaufort wind scale, developed in 1805, is also used today to classify wind conditions, and is provided in Appendix H (Supplementary Data).

Table 5.4.9-1. 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 2010
mph miles per hour

The NWS issues advisories and warnings for winds that are typically site-specific. The NWS issues high wind advisories, watches, and warnings when wind speeds can pose a hazard or are life threatening. The criterion for each of these varies from state to state. According to the NWS (2020), wind warnings and advisories for New York State are as follows:

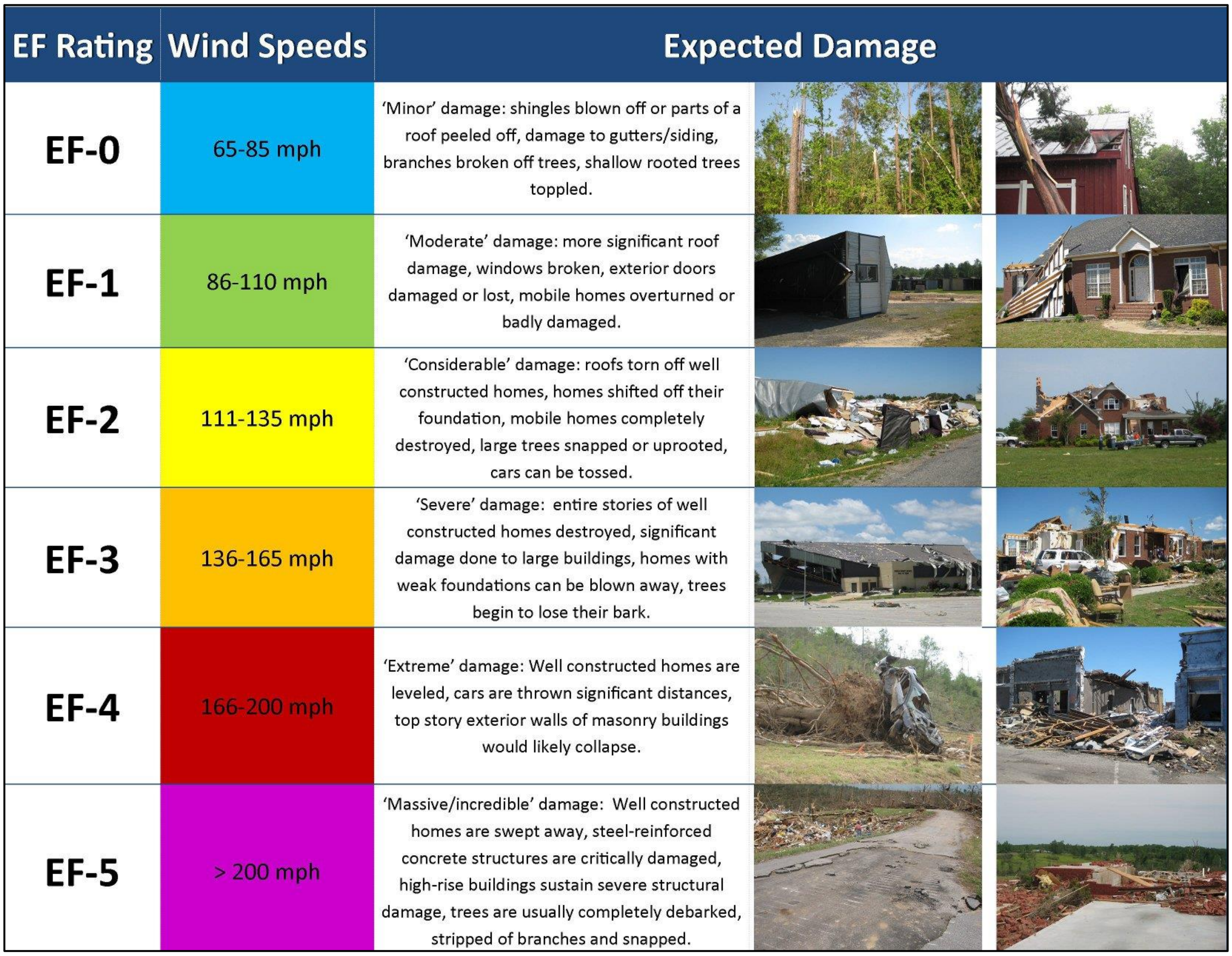
- *High Wind Warnings* are issued when sustained wind speeds of 40 mph or greater lasting for one hour or longer or for winds of 58 mph or greater for any duration or widespread damage are possible.
- *Wind Advisories* are issues when sustained winds of 30 to 39 mph are forecast for one hour or longer,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

Tornadoes

The magnitude or severity of a tornado is categorized using the Enhanced Fujita Tornado Intensity Scale (EF Scale). This is the scale now used exclusively for determining tornado ratings by comparing wind speed and actual damage. Figure 5.4.9-4 illustrates the relationship between EF ratings, wind speed, and expected tornado damage.

Tornado watches and warning are issued by the local NWS office. A tornado watch is released when tornadoes are possible in an area. A tornado warning means a tornado has been sighted or indicated by weather radar. The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly, that little, if any, advance warning is possible (NOAA SPC 2018).

Figure 5.4.9-4 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: NOAA 2020

Tropical Cyclones

The extent of a hurricane or tropical storm is commonly categorized in accordance with the Saffir-Simpson Hurricane Wind Scale, which assigns a designation of tropical storm for storms with sustained wind speeds below 74 mph and a hurricane category rating of 1–5 based on a hurricane's increasing sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered *major hurricanes* because of their potential for significant loss of life and damage. Tropical Storms and Category 1 and 2 storms are still dangerous and require preventative measures (NOAA 2020). Figure 5.4.9-5 presents this scale, which is used to estimate the potential property damage and flooding expected when a hurricane makes landfall. Most tropical cyclones that impact Monroe County are remnants of former tropical storms or hurricanes.

Figure 5.4.9-5 The Saffir-Simpson Scale

Source: NOAA 2020

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with severe storms throughout New York State and Monroe County; therefore, the loss and impact information for many events varies depending on the source. The accuracy of monetary figures discussed is based on the available information in cited sources.

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, New York State was included in 45 FEMA declared severe storm or hurricane specific disasters (DR) or emergency declarations (EM). Monroe County was included in 5 of these 45-related declarations (Table 5.4.9-2). In addition, Monroe County was included in a special hurricane related emergency declaration for support for the Hurricane Katrina evacuation in 2005.

Table 5.4.9-2. FEMA DR and EM Declarations for Severe Storm Events in Monroe County, 1954 to 2020

FEMA Declaration Number	Date(s) Of Event	Event Type	Details
DR-1244	September 7, 1998	Severe Weather	New York - Severe Weather
DR-1233	June 25, 1998 - July 10, 1998	Severe Weather	New York Severe Storms and Flooding
DR-1534	May 13, 2004 - June 17, 2004	Severe Weather	New York Severe Storms and Flooding
DR-1564	August 13, 2004 - September 16, 2004	Severe Weather	New York Severe Storms and Flooding
EM-3351	Oct 27, 2012 - Nov 8, 2012	Hurricane	New York Hurricane Sandy

Source: FEMA 2022

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was included in the following USDA-designated agricultural disasters that included or may have included losses due to severe storms:

- S3885 - 2015 Excessive Rain, High Winds, Hail, Lightning, and Tornado
- S4595 - 2019 Hail (USDA 2022)

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are low the following years as well. USDA records indicate that Monroe County has experienced crop losses from severe storm events in the years when USDA disasters were declared. Table 5.4.9-3 provides details regarding crop losses in Monroe County according to USDA records.

Table 5.4.9-3. USDA Crop Losses from Severe Storms in Monroe County (2015-2022)

Year	Crop Type	Cause of Loss	Losses
2015	Apples	Hail	$57,906
2015	Apples	Wind/Excess Wind	$29,122
2015	All Other Crops	Hail	$3,870
2019	Corn	Wind/Excess Wind	$5,112
2019	Apples	Hail	$23,503

Source: USDA 2022

Previous Events

Table 5.4.9-4 identifies the known severe storm events that impacted Monroe County between 2015 and 2022. For events prior to 2015, refer to Appendix H (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Table 5.4.9-4. Severe Storm Events in Monroe County, 2015 to 2022

Dates of Event	Event Type	FEMA Declaration Number	Monroe County Designated?	Location	Losses / Impacts
January 4, 2015	High Wind	N/A	N/A	Monroe County	Deepening low pressure tracked from western Lake Erie across far southern Ontario to Quebec dragging a cold front across the region. Strong winds increased to near 60 mph about two to three hours after the cold front passage. The strong winds downed trees and wires across western New York. Scattered power outages resulted. Some specific damage locations included St. Paul Boulevard in Irondequoit. The County experienced an estimated $20,000 in property damage.
April 10, 2015	High Wind	N/A	N/A	Monroe County	In the wake of a cold front, strong, damaging winds developed across parts of the area mainly downwind of Lakes Erie and Ontario. Wind gusts were measured to 62 mph at the Buffalo Airport, 60 mph at the Rochester Coast Guard and 58 mph at the Niagara Falls and Rochester Airports. The winds downed trees and powers lines across the eight county area. Tens of thousands were without power. The County experienced an estimated $20,000 in property damage.
May 27, 2015	Thunderstorm Wind	N/A	N/A	Riga, Severance	A line of thunderstorms crossed the Niagara Frontier and western Finger Lakes during the evening hours. Two storms merged over Monroe County and produced isolated damage. Trees and power lines were reported downed by thunderstorm winds near Churchville and Chili. Law enforcement reported trees and wires down by thunderstorm winds in the Town of Riga and Severance. Property damage was an estimated $25,000.
June 10, 2015	Thunderstorm Wind, Hail	N/A	N/A	Ogden, Gates, Chili, Maplewood, Henrietta, Pittsford, Blackwatch Hills, Bushnell Basin	Thunderstorms developed along outflow boundary in a warm, humid airmass during the late evening hours. The thunderstorms produced damaging winds and large hail. Although wind gusts were measured to 58 mph at the Rochester airport, after a NWS survey of the damage it was estimated that wind gusts were probably 65 to 70 mph. The storms produced a swath of damage extending across southern Monroe. The storms downed trees and power lines throughout a three-county region with several reports of significant structural and property damage. Hail, up to one inch in diameter, was reported in Fairport. The NWS surveyed damage in Ogden Center, Gate, Chili, Henrietta, Pittsford, Fairport and Bushnell Basin. Law enforcement reported numerous trees and wires down from thunderstorm winds near Ogden Center in the Town of Ogden. Social media contained reports of numerous trees and wires down from thunderstorm winds near Gates. Law enforcement reported numerous trees and wires down from thunderstorm winds near Chili Center. Thunderstorm winds downed trees and poles at the Double Tree Hotel near Henrietta. Several cars were damaged by downed trees in Henrietta. Law enforcement reported numerous trees and wires down from thunderstorm winds near Pittsford. A power transformer was damage near South Main Street and Mile Post Lane. Social media showed numerous reports of downed trees and wires in Bushnell Basin. The County experienced an estimated $130,000 in property damage.
June 12, 2015	Thunderstorm Wind	N/A	N/A	North Rush	Two lines of showers and thunderstorms moved across the region during the afternoon and early evening hours. The strong thunderstorms produced damaging winds that downed trees and powers lines across the western southern tier and Finger Lakes region.

Dates of Event	Event Type	FEMA Declaration Number	Monroe County Designated?	Location	Losses / Impacts
					Law Enforcement reported trees and wires downed by thunderstorm winds on East River Road. The County experienced an estimated $10,000 in property damage.
June 23, 2015	Thunderstorm Wind	N/A	N/A	Honeoye Falls, Rush, Mendon	An area of showers and thunderstorms moved across the lower Great Lakes region during the overnight and very early morning hours. The first round of showers moved across southern Ontario and cross the Buffalo area before moving across the Genesee Valley and western Finger Lakes. The second round moved across Lake Erie into the western southern tier. The thunderstorms produced strong winds that downed trees and power lines. Several of the downed trees damage structures and cars. Some roads were temporarily blocked by debris. News reports of trees and wires downed by thunderstorm winds at Honeoye Falls Airport were received. Law enforcement reported trees and wires downed by thunderstorm winds in Rush and Mendon. The County experienced an estimated $30,000 in property damage.
July 7, 2015	Thunderstorm Wind	N/A	N/A	Spencerport	Thunderstorms accompanied the passage of a cold front across the region. Thunderstorm winds produced wind gusts that downed trees and power lines. Damage from downed trees was reported in Spencerport. Winds were estimated near 60 mph. Total property damage was an estimated $15,000.
January 10, 2016	High Wind	N/A	N/A	Monroe County	On Sunday, January 10th, deep low pressure crossed Ohio during the morning, southern Ontario through the day, reaching Quebec Sunday evening. The system dragged a cold front across the region during the late afternoon hours. Ahead of the cold front, southeast wind resulted in downslope wind off the Chautauqua Ridge. Across the entire south shore of Lake Ontario, winds increased following the front. The strong winds brought down trees and power lines. Utilities reported thousands without power scattered throughout the region. Some of the falling trees damaged homes and automobiles. Specific wind gusts downwind of Lake Ontario included 58 mph at Rochester Airport. The County experienced an estimated $15,000 in property damage.
May 29, 2016	Thunderstorm Wind	N/A	N/A	Mumford	With warm, humid air in place, the passage of an upper air disturbance initiated scattered showers and thunderstorms across the region. Some of these storms reached produced damaging wind gusts that downed trees and power lines. Law enforcement reported a large tree downed by thunderstorm winds at the intersection of Oatka Creek Road and Route 36. Total property damage was an estimated $15,000.
June 20, 2016	Hail	N/A	N/A	Brighton	Thunderstorms developed ahead of an approaching cold front. Several of the storms produced three quarter inch hail near Brighton.
July 1, 2016	Thunderstorm Wind	N/A	N/A	Rochester, Penfield	Thunderstorms developed as a cold front interacted with the lake breezes off Lakes Erie and Ontario. Nickel-sized hail fell in Bemus Point, Chautauqua County, and near Shelby, Orleans County. Thunderstorms the moved into Monroe County briefly pulsed up and produced damage in Rochester and Penfield before rapidly weakening. In Rochester, a tree fell onto a house on Meredith Street. In Penfield, several large tree limbs were downed. One falling tree caused minor structural damage to the corner of a house. Total property damage was an estimated $35,000.

Dates of Event	Event Type	FEMA Declaration Number	Monroe County Designated?	Location	Losses / Impacts
August 13, 2016	Thunderstorm Wind	N/A	N/A	Greece, Brighton	Numerous thunderstorms developed on outflow and lake breeze boundaries. The thunderstorms downed trees and wires throughout the region. Law enforcement reported wires downed by thunderstorm winds in Greece and Brighton. Total property damage was an estimated $10,000.
January 11, 2017	High Wind	N/A	N/A	Monroe County	Gusty winds accompanied the passage of a deepening storm system crossing the upper Great Lakes. Wind gusts were measured to 58 mph at Rochester Airport. The strong winds downed trees and power lines. In the region, several thousand customers were without power. Numerous roads were closed because they were blocked by fallen trees. Total property damage was an estimated $125,000.
March 1-2, 2017	High Wind	N/A	N/A	Monroe County	Strong winds followed the passage of a cold front across the area. The winds increased during the evening hours of March first before subsiding by daybreak on the second. Gusts as high as 64 mph were measured. The strong winds downed trees and power lines throughout the region. Falling trees damaged homes or automobiles in: Rochester (on North Clinton Avenue), Webster, and Irondequoit. Measured wind gusts included 64 mph at Rochester Airport. $40,000 in property damages were reported.
March 8, 2017	High Wind	N/A	N/A	Monroe County	Unusually deep low pressure moved from northwest Ontario across Hudson Bay. The low brought strong winds to the entire region with sustained winds up to 49 mph and wind gusts as high as 81 mph. A significant amount of damage resulted with hundreds of thousands left without power, over 100,000 in Monroe County alone. Trees and power lines were downed. Power poles were snapped. In Chili, a large section of fence was impaled into the second story of a house. Numerous flights into the Buffalo and Rochester Airports had to be diverted due to the winds. This in turn resulted in cancellation of some outbound flights from those airports. Measured wind gusts included: 81 mph at Rochester Airport (Monroe County), 67 mph at Brockport (Monroe County), and 47 mph at Gates (Monroe County). Falling trees damaged homes or automobiles in Irondequoit, Braddock Bay, Webster and Brighton (Monroe County). $1.5 million in property damages were reported.
April 4, 2017	High Wind	N/A	N/A	Monroe County	Strong winds followed the passage of a cold front across the area. The winds increased during the afternoon hours and evening hours of April 4th. Wind gusts as high as 59 mph were measured. The strong winds downed trees and power lines throughout the region. A portion of Route 19 in Warsaw was closed by downed trees and wires. $30,000 in property damage was reported.
May 1, 2017	Thunderstorm Wind	N/A	N/A	Gates	Thunderstorm winds downed trees on Pasadena Drive and knocked a tree onto a house on Tarwood Drive in Gates. Total property damage was an estimated $35,000.
May 14, 2017	Hail	N/A	N/A	Rochester	A thunderstorm moving across the Finger Lakes dropped pea- to dime-sized hail on Rochester and the southeast suburbs, including the annual Lilac Festival.
June 15, 2017	Thunderstorm Wind	N/A	N/A	Mendon	Under the influence of a warm, moist airmass, thunderstorms developed across western and north-central New York. Law enforcement reported trees and wires downed by thunderstorm winds in Mendon. Total property damage was an estimated $14,000.
June 18, 2017	Thunderstorm Wind	N/A	N/A	Scottsville, Brighton	Broadcast media reported trees and wires downed by thunderstorm winds on Quaker Road in Scottsville. Total property damage was an estimated $10,000. Social media had reported of trees and wires downed by thunderstorm winds in Brighton. Total property damage was estimated at $12,000.

Dates of Event	Event Type	FEMA Declaration Number	Monroe County Designated?	Location	Losses / Impacts
July 8, 2017	Lightning	N/A	N/A	Monroe County	A cold front slowly advanced its way across the eastern Great Lakes region during the overnight and early morning hours. The thunderstorms produced damaging winds and large hail. The thunderstorm winds downed trees and power lines. Route 183 near Williamstown and Route 11 in Hastings were blocked by debris. Two homes in Monroe County, one in Brockport on Monroe-Orleans County Line Road and one in Penfield on Pipers Meadow Trail, were struck by lightning during the pre-dawn hours. All occupants were able to get out without injury. Total property damage was an estimated $45,000.
July 24, 2017	Lightning	N/A	N/A	Rochester Airport	Thunderstorms developed during the early morning hours along a warm front extending across the Genesee Valley and Finger Lakes. A lightning strike hit the Air Traffic Control Tower. No one was injured or evacuated and flights were not affected however smoke was reported in the air traffic control room. $5,000 in property damage was reported.
August 1, 2017	Hail	N/A	N/A	Spencerport	Thunderstorms developed in afternoon summertime warmth and humidity. One of the storms that developed along the boundary of the Lakes Erie and Ontario lake breezes produced large hail. Hail up to one inch in diameter was reported in near Spencerport.
August 22, 2017	Thunderstorm Wind	N/A	N/A	Point Pleasant, Henrietta	Three waves of severe storms moved across western and north-central NY making for an almost 8-hour severe event. Law enforcement reported wires downed by thunderstorm winds on Laser Street, as well as trees downed by thunderstorm winds that were blocking Brighton-Henrietta Town Line Road. Total property damage was an estimated $65,000.
October 15, 2017	Thunderstorm Wind	N/A	N/A	Crittenden, Maplewood, Beechwood, Barnard, Webster, Railroad Mills, Bushnell Basin, Fairport, Blackwatch Hills	Thunderstorms ahead of and along an approaching strong cold front produced damaging winds during the afternoon and early evening hours. The thunderstorm winds downed trees and power lines throughout the region. Wind gusts were measured to 63 mph at Rochester Airport. Law enforcement reported trees and wires downed by thunderstorm winds near Genesee and Vixette Streets. Law enforcement reported wires downed by thunderstorm winds on Wilcox Street and Crombie Street in Beechwood. Law enforcement reported trees and wires downed by thunderstorm winds on West Avenue in Barnard. Law enforcement reported trees and wires downed by thunderstorm winds on Meadow Drive in Webster. Law enforcement reported trees and wires downed by thunderstorm winds on Thornell Road at Railroad Mills. Law enforcement reported trees and wires downed by thunderstorm winds near Mitchell Road and Route 31 at Bushnell Basin. Law enforcement reported trees and wires downed by thunderstorm winds on Crystal Spring Lane in Fairport. Photos of a tree blown down onto a house and car were posted on social media in Blackwatch Hills. Total property damage was an estimated $100,000.
October 30, 2017	High Wind	N/A	N/A	Monroe County	Low pressure across the mid-Atlantic rapidly intensified as it tracked across central New York. The winds were especially strong along the Lake Ontario shoreline counties. The winds downed trees and power lines. Some structural damage was reported. There were reports road closures due to downed limbs and wires. Several tens of thousands were without power due to scattered outages. Total property damage in the County was estimated at $35,000.
April 4, 2018	High Wind	N/A	N/A	Barnard	A surface low deepened resulted in damaging wind gusts occurred across the entire area with multiple trees down, wires down, and overturned semis. Multiple trees and wires were reported down throughout the County through the event. A tree fell onto a house in Barnard. Total property damage in the County was estimated at $40,000.

Dates of Event	Event Type	FEMA Declaration Number	Monroe County Designated?	Location	Losses / Impacts
July 16, 2018	Thunderstorm Wind, Hail	N/A	N/A	Rochester, Penfield, Webster	A very warm and humid air mass was in place across western and north central New York. As is usually the case with an approaching cold front, thunderstorms fired up along a pre-frontal boundary that extended from the Lake Erie shoreline northeast to Rochester. Trees and wires were down on Garland Avenue, Maple Street, and Campbell Street and a tree fell on a house in Rochester. 0.75 inch hail was reported in Penfield. Trees and wires were down in Webster. Total property damage was an estimated $15,000.
August 6, 2018	Thunderstorm Wind	N/A	N/A	Egypt	Storms developed south of Lake Ontario. A tree fell on a vehicle on Mason Road. Total property damage was an estimated $10,000.
November 6, 2018	High Wind	N/A	N/A	Spencerport, Brighton, Chili	Strong winds developed behind a cold front. Trees, utility poles, and wires were down in Spencerport, Brighton, and Chili.
January 1, 2019	High Wind	N/A	N/A	Monroe County	The new year was rung in by damaging wind gusts. The early morning saw gusts reported up to 61 mph. Trees and wires were reported down, especially in the western and northern portions of the County. Total property damage was an estimated $25,000.
February 8, 2019	High Wind	N/A	N/A	Monroe County	Strong and deepening low pressure moved across the Upper Great Lakes with a trailing cold front crossing the region. The track of the low was quite far north, and it tracked more NNE instead of ENE. The wind field aloft decreased quickly after the cold frontal passage, leaving only a very narrow 1-2 hour window just behind the cold front where warning criteria gusts occurred to the northeast of the lakes. Wet ground conditions increased the impact as the roots of trees were weaker because of this. Maximum wind gusts reported during the event included 59 mph at the Rochester Airport. Trees were reported down in many parts of Monroe County. $15,000 in property damage was estimated.
February 24-25, 2019	High Wind	N/A	N/A	Monroe County	Low pressure over the central Plains rapidly deepened as it moved into the central Great Lakes, ending up as a 970 mb low over western Quebec. A strong cold front trailing the low sliced through western New York trailing it and ushering in very gusty winds. Selected peak wind gusts included 66 mph at Rochester. Damage was reported from the wind. $50,000 in property damage was estimated. Many reports were received of trees and wires down throughout the County causing substantial structural damage to homes and businesses. Thousands were reported without power.
March 10, 2019	High Wind	N/A	N/A	Monroe County	A post cold frontal southwest wind event to the northeast of Lake Erie and Lake Ontario. Trees and powerlines were reported down, resulting in $5,000 in property damage.
May 19, 2019	Hail	N/A	N/A	Webster, Union Hill	Pea to dime sized hail was reported from a thunderstorm in Webster. 0.88 inch hail lasted about three minutes in Union Hill.
August 8, 2019	Hail, Thunderstorm Wind	N/A	N/A	Henrietta, Penfield, Pittsford, East Rochester	Ahead of a strong cold front, storms along a prefrontal trough became severe. 0.75 inch hail was reported in Henrietta and Penfield. A tree was down and blocking Kennedy Road in Penfield. A tree was reported down onto power lines near Jefferson and Eastview Terrance in Pittsford resulting in $1,000 in property damage. A tree was reported down onto power lines on the 900 block of South Washington in East Rochester resulting in $1,000 in property damage.
October 31-	High Wind	DR-4472	No	Monroe County	A deepening area of consolidated low pressure tracked from the north shoreline of Lake Erie to Toronto, and then along the northern shoreline of Lake Ontario Thursday evening, October 31st.

Dates of Event	Event Type	FEMA Declaration Number	Monroe County Designated?	Location	Losses / Impacts
November 1, 2019					Immediately behind the front, winds were southwest and channeled across the typical locations northeast of Lake Erie from Dunkirk to the Niagara Frontier and eastward to Rochester. Southwest wind gusts were 45 to 50 mph. Enough damage was done across New York to have a Presidential Disaster Declaration. Heavy rain also brought flooding concerns. All three climate stations broke their daily October 31 records with 1 to 3 inches of rain falling across the CWA. $600,000 in property damage was reported.
January 12, 2020	High Wind	N/A	N/A	Monroe County	Post-frontal winds mixed well behind an early morning cold front. Widespread non-thunderstorm wind damage was reported in all lakeshore counties from Monroe westward along Lake Ontario. $20,000 in property damage was reported.
April 13, 2020	High Wind	N/A	N/A	Monroe County	Low pressure strengthened rapidly as it tracked from the mid-Mississippi River Valley resulting in high winds. Trees were reported down in multiple portions of the County resulting in $10,000 in property damage.
July 29, 2020	Thunderstorm Wind, Tornado	N/A	N/A	Beechwood, Irondequoit, Scottsville	A leading surface boundary sagged from lower Michigan across the Southern Tier and Genesee Valley. Ample moisture pooling evidenced by precipitable water values in excess of 1.5 inches and modest shear generated instability that allowed for thunderstorms to vertically develop into a layer of dry air aloft. This provided the first set of wind damage producing thunderstorms. These storms developed notable rotation, resulting in one tornado in Monroe County. A tree was down onto a parked car on Baycliff Drive in Beechwood. A large tree fell onto a home on Druid Hill Park in Irondequoit. Two trees were down on Quaker Road in Scottsville. Total property damage was an estimated $17,000. A supercell thunderstorm developed over Genesee County and tracked east-southeast from just south of the interchange of the New York State Thruway and I-490. Scattered tree limb damage consistent with straight line winds was found along the Oatka Creek upon following the path of this storm into Monroe County starting just east of Beulah Road and continuing through Mumford. Damage became more concentrated upon crossing Wheatland Center Road and entering Oatka Creek Park. A grassy field was laid down flat in the opposite direction of the storm motion with tree damage to the south end of the field indicating rotation with several damaged trees having broken to the northeast. Farther east, a partially- flattened corn field with two shallow-rooted uprooted trees along its southern periphery was coupled with several broken trees along a hiking path through Oatka Creek Park indicating opposing directional damage. Scattered damage continued farther east from Oatka Creek Park along Quaker Road south of Scottsville. A second more concentrated area of damage was found near the intersection of Quaker Road and Route 251. Several trees were downed along the hillside west of Route 251, into Route 251, and on the property at the southeast corner of Route 251 and Quaker Road. This included at least three uprooted shallow-rooted trees and one approximately five foot diameter broken and twisted hardwood tree along with many downed smaller limbs that indicated a convergent damage path. Due to the fact that the majority of the path of this storm was along Oatka Creek and through the Oatka Creek Park and in an area that is primarily rural, there was no damage to any

Dates of Event	Event Type	FEMA Declaration Number	Monroe County Designated?	Location	Losses / Impacts
					structures. Because of this, the National Weather Service use exclusively tree damage indicators to reach a conclusion of an EF0 strength and maximum wind speed of 75 mph. $10,000 in property damage was reported.
November 15-16, 2020	High Wind	N/A	N/A	Monroe County	A rapidly intensifying low pressure system pushed a cold front across the area during the latter half of November 15. Along the cold front, shallow convection developed with widespread non-severe hail and widespread wind gusts over 60 mph. In the wake of the front, a second and longer-lasting period of non-convective high winds persisted through much of the evening and into the overnight east of Lake Ontario. Widespread damage was reported from both the thunderstorm winds and non-thunderstorm winds. $150,000 in property damages were reported.
March 26, 2021	High Wind	N/A	N/A	Monroe County	A compact closed low passed just to the northwest of the area. Non-thunderstorm measured wind gusts included 59 mph at the Rochester Airport. $10,000 in property damage was reported.
June 21, 2021	Thunderstorm Wind	N/A	N/A	Rush, Henrietta, Bushnell Basin, Railroad Mills, Irondequoit, Beechwood	Storms developed along a pre-frontal trough around midday and moved east across the area. Storms did produce high rainfall rates, but they were moving at a fast enough pace that the overall flooding threat was limited. The main line of storms associated with the pre-frontal trough initiated along a line stretching from Lake Ontario southwest across Lake Erie into eastern Ohio. This line of storms just took off from there with bowing segments and some supracellular development occurring basically across the entire area. Multiple trees and power lines down onto Route 15 near I-390 in Rush. Extensive damage was reported along I-90 near Henrietta. A large tree fell onto a house and significant tree damage reported on I-490 at Route 96 in Bushnell Basin. A half of a dozen trees were blown down or uprooted, with a tree falling onto a house near Highway 31 in Railroad Mills. A few of the trees were snapped off about 25 feet above the ground. Several reports of trees and powerlines down were received in Irondequoit. A large tree was uprooted on Sethland Drive in Beechwood. Total property damage was an estimated $46,000.
December 11, 2021	High Wind	N/A	N/A	Monroe County	A strong cold front crossed the region. Selected peak wind gusts included 60 mph at Rochester Airport. Strong surface high pressure over the southern Plains amplified the pressure gradient such that a lake seiche did occur on Lake Erie with a smaller one evident on Lake Ontario, as well. Dozens of reports of trees and powerlines down were received, resulting in $100,000 in property damage.
March 6, 2022	High Wind	N/A	N/A	Monroe County	Low pressure tracked from the upper Great Lakes to Quebec with a trailing cold front crossing the region. Selected wind gust reports included 72 mph at the Rochester Airport. $100,000 in property damage was reported.
April 25, 2022	Thunderstorm Wind	N/A	N/A	Rochester Airport, Brighton, Beechwood, Fairport	A cold front advanced slowly towards western New York in the afternoon and evening with convection focused along a pre-frontal trough and an outflow boundary ahead of the main cold front. Multiple reports of wind damage were received. Trees and powerlines were reported to be down on Frost Avenue at Rochester Airport. Trees and powerlines were reported to be down on Hawthorne Street in Brighton. Numerous large tree limbs and powerlines were reported to be down in Beechwood. Trees and powerlines were reported to be down at Golf Avenue and Marsh Road in Fairport. $9,000 in property damage was reported.

Source: NOAA-NCEI 2022; FEMA 2022

Climate Change Impacts

Climate change is beginning to affect both people and resources in Monroe County, and these impacts are projected to continue growing. The Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011)

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Monroe County is part of Region 1, Western New York, Great Lakes Plain. In Region 1, it is estimated that temperatures will increase by 3.0 ºF to 5.5 ºF by the 2050s and 4.5 ºF to 8.5 ºF by the 2080s (baseline of 48.0 ºF, mid-range projection). Precipitation totals will increase between 0 and 10 percent by the 2050s and 0 to 15 percent by the 2080s (baseline of 37.0 inches, mid-range projection). Table 5.4.9-5 displays the projected seasonal precipitation change for ClimAID Region 1 (NYSERDA 2014).

Table 5.4.9-5. Projected Seasonal Precipitation Change in Region 1, 2050s (% change)

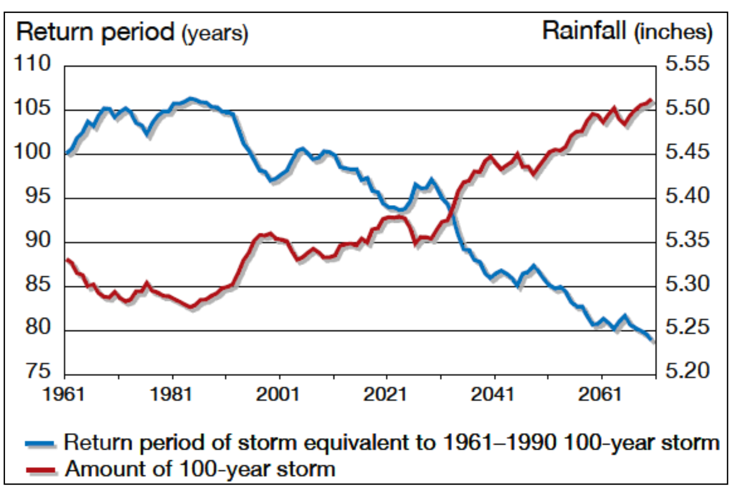
Winter	Spring	Summer	Fall
+5 to +15	0 to +10	-5 to +10	-5 to +10

Source: NYSERDA 2014

The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. Downpours are very likely to increase in frequency and intensity, a change which has the potential to affect drinking water; heighten the risk of riverine flooding; flood key rail lines, roadways, and transportation hubs; and increase delays and hazards related to extreme weather events (NYSERDA 2011). Less frequent rainfall during the summer months may impact the ability of water supply systems. Increasing water temperatures in rivers and streams will affect aquatic health and reduce the capacity of streams to assimilate effluent wastewater treatment plants (NYSERDA 2011).

Figure 5.4.9-6 displays the project rainfall and frequency of extreme storms in New York State. The amount of rainfall in a 100-year event is projected to increase, while the number of years between such storms (return period) is projected to decrease. Rainstorms will become more severe and more frequent (NYSERDA 2011).

Figure 5.4.9-6. Projected Rainfall and Frequency of Extreme Storms



Source: NYSERDA 2011

Probability of Future Occurrences

Based on the historic and more recent severe storm events in Monroe County, and the future climate projections for this region, the County has a high probability of future severe storm events. It is anticipated that Monroe County will continue to experience direct and indirect impacts of severe stirn events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, and transportation delays, accidents and inconveniences. Additionally, climate change is expected to increase the severity and frequency of severe storm events in Monroe County. According to available record keeping, Monroe County has a 100% annual chance of occurrence of severe storm events in any given year.

Table 5.4.9.1-6. Probability of Future Occurrence of Severe Storm Events

Hazard Type	Number of Occurrences Between 1996 and 2022	% chance of occurrence in any given year
Hail	38	100%
High Wind	63	100%
Lightning	10	38.46
Thunderstorm Wind	97	100%
Tornado	3	11.54
TOTAL	**211**	**100%**

Source: NOAA-NCEI 2022; FEMA 2022
Note: Disaster occurrences include federally declared disasters and selected severe storm events between January 1, 1996 and January 1, 2022. Due to limitations in data, not all severe storm events occurring between 1996 and 2022 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

In addition to the events listed above, six tropical cyclones have passed within 60 nautical miles of Monroe County since 1861 (2 tropical depressions, 3 tropical storms, 1 Category 1 hurricane) resulting in 3.73% chance of occurrence in any given year over the 160-year record keeping (NOAA n.d.).

Section 5.3 ranks the identified hazards of concern for Monroe County. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee, the probability of occurrence for severe storms in the County is considered ‘frequent’ (100 percent annual probability; a hazard event may occur multiple times per year).

5.4.9.2 Vulnerability Assessment

A probabilistic assessment was conducted for the 100- year and 500-year MRP hurricane wind event through a Level 2 analysis in Hazus to analyze the severe storm hazard and provide a range of loss estimates due to wind impacts. Section 5.1, Methodology includes additional details on the methodology used to assess the severe storm risk.

Impact on Life, Health, and Safety

The impact of a severe weather event and wind on life, health, and safety is dependent upon several factors, including the severity of the event and whether adequate warning time was provided to residents. For the purposes of this HMP, all of Monroe County is considered vulnerable to a severe weather event and wind impacts (i.e., 753,109 persons total, US Census 2020). Hazus estimates that zero persons will be displaced from their homes or will seek shelter during a 500-year MRP hurricane wind event. Secondary impacts caused by extreme wind events include downed trees, damaged buildings, and debris carried by high winds, which can lead to injury or loss of life.

Socially vulnerable populations are most susceptible to severe weather events based on several factors, including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Vulnerable populations include homeless persons, elderly (over 65 years old), low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. The population over the age of 65 is also more vulnerable and, physically, they may have more difficulty evacuating. They may require extra time or outside assistance during evacuations and are more likely to seek or need medical attention, which may not be available due to isolation during a storm event. According to the 5-Year 2020 American Community Survey Population Estimates, there are 127,588 persons over 65 and 100,484 persons living in poverty in Monroe County (American Community Survey 2020).

Additionally, people located outdoors (i.e., recreational activities and farming) are considered most vulnerable to hailstorms, thunderstorms, and tornadoes. This is because there is little to no warning, and shelter may not be available. Moving to a lower risk location will decrease a person's vulnerability. See Section 4, County Profile for population statistics for each participating jurisdiction.

Impact on General Building Stock

Damage to buildings is dependent upon several factors, including wind speed, storm duration, and path of the storm track. Building construction also plays a major role in the extent of damage resulting from a coastal storm. Due to differences in construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Wood and masonry buildings, in general, regardless of their occupancy class, tend to experience more damage than concrete or steel buildings. Furthermore, high-rise buildings are also very vulnerable structures. Hazus estimates that there will be no damages in the event of a 100-year or 500-year MRP wind event.

Impact on Critical Facilities

Critical facilities are at risk of being impacted by high winds associated with structural damage or falling tree limbs/flying debris, which can result in the loss of power. Power loss can greatly impact households, business operations, public utilities, and emergency personnel. For example, vulnerable populations in Monroe County are at risk if power loss results in interruption of heating and cooling services, stagnated hospital operations, and potable water supplies. 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 its citizens.

Hazus estimates the probability that critical facilities (i.e., medical facilities, fire/EMS, police, emergency operation centers [EOC], schools, and user-defined facilities such as shelters and municipal buildings) may sustain damage as a result of the 100-year or 500-year MRP hurricane wind events. Additionally, Hazus estimates the loss of use for each facility in number of days. Overall, Hazus estimates that none of the critical facilities in Monroe County are estimated to experience damage or loss of functionality due to a 100-year or a 500-year MRP hurricane wind event.

Impact on Economy

Severe storm events can have short- and long-lasting impacts on the economy. 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. 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.

Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting and goods transport) transportation needs. Utility infrastructure (power lines, gas lines, electrical systems) could suffer damage and impacts can result in the loss of power, which can impact business operations and can impact heating or cooling provision to the population.

Hazus estimates the total economic loss associated with the 100-year and 500-year MRP hurricane wind events (direct building losses and business interruption losses). Direct building losses are the estimated costs to repair or replace the damage caused to the building. This is reported in the “Impact on General Building Stock” section discussed earlier. Business interruption losses are the losses associated with the inability to operate a business because of the wind damage sustained during the storm or the temporary living expenses for those displaced from their home because of the event. Hazus estimates that there would be no building and content losses in the event of a 500-year MRP wind event.

Debris management can be costly and may also impact the local economy. Hazus estimates the amount of building and tree debris that may be produced as a result of the 100-year and 500-year MRP hurricane wind events. Because the estimated debris production does not include flooding, this is likely a conservative estimate and may be higher if multiple impacts occur. According to the Hazus Hurricane User Manual, estimates of weight and volume of eligible tree debris consist of downed trees that would likely be collected and disposed at public expense. Hazus estimates that the 100-year and 500-year MRP hurricane wind event will not cause any debris for Monroe County.

Impact on the Environment

The impact of severe weather events on the environment varies, but researchers are finding that the long-term impacts of more severe weather can be destructive to the natural and local environment. National organizations such as USGS and NOAA have been studying and monitoring the impacts of extreme weather phenomena as it impacts long-term climate change, streamflow, river levels, reservoir elevations, rainfall, floods, landslides, erosion, etc. (USGS 2020). For example, severe weather that creates longer 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. Researchers also believe that a greater number of diseases will spread across ecosystems because of impacts that severe weather and climate change will have on water supplies (NOAA 2019). Overall, as the physical environment becomes more altered, species will begin to contract or migrate in response, which may cause additional stressors to the entire ecosystem within Monroe County.

Cascading Impacts on Other Hazards

Severe weather events and severe wind events can escalate the impacts of flooding and utility failure. Severe winds can be destructive to the functionality of utilities by breaching power lines and disconnecting the utility systems. Severe weather may carry extreme rainfall that could exacerbate flooding. More information about flooding can be found in Section 5.4.5 of this HMP.

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the county can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. Changes in the natural environment and built environment and how they interact can also provide insight about ways to plan.

Projected Development

Any areas of growth could be potentially impacted by the severe storm hazard because the entire county is exposed and vulnerable to the wind hazard associated with severe storms. However, due to increased standards and codes, new development may be less vulnerable to the severe storm hazard compared to the aging building stock in the county. Please refer to Section 4 and Section 9 for additional information regarding the areas targeted for future growth and development in the County.

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). An increase in population will result in more of the population exposed to the sever storm hazard as it impacts the entire planning area. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

As discussed previously, the entire State of New York is projected to experience an increase in the frequency and severity of extreme storms and rainfall. Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate, unleashing far more rain and posing a greater threat of flooding across wide areas (NASA 2013). Section 5.4.5, Flood, includes a discussion related to the impact of climate change due to increases in rainfall. An increase in storms will produce more wind events and may increase tornado activity. Additionally, an increase in temperature will provide more energy to produce storms that generate tornadoes (NASA 2013). With an increased likelihood of strong winds and tornado events, all the county's assets will experience additional risk for losses as a result of extreme wind events.

Changes in Vulnerability Since the 2017 HMP

Monroe County's vulnerability to severe storm events has remained unchanged. Since the 2017 HMP analysis, population statistics have been updated using the 2020 Census. The general building stock and the 2017 critical facility dataset was updated by the County and participating jurisdictions. Overall, this vulnerability assessment uses a more accurate and updated building inventory than that used in the 2017 HMP.

5.4.10 Severe Winter Storm

This section provides a profile and vulnerability assessment of the severe winter storm hazard for Monroe County.

5.4.10.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections and the probability of future occurrences for the severe winter storm hazard.

Hazard Description

A winter storm is a weather event in which the main types of precipitation are snow, sleet, or freezing rain. They can be a combination of heavy snow, blowing snow, and dangerous wind chills. According to the National Severe Storms Laboratory (n.d.), the three basic components needed to make a winter storm include the following:

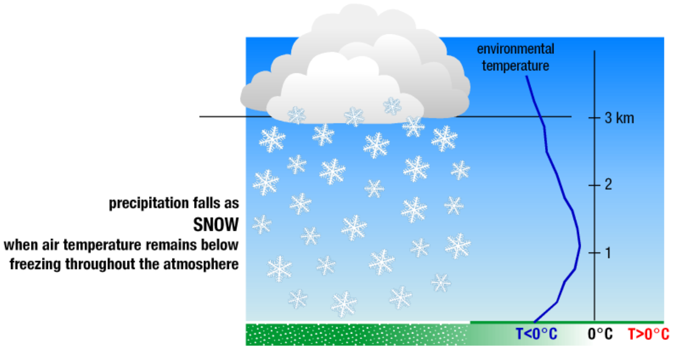
- Below freezing temperatures (cold air) in the clouds and near the ground to make snow and ice.
- Lift, something to raise the moist air to form clouds and cause precipitation, such as warm air colliding with cold air and being forced to rise over the cold dome or air flowing up a mountainside (oliographic lifting).
- Moisture to form clouds and precipitation, such as air blowing across a large lake or the ocean (NOAA 2021).

Some winter storms can immobilize an entire region, while others might only affect a single community. Winter storms typically are accompanied by low temperatures, high winds, freezing rain or sleet, and heavy snowfall. The aftermath of a winter storm can have an impact on a community or region for days, weeks, or even months; potentially causing cold temperatures, flooding, storm surge, closed and blocked roadways, downed utility lines, and power outages. Monroe County's winter storms include blizzards, snowstorms, and ice storms. Extreme cold temperatures and wind chills are associated with winter storms. For more information on extreme cold temperatures, refer to the Section 5.4.4. (Extreme Temperature).

Heavy Snow

According to the National Snow and Ice Data Center (NSIDC), 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 snow crystals or a snow pellet, which then falls to the earth. Snow falls in different forms: snowflakes, snow pellets, or sleet. Snowflakes are clusters of ice crystals that form from a cloud. Figure 5.4.10-1 depicts snow creation.

Figure 5.4.10-1. Snow Creation



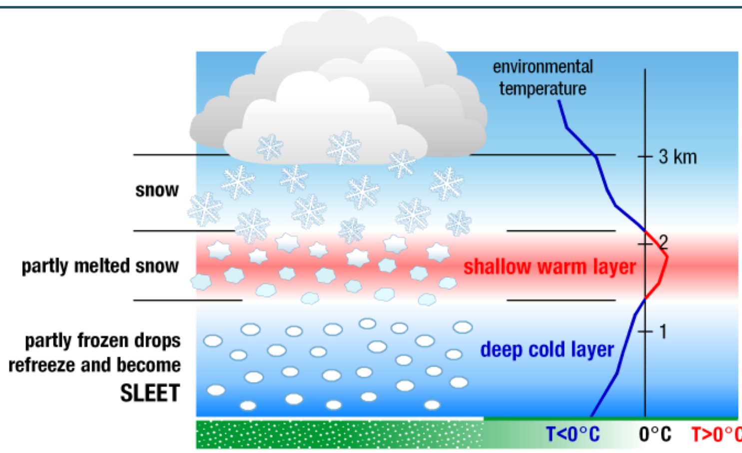
Source: NOAA-NSSL 2015

Snow pellets are opaque ice particles in the atmosphere. They form as ice crystals fall through super-cooled cloud droplets, which are below freezing but remain a liquid. The cloud droplets then freeze to the crystals.

Sleet

Sleet is made up of drops of rain that freeze into ice as they fall through colder air layers. They are usually smaller than 0.30 inches in diameter (NSSL 2021). Figure 5.4.10-2 depicts snow creation.

Figure 5.4.10-2. Sleet Creation



Source: NOAA-NSSL 2020

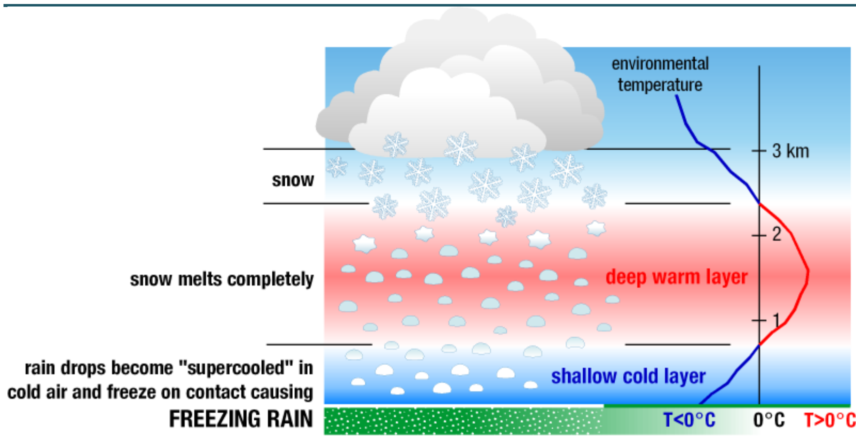
Blizzards

A blizzard is a winter snowstorm with sustained or frequent wind gusts of 35 miles per hour (mph) or more, accompanied by falling or blowing snow reducing visibility to or below 0.25 mile, as the predominant conditions over a 3-hour period. Extremely cold temperatures often are associated with blizzard conditions but are not a formal part of the 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, moister 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 and the higher pressure to the west creates a tight pressure gradient, resulting in strong winds and extreme conditions caused by the blowing snow (Lam 2019).

Ice Storms

An ice storm describes those events when damaging accumulations of ice are expected during freezing rain situations. Significant ice accumulations typically are accumulations of 0.25-inches or greater (NWS 2013). Heavy accumulations of ice can bring down trees, power lines, utility poles, and communication towers. Ice can disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians (Dolce 2012). Figure 5.4.10-3 depicts freezing rain creation.

Figure 5.4.10-3. Freezing Rain Creation



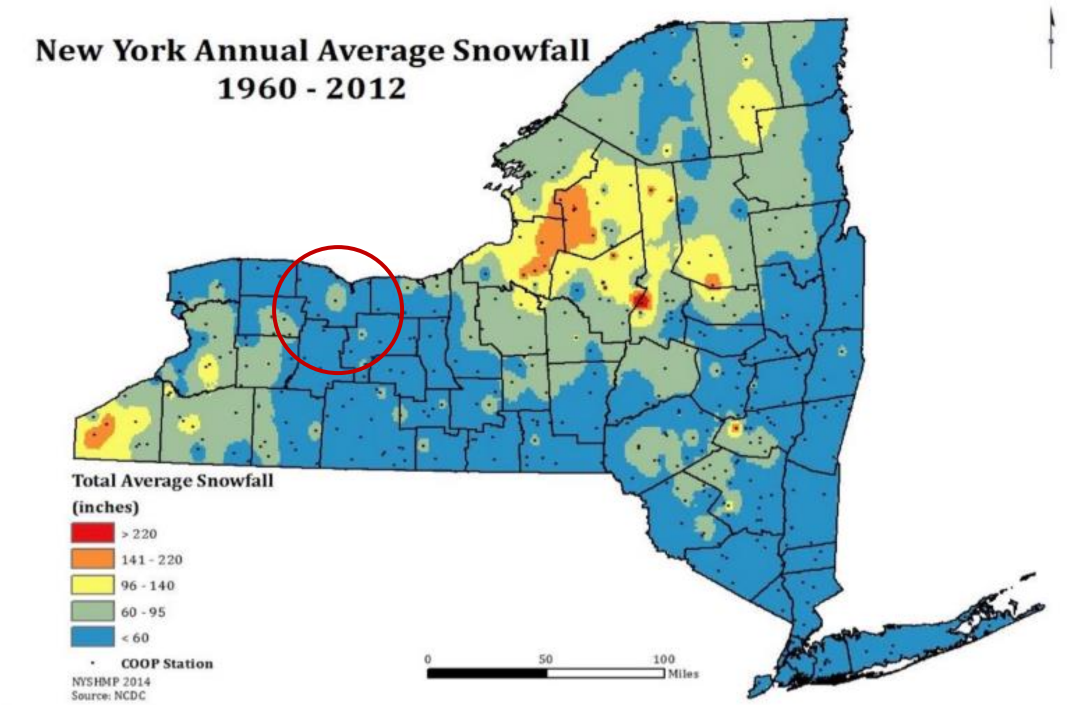
Source: NOAA-NSSL 2020

Location

The climate of New York State is marked by abundant snowfall. Winter weather can reach New York State as early as October and is usually in full force by late November with average winter temperatures between 20 and 40 F. The inland regions of New York State receive more snow than most other communities in the nation. Although the entire state is subject to winter storms, the easternmost and west-central portions of the state are more likely to suffer under winter storm occurrences than any other location (NYS DHSES 2019). With the exception of coastal New York State, the state receives an average seasonal amount of 40 inches of snow or more. The average annual snowfall is greater than 70 inches over 60 percent of New York State's area, with Monroe County's averages less than 60 to 95inches annually. The City of Rochester is typically in the top ten cities in the nation in annual snowfall (NYS DHSES 2019). According to the Northeast Regional Climate Center, average annual snowfall in Rochester is 93.4 inches (Northeast Regional Climate Center 2009).

Figure 5.4.10-4, an annual average snowfall map, illustrates the annual average snowfall totals over a 50-year period for New York State.

Figure 5.4.10-4. New York Annual Average Snowfall, 1960-2012



Source: NYS DHSES 2014
Note: The red circle indicates the location of Monroe County

Extent

The magnitude or severity of a severe winter storm depends on several factors, including snowfall rates, regional climatological susceptibility to snowstorms, snowfall amounts, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day and week (e.g., weekday versus weekend), and time of season.

The extent of a severe winter storm can be classified both by meteorological measurements and by evaluating societal impacts. The National Oceanic and Atmospheric Administration's (NOAA's) National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from 1 to 5 and is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population. The NCDC has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA n.d.). Table 5.4.10-1. presents the five RSI ranking categories.

Table 5.4.10-1. RSI Ranking Categories

Category	Description	RSI Value
1	Notable	1–3
2	Significant	3–6
3	Major	6–10
4	Crippling	10–18
5	Extreme	18.0+

Source: NOAA 2020
Note: RSI = Regional Snowfall Index

The NWS operates a widespread network of observing systems, such as geostationary satellites, Doppler radars, and automated surface observing systems that feed into the current state-of-the-art numerical computer models to provide a look into what will happen next, ranging from hours to days. The models are then analyzed by NWS meteorologists who then write and disseminate forecasts. According to NWS (NWS 2021), the magnitude of a severe winter storm can be qualified into five main categories by event type:

Table 5.4.10-2. Winter Storm Category Thresholds

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

Additionally, the NWS uses winter weather watches, warnings, and advisories to help people anticipate what to expect in the days and hours prior to an approaching storm (NWS 2021). Refer to Figure 5.4.10.1-5 for the warning thresholds.

Figure 5.4.10.1-5. Winter Storm Warning Thresholds

Source: NWS 2021

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with severe winter storms throughout New York State and Monroe County; therefore, the loss and impact information for many events varies depending on the source. The accuracy of monetary figures discussed is based on the available information in cited sources.

FEMA Major Disaster and Emergency Declarations

Between 1953 and 2022, New York State was included in 22 FEMA declared disasters (DR) or emergency declarations (EM) that involved snow or ice storms. Monroe County was included in six of these 22 severe winter weather-related declarations (Table 5.4.10-1).

Table 5.4.10-3. FEMA DR and EM Declarations for Severe Winter Storm Events in Monroe County, 1954 to 2022

FEMA Declaration Number	Date(s) Of Event	Event Type	Details
DR-494	March 19, 1976	Ice Storm, Severe Storms, Flooding	New York Ice Storm, Severe Storms, Flooding
DR-898	March 3-4, 1990	Severe Winter Storm	New York Severe Storm, Winter Storm
EM-3107	March 13-17, 1993	Severe Blizzard	New York Severe Blizzard
DR-1196	January 5-17, 1998	Severe Storms and Flooding	New York Severe Winter Storms
EM-3138	March 3-6, 1999	Snow	New York Winter Storm
DR-1467	April 3-5, 2003	Ice Storm	New York Ice Storm

Source: FEMA 2022

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was not included in any USDA-designated agricultural disasters that included severe winter storm events (USDA 2022).

Previous Events

Table 5.4.10-4 identifies the known severe winter storm events that impacted Monroe County between 2015 and 2022. For events prior to 2015, refer to Appendix E (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Table 5.4.10-4. Severe Winter Storm Events in Monroe County, 2015 to 2022

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
February 1-2, 2015	Winter Storm	Monroe County	N/A	N/A	Low pressure brought a general eight to fourteen inches of snow to the entire region. Heaviest amounts were along the southern tier counties and over the counties along the south shore of Lake Ontario. Northeast winds became quite strong near Lake Ontario with near blizzard conditions occurring closer to the shore. While the snow did not result in many closings the general snow across the entire region did result in many delays and late openings. Specific snowfall reports included: 17 inches at Webster; and 16 inches at Greece and Oswego
February 9, 2015	Winter Storm	Monroe County	N/A	N/A	Low pressure brought a light general snowfall to the area. The northerly flow crossing the warmer waters of Lake Ontario and higher elevations resulted in enhanced snowfall amounts across parts of the Genesee Valley and northern Finger Lakes. Given the harsh winter conditions, the effects of this storm on the region were generally minimal with just some delays and longer travel times. Specific snowfall reports included 12 inches near Rochester.
February 14-15, 2015	Winter Storm	Monroe County	N/A	N/A	A strong clipper crossed the Great Lakes and brought snow and blowing snow to the region and some of the coldest air of the season. The snowfall amounts were enhanced downwind of Lake Ontario and upslope east of Lake Erie where snowfall amounts around a foot were recorded. Gusty winds accompanied the system and produced reduced visibilities in blowing snow. On the back side of the system, temperatures plummeted and struggled to reach zero on Sunday the 15th. Combined with the winds, wind chill temperatures of minus 25 to minus 35 degrees F were recorded.
January 18-19, 2016	Lake-Effect Snow	Monroe County	N/A	N/A	Lake effect snow, arctic air flowed over the eastern Great Lakes Sunday, January 17th, with early weekend air temperatures in the 40s plummeting back below freezing. The lake effect snows began during the morning. This northwest flow over Lake Ontario continued varying intensity to the snow bands through the night and into Tuesday, with subtle variations in the wind flow carrying the snows over the southern and southeastern shorelines Specific storm totals off Lake Ontario included 13 inches at Irondequoit.
February 10-11, 2016	Lake-Effect Snow	Monroe County	N/A	N/A	A west wind brought the steadiest snows east of Lake Erie across ski country through the day, while on the southwestern shoreline of Lake Ontario a band of snow hugged the shoreline, dropping upwards of a half a foot of snow.
February 15-16, 2016	Winter Storm	Monroe County	N/A	N/A	Low pressure moved north across central Pennsylvania and central New York. It was on the only major synoptic event of the winter. This brought all snow to western New York. Across central New York what started initially as snow changed to rain Tuesday morning (16th) then back to snow for the evening hours. Across the north country minor snow accumulations accompanied up to a half inch of ice. The axis of heaviest snow (eighteen to twenty-two inches) fell across the Monroe county and the City of Rochester. The heavy snow began to fall during the early morning hours bringing the morning commute to a standstill.
November 20-22, 2016	Lake-Effect Snow	Monroe County	N/A	N/A	A strong cold front moved across the Lower Great Lakes creating marginally cold temperatures. Lake enhanced snow covered a much larger area than typical lake effect snow events. The most persistent lake enhanced snow was found east and southeast of Lake Ontario with storm totals of over one foot in a large area from Rochester eastward to the Tug Hill region. Snowfall reports off Lake Ontario included 16 inches at Fairport and 15 inches at Rochester.

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
December 15-16, 2016	Lake-Effect Snow	Monroe County	N/A	N/A	A cold front moved through the region, with the wind direction from the southwest initially developing lake effect snow. Lake Ontario experiences the heaviest snow period during the morning of the 15th. Following the passage of the arctic front, winds become more northwest, with a band of heavy snow settling south into the Rochester area during the late afternoon and evening. The combination of heavy snow and gusty winds brought a difficult afternoon and evening drive in the Rochester area. Heavy lake effect snow persisted through much of the night on the 15th for Rochester. Lake Ontario, specific snowfall reports included: 14 inches at Rochester Airport, 10 inches at Irondequoit and Webster.
February 9-10, 2017	Lake-Effect Snow	Monroe County	N/A	N/A	Lake effect snow developed behind a departing coastal nor'easter as cold air spilled across the region on a northwesterly flow. The northwesterly flow became perfectly aligned from Lake Superior across the Georgian Bay to Lake Ontario Thursday night into Friday morning. This helped to organize and lock-in an intense single band of lake effect snow that came on shore in northeast Monroe County. Specific snowfall reports included 8 inches in Webster.
December 12-13, 2017	Winter Storm	Monroe County	N/A	N/A	A general snow across the region was enhanced by the Great Lakes before transitioning to lake effect snow bands east and southeast of the lakes. The lake effect snow taper off and ended by late Wednesday. Off Lake Ontario, synoptic snow became lake enhanced on Tuesday and Tuesday night, before transitioning to purely lake effect snow by late Tuesday night through Wednesday. A robust lake effect snow plume was centered on the Tug Hill under a westerly flow with snowfall rates exceeding 2 inches per hour. Overnight, winds became northwest and pushed this band to the south, breaking it apart into multi-bands on a northwest flow. The lake effect snow ended Wednesday night. Snowfall amounts were generally highest toward the southeast corner of Lake Ontario, which saw the most persistent lake enhancement of snowfall.
December 29-30, 2017	Lake-Effect Snow	Monroe County	N/A	N/A	Tea kettle bands of lake effect snow developed offshore over Lake Erie and Lake Ontario for an extended period of time prior to moving onshore, first on Lake Erie and eventually on Lake Ontario. By early evening, the entire band moved onshore as an arctic front crossed the lake. The lake effect snow diminished to flurries and light snow showers by midday on the 31st. Specific snowfall reports included: 8 inches at Greece.
January 4-6, 2018	Lake-Effect Snow	Monroe County	N/A	N/A	The heaviest lake effect snow fell at the beginning of this event during the evening of the 4th as an arctic front slowly crossed Lake Ontario and merged with a band of lake effect snow from Rochester to southern Oswego County. Snowfall rates reached 2 inches per hour at times for a few hours during the evening from the Monroe County shoreline. Specific snowfall reports included:12 inches at Webster and 8 inches at Irondequoit.
January 12-13, 2018	Winter Storm	Monroe County	N/A	N/A	A developing winter storm brought first a wintry mix of precipitation during the evening of the 12th and then heavy snow through the morning of the 13th. Rain changed to a mix of freezing rain and snow during the evening. Ice accumulations up to a tenth of an inch were reported along the lake shore counties. Once the precipitation changed to snow, the heavy snow fell at one to two inches an hour during the overnight hours. Travel was difficult especially on untreated roads as the snow covered the ice below. Winds gusting to 35 mph at times caused areas of blowing and drifting snow.
November 15-16, 2018	Winter Storm	Monroe County	N/A	N/A	A complex system moved into the area with wildly varying thermal profiles. An initial mid-level trough and surface low moved across the southeast United States that gave way to secondary cyclogenesis near the southern tip of the Delmarva. The secondary low then moved northward along the east coast to the Gulf of Maine. The system had very marginal cold air to work with, particularly in western New York. As

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
					the event unfolded, precipitation type was mostly snow from Rochester eastward, with just a few brief periods of sleet. More sleet and some freezing rain mixed in through the first half of the event across far western New York, cutting back on snow accumulation there.
April 14-15, 2018	Ice Storm	Monroe County	N/A	N/A	Two rounds of mixed winter precipitation moved over the area with warm air aloft overriding a deep layer of cold air at the surface. This resulted in sleet initially that transitioned to freezing rain before temperatures eventually increased above freezing. Several areas saw nearly an inch of sleet combined with around one half of an inch of freezing rain. This resulted in thousands of power outages and substantial tree damage.
January 1-20, 2019	Winter Storm	Monroe County	N/A	N/A	A system tracked along the New York/Pennsylvania line and spread heavy snow across our region over the weekend. The low pressure track fit perfectly with climatology for widespread heavy snow in our area. The heaviest amounts that model solutions generally had across the western Southern Tier ended up being across the entirety of the Thruway corridor, resulting in over a foot of snow for much of the area. Northeasterly flow off of Lake Ontario resulted in localized maxima along the southwestern shore of the lake, as well. Even with more than a foot of snow, impacts were not as severe as they would otherwise have been because all of the snow fell over a weekend, resulting in lower impacts to transportation.
February 27, 2019	Winter Storm	Monroe County	N/A	N/A	Snow developed across the area south of Lake Ontario as a surface low translated across Pennsylvania. The heaviest snow generally fell along the Thruway corridor during the daytime hours of February 27. This snow impacted both the morning and evening commutes with up to 1 inch per hour snowfall rates. Most areas received between 4 and 7 inches, however local daytime accumulation in the northern Finger Lakes and Rochester area slightly exceeded these values.
November 11-12, 2019	Winter Storm	Monroe County	N/A	N/A	A cold front moved slowly south across the area and stalled just south of the area. A deep upper level trough became carved out in the flow over the Upper Great Lakes, which forced a strong wave to develop along the stalled frontal zone just south of our area. Frontogenesis to the north of the low track and just north of the stalled frontal zone acted as a focus for moderate to heavy snow. Model guidance with this system trended south and weaker before trending back north and stronger. Winter storm watches and warnings were issued for much of the area, but the heavy snow ended up being a bit farther north and west than had been warned for.
January 22-23, 2021	Lake-Effect Snow	Monroe County	N/A	N/A	Weakening low pressure system passed to our north across Ontario and Quebec. This provided large scale moisture that when combined with pre-frontal temps aloft just cold enough to support lake effect resulted in snow east of Lake Ontario. Upslope initially aided the combined synoptic moisture and lake-induced instability to generate heavy snow in the Tug Hill region. This resulted in heavy snow sinking southward in the Monroe County to Cayuga County shoreline. Selected snow totals included 10 inches in Gates and 9 inches in Webster.
February 2-3, 2021	Winter Storm	Monroe County	N/A	N/A	A stacked coastal storm threw Atlantic moisture back across western and north central New York Tuesday (Groundhog Day) and into Wednesday. Strong mesoscale banding occurred over the North Country and on the western edge of the mid-upper level low. Later, banding within the shield of synoptic snow enhanced snowfall rates to over an inch an hour for sites Rochester and eastward with total snowfall approaching 10 -12 inches in some areas. The Rochester evening commute was slow with snow covered roads.

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
February 15-16, 2021	Winter Storm	Monroe County	N/A	N/A	A deep trough dug across the nation's midsection with an outbreak of Arctic air from the Great Plains to Texas. Low pressure developed near Louisiana and tracked across Pennsylvania toward southern New England on the eastern fringe of the cold air mass. A weaker initial wave of precipitation produced 1-3 inches of snow with a lull before the main event with deeper moisture, isentropic lift, and favorable jet dynamics arrived later in the day on February 15. While most of the area was originally forecast to see heavy snow, large scale drying aloft encroached from the south. This resulted in far less snow over the Southern Tier and from the Genesee Valley eastward.
January 16-17, 2022	Winter Storm	Monroe County	N/A	N/A	Low pressure across the Carolinas rapidly intensified to 980 hPa as it tracked across eastern Pennsylvania and New York. This brought a deepening surface low track inland of the coast and the climatologically favored baroclinic zone along the periphery of the Gulf Stream. Other than the unusual track, it was a classic Nor'easter driven by a strong closed low across the southeast interacting with a longwave trough. Forcing for ascent was supported by strong differential vorticity advection ahead of the sharp mid-level closed low, impressive upper level coupled jet structure, and strongly diffluent flow aloft. A very strong southeasterly low level jet supported a strong warm conveyor belt, which resulted in a clearly defined deformation zone developing northwest of the storm early on January 17 and lingering over much of western New York with extreme snowfall rates for several hours.
February 2-4, 2022	Winter Storm	Monroe County	N/A	N/A	A frontal boundary slowly sagged southward through the area. This allowed for deep cold air to make its way south of the Pennsylvania state line. A series of weak disturbances then worked down this front bringing several rounds of moderate to heavy snow. The heaviest snow fell in the evening of February 3 for most areas. This occurred after a slow changeover from rain to snow as the front sagged southward. By the end of the event, many portions of the area received more than a foot of snow.

Source: NOAA NCEI 2022; FEMA 2022; NYS DHSES 2019

Climate Change Impacts

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to increase. The impacts related to increasing temperatures and sea level rise are already causing complications in the state. *ClimAID: The Integrated Assessment for Effective Climate Change in New York State (ClimAID)* was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011/2014).

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across New York State by 2–3.4 °F by the 2020s, 4.1–6.8 °F by the 2050s, and 5.3–10.1 °F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the state (NYSERDA 2011/2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Monroe County is part of Region 1 (Western New York and the Great Lake Plains), where temperatures are estimated to increase by 4.3 to 6.3ºF by the 2050s and 5.7 to 9.6ºF by the 2080s (baseline of 47.7ºF, middle range projection). Precipitation totals are estimated to increase between four to ten percent by the 2050s and four to thirteen percent by the 2080s (baseline of 34.0 inches, middle range projection). Table 5.4.1010-44 displays the projected seasonal precipitation change for the region for 2050 (NYSERDA 2011/2014). The winter season is projected to have a precipitation increase of 5-15 percent.

Table 5.4.1010-4. Projected Seasonal Precipitation Change in Region 2, 2050s (% change)

Winter	Spring	Summer	Fall
+5 to +15	0 to +15	-10 to +10	-5 to +10

Source: NYSERDA 2014

New York State already is experiencing the effects of climate change during the winter season. Annual ice cover has decreased 71 percent on the Great Lakes since 1973. This decrease may lead to increased lake-effect snow in Erie County in the next two decades through greater moisture availability. By mid-century, however, lake-effect snow will generally decrease as temperatures below freezing become less frequent. Winter snow cover is decreasing, and spring comes, on average, about a week earlier than it did a few years ago. Nighttime temperatures are measurably warmer, even during the colder months. Overall winter temperatures in New York State are almost 5 degrees warmer than in 1970 (NYSERDA 2011/2014). The state has experienced a decrease in the number of cold winter days (below 32 °F) and can expect to see a decrease in snow cover by as much as 25–50 percent by end of the next century. The lack of snow cover may jeopardize opportunities for skiing, snowmobiling, and other types of winter recreation; and natural ecosystems will be affected by the changing snow cover (Cornell University College of Agriculture and Life Sciences 2011).

As the century progresses, snowfall is likely to become less frequent, with the snow season decreasing in length. It is uncertain if there will be changes in the intensity of snowfall during each storm; however, it is possible that higher temperatures in colder parts of New York State could support higher snowfall totals during snowstorm events (NYSERDA 2011/2014).

Probability of Future Occurrences

Based on geography, location, past event history, and climate projections, Monroe County will continue to experience winter storm events.

Table 5.4.10-5. summarizes data regarding the probability of occurrences of severe winter storm events in Monroe County based on the historic record. Heavy snow events and winter storms are the first and second most common in Monroe County, respectively. The information used to calculate the probability of occurrences is based solely on NOAA-NCEI storm events database results.

Table 5.4.10-5. Probability of Future Occurrence of Severe Winter Weather Events in Monroe County

Hazard Type	Number of Occurrences Between 1996 and 2022	% chance of occurrence in any given year
Blizzard	2	7.41%
Heavy Snow	39	100%
Ice Storm	4	14.8%
Winter Storm	30	100%
Winter Weather	1	3.7%
TOTAL	**76**	**100%**

Source: NOAA-NCEI 2022
Note: Disaster occurrences include federally declared disasters and selected winter storm events between January 1, 1996 and January 1, 2022. Due to limitations in data, not all winter storm events occurring between 1996 and June 2022 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Based on historical data from NYSERDA (2014), it is expected that the following will occur at least once per 100 years:

- Up to four inches of freezing rain in the ice band near central New York State of which between 1–2 inches of accumulated ice will occur over a 24-hour period.
- Up to two feet of accumulated snow in the snow band in northern and western New York State over a 48-hour period.

Section 5.3 ranks the identified hazards of concern for Monroe County. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee, the probability of occurrence for severe winter storm in the County is considered 'frequent' (100 percent annual probability; a hazard event may occur multiple times per year).

5.4.10.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the severe winter storm hazard, all of Monroe County has been identified as the hazard area. Therefore, all assets in the County (population, structures, critical facilities and lifelines), as described in the County Profile (Section 4), are vulnerable to a winter storm event.

Impact on Life, Health and Safety

The entire population of Monroe County (753,109) is exposed to severe winter storm events (US Census 2020). According to the NOAA National Severe Storms Laboratory (NSSL); every year, winter weather indirectly and deceptively kills hundreds of people in the U.S., primarily from automobile accidents, overexertion and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, drifting snow and extreme cold temperatures and dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. People can die in traffic accidents on icy roads, heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold (NSSL 2021).

The homeless and elderly are considered most susceptible to this hazard. The elderly are considered susceptible to this hazard due to their increased risk of injuries and death from falls and overexertion and/or hypothermia from attempts to clear snow and ice. According to the 2020 American Community Survey 5-Year population estimate, there are 127,588 persons over 65 years old that reside in the County that are considered vulnerable to severe winter weather (16.9 percent of the County population). In addition, severe winter storm events can reduce the ability of these populations to access emergency services

Impact on General Building Stock

The entire general building stock inventory is exposed and vulnerable to the severe winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. As an alternate approach, this plan considers percent damages that could result from severe winter storm conditions. This allows planners and emergency managers to select a range of potential economic impact based on an estimate of the percent of damage to the general building stock. Given professional knowledge and the currently available information, the potential loss for this hazard is many times considered to be overestimated because of varying factors (building structure type, age, load distribution, building codes in place, etc.). Therefore, the following information should be used as estimates only for planning purposes with the knowledge that the associated losses for severe winter storm events vary greatly.

Impact on Critical Facilities

Full functionality of critical facilities such as police, fire, and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Because power interruption can occur, backup power is recommended. Infrastructure at risk for this hazard includes roadways that could be damaged from the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires clearing of roadways and alerting of citizens to dangerous conditions; following the winter season, resources for road maintenance and repair are required.

Impact on Economy

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. In addition to snow removal costs, severe winter weather affects the ability of persons to commute into and out of the area for work or school. The loss of power and closure of roads prevents the commuter population traveling to work within and outside of the County and may cause a loss in economic productivity.

Impact on the Environment

Severe winter weather can have a major impact on the environment. Not only does winter weather create changes in natural processes, the residual impacts of a community's methods to maintain its infrastructure through winter weather maintenance may also have an impact on the environment. For example, an excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources (USGS 2020). Rain-on-snow events can also exacerbate runoff rates with warming winter weather. Consequentially, these flow rates and excess volumes of water can erode banks, tear apart habitat along the banks and coastline, and disrupt terrestrial plants and animals.

Cascading Impacts on Other Hazards

Severe winter weather events may exacerbate flooding. As discussed, the freezing and thawing of snow and ice associated with winter weather events can create major flooding issues in the County. Maintaining winter weather hazards through snow and ice removal could minimize the potential risk of flooding during a warming period. Refer to 5.4.5 (Flood) for more information about the flood hazard of concern.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth located could be potentially impacted by severe winter storm events. Current New York State land use and building codes incorporate standards that address and mitigate snow accumulation. Some local municipalities in the State have implemented the following activities to eliminate loss of life and property and infrastructure damages during winter storm events:

- Removal of snow from roadways
- Removal of 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
- Removal of debris/obstructions in waterways and develop routine inspections/maintenance plans to reduce potential flooding
- Replace substandard roofs of critical facilities to reduce exposure to airborne germs resulting from leakage
- Purchase and install backup generators in evacuation facilities and critical facilities to essential services to residents
- Install cell towers in areas where limited telecommunication is available to increase emergency response and cell phone coverage (NYS DHSES 2019).

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). Any increase in growth can create changes in density throughout the County, which may impact the ability of persons in the County to mobilize or receive essential services during severe winter storm events. Historically, winter weather events with associated snowfall and ice accumulation have severely impacted transportation corridors as well as infrastructure. Refer to Section 4 (County Profile), which includes a more thorough discussion about population trends for the County.

Climate Change

As discussed above, most studies project that the State of New York 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 rainfalls, which have the potential to freeze into heavy snowfall and icing. This increase in snow and ice could result in an increased risk to life and health, an increase in structural losses, a diversion of additional resources to response and recovery efforts, and an increase in business closures affected by severe winter events due to loss of service or access.

Change of Vulnerability Since 2017 HMP

Monroe County remains vulnerable to severe winter storm events. Since the 2017 analysis, population statistics have been updated using the 2020 US Census. Additionally, this updated analysis estimated exposure and losses at the structure level with updated building stock data. The general building stock was updated using building stock data provided by the County to update the user-defined facility inventory and critical facility inventory dataset.

Overall, this vulnerability assessment uses a more accurate and updated building inventory which provides more accurate estimated exposure and potential losses for Monroe County.

5.4.11 WILDFIRE

This section provides a profile and vulnerability assessment of the wildfire hazard for Monroe County.

5.4.11.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections and the probability of future occurrences for the wildfire hazard.

Hazard Description

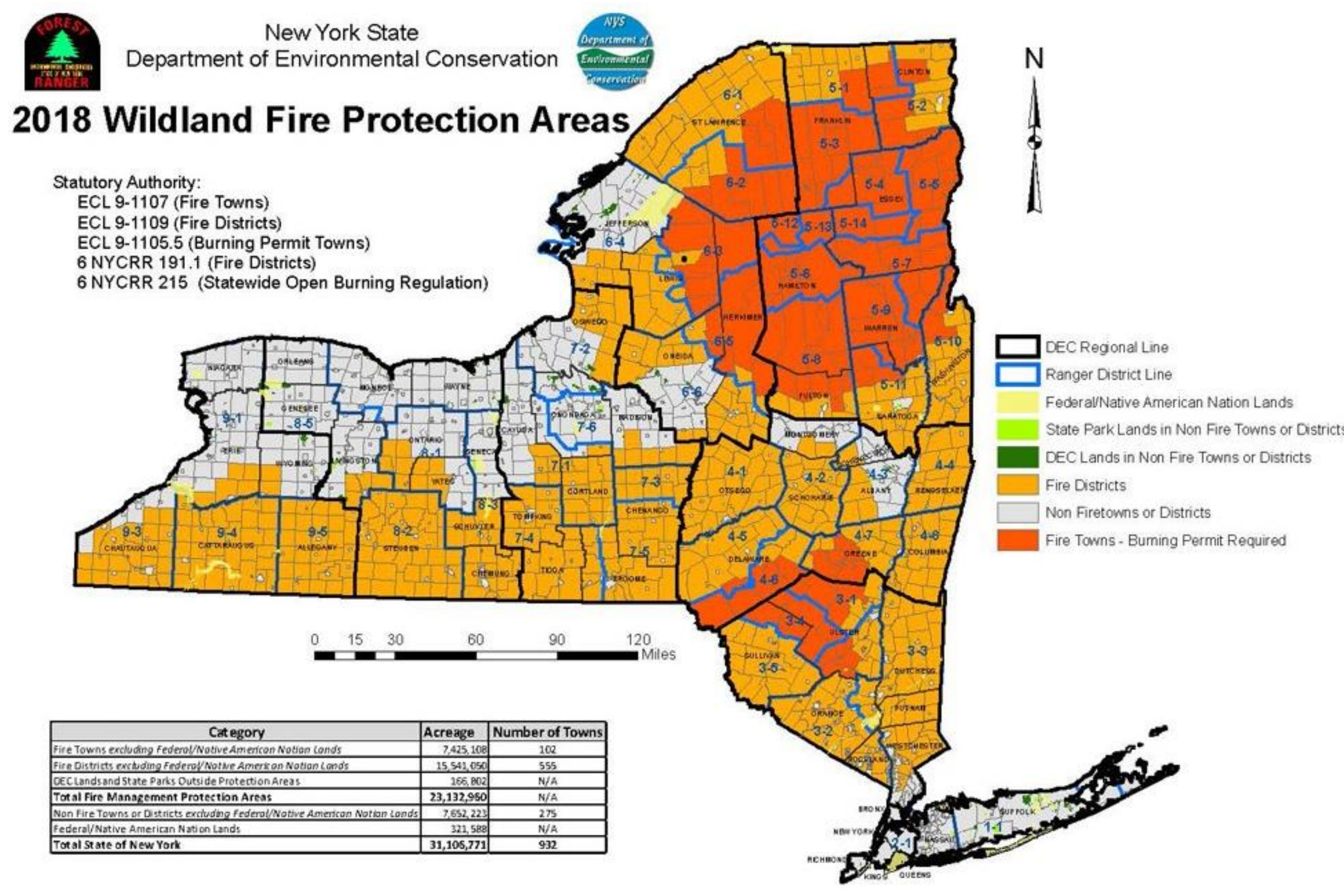
Wildfire is defined as an uncontrolled fire spreading through natural or unnatural vegetation that can threaten lives and property if not contained. Wildfires are commonly termed forest fires, brush fires, grass fires, wildland-urban interface fires, range fires, or ground fires. Wildfires do not include fires naturally or purposely ignited to manage vegetation for one or more benefits (NYS DHSES 2019). Although destructive fires do not occur annually, the State's fire history shows a cycle of outbreaks that have caused human death, property loss, forest destruction, and air pollution (NYS DHSES 2019).

Location

According to the U.S. Fire Administration (USFA), the fire problem in the United States varies from region to region. This variation often is a result of climate, poverty, education, demographics, and other causal factors (USFA 2015). Wildfires do occur in Monroe County. Many areas in the County, particularly those that are heavily forested or contain large tracts of brush and shrubs, are prone to fires (NYSDEC 2015).

In New York State, the NYSDEC's Division of Forest Protection (Forest Ranger Division) is designated as the state's lead agency for wildfire mitigation. The Forest Ranger Division has a statutory requirement to provide a forest fire protection system for 657 of the 932 jurisdictions throughout New York State. This jurisdiction includes cities and villages and covers 23.1 million acres of land, including all state-owned land outside of the jurisdictions. The Lake Ontario Plains and New York City-Long Island areas are the general areas not under the statutory requirement. Records on wildfires in this area are collected from fire department reports to evaluate any need to expand statutory responsibilities. displays the fire protection areas in New York State. Figure 5.4.11-1 indicates that, as of 2018, Monroe County is not part of the wildfire protection area. Figure 5.4.11-2 shows the Forest Ranger Divisions in New York State. Monroe County is part of Forest Ranger Division 8 (NYSDEC 2022).

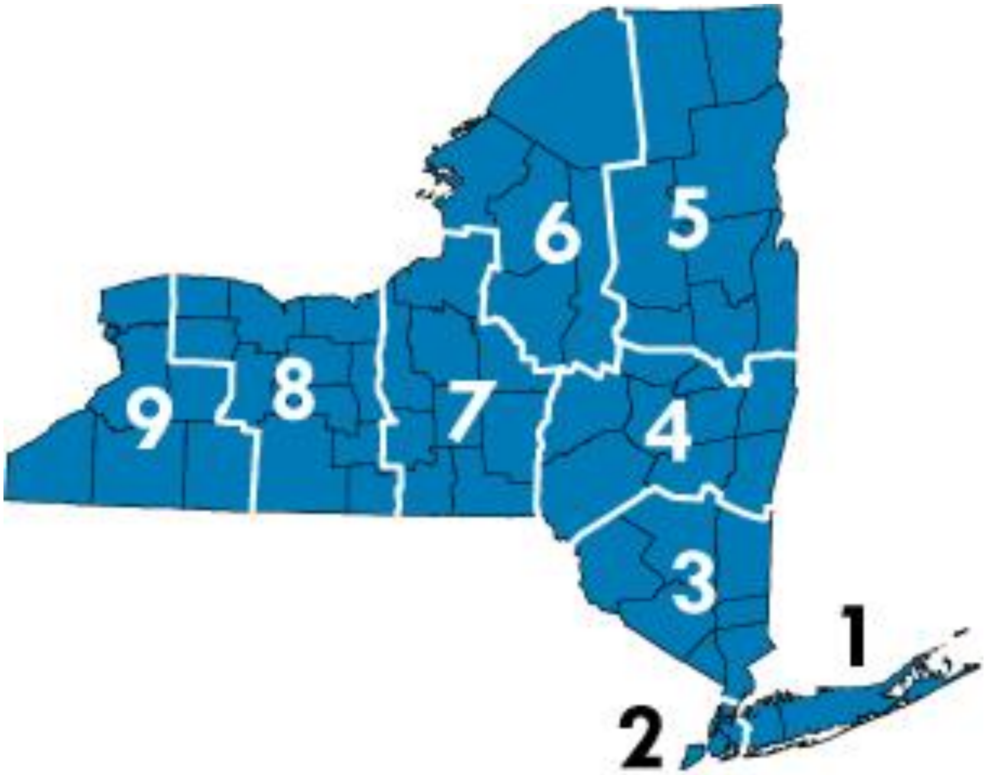
Figure 5.4.11-1. Forest Ranger Division Wildfire Protection Areas



Category	Acreage	Number of Towns
Fire Towns *excluding Federal/Native American Nation Lands*	7,425,108	102
Fire Districts *excluding Federal/Native American Nation Lands*	15,541,050	555
DEC Lands and State Parks Outside Protection Areas	166,802	N/A
Total Fire Management Protection Areas	**23,132,960**	N/A
Non Fire Towns or Districts *excluding Federal/Native American Nation Lands*	7,652,223	275
Federal/Native American Nation Lands	321,588	N/A
Total State of New York	**31,105,771**	**932**

Source: NYSDEC 2018

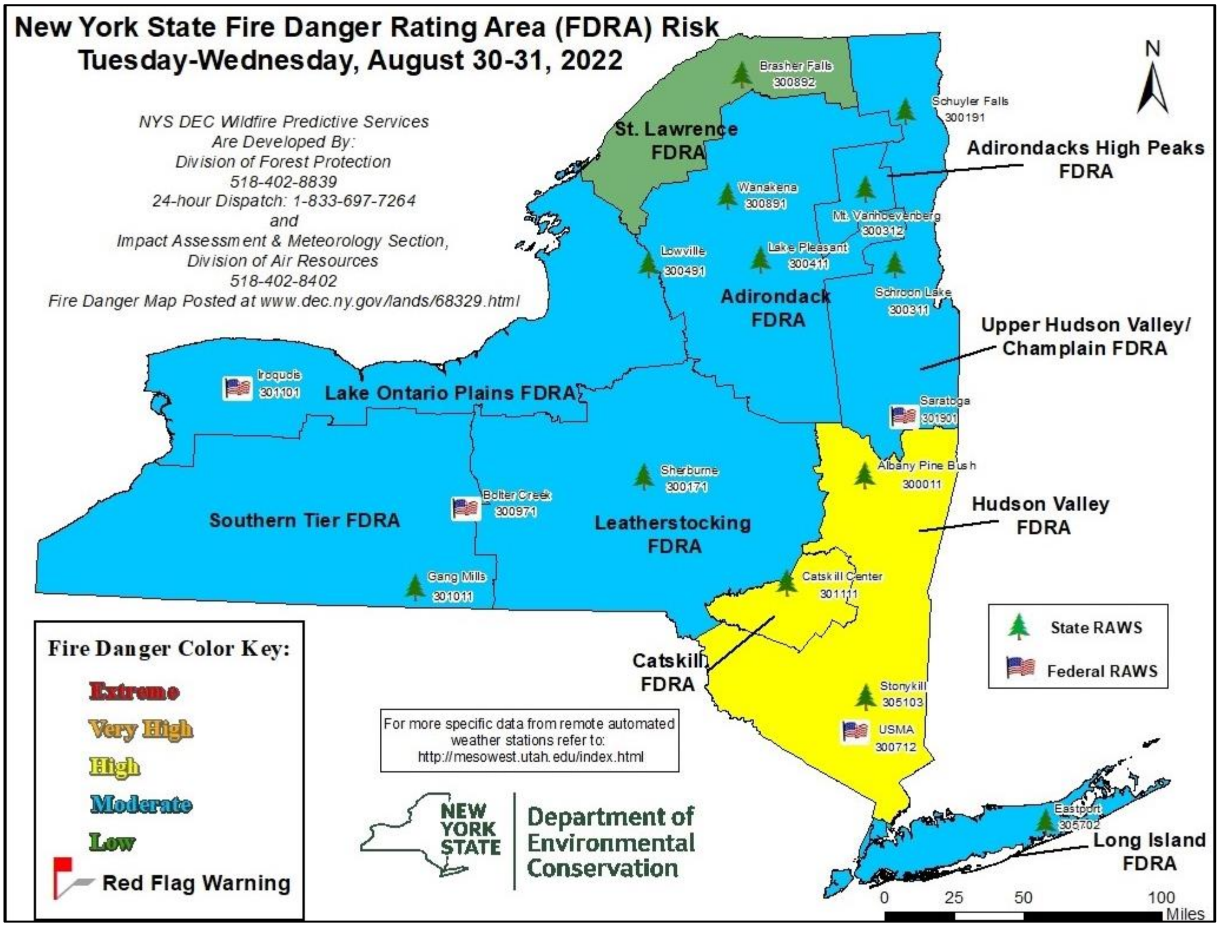
Figure 5.4.11-2. Forest Ranger Divisions in New York State



Source: NYSDEC 2022

New York State is divided into 10 Fire Danger Rating Areas (FDRAs). FDRAs are defined as areas of similar vegetation, climate, and topography in conjunction with agency regional boundaries, NWS fire weather zones, political boundaries, fire occurrence history, and other influences. Monroe County is part of the Lake Ontario Plains FDRA. The Forest Ranger Division issues daily fire danger warnings when the fire danger rating within one or more FDRAs is at "high" or above. A current fire danger rating map is updated daily on the NYSDEC website. Figure 5.4.11-3 shows an example of this map.

Figure 5.4.11-3. New York State Fire Danger Rating Areas



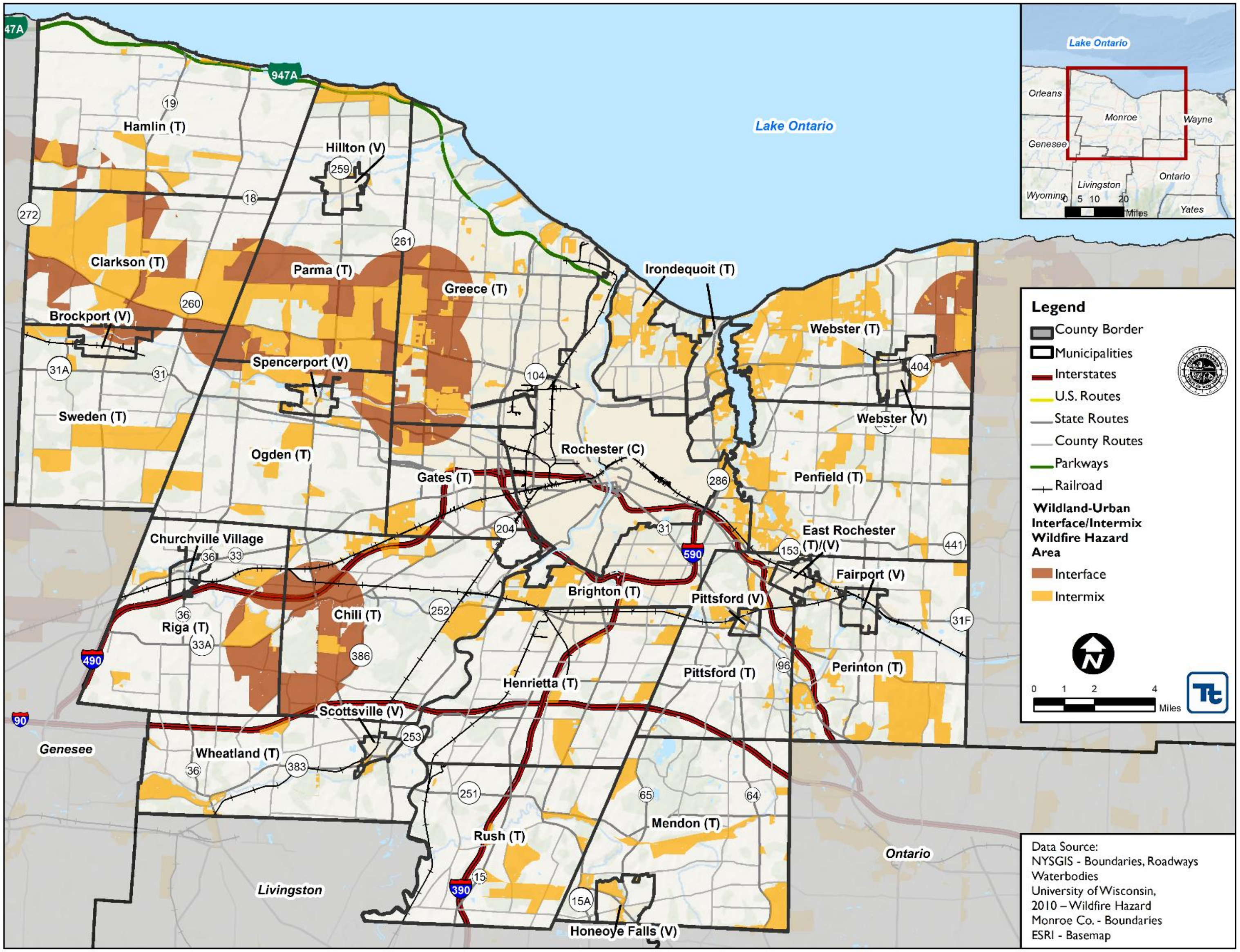
Source: NYSDEC 2022

Wildfire/Urban Interface (WUI) in New York State/Monroe County

The wildland/urban interface (WUI) is any location where human structures and woodlands intermingle, allowing a wildland fire to reach beyond trees, brush, and other natural fuels to ignite homes and their immediate surroundings (NYSDEC n.d.). The WUI can also be subdivided into three categories: intermix, interface, and occluded / interior (Sustainable Defensible Space n.d.). The NYS HMP indicates that New York State has all three types of WUI interfaces. The Adirondack and Catskill Mountains contain large tracts of forests with the mixed, and to a lesser extent, the classic interface occurring throughout. The remainder of the state contains classic and mixed interfaces, with some major cities containing an occluded interface. Population migration from urban to suburban and rural living will continue, increasing the possibility of loss or damage to structures in the WUI, for a number of reasons. Many property owners are unaware that a threat from a wildfire exists or that their homes are not defensible from it. Water supplies at the scene in the WUI are often inadequate. Access by firefighting equipment is often blocked or hindered by driveways that are narrow, winding, dead-ended, have tight turning radii, or have weight restrictions. Most wildland fire suppression personnel are inadequately prepared for fighting structural fires, and local fire departments are not usually fully trained or equipped for wildfire suppression. Furthermore, the mix of structures, ornamental vegetation, and wildland fuels may cause erratic fire behavior. These factors and others substantially increase risk to life, property, and economic welfare in the WUI. While many interface communities are present throughout New York State and Monroe County, an official list that details the location, type of interface, and surrounding fuel makeup does not exist (NYS DHSES 2011).

A detailed WUI (interface and intermix) that also defines the wildfire hazard area was obtained through the SILVIS Laboratory, Department of Forest Ecology and Management, University of Wisconsin – Madison**.** The California Fire Alliance determined that areas within 1.5 miles of wildland vegetation are the approximate distance that firebrands can be carried from a wildland fire to the roof of a house. Therefore, even structures not located within the forest are at risk from wildfire. This buffer distance, along with housing density and vegetation type, were used to define the WUI illustrated on Figure 5.4.11-4 below (Radeloff 2018). Specifically, significant portions of land area in the Towns of Clarkson, Parma, Greece, Webster, Chili, and Riga are within the WUI interface/intermix, as shown in Figure 5.4.11-4.

Figure 5.4.11-4. WUI in Monroe County



Extent

Wildfire events can range in size and intensity. A wildfire's intensity depends significantly on both meteorological conditions and human activity.

Wildfire Behavior and Fire Ecology

Fire behavior is defined as the way fuel ignites, flame develops, and fire spreads, which depend on interactions among fuel, weather, and topography. Fire behavior is one of the most important aspects of wildfires because almost all actions in response to a fire depend on how it behaves. The extent to which fire manages can understand and predict fire behavior relies on success in pre-suppression planning and actual suppression of wildfires.

Potential for wildfire and its subsequent development (growth) and severity are controlled by the three principal factors of topography, fuel, and weather, described as follows:

Topography – Topography can powerfully influence wildfire behavior. 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 behavior 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 1997).

Fuel – Fuels are classified by weight or volume (fuel loading) and by type. Fuel loading is used to describe 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 burn qualities, and some burn more easily than others. Grass fires release relatively little energy but can sustain very high rates of spread (FEMA 1997). According to the U.S. Forest Service (USFS), a forest stand may consist of several layers of live and dead vegetation in the understory (surface fuels), midstory (ladder fuels), and overstory (crown fuels):

- 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 likelihood that future wildfires will grow into crown fires.
- 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 (USFS 2003).

Weather / Air Mass – Weather is the most important factor influencing fire behavior, but it is always changing. Air mass, defined by the National Weather Service (NWS) as a body of air covering a relatively wide area and exhibiting horizontally uniform properties, can affect wildfire through climatic factors that include temperature and relative humidity, local wind speed and direction, cloud cover, precipitation amount and duration, and stability of the atmosphere at the time of the fire (NWS 2009). Extreme weather leads to extreme events, and often a subsidence of severe weather 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 1997).

Several tools are available to estimate fire potential, extent, danger, and growth, including, but not limited to, the following:

- The Wildland Fire Assessment System (WFAS) is an internet-based information system that provides a national view of weather and fire potential, including national fires danger, weather maps, and satellite-derived “greenness” maps (USFS n.d.).
- The Fire Potential Index (FPI) is derived by combining information on daily weather and vegetation condition and can identify areas most susceptible to fire ignition (Burgan, Klaver and Klaver 2000).
- Fuel Moisture (FM) content is quantity of water in a fuel particle expressed as a percent of oven-dry weight of the fuel particle and is an expression of cumulative effects of past and present weather events, to help evaluate the effects of current or future weather on fire potential (Burgan, Klaver and Klaver 2000).
- The Keetch-Byram Drought Index (KBDI) is designed for fire potential assessment and is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers (USFS n.d.).
- The Haines Index, also known as the Lower Atmosphere Stability Index, is a fire weather index based on stability and moisture content of the lower atmosphere that measures potential for existing fires to become large fires (USFS n.d.).
- The Buildup Index (BUI) is a number that reflects combined cumulative effects of daily drying and precipitation in fuels with a 10-day time lag constant (North Carolina Forest Service 2009).

The Fire Danger Rating in New York is established using information from the National Fire Danger Rating System (NFDRS) and takes into account current and antecedent weather, fuel types, and both live and dead fuel moisture. This information is provided by local station managers (USFS n.d.) in each of the ten regions of New York State. Figure 5.4.11-3 shows an example of a Fire Danger Rating Areas (FDRA) in NYS and the fire danger risk within each area on a specific date. Monroe County is part of the Lake Ontario Plains FDRA. On this particular day, the Lake Ontario Plains Fire Danger Rating was low, however some parts of the state were experiencing moderate fire danger. Table 5.4.11-1 lists fire danger ratings and color codes, also used by NYSDEC to update its fire danger rating maps, identified earlier in Figure 5.4.11-3.

Table 5.4.11-1. 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.

Adjective Rating Class and Color Code	Class Description
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: NYS DHSES 2022

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with wildfires throughout New York State and Monroe County; therefore, the loss and impact information for many events varies depending on the source. The accuracy of monetary figures discussed is based on the available information in cited sources.

Short-term effects of wildfires can include destruction of timber, forest, wildlife habitats, scenic vistas, and watersheds. Business and transportation can also be disrupted in the short term. Long-term effects can include reduced access to recreational areas and destruction of community infrastructure and cultural and economic resources (USDA n.d.).

According to Ranger Division wildfire occurrence data from 1993 through 2017, 95 percent of wildfires in the state were human-caused; the remaining 5 percent are the result of lightning. With regards to human-caused fires, debris burning accounted for 33 percent; arson accounted for 16 percent; campfires accounted for 16 percent; children accounted for 4 percent; and smoking, equipment, and railroads accounted for 25 percent (NYSDEC 2022). Figure 5.4.11-5 illustrates occurrences of natural vegetation wildfires in New York State between 2003 and 2017. This figure reveals occurrences of between 0 and 18.5 wildfires per square mile within Monroe County municipalities with the highest number focused on the center and eastern two thirds of the County.

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, New York State was included in two FEMA declared wildfire specific disasters (DR) or emergency declarations (EM). Monroe County was not included in either of these declarations (FEMA 2022).

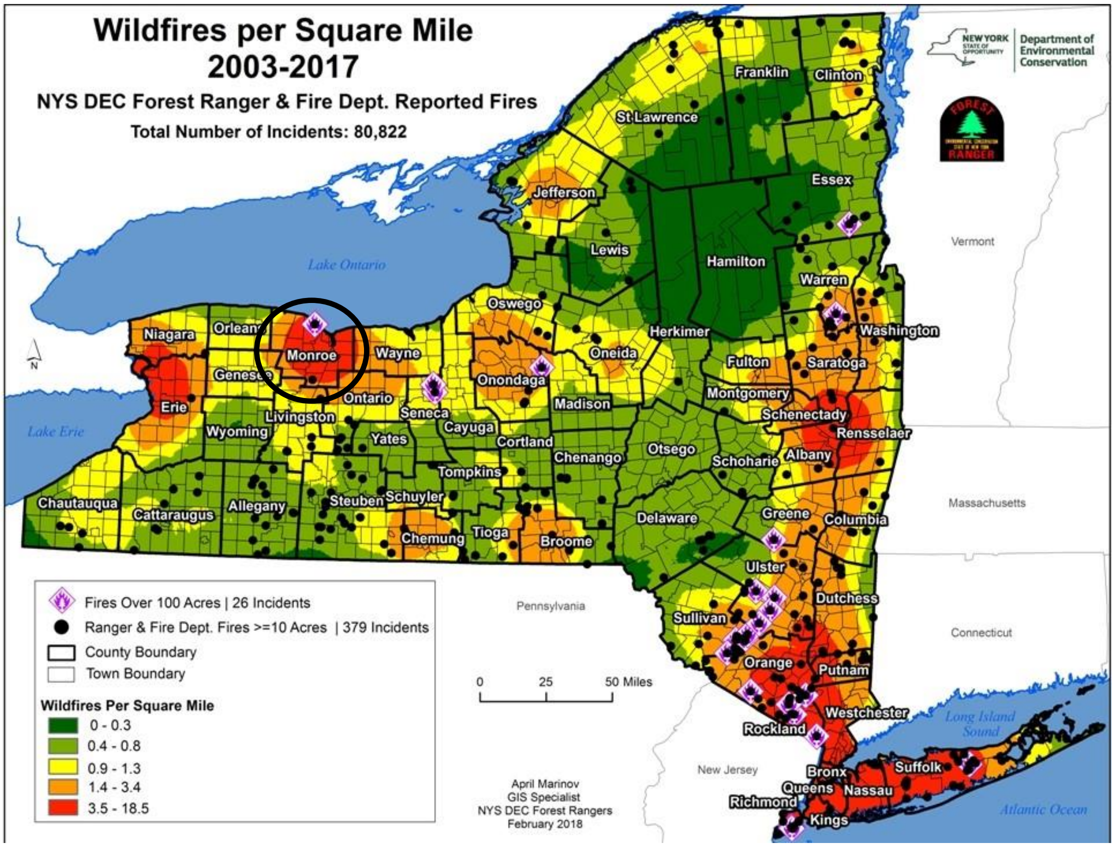
USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was included in the following USDA-designated agricultural disasters that noted wildfire was a contributing factor:

- S4023 - 2016 Drought
- S4031 - 2016 Drought
- S4052 - 2016 Drought (USDA 2022)

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are low the following years as well. USDA records indicate that Monroe County did not have crop losses specifically attributed to wildfire.

Figure 5.4.11-5. Wildfire Occurrences in New York State, 2003-2017



Source: NYSDEC 2022
Note: The black oval indicates the location of Monroe County.

Previous Events

Table 5.4.11-2 identifies the known wildfire events that impacted Monroe County between 2015 and 2022. For events prior to 2015, refer to Appendix H (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Table 5.4.11-2. Wildfire Events between 2015 and 2022

Date(s) of Event	Event Type	FEMA Declaration Number	Location / County Designated?	Losses / Impacts
May 26, 2015	Wildfire	N/A	No	A wildfire detected in the Town of Hamlin

Sources: NASA FIRMS 2015; Monroe County Fire Wire 2015
Note: Monetary figures within this table were U.S. Dollar (USD) figures calculated during or after the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.
FEMA Federal Emergency Management Agency
N/A Not applicable

Climate Change Impacts

Fire potential depends on climate variability, local topography, and human intervention. Climate change can affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot, dry spells create the highest fire risk. With temperatures increasing in New York State, wildfire danger may intensify with warming and drying of vegetation. When climate alters fuel loads and fuel moisture, the susceptibility of the forest to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25 °F per decade. Average annual temperatures are projected to increase across New York State by 2 °F to 3.4 °F by the 2020s, 4.1 °F to 6.8 °F by the 2050s, and 5.3 °F to 10.1 °F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the State (NYSERDA 2014). The total number of hot days in New York State is expected to increase as this century progresses. The frequency and duration of heat waves, defined as three or more consecutive days with maximum temperatures at or above 90 ˚F, are also expected to increase. In contrast, extreme cold events, defined both as the number of days per year with minimum temperature at or below 32 ˚F and those at or below 0 ˚F, are expected to decrease as average temperatures rise (NYSERDA 2011).

Each region within NYS, as defined by the Integrated Assessment for Effective Climate Change in New York State (ClimAID), contains attributes that climate change will affect. Monroe County is part of ClimAID Region 1: The Great Lake Plains. In ClimAID Region 1, temperatures are estimated to increase between 3.7 to 7.3 ºF by the 2050s and 4.2 to 12 ºF by the 2080s (baseline of 47.7 ºF) (NYSERDA 2014). Extreme heat events and heat waves are also projected to increase, as listed in Table 5.4.11-3 below. Prolonged heat waves are likely to generate a greater number of wildfires. Stronger winds from larger storms may lead to more fallen branches for wildfires to consume. Increases in rain and snow events prime forests for fire by supporting growth of more fuel. Drought and warmer temperatures lead to drier forest fuels (NYS DHSES 2014).

In Region 1, it is estimated that temperatures will increase by 4.3ºF to 6.3ºF by the 2050s and 5.7ºF to 9.6ºF by the 2080s (baseline of 47.7ºF) (NYSERDA 2014). Extreme events are also projected to increase, as illustrated in Table 5.4.11-3 below.

Table 5.4.11-3. Extreme Event Projections for Region 1

Event Type (2020s)	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
Days over 90 °F (8 days)	12	14-17	19
# of Heat Waves (0.7 heat waves)	2	2	2
Duration of Heat Waves (4 days)	4	4	4
Days below 32 °F (133 days)	99	103 to 111	116

Source: NYSERDA 2014

A gradual change in temperatures will alter the growing environment of many tree species throughout the United States and New York, reducing the growth of some trees and increasing the growth of others. Tree growth and regeneration may be affected more by extreme weather events and climatic conditions than by gradual changes in temperature or precipitation. Warmer temperatures may lead to longer dry seasons and multi-year droughts, creating triggers for wildfires, insects, and invasive species. Increased temperature and change in precipitation will also affect fuel moisture during wildfire season and the length of time wildfires can burn in a given year (USDA 2011).

Climate change may also increase the frequency of lightning strikes. A warmer atmosphere holds more moisture, which is one of the key items for triggering a lightning strike. Lightning strikes cause approximately half of the wildfires in the United States. If the frequency of lightning strikes increases, the potential for wildfires from these strikes also increases (Lee 2014). Wildfire incidents are predicted to increase throughout the United States because of climate change, causing at least a doubling of areas burned within the next century (USDA 2011).

Climate change directly and indirectly affects growth and productivity of forests: directly as a result of changes in atmospheric carbon dioxide and climate, and indirectly through complex interactions within forest ecosystems. Climate also affects the frequency and severity of many forest disturbances, such as infestations, invasive species, wildfires, and storm events. As temperatures increase, the suitability of a habitat for specific types of trees changes. There is also evidence that prolonged heat waves are likely to lead to a greater number of wildfires. Stronger winds from larger storms may lead to more fallen branches for wildfires to consume. An increase in rain and snow events primes forests for fire by supporting growth of more fuel. Drought and warmer temperatures lead to drier forest fuels (NYS DHSES 2014).

Probability of Future Occurrences

According to the New York State Forest Ranger Division, wildfire occurrence data from 1993 to 2017 have shown that New York State, including Monroe County, is susceptible to wildfires. Beginning in 2010, New York State enacted revised open burning regulations that ban brush burning statewide during this time period. Forest ranger data indicate that this new statewide ban resulted in 74 percent fewer wildfires caused by debris burning in upstate New York from 2010 to 2012. Forest ranger and fire department historical fire occurrence data recorded after the new burn ban regulations were enacted in 2010 will serve as a benchmark for analysis of wildfire occurrence (NYS DHSES 2014).

Fire probability depends on local weather conditions, outdoor activities (such as camping, debris burning, and construction) and the degree of public cooperation with fire prevention measures. Dry weather, such as drought, can increase the likelihood of wildfire events. Lightning can also trigger wildfire and urban fire events. Other natural disasters can increase the probability of wildfires by producing fuel in both urban and rural areas. Forest damage from hurricanes and tornadoes may block interior access roads and fire breaks, pull down overhead power lines, or damage pavement and underground utilities (NVRC 2006).

Wildfire experts point to four reasons why wildfire risks are increasing:

- Fuel, in the form of fallen leaves, branches, and plant growth, has accumulated over time on the forest floor. Now, this fuel has the potential to “feed” a wildfire.
- Increasingly hot, dry weather has occurred and will occur within the United States.
- Weather patterns across the country are changing.
- More homes are built within areas of WUI, meaning that homes are built closer to wildland areas where wildfires can occur (NYS DHSES 2011).

Annual small wildfires likely will occur throughout New York State (as the state has regularly undergone in the past). However, advanced methods of wildfire management and control and a better understanding of the fire ecosystems should reduce the number of devastating fires in the future (NYS DHSES 2011).

The hazards of concern identified for Monroe County were ranked in Section 5.3. Probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence of wildfire within the County is considered "occasional" (between 10 and 100 percent annual probability of a hazard event occurring).

5.4.11.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable within the hazard area identified. The following discusses Monroe County's vulnerability to the wildfire hazard.

Impact on Life, Health and Safety

Wildfires have the potential to impact human health and life of residents and responders, structures, infrastructure, and natural resources. Given the immediate response times to reported wildfires, the likelihood of injuries and casualties is minimal. Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment. Table 5.4.11-4 summarizes the estimated population exposed to the wildfire hazard by jurisdiction.

Based on the analysis, an estimated 43,218 residents (5.7 percent of the County population) are located in the WUI interface hazard area and 59,539 residents (7.9 percent of the County's population) are located in the WUI intermix hazard areas. Overall, the Town of Greece has the greatest number of individuals located in the wildfire hazard areas (i.e., 19,164 persons in the WUI interface and 4,981 in the WUI intermix).

Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Monroe County contains approximately 127,588 people over the age of 65 and 100,484 people below the poverty level (US Census 2020). Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a wildfire event, and they may have more difficulty evacuating. Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, and nitrogen oxides), and toxics (formaldehyde and benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Table 5.4.11-4. Estimated Population within the WUI in Monroe County

Jurisdiction	Total Population (2020 Decennial Census)	Estimated Population Located Within the Wildland-Urban Interface/Intermix (WUI) Wildfire Hazard Areas			
		Number of People in the WUI Interface Wildfire Hazard Area	Percent of Total	Number of People in the WUI Intermix Wildfire Hazard Area	Percent of Total
Brighton (T)	37,137	0	0.0%	4,397	11.8%
Brockport (V)	7,104	4,174	58.8%	106	1.5%
Chili (T)	29,123	4,680	16.1%	2,615	9.0%
Churchville (V)	2,091	0	0.0%	0	0.0%
Clarkson (T)	6,904	3,147	45.6%	2,384	34.5%

Jurisdiction	Total Population (2020 Decennial Census)	Estimated Population Located Within the Wildland-Urban Interface/Intermix (WUI) Wildfire Hazard Areas			
		Number of People in the WUI Interface Wildfire Hazard Area	Percent of Total	Number of People in the WUI Intermix Wildfire Hazard Area	Percent of Total
East Rochester (T/V)	6,334	0	0.0%	91	1.4%
Fairport (V)	5,501	0	0.0%	0	0.0%
Gates (T)	29,167	4,151	14.2%	1,868	6.4%
Greece (T)	96,926	19,164	19.8%	4,981	5.1%
Hamlin (T)	8,725	606	6.9%	1,021	11.7%
Henrietta (T)	47,096	0	0.0%	2,360	5.0%
Hilton (V)	6,027	0	0.0%	54	0.9%
Honeoye Falls (V)	2,706	0	0.0%	496	18.3%
Irondequoit (T)	51,043	0	0.0%	7,114	13.9%
Mendon (T)	6,389	0	0.0%	667	10.4%
Ogden (T)	16,585	2,302	13.9%	1,894	11.4%
Parma (T)	10,190	2,083	20.4%	3,095	30.4%
Penfield (T)	39,438	0	0.0%	4,679	11.9%
Perinton (T)	39,128	0	0.0%	4,831	12.3%
Pittsford (T)	25,714	0	0.0%	1,923	7.5%
Pittsford (V)	1,419	0	0.0%	181	12.7%
Riga (T)	3,495	799	22.9%	353	10.1%
Rochester (C)	211,328	0	0.0%	589	0.3%
Rush (T)	3,490	0	0.0%	561	16.1%
Scottsville (V)	2,009	0	0.0%	55	2.8%
Spencerport (V)	3,685	0	0.0%	531	14.4%
Sweden (T)	6,140	235	3.8%	611	10.0%
Webster (T)	39,676	1,877	4.7%	11,357	28.6%
Webster (V)	5,651	0	0.0%	399	7.1%
Wheatland (T)	2,888	0	0.0%	326	11.3%
Monroe County (Total)	**753,109**	**43,218**	**5.7%**	**59,539**	**7.9%**

Sources: U.S. Census 2020; University of Wisconsin 2010
Notes: (C) = City, (T) = Town, (V) = Village

Impact on General Building Stock

The most vulnerable structures to wildfire events are those located within the WUI areas. If a wildfire occurs at a WUI, it can also cause an urban fire and in this case has the potential for great damage to infrastructure, because of the high density of population and structures in these areas. Buildings constructed of wood or vinyl siding are generally more likely to be damaged by the fire hazard than buildings constructed of brick or concrete. The hazard areas were overlaid on the building inventory in the County (Census block) to estimate the buildings exposed to the wildfire hazard. The replacement cost value of the structures with their center in the hazard area were totaled. Table 5.4.11-5 summarizes the number of buildings exposed by municipality. The limitations of this analysis are recognized, and as such the analysis is only used to provide a general estimate. Approximately 5.5 percent of the County's buildings are located in the WUI interface hazard area, and approximately 0.1 percent of the County's buildings are located in the WUI intermix hazard area.

Table 5.4.11-5. Building Stock within the WUI in Monroe County

Jurisdiction	Total Number of Buildings	Estimated Number of Structures Located in the Wildfire Hazard Areas			
		Number of Buildings in the WUI Interface Wildfire Hazard Area	Percent of Total	Number of Buildings in the WUI Intermix Wildfire Hazard Area	Percent of Total
Brighton (T)	11,693	0	0.0%	1,442	12.3%
Brockport (V)	2,224	1,270	57.1%	32	1.4%
Chili (T)	11,534	1,918	16.6%	1,047	9.1%
Churchville (V)	1,112	0	0.0%	0	0.0%
Clarkson (T)	3,411	1,405	41.2%	1,271	37.3%
East Rochester (T/V)	2,924	0	0.0%	35	1.2%
Fairport (V)	2,394	0	0.0%	0	0.0%
Gates (T)	11,801	1,564	13.3%	796	6.7%
Greece (T)	36,414	6,984	19.2%	1,953	5.4%
Hamlin (T)	5,539	336	6.1%	683	12.3%
Henrietta (T)	15,982	0	0.0%	765	4.8%
Hilton (V)	2,143	0	0.0%	17	0.8%
Honeoye Falls (V)	1,155	0	0.0%	218	18.9%
Irondequoit (T)	21,885	0	0.0%	2,928	13.4%
Mendon (T)	3,835	0	0.0%	374	9.8%
Ogden (T)	7,407	961	13.0%	880	11.9%
Parma (T)	5,509	1,193	21.7%	1,663	30.2%
Penfield (T)	15,882	0	0.0%	1,885	11.9%
Perinton (T)	16,817	0	0.0%	2,159	12.8%
Pittsford (T)	10,590	0	0.0%	789	7.5%
Pittsford (V)	804	0	0.0%	111	13.8%
Riga (T)	2,356	440	18.7%	203	8.6%
Rochester (C)	89,392	0	0.0%	229	0.3%
Rush (T)	2,808	0	0.0%	447	15.9%
Scottsville (V)	1,069	0	0.0%	28	0.0%
Spencerport (V)	1,654	0	0.0%	212	0.1%
Sweden (T)	3,465	131	3.8%	420	0.1%
Webster (T)	16,660	1,050	6.3%	4,688	0.3%
Webster (V)	1,633	0	0.0%	98	0.1%
Wheatland (T)	1,926	0	0.0%	178	0.1%
Monroe County (Total)	**312,018**	**17,252**	**5.5%**	**25,551**	**0.1%**

Sources: Monroe County GIS 2022; University of Wisconsin 2010
Notes: (C) = City, (T) = Town, (V) = Village

Impact on Critical Facilities

A number of critical facilities are within the wildfire hazard area, and are also vulnerable to the threat of wildfire. Many of these facilities are locations of vulnerable populations (schools and senior facilities) and agencies that respond to wildfire events (fire and police). Table 5.4.11-6 summarizes the number of critical facilities and lifelines within the WUI Intermix and Interface hazard areas by jurisdiction. Overall, 124 critical facilities (120 of which are considered lifelines) are located in the wildland-urban intermix hazard area and 82 critical facilities (72 of which are considered lifelines) are located in the wildland-urban interface hazard area. The Town of Greece has the greatest number of critical facilities built in the wildland-urban interface (i.e., 21 critical facilities) and the Town of Chili and Town of Greece have the greatest number of critical facilities built in the wildland-urban intermix hazard areas (i.e., 14 critical facilities each). Critical facilities are further broken out by type within the WUI Interface and Intermix hazard areas, as summarized in Table 5.4.11-6. Lifeline types located in the wildfire hazard areas are identified in Table 5.4.11-7.

Table 5.4.11-6. Facilities within the WUI (Intermix or Interface) in Monroe County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Wildland-Urban Intermix Wildfire Hazard Area				Number of Critical Facilities and Lifeline Facilities Located in the Wildland-Urban Intermix Wildfire Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Brighton (T)	69	65	5	7.2%	5	7.7%	5	7.2%	5	7.7%
Brockport (V)	29	28	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Chili (T)	111	102	14	12.6%	14	13.7%	14	12.6%	14	13.7%
Churchville (V)	24	23	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Clarkson (T)	14	10	2	14.3%	2	20.0%	2	14.3%	2	20.0%
East Rochester (T/V)	31	29	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Fairport (V)	17	16	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Gates (T)	58	54	4	6.9%	4	7.4%	4	6.9%	4	7.4%
Greece (T)	165	158	14	8.5%	14	8.9%	14	8.5%	14	8.9%
Hamlin (T)	23	22	8	34.8%	8	36.4%	8	34.8%	8	36.4%
Henrietta (T)	111	103	5	4.5%	5	4.9%	5	4.5%	5	4.9%
Hilton (V)	21	20	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Honeoye Falls (V)	17	16	8	47.1%	7	43.8%	8	47.1%	7	43.8%
Irondequoit (T)	103	100	3	2.9%	3	3.0%	3	2.9%	3	3.0%
Mendon (T)	21	20	4	19.0%	4	20.0%	4	19.0%	4	20.0%
Ogden (T)	42	38	6	14.3%	5	13.2%	6	14.3%	5	13.2%
Parma (T)	18	16	6	33.3%	6	37.5%	6	33.3%	6	37.5%
Penfield (T)	73	68	7	9.6%	7	10.3%	7	9.6%	7	10.3%
Perinton (T)	64	57	8	12.5%	7	12.3%	8	12.5%	7	12.3%
Pittsford (T)	45	39	4	8.9%	3	7.7%	4	8.9%	3	7.7%
Pittsford (V)	14	13	4	28.6%	4	30.8%	4	28.6%	4	30.8%
Riga (T)	20	18	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Rochester (C)	639	605	1	0.2%	1	0.2%	1	0.2%	1	0.2%
Rush (T)	29	26	6	20.7%	6	23.1%	6	20.7%	6	23.1%
Scottsville (V)	14	13	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Spencerport (V)	13	13	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Sweden (T)	11	11	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Webster (T)	55	53	13	23.6%	13	24.5%	13	23.6%	13	24.5%
Webster (V)	16	15	1	6.3%	1	6.7%	1	6.3%	1	6.7%
Wheatland (T)	23	21	1	4.3%	1	4.8%	1	4.3%	1	4.8%
Monroe County (Total)	**1,890**	**1,773**	**124**	**6.6%**	**120**	**6.8%**	**124**	**6.6%**	**120**	**6.8%**

Source: *Monroe County 2022; University of Wisconsin 2010*
Notes: *(C) = City, (T) = Town, (V) = Village*

Table 5.4.11-7. Lifeline Facilities within the WUI (Intermix or Interface) in Monroe County

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Wildland-Urban Interface Wildfire Hazard Area	Number of Lifelines Located in the Wildland-Urban Intermix Wildfire Hazard Area
Communications	68	5	8
Energy	14	0	0
Food, Water, Shelter	286	18	25
Hazardous Material	1	0	0
Health and Medical	93	1	10
Safety and Security	1,274	47	77
Transportation	36	1	0
Monroe County (Total)	**1,772**	**72**	**120**

Source: Monroe County 2022; University of Wisconsin 2010

Impact on 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 businesses and decreases 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 provide employees with time off to volunteer to fight these fires.

Table 5.4.11-8 summarizes the estimated building stock inventory exposed by municipality. The limitations of this analysis are recognized, and as such the analysis is only used to provide a general estimate. Approximately 3.9 percent ($12.2 billion) of the County's replacement cost value is located in the WUI interface hazard area, and approximately 5.2 percent ($16.4 billion) of the County's replacement cost value is located in the WUI intermix hazard area.

Table 5.4.11-8. Building Stock Replacement Cost Value within the WUI in Monroe County

Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Total Replacement Cost Value of Structures Located in the Wildfire Hazard Areas			
		Total RCV of Buildings Located in the WUI Interface Wildfire Hazard Area	Percent of Total	Total RCV of Buildings Located in the WUI Intermix Wildfire Hazard Area	Percent of Total
Brighton (T)	$14,443,886,002	$0	0.0%	$1,186,836,024	8.2%
Brockport (V)	$5,158,789,593	$2,472,603,273	47.9%	$9,532,926	0.2%
Chili (T)	$9,206,843,885	$1,305,889,268	14.2%	$622,171,237	6.8%
Churchville (V)	$938,164,078	$0	0.0%	$0	0.0%
Clarkson (T)	$1,887,392,030	$668,022,331	35.4%	$828,501,014	43.9%
East Rochester (T/V)	$3,440,171,127	$0	0.0%	$13,844,475	0.4%
Fairport (V)	$2,281,456,075	$0	0.0%	$0	0.0%
Gates (T)	$12,220,599,285	$545,862,128	4.5%	$821,130,034	6.7%
Greece (T)	$26,954,378,684	$4,164,052,659	15.4%	$1,468,468,649	5.4%
Hamlin (T)	$2,318,778,027	$116,872,394	5.0%	$342,147,263	14.8%
Henrietta (T)	$23,460,566,322	$0	0.0%	$578,353,234	2.5%
Hilton (V)	$2,120,287,988	$0	0.0%	$5,656,507	0.3%
Honeoye Falls (V)	$1,813,180,690	$0	0.0%	$219,371,913	12.1%
Irondequoit (T)	$13,427,006,840	$0	0.0%	$1,169,893,590	8.7%
Mendon (T)	$2,852,155,915	$0	0.0%	$221,664,720	7.8%
Ogden (T)	$5,558,087,440	$648,996,610	11.7%	$655,119,709	11.8%
Parma (T)	$3,373,412,574	$940,465,375	27.9%	$991,289,442	29.4%
Penfield (T)	$11,119,233,991	$0	0.0%	$1,263,191,307	11.4%
Perinton (T)	$13,125,415,407	$0	0.0%	$1,461,139,537	11.1%
Pittsford (T)	$10,686,774,000	$0	0.0%	$477,211,403	4.5%
Pittsford (V)	$1,776,834,511	$0	0.0%	$195,408,082	11.0%
Riga (T)	$1,539,492,845	$186,597,276	12.1%	$178,658,659	11.6%
Rochester (C)	$119,943,371,056	$0	0.0%	$78,776,290	0.1%
Rush (T)	$1,816,445,354	$0	0.0%	$214,448,885	11.8%
Scottsville (V)	$908,716,753	$0	0.0%	$75,724,774	8.3%
Spencerport (V)	$1,580,844,696	$0	0.0%	$118,792,132	7.5%
Sweden (T)	$3,402,258,236	$73,724,593	2.2%	$226,661,211	6.7%
Webster (T)	$11,510,191,170	$1,081,442,876	9.4%	$2,706,113,413	23.5%
Webster (V)	$3,634,066,282	$0	0.0%	$76,383,368	2.1%
Wheatland (T)	$2,509,077,040	$0	0.0%	$234,376,260	9.3%

Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Total Replacement Cost Value of Structures Located in the Wildfire Hazard Areas			
		Total RCV of Buildings Located in the WUI Interface Wildfire Hazard Area	Percent of Total	Total RCV of Buildings Located in the WUI Intermix Wildfire Hazard Area	Percent of Total
Monroe County (Total)	**$315,007,877,896**	**$12,204,528,782**	**3.9%**	**$16,440,866,055**	**5.2%**

Sources: Monroe County GIS 2022; University of Wisconsin 2010
Notes: (C) = City, (T) = Town, (V) = Village

Impact on the Environment

Wildfire can lead to ancillary impacts such as landslides in steep ravine areas and flooding caused by the impacts of silt in local watersheds. According to the USGS, post-fire runoff polluted with debris and contaminants can be extremely harmful to ecosystem and aquatic life. Studies show that urban fires in particular are more harmful to the environment compared to forest fires (USGS 2018). The age and density of infrastructure within Monroe County can exacerbate consequences of fires on the environment because of the increased amount of chemicals and contaminants that would be released from burning infrastructure. These chemicals, such as iron lead, and zinc, may leach into the storm water, contaminate nearby streams, and impair aquatic life.

Cascading Impacts On Other Hazards

Wildfires result in the uncontrolled destruction of forests, brush, field crops, grasslands, real estate, and personal property, and have secondary impacts on other hazards such as flooding, by removing vegetation and destroying watersheds. Additionally, wildfires can increase because of rising temperatures and increased droughts. More information about extreme temperature and drought hazards of concern is provided in Section 5.4.4 and Section 5.4.2, respectively.

Severe wildfires can result in a loss of vegetation that causes slope instability. This can contribute to an increase in landslide events. For more information on landslides, refer to Section 5.4.8. Vegetation loss can also increase the amount of runoff during rainfall events, increasingly the likelihood for flash flooding. For more information on the flood hazard, refer to Section 5.4.5.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

Areas targeted for potential future growth and development within the next 5 years have been identified across Monroe County at the jurisdiction level. Refer to the jurisdictional annexes in Volume II of this HMP. Any new development and new residents within the WUI are expected to be exposed to the wildfire hazard. Refer to the jurisdictional annexes in Volume II of this HMP for maps which include new development project areas and their proximity to the wildland-urban interface/intermix hazard areas.

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). Changes in the density of population, particularly in the WUI, can impact the number of persons exposed to the wildfire hazard. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

According to the USDA Forest Service, climate change will likely alter the atmospheric patterns that affect fire weather. Changes in fire patterns will, in turn, impact carbon cycling, forest structure, and species composition (US EPA 2020). Climate change associated with warmer temperatures, changes in rainfall, and increased periods of drought may create an atmospheric and fuel environment that is more conductive to large, severe fires. Under a changing climate, wildfires exceeding 50,000 acres have increased over the past 30 years (USDA 2012a). Understanding the climate/fire/vegetation interactions is essential for addressing issues associated with climate change that include:

- Effects on regional circulation and other atmospheric patterns that affect fire weather
- Effects of changing fire regimes on the carbon cycle, forest structure, and species composition, and
- Complications from land use change, invasive species, and an increasing WUI.

As discussed earlier, average temperatures are anticipated to increase in New York; therefore, the suitability of habitats for specific types of trees will potentially change, altering the fire regime and resulting in more frequent fire events and changes in intensity. Prolonged and more frequent heat waves have the potential to increase the likelihood of a wildfire. The increased potential combined with stronger winds may make it harder to contain fires and thus will increase the County's vulnerability to this hazard.

Change of Vulnerability Since 2017 HMP

Monroe County continues to be vulnerable to the wildfire hazard. However, there are several differences between the exposure estimates of this plan update and the results reported in the 2017 HMP. Population statistics have been updated using the 2020 US Census. The building stock inventory was updated using data from Monroe County. Additionally, the critical facility inventory list was updated by Monroe County.

SECTION 6. MITIGATION STRATEGIES

This section presents mitigation strategies for Monroe County to reduce potential exposure and losses identified as concerns in the Risk Assessment portion of this plan. The Steering Committee reviewed the Risk Assessment to identify and develop these mitigation actions, which are presented herein.

Hazard mitigation reduces the potential impacts of, and costs associated with, emergency and disaster-related events. Mitigation actions address a range of impacts, including impacts on the population, property, the economy, and the environment.

Mitigation actions can include activities such as revisions to land-use planning, training and education, and structural and nonstructural safety measures.

This section includes:

1. Background and Past Mitigation Accomplishments
2. General Planning Approach
3. Review and Update of Mitigation Goals and Objectives
4. Capability Assessment
5. Mitigation Strategy Development

6.1 BACKGROUND AND PAST MITIGATION ACCOMPLISHMENTS

In accordance with the requirements of the Disaster Mitigation Act of 2000 (refer to Section 1 [Introduction] for more detail on DMA 2000), a discussion regarding past mitigation activities and an overview of past efforts are provided as a foundation for understanding the mitigation goals, objectives, and activities outlined in this plan update. The County, through previous and ongoing hazard mitigation activities, has demonstrated that it is proactive in protecting its physical assets and citizens against losses from natural hazards. Examples of previous and ongoing actions and projects include the following:

- The County facilitated the development of the original Monroe County Multi-Jurisdictional Hazard Mitigation Plan. The current planning process represents the regulatory five-year plan update process, which includes the participation of 30 jurisdictions in the County, along with key County and regional stakeholders.
- 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 Monroe County have been reviewed and incorporated into this plan update as appropriate, as discussed in Section 3 (Planning Process) and References.

6.2 GENERAL MITIGATION PLANNING APPROACH

The overall approach used to update the County and local hazard mitigation strategies is based on FEMA and New York State (NYS) regulations and guidance regarding local mitigation plan development, including:

- DMA 2000 regulations, specifically 44 CFR 201.6 (local mitigation planning).
- FEMA *Local Mitigation Planning Handbook*, March 2013.
- FEMA *Local Mitigation Plan Review Guide*, October 1, 2011.
- FEMA *Integrating Hazard Mitigation into Local Planning*, March 1, 2013.
- FEMA *Plan Integration: Linking Local Planning Efforts*, July 2015.
- FEMA *Mitigation Planning How-To Guide #3, Identifying Mitigation Actions and Implementing Strategies* (FEMA 386-3), April 2003.
- FEMA *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, January 2013.

- NYS DHSES *New York State Hazard Mitigation Planning Standards*, 2017.
- NYS DHSES *New York State Hazard Mitigation Planning Standards Guide*, 2017.

The mitigation strategy update approach includes the following steps that are further detailed in later subsections of this section:

- Section 6.3 - Review and update mitigation goals and objectives.
- Section 6.4 - Identify mitigation capabilities and evaluate their capacity and effectiveness to mitigate and manage hazard risk.
- Section 6.5 - Prepare an implementation strategy, including:
  - Identification of progress on previous County and local mitigation strategies;
  - Development of updated County and local mitigation strategies; and
  - Prioritization projects and initiatives in the updated mitigation strategy.

6.3 REVIEW AND UPDATE OF MITIGATION GOALS AND OBJECTIVES

This section documents the efforts to develop hazard mitigation goals and objectives established to reduce or avoid long-term vulnerabilities to the identified hazards.

6.3.1 Goals and Objectives

> FEMA defines ***Goals*** as general guidelines that explain what should be achieved. Goals are usually broad, long-term, policy statements, and represent a global vision.
>
> FEMA defines ***Objectives*** as strategies or implementation steps to attain mitigation goals. Unlike goals, objectives are specific and measurable, where feasible.
>
> FEMA defines ***Mitigation Actions*** as specific actions that help to achieve the mitigation goals and objectives.

According to CFR 201.6(c)(3)(i): "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards." The mitigation goals were developed based on the risk assessment results, discussions, research, and input from the committee, existing authorities, policies, programs, resources, stakeholders, and the public. The Steering Committee reviewed the 2015 goals and objectives and made revisions for the 2022 update based on the risk assessment results, discussions, research, and input from among the committee, existing authorities, policies, programs, resources, stakeholders, and the public. For the purposes of this plan, goals and objectives are defined as follows:

Goals are general guidelines that explain what is to be achieved. They are usually broad, long-term, policy-type statements and represent global visions. Goals help define the benefits that the plan 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).

Objectives are short-term aims that form a strategy or course of action to meet a goal. Unlike goals, objectives are stand-alone measurements of the effectiveness of a mitigation action. The objectives also are used to help establish priorities.

During the 2022 plan update process, the Steering Committee reviewed the goals and objectives established in the 2015 HMP. These goals and objectives were reviewed in consideration of the hazard events and losses since the 2015 plan, the updated hazard profiles and vulnerability assessment, the goals and objectives established in the New York State 2019 HMP, Monroe County, and local risk management plans as well as direct input on how the County and municipalities need to move forward to best manage their hazard risk. Amendments include additions/edits to goals and/or objectives to express the Planning Partnership's interests in integrating this plan with other planning mechanisms/programs and to support mitigation through the protection and preservation of natural systems, including particular reference to certain goals and objectives in the NYS 2019 HMP update, as identified in the table below.

As a result of this review process, the goals and objectives for the 2022 update were updated to those presented in Table 6-1.

Table 6-1. Monroe County Hazard Mitigation Plan Goals and Objectives

Goals	Objectives
Goal 1: Coordinate hazard mitigation programs and other planning efforts that affect the County.	Objective 1.1: Develop and maintain multi-jurisdictional coordination efforts related to hazard mitigation and planning.
	Objective 1.2: Develop and maintain partnerships with external federal, state, municipal, and community stakeholders that have a role in hazard mitigation to leverage and share resources.
	Objective 1.3: Track and/or recommend local, County, state, and federal legislation and regulations related to hazard mitigation.
Goal 2: Prevent hazards from negatively impacting new development.	Objective 2.1: Develop and maintain local regulations that reduce vulnerability to hazards.
	Objective 2.2: Develop and maintain local plans that build resilience to hazards.
	Objective 2.3: Continue to better integrate and update the stormwater management systems within the County.
Goal 3: Protect life, property, and the environment from current and future impacts.	Objective 3.1: Encourage homeowners, renters, and businesses to insure their properties against all hazards, including flood coverage under the National Flood Insurance Program (NFIP).
	Objective 3.2: Acquire, relocate, elevate, and/or retrofit existing structures located in hazard areas.
	Objective 3.3: Acquire, relocate, elevate, and/or retrofit repetitive loss properties from flood-prone areas.
	Objective 3.4: Encourage local participation in the Community Rating System (CRS) Program.
	Objective 3.5: Maintain, and continuously look to improve, emergency response capability.
	Objective 3.6: Identify, and provide additional resources to, vulnerable and marginalized populations that have reduced capacity to respond to hazards compared with the general population.
Goal 4: Increase public awareness of current and future hazards, their impacts, and ways to reduce vulnerability through education and outreach.	Objective 4.1: Improve public alert, warning, and communications systems by promoting redundant and multi-faceted communications methods.
	Objective 4.2: Conduct a coordinated public information program related to hazards and their impacts throughout the County.
	Objective 4.3: Encourage property owners to implement hazard mitigation and preparedness measures on their properties.
	Objective 4.4: Promote personal, family, and social group preparedness.
Goal 5: Protect, preserve, and restore the functions of natural systems.	Objective 5.1: Encourage the use of green and natural infrastructure
	Objective 5.2: Coordinate with local, County, state, federal, international, and other stakeholder agencies to maintain natural systems, including wetlands, parks, and riverine and coastal areas.

6.4 CAPABILITY ASSESSMENT

According to FEMA's *Mitigation Planning How-To Guide #3*, a capability assessment is an inventory of a community's missions, programs, and policies and an analysis of its capacity to carry them out. This assessment is an integral part of the planning process. The assessment process enables identification, review, and analysis of current local and state programs, policies, regulations, funding, and practices that could either facilitate or hinder mitigation.

During the original planning process, the County and participating jurisdictions identified and assessed their capabilities in the areas of existing programs, policies, and technical documents. By completing this assessment, each jurisdiction learned how or whether they would be able to implement certain mitigation actions by determining the following:

- Limitations that may exist on undertaking actions;
- The range of local and/or state administrative, programmatic, regulatory, financial, and technical resources available to assist in implementing their mitigation actions;
- Actions deemed infeasible as they are currently outside the scope of capabilities;
- Types of mitigation actions that may be technically, legally (regulatory), administratively, politically, or fiscally challenging or infeasible;
- Opportunities to enhance local capabilities to support long-term mitigation and risk reduction.

During the plan update process, all participating jurisdictions were tasked with developing or updating their capability assessment, paying particular attention to evaluating the effectiveness of these capabilities in supporting hazard mitigation and identifying opportunities to enhance local capabilities.

County and municipal capabilities in the Planning and Regulatory, Administrative and Technical, and Fiscal arenas may be found in the Capability Assessment section of each jurisdictional annex in Section 9 - Annexes. Within each annex, participating jurisdictions identified how they have integrated hazard risk management into their existing planning, regulatory, and operational/administrative framework ("integration capabilities") and how they intend to promote this integration ("integration actions"). A further summary of these continued efforts to develop and promote a comprehensive and holistic approach to hazard risk management and mitigation is presented in Section 7 – Plan Maintenance.

The Monroe County Office of Emergency Management (OEM) staff provided leadership for the Monroe County HMP Update planning effort. In addition, the County staff on the Steering Committee provided continuous support for the implementation of mitigation projects and mitigation educational outreach and serves as a resource to the county and municipalities.

A summary of the various federal, state, county, and local planning and regulatory, administrative and technical, and fiscal programs available to promote and support mitigation and risk reduction in Monroe County are presented below.

6.4.1 Planning and Regulatory Capabilities - County and Local

Municipal Land Use Planning and Regulatory Authority

The County and municipalities have various land use planning mechanisms that can be leveraged to mitigate flooding and support natural hazard risk reduction. Specific County and local planning and regulatory capabilities are identified in their jurisdictional annexes in Section 9 – Annexes. These include but are not limited to: comprehensive plans, flood damage prevention ordinances, local codes and regulations, stormwater regulations, and municipal level plans. A list of plans reviewed is provided in each annex in Section 9 (Table 9.X-2.

Section 239 of New York State General Municipal Law (GML) requires the referral of certain local planning actions to the Monroe County Planning Board for the examination of possible intermunicipal impacts. The Monroe County Planning Board operates under New York State General Municipal Law §239 l and m to advise local boards on the potential intermunicipal or countywide impact of local land use decisions. The Planning

Board uses the Monroe County Comprehensive Plan to direct recommendations on municipal land use referrals and to review proposed County capital improvement projects.

Emergency and Evacuation Plans

The Monroe County Department of Public Safety is designated to coordinate all emergency management activities in the County, including planning, response, and management. The department works collaboratively with many other agencies and organizations, which enables the County to better protect life and property during disasters and emergencies. This Department maintains the Monroe County Comprehensive Emergency Management Plan (CEMP), which is a comprehensive approach to emergency management. The CEMP is an all-hazards plan that outlines how the County will efficiently and effectively manage emergencies and disaster situations. An update to the EMP is currently underway.

The American Red Cross is the lead organization for Monroe County sheltering operations. The County has roughly 130 shelters that have been identified in the past but updating of the sheltering list and memorandums of understanding for facility use is needed.

The Monroe County Mass Shelter Plan is maintained by the Office of Emergency Management and is an annex to the CEMP (last updated in 2018). The Independently Managed Shelter Operations Plan was developed after the 2017 Windstorm and is a manual for operating an independently managed shelter. It establishes specific requirements that shelters must follow, as well as recommended best practices. The goal is to provide a temporary, safe environment for the citizens of Monroe County in the time of an emergency rendering normal habitation unsafe or impossible until the situation is resolved or other, more permanent arrangements can be safely made possible.

The Office of Public Health Preparedness is a collaborative partner in both plans and also maintains a Special Medical Needs Shelter Plan, an annex to the Monroe County Mass Sheltering Plan. The Special Medical Needs Shelter Plan guides the sheltering of medically fragile individuals.

The Monroe County annex to this HMP (Section 9.1) includes an action to work with municipalities to improve evacuation, sheltering, temporary housing and permanent housing planning.

The County's Radiological Plan for events at the Ginna Nuclear Generating Station includes a sheltering component. It also includes evacuation routes for the Towns of Penfield and Webster. The County's road network is incorporated into the County's GIS. Evacuation routes are determined at time of incident.

Local Waterfront Revitalization Program

The 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 more detailed implementation of the State's CMP through use of such existing broad powers as zoning and site plan review (New York State Division of Planning 2018).

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. Title 19 of NYCRR Part 600, 601, 602, and 603 provide the rules and regulations that implement each of the provisions of the Waterfront Revitalization of Coastal Areas and Inland Waterways Act, including but not limited to the required content of an LWRP, the processes of review and approval of an LWRP, and LWRP amendments (New York State Division of Planning 2018).

A LWRP consists of a planning document prepared by a community and the program established to implement the plan. An LWRP 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. 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. Also, funding to advance preparation, refinement, or implementation of Local Waterfront Revitalization Programs is available under Title 11 of the New York State Environmental Protection Fund Local Waterfront Revitalization Program (EPF LWRP), among other sources (New York State Division of Planning 2018).

Any village, town, or city located along the State's coast or designated inland waterway can prepare a new or amend an existing Local Waterfront Revitalization Program. Municipalities are encouraged to address local revitalization issues in a broader context, aligned with regional economic development strategies and regional resource protection and management programs (New York State Division of Planning 2018).

Comprehensive Master Plans

Comprehensive planning is a term used in the United States by land use planners to describe a process that determines community goals and aspirations in terms of community development. The outcome of comprehensive planning is the "Comprehensive Plan" or "Master Plan," which dictates public policy in terms of transportation, utilities, land use, recreation, and housing. 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. State statutes require that all land use laws in a municipality be consistent with a comprehensive plan.

6.4.2 Planning and Regulatory Capabilities – State and Federal

National Flood Insurance Program (NFIP)

The U.S. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968 (FEMA's 2002 National Flood Insurance Program (NFIP): Program Description). The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Please refer to the Flood Hazard Profile in Section 5.4.6 (Flood) for information on legislation related to reforms to the NFIP.

There are three components to the NFIP: flood insurance, floodplain management and flood hazard mapping. Communities participate in the NFIP 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. Community participation in the NFIP is voluntary. 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% less damage annually than those not built in compliance (FEMA, 2008).

All municipalities in Monroe County actively participate in the NFIP. As of 2015, there were 1,815 NFIP policies in Monroe County. There have been 366 claims made, totaling over $3 million for damages to structures and contents. There are 13 NFIP Repetitive Loss (RL) properties in the County. Further details on the County's flood vulnerability may be found in the flood hazard profile in Section 5.4.5 - Flood.

Municipal compliance with the NFIP is described in each of the jurisdictional annex in Section 9 (Jurisdictional Annexes). The County's municipalities have been compliant with the NFIP. To enhance their flood damage prevention programs and enhance compliance with the NFIP in the future, several municipalities propose actions in their mitigation strategies to ensure that their floodplain administrators complete training on floodplain management and the NFIP or update their flood damage prevention ordinance. All municipalities have included an action to improve Substantial Damage determination procedures. In addition, Monroe County's mitigation strategy (see Section 9.1) includes an action to encourage and empower municipalities to participate in FEMA's Community Rating System. Additional information on the NFIP program and its implementation throughout the County may be found in the flood hazard profile (Section 5.4.5 - Flood).

The state and municipalities within it may adopt higher regulatory standards when implementing the provisions of the NFIP. Specifically identified are the following:

Freeboard: By law, NYS requires Base Flood Elevation plus 2 feet (BFE+2) for all construction. When there is a base flood elevation available, the lowest floor, including any basement, must be at or above the base flood elevation (plus two feet beginning in 2007). 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 historic 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 (NYDEC 2018). 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.

Cumulative Substantial Improvements/Damages: The NFIP allows improvements valued at up to 50% of the building's pre-improvement value to be permitted without meeting the 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.

NFIP Community Rating System (CRS)

As an additional component of the NFIP, the CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates 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 (FEMA, 2012).

As of November 2022, there is one community within Monroe County that participate in the CRS program, the Town of Greece. Monroe County is exploring the program requirements of the Community Rating System (CRS) through technical expertise and assistance to guide interested municipalities through the application process, as well as help maintain and enhance their participation in the program.

U.S. Army Corps of Engineers

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. A nationwide permit (NWP) 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 54 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 2017). Details on each NWP can be found here: https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll7/id/6711.

There are three types of USACE permits: standard, nationwide (described above), and regional. Standard permits are individual permits that involve full public interest review of an individual permit application and includes the issuance of a public notice for any project that does not meet the terms and conditions of an NWP or a Letter of Permission (LOP). Regional general permits are for small, specialized projects. In New York State, there are six regional general permit categories (see https://www.lrb.usace.army.mil/Missions/Regulatory/New-York-Permit-Information/) (USACE Buffalo District 2019).

New York State Floodplain Management

There are two departments that have statutory authorities and programs that affect floodplain management at the local jurisdiction level in New York State: the NYSDEC and the Department of State's Division of Code Enforcement and Administration (DCEA).

The NYSDEC is charged with conserving, improving, and protecting the state's natural resources and environment, and preventing, abating, and controlling water, land, and air pollution. Programs that have bearing on floodplain management are managed by the Bureau of Flood Protection and Dam Safety, which cooperates with federal, state, regional, and local partners to protect lives and property from floods, coastal erosion, and dam failures. These objectives are accomplished through floodplain management and both structural and nonstructural means.

The Dam Safety Section is responsible for "reviewing repairs and modifications to dams and assuring [sic] that dam owners operate and maintain dams in a safe condition through inspections, technical reviews, enforcement, and emergency planning." The Flood Control Projects Section is responsible for reducing flood risk to life and property through construction, operation, and maintenance of flood control facilities.

The Floodplain Management Section is responsible for reducing flood risk to life and property through management of activities, such as development in flood hazard areas, and for reviewing and developing revised flood maps. The Section 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. The Section provides a wide range of technical assistance.

Stormwater Management Planning

When proper controls are not in place, research studies show a clear link between urbanization and increased flooding and pollutant export. 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 (NYSDEC 2015).

According to the federal law commonly known as Stormwater Phase II, permits are required for stormwater discharges from Municipal Separate Storm Sewer Systems (MS4s) in urbanized areas and those additionally designated by the New York State Department of Environmental Conservation (NYSDEC). Owners or operators of such MS4s must be authorized in accordance with the State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems. The permit requires development of a Stormwater Management Program (SWMP).

6.4.3 Administrative and Technical Capabilities - County and Local

This subsection provides a summary of capabilities to support hazard mitigation for local jurisdictions, some of whom sat on the Steering Committee and others who provide a resource for support and information to communities. Specific local capabilities (e.g., police, fire, EMS, highway and public works departments, etc.) are provided in Section 9 (Jurisdictional Annexes).

Monroe County Department of Public Safety

The Monroe County Department of Public Safety, through the effective, dedicated efforts of its divisions, contractors, employees, volunteers, and the community, provides education, prevention, technical support, inter-agency coordination and direct services that meet or exceed the expectations of the courts, individuals, and the public and private agencies receiving these services in order to enhance the quality of life in Monroe County, NY. The Department of Public Safety includes the Divisions of Communications & Radio Center, Emergency Management, Emergency Medical Services, Fire Bureau, and Safety and Security.

The Department led and helped to organize the update of this Hazard Mitigation Plan and was also an active participant in the Steering Committee.

Monroe County Planning and Development Department

The Monroe County Planning and Development Department coordinates a broad range of programs, including those for land use planning and resource integration. The Department supports programs that meet multiple objectives, e.g., quality land use planning and economic development. Land use planning in the County also considers impacts of potential hazard areas. The County Planning Department participates in hazard mitigation planning efforts directed through the County OEM. The Department also provides technical support to municipal planning agencies and provides training programs for professionals, residents, elected officials, and board members. The County Planning Board does not review development proposals—only the County Capital Improvement Plan. County Planning staff provide technical assistance to various planning activities within the County.

For more information about the County's Planning activities please visit
https://www.monroecounty.gov/planning-planning.

Monroe County Department of Health

The Monroe County Department of Health protects the health and safety of Monroe County residents and visitors. Through a wide range of services, we prevent disease, promote healthy habits, and improve quality of life.

Monroe County Legislature

The Legislature serves as the governing body of the County. Each legislator represents a district of approximately 25,000 people. The Legislature has numerous standing committees including:

- Agenda/Charter
- Environment and Public Works
- Intergovernmental Relations
- Planning and Economic Development
- Recreation and Education
- Human Services
- Transportation

- Public Safety
- Ways and Means

Monroe County Department of Environmental Services

The Monroe County Department of Environmental Services (DES) combines advanced wastewater and solid waste management into one sophisticated and proactive organization. DES is comprised of the following divisions:

- The Division of Pure Waters was established by the County Legislature to implement the Pure Waters Master Plan to reduce the levels of pollution in Irondequoit Bay, the Genesee River, areas of Lake Ontario and other waters of Monroe County to safe and healthy levels. Pure Waters' staff manages four geographic districts containing several miles of major interceptor tunnel, two wastewater treatment facilities, pump stations and the sewer collection systems for the Rochester and Gates-Chili-Ogden districts. Collection sewers in the other districts are operated, maintained, and funded by local municipalities. The districts obtain the majority of their revenue from user charges. The County Legislature, which is also the Pure Waters Administrative Board, oversees the districts, approves contracts, holds public hearings, establishes annual rates, and approves Pure Water's annual operating budget.
- Solid Waste and Recycling is responsible for solid waste management and recycling, guided through the Local Solid Waste Management Plan (LSWMP).
- The Geographic Information System (GIS) Services Division manages Monroe County's interagency GIS program. The GIS Services Division provides leadership, coordination, infrastructure, education, and a variety of services to realize the full potential of a Community GIS. The mission of the GIS Services Division is to develop a fully integrated GIS that will support the needs of all Monroe County Departments, the City of Rochester, and local towns and villages. The division fosters Countywide access to current, accurate spatial information and the elimination of duplication of effort.
- The Division of Engineering provides professional engineering and construction services to County departments (e.g., Transportation, Parks, Aviation, MCC, Sheriff, Facilities, Community Hospital, and Pure Waters) that require technical support for capital planning, engineering design, and construction management. The Division is also responsible for overseeing all real estate functions within the County including leasing of County-owned/required space and facilities, lease management, acquisition and disposition of real estate, open space acquisition, easements, right-of-way, options, licenses and permits. Topographic surveys are also conducted and coordinated by the Division. In addition, the Division enforces the NYS Unified Building Code, issues demolition and building permits and certificates of occupancy, and manages ADA accessibility compliance for over 400 County owned and leased facilities.
- The Fleet Division of Monroe County's Department of Environmental Services (DES) is responsible for managing a diverse fleet of licensed and non-licensed motor vehicles, construction, maintenance, and snow removal equipment, and firefighting and other specialized vehicles including repairs to light, medium and heavy-duty vehicles and equipment at a centralized Fleet Center facility located on Paul Road, adjacent to the Greater Rochester International Airport. The Fleet Division has received the distinction of being recognized as one of the top municipal operations in the country, in large part due to its leadership with "green" fuels.

The staff members of these divisions work together, both in the office and out in the field, to minimize the adverse impacts that the County's population has on its surrounding land and waterways.

Monroe County Department of Transportation

The Monroe County Department of Transportation is responsible for the safe and efficient operation and maintenance of approximately 1,500 lane miles (665 centerline miles) of County-owned highways, 180 bridges, 275 major culverts, and 805 traffic signal and flasher devices on the Monroe County highway system. In addition, the department is responsible for:

- County-wide traffic, highway, and bridge engineering;
- County-wide road sign fabrication, installation, and maintenance;
- County-wide pavement marking;
- installation and maintenance of all traffic control devices on County highways and streets within the City of Rochester;
- operating and maintaining 4,530 light fixtures along the Rochester area expressway system;
- operating and maintaining 760 light fixtures along some state highways and 240 light fixtures along some County highways;
- highway permit issuance for construction activities along County highway right-of-ways;
- assisting the Towns and Villages with traffic engineering needs upon request;
- providing surveying and mapping services; and
- administering the In Bloom and the ADOPT-A-HIGHWAY programs.

To accomplish its work, the department is divided into five divisions:

- Highway Engineering and Operations
- Bridge Engineering and Operations
- Traffic Operations and Permits
- Traffic Signal Engineering and Operations
- Project Planning and Administration

Stormwater Coalition of Monroe County

Established in 2000, the Stormwater Coalition of Monroe County is a collective group of 29 municipal representatives from towns and villages throughout the County. Through collaboration the Stormwater Coalition of Monroe County complies with federal and state stormwater regulations. The work of the Coalition is advanced by several task groups including Education, Construction, and Illicit Discharges/Pollution Prevention. The Coalition implements a wide range of projects and programs including public education, training for municipal employees and the land development community, demonstrations of practices that reduce polluted runoff from developed land, technical assistance with permits and erosion control, investigations of stormwater outfalls for indicators of illegal discharges, assessments of municipal facilities for opportunities to prevent pollution.

Monroe County Soil & Water Conservation District (MCSWCD)

The MCSWCD is a municipal subdivision that partners with state, local and federal agencies, as well as watershed groups to educate and assist landowners and municipalities in planning and implementing best management practices that stabilize soil, improve water quality, manage stormwater runoff, preserve open space, and manage fish and wildlife habitat. The District provides technical assistance in the preservation and restoration of streams, wetlands, woodlots, agricultural land and low impact development to landowners, farmers, engineers, contractors, developers, and municipalities.

6.4.4 Administrative and Technical Capabilities - State and Federal

New York State Division of Homeland Security and Emergency Services (NYS DHSES)

For more than 50 years, NYS DHSES (formerly New York State Office of Emergency Management) and its predecessor agencies have been responsible for coordinating the activities of all State agencies to protect New York's communities, the State's economic well-being, and the environment from natural and man-made disasters and emergencies. NYS DHSES routinely assists local governments, voluntary organizations, and private industry through a variety of emergency management programs, including hazard identification, loss prevention, planning, training, operational response to emergencies, technical support, and disaster recovery assistance.

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. NYS DHSES prepared the current State Hazard Mitigation Plan working with input from other State agencies, authorities, and organizations. It was approved by FEMA in 2018, and it 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 2019 New York State HMP was used as guidance in completing the Monroe County HMP Update. The State HMP can be found here: https://mitigateny.availabs.org/.

For the purpose of this HMP, representatives from NY DHSES completed stakeholder surveys, provided technical assistance and data, and attended planning partnership meetings. NYS DHSES also presented about state requirements for hazard mitigation plans at the October 2022 Mitigation Action Workshop.

New York State Department of Environmental Conservation (NYSDEC) – Region 9 – Central New York

NYSDEC – Region 9 is located in western New York and includes Allegany, Erie, Chautauqua, Erie, Niagara, and Wyoming counties. The main Department of Environmental Conservation (DEC) office is located in Buffalo with a sub-office in Allegany. DEC staff have two main areas of responsibility: natural resource management and environmental quality protection. As part of natural resource management, staff oversee state fish and wildlife resources as well as state forests (NYSDEC Region 9 2019).

New York State Department of Environmental Conservation (NYSDEC) – Division of Water - Bureau of Flood Protection and Dam Safety

Within the NYSDEC – Division of Water, the Bureau of Flood Protection and Dam Safety (https://www.dec.ny.gov/lands/4991.html) 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. The bureau consists of the following sections:

- Coastal Management: Works to reduce coastal erosion and storm damage to protect lives, natural resources, and properties through structural and nonstructural means.
- Dam Safety: Is responsible for reviewing repairs and modifications to dams and assuring that dam owners operate and maintain dams in a safe condition through inspections, technical reviews, enforcement, and emergency planning.
- Flood Control Projects: Is responsible for reducing flood risk to life and property through construction, operation, and maintenance of flood control facilities.

- Floodplain Management: Is responsible for reducing flood risk to life and property through proper management of activities including, development in flood hazard areas and review and development of revised flood maps (NYSDEC Bureau of Flood Protection and Dam Safety 2019).

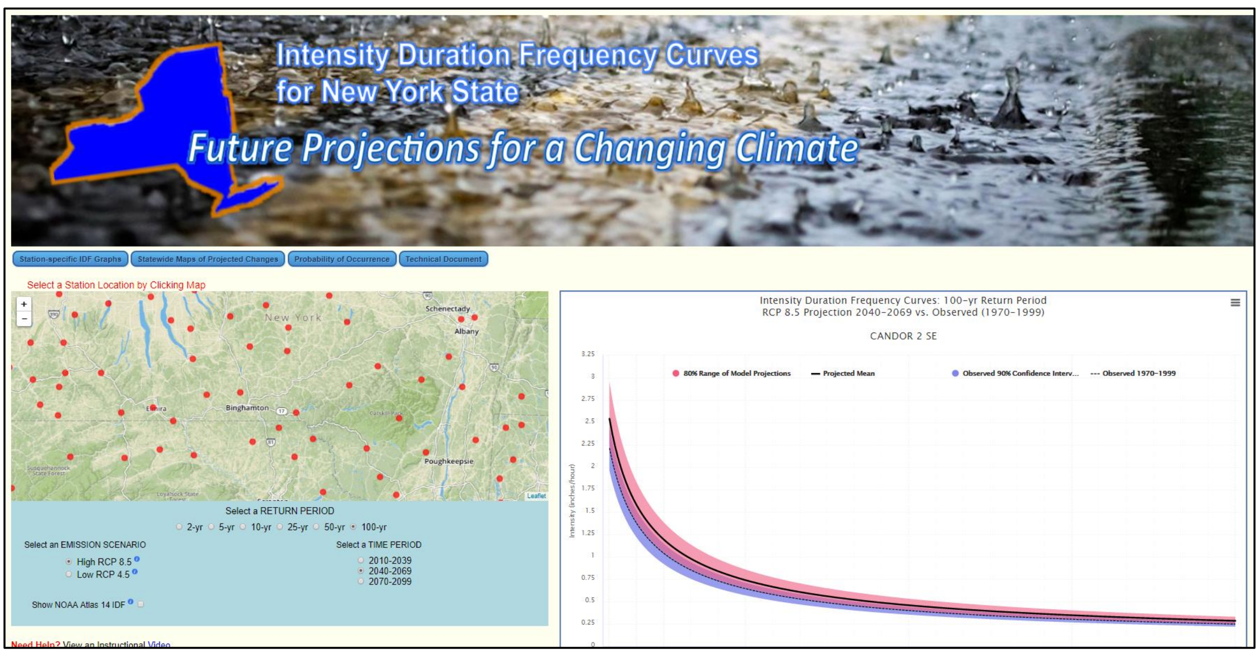
The NYSDEC's Mission is "To conserve, improve and protect New York's natural resources and environment and to prevent, abate and control water, land and air pollution, in order to enhance the health, safety and welfare of the people of the state and their overall economic and social well-being."

DEC'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.

Northeast Regional Climate Center

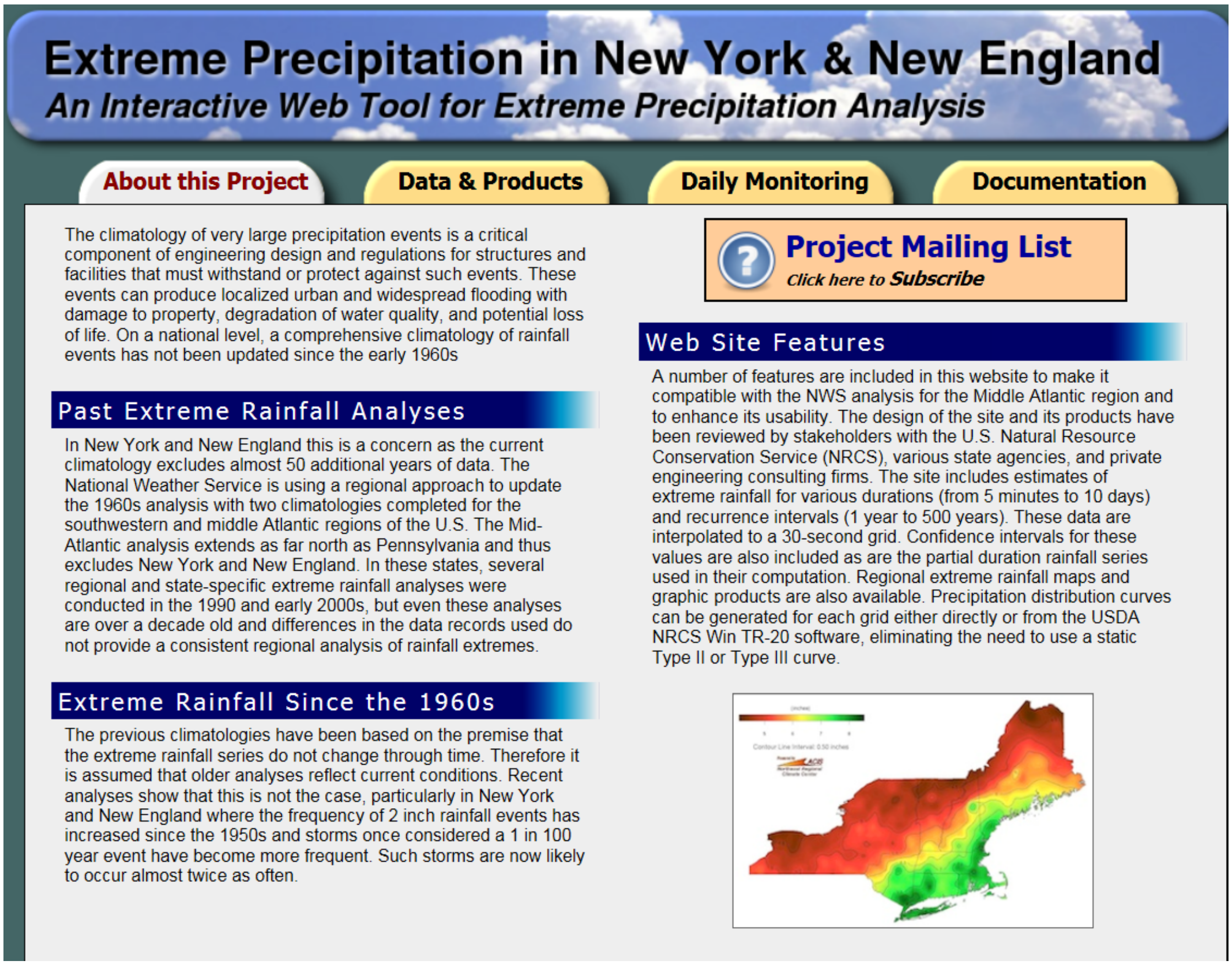
The Northeast Regional Climate Center (NRCC) partnered with the New York State Energy Research and Development Authority (NYSERDA) to compare various methods of downscaling global climate model (GCM) output and create extreme precipitation projections for New York State. These projections will ultimately be incorporated into climate change adaptation planning. In 2009 alone, 175 total flooding events in New York State led to $32.82 million in property damage. The state is also still recovering from the $42 billion toll of Superstorm Sandy. Climate change is resulting in an increase in the frequency of heavy rainfall events. To help New York State communities plan for effects of climate change, new graphics are now available showing the increased likelihood of heavy precipitation events. These graphs, called Intensity Duration Frequency (IDF) curves, show anticipated increases of storm events from 2- to 100-year intervals and are projected into the future as far as 2099. These products are designed for use by municipal officials, researchers, planners, highway departments, and other decision-makers who need to take storm events into account. These IDF curves display how precipitation events are being affected by New York State's rapidly changing climate (NRCC 2015). Figure 6-1 displays the screenshot of the website.

Figure 6-1. Screenshot of the IDF Curves for New York State



NRCC also maintains the Extreme Precipitation in New York & New England website, 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). These data are interpolated to a 30-second grid. Confidence intervals for these values are included as are the partial duration rainfall series used in their computation. Regional extreme rainfall maps and graphic products are available. Precipitation distribution curves can be generated for each grid either directly or from the USDA NRCS Win TR-20 software, eliminating the need to use a static Type II or Type III curve (NRCC 2018). 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. Figure 6-2 shows a screenshot of the website.

Figure 6-2. Screenshot of the Extreme Precipitation in New York & New England website



Department of State's Division of Code Enforcement and Administration (DCEA)

Technical Bulletins for the 2010 Codes of New York State

The DCEA publishes technical bulletins for its building codes. TB-1004 came into effect in October 2017 and addressed Flood Venting in Foundations and Enclosures in Flood Areas. The bulletin clarifies definitions and requirements with regard to Residential and Building Construction (19NYCRR 1220 and 1221). Bulletins also address requirements for critical facilities such as fire stations, requirements for fire extinguishers, and other hazards.

Forms and Publications

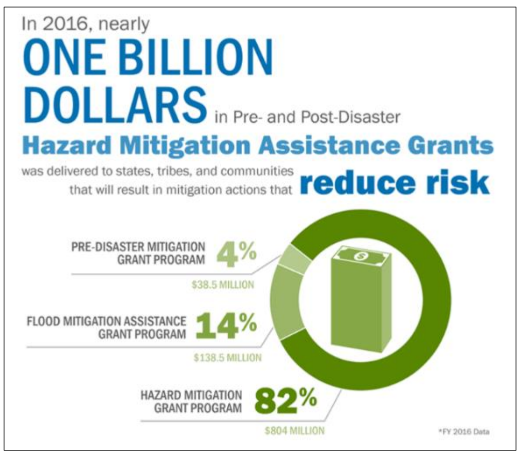
The DCEA posts several model reporting forms and related publications on its web page. The Building Permit Application requests the applicant to indicate whether the site is or is not in a floodplain and advises checking with town clerks or NYSDEC. The General Residential Code Plan Review form includes a reminder to "add 2' 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 International Code Series published by International Code Council and FEMA (2008).

6.4.5 Fiscal Capabilities – County and Local

Municipal Fiscal Capabilities

Monroe County and individual municipalities are (legally, not necessarily practically) able to fund mitigation projects though existing local budgets, local appropriations (including referendums and bonding), and a variety of federal and state loan and grant programs. Many municipalities 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, municipalities have continued to leverage the sharing of resources and combining available funding with grants and other sources and note that plans and intermunicipal cooperation are beneficial in obtaining grants.

6.4.6 Fiscal Capabilities – State and Federal



Source: FEMA 2018

The *NYS Capabilities* section of the 2019 New York State Hazard Mitigation Plan features a section on mitigation-related funding administered by state agencies that eligible jurisdictions can use to find mitigation actions. A list of funding opportunities can be accessed here: https://mitigateny.availabs.org/strategies/funding

As noted on the FEMA hazard mitigation assistance website (https://www.fema.gov/hazard-mitigation-assistance), FEMA administers five programs that provide funding for eligible mitigation planning and projects that reduces disaster losses and protect life and property from future disaster damages. The programs are the Hazard Mitigation Grant Program (HMGP), and the HMGP Post Fire Grant, the Flood Mitigation Assistance (FMA) Program, the Pre-Disaster Mitigation (PDM) Program, and the new Building Resilient Infrastructure & Communities (BRIC) Program.

HMGP assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration. PDM provides funds for hazard mitigation planning and projects on an annual basis. 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. BRIC supports jurisdictions in hazard mitigation projects, reducing the risks they face from disasters and natural hazards. The BRIC program will replace the existing Pre-Disaster Mitigation (PDM) program. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency (FEMA 2020).

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. PDM and FMA funding depends on the amount congress appropriates each year for those programs. BRIC is funded by a 6 percent ($500 million) set-aside from federal post-disaster grant funding.

Individual homeowners and business owners may not apply directly to FEMA. Eligible local governments may apply on their behalf (FEMA 2020).

Table 6-2 provides an overview of program funding eligibility and cost share.

Table 6-2. FEMA HMA Grant Cost Share Requirements

Programs	Cost Share (Percent of Federal / Non-Federal Share)
HMGP	75 / 25
FMA – insured properties and planning grants	75 / 25
FMA – repetitive loss property[(2)]	90 / 10
FMA – severe repetitive loss property[(2)]	100 / 0
BRIC	75 / 25
BRIC – subrecipient is small and impoverished community	90 / 10

Source: FEMA HMA Guidance 2015; Regulations.gov; FEMA 2020

(1) Subapplicants should consult their State Hazard Mitigation Officer (SHMO) for the amount of percentage of HMGP subrecipient management cost funding their State has determined to be passed through subrecipients.

(2) 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.

Federal Hazard Mitigation Funding Opportunities

Federal mitigation grant funding is available to all communities with a current hazard mitigation plan (this plan); however, most of these grants require a "local share" in the range of 10-25 percent of the total grant amount. Details about this program and a further description of these opportunities can be found at: https://www.fema.gov/hazard-mitigation-assistance. The FEMA mitigation grant programs are described below.

Hazard Mitigation Grant Program (HMGP)

The HMGP is a post-disaster mitigation program. It is made available to states by FEMA after each Federal disaster declaration. The HMGP can provide up to 75 percent funding for hazard mitigation measures. The HMGP can be used to fund cost-effective projects that will protect public or private property in an area covered by a federal disaster declaration or that will reduce the likely 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. All applicants must have a FEMA-approved Hazard Mitigation Plan (this plan).

Applicants who are eligible for the HMGP are state and local governments, certain nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf. 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. For additional information regarding HMGP, please refer to: https://www.fema.gov/hazard-mitigation-grant-program

Flood Mitigation Assistance (FMA) Program

The FMA program combines the previous Repetitive Flood Claims and Severe Repetitive Loss Grants into one grant program. The FMA 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 very 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.

For additional information regarding the FMA program, please refer to: https://www.fema.gov/flood-mitigation-assistance-grant-program

Building Resilient Infrastructure and Communities (BRIC) Program

Building Resilient Infrastructure and Communities (BRIC) will support states, local communities, tribes, and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the existing Pre-Disaster Mitigation (PDM) program.

The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency.

For additional information regarding the BRIC program, please refer to:
https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities

Rehabilitation of High Hazard Potential Dams (HHPD) Program

The Rehabilitation of High Hazard Potential Dams (HHPD) grant program provides technical, planning, design, and construction assistance for eligible rehabilitation activities that reduce dam risk and increase community preparedness.

The HHPD Grant Program will provide assistance for technical, planning, design, and construction activities toward:

- Repair
- Removal
- Structural/nonstructural rehabilitation of eligible high hazard potential dams

For additional information regarding the HHPD program, please refer to: https://www.fema.gov/emergency-managers/risk-management/dam-safety/grants/resources.

Extraordinary Circumstances

For BRIC and FMA project subawards, the (FEMA) Region may apply extraordinary circumstances when justification is provided and with concurrence from FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) prior to granting an exception. If this exception is granted, a local mitigation plan must be approved by FEMA within 12 months of the award of the project subaward to that community.

For HMGP, BRIC, and FMA, extraordinary circumstances exist 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 (Standard or Enhanced) Mitigation Plan and that the jurisdiction meets at least one of the criteria below. If the jurisdiction does not meet at least one of these criteria, the Region must coordinate with FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) for HMGP; however, for BRIC and FMA the Region must coordinate and seek concurrence prior to granting an exception:

- The jurisdiction meets the small, impoverished community criteria (see Part VIII, B.2).
- 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 the local or Tribal Mitigation Plan.

For HMGP, BRIC, 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 shall acknowledge in writing to the Regional Administrator that a plan will be completed within 12 months of the subaward. The Recipient must provide a work plan for completing the local or Tribal Mitigation Plan, including milestones and a timetable, to ensure that the jurisdiction will complete the plan in the required time. This requirement shall be incorporated into the award (both the planning and project subaward agreements if a planning subaward is also awarded).

Federal and State Disaster and Recovery Assistance Programs

Following a disaster, various types of assistance may be made available by local, state, and federal governments. The types and levels of disaster assistance depend on the severity of the damage and the declarations that result from the disaster event. Among the general types of assistance that may be provided should the President of the United States declare the event a major disaster includes the following:

Individual Assistance (IA)

IA provides help for homeowners, renters, businesses, and some nonprofit entities after disasters occur. This program is largely funded by the U.S. Small Business Administration. For homeowners and renters, those who suffered uninsured or underinsured losses may be eligible for a Home Disaster Loan to repair or replace damaged real estate or personal property. Renters are eligible for loans to cover personal property losses. 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. For businesses, loans may be made to repair or replace disaster damages 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. 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. For additional information regarding IA, please refer to: https://www.fema.gov/individual-disaster-assistance

Public Assistance (PA)

PA 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. For additional information regarding PA, please refer to: https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit

Small Business Administration (SBA) Loans

SBA provides low-interest disaster loans to homeowners, renters, business of all sizes, and most private nonprofit organizations. SBA 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.

Homeowners may apply for up to $200,000 to replace or repair their primary residence. Renters and homeowners 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. Physical disaster loans of up to $2 million are available to qualified businesses or most private nonprofit organizations. For additional information regarding SBA loans, please refer to: https://www.sba.gov/managing-business/running-business/emergency-preparedness/disaster-assistance

Social Services Block Grant Program (SSBG)

To address the needs of critical health and human service providers and the populations they serve, the State of New York will receive a total of $235.4 million in federal Superstorm Sandy SSBG funding. The state will distribute $200,034,600 through a public and transparent solicitation for proposals and allocate $35.4 million in State Priority Projects, using the SSBG funding. Sandy SSBG resources are dedicated to covering necessary expenses resulting from Superstorm Sandy, including social, health, and mental health services for individuals, and for repair, renovation, and rebuilding of health care facilities, mental hygiene facilities, childcare facilities, and other social services facilities. Additional information regarding the SSBG program is available on the website: https://www.acf.hhs.gov/ocs/programs/ssbg.

Department of Homeland Security Grant Program (HSGP)

The Homeland Security Grant Program (HSGP) plays an important role in the implementation of the National Preparedness System by supporting 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 two priorities: building and sustaining law enforcement terrorism prevention capabilities and maturation and enhancement of state and major urban area fusion centers. HSGP is composed of three interconnected grant programs including the State Homeland Security Program (SHSP), Urban Areas Security Initiative (UASI), and the Operation Stonegarden (OPSG). Together, these grant programs fund a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration. For additional information regarding HSGP, please refer to: https://www.fema.gov/grants/preparedness/homeland-security

Community Development Block Grants (CDBG)

CDBG are federal funds intended to provide low and moderate-income households with viable communities, including decent housing, as 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 the times of "urgent need" (e.g., post-disaster) as defined by the CDBG National Objectives, CDBG funding may be used to acquire a property located 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. For additional information regarding CDBG, please refer to: https://www.hudexchange.info/programs/cdbg-entitlement/

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. Through its Public Works Program, USEDA invests in key public infrastructure, such as in traditional public works projects, including water and sewer systems 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, and development facilities. Through its Economic Adjustment Program, USEDA administers its Revolving Loan Fund (RLF) 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. Please refer to the USEDA website (https://www.eda.gov/) for additional information.

Federal Highway Administration - Emergency Relief (FHWA-ER)

The FHWA- ER is a grant program that may be used for repair or reconstruction of Federal-aid highways and roads on Federal lands which have suffered serious damage as a result of a disaster. NYS is serving as the liaison between local municipalities and FHWA. $30 million in funding was released in October−November of 2012 for emergency repair work conducted in the first 180 days following Hurricane Sandy. Another $220 million in additional funding became available February 2013. For information regarding the FHWA-ER Program, please refer to: https://www.fhwa.dot.gov/programadmin/erelief.cfm

Federal Transit Administration - Emergency Relief (FTA-ER)

The FTA-ER 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 at the U.S. Department of Transportation and directly allocated to metropolitan transit authorities (MTA) and port authorities, this transportation-specific fund was created as an alternative to FEMA PA. Currently, a total of $5.2 billion has been allocated to NYS-related entities. For information regarding the FTA-ER Program, please refer to: https://www.transit.dot.gov/funding/grant-programs/emergency-relief-program/emergency-relief-program

State Hazard Mitigation Funding Opportunities

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 associated with project development and brownfield remediation and redevelopment. For additional information regarding Empire State Development, please refer to: https://esd.ny.gov/

Local Waterfront Revitalization Program

The Waterfront Revitalization of Coastal Areas and Inland Waterways Act offers local governments the opportunity to participate in the State's Coastal Management Program (CMP) (pdf) on a voluntary basis by preparing and adopting a LWRP, providing more detailed implementation of the State's CMP through use of such existing broad powers as zoning and site plan review. 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.

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. Also, funding to advance preparation, refinement, or implementation of Local Waterfront Revitalization Programs is available under Title 11 of the New York State EPF LWRP, among other sources.

In addition, State permitting, funding, and direct actions must be consistent, to the maximum extent practicable, with an approved LWRP. Within the federally defined coastal area, federal agency activities are also required to be consistent with an approved LWRP. 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.

New York State Department of Transportation (NYSDOT)

Scour Critical/Flood Prone Bridge Program

The Scour Critical/Flood Prone Bridge Program is an initiative developed to harden New York State’s at-risk bridges to withstand extreme weather events. In the past three years, the State has suffered nine presidentially declared disasters due to extreme weather, many involving severe flooding (NYSDOT 2015).

For this initiative, 105 scour critical/flood prone bridges (https://www.dot.ny.gov/main/business-center/cbow/repository/CBOW_list_2015.pdf) throughout New York State were identified as most at-risk from repeated flooding and are located in the Capital District, Long Island, Mid-Hudson, Mohawk Valley, North Country, Finger Lakes, Central/Western and Southern Tier regions. The locations encompass 78 communities within 30 counties across the State (NYSDOT 2015).

All of the bridges included in this program were built to the codes and standards of their time and remain safe and open for everyday traffic. However, due to a variety of natural severe weather events and the increasing frequency of major storms and floods, they are vulnerable to scour, and flooding caused by the intensity and velocity of water from extreme natural events. Bridge scour erodes and carries away foundation materials such as sand and rocks from around and beneath bridge abutments, piers, foundations, and embankments (NYSDOT 2015).

This program encompasses a variety of bridge improvement work, including upgrading concrete bridge abutments and/or piers by adding steel or concrete pile foundations, increasing the size of waterway openings to meet 100-year flood projections and reducing or eliminating the number of bridge piers in the water to prevent debris and ice jams that can flood surrounding areas. Completion of the program will ensure continual access to critical facilities and essential personnel during emergency events. Adverse impacts to travel throughout the State will be greatly reduced during severe weather events as well (NYSDOT 2015).

Through HMGP, this program aims to increase the State's resiliency and mitigate the risks of loss and damage associated with future disasters. The total cost of the program, including all 105 bridges across the state, is $518 million. It will be paid for with a mix of funding from FEMA and the U.S. Department of Housing and Urban Development. No state funding will be required (NYSDOT 2015).

Emergency Watershed Protection Program

The purpose of the Emergency Watershed Protection Program (EWP) was established by Congress to respond to emergencies created by natural disasters. The EWP Program is designed to help people and conserve natural resources by relieving imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences. The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) administers the EWP Program; EWP-Recovery, and EWP–Floodplain Easement (FPE). For additional information regarding the EWP, please refer to:
https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/

EWP - Recovery

The EWP Program is a recovery effort program 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 must be a legal subdivision of the State, such as a city, county, township or conservation district, and Native American Tribes or Tribal governments. NRCS may 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 work is not limited to any one set of measures. It is designed for installation of recovery measures to safeguard lives and property as a result of a natural disaster. NRCS completes a Damage Survey Report (DSR) which provides a case-by-case investigation of the work necessary to repair or protect a site.

Watershed impairments that the EWP 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 (FPE)

Privately-owned lands or lands owned by local and state governments may be eligible for participation in EWP-FPE. To be eligible, lands must 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 are eligible, provided the lands would contribute to the restoration of the flood storage and flow, provide for control of erosion, or that would improve the practical management of the floodplain easement
- Lands that would be inundated or adversely impacted as a result of a dam breach

EWP-FPE easements are restored to the extent practicable to the natural environment and may include both structural and nonstructural practices to restore the flood storage and flow, erosion control, and improve the practical management of the easement.

Structures, including buildings, within the floodplain easement must be demolished and removed or relocated outside the 100-year floodplain or dam breach inundation area.

New York State Department of Environmental Conservation Climate Smart Communities (CSC) Program

The CSC program is jointly sponsored by the following six New York State agencies: DEC; Energy Research and Development Authority; Public Service Commission; Department of State; NYSDOT; and the Department of Health. The program encourages municipalities to minimize the risks of climate change and reduce long-term costs through actions which reduce greenhouse gas emissions and adapt to a changing climate. The program offers free technical support on energy and climate and guidance tailored to New York State communities. As of April 2020, more than 303 communities, representing 8.7 million New Yorkers in every region of the state, have committed to acting on climate through New York State's Climate Smart Communities program.

Benefits of participating in the program include saving taxpayer dollars, improving operations and infrastructure, increasing energy independence and security, demonstrating leadership, and positioning for economic growth. Registered Climate Smart Communities receive notification of state and federal assistance that they can leverage to help adopt low-carbon technologies and of programs and support for efficiency improvements and energy conservation. Further, those communities receive an advantage in accessing some state assistance programs, can call on the help of other local governments that already have adopted climate smart practices and policies, and receive statewide recognition for their climate-smart accomplishments. Key elements of the Climate Smart Communities program are described below.

For additional information regarding the CSC program, please refer to: https://climatesmart.ny.gov/

Climate Smart Communities Pledge

Any city, town, village, or county in New York can join the program by adopting the Climate Smart Communities Pledge. To become a registered Climate Smart Community, the municipality's governing body must adopt a resolution that includes all 10 elements of the Pledge and inform DEC of the passage of the resolution. The required 10 elements of the Pledge are as follows:

- Pledge to be a Climate Smart Community.
- Set goals, inventory emissions, plan for climate action.
- Decrease community energy use.
- Increase community use of renewable energy.
- Realize benefits of recycling and other climate smart solid waste management practices.
- Reduce greenhouse gas emissions through use of climate smart land use tools.
- Enhance community resilience and prepare for the effects of climate change.
- Support development of a green innovation economy.
- Inform and inspire the public.
- Commit to an evolving process of climate action.

Numerous communities in Monroe County have registered to take the Climate Smart Communities Pledge.

Climate Smart Communities Certification (CSC) Program

The Climate Smart Communities Certification (CSC) program enables high-performing registered communities to achieve recognition for their leadership. Designed around the existing ten pledge elements, the certification program recognizes communities achieving any on 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. Details of the program and the specific documentation required for each action are described in the CSC Certification Manual at https://climatesmart.ny.gov/actions-certification/actions/

At the time of this plan update, two communities have achieved certification: Town of Brighton and the Town of Pittsford.

Climate Smart Communities Grant Program

In 2019 DEC announced an expansion of the Environmental Protection Fund to support communities ready to reduce greenhouse gas emissions and prepare for the effects of climate change. Climate Smart Community Implementation grants support mitigation and adaptation projects and range from $100,000 to $2 million. Competitive grants have typically ranged from $25,000 to $100,000 will also provide support for local governments to become certified Climate Smart Communities. All counties, cities, towns, and villages of the State of New York are eligible to receive funding. The CSC Grant Program will provide 50/50 matching grants for eligible projects in the following categories.

Funding is available for implementation projects that advance a variety of climate adaptation and mitigation actions, including the following:

- Construction of natural resiliency measures
- Relocation or retrofit of climate-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

Funding is also available for **certification projects** that advance several specific actions aligned with Climate Smart Communities Certification requirements:

- Right-sizing of 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

In scoring grant applications, increasing points are awarded to communities who have already taken the CSC pledge and to those that have achieved certification status. All grant recipients must take the Climate Smart Communities Pledge within the term of their grant contract. For climate mitigation projects, grant recipients must provide a report of estimates of emissions reduction. Certification actions must adhere to the requirements and standards described in the Climate Smart Communities Certification Manual that is available on the website: https://www.dec.ny.gov/energy/76483.html. For implementation projects involving property (construction, improvements, restoration, rehabilitation), grant recipients that do not have ownership of the property must obtain a climate change mitigation easement.

The Climate Smart Communities Toolkit was developed to educate New York communities on recommended practices that will help to reduce greenhouse gas emissions and adapt to the effects of climate change, specifically in the areas of land-use, transportation policy, green buildings, infrastructure investment, green infrastructure, housing policy, adaptation, and resilience. The Climate Smart Communities Guide to Local Action contains overviews of possible community actions, how-to's and case studies to help communities implement the CSC pledge. The Climate Smart Communities Land Use Toolkit allows New York communities to find recommended practices that will help to reduce greenhouse gas emissions in the areas of land use, transportation policy, green building, infrastructure investment, green infrastructure, and housing policy.

New York State Department of Environmental Conservation (NYSDEC)

Water Quality Improvement Project (WQIP) Program

The WQIP 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:

- 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 (MS4)

Details regarding this program are available here: https://www.dec.ny.gov/pubs/4774.html.

New York State DEC/Environmental Facilities Corporation (EFC) Grants

The New York State DEC, in conjunction with the New York State EFC, will offer grants to municipalities to help pay for eligible water quality projects.

Engineering Planning Grants (EPG) help fund the development of an engineering report. Engineering reports are required in the EFC financing application process. Grants are available to help municipalities jump start their work early on with funding for initial planning, so they can be better prepared to seek financing to help them complete their wastewater, sewer, and water quality projects. Grants of up to $100,000 are available to municipalities to help fund an engineering report.

The Green Innovation Grant Program (GIGP) supports projects across New York State that utilize unique EPA-designated green stormwater infrastructure design and create cutting-edge green technologies. Competitive grants are awarded annually to projects that improve water quality and mitigate the effects of climate change through the implementation of one or more of the following green practices: Green Stormwater Infrastructure, Energy Efficiency, Water Efficiency and Environmental Innovation.

Water Infrastructure Improvement & Intermunicipal Grants (WIIA) provides competitive grants to help municipalities fund water quality infrastructure projects. WIIA grants are available for wastewater and drinking water projects that protect or improve water quality and/or protect public health. Municipalities may submit applications for multiple projects, including wastewater, sewer and drinking water projects.

Intermunicipal Grants (IMG) is available for both drinking water and wastewater/sewer (clean water) projects that serve multiple municipalities, such as a shared water quality infrastructure project or the interconnection of multiple municipal water systems.

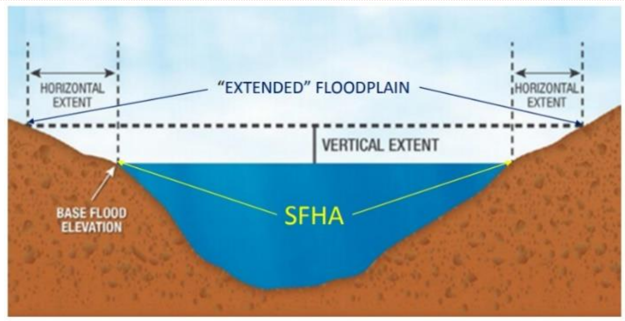
Details regarding this program can be found here: https://efc.ny.gov/wiia

New York State Department of Transportation

BRIDGE NY

The BRIDGE NY program, administered by the NYSDOT, is open to all municipal owners of bridges and culverts. Projects will be awarded through a competitive process and will support all phases of project development. Projects selected for funding under the BRIDGE NY Initiative will be evaluated based on the resiliency of the structure, including such factors as hydraulic vulnerability and structural resiliency; 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. Information regarding the program can be found here: https://www.dot.ny.gov/BRIDGENY

Community Risk and Resiliency Act (CRRA)



On September 22, 2015, Governor Andrew Cuomo signed bill A06558/S06617-B, the CRRA. The purpose of the bill is to ensure that certain state monies, facility-siting regulations, and permits include consideration of the effects of climate risk and extreme weather events. The bill's provisions will apply to all applications and permits no later than January 1, 2017. CRRA includes five major provisions:

- Official Sea-Level Rise Projections - CRRA requires the DEC to adopt science-based sea-level rise projections into regulation.
- Consideration of Sea-Level Rise, Storm Surge and Flooding - CRRA 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, and that DEC consider incorporating these factors into certain facility-siting regulations.
- Smart-Growth Public Infrastructure Policy Act Criteria - CRRA 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.
- Guidance on Natural Resiliency Measures - CRRA requires DEC, in consultation with the Department of State (DOS), to develop guidance on the use of natural resources and natural processes to enhance community resiliency.
- Model Local Laws Concerning Climate Risk - CRRA requires DOS, in cooperation with DEC, 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 (NYSDEC 2020).

CRRA requires NYSDEC, in consultation with DOS, to prepare guidance on implementation of the statute. To meet its obligation to develop guidance for the implementation of CRRA, DEC is proposing a new document, State Flood Risk Management Guidance (SFRMG). The SFRMG is intended to inform state agencies as they develop program-specific guidance to require that applicants demonstrate consideration of sea-level rise, storm surge, and flooding, as permitted by program-authorizing statutes and operating regulations. The SFRMG 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).

For additional details on the CRRA, please refer to: https://www.dec.ny.gov/energy/102559.html

6.4.7 Potential Mitigation Funding Sources

While it is important to recognize the mitigation strategies for each jurisdiction to help achieve the mitigation goals and objectives of the (HMP, it is also important to provide sources for funding to implement these strategies. The table below provides a list of programs, descriptions, and links for those seeking funding sources. This table is not intended to be a comprehensive list, but rather a starting point to help identify potential sources of funding for the identified mitigation strategies.

Table 6-3. Mitigation Funding Sources

Program	Description	Lead Agency	Website
Federal			
Hazard Mitigation Assistance (HMA)	Grants to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages – includes FMA, HMGP, BRIC.	FEMA	https://www.fema.gov/hazard-mitigation-assistance
Flood Mitigation Assistance (FMA)	Program grants to States and communities for pre-disaster mitigation planning and projects to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program.	FEMA	https://www.fema.gov/flood-mitigation-assistance-grant-program
Hazard Mitigation Grant Program (HMGP)	Grants to States and communities for planning and projects providing long-term hazard mitigation measures following a major disaster declaration.	FEMA	https://www.fema.gov/hazard-mitigation-grant-program
Building Resilient Infrastructure and Communities (BRIC)	Grants to States local communities, tribes, and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the Pre-Disaster Mitigation (PDM) program.	FEMA	https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities
Public Assistance: Hazard Mitigation Funding Under Section 404 and Section 406	Hazard mitigation discretionary funding available under Section 404 and 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act following a Presidentially declared disaster.	FEMA	https://www.fema.gov/press-release/20220328/fema-hazard-mitigation-grants-404-and-406#:~:text=Section%20406%20mitigation%20measures%20are%20funded%20under%20the,limited%20to%20declared%20counties%20and%20eligible%20damaged%20facilities.
Assistance to Firefighters Grant Program	The primary goal of the Assistance to Firefighters Grants (AFG) is to enhance the safety of the public and firefighters with respect to fire-related hazards by providing direct financial assistance to eligible fire departments, nonaffiliated Emergency Medical Services organizations, and State Fire Training Academies. This funding is for critically needed resources to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience.	FEMA	https://www.fema.gov/welcome-assistance-firefighters-grant-program
Disaster Housing Program	Emergency assistance for housing, including minor repair of home to establish livable conditions, mortgage, and rental assistance.	HUD	https://www.hud.gov/program_offices/public_indian_housing/publications/dhap
HOME Investment Partnerships Program	Grants to local and state government and consortia for permanent and transitional housing, (including financial support for property acquisition and rehabilitation for low income persons).	HUD	https://hcr.ny.gov/new-york-state-home-program-home#:~:text=The%20New%20York%20State%20HOME%20Program%20is%20administered,decent%2C%20safe%2C%20and%20affordable%20housing%20within%20the%20State.
HUD Disaster Recovery Assistance	Grants to fund gaps in available recovery assistance after disasters (including mitigation).	HUD	https://www.hud.gov/info/disasterresources

Program	Description	Lead Agency	Website
Section 108 Loan Guarantee	Enables states and local governments participating in the Community Development Block Grant (CDBG) program to obtain federally guaranteed loans for disaster-distressed areas.	HUD	https://www.hudexchange.info/programs/section-108/
Smart-Growth Implementation Assistance (SGIA) program	The SGIA program focuses on complex or cutting-edge issues, such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, green building, and climate change. Applicants can submit proposals under 4 categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design or medical and social service facilities siting.	EPA	https://www.epa.gov/smartgrowth
Partners for Fish and Wildlife	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.	U.S. Fish and Wildlife Service	https://www.fws.gov/partners/
FHWA Emergency Relief Program	Fund for the repair or reconstruction of Federal-aid highways that have suffered serious damage as a result of (1) natural disasters or (2) catastrophic failures from an external cause.	U.S. Department of Transportation (DOT)	https://www.fhwa.dot.gov/programadmin/erelief.cfm
Rebuilding American Infrastructure with Sustainability and Equity (RAISE)	Investing in critical road, rail, transit, and port projects across the nation	U.S. DOT	https://www.transportation.gov/RAISEgrants/about
Community Facilities Direct Loan & Grant Program	This program provides affordable 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.	USDA	https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program
Emergency Loan Program	USDA's Farm Service Agency (FSA) provides emergency loans to help producers recover from production and physical losses due to drought, flooding, other natural disasters or quarantine.	USDA	https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/emergency-farm-loans/index
Emergency Watershed Protection (EWP) Program	Provide assistance to relieve imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences.	NRCS	https://www.nrcs.usda.gov/programs-initiatives/ewp-emergency-watershed-protection
Financial Assistance	Financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal and related resources on agricultural lands and non-industrial private forest land.	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/
Regional Conservation Partnership Program (RCPP)	The RCPP 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 RCPP, NRCS seeks to co-invest with partners to implement projects that demonstrate innovative solutions to conservation	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/rcpp/

Program	Description	Lead Agency	Website
	challenges and provide measurable improvements and outcomes tied to the resource concerns they seek to address.		
Emergency Management Performance Grants (EMPG) Program	Assist local, tribal, territorial, and state governments in enhancing and sustaining all-hazards emergency management capabilities.	U.S. DHS	https://www.fema.gov/emergency-management-performance-grant-program
Land & Water Conservation Fund	Matching grants to states and local governments for the acquisition and development of public outdoor recreation areas and facilities (as well as funding for shared federal land acquisition and conservation strategies).	National Park Service	https://www.nps.gov/subjects/lwcf/index.htm
Coastal Watersheds Grant Program	Restore America's Estuaries, in close coordination with and financial support from EPA, administers the National Estuary Program (NEP) Coastal Watersheds Grant Program. This grant program funds projects within the geographic areas shown here and supports the following Congressionally-set priorities: •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; and •Contaminants of emerging concern found in coastal and estuarine waters such as pharmaceuticals, personal care products, and microplastics.	National Estuary Program	https://estuaries.org/initiatives/watershedgrants/
Rehabilitation of High Hazard Potential Dams Grant Program	The main objective of the HHPD grant program is to provide technical, planning, design, and construction assistance in the form of grants to non-federal sponsors for rehabilitation of eligible high hazard potential dams.	FEMA	https://www.fema.gov/emergency-managers/risk-management/dam-safety/grants/resources
State			
Local Government Records Management Improvement Fund (LGRMIF) Disaster Recovery Grants	Grants for disaster recovery projects related to damage caused by a sudden, unexpected event involving fire, water, man-made or natural phenomena where a timely response is necessary to prevent the irretrievable loss of vital or archival records, or to ensure reasonable, timely access to vital records.	New York State Archives / New York State Education Department	http://www.archives.nysed.gov/grants/grants_lgrmif.shtml

Program	Description	Lead Agency	Website
The New York State Emergency Services Revolving Loan	Repair of firefighting apparatus, ambulances, or rescue vehicles; Renovation, rehabilitation, or repair of facilities that house firefighting equipment, ambulances, rescue vehicles, and related equipment.	NYS DHSES	http://www.dhses.ny.gov/ofpc/services/loan/
Environmental Protection Fund (EPF)	Matching grants for the acquisition, planning, development, and improvement of parks, historic properties.	New York State Parks, Recreation & Historic Preservation (NYSOPRHP)	https://www.dec.ny.gov/about/92815.html
Recreational Trails (RTP)	Program Matching grants for the acquisition, development, rehabilitation and maintenance of trails and trail-related projects.	NYSOPRHP	https://parks.ny.gov/grants/recreational-trails/default.aspx
Environmental Protection & Improvement Grants	Competitive grants for environmental protection and improvement; available for municipalities, community organizations, not-for-profit organizations, and others.	New York State Department of Environmental Conservation	https://www.dec.ny.gov/about/92815.html
Volunteer Fire Assistance Grants	The grant is a 50/50 matching funds program. Its purpose is to make 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, hose, portable radios, and dry hydrants.	NYSDEC	https://www.dec.ny.gov/regulations/2364.html
Clean Water Act Section 604(b) 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. 604(b) 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.	NYSDEC	https://www.dec.ny.gov/lands/53122.html
Water Quality Improvement Project (WQIP) Program	The WQIP program is a competitive, reimbursement grant program that funds projects that directly address documented water quality impairments. Applications are typically available each spring through the Consolidated Funding Application.	NYSDEC	https://www.dec.ny.gov/pubs/4774.html
New York State DEC/EFC Wastewater Infrastructure Engineering Planning Grant (EPG)	The New York State Department of Environmental Conservation (DEC), in conjunction with the New York State Environmental Facilities Corporation (EFC), will offer grants to municipalities to help pay for the initial planning of eligible Clean Water State Revolving Fund (CWSRF) water quality projects. The ultimate goal of the EPG 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.	NYSDEC	https://www.dec.ny.gov/pubs/81196.html

Program	Description	Lead Agency	Website
Climate Smart Communities Grant Program	The CSC Grant program was established in 2016 to provide 50/50 matching grants to cities, towns, villages, and counties (or boroughs of New York City) of the State of New York for eligible climate adaptation and mitigation projects.	NYSDEC	https://www.dec.ny.gov/energy/109181.html
BRIDGE NY	The state is making funding available for local governments to rehabilitate and replace bridges and culverts statewide.	NYS DOT	https://www.dot.ny.gov/BRIDGENY

6.5 MITIGATION STRATEGY DEVELOPMENT AND UPDATE

6.5.1 Update of Municipal Mitigation Strategies

To evaluate progress on local mitigation actions, each jurisdiction was provided with a Mitigation Action Plan Review Worksheet, pre-populated with those actions identified for their jurisdiction in the prior (2017) plan. For each action, municipalities were asked to indicate the status of each action ("No Progress/Unknown," "In Progress/Not Yet Complete," "Continuous," "Completed," "Discontinued") and provide review comments on each. Municipalities were requested to quantify the extent of progress and provide reasons for the level of progress or why actions were discontinued. Each jurisdictional annex provides a table identifying their prior mitigation strategy, the status of those actions and initiatives, and their disposition within their updated strategy.

Local mitigation actions identified as "Complete" and actions identified as "Discontinued" have been removed from the updated strategies. Those local actions that municipalities identified as "No Progress/Unknown" or "In Progress/Not Yet Complete," as well as certain actions/initiatives identified as "Continuous," have been carried forward in their local updated mitigation strategies. Actions considered ongoing capabilities were marked as "Discontinued" and included in the plan as ongoing capabilities. Municipalities were asked to provide further details on these projects to help better define the projects, identify benefits and costs, and improve implementation.

At the Kick-Off and during subsequent local level planning meetings, all participating municipalities were further surveyed to identify mitigation activities completed, ongoing, and potential/proposed. As new additional potential mitigation actions, projects or initiatives became evident during the plan update process, including as part of the risk assessment update and as identified through the public and stakeholder outreach process (see Section 3 – Planning Process), communities were made aware of these either through direct communication (local meetings, email, phone) or via their draft municipal annexes.

To help support the selection of an appropriate, risk-based mitigation strategy, each annex provided a summary of hazard vulnerabilities identified during the plan update process, either directly by municipal representatives or through review of available County and local plans and reports, and through the hazard profiling and vulnerability assessment process.

Beginning in August 2022, members of the Steering Committee and contract consultants worked directly with each jurisdiction (phone, email, virtual support meetings) to assist with the development and update of their annex and include mitigation strategies, focusing on identifying well-defined, implementable projects with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).

Concerted efforts were made to ensure that municipalities develop updated mitigation strategies that included activities and initiatives covering the range of mitigation action types described in recent FEMA planning guidance (FEMA "Local Mitigation Planning Handbook" March 2013), specifically:

- <u>Local Plans and Regulations</u> – These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.

- <u>Structure and Infrastructure Project</u> – These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct man-made structures to reduce the impact of hazards.

- Natural Systems Protection – These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.

- Education and Awareness Programs – These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as the National Flood Insurance Program and Community Rating System, StormReady (NOAA), and Firewise (NFPA) Communities.

A mitigation strategy workshop was conducted on October 17, 2022 for all participating jurisdictions to support the development of focused problem statements based on the impacts of natural hazards in the County and their communities. These problem statements are intended to provide a detailed description of the problem area, including its impacts to the municipality/jurisdiction; past damages; loss of service; etc. An effort was made to include the street address of the property/project location, adjacent streets, water bodies, and well-known structures as well as a brief description of existing conditions (topography, terrain, hydrology) of the site. These problem statements form a bridge between the hazard risk assessment, which quantifies impacts to each community with the development of actionable mitigation strategies. Following the workshop, three annex support meetings were held for Monroe County's municipalities to assist in the development of additional actions, foster collaboration between neighboring municipalities for mitigation actions, discuss actions that involved cooperation between the County and municipalities, and steps needed to complete the municipal annexes.

A strong effort has been made to better focus local mitigation strategies to clearly defined, readily implementable projects and initiatives that meet the definition or characteristics of mitigation. Broadly defined mitigation objectives have been eliminated from the updated strategy unless accompanied by discrete actions, projects, or initiatives.

Certain continuous or ongoing strategies that represent programs that are, or since prior and existing plans have become, fully integrated into the normal operational and administrative framework of the community have been identified within the Capabilities section of each annex and removed from the updated mitigation strategy.

At least two mitigation projects per jurisdiction have been documented with an Action Worksheet, as per the New York State Hazard Mitigation Planning Standards Guide.

As discussed within the hazard profiles in Section 5.4 (Risk Assessment), the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards, including flood, severe storm, severe winter storm, and wildfire. By way of addressing these climate change-sensitive hazards within their local mitigation strategies and integration actions, communities are working to evaluate and recognize these long-term implications and potential impacts, and to incorporate in planning and capital improvement updates.

Municipalities included mitigation actions to address vulnerable critical facilities. These actions have been proposed in consideration of protection against 500-year events or worst-case scenarios. It is recognized, however, that in the case of projects being funded through Federal mitigation programs, the level of protection may be influenced by cost-effectiveness as determined through a formal benefit-cost analysis. In the case of "self-funded" projects, municipal discretion must be recognized. Further, it must be recognized that the County and municipalities have limited authority over privately-owned critical facility owners with regard to mitigation at any level of protection.

6.5.2 Update of County Mitigation Strategy

The update of the County-level mitigation strategies included a review of progress on the actions/initiatives identified in the 2017 HMP using a process similar to that used to review municipal mitigation strategy progress. The County, through their various department representatives, was provided with a Mitigation Action Plan Review Worksheet identifying all County-level actions and initiatives from the 2017 plan. The County reviewed each action and provided progress. For each action, relevant County representatives were asked to indicate the status of each action (*No Progress/Unknown*, *In Progress/Not Yet Complete*, *Ongoing*, *Completed*, or *Discontinued*), and provide review comments on each.

Projects/initiatives identified as "*Complete*", as well as those actions identified as *Discontinued*, have been removed from this plan update. Those actions the County has identified as *No Progress/Unknown*, *In Progress/Not Yet Complete*, or *Ongoing* have been carried forward in the County's updated mitigation strategy. Actions considered ongoing capabilities were marked as *Discontinued* and included in the plan as ongoing capabilities.

Throughout the course of the plan 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 county and regional agencies, including:
    - Monroe County Department of Environment and Planning
    - Monroe County Department of Homeland Security and Emergency Services
    - Monroe County Department of Health
    - Monroe County Soil and Water Conservation District
    - Monroe County Department of Public Works
    - Monroe County Water Authority
- Input received through the public and stakeholder outreach process.

As discussed within the hazard profiles in Section 5.4 (Risk Assessment), the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards including drought, flood, severe storm, and severe winter storm. The County has included mitigation actions and initiatives, including continuing and long-term planning and emergency management support, to address these long-term implications and potential impacts.

Various County departments and agencies included mitigation actions to address vulnerable critical facilities. These actions were proposed in consideration of protection against 0.2-percent annual chance (500-year) events, or worst-case scenarios.

It is recognized, however, that in the case of projects being funded through federal mitigation programs, the level of protection can be influenced by cost-effectiveness, as determined through a formal benefit-cost analysis. In the case of "self-funded" projects, local government authority can affect the ability to implement. Further, the County has limited authority over privately-owned critical facility owners regarding mitigation at any level of protection.

6.5.3 Mitigation Best Practices

Catalogs of hazard mitigation best practices were developed that present a broad range of alternatives to be considered for use in Monroe County, 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 in two ways:

- By whom would have responsibility for implementation:
    - Individuals – personal scale
    - Businesses – corporate scale
    - Government – government scale
- By what the alternatives would do:
    - Manipulate the hazard
    - Reduce exposure to the hazard
    - Reduce vulnerability to 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. Hazard mitigation actions recommended in this plan were selected from among the alternatives presented in the catalogs. 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. Actions in the catalog that are not included for the partnership's action plan 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.

6.5.4 Mitigation Strategy Evaluation and Prioritization

Section 201.c.3.iii of 44 CFR requires how the identified mitigation strategies will be prioritized, implemented, and administered by the local jurisdictions. For this plan update, each mitigation strategy was prioritized using a modified STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) mitigation action evaluation methodology based on a set of evaluation criteria suited to the purposes of hazard mitigation strategy evaluation. This method provides a systematic approach that considers the opportunities and constraints of implementing a particular mitigation action.

The Steering Committee applied an action evaluation and prioritization methodology, which includes an expanded set of 14 criteria to include the consideration of cost-effectiveness, availability of funding, anticipated timeline, and if the action addresses multiple hazards. The 14 evaluation/prioritization criteria used in the 2023 update process are:

1. Life Safety – How effective will the action be at protecting lives and preventing injuries?
2. Property Protection – How significant will the action be at eliminating or reducing damage to structures and infrastructure?
3. Cost-Effectiveness – Are the costs to implement the project or initiative commensurate with the benefits achieved?
4. Technical – Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.

5. Political – Is there overall public support for the mitigation action? Is there the political will to support it?
6. Legal – Does the municipality have the authority to implement the action?
7. Fiscal – Can the project be funded under existing program budgets (i.e., is this initiative currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
8. Environmental – What are the potential environmental impacts of the action? Will it comply with environmental regulations?
9. Social – Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
10. Administrative – Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?
11. Multi-hazard – Does the action reduce the risk to multiple hazards?
12. Timeline – Can the action be completed in less than 5 years (within our planning horizon)?
13. Local Champion – Is there a strong advocate for the action or project among the jurisdiction's staff, governing body, or committees that will support the action's implementation?
14. 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 assist them in evaluating and prioritizing mitigation actions identified in the 2023 update. Specifically, for each mitigation action, the jurisdictions were asked to assign a numeric rank (-1, 0, or 1) for each of the 14 evaluation criteria, defined as follows:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Further, jurisdictions were asked to provide a brief summary of the rationale behind the numeric rankings assigned, as applicable. 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 4 were categorized as *low*; actions with numerical values between 5 and 8 were categorized as *medium*; and actions with numerical values between 9 and 14 were categorized as *high*. 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 and initiatives from prior mitigation strategies that were prioritized using a different, but not inherently contrary, approach. Mitigation actions in the prior (2017) Monroe County HMP were "qualitatively evaluated against the mitigation goals and objectives and other evaluation criteria. They were then prioritized into three categories: high, medium, and low." At their discretion, jurisdictions carrying forward prior initiatives were encouraged to re-evaluate their priority, particularly if conditions that would affect the prioritization criteria had changed.

For the plan update there has been an effort to develop more clearly defined and action-oriented mitigation strategies. These local strategies include projects and initiatives 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 municipality was asked to develop problem statements. With active support from NYS DHSES planning staff, municipalities were able to develop action-oriented and achievable mitigation strategies.

As such, many of the initiatives 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 not-withstanding. In general, initiatives that would have had *low* priority rankings were appropriately screened out during the local action evaluation process.

6.5.5 Benefit/Cost Review

Section 201.6.c.3iii of 44CFR requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a cost/benefit review of the proposed projects and their associated costs. Stated otherwise, cost-effectiveness is one of the criteria that must be applied during the evaluation and prioritization of all actions comprising the overall mitigation strategy.

The benefit/cost review applied for the evaluation and prioritization of projects and initiatives in this plan update process was qualitative; that is, it does not include the level of detail required by FEMA for project grant eligibility under the Hazard Mitigation Assistance (HMA) grant programs. For all actions identified in the local strategies, jurisdictions have identified both the costs and benefits associated with project, action, or initiative.

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 attributed to project implementation. These can include life safety, structure and infrastructure damages, 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. Often numerical costs and/or benefits were not identified and may be impossible to quantify. In this case, jurisdictions were asked to evaluate project cost-effectiveness using *high*, *medium*, and *low* ratings. Where estimates of costs and benefits were available, the ratings were defined as the following:

Low < = $10,000 Medium = $10,000 to $100,000 High > = $100,000

Where quantitative estimates of costs and/or benefits were not available, qualitative ratings using the following definitions were used:

Table 6-4 Qualitative Cost and Benefit Ratings

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 Monroe County initiatives identified, the Planning Partnership may seek financial assistance under FEMA's HMA programs. These programs require detailed benefit/cost analysis as part of the application process. These analyses will be performed when funding applications are prepared, using the FEMA BCA model process. 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.

SECTION 7. PLAN MAINTENANCE PROCEDURES

This section details the formal process that will ensure that the Hazard Mitigation Plan (HMP) 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 plan annually and producing an updated plan every 5 years. In addition, this section describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this plan 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. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

The plan maintenance matrix shown in Table 7-1 provides a synopsis of responsibilities for plan monitoring, integration, evaluation, and update, which are discussed in further detail in the sections below.

Table 7-1. Plan Maintenance Matrix

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring	Outreach to planning partners to recommend update of mitigation strategies and progress toward implementation of project and identification of new projects and to provide updated information on funding opportunities.	Each June or after the occurrence of a presidentially declared disaster	Jurisdictional points of contact identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)	Jurisdictional implementation lead identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)
Integration	In order for integration of mitigation principles action to become an organic part of the ongoing county and municipal activities, the county will incorporate the distribution of the safe growth worksheet (see 7.1.2 below) 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 jurisdictional points of contact identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)	HMP Coordinator
Evaluation	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	Jurisdictional points of contact identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)	Alternate jurisdictional points of contact
Update	Reconvene the planning partners, at a minimum, every 5 years 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	Monroe County HMP Coordinator	Jurisdictional points of contacts identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)

7.1 MONITORING, EVALUATING, AND UPDATING THE PLAN

The procedures for monitoring, evaluating, and updating the plan are provided below.

The HMP Coordinator is assigned to manage the maintenance and update of the plan during its performance period. The HMP Coordinator will convene the Planning Partnership and be the prime point of contact for questions regarding the plan and its implementation and will also coordinate the incorporation of additional information into the plan.

The HMP Coordinator will manage the monitoring, evaluation, and updating responsibilities identified in this section. As of the date of this plan, primary and secondary mitigation planning representatives (points of contact) are identified in each jurisdictional annex in Section 9 (Jurisdictional Annexes).

It will be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation.

Currently, the Monroe County HMP Coordinator is designated as:

Timothy Henry, Office of Emergency Management
Monroe County Department of Public Safety
1190 Scottsville Road, Suite 200
Rochester, NY 14624
(585) 753-3816
Email: timhenry@monroecounty.gov

7.1.1 Monitoring

The Planning Partnership will be responsible for monitoring progress on and evaluating the effectiveness of the plan and documenting annual progress. Each year, beginning one year after plan development, Monroe County and local Planning Partnership representatives will collect and process information from the departments, agencies, and organizations involved in implementing mitigation projects or activities identified in their jurisdictional annexes (Section 9) of this plan, by contacting persons responsible for initiating and/or overseeing the mitigation projects.

In the first year of the performance period, this will be accomplished by utilizing an online performance progress reporting system (the BATool^{SM}), which will enable municipal and county representatives to directly access mitigation initiatives to easily update the status of each project, document successes or obstacles to implementation, and add or delete projects to maintain mitigation project implementation. It is anticipated that all participating partners will be prompted by the tool to update progress on a quarterly basis, providing an incentive for participants to refresh their mitigation strategies and to continue implementation of projects. It is expected that this reporting system will support the submittal of an increased number of project grant fund applications due to the functionality of the system, which facilitates the sorting and prioritization of projects.

In addition to progress on the implementation of mitigation actions, including efforts to obtain outside funding and obstacles or impediments to implementation of actions, the information that Planning Partnership representatives shall be expected to document, as needed and appropriate, includes:

- 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 plan performance period will be similarly addressed via the BATool[SM] or manually.

7.1.2 Integration of 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 that reduce risk from known hazards or to redevelopment that reduces risk from known hazards. The Monroe County Planning Partnership was tasked with identifying how hazard mitigation is integrated into existing planning mechanisms. Section 9 (Jurisdictional Annexes) describes how this is done for each participating municipality. During this process, many municipalities recognized the importance and benefits of incorporating hazard mitigation into future municipal planning and regulatory processes.

The Planning Partnership representatives will 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. Further, the sample adoption resolution (Section 2 – Plan Adoption) includes a resolution 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 that:

1. Hazard mitigation planning will be formally recognized as an integral part of overall planning and emergency management efforts.
2. 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.

During the HMP annual review process, each participating municipality will be asked to document how they are utilizing and incorporating the Monroe County HMP into their day-to-day operations and planning and regulatory processes. Each municipality will also 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 following checklist was adapted from FEMA's Local Mitigation Handbook (2013), Appendix A, Worksheet 4.2. This checklist will help a community analyze how hazard mitigation is integrated into local plans, ordinances, regulations, ordinances, and policies. By completing the checklist, it will help municipalities identify areas that currently integrate hazard mitigation and where to make improvements and reduce vulnerability to future development.

Table 7-2. Safe Growth Check List

Planning Mechanisms	Do You Do This? Yes	No	Notes: 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, hazard mitigation actions will be funded as budget allows. Construction projects will be evaluated to see if they meet the hazard mitigation goals.			
• Annually, during adoption process, the municipality will review mitigation actions when allocating funding.			
• Do budgets limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?			

Planning Mechanisms	Do You Do This? Yes	No	Notes: How is it being done or how will this be utilized in the future?
• 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, the municipality will 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 ordinance contain natural overlay zones that set conditions			
• Does the 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 ordinance prohibit development within or filling of wetlands, floodways, and floodplains?			
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?			
• Do the land use policies discourage development or redevelopment with 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 with natural hazard areas?			
• Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			

Planning Mechanisms	Do You Do This? Yes	No	Notes: How is it being done or how will this be utilized in the future?
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			
• Data and maps will be used as supporting documentation in grant applications.			
Municipal Ordinances			
• When updating municipal ordinances, hazard mitigation will be a priority			
Economic Development			
• Local economic development group will 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?			

7.1.3 Evaluating

Evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, if 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 either in person or via teleconference approximately 1 year from the date of local adoption of this update and successively thereafter. At least 2 weeks before the annual plan review meeting, the Monroe County HMP Coordinator will advise Planning Partnership members of the meeting date, agenda, and expectations of the members.

The Monroe County 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. 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 county, city, town, or village resources impacted plan implementation (e.g., funding, personnel, and equipment)
- New agencies/departments/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

Finally, the Planning Partnership will evaluate how other programs and policies have conflicted or augmented planned or implemented measures and will identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions ("Implementation of Mitigation Plan through Existing Programs" subsection later in this section discusses this process). Other programs and policies can include those that address:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and/or safety
- Recreation
- Land use/zoning
- Public education and outreach
- Transportation

The Planning Partnership should refer to the evaluation forms, Worksheets #2 and #4 in the FEMA 386-4 guidance document, to assist in the evaluation process (see Appendix G – 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 plan review processes established for prior or existing local HMPs within the county.

The Monroe County HMP Coordinator will be responsible for preparing an Annual HMP Progress Report for each year of the performance period, based on the information provided by the Planning Partnership and municipal points of contact, and other information as appropriate and relevant. These annual reports will provide data for the 5-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 projects are completed, which are no longer feasible, and which projects should 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 Section 5.4 (Hazard Profiles) of this plan 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.

7.1.4 Updating

44 CFR 201.6.d.3 requires that local hazard mitigation plans be reviewed, revised as appropriate, and resubmitted for approval to remain eligible for benefits awarded under DMA 2000. It is the intent of the Monroe County HMP Planning Partnership to update this plan on a 5-year cycle from the date of initial plan adoption.

To facilitate the update process, the Monroe County 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 5-year update, the Monroe County HMP Coordinator will invite representatives from the New York State Division of Homeland Security and Emergency Services (NYS DHSES) to provide guidance on plan update procedures. At a minimum, this will establish who will be responsible for managing and completing the plan 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.

7.1.5 Grant Monitoring and Coordination

Monroe 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 partnership during openings for grant applications. As part of grant monitoring and coordination, Monroe 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.

7.2 IMPLEMENTATION OF MITIGATION PLAN THROUGH EXISTING PROGRAMS

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 thus it is critical that this HMP integrate and coordinate with and complement those existing plans and programs.

The Capability Assessment section of Section 6 (Mitigation Strategy) 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. Within each jurisdictional annex in Section 9 (Jurisdictional Annexes), the county and each participating jurisdiction identified how they have integrated hazard risk management into their existing planning, regulatory, and operational/administrative framework ("existing integration") and how they intend to promote this integration ("opportunities for future integration").

It is the intention of Planning Partnership representatives 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. Further, the sample adoption resolution (Section 2 – Plan Adoption) includes a resolution 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 that:

1) Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts.
2) 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
- Resiliency plans
- Community Development Block Grant-Disaster Recovery action plans
- Public information/improved public participation
- Educational programs
- Continued interagency coordination

During the annual plan evaluation process, the HMP Coordinator and Planning Partnership will strive to 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 Reporting.

7.3 CONTINUED PUBLIC INVOLVEMENT

Monroe County and participating jurisdictions 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 link: https://www.monroecountynyhmp.com/. In addition, public outreach and dissemination of the HMP will include:

- Links to the plan on municipal websites of each jurisdiction with capability
- Continued utilization of existing social media outlets (Facebook, Twitter) 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 Monroe County 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 plan via the hazard mitigation website at any time. The Monroe County 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 Monroe 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.

SECTION 8. PLANNING PARTNERSHIP

This section describes the Monroe County's Hazard Mitigation Plan (HMP) Planning Partnership, its responsibilities throughout the planning process, and the jurisdictional annexes developed as a result of the plan update efforts.

8.1 BACKGROUND

The Federal Emergency Management Agency (FEMA) encourages multi-jurisdictional planning for hazard mitigation. All participating jurisdictions must meet the requirements of Chapter 44 of the Code of Federal Regulations (44 CFR):

"Multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan" [Section 201.6a(4)]

For the Monroe County HMP, a Planning Partnership was formed to leverage resources and to meet requirements for the federal Disaster Mitigation Action of 2000 (DMA) for as many eligible governments as possible. Members of the Planning Partnership consisted of representatives from each jurisdiction. The DMA defines a local government as follows:

> Members of the Planning Partnership have the expertise to develop the plan and have their jurisdiction's authority to implement the mitigation strategy developed during the planning process. The Planning Partnership is responsible for developing and reviewing draft sections of the plan, creating the mitigation strategy for their jurisdiction, and adopting the final plan.

Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Each participating planning partner has prepared a jurisdictional annex to this plan. These annexes, as well as information on the process by which they were created, are contained in this volume.

8.2 INITIAL SOLICITATION AND LETTERS OF INTENT

Monroe County solicited the participation of all municipalities in the County at the commencement of this project. All municipalities interested signed a Letter of Intent and/or a resolution committing their participation and resources to the development of the Monroe County HMP (Appendix B). Table 8-1 lists the jurisdictions that elected to participate in the update process and have met the minimum requirements of participation as established by the County and the Steering Committee. Monroe County and the municipalities indicated in Table 8-1 participated in the HMP update.

Table 8-1. Participating Jurisdictions in Monroe County

Jurisdictions		
Monroe County	Town of Henrietta	Town of Riga
Town of Brighton	Village of Hilton	City of Rochester
Village of Brockport	Village of Honeoye Falls	Town of Rush

Jurisdictions		
Town of Chili	Town of Irondequoit	Village of Scottsville
Village of Churchville	Town of Mendon	Village of Spencerport
Town of Clarkson	Town of Ogden	Town of Sweden
Town/Village of East Rochester	Town of Parma	Town of Webster
Village of Fairport	Town of Penfield	Village of Webster
Town of Gates	Town of Perinton	Town of Wheatland
Town of Greece	Town of Pittsford	-
Town of Hamlin	Village of Pittsford	-

8.2.1 Planning Partner Expectations

The following list of planning partner expectations were agreed to in each Letter of Intent to Participate (see Appendix C [Meeting Documentation] for details):

- Identify municipal representatives to serve as the planning point of contacts (POC). These people were responsible for representing the community and assuring that these participation expectations are met by their community.
- Support the Steering Committee selected to oversee the development of this plan.
- Provide representation at municipal Planning Committee meetings
- Provide data and information about the community as requested by the Steering Committee or the contract consultant, including:
    - Structure and facility inventory data
    - Identification of new development and anticipated development
    - Identification of natural hazard risk areas
    - Identification of natural hazard events and losses that have impacted the community in the last five years
    - Identification of plans, studies, reports, and ordinances addressing natural hazard risk
    - Identify mitigation activity in the community in the last five years, including progress on previously identified mitigation actions.
- Support public outreach efforts in the community which may include:
    - Providing notices of the planning project on the municipal website with links to a County project website
    - Providing notice of the planning project, the availability of Plan documents, and notice of public meetings via available local media (e.g. newsletters, flyers, email blasts, social media, etc.)
    - Advertising and supporting public meetings in the area
    - Supporting outreach to National Flood Insurance Program (NFIP) Repetitive Loss and Severe Repetitive Loss property owners in the community.
- Assist with the identification of stakeholders within the community that should be informed and potentially involved with the planning process.
- Completing data and information collection survey forms in a timely manner.
- Identify specific mitigation actions to address each of the natural hazards posing significant [or high or medium] risk to the community.
- Involve the local NFIP Floodplain Administrator in the planning process.
- Review draft Plan sections when requested and provide comment and input as appropriate.

- Adopt the Plan by resolution of the local governing body after FEMA conditional approval.
- Periodically provide the Steering Committee with reports of municipal staff and volunteer labor spent on the planning process.

By adopting this plan, each planning partner also agrees to the plan implementation and maintenance protocol established in Volume I. As described in Volume I, Section 7 (Plan Maintenance), it is intended that the Planning Partnership remain active beyond the regulatory update to support plan maintenance. Regarding the composition of the Steering Committee and Planning Partnership, it is recognized that individual commitments change over time, and it shall be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation.

8.2.2 Jurisdictional Annex Preparation Process

As stated in the 2017 New York State Hazard Mitigation Planning Standards, jurisdictional annexes provide a unique, stand-alone guide to mitigation planning for each jurisdiction. The Monroe County HMP Update is organized so that there is an annex for Monroe County and for every jurisdiction within the County's borders. Section 9 (Jurisdictional Annexes) includes an annex for each jurisdiction in Monroe County, including those that did not fully participate.

During the Monroe County HMP planning process, the nation, the State of New York, and Monroe County were continuing to be impacted by the COVID-19 pandemic. The COVID-19 pandemic was declared a major disaster on March 20, 2020 (DR-4480). While stay-at-home orders were no longer in place, all meetings of the planning partnership during the planning process were held virtually to prevent exposure and allow for greater ease of participation in meetings.

Annex Development

In order to facilitate update of the County and Jurisdictional Annexes, data from the 2017 Monroe County HMP annexes was transferred to the new annex format, which was developed to meet federal and state criteria. Clear instructions were provided to the County and municipalities. These instructions provided a basis to address the following:

- Document changes in capabilities and vulnerabilities.
- Provide a current status of the 2017 HMP mitigation strategy.
- Develop a new mitigation strategy to address identified issues and to increase community resiliency.

The County invited all municipalities to participate in a municipal kick-off meeting held on August 10, 2022, to provide an overview of the planning process. Key elements of the worksheets were discussed and subsequently completed by the appropriate jurisdictional personnel for each worksheet. The worksheets were collected, and the information was incorporated into each jurisdictional annex. In the event additional information was needed, the jurisdictional point of contact was contacted to provide more input into their annex.

A mitigation workshop was held on October 17, 2022, to provide an overview of developing a strong mitigation strategy. In preparation for this workshop, the consultant provided a consolidated list of problem areas/vulnerabilities identified during the planning process and feedback from the citizen survey to support the development of relevant projects to form the mitigation strategy.

Hazard Ranking Exercise

The presentation of the risk assessment and risk ranking for each jurisdiction was done on October 13, 2022. At this meeting, the consultant presented the overall risk assessment for the hazards of concern. In addition, each planning partner was asked to review the ranked risk specific for its jurisdiction. Refer to Section 5.3 (Hazard Ranking) for the methodology of the hazard ranking process. The calculated ranking was presented to each jurisdiction, and they were asked to review the ranking and revise based on history of events, probability of occurrence, and the potential impact on people, property, and the economy. The objectives of this exercise were to familiarize the partnership with how to use the risk assessment as a tool to support other planning and hazard mitigation processes and to help prioritize types of mitigation actions that should be considered. Hazards that were ranked as "high" for each jurisdiction as a result of this exercise were considered to be priorities for identifying appropriate mitigation actions, although jurisdictions also identified actions to mitigate "medium" or "low" ranked hazards as appropriate.

Mitigation Strategy Workshop

A mitigation strategy workshop was held was conducted on October 17, 2022, for all participating jurisdictions to support the development of focused problem statements based on the impacts of natural hazards in the County and its communities. These problem statements are intended to provide a detailed description of the problem area, including its impacts to the municipality/jurisdiction, past damages, loss of service, etc. An effort was made to include the street address of the property/project location, adjacent streets, water bodies, and well-known structures as well as a brief description of existing conditions (topography, terrain, hydrology) of the site. These problem statements form a bridge between the hazard risk assessment, which quantifies impacts to each community with the development of actionable mitigation strategies. The nearly 100 percent participation of the planning partners reflects the excellent outreach and dedication of the planning team. The County and the mitigation consultant team worked with each jurisdiction to identify clear, implementable mitigation actions as well as to further support the completion of the jurisdictional annexes. The NYS DHSES Action Worksheet template and instructions are provided in Appendix J (NYS DHSES Planning Standards).

Municipal Support Meetings

In addition to the mitigation strategy workshop, municipal support meetings were held November 1 and 3. At these support meetings, the consultant worked with the Planning Partnership members to discuss additional ideas for mitigation projects, collaborative efforts, and remaining information that needed to be collected for municipal annexes.

Jurisdictional Annexes

While the jurisdictional annex format is designed to document and ensure local compliance with the DMA 2000 regulations, its greater purpose and function includes:

- Providing a locally relevant synthesis of the overall mitigation plan that can be readily presented, distributed, and maintained;
- Facilitating local understanding of the community's risk to natural hazards;
- Facilitating local understanding of the community's capabilities to manage natural hazard risk, including opportunities to improve those capabilities;
- Facilitating local understanding of the efforts the community has taken, and plans to take, to reduce their natural hazard risk;
- Facilitating the implementation of mitigation strategies, including the development of grant applications;
- Providing a framework by which the community can continue to capture relevant data and information for future plan updates.

Each jurisdiction's annex is intended to be a *living document* and will continue to be improved as resources permit. As such, its design is intended to promote and accommodate continued efforts to maintain the annex to be current and to improve the effectiveness of the annex as the key tool, reference, and guiding document by which the jurisdiction will implement hazard mitigation locally. The following provides a description of the various elements of the jurisdictional annex.

Section 9.X.1: Hazard Mitigation Planning Team: Identifies the hazard mitigation planning primary and alternate(s) contacts and Floodplain Administrators as identified by the jurisdiction. Provides details on which departments were involved throughout the development of the jurisdictional annex. Plans developed with the participation of the widest range of departments, stakeholders, and persons familiar with the jurisdiction should be involved in the development of the jurisdictional annexes. Further detail is provided in Section 3 (Planning Process) and Appendix B (Participation Matrix).

Section 9.X.2: Municipal Profile: Provides an overview and profile of the jurisdiction, including population and socially vulnerably populations.

Section 9.X.3: Jurisdictional Capability Assessment and Integration: Provides an inventory and evaluation of the jurisdiction's tools, mechanisms, and resources available to support hazard mitigation and natural hazard risk reduction. Within the municipal annexes, tables provide an inventory of the municipality's planning, regulatory, administrative, technical, and fiscal capabilities. Further, another table identifies the municipality's level of participation in state and federal programs designed to promote and incentivize local risk reduction efforts.

Section 9.X.4: National Flood Insurance Program (NFIP) Compliance: Summarizes jurisdiction-specific information related to managing and regulating the regulatory floodplain, including current and future compliance with the NFIP.

Section 9.X.5: Evacuation, Sheltering, Temporary Housing, and Permanent Housing: To meet the NYS DHSES requirement, jurisdictions provided evacuation routes, sheltering measures, and potential locations for temporary and permanent housing.

Section 9.X.6: Growth/Development Trends: Summarizes recent and expected future development trends, including major residential/commercial development and major infrastructure development.

Section 9.X.7: Jurisdictional Risk Assessment: Provides information regarding each plan participant's vulnerability to the identified hazards. Full data and information on the hazards of concern, the methodology used to develop the vulnerability assessments, and the results of those assessments that serve as the basis of these local risk rankings may be found in Section 5.

- ***Hazard Area Extent and Location Map:*** Each annex includes a map (or series of maps) illustrating identified hazard zones and critical facilities. Further, these maps show areas of known or anticipated future development, as available and provided by the jurisdiction.
- ***Hazard Event History:*** Identifies hazard events that have caused significant impacts within the jurisdiction, including a summary characterization of those impacts identified by the jurisdiction.
- ***Hazard Ranking and Vulnerabilities:*** The Monroe County HMP identifies and characterizes the broad range of hazards that pose risk to the entire planning area; however, each jurisdiction has differing degrees of risk exposure and vulnerability aside from the whole. The local risk ranking serves to identify each jurisdiction's degree of risk to each hazard as it pertains to them, supporting the appropriate selection and prioritization of initiatives that will reduce the highest levels of risk for each community.
- ***Critical Facilities:*** Identifies potential flood losses to critical facilities in the jurisdiction based on the flood vulnerability assessment process presented in Section 5.
- ***Identified Issues:*** Presents other specific hazard vulnerabilities as identified by the jurisdiction.

Section 9.X.8: Mitigation Strategy and Prioritization: Discusses and provides the status of past mitigation actions and status and describes proposed hazard mitigation initiatives and prioritization.

- ***Past Mitigation Initiative Status:*** Where applicable, a review of progress on the jurisdiction's prior mitigation strategy is presented, identifying the disposition of each prior action, project, or initiative in the jurisdiction's updated mitigation strategy. Other completed or ongoing mitigation activities that were not specifically part of a prior local mitigation strategy may be included in this subsection as well.
- ***Completed Mitigation Initiatives Not Identified in the Previous Mitigation Strategy:*** Other completed or ongoing mitigation activities that were not specifically part of a prior local mitigation strategy may be included in this subsection as well.
- ***Proposed Hazard Mitigation Initiatives for the Plan Update:*** Table 9.X-20 presents the jurisdiction's updated mitigation strategy. As indicated, applicable mitigation actions, projects, and initiatives are further documented on an Action Worksheet, which provides details on the project identification, evaluation, prioritization, and implementation process. Table 9.X-21 provides a summary of the local mitigation strategy prioritization process discussed in Section 6.

Section 9.X.9: Action Worksheets: Provides each municipality with a more developed starting point for project implementation should funding become available. Following NYS DHSES HMP Standards Guide, each municipality developed a minimum of two action worksheets.

Workshops and additional meetings (in person, by email, or by teleconference) to complete the jurisdictional annexes were held with the Steering and Planning Committees throughout the planning process. In summary, all participating communities and the county completed the planning partner expectations and annex preparation process. Details regarding these meetings are described further in Sections 3 (Planning Process) and 6 (Mitigation Strategy). Completed jurisdictional annexes are provided in Section 9 (Jurisdictional Annexes).

8.2.3 Coverage Under the Plan

Of the 31 planning partners, all fully met the participation requirements specified by the Steering Committee. All planning partners are included in this volume. Those that did not meet the requirements will not be able to seek FEMA or NYS DHSES approval at the time of plan submittal nor will they be eligible to obtain FEMA grant funding.

Table 8-2 lists the status of each jurisdiction as well as their status in this plan update. It is noted that participation in scheduled Planning Partnership meetings provides only a partial indication of the level of participation of each jurisdiction. Throughout the bulk of the process, all municipalities' resources were strained due to the Covid-19 pandemic. Due to this, the consultant provided support in the manner of numerous calls as well as virtual meetings to ensure each planning partner seeking approval for the HMP met the threshold for participation. Appendix B (Participation Matrix) and Appendix C (Meeting Documentation) provide details on participation and meeting attendance.

Table 8-2. Jurisdictional Status

Municipality	Letter of Intent to Participate	Attended Workshops and/or Meetings and Project Calls	Provided Update on Past Projects	Submitted Mitigation Actions for Current Plan	Seeking Approval for Adoption (meets all previous requirements)
Monroe County	N/A	X	X	X	X
Town of Brighton	X	X	X	X	X
Village of Brockport	X	X	X	X	X

Municipality	Letter of Intent to Participate	Attended Workshops and/or Meetings and Project Calls	Provided Update on Past Projects	Submitted Mitigation Actions for Current Plan	Seeking Approval for Adoption (meets all previous requirements)
Town of Chili	X	X	X	X	X
Village of Churchville	X	X	X	X	X
Town of Clarkson	X	X	X	X	X
Town/Village of East Rochester	X	X	X	X	X
Village of Fairport	X	X	X	X	X
Town of Gates	X	X	X	X	X
Town of Greece	X	X	X	X	X
Town of Hamlin	X	X	X	X	X
Town of Henrietta	X	X	X	X	X
Village of Hilton	X	X	X	X	X
Village of Honeoye Falls	X	X	X	X	X
Town of Irondequoit	X	X	X	X	X
Town of Mendon	X	X	X	X	X
Town of Ogden	X	X	X	X	X
Town of Parma	X	X	X	X	X
Town of Penfield	X	X	X	X	X
Town of Perinton	X	X	X	X	X
Town of Pittsford	X	X	X	X	X
Village of Pittsford	X	X	X	X	X
Town of Riga	X	X	X	X	X
City of Rochester	X	X	X	X	X
Town of Rush	X	X	X	X	X
Village of Scottsville	X	X	X	X	X
Village of Spencerport	X	X	X	X	X
Town of Sweden	X	X	X	X	X
Town of Webster	X	X	X	X	X
Village of Webster	X	X	X	X	X
Town of Wheatland	X	X	X	X	X