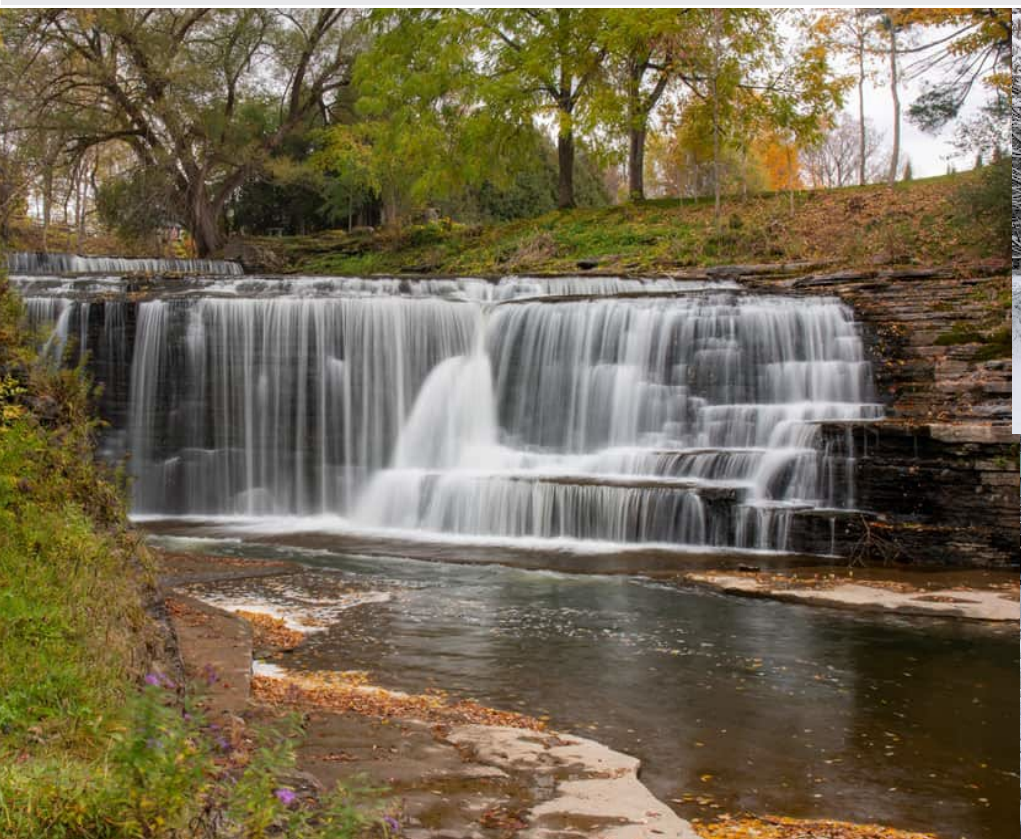




2025 Hazard Mitigation Plan

Volume I—Basic Plan



July 2025



Lewis County 2025 Hazard Mitigation Plan

July 2025
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PART 1:

THE PLANNING

PROCESS AND

PLANNING AREA

1. INTRODUCTION

Lewis County has developed a hazard mitigation plan (HMP) to reduce risks from disasters to the people, property, economy, and environment within the County. Developed by the County and 25 participating local jurisdictions (the Planning Partners), this HMP updates the 2020 Lewis County HMP. The updated 2025 HMP (also referred to as “the plan”) includes countywide analysis and assessment of hazards, risk, and capabilities.

1.1 OVERVIEW TO HAZARD MITIGATION PLANNING

1.1.1 What Is Hazard Mitigation?

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

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

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

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

1.1.2 Regulatory Framework

The U.S. government encourages communities to assess their vulnerability to various hazards before disaster strikes and then take actions to reduce potential risks. This allows communities to rebound from a natural disaster more quickly, with less loss of property or human injury and at much lower cost. Effective cost benefits include reductions in the time lost from productive activity by businesses and industries.

The federal Disaster Mitigation Act of 2000 (DMA 2000) updated the mitigation planning provisions of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Under the new requirements, communities seeking certain hazard-related federal funding must have a plan that identifies actions to mitigate hazards, risks, and vulnerabilities and establishes a strategy to implement those actions. Regulations implementing the DMA 2000 are included in Title 44 of the Code of Federal Regulations, Section 201 (44 CFR 201). In New York, responsibility for fulfilling the requirements of DMA 2000 and 44 CFR 201 and administering the FEMA Hazard Mitigation

Program has been delegated to the New York State Division of Homeland Security and Emergency Services (NYS DHSES).

To be eligible for federal hazard mitigation assistance, communities must prepare and maintain an HMP and update it every 5 years. Each local jurisdiction's HMP must 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.

One goal of the federal regulations is to facilitate cooperation between state and local authorities, prompting them to work together. This enhanced planning process enables local and state governments to better articulate accurate needs for mitigation, resulting in faster allocation of funding and more effective risk reduction projects.

Table 1-1 summarizes the 44 CFR 201 requirements and where each is addressed in this hazard mitigation plan.

Table 1-1. FEMA Local Mitigation Plan Review Crosswalk

Plan Criteria	Primary Location in Plan
Prerequisites	
Adoption by the Local Governing Body: §201.6(c)(5)	Appendix A
Planning Process	
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Chapter 2
Risk Assessment	
Identifying Hazards: §201.6(c)(2)(i)	Chapter 5
Profiling Hazards: §201.6(c)(2)(i)	Chapters 6 – 15
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)	Chapter 4
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)	Chapter 4
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)	Chapter 4
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)	Chapter 4; Volume II
Mitigation Strategy	
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Chapter 17; Volume II
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)	Chapter 17; Volume II
Implementation of Mitigation Actions: §201.6(c)(3)(iii)	Chapter 17; Volume II
Multi-Jurisdictional Mitigation Actions: §201.6(c)(3)(iv)	Chapter 17; Volume II
Plan Maintenance Process	
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)	Chapter 18
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Chapter 18; Volume II Annexes
Continued Public Involvement: §201.6(c)(4)(iii)	Chapter 18

1.1.3 Specialized Terms and Concepts

Like any technical field, hazard mitigation has developed over the years its own set of terms and concepts with particular meanings within the hazard mitigation practice. A full glossary and list of acronyms is provided at the back of this volume. The list below provides a quick reference for specialized terms whose use is especially prominent in this hazard mitigation plan:

- **Adaptive capacity**—the ability of a human or natural system to adjust to climate change by moderating potential damage, taking advantage of opportunities, or coping with the consequences (EPA 2023)

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

1.2 HISTORY OF HAZARD MITIGATION PLANNING IN LEWIS COUNTY

1.2.1 Previous Lewis County HMPs

Lewis County has been included in 28 federal hazard-related declarations (major disaster, fire management, and emergency) since 1954. Following the adoption of DMA 2000 and the new national focus on mitigating hazards through advance planning, the County prepared and adopted its first hazard mitigation plan in 2010. The plan has been updated since then, with an update adopted in 2020.

1.2.2 Key Changes in the Current Update

The following are the most significant changes made between the previous County HMP (2020) and the current (2025) update:

- In the 2020 HMP, the hazard profile section was presented in Section 5. For the 2025 HMP update each profile is presented in stand-alone chapters.
- In the 2020 HMP, the methodology and tools and hazards of concern identification sections were presented in Section 5. For the 2025 HMP update these sections are presented as stand-alone chapters.
- In the 2020 HMP, the planning partnership section was presented in Section 8. For the 2025 HMP update this section is presented as an introductory chapter in Volume II.

1.3 PLAN ORGANIZATION

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

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

- Part 1: The Planning Process and Planning Area
 - Chapter 1: Introduction
 - Chapter 2: Planning Process—A description of the plan methodology and development process, committee and stakeholder roles and activities, and how the plan will be incorporated into existing programs. Information regarding the adoption of the plan by each participating jurisdiction.
 - Chapter 3: County Profile—An overview of Lewis County, including general information and physical conditions, land use patterns and trends, population and demographics, economy, general building stock inventory, community lifelines, and natural, historic, and cultural resources
- Part 2: Risk Assessment
 - Chapter 4: Methodology—Description of the methodology used to assess hazard risk and the status of local data.
 - Chapter 5: Hazards of Concern Identification—Documentation of the process of identifying the natural hazards of concern for further profiling and evaluation.

- Chapters 6 – 15—Hazard profiles and findings of the risk assessment (estimates of the impact of hazard events on life, safety, and health; general building stock; critical facilities; the economy, and natural, historic, and cultural resources).
- Part 3: Capability Assessment
 - Chapter 16: Capability Assessment—A summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, local) that support hazard mitigation within the County.
- Part 4: Mitigation Strategy
 - Chapter 17: Mitigation Strategy—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.
- Part 5: Plan Maintenance
 - Chapter 18: Plan Maintenance Procedures—A system to continue to monitor, evaluate, maintain, and update the plan.

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

Appendices include the following:

- Appendix A: Resolutions
- Appendix B: Outreach, Participation and Meeting Documentation
- Appendix C: Action Worksheet Template and Instructions
- Appendix D: Plan Maintenance Tools
- Appendix E: Critical Facility and Community Lifeline Inventory
- Appendix F: Linkage Procedures

2. PLANNING PROCESS

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

- The plan will be multi-jurisdictional, including all municipalities in the County. Lewis County invited all jurisdictions in the County to join in the planning process. To date, all the 24 local municipal governments in the County (the Planning Partnership) have participated in the 2025 plan update process:
 - Lewis County
 - Village of Constableville
 - Village of Copenhagen
 - Village of Croghan
 - Village of Lowville
 - Village of Lyons Falls
 - Village of Port Leyden
 - Village of Turin
 - Town of Croghan
 - Town of Denmark
 - Town of Diana
 - Town of Greig
 - Town of Harrisburg
 - Town of Lewis
 - Town of Leyden
 - Town of Lowville
 - Town of Lyonsdale
 - Town of Martinsburg
 - Town of Montague
 - Town of New Bremen
 - Town of Osceola
 - Town of Pinckney
 - Town of Turin
 - Town of Watson
 - Town of West Turin
- The format of this plan is such that other entities can easily join at a later date as part of the regulatory 5-year plan update process.
- The plan considers all natural hazards that pose a risk to the area, as required by 44 CFR 201. Non-natural hazards that pose significant risk were considered as well.
- The plan was developed following FEMA regulations and prevailing FEMA and state guidance. This ensures that all the requirements are met and supports plan review. In addition, this plan will meet criteria for the National Flood Insurance Program (NFIP), Community Rating System (CRS), and the Flood Mitigation Assistance (FMA) programs.

Lewis County applied for and was awarded a multi-jurisdictional planning grant under the Building Resilient Infrastructure and Communities (BRIC) grant program (EMN-2022-BR-004-0006), which has supported the development of this HMP. Grant administration was the responsibility of the Lewis County Department of Emergency Response.

2.1 GENERAL MITIGATION PLANNING APPROACH

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

- FEMA Mitigation Planning How-to Series (FEMA 386-1 through 4, 2002).
- FEMA Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, January 2013.
- FEMA Integrating Hazard Mitigation into Local Planning, March 1, 2013.
- FEMA Plan Integration: Linking Local Planning Efforts, July 2015.
- FEMA Local Mitigation Planning Policy Guide, April 19, 2022.
- FEMA Local Mitigation Planning Handbook, May 2023.
- DMA 2000 (Public Law 106-390, October 30, 2000).

- 44 CFR 201 and 206 (including: Feb. 26, 2002, Oct. 1, 2002, Oct. 28, 2003, and Sept. 13, 2004, Interim Final Rules).
- NYSDHSES Hazard Mitigation Planning Standard, 2022.
- NYSDHSES Hazard Mitigation Plan, 2023.

2.2 ORGANIZATION OF PLANNING PROCESS

2.2.1 Planning Process Participants

Project Management and Planning Consultant

Project management was the responsibility of Lewis County's Planning and Community Development Department. Lewis County and Tetra Tech (the contracted planning consultant) met at least bi-weekly to coordinate the planning process and engage other planning participants and were tasked with the following:

- Assisting with the organization of a Steering Committee and the 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 strategy progress
- Assistance with the screening of mitigation actions and the identification of appropriate actions
- Assistance with the prioritization of mitigation actions
- Authoring of the draft and final plan documents

Steering Committee

Lewis County developed a Steering Committee to provide guidance and direction to the HMP update effort, and to ensure that the resulting document will be embraced by local government leaders as well as all who live and work within the planning area. Steering Committee members were charged with the following:

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

The Steering Committee provided guidance, leadership, and oversight of the planning process and acted as the point of contact for all participating jurisdictions and various interest groups in the planning area. Table 2-1 lists the members of the Steering Committee.

Table 2-1. Lewis County Hazard Mitigation Steering Committee Members

Affiliation	Name	Title
Lewis County Department of Planning and Community Development	Cassandra Buell	Director
Lewis County Department of Planning and Community Development	Lauryn Tabolt	Community Development Specialist
Lewis County Department of Planning and Community Development	Grace Metzler	Grant Coordinator
Lewis County Emergency Management Department	Robert A. MacKenzie III	Director
Lewis County Emergency Management Department	Jen Marachion	Deputy Director
Lewis County Highway Department	John Reed	Highway Superintendent
Lewis County Soil & Water Department	Nichelle Swisher	Director

Planning Partnership (Jurisdictional Participation)

All participating jurisdictions, including the County, belong to the Planning Partnership for this HMP. Lewis County's encouraged participation by all jurisdictions. The various jurisdictions in Lewis County have differing levels of capabilities and resources available to their ability to participate in the plan update process, as well as differing levels of vulnerability to and impacts from the natural hazards considered in this plan. Ultimately, jurisdictional participation is evidenced by a completed annex of the HMP, wherein jurisdictions individually identify their planning points of contact, evaluate their risk from the hazards of concern, identify their capabilities to effect mitigation in their community, identify and prioritize a suite of actions to mitigate their hazard risk, and adopt the updated plan via resolution. Annexes are included in Volume II of this HMP.

After completion of the plan, implementation and ongoing maintenance will become a function of the Planning Partnership as described in Chapter 18 (Plan Maintenance). The Planning Partnership, as shown in Table 2-2, will be 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. Representatives are responsible for 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 actions
- Reporting on 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 2-2. Planning Partnership

Jurisdiction	Participant	Participant Title
Castorland (V)	Heidi Lehman	Mayor
	Robin Grunert	Clerk
Constableville (V)	Samantha Brown	Mayor
	Mary Failing	Clerk
Copenhagen (V)	Kim Vogt	Village Board Member
	Richard Ross	Department of Public Works
Croghan (T)	Larry Boliver	Supervisor
	Kevin Zehr	Highway Superintendent
Croghan (V)	Julie Robinson	Mayor
	Mitch Robinson	Department of Public Works
Denmark (T)	Scott Doyle	Supervisor
	Pat Mahar	Highway Superintendent
Diana (T)	Zach Smith	Supervisor
	Joseph Langs	Highway Superintendent
Greig (T)	Bob Johnson	Supervisor
	Michael Alfano	Highway Superintendent
Harrisburg (T)	Stephen Bernat	Supervisor
	Terry Snyder	Highway Superintendent
Lewis (T)	Dawn Zagurski	Supervisor
	John Race	Highway Superintendent
Leyden (T)	Rosalie White	Supervisor
	Bruce W. Myers	Highway Superintendent
Lowville (T)	Bob Mullin	Supervisor
	Thomas Widrick	Highway Superintendent
Lowville (V)	Joe Beagle	Mayor
	Paul Denise	Department of Public Works
Lyons Falls (V)	Donna Dolhof	Mayor
	Shawn Smith	Department of Public Works
Lyonsdale (T)	Dale Hawk	Department of Public Works
	Megan Krokowski	Town Council Member
Martinsburg (T)	Terry Thisse	Supervisor
	Tyler Jones	Highway Superintendent
Montague (T)	Bruce Williams	Supervisor
	Tony Young	Highway Superintendent
New Bremen (T)	Doug Herzig	Highway Superintendent
	Peter Keys	Supervisor
Osceola (T)	John Holliday	Supervisor
	Richard Meagher	Highway Superintendent
Pinckney (T)	Don Cook	Highway Superintendent
	Sherry Harmych	Supervisor
Port Leyden (V)	Heather Collins	Mayor
	Marshall Mooney Jr	Department of Public Works
Turin (T)	Jane Gillette	Supervisor
	Paul Dickinson	Highway Superintendent

Jurisdiction	Participant	Participant Title
Turin (V)	Josh Leviker	Mayor
	Thomas Smith	Department of Public Works
Watson (T)	Jeff Hoch	Supervisor
	Steve Skiff	Highway Superintendent
West Turin (T)	Edward Hayes	Supervisor
	Douglas Salmon	Superintendent

2.2.2 Planning Activities

The update of the Lewis County Hazard Mitigation Plan was a collaborative, countywide effort involving representatives from all participating jurisdictions, county departments, and other stakeholders. This partnership played a central role in guiding the planning process, ensuring that local knowledge, priorities, and capabilities were fully integrated into the plan. Throughout the planning process, planning participants, both individually and in their planning groups, engaged in a series of structured activities including:

- **Organize data and resources:** The Lewis County Planning and Community Development Department served as the lead coordinating agency, working closely with the consultant team and local jurisdictions to organize the planning effort. This included establishing a Planning Partnership, defining roles and responsibilities, and developing a schedule for meetings, workshops, and deliverables.
- **Profile the community and assess risks:** A series of countywide workshops and meetings were held to identify and profile natural hazards, assess vulnerabilities, and update inventories of critical facilities and infrastructure. These sessions allowed participants to share local hazard experiences, review historical data, and evaluate potential future impacts. The risk assessment phase was essential in identifying the most significant threats to Lewis County and its communities.
- **Develop the mitigation strategy:** Based on the risk assessment findings, Planning Partnership members collaborated to update the plan's mitigation goals, objectives, and actions. This included identifying feasible, cost-effective strategies to reduce risk and enhance community resilience. Jurisdictions were encouraged to tailor mitigation actions to their specific needs while aligning with countywide priorities. All members had the opportunity to review and provide feedback on the draft plan, ensuring that the final document reflected a shared vision for hazard mitigation across the county.
- **Plan maintenance and public involvement:** Public engagement was a key component of the planning process. Planning Partnership members supported outreach efforts to involve residents, local officials, and other stakeholders. These efforts included public meetings, online surveys, and the dissemination of draft materials for review and comment. The feedback received helped shape the final plan and fostered community ownership of the mitigation strategy. A detailed plan maintenance strategy was also developed to guide future updates and ensure continued relevance.

Throughout the process, there was consistent and open communication between the Lewis County Planning and Community Development Department, the Steering Committee, Planning Partnership members, and the consultant team. This communication took place through a combination of virtual and in-person meetings, phone calls, and email correspondence. These interactions ensured continuity, transparency, and responsiveness to emerging issues or concerns. Planning activity documentation, including meeting agendas, attendance records, presentation materials, and public outreach documentation, are compiled in Appendix B: Outreach, Participation, and Meeting Documentation.

2.3 STAKEHOLDER OUTREACH AND INVOLVEMENT

The Lewis 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. A 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.

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 ensure broad regional, county, and local representation in this planning process. A comprehensive list of stakeholders was developed with the support of the Steering Committee and Planning Partnership. Stakeholder outreach was performed early and throughout the planning process, including mass media notification efforts. Identified stakeholders were invited to attend the Planning Partnership risk assessment meeting, and key stakeholders were requested to participate on the Steering Committee and/or Planning Partnership. Information and input provided by these stakeholders has been included throughout this plan.

The following sections list the stakeholders who were invited to participate in the development of this plan and describe how they contributed to the plan. This information demonstrates the scope and breadth of the stakeholder outreach efforts during the planning process. Beyond those described here, many stakeholders were aware of and/or contributed to this plan through formal and informal outreach efforts by the Planning Partners involved in the plan update.

2.3.1 Federal, State, County and Regional Agency Participation

Table 2-3 summarizes participation in the HMP update by governmental agencies at the federal, state, county, and regional level.

Table 2-3. Federal, State, County and Regional Agency Participation

Agency	Participation
FEMA Region 2	Provided updated planning guidance; provided summary and detailed NFIP data for planning area; presented preliminary regulatory flood products to municipalities and the public; conducted plan review.
• National Centers for Environmental Information (NCEI) • National Hurricane Center (NHC) • National Oceanic and Atmospheric Administration (NOAA) • National Weather Service (NWS) • Storm Prediction Center (SPC) • U.S. Army Corps of Engineers (USACE) • U.S. Census Bureau • U.S. Geological Survey (USGS)	Information regarding hazard identification and the risk assessment for this HMP update was requested and received or incorporated by reference

Agency	Participation
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 (NYS DEC)	Provided data and information on various hazards. Provided dates of most recent Community Assistance Visits and Community Assistance Contacts for municipalities enrolled in the NFIP.
• Lewis County Department of Planning and Community Development • Lewis County Department of Planning and Community Development • Lewis County Department of Planning and Community Development • Lewis County Emergency Management Department • Lewis County Emergency Management Department • Lewis County Highway Department • Lewis County Soil & Water Department	Served on steering committee, attended meetings, completed hazard of concern exercise and goals and objectives exercise, completed surveys, developed mitigation actions, reviewed draft plan.
• Lewis County Board of Legislators	Approved the grant funding application, directly communicated with jurisdiction's to encourage participation, attended meetings.
• Naturally Lewis	Contributed to the Lewis County Jurisdictional Annex. Integrated the County's economic development goals and initiatives.
• Cornell Cooperative Extension: Lewis County	Provided information about how the County communicates with the Amish community, particularly as it relates to emergency communications and hazard impacts to their farms/crops.
• South Lewis Central School District • Lewis County Health System • Lowville Lions Club • Lewis County Public Health Department • Lewis County Building and Fire Code Department • Town of New Bremen Highway Department • Town of Leyden	Completed a Stakeholder Organization Survey

To address the three high hazard potential dams located within Lewis County, outreach was conducted with private dam owners and dam safety agencies. The following information was requested:

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

Information from the dam owners was not received, including information on emergency action plans, inundation maps, or any concerns owners might have. Information was instead incorporated from other resources, namely

jurisdictional stakeholder input, the New York State Dams Inventory (NYS DEC), the US Army Corps of Engineers' National Inventory of Dams, and other public information (e.g., a grant from the State of New York to the City of Rome to repair the Rome City Dam (Boyd Dam)). No inundation modeling or dam breach modeling was incorporated. The 2010 Black River Watershed Management Plan discusses the dams in Lewis County, but does not address failure risks or vulnerabilities.

2.3.2 Additional Stakeholder Groups

To ensure broad and inclusive stakeholder engagement, outreach efforts extended to neighboring jurisdictions, academia, community-based organizations, fire districts, law enforcement, medical centers, school districts, private firms, and other entities that support socially vulnerable and underserved populations. Adjoining counties and jurisdictions were notified about the project website, draft plan documents, and surveys, and were invited to participate in the planning process by providing feedback and completing a neighboring community survey. School districts, colleges, and academic organizations were specifically invited to complete a stakeholder survey and review the draft plan. Agencies and groups working directly with underserved communities were similarly engaged to ensure their perspectives were included in the planning process. Additionally, all stakeholders were asked to distribute the public survey via their communication channels and offices to broaden the distribution of the survey.

The stakeholder outreach during the HMP update included the following groups:

- American Red Cross
- Beaver Falls Fire Department
- Beaver River Central School District
- Castorland Fire Company
- Community Services & Mental Health
- Constableville Fire Company
- Cornell Cooperative Extension: Lewis County
- Cornell University
- County Manager
- Croghan Volunteer Fire Department
- Gerry Haenlin
- Glenfield Fire Department
- Harrisville Central School
- Harrisville Fire Department
- Herkimer County Emergency Services
- Jefferson County Emergency Management
- Lewis County Bridges out of Poverty
- Lewis County Buildings & Codes
- Lewis County Buildings & Codes Department
- Lewis County Buildings & Grounds Department
- Lewis County Emergency Management
- Lewis County General Hospital
- Lewis County Grant Coordinator
- Lewis County Highway Department
- Lewis County Historical Society
- Lewis County Office for the Aging
- Lewis County Opportunities, Inc.
- Lewis County Planning & Community Development
- Lewis County Public Health Department
- Lewis County Real Property
- Lewis County Recreation Forestry and Parks
- Lewis County Search & Rescue
- Lewis County Sheriff's Department
- Lewis County Social Services
- Lewis County Soil and Water Conservation District
- Linking Lewis County
- Lowville Academy
- Lowville Fire Department
- Lowville Producers Dairy Co-Op
- Lyons Falls Fire Department
- Martinsburg Fire Department
- Naturally Lewis, Inc.
- Naturally Lewis, Inc.
- New Bremen Fire Department
- Norh Country Library System
- NYS DEC
- Oneida County Emergency Services
- Oswego County Emergency Management
- Port Leyden Fire Department
- Public Transportation
- Snow Belt Housing, Inc.
- South Lewis Central School District
- St. Lawrence County
- The Moose
- Tug Hill Commission
- Turin Fire Company
- Village of Lowville Police
- Watertown Daily Times/Journal & Republican
- West Leyden Fire Department

2.3.3 Outreach Methods

Lewis County prioritized inclusive and transparent public engagement throughout the update of its Hazard Mitigation Plan (HMP). The County and its Planning Partnership implemented a multi-faceted outreach strategy to

ensure residents, stakeholders, and neighboring jurisdictions were informed and had opportunities to participate meaningfully in the planning process.

Dedicated Project Website and Page on County Website

A public-facing website developed on the StoryMap platform was established to serve as a central hub for information and engagement about the HMP update (tinyurl.com/lewiscountystorymap; see Figure 2-1).

Figure 2-1. Lewis County Hazard Mitigation Plan Update StoryMap Website



The StoryMap site includes:

- A comprehensive overview of the HMP project
- Contact information for the County's Hazard Mitigation Plan Coordinator
- Overviews of each of the County's hazards of concern with data and information specific to Lewis County and its jurisdictions
- Access to the Citizens Hazard Perception Survey
- Stakeholder-specific surveys (e.g., for emergency services, healthcare providers, and educators)
- Draft sections of the HMP for public review and comment

Information about the HMP update also was posted on the County's existing website at [Hazard Mitigation Plan - Lewis County, NY](#) (see Figure 2-2).

Figure 2-2. Lewis County Hazard Mitigation Webpage



Public Notification, Local Promotion and Printed Materials

All participating municipalities were asked to promote the planning effort through their own communication channels. This request included sharing meetings, press releases, the project website, surveys and the draft plan on municipal social media accounts, links on town and village websites, email newsletters to residents and flyers posted in public buildings such as libraries, town halls, and community centers.

To ensure accessibility for residents without internet access, a printed copy of the Draft Plan and Public Comment Survey was made available at the Lewis County Courthouse at 7660 N State Street in Lowville, NY. Additional copies were distributed to select town offices and libraries upon request.

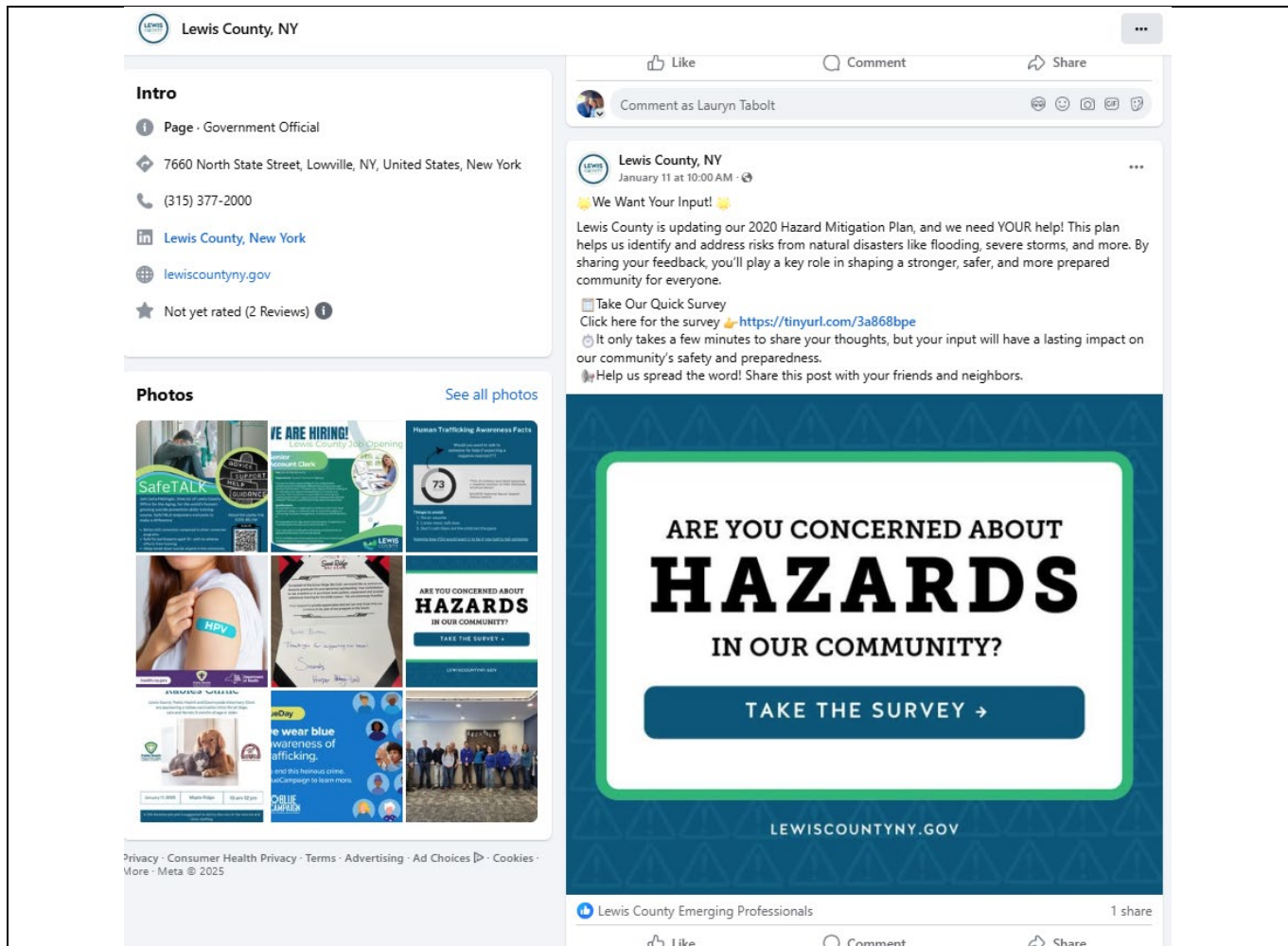
These materials are archived in Appendix B.

Surveys and Community Input

To gather meaningful input, Lewis County developed and distributed several targeted surveys. Jurisdiction-specific responses can be found in Volume II. Refer to Appendix B (Public and Stakeholder Outreach) for the full list of survey questions and responses.

- **Public Survey**—Designed to assess residents’ understanding of hazard mitigation tools and techniques, this survey collected quantifiable data on public perception of risk, awareness of mitigation strategies, and support for community programs. Responses helped shape the County’s outreach and education priorities.
- **Stakeholder Survey**—Distributed to County and municipal departments and agencies, as well as the stakeholders listed in 2.3.2 Additional Stakeholders above this survey aimed to identify general needs for hazard mitigation and resilience, as well as specific projects for inclusion in the plan.
- **Neighboring Community Survey**—Sent to bordering counties and municipalities, this survey focused on regional coordination and included five sections:
 - Emergency Operations and Continuity of Operations Planning
 - Risk and Vulnerability
 - Evacuation and Sheltering
 - Information Sharing
 - Projects, Grants, Education, and Outreach

The survey was publicized on the project web pages and through social media posts such as shown in Figure 2-3.

Figure 2-3. Public Survey Social Media Post


Public Review and Comment Period

The Draft Plan was posted online in August 2025 for a formal public review period. Comments were collected via the website and directed to the Lewis County Planning and Community Development Department. No comments were received from the public during the 30-day public review period or otherwise during the development of the plan.

Once approved by NYSDHSES and FEMA, the Final Plan will be made available for public review in the same formats as the draft—online and in print. Hard copies will be maintained at the Department of Public Safety and other locations identified in Chapter 18, “Plan Maintenance.”

Examples of virtual outreach via websites and social media completed by the Planning Partners are provided in the figures below and in Appendix B

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

The Lewis County HMP uses the best available information to support hazard profiling, risk assessment, review and evaluation of mitigation capabilities, and the development and prioritization of County and local mitigation strategies. Plans, reports, and other technical information were identified and accessed online through independent research by the planning consultant or provided directly by the County, participating jurisdictions, and stakeholders involved in the planning effort. Detailed sources of technical data and information used are listed in the References section.

The asset inventory data used for the risk assessment is presented in Chapter 3. Details of the source of this data, along with technical information on how the data was used to develop the risk assessment, are presented in Chapter 4, as well as throughout the hazard profiles in this HMP. The County and participating jurisdictions provided relevant jurisdiction-specific planning and regulatory documents, which were reviewed to identify:

- Existing jurisdictional capabilities
- Needs and opportunities to develop or enhance capabilities, which may be identified in the County or local mitigation strategies
- Mitigation-related goals or objectives, considered in the review and update of the overall Goals and Objectives
- Proposed, in-progress, or potential mitigation actions to be incorporated into the updated County and local mitigation strategies

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

- Comprehensive/master plans
- Building codes
- Zoning and subdivision ordinances
- Flood insurance studies
- Flood insurance rate maps
- 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, 2023

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

2.5 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. Many existing plans and programs support hazard mitigation in the County. It is critical that this HMP integrate, coordinate with, and complement, those existing plans, and programs.

The capability assessment presented in Chapter 16 provides a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county and local) that support hazard mitigation in the County. In the jurisdictional annexes in Volume II, each participating jurisdiction identifies how it has already integrated hazard mitigation into its planning, regulatory and administrative framework (“integration capabilities”) and how it intends to promote this integration (“integration actions”).

2.6 PLAN ADOPTION

Adoption by the local governing bodies of each participating jurisdiction demonstrates the commitment of the Planning Partners to fulfill the mitigation goals and strategies outlined in this HMP. Adoption via a municipal resolution legitimizes the HMP and authorizes responsible agencies to execute their responsibilities.

All participating jurisdictions will proceed with formal adoption proceedings. Each jurisdiction must submit a copy of its formal adoption resolution or other legal instrument to the Lewis County HMP Coordinator in the Lewis County Department of Emergency Services. Lewis County will forward the executed resolutions to the New York State Department of Homeland Security and Emergency Services (NY DHSES), after which they will be forwarded to FEMA for the record. FEMA allows two options for submitting adoption resolutions:

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

In addition to being required by DMA 2000, adoption of the HMP 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 program and grant administrators that the plan’s recommendations have been properly considered and approved by the jurisdictions’ governing authority and citizens.
- It helps to ensure the continuity of mitigation programs and policies over time because elected officials, staff, and other community decision-makers can refer to the official document when making decisions about the community’s future.

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

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

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

2.7 CONTINUED PUBLIC INVOLVEMENT

The Planning Partners are committed to the continued involvement of the public in the hazard mitigation process. This Plan update will be posted on-line at multiple locations:

- tinyurl.com/lewiscountystorymap
- <https://lewiscountyny.gov/departments/planning-and-community-development/>
- <https://lewiscountyny.gov/departments/emergency-management/#emergencymanagementresources>

Jurisdictions 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. 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 is responsible for coordinating the plan evaluation portion of the meeting, soliciting feedback, collecting, and reviewing the comments, and ensuring

their incorporation in the 5-year plan update as appropriate; however, members of the Planning Partnership will assist the HMP Coordinator. Additional meetings may also be held as deemed necessary by the Planning Partnership. The purpose of these meetings would be to provide the public an opportunity to express concerns, opinions, and ideas about the plan.

After completion of this plan, implementation and ongoing maintenance will continue to be a function of the Planning Partnership. The Planning Partnership will review the 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.

Lauryn Tabolt of the Lewis County Planning and Community Development has been identified as the ongoing County HMP Coordinator, and is responsible for receiving, tracking, and filing public comments regarding this Plan Update. Contact information is:

Mailing Address:	Lewis County Planning and Community Development 7660 North State Street Lowville, NY 13367
Contact Name:	Lauryn Tabolt
Email Address:	lauryntabolt@lewiscounty.ny.gov
Telephone:	315-376-5780

Further details regarding continued public involvement are provided in Chapter 19.

3. COUNTY PROFILE

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

3.1 LOCATION

Lewis County is in the scenic region of Northern New York. The County is bordered to the north by St. Lawrence County, to the east by Herkimer County, to the south by Oneida County, to the southwest by Oswego County, and to the northwest by Jefferson County. Lewis County is made up of 26 municipalities (towns and villages) and encompasses an area of approximately 1,290 square miles (Lewis County HMP, 2010). Lewis County is easily accessible from several major interstates and is only 40 miles south of the Canadian border. Located in the Black River Valley, it is within a day's drive from major Northeast cities, such as New York City, Boston, and Buffalo. Figure 3-1 illustrates the County and its municipalities.

3.2 HISTORY

Lewis County was officially established in 1805, carved out of Oneida County during a period of rapid settlement and expansion in northern New York. After the Revolutionary War, New York State took control of the land, which was then largely unmapped and sparsely settled. It was named after Morgan Lewis, a Revolutionary War officer and Governor of New York from 1804 to 1807.

The area was originally inhabited by the Iroquois Confederacy, particularly the Oneida Nation, before European-American settlers began arriving in the late 18th century. Early development was driven by logging, agriculture, and hydropower, with the Black River Canal playing a key role in connecting the region to the Erie Canal and broader markets in the 19th century.

Lowville, the county seat, became a hub of commerce and governance. Over time, dairy farming emerged as a dominant industry, and Lewis County remains one of New York's leading producers of milk and cheese. The county's economy has also long relied on timber harvesting, paper production, and outdoor recreation, thanks to its vast forests and proximity to the Adirondack Park. Today, Lewis County retains its rural character, with a population of just under 27,000 and is known for its scenic landscapes and agricultural heritage. The county's natural beauty, including parts of the Adirondack Park and the Tug Hill Plateau, attracts tourists (Historically Lewis n.d.).

3.3 JURISDICTIONS WITHIN THE COUNTY

The County consists of 24 municipalities: 17 towns and seven villages, as listed in Table 3-1.

Figure 3-1. Lewis County Hazard Mitigation Plan Area

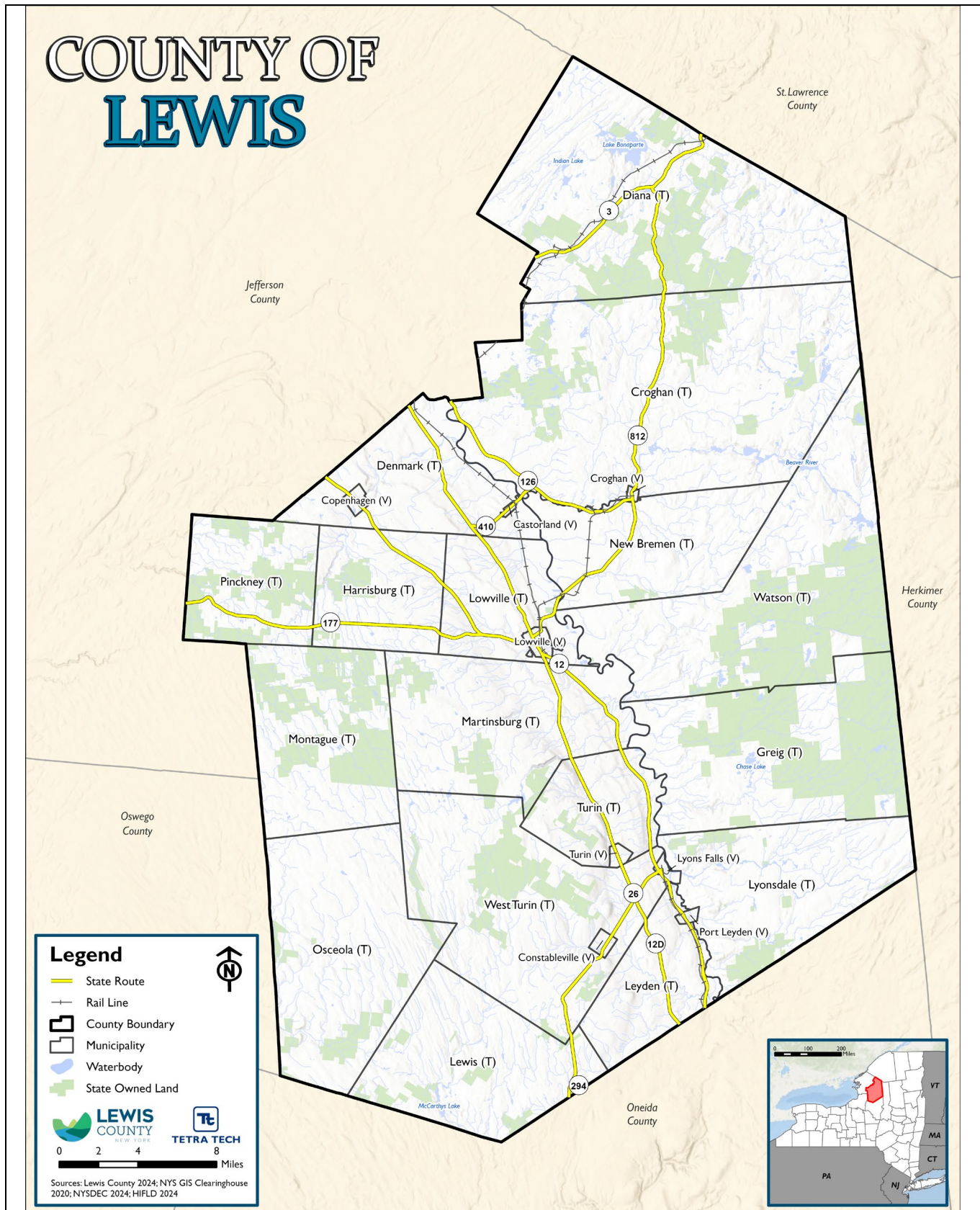


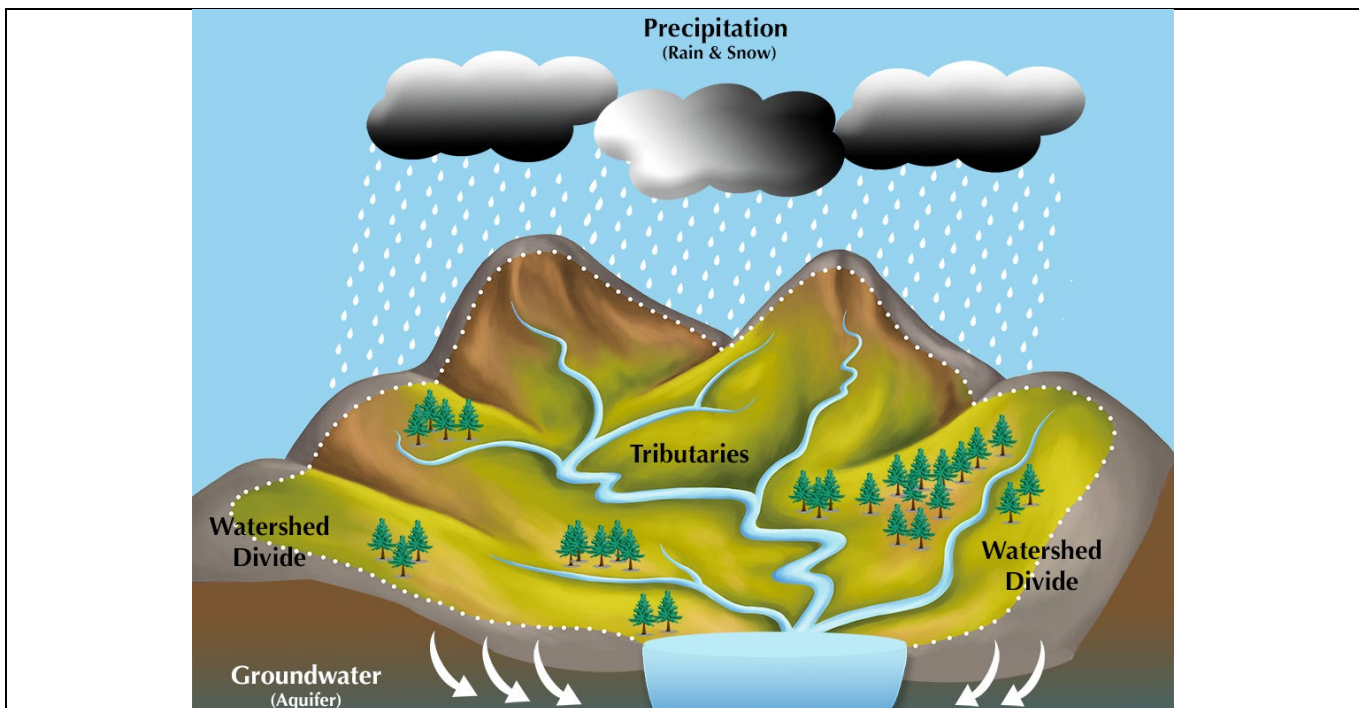
Table 3-1. Lewis County Municipalities

Villages		
• Village of Constableville • Village of Copenhagen • Village of Croghan	• Village of Lowville • Village of Lyons Falls	• Village of Port Leyden • Village of Turin
Towns		
• Town of Croghan • Town of Denmark • Town of Diana • Town of Greig • Town of Harrisburg • Town of Lewis	• Town of Leyden • Town of Lowville • Town of Lyonsdale • Town of Martinsburg • Town of Montague • Town of New Bremen	• Town of Osceola • Town of Pinckney • Town of Turin • Town of Watson • Town of West Turin

3.4 PHYSICAL SETTING

3.4.1 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 (see Figure 3-2). Drainage basins generally refer to large areas that encompass the watersheds of many smaller rivers and streams.

Figure 3-2. Watershed


Source: Hudson River Watershed Alliance n.d.

New York State's waters (lakes, rivers, and streams) fall within one of 17 major watersheds (or drainage basins). Numerous ponds, lakes, creeks, and rivers make up the waterscape of Lewis County, which lies within several major drainage basins (St. Lawrence River Basin, Black River Basin, Mohawk River, Oswego River/Finger Lakes Basin, Lake Ontario Tributaries Basin) and numerous sub-basins, as shown on Figure 3-3. The major rivers within the County include the Black River and its tributaries, Beaver River, Douglas Creek, House Falls Creek, Independence River, Moose River, North Branch Sugar River, Oswegatchie River, and South Sandy Creek. Major lakes in Lewis County include Beavery Lake, Lake Bonaparte, Brantingham Lake, Francis Lake, High Falls Pond, Long Pond, Pine Lake, Potash Creek, and Stony Lake.

The Black River Basin is the dominant watershed in Lewis County, encompassing a large portion of the county's land area. The Black River drains approximately 1,920 square miles of land, primarily from the western slopes of the Adirondack Mountains and the eastern edge of the Tug Hill Plateau. The basin spans Lewis, Jefferson, and Herkimer Counties, with smaller portions extending into Hamilton and Oneida Counties. The watershed includes over 3,900 miles of freshwater rivers and streams, supporting diverse ecosystems and providing critical water resources for the region (USGS n.d.). Much of the basin remains undeveloped and sparsely populated, contributing to its ecological value and flood storage capacity.

Historically, settlement and population in Lewis County have concentrated in the Black River Valley, a trend that continues today. The valley has served as a key transportation corridor, notably through the Black River Canal, which once connected local communities to the Erie Canal system, facilitating commerce and mobility. The fertile floodplain of the Black River has also supported agriculture and hydropower development, making it the most densely populated and economically active area in the county.

Flood risks in the basin are influenced by seasonal snowmelt, ice jams, and increasingly, climate-driven extreme precipitation events. These risks are being monitored and modeled through tools like the USGS National Water Information System (NWIS) and the NYSDEC Environmental Resource Mapper, which provide data on streamflow, floodplains, and protected resources (NYSDEC n.d.).

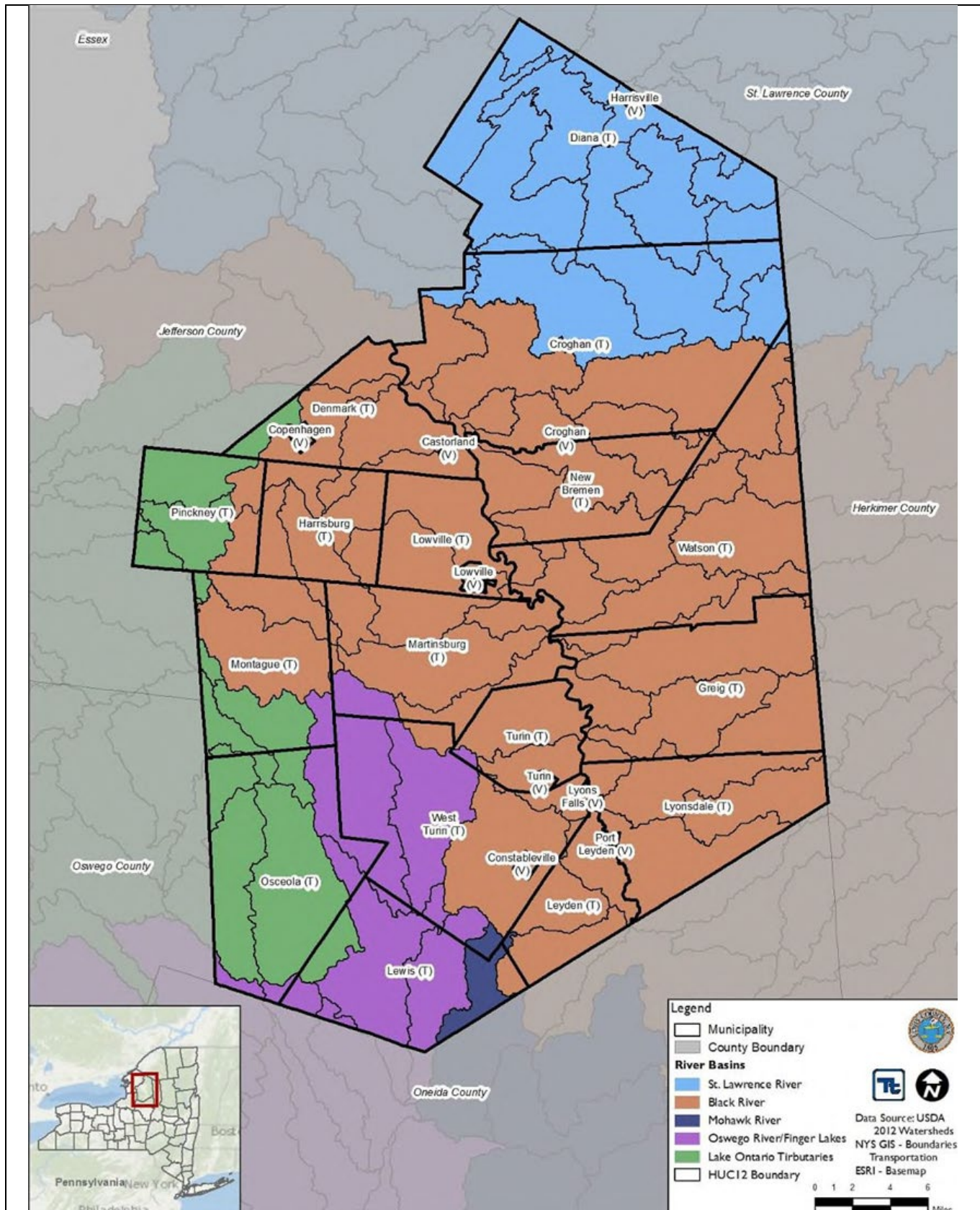
3.4.2 Topography and Geology

The primary feature of Lewis County is the Black River Valley, which runs south-north through its center. The Black River Valley is flanked by the Tug Hill Plateau to the west and the Adirondack Foothills to the east. Eastern portions of five of the towns in Lewis County are also within the Adirondack Park Blue-Line boundary (Lewis County Comprehensive Plan 2009).

The Black River flows 114 miles from the western Adirondacks, through the county along the edge of the Tug Hill Plateau and into Lake Ontario. The 42-mile flatwater section through Lewis County from Lyons Falls to Carthage is known locally as the "Black River Flats." The river drops only approximately 15 feet over the 42-mile distance. The river is in a broad open valley that is between two and five miles in width. The Black River was a connection point for the Erie Canal at Lyons Falls via the Black River Canal. Periodic flooding of the river valley has resulted in the presence of high-quality soils, which contributes to the dominance of agricultural land uses in the valley (Lewis County Comprehensive Plan 2009).

The Tug Hill Plateau is one of the few examples in the eastern United States of a distinct, large plateau at 2,100 square miles. It lies between Lake Ontario, the Black River, and Oneida Lake. It encompasses towns and villages scattered in a vast acreage of forest and farm land. At the core of the plateau is more than 800 square miles of remote forest land and the headwaters of several major rivers. The plateau's location on the eastern end of Lake Ontario makes it the most substantial lake-effect snow location in the country (Lewis County Comprehensive Plan 2009).

Figure 3-3. Watersheds in Lewis County



Lewis County contains a portion of the western foothills of the Adirondack Mountains. The Adirondack Park was created in 1892 by the State of New York amid concerns for the water and timber resources of the mountainous region. Today, the park is the largest publicly protected area in the contiguous United States, greater in size than Yellowstone, Everglades, Glacier, and Grand Canyon National Parks combined. The boundary of the park encompasses approximately 6 million acres, nearly half of which belongs to all the people of New York State and is constitutionally protected to remain “forever wild” forest preserve. The remaining half of the park is private land which includes settlements, farms, timber lands, businesses, homes, and camps. The wild forest, water, wildlife, and aesthetic resources of the park along with its open space character provide an outdoor recreational experience of national and international significance (Lewis County Comprehensive Plan 2009).

3.4.3 Climate

Lewis County, located on the western edge of the Adirondack Mountains and adjacent to the Tug Hill Plateau, experiences a humid continental climate, typical of much of upstate New York. This climate is characterized by cold, snowy winters and warm, humid summers, with significant seasonal variation in temperature and precipitation.

Warm Season (April–September): Precipitation during the growing season is often driven by convective thunderstorms, which form ahead of cold fronts or during periods of local atmospheric instability. Occasionally, tropical systems moving northward from the Atlantic or Gulf coasts can bring heavy rainfall to the region. These events typically produce short-duration, high-intensity rainfall, leading to rapid surface runoff and increased flood risk.

Cool Season (October–March): The cold season is dominated by large low-pressure systems that track along the Atlantic coast or the Great Lakes. These systems bring prolonged precipitation in the form of rain, snow, or ice. Snowmelt events, particularly in late winter or early spring, can contribute to ice jam flooding and elevated stream flows. The Tug Hill Plateau, which extends into the western part of Lewis County, is one of the snowiest regions in the eastern U.S., due to lake-effect snow generated by cold air passing over Lake Ontario.

- Average annual precipitation: 41.35 inches
- Average annual snowfall: 119 inches
- Average summer highs: 69°F to 78°F
- Average winter highs: 26°F to 38°F (NOAA n.d.)

The New York State Climate Impacts Assessment projects that by the 2050s, the North Country region, including Lewis County, could see a 5–15% increase in annual precipitation, with more frequent extreme rainfall events. These changes are expected to increase the risk of flash flooding, erosion, and infrastructure stress, particularly in rural areas with limited stormwater capacity (NYSERDA 2023).

3.4.4 Land Cover

Lewis County is characterized by a diverse and predominantly rural land cover, shaped by its location between the Adirondack Mountains and the Tug Hill Plateau. According to the National Land Cover Database and the New York State Department of Environmental Conservation, the county’s land cover includes the following major categories (USGS 2018) (NYSDEC n.d.):

- **Forests:** Forests dominate the landscape, particularly in the eastern and southern portions of the county within the Adirondack Park Forest Preserve. These include deciduous, coniferous, and mixed forests,

which support timber harvesting, wildlife habitat, and recreation. Much of this land is protected under state forest classifications such as Wilderness and Wild Forest.

- **Agricultural Land:** Dairy farming is the primary agricultural activity, with large expanses of pasture and cropland in the Black River Valley and western parts of the county. These lands are typically found in flatter, more fertile areas and are integral to the county's economy.
- **Wetlands and Open Water:** Numerous wetlands, streams, and ponds are scattered throughout the county, especially in low-lying areas and along the Black River and its tributaries. These areas provide important flood storage, water filtration, and wildlife habitat.
- **Developed Areas:** Urban and suburban development is limited and concentrated in small towns and villages such as Lowville, Copenhagen, and Croghan. Developed land includes residential, commercial, and transportation infrastructure, but accounts for a small percentage of total land area.
- **Grasslands and Shrublands:** These transitional areas are often found between forest and agricultural zones and may include abandoned farmland or utility corridors.

The distribution of land cover across the county is listed in Table 3-2 and shown on Figure 3-4.

Table 3-2. Land Cover Categories in Acres

Land Use Category	2021 Data	
	Acreage	% of County
Agriculture	123,270	14.9%
Barren Land	611	0.1%
Forest	508,741	61.6%
Rangeland	16,742	2.0%
Urban Area	29,457	3.6%
Water	10,171	1.2%
Wetlands	136,476	16.5%
Lewis County (Total)	825,466	100.0%

Source: Source: USGS/NLCD 2021

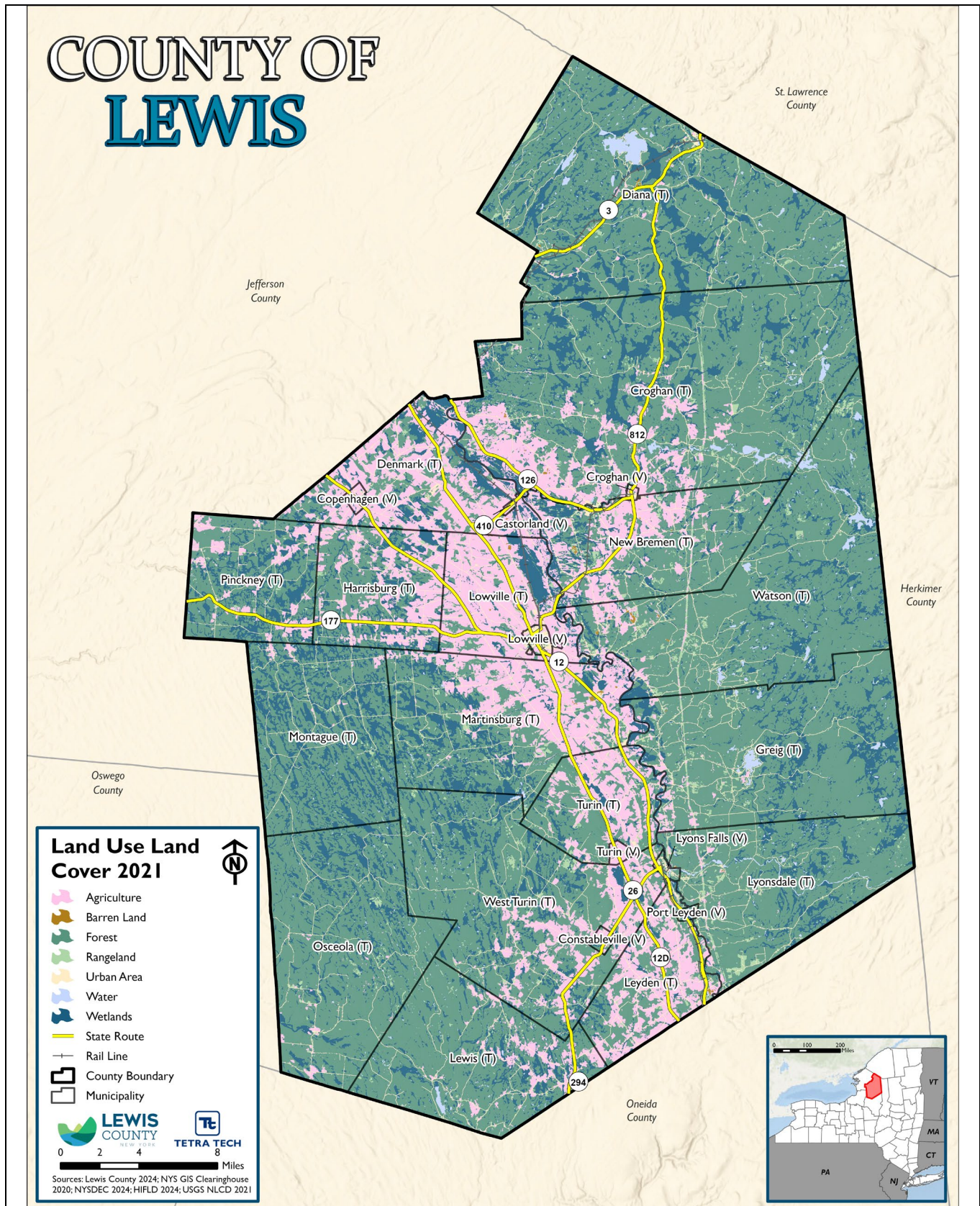
3.5 LAND USE

3.5.1 Current Land Use and Land Use Trends

Lewis County, New York, is defined by a predominantly rural land use pattern shaped by its geography, agricultural economy, and historical development. The county's landscape is a mosaic of farmland, forest, and small population centers, with land use decisions closely tied to natural features such as the Black River Valley, the Tug Hill Plateau, and the foothills of the Adirondack Mountains.

Agriculture remains the dominant land use in Lewis County, particularly in the fertile Black River Valley. The county is well known for its dairy industry, as well as the production of hay and corn. Large tracts of active farmland contribute significantly to the local economy and tax base. According to the New York State Office of Real Property Tax Services (ORPTS), agricultural parcels make up a substantial portion of the county's assessed land value (NYSDEC n.d.).

Figure 3-4. Lewis County Land Cover



Forested land is another major component of the county's landscape, especially across the Tug Hill Plateau and the Adirondack foothills. These forests support a robust timber industry, provide critical wildlife habitat, and offer recreational opportunities such as hunting, snowmobiling, and hiking. Much of this land is privately owned, though significant portions are managed by the state as part of forest preserves and conservation areas. The NYSDEC Environmental Resource Mapper identifies these areas as significant natural communities and conservation zones (NYSDEC n.d.).

Residential and developed land uses are concentrated in villages such as Lowville, Copenhagen, and Croghan, with scattered rural housing throughout the county. Commercial and industrial development is limited but present, primarily located in village centers and along major transportation corridors. These developed areas support essential services and small-scale economic activity, while maintaining the county's overall rural character.

Recreational and open space uses are also prominent in Lewis County. The county is home to several state forests, extensive snowmobile trail networks, and public lands that support seasonal tourism and outdoor recreation. These areas not only contribute to the local economy but also serve as natural buffers that help manage stormwater and preserve ecological integrity.

Emerging land use trends reflect both opportunities and challenges. There is growing interest in farmland preservation through agricultural conservation easements and right-to-farm protections. At the same time, residential growth remains low-density and dispersed, which can strain infrastructure and emergency services. The county has also seen increased interest in renewable energy development, particularly wind and solar projects on the Tug Hill Plateau. Lewis County is already home to multiple wind farms and is seeing an increase in solar energy development, with a focus on utilizing marginal agricultural land for solar projects (Lewis County, NY n.d.).

3.6 DEMOGRAPHICS

3.6.1 Current Population and Changes Over Time

Table 3-3 shows the most recent population data for Lewis County and municipalities within it, as reported in the 2020 U.S. decennial census and the 2023 5-year estimates from the U.S. Census Bureau's American Community Survey (ACS).

The County population difference between the 2010 and 2020 Census is a decrease of 212 (from 27,087 to 26,875). From 2020 to 2023 the total population increased slightly from 26,875 to 26,974. Most jurisdictions experienced modest changes, with some villages and towns showing slight growth or decline. Lowville (V), the county's largest population center, grew by 160 residents, reinforcing its role as a regional hub. Smaller towns like Montague (T) and Turin (V) also saw notable percentage increases, though from smaller population bases.

3.6.2 Socially Vulnerable Populations

Identifying concentrations of socially vulnerable populations is essential for effective emergency preparedness, response, and mitigation planning in Lewis County. Vulnerable populations are more likely to experience adverse outcomes during disasters due to limited access to resources, mobility challenges, or communication barriers. In Lewis County, these populations include children, older adults, economically disadvantaged individuals, people with physical or mental disabilities, and non-English speakers. Table 3-4 summarizes current estimates of these population groups from the 2023 5-year ACS estimates.

Table 3-3. Total Population

Jurisdiction	U.S. Census Bureau 2020 Decennial		2023 ACS 5-Year Estimates	
	Total Population	% of County Total	Total Population	% of County Total
Constableville (V)	293	1.1%	356	1.3%
Copenhagen (V)	631	2.3%	652	2.4%
Croghan (T)	2,909	10.8%	2,911	10.8%
Croghan (V)	639	2.4%	642	2.4%
Denmark (T)	1,661	6.2%	1,589	5.9%
Diana (T)	1,610	6.0%	1,503	5.6%
Greig (T)	1,179	4.4%	1,020	3.8%
Harrisburg (T)	480	1.8%	515	1.9%
Lewis (T)	844	3.1%	801	3.0%
Leyden (T)	1,173	4.4%	1,235	4.6%
Lowville (T)	1,616	6.0%	1,442	5.3%
Lowville (V)	3,272	12.2%	3,432	12.7%
Lyons Falls (V)	570	2.1%	478	1.8%
Lyonsdale (T)	946	3.5%	885	3.3%
Martinsburg (T)	1,316	4.9%	1,232	4.6%
Montague (T)	97	0.4%	159	0.6%
New Bremen (T)	2,434	9.1%	2,436	9.0%
Osceola (T)	243	0.9%	140	0.5%
Pinckney (T)	313	1.2%	246	0.9%
Port Leyden (V)	554	2.1%	680	2.5%
Turin (T)	571	2.1%	827	3.1%
Turin (V)	197	0.7%	312	1.2%
Watson (T)	1,802	6.7%	1,888	7.0%
West Turin (T)	1,190	4.4%	1,178	4.4%
Lewis County (Total)	26,875	100.0%	26,974	100.0%

Source: U.S. Census Bureau 2020 Decennial; U.S. Census Bureau 2023 ACS

Note:

Copenhagen (V) is 100% within Denmark (T); Castorland (V) is 100% within Denmark (T); Turin (V) is 100% within Turin (T). Lowville (V) is 100% within Lowville (T). Constableville (V) is 100% within West Turin (T). Subtracted village totals from town to assign correct town totals.

Croghan (V) falls within both Croghan (T) and New Bremen (T). Lyons Falls (V) falls within both Lyonsdale (T) and West Turin (T). Port Leyden (V) falls within both Leyden (T) and Lyonsdale (T). An area analysis was conducted on Residential structures to identify an approximate population per Town. Village totals are subtracted from the corresponding Town to more accurately reflect the Town totals. In addition, the following multipliers were applied: 0.45 was applied to Croghan (T), 0.55 was applied to New Bremen (T), 0.12 was applied to Lyonsdale (T), 0.88 was applied to West Turin (T), 0.72 was applied to Leyden (T), and an additional multiplier of 0.28 was applied to Lyonsdale (T) for the area analysis.

Table 3-4. Lewis County Population and Demographic Statistics

	2020 Decennial Total Population	American Community Survey 5-Year Population Estimates (2023)									
		65 and Older		5 and Younger		Non-English-Speaking		Disability		Below Poverty Level	
		Population	% of Total	Population	% of Total	Households	% of Total	Population	% of Total	Population	% of Total
Constableville (V)	293	60	16.9%	53	14.9%	0	0.0%	52	14.6%	35	9.8%
Copenhagen (V)	631	57	8.7%	33	5.1%	0	0.0%	140	21.5%	104	16.0%
Croghan (T)	2,909	435	14.9%	186	6.4%	0	0.0%	393	13.5%	447	15.3%
Croghan (V)	639	136	21.2%	35	5.5%	0	0.0%	85	13.2%	112	17.4%
Denmark (T)	1,661	384	24.2%	109	6.9%	0	0.0%	197	12.4%	241	15.2%
Diana (T)	1,610	284	18.9%	29	1.9%	0	0.0%	280	18.6%	223	14.8%
Greig (T)	1,179	240	23.5%	43	4.2%	24	2.4%	147	14.4%	117	11.5%
Harrisburg (T)	480	57	11.1%	50	9.7%	0	0.0%	84	16.3%	57	11.1%
Lewis (T)	844	94	11.7%	35	4.4%	0	0.0%	100	12.5%	37	4.6%
Leyden (T)	1,173	173	14.0%	96	7.8%	0	0.0%	127	10.3%	208	16.8%
Lowville (T)	1,616	482	33.4%	62	4.3%	0	0.0%	190	13.2%	220	15.3%
Lowville (V)	3,272	648	18.9%	117	3.4%	0	0.0%	568	16.6%	456	13.3%
Lyons Falls (V)	570	133	27.8%	28	5.9%	0	0.0%	68	14.2%	41	8.6%
Lyonsdale (T)	946	201	22.7%	49	5.5%	0	0.0%	247	27.9%	139	15.7%
Martinsburg (T)	1,316	299	24.3%	51	4.1%	0	0.0%	198	16.1%	94	7.6%
Montague (T)	97	21	13.2%	3	1.9%	0	0.0%	15	9.4%	9	5.7%
New Bremen (T)	2,434	373	15.3%	265	10.9%	0	0.0%	236	9.7%	133	5.5%
Osceola (T)	243	42	30.0%	4	2.9%	0	0.0%	17	12.1%	14	10.0%
Pinckney (T)	313	41	16.7%	28	11.4%	0	0.0%	30	12.2%	21	8.5%
Port Leyden (V)	554	174	25.6%	71	10.4%	0	0.0%	131	19.3%	142	20.9%
Turin (T)	571	200	24.2%	46	5.6%	0	0.0%	115	13.9%	59	7.1%

	2020 Decennial Total Population	American Community Survey 5-Year Population Estimates (2023)									
		65 and Older		5 and Younger		Non-English-Speaking		Disability		Below Poverty Level	
		Population	% of Total	Population	% of Total	Households	% of Total	Population	% of Total	Population	% of Total
Turin (V)	197	94	30.1%	23	7.4%	0	0.0%	86	27.6%	19	6.1%
Watson (T)	1,802	397	21.0%	73	3.9%	5	0.3%	258	13.7%	155	8.2%
West Turin (T)	1,190	260	22.1%	111	9.5%	0	0.0%	140	11.9%	110	9.3%
Lewis County (Total)	26,875	5,347	19.8%	1,635	6.1%	29	0.1%	3,972	14.7%	3,265	12.1%

Source: U.S. Census Bureau 2020 Decennial; U.S. Census Bureau 2023 ACS Vulnerable Population Totals

Note:

Copenhagen (V) is 100% within Denmark (T); Castorland (V) is 100% within Denmark (T); Turin (V) is 100% within Turin (T). Lowville (V) is 100% within Lowville (T).

Constableville (V) is 100% within West Turin (T). Subtracted village totals from town to assign correct town totals.

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The following are summary statistics about various County population groups (Census 2020, Data USA n.d.):

- Countywide Vulnerability Overview
 - Seniors (65+): 19.8% of the population
 - Children under 5: 6.1%
 - Individuals with disabilities: 14.7%
 - Residents below the poverty level: 12.1%
 - Non-English-speaking households: 0.1% (very limited)
- Jurisdictions with the Highest Vulnerability Rates
 - Seniors: Lowville (T) – 33.4% of the population is 65 or older
 - Young Children (5 and under): Constableville (V) – 14.9%
 - Disability: Lyonsdale (T) – 27.9%
 - Poverty: Port Leyden (V) – 20.9%
- Jurisdictions with the Lowest Vulnerability Rates
 - Seniors: Copenhagen (V) – 8.7%
 - Young Children: Diana (T) – 1.9%
 - Disability: Montague (T) – 9.4%
 - Poverty: Lewis (T) – 4.6%
- Five largest ethnic groups in Lewis County
 - White (Non-Hispanic) (93.9%)
 - Two Races Excluding Other and Three or More Races (Non-Hispanic) (1.51%)
 - Two Races Including Other (Non-Hispanic) (1.44%)
 - Black or African American (Non-Hispanic) (0.725%)
- Residents in Lewis County are U.S. citizens – 99.4% of
- Households in Lewis County that reported speaking a non-English language at home as their primary shared language – None (This does not consider the potential multi-lingual nature of households, but only the primary self-reported language spoken by all members of the household)

3.7 ECONOMY

3.7.1 Agriculture and Forestry

The economy in Lewis County continues to be based largely on agriculture and forestry including dairy farming, paper milling, and logging. The manufacture and production of raw goods and value-added products from those industries provide for the county's primary employment generators. Other significant farming activities in Lewis County include maple production, Christmas tree farms, and direct sales. Lewis County is ranked fifth in the state for the market value of cultivated Christmas trees sold and 11th for both cattle and cow's milk sales.

Agriculture is the dominant land use in Lewis County (151,420 acres), a major economic driver, and a major employer. The most recent data on the agriculture industry in the County is summarized in Figure 3-5 and Figure 3-6. Since 2017 the market value of products sold has increased 17% to \$178,605,000 total and an average of \$375,220 per farm: an increase of 53% since 2017. Agriculture is critical not just to the County's economy, but to Lewis' rural landscape, community character, environment and public health (Lewis County 2021).

Since 2017 the number acres has decreased, the number of farms has decreased, but the average size of existing farms has increased. Pressures on agriculture include low profitability, solar development on prime farmlands, residential development, loss of small dairy farms, aging farmers, lack of a new generation of farmers, and changing weather patterns. Opportunities include value-added farming enterprises, increased demand for local food and farm products, agri-tourism, and a recognized desire to maintain Lewis County as a rural community.

New York State receives significant benefits from the forest industry. The sector is composed of 4 broad categories of output: Forestry and Logging; Solid Wood Products; Pulp and Paper Products; and Wood Furniture. The forest economy of New York generated \$13.1 billion in direct output with around 70% attributable to the production activities of the pulp and paper industry. In addition, the sector provides more than 41,000 direct employment and \$2.5 billion in direct labor income. This provides for an average labor income per worker of \$61,526 (NYS Wood Products Development Council 2021).

Logging plays a significant role in Lewis County, New York's economy, providing a primary source of employment and income for residents through the timber industry, supporting local sawmills and wood product companies, and contributing to the overall economic activity in the region.

Logging operations directly employ a substantial number of people in Lewis County, including loggers, truck drivers, and sawmill workers. The logging industry supports a network of related businesses like equipment suppliers, repair shops, and transportation services, further boosting the local economy. The harvested timber is processed into various wood products like lumber, plywood, and paper pulp, which are then sold to regional and national markets. In the past, logging has sometimes facilitated land development by clearing forested areas for new settlements and agricultural use.

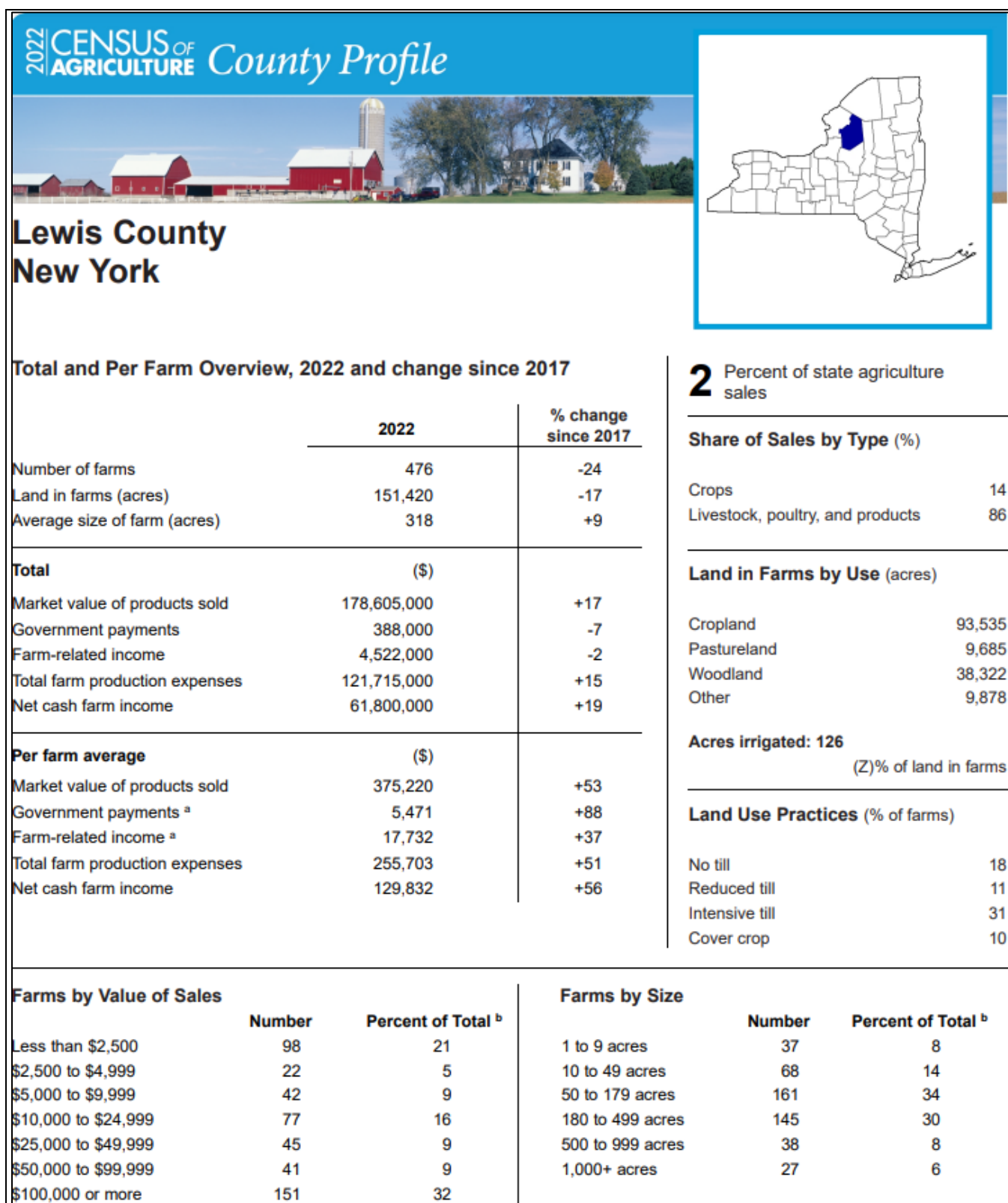
3.7.2 Tourism

In Lewis County, New York, tourism significantly impacts the local economy by generating substantial income through visitor spending on lodging, food, recreation, and retail, which directly supports local businesses, creates jobs, and contributes to tax revenue, particularly through the popularity of snowmobiling activities in the Tug Hill region; essentially acting as a key economic driver for the county, especially during winter months.

In 2023, visitor spending at local businesses totaled \$62,600,000:

- \$9M was spent on Lodging / Accommodations
- \$700K was spent on Recreation / Entertainment
- \$8.4M was spent on Food & Beverage
- \$3.5M was spent on Retail Goods and Services
- \$0 was spent on Local Transportation
- \$40.9M was spent on Vacation Property / Second Homes

Figure 3-5. Lewis County 2022 Census of Agriculture County Profile: Farms Overview



Source: (USDA 2022)

Figure 3-6. Lewis County 2022 Census of Agriculture County Profile: Products Overview

Lewis County

New York, 2022

Page 2

2022

CENSUS OF AGRICULTURE

County Profile

Market Value of Agricultural Products Sold

	Sales (\$1,000)	Rank in State ^c	Counties Producing Item	Rank in U.S. ^c	Counties Producing Item
Total	178,605	19	62	936	3,078
Crops	24,748	37	62	1,708	3,074
Grains, oilseeds, dry beans, dry peas	9,636	29	55	1,561	2,917
Tobacco	-	-	-	-	267
Cotton and cottonseed	-	-	-	-	647
Vegetables, melons, potatoes, sweet potatoes	241	53	61	1,406	2,831
Fruits, tree nuts, berries	266	51	59	1,176	2,711
Nursery, greenhouse, floriculture, sod	231	56	60	1,319	2,660
Cultivated Christmas trees, short rotation woody crops	775	5	52	79	1,274
Other crops and hay	13,599	8	56	251	3,035
Livestock, poultry, and products	153,857	12	60	446	3,076
Poultry and eggs	110	46	59	1,319	3,027
Cattle and calves	17,204	11	56	936	3,047
Milk from cows	136,051	11	54	92	1,770
Hogs and pigs	72	36	55	982	2,814
Sheep, goats, wool, mohair, milk	138	38	55	1,231	2,967
Horses, ponies, mules, burros, donkeys	64	44	55	1,744	2,907
Aquaculture	-	-	30	-	1,190
Other animals and animal products	217	32	58	678	2,909

Producers ^d

924

Sex

Male

579

Female

345

Age

<35

145

35 – 64

543

65 and older

236

Race

American Indian/Alaska Native

-

Asian

-

Black or African American

-

Native Hawaiian/Pacific Islander

-

White

921

More than one race

3

Other characteristics

Hispanic, Latino, Spanish origin

5

With military service

60

New and beginning farmers

285

Percent of farms that:

Have internet access

74

Farm organically

5

Sell directly to consumers

19

Hire farm labor

28

Are family farms

97

Top Crops in Acres ^e

Forage (hay/haylage), all

50,867

Corn for silage/greenchop

23,474

Corn for grain

5,929

Soybeans for beans

1,972

Oats for grain

1,136

Livestock Inventory (Dec 31, 2022)

Broilers and other meat-type chickens

1,382

Cattle and calves

48,525

Goats

362

Hogs and pigs

209

Horses and ponies

419

Layers

2,685

Pullets

469

Sheep and lambs

665

Turkeys

107

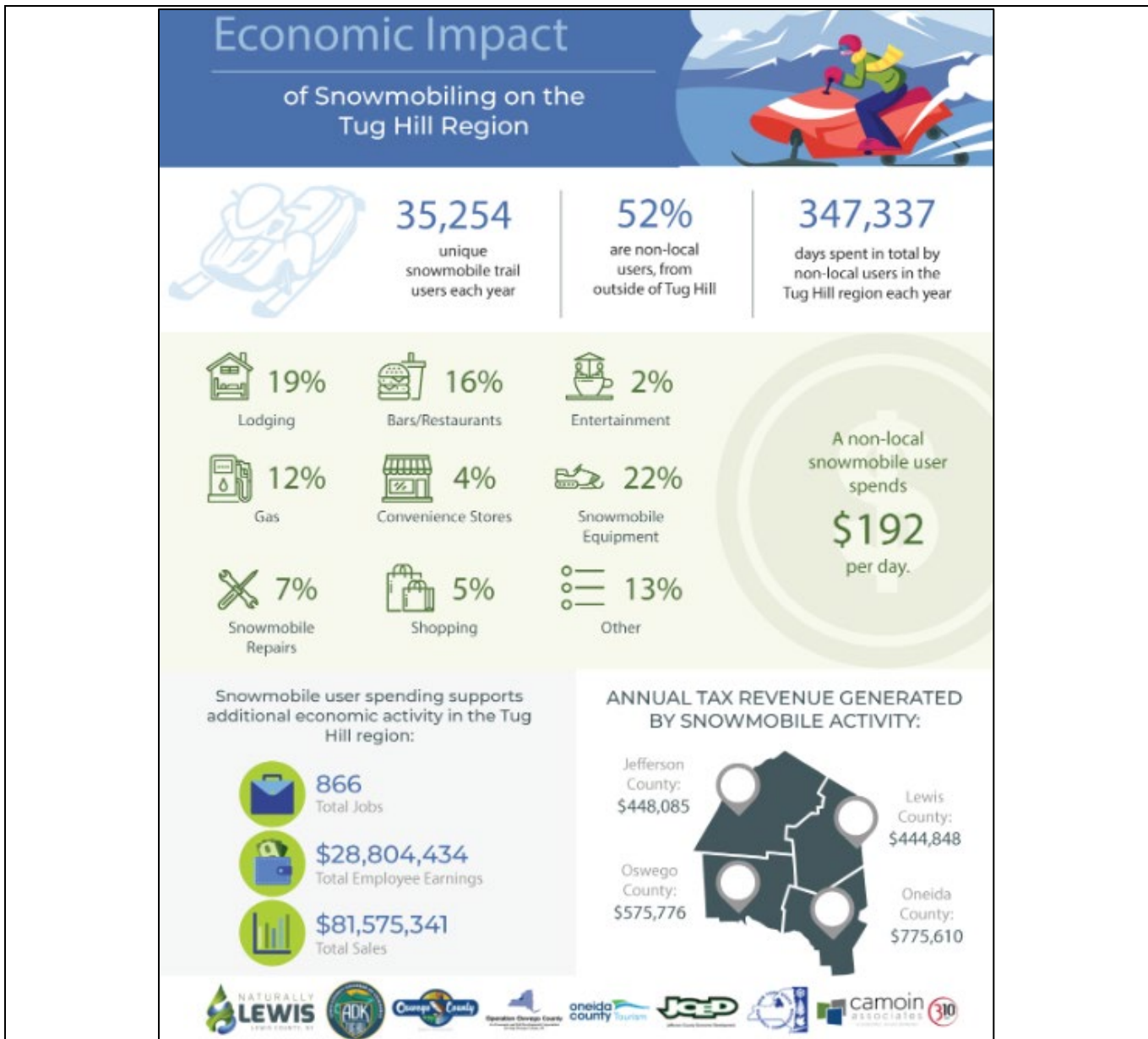
^a Average per farm receiving. ^b May not add to 100% due to rounding. ^c Among counties whose rank can be displayed. ^d Data collected for a maximum of four producers per farm. ^e Crop commodity names may be shortened; see full names at www.nass.usda.gov/go/cropnames.pdf. ^f Position below the line does not indicate rank. (D) Withheld to avoid disclosing data for individual operations. (NA) Not available. (Z) Less than half of the unit shown. (-) Represents zero.

Source: (USDA 2022)

Visitor spending generates \$4M in County tax revenue, reducing the tax burden on residents and \$21M Local employment income supported by visitor spending (NYS Tourism Industry Association n.d.).

Most of the tourism in Lewis County is driven by snowmobiling enthusiasts who visit the Tug Hill region for its extensive trail network, resulting in significant spending on lodging, gas, food, and equipment rentals. Figure 3-7 summarizes the economic impact of snowmobiling in Lewis County. Throughout early 2021, a survey was conducted to evaluate the impact of snowmobile user spending on the Tug Hill region. The Center for Community Studies at Jefferson Community College (JCC) developed this survey to gather information related to snowmobile users, including number of visits, spending habits, location of origin, and feedback on the trail network. In total, 2,416 surveys were completed (Naturally Lewis 2021).

Figure 3-7. Economic Impact of Snowmobiling on the Tug Hill Region



Source: (Naturally Lewis 2021)

Tug Hill Region Economic and Fiscal Impact Highlights:

- There are 35,254 unique snowmobile users of Tug Hill trails each year
- 52% of unique users are non-local users, from outside of the Tug Hill region
- Non-local users spend a total of 347,337 days in the Tug Hill region each year and participate in activities beyond snowmobiling, including dining out and local events/festivals
- A non-local snowmobile user spends on average \$192 per day
- In total, 866 jobs, over \$28.8 million in wages (earnings), and nearly \$81.6 million in sales are attributed to snowmobile activity
- Total tax revenue that results from snowmobile activity is estimated to be nearly \$445,000 in Lewis County each year

While tourism is particularly significant during winter months due to snowmobiling, other outdoor activities like hiking and fishing can also attract visitors throughout the year.

3.7.3 Income

The economy of Lewis County, NY employs approximately 11.8k people. The median household income in \$68,329, a 6.1 percent increase from 2022. The most common job groups, by number of people living in Lewis County, NY, are Management Occupations (1,201 people), Office & Administrative Support Occupations (1,097 people), and Construction & Extraction Occupations (1,086 people). The highest paying industries were Utilities (\$97,979), Information (\$59,931), and Professional, Scientific, & Technical Services (\$57,674) (Data USA n.d.).

3.7.4 Property and Vehicles

In 2023, the median property value in Lewis County, NY was \$158,000, and the homeownership rate was 80.4%. The average car ownership in Lewis County, NY was 2 cars per household. Most people in Lewis County, NY drove alone to work, and the average commute time was 24.2 minutes (Data USA n.d.).

3.8 GENERAL BUILDING STOCK

3.8.1 Existing Development

The total replacement cost value for all occupancies (including both structures and contents) across Lewis County is approximately \$23.1 billion. Among the county's jurisdictions the Town of Croghan has the highest total replacement cost value, estimated at \$2.72 billion, reflecting its large number of structures and economic assets. The Village of Turin has the lowest total replacement cost value, at approximately \$167.6 million, consistent with its smaller population and built environment. Other jurisdictions with high total values include Lowville (V): \$1.97 billion, Martinsburg (T): \$1.85 billion, and Lowville (T): \$1.76 billion.

See Table 3-5 for the building stock count and replacement cost value and Table 3-6 for replacement cost value by occupancy type for all jurisdictions below. The value density of residential, commercial, and industrial buildings in the county is shown on Figure 3-8, Figure 3-9, and Figure 3-10.

Table 3-5. Building Stock Count and Replacement Cost Value

Jurisdiction	All Occupancies			
	Count	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value (Structure + Contents)
Constableville (V)	331	\$120,328,151	\$93,683,189	\$214,011,340
Copenhagen (V)	502	\$268,084,169	\$202,810,374	\$470,894,543
Croghan (T)	4,564	\$1,487,360,627	\$1,229,343,379	\$2,716,704,006
Croghan (V)	516	\$229,228,865	\$177,585,076	\$406,813,941
Denmark (T)	2,262	\$910,158,761	\$773,112,675	\$1,683,271,436
Diana (T)	3,305	\$780,797,493	\$556,234,923	\$1,337,032,416
Greig (T)	2,962	\$708,523,792	\$452,057,545	\$1,160,581,336
Harrisburg (T)	863	\$288,012,498	\$245,624,148	\$533,636,646
Lewis (T)	1,495	\$418,634,348	\$303,758,711	\$722,393,059
Leyden (T)	1,988	\$599,416,783	\$466,546,677	\$1,065,963,460
Lowville (T)	1,752	\$926,295,511	\$836,524,238	\$1,762,819,749
Lowville (V)	2,332	\$1,078,101,389	\$888,202,621	\$1,966,304,011
Lyons Falls (V)	568	\$211,990,552	\$164,857,547	\$376,848,099
Lyonsdale (T)	1,614	\$362,701,751	\$293,412,507	\$656,114,259
Martinsburg (T)	2,180	\$989,117,146	\$858,057,631	\$1,847,174,778
Montague (T)	616	\$143,168,651	\$89,114,867	\$232,283,519
New Bremen (T)	3,030	\$933,337,631	\$728,859,752	\$1,662,197,383
Osceola (T)	1,190	\$237,128,403	\$158,838,295	\$395,966,698
Pinckney (T)	807	\$160,457,907	\$114,678,405	\$275,136,312
Port Leyden (V)	525	\$158,707,067	\$107,833,766	\$266,540,832
Turin (T)	1,094	\$481,283,361	\$400,194,204	\$881,477,564
Turin (V)	249	\$98,518,303	\$69,057,549	\$167,575,852
Watson (T)	3,311	\$783,531,080	\$524,531,108	\$1,308,062,188
West Turin (T)	1,869	\$578,479,131	\$426,659,457	\$1,005,138,588
Lewis County (Total)	40,162	\$13,064,970,086	\$10,259,726,448	\$23,324,696,534

Source: Lewis County 2024; NYS GIS 2024; RS Means 2024

Note: T: Town; V: Village

Table 3-6. Replacement Cost Value by Occupancy

Jurisdiction	Residential		Commercial		Industrial		Government, Religion, Agriculture, and Education	
	Building Count	Total Replacement Cost Value	Building Count	Total Replacement Cost Value	Building Count	Total Replacement Cost Value	Building Count	Total Replacement Cost Value
Constableville (V)	138	\$86,725,689	150	\$68,391,041	1	\$254,098	42	\$58,640,511
Copenhagen (V)	258	\$217,554,479	191	\$64,014,357	4	\$23,856,351	49	\$165,469,356
Croghan (T)	1,847	\$973,121,782	2,090	\$707,417,325	138	\$313,692,885	489	\$722,472,014
Croghan (V)	243	\$180,024,732	235	\$147,186,704	5	\$22,561,858	33	\$57,040,647
Denmark (T)	706	\$429,130,172	948	\$425,702,083	16	\$29,986,523	592	\$798,452,656
Diana (T)	1,854	\$747,879,456	1,359	\$430,582,445	41	\$109,417,779	51	\$49,152,736
Greig (T)	1,688	\$771,739,275	1,198	\$340,282,903	7	\$3,212,028	69	\$45,347,129
Harrisburg (T)	255	\$127,165,051	349	\$87,571,155	0	\$0	259	\$318,900,440
Lewis (T)	587	\$351,048,234	795	\$245,433,611	6	\$5,865,888	107	\$120,045,326
Leyden (T)	755	\$407,315,985	854	\$261,245,448	18	\$14,509,443	361	\$382,892,585
Lowville (T)	466	\$380,940,823	522	\$373,390,243	15	\$99,096,643	749	\$909,392,041
Lowville (V)	1,183	\$776,359,961	1,000	\$627,794,964	52	\$306,464,462	97	\$255,684,624
Lyons Falls (V)	257	\$170,916,418	296	\$146,021,828	5	\$36,198,774	10	\$23,711,078
Lyonsdale (T)	710	\$259,080,570	832	\$291,670,539	38	\$85,354,731	34	\$20,008,418
Martinsburg (T)	746	\$410,342,240	726	\$256,145,712	18	\$7,094,129	690	\$1,173,592,697
Montague (T)	413	\$162,161,352	180	\$60,775,684	0	\$0	23	\$9,346,482
New Bremen (T)	1,192	\$631,747,097	1,409	\$470,466,428	38	\$18,245,177	391	\$541,738,681
Osceola (T)	692	\$234,870,322	478	\$139,394,992	0	\$0	20	\$21,701,383
Pinckney (T)	360	\$137,338,506	373	\$95,315,357	0	\$0	74	\$42,482,449
Port Leyden (V)	268	\$154,438,137	239	\$80,383,127	6	\$3,030,389	12	\$28,689,179
Turin (T)	383	\$243,485,949	462	\$175,038,159	1	\$364,129	248	\$462,589,328
Turin (V)	119	\$94,929,897	109	\$29,311,405	0	\$0	21	\$43,334,550
Watson (T)	1,816	\$798,172,266	1,348	\$378,855,878	30	\$35,287,249	117	\$95,746,795
West Turin (T)	855	\$457,335,150	702	\$221,915,028	1	\$3,126,881	311	\$322,761,529
Lewis County (Total)	17,899	\$9,284,226,296	16,940	\$6,158,896,849	450	\$1,174,838,619	4,873	\$6,706,734,770

Source: Lewis County 2024; NYS GIS 2024; RS Means 2024

Note: T: Town V: Village

Figure 3-8. Distribution of Residential Building Stock and Value Density in Lewis County

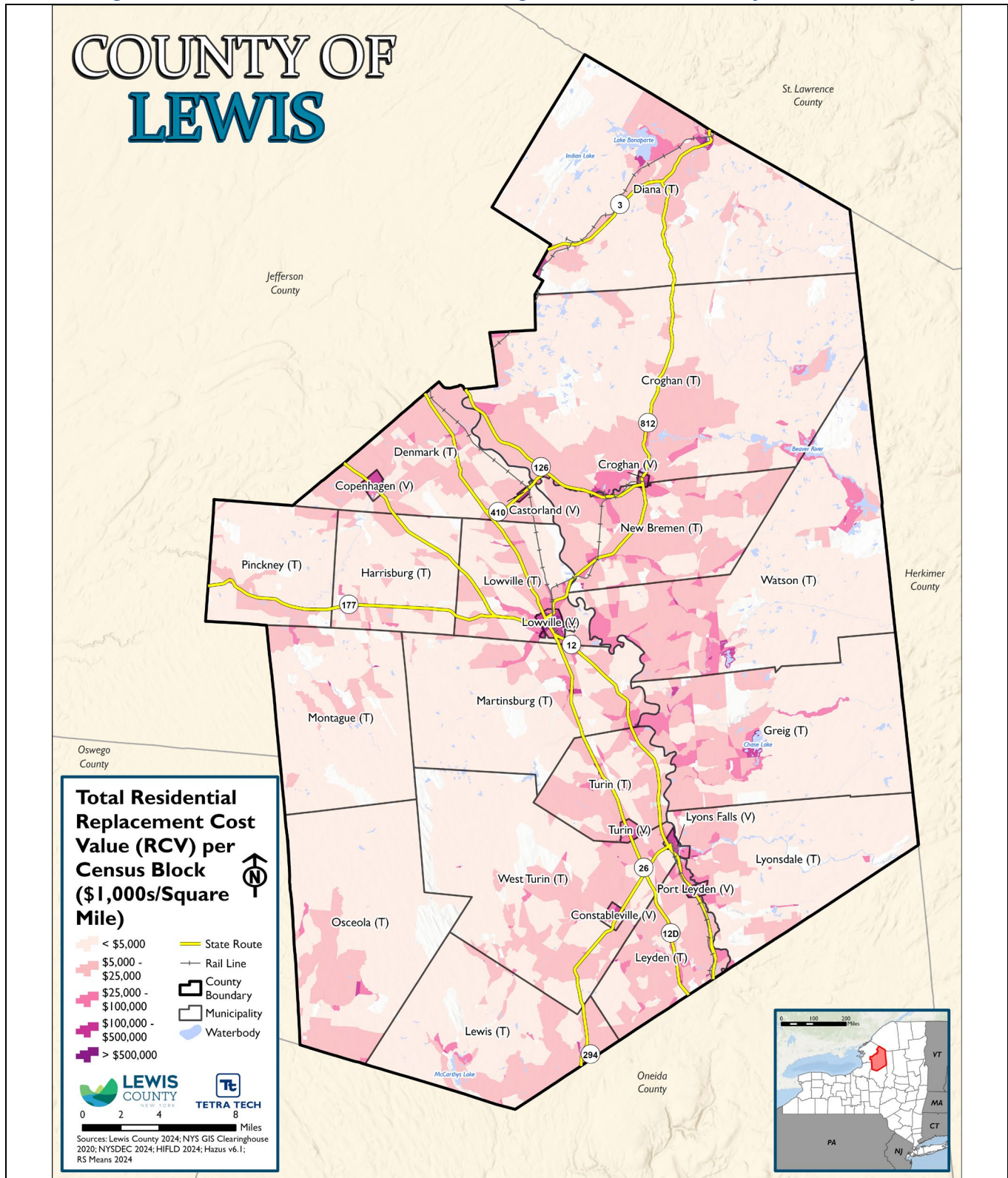


Figure 3-9. Distribution of Commercial Building Stock and Value Density in Lewis County

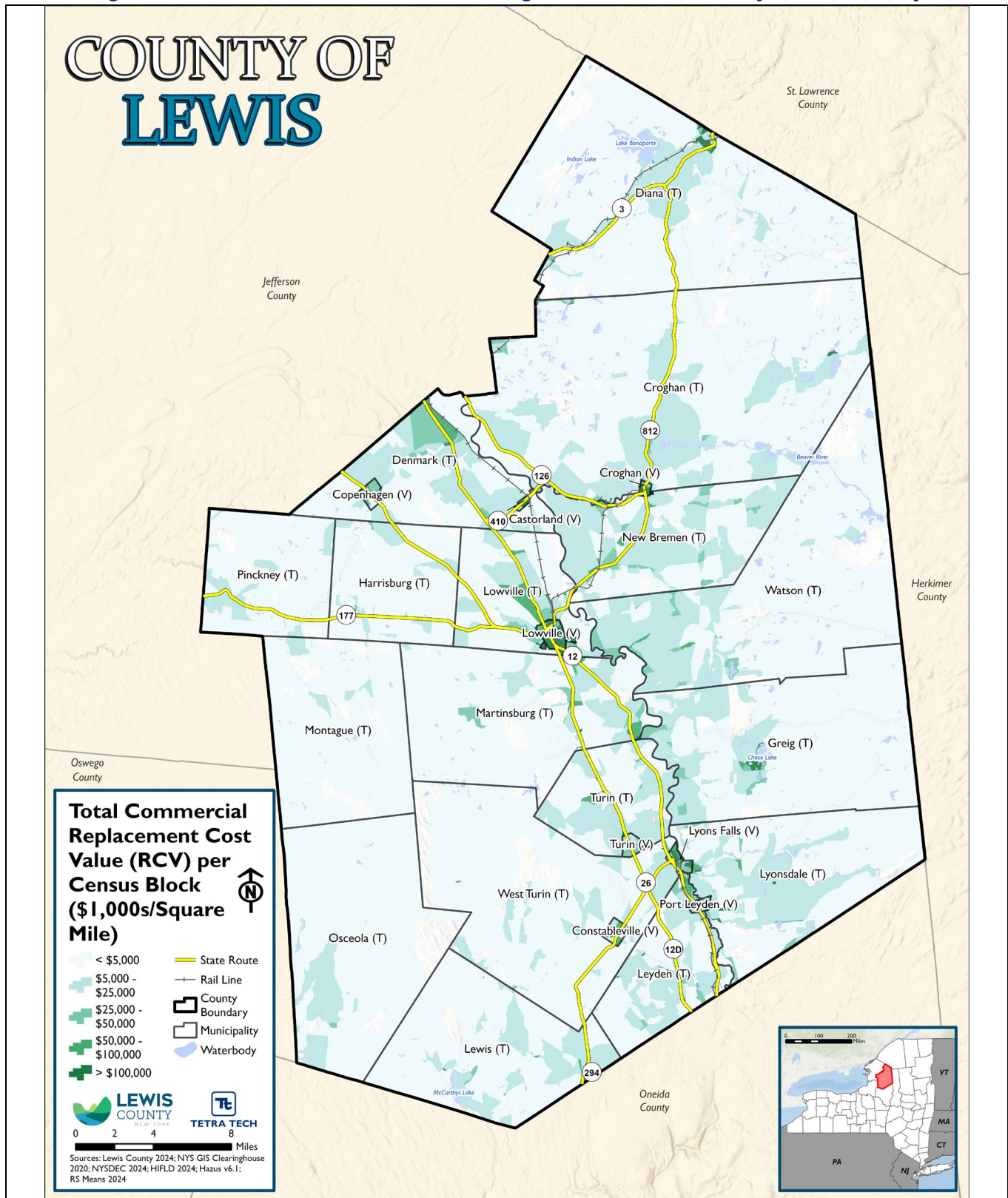
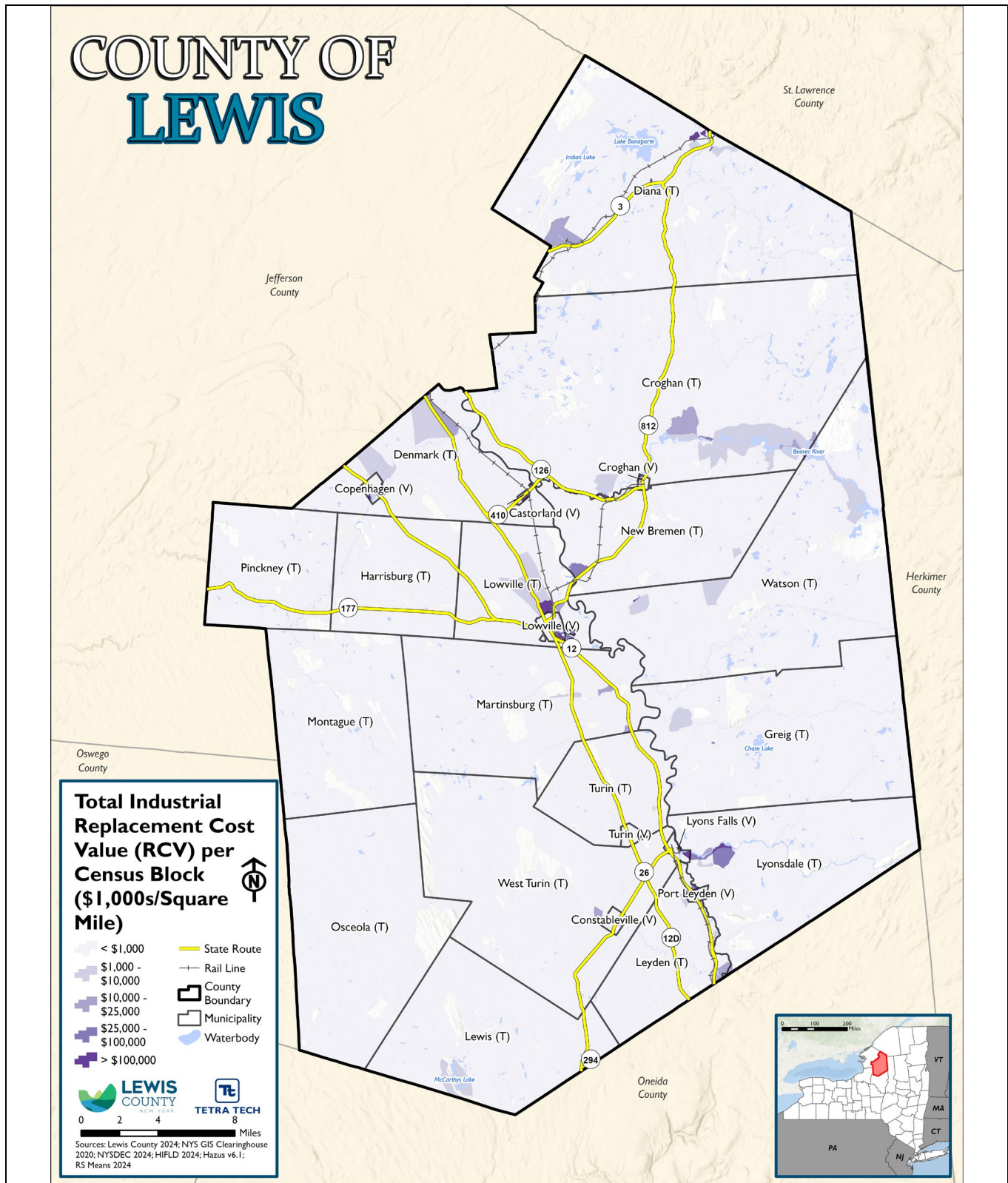


Figure 3-10. Distribution of Industrial Building Stock and Value Density in Lewis County



3.8.2 Recent and New Development

Key Development Highlights in Lewis County include:

- **Hydrostor Compressed Air Energy Storage (A-CAES) Facility:** One of the most notable projects is the proposed Hydrostor A-CAES facility, a large-scale compressed air energy storage project. This facility would store renewable energy and release it during peak demand, supporting grid reliability and clean energy goals. The project is currently in the planning and permitting stages, with support from the Lewis County Planning and Community Development Department (Lewis County, NY n.d.).
- **Brownfield Redevelopment and Demolition Projects:** Lewis County has been actively pursuing EPA Brownfield Grant funding to support the cleanup and redevelopment of contaminated or underutilized properties. A recent RFP (2025-108) was issued for assistance with grant application and implementation. Additionally, the county issued RFP 2025-111 for the demolition and removal of condemned structures in West Leyden, signaling ongoing efforts to revitalize blighted areas and improve public safety (Lewis County, NY n.d.).
- **Broadband and Connectivity Expansion:** Through the Affordable Connectivity Program and other broadband initiatives, Lewis County is working to expand high-speed internet access to underserved rural areas. This is critical for supporting remote work, education, and telehealth services in a largely rural county (Lewis County, NY n.d.).
- **Infrastructure Investments:** Lewis County is benefiting from state and federal infrastructure funding, including allocations from the Bipartisan Infrastructure Law. Projects include road and bridge improvements, water and sewer upgrades, and energy efficiency retrofits. These are tracked through the New York State Infrastructure Hub, which maps capital investments across the state (NYS Governor's Office n.d.).

These developments align with the goals of the Lewis County Comprehensive Plan, which emphasizes sustainable growth, infrastructure modernization, and economic diversification.

PART 2:

RISK ASSESSMENT

4. RISK ASSESSMENT METHODOLOGY

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

- **Identify Hazards of Concern**—Use all available information to determine what types of hazards may affect a jurisdiction.
- **Profile Each Hazard**—Understand each hazard in terms of:
 - Extent—The potential severity of each hazard
 - Location—Geographic area most likely to be affected by the hazard
 - Previous occurrences and losses
 - Impacts of Climate Change
 - Probability of future hazard events
- **Assess Risk**—Use all available information to estimate to what extent populations and assets may be adversely affected by a hazard:
 - Determine vulnerability—Estimate the total number of assets in the jurisdiction that are likely to experience a hazard event if it occurs by overlaying hazard maps with the asset inventories.
 - Estimate potential impacts—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.
 - Evaluate future changes that may affect vulnerability and impacts—Analyze how demographic changes, projected development and climate change impacts can alter current vulnerability and potential impacts.

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

- A new building stock inventory was generated using 2024 building footprints provided by Lewis County GIS, parcel information obtained from the State of New York (2024), and 2024 RS Means cost adjustment values.
- 2020 Decennial Census Population data and 2018-2022 American Community Survey 5-year Population Estimates were utilized.
- Critical facilities were updated and reviewed by the Planning Partnership and Steering Committee.
- Lifelines were identified in the critical facility inventory to align with FEMA's community lifeline definition.
- FEMA's Hazus program was used to estimate potential impacts from the flood, wind, and seismic hazards.
- Best-available hazard data were used, as described in this section.

4.1 ASSET INVENTORIES

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

4.1.1 Population

Statistics from the 2020 Decennial Census Population estimate and 2018-2022 American Community Survey (ACS) 5-year estimate were used to estimate the vulnerability of and potential impacts on the County's population. To determine population statistics for villages 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.

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

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 contains 2020 U.S. Census data and was used to estimate displacement, shelter needs, and injuries as part of the hazard analysis.

Vulnerable populations in Lewis County included in the risk assessment are children, elderly, population below the poverty level, non-English speaking individuals, and persons institutionalized with a disability.

4.1.2 Buildings

The general building stock was updated countywide with a custom-building inventory using the most current building footprint data provided by Lewis County (2024) and parcel data sourced from the State of New York (2024). The tax assessment parcels were then joined to the spatial layer of structure footprints. Attributes provided in the associated parcel dataset were used to further define each structure, such as year built, number of stories, garage type, and occupancy class. Buildings were assigned occupancy classes for compatibility in Hazus. To facilitate analysis and presentation of results, the Hazus classes were condensed into the categories of residential (including multi-family and single-family), commercial, industrial, and other (agricultural, religious, governmental, and educational).

Structural and content replacement cost values (RCV) were calculated for each building using the available assessor data, building footprints, and RS Means 2024 values. RCV is the current cost of returning a destroyed asset to its pre-damaged condition using present-day cost of labor and materials. Total RCV consists of both the structural cost to replace a building and the estimated value of contents of a building. The analysis used a location factor associated by location zip-code, as follows:

- For Zip codes beginning in 133 or 134 (Utica): Residential – 0.97 | Non-Residential – 0.98
- For Zip codes beginning in 136 (Watertown): Residential – 0.94 | Non-Residential – 0.98

4.1.3 Critical Facilities and Community Lifelines

A critical facility inventory, which includes dams, essential facilities, utilities, transportation features and user-defined facilities, was created and included in the GIS Risk Assessment. Data sources include Lewis County, NYSDEC, NYS GIS Clearing House, DHS HIFLD and the US Energy Atlas. 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.

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).

4.1.4 Environment and Land Use

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.

4.1.5 New Development

New Development was not analyzed as part of this hazard mitigation plan update. The County believes there may have been construction in the last 5 years since the previous plan update, but that information was not readily available, nor were any known future projects. Therefore, all county structures were accounted for in the general building inventory.

4.2 VULNERABILITY AND IMPACT ASSESSMENT METHODOLOGY

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

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

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

Table 4-1. Summary of Risk Assessment Analyses

Hazard	Population	General Building Stock	Critical Facilities
Agricultural Product Spill	Q	Q	Q
Dam Failure	Q	Q	Q
Drought	Q	Q	Q
Earthquake	V, L	V, L	V, L
Extreme Temperature	Q	Q	Q
Flood	V, L	V, L	V, L
Hazardous Materials	Q	Q	Q
Landslide	V	V	V
Pandemic/Disease Outbreak	Q	Q	Q
Severe Storm	L	L	L
Severe Winter Storm	Q	Q	Q
Wildfire	V	V	V

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

4.2.1 Hazus

Hazus is a GIS-based software tool developed by FEMA that uses engineering and scientific risk calculations to estimate damage and loss. Its use is accepted by FEMA and provides a consistent framework for assessing risk across a variety of hazards. Hazus uses GIS technology to produce detailed maps and analytical reports that estimate direct physical damage to building stock, critical facilities, transportation systems and utility systems. 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. Table 4-2 displays the levels of analysis that can be conducted using the Hazus software depending on the hazard and inventory data provided.

Table 4-2. Summary of 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.

Hazus 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.

For this HMP, losses were estimated in Hazus using a depth grid for the flood analysis and probabilistic (mean return period) analyses for the seismic and wind hazards. The probabilistic model generates estimated damage and losses for specified return periods (e.g., 100- and 500-year)

4.2.2 Hazard-Specific Methodologies

All of Lewis County is exposed and vulnerable to Agricultural Product Spill, Drought, Extreme Temperature, Hazardous Materials, and Severe Winter Storm. Current modeling tools are not available to estimate specific losses for this hazard. Qualitative analyses were conducted to assess the county's vulnerability to these hazards of concern.

Dams were included in the qualitative analyses described below as it relates to the exposure of their mapped location. However, geospatial dam inundation data does not exist for the three high hazard potential dams located in Lewis County. Risk and impacts were described qualitatively in the flood profile and the jurisdictional annexes.

Earthquake

Vulnerability Analysis

Ground shaking is the primary cause of earthquake damage to built 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.

A vulnerability analysis was conducted for the county's assets (population, building stock, and critical facilities) using NEHRP soil data obtained from the New York State Division of Homeland Security and Emergency Services (2014). The vulnerability 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.

Loss Estimation

A probabilistic assessment was conducted for Lewis County for the 500-year mean return period event 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 historical 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.

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 were 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, boilers, etc.

Flood

The 1-percent annual chance flood event was examined to evaluate the county's risk from the flood hazard. This flood event – in addition to the 0.2-percent annual chance flood - are generally those considered by planners and evaluated under federal programs such as NFIP.

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

- Flood data depicted as digitized by Lewis County using effective Flood Insurance Rate Maps (FIRMs) from 1976, 1977, 1982, 1984, 1985, 1994, 2000.
- A riverine depth grid was created by use of the County-digitized effective FIRM data and a 1-meter Digital Elevation Model provided by FEMA (2017, 2019) and USGS (2022).

The County-digitized effective FIRM data was used to evaluate vulnerability and determine potential future losses. The depth grid generated using the FIRM and 1-meter DEM was integrated into the Hazus riverine flood model and used to estimate potential losses for the 1-percent annual chance flood event.

Vulnerability Analysis

To estimate vulnerability to the 1-percent annual chance flood event, the FIRM flood boundaries were overlaid on the centroids of updated assets (population, building stock, and critical facilities including dams). Centroids that intersected the flood boundaries were totaled to estimate the building RCV and population vulnerable to the flood inundation areas.

Loss Estimation

The Hazus riverine flood model was run to estimate potential losses in Lewis County for the 1-percent annual chance flood event. A Level 2 analysis was performed for the building stock and critical facilities. Buildings located within the floodplain were imported as user-defined facilities to estimate potential losses at the structural level. Hazus calculated the estimated potential losses to the population (default 2020 U.S. Census data), potential damage to the general building stock, and potential damage to critical facilities based on the depth grid generated and the default Hazus damage functions in the flood model.

Landslide

A vulnerability analysis was conducted using steep slope information extracted from the 1-meter Digital Elevation Model (FEMA 2017, 2019 and USGS 2022) to determine the county's risk to the landslide hazard. The county's assets (population, buildings, and critical facilities including dams) were examined to determine if they are built in the 15-20%- and >20% grade hazard areas. Assets with their centroid located in the hazard area were totaled to estimate the totals and values at risk from the impacts of landslides.

Severe Storm

A Hazus probabilistic analysis was performed to analyze the wind hazard losses for Lewis County for the 500-year mean return period event. 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 Lewis County. Hazus contains data on historical 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.

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 2020 Census and 2019 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 estimate vulnerability to wildfire, the interface and intermix boundaries were overlaid on the centroids of updated assets (population, building stock, critical facilities). Assets with their centroid located in the hazard area were totaled to estimate the totals and values at risk from the impacts of a wildfire event.

4.3 RATING PROBABILITY OF OCCURRENCE

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

- Unlikely—not likely to occur or less than 1% annual chance of occurring
- Rare—between 1 and 10% annual chance of occurring
- Occasional—between 10 and 100% annual chance of occurring
- Frequent—100% chance occurring; occurs multiple times a year

4.4 DATA SOURCE SUMMARY

Table 4-3 summarizes the data sources used for the risk assessment for this plan.

Table 4-3. Risk Assessment Data Documentation

Data	Source	Date	Format
Population	U.S. Census Bureau; American Community Survey 5-Year Estimates	2020; 2023	Digital (GIS) format
Building Inventory	Lewis County; NYS GIS; RS Means	2024	Digital (GIS) format
Critical Facilities and Lifelines	Lewis County; NYSDEC; NYS GIS; HIFLD; US Energy Atlas	2020, 2024; 2023, 2024; 2024; 2024; 2024	Digital (GIS) format
Land Cover	USGS	2021	Digital (GIS) format
Digitized Effective FIRM maps	Lewis County; FEMA	2020; 1976, 1977, 1982, 1984, 1985, 1994, 2000	Digital (GIS) format
1-Meter Digital Elevation Model	FEMA; USGS	2017, 2019; 2022	TIFF
Landslide – Steep Slope	FEMA; USGS	2017, 2019; 2022	Digital (GIS) format
NEHRP Soils	NYSDHSES	2014	Digital (GIS) format
Wildfire Hazard Data	University of Wisconsin-Madison; MRLC Consortium; U.S. Census Bureau	2020	Digital (GIS) format

Note: DOT = Department of Transportation; FEMA = Federal Emergency Management Agency; HIFLD = Homeland Infrastructure Foundation-Level Data; MRLC = Multi-Resolution Land Characteristics Consortium; NEHRP = National Earthquake Hazards Reduction Program; NRCS = Natural Resources Conservation Service; NYSDEC = New York State Department of Environmental Conservation; NYSDHSES = New York State Division of Homeland Security and Emergency Services; USGS = U.S. Geological Survey

4.5 LIMITATIONS

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

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

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential vulnerability and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, Lewis County will collect additional data and update and refine existing inventories to assist in estimating potential losses.

Potential economic loss is based on the present value of the general building stock using best-available data. The county acknowledges significant impacts may occur to critical facilities and infrastructure as a result of these hazard events causing great economic loss. However, monetized damage estimates to critical facilities and

infrastructure, and economic impacts were not quantified and require more detailed loss analyses. In addition, economic impacts to industry such as tourism and the real-estate market were not analyzed.

4.6 CONSIDERATIONS FOR MITIGATION AND NEXT STEPS

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

- All Hazards
 - Create an updated user-defined general building stock dataset using up-to-date parcels, footprints, and RS Means values.
 - Utilize updated and current demographic data.
- Dam Failure
 - Obtain the most current dam inundation hazard areas in order to support vulnerability and loss estimation analyses.
- Earthquake
 - Identify unreinforced masonry in critical facilities and privately-owned buildings (i.e., residences) by accessing local knowledge, tax assessor information, and/or pictometry/orthophotos. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response or recovery efforts at these properties can be developed.
- Extreme Temperatures
 - Track extreme temperature data for injuries, deaths, shelter needs, pipe freezing, agricultural losses, and other impacts to determine distributions of most at-risk areas.
- Flood
 - The general building stock inventory can be updated to include attributes regarding first floor elevation and foundation type (basement, slab on grade, etc.) to enhance loss estimates.
 - Conduct a Hazus loss analysis for more frequent flood events (e.g., 10- and 50-year flood events) as data becomes available.
 - 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., FIRMs), update the vulnerability 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 from 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 percentage 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 is currently being developed.
- Severe Winter Storm
 - If available for the region, obtain average snowfall distributions to determine if various areas in the county have historically received higher snowfalls and might continue to be more susceptible to higher snowfalls and snow loads on the building stock and critical facilities and infrastructure.
- Wildfire
 - General building stock inventory can be updated to include attributes such as roofing material, fire detection equipment, or distance to fuels as another measure of vulnerability.

5. IDENTIFICATION OF HAZARDS

5.1 HAZARD REVIEW AND SELECTION

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

- Input from all Planning Partners
- Review of the 2023 New York State Hazard Mitigation Plan
- Review of the 2020 Lewis County HMP
- Research on the frequency, magnitude, and costs associated with hazards that have previously or could feasibly impact the region
- Qualitative information regarding natural (not human-caused) hazards and the perceived vulnerability of the study area's assets to them.

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

Natural Hazards are hazards created by a meteorological, environmental, or geological event.

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

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

Hazard	In Lewis County		Why was this determination made?	Sources
	May Occur	Poses Significant Threat		
Agricultural Product Spill	Yes	Yes	The 2023 New York State HMP does not identify agricultural product spill as a hazard of concern for New York State, however, Lewis County has experienced numerous spills that have resulted in contamination related issues including water quality concerns and crop concerns.	NYSDHSES Input from Steering Committee and Planning Partnership
Avalanche	No	No	The 2023 New York State HMP identifies avalanche as a hazard of concern. Avalanche was identified as a hazard in the New York State HMP, and there have been occurrences in the state; however, there were no occurrences in Lewis County. The topography and climate of Lewis County does not support the occurrence of an avalanche. The Steering Committee and Planning Partnership do not consider the hazard to be a significant concern.	NYSDHSES Input from Steering Committee and Planning Partnership
Coastal Hazards	Yes	No	The New York State HMP identifies coastal hazards as a hazard of concern for New York State. Coastal hazards can impact all the state's coastal counties along Lake Erie and the Niagara River, Lake Ontario and the St. Lawrence River, Atlantic Ocean and Long Island Sound, Hudson River south of the federal dam in Troy, the East River, the Harlem River, the Kill van Kull, and Arthur Kill, and all connecting waterbodies, bays, harbors, shallows, and wetlands. Coastal hazards may also impact inland counties and communities.	NYSDHSES Input from Steering Committee and Planning Partnership

Hazard	In Lewis County		Why was this determination made?	Sources
	May Occur	Poses Significant Threat		
			Lewis County does not have coastline. The Steering Committee and Planning Partnership did not identify coastal hazards as a hazard of concern.	
Dam Failure	Yes	Yes	The 2023 New York State HMP does not identify dam failure as a hazard of concern for New York State, though it is included in the Flood hazard profile. According to the NYSDEC, there are 90 dams within Lewis County: 79 low hazard, 8 intermediate hazard, and 3 high hazard. Upon consultation with the Steering Committee dam failure was included in the flood profile for this update, remaining consistent with the County's 2020 HMP. Dam failure and HHPD content were expanded in this update.	NYSDHSES NYSDEC NYS GIS Input from Steering Committee and Planning Partnership
Drought	Yes	Yes	The New York State HMP identifies drought as a hazard of concern for the state. Lewis County has been impacted by several drought events that have occurred in New York State. Agriculture is a substantial industry in Lewis County, and drought conditions would severely impact the County's economy. According to the U.S. Drought Monitor, Lewis County has experienced numerous Droughts since 2019. The Steering Committee and Planning Partnership has identified drought as a hazard of concern for Lewis County.	NYSDHSES FEMA USDA NOAA-NCEI NRCC US Drought Monitor Input from Steering Committee and Planning Partnership
Earthquake	Yes	Yes	The New York State HMP identified earthquake as a hazard of concern for New York State. New York State was included in one FEMA earthquake-related disaster declaration (DR-1415); Lewis County was not included in this declaration. There have been three significant earthquakes that have been documented to have impacted Lewis County since 1837. Based on input from the Steering Committee and Planning Partnership, earthquake was identified as a hazard of concern for Lewis County.	NYSDHSES U.S. Geological Survey (USGS) – Earthquake Hazards Program, Review of USGS Seismic Maps Input from Steering Committee and Planning Partnership
Extreme Temperature	Yes	Yes	Please see Severe Storm Profile	
Flood (riverine, lakeshore, ice jam, urban flooding, and	Yes	Yes	The New York State HMP identifies flooding as a hazard of concern for New York State. Between 1956 and 2024, Lewis County was included in ten flood-related declarations. • DR-733; March 20, 1985; Flooding • DR-1095; January 24, 1996; Severe Storms and Flooding	NYSDHSES NOAA-NCEI USACE CRREL Ice Jam Database FEMA

Hazard	In Lewis County		Why was this determination made?	Sources
	May Occur	Poses Significant Threat		
flash flooding)			- DR-1148; December 9, 1996; Severe Storms, High Winds, Rain and Flooding - DR-1335; July 21, 2000; Severe Storms and Flooding - DR-1534; August 3, 2004; Severe Storms and Flooding - DR-1993; June 10, 2011; Severe Storms, Flooding, Tornadoes, and Straight-Line Winds - DR-4180; July 8, 2014; Severe Storms and Flooding - DR-4472; December 19, 2019; Severe Storms, Straight-Line Winds, and Flooding - DR-4814; August 29, 2024; Severe Storm, Tornadoes, and Flooding - DR-4839; October 21, 2024; Severe Storm and Flooding Based on the history of flooding and its impacts on Lewis County and input from the Steering Committee and Planning Partnership, flooding has been identified as a hazard of concern for the County.	Input from Steering Committee and Planning Partnership
Hail	Yes	Yes	Please see Severe Storm Profile	
Hazardous Materials	Yes	Yes	The 2023 New York State HMP does not identify hazardous materials as a hazard of concern for New York State, however Lewis County has experienced numerous contamination related issues.	NYSDHSES Input from Steering Committee and Planning Partnership
Hurricane	Yes	No	Please see Severe Storm Profile	
Ice Jams	Yes	Yes	Please see Flood Profile	
Ice Storm	Yes	Yes	Please see Severe Winter Storm Profile	
Landslide	Yes	Yes	The 2023 New York State HMP includes landslide as a hazard of concern for New York State. Between 1954 and 2024, New York State was not included in any landslide-related disaster declarations; however, there were six occurrences according to NOAA's NCEI Storm Events Database. None of these events occurred in Lewis County. Based on input from the Steering Committee and Planning Partnership, the landslide hazard was identified as a hazard of concern for Lewis County.	NYSDHSES NOAA NCEI FEMA Input from Steering Committee and Planning Partnership
Levee Failure	Yes	Yes	The 2023 New York State HMP does not identify levee failure as a hazard of concern for New York State, though it is included in the Flood hazard profile. Levee failure was mentioned in the flood profile for this update, though no known levees are documented in Lewis County.	NYSDHSES USACE Input from Steering Committee and Planning Partnership
Lightning	Yes	Yes	Please see Severe Storm Profile	
Pandemic	Yes	No	The 2023 New York State HMP does not identify pandemic as a hazard of concern for New York State. Lewis County was included in three pandemic-related disaster declarations: EM-3155; May 22–November 1, 2000; New York Virus Threat	NYSDHSES FEMA Input from Steering Committee

Hazard	In Lewis County		Why was this determination made?	Sources
	May Occur	Poses Significant Threat		
			- EM-3434; January 20, 2020–May 11, 2023; New York COVID-19 - DR-4480; January 20, 2020–May 11, 2023; New York COVID-19 Pandemic The Steering Committee and Planning Partnership did not identify pandemic as a hazard of concern for Lewis County, as it is addressed in other recent plans developed by the County.	and Planning Partnership
Severe Storm (wind, extreme temperature, thunderstorms, hail, lightning, hurricanes, and tornadoes)	Yes	Yes	The New York State HMP identifies severe storm as a hazard of concern for New York State; however, for the state HMP, the hazards were profiled in individual sections coastal hazards, hail, hurricane, lightning, tornado, and high winds. For the Lewis County HMP, the hazards were combined into one profile. Between 1954 and 2024, Lewis County was included in 13 severe storm-related declarations: - DR-733; March 20, 1985; Flooding - DR-1095; January 19-20, 1996; Severe Storms and Flooding - DR-1148; November 8-15, 1996; Severe Storms, High Winds, Rain, and Flooding - DR-1335; May 3–August 12, 2000; New York Severe Storms - DR-1534; May 13–June 17, 2004; New York Severe Storms and Flooding - EM-3262; August 29–October 1, 2005; New York Hurricane Katrina Evacuation - DR-1993; April 26-May 8, 2011; Severe Storms, Flooding, Tornadoes, and Straight-Line Winds - EM-3351; October 27–November 8, 2012; Hurricane Sandy in New York - EM-4180; May 13–22, 2014; Severe Storms and Flooding in New York - DR-4472; October 31-November 1, 2019; Severe Storms, Straight-Line Winds, and Flooding - DR-4625; August 18-19, 2021; Remnants of Tropical Storm Fred - DR-4814; July 10-11, 2024; Severe Storm, Tornadoes, and Flooding - DR-4839; August 18-19, 2024; Severe Storm and Flooding Based on previous occurrences and input from the Steering Committee and Planning Partnership, severe storm is identified as a hazard of concern for Lewis County.	NYSDHSES FEMA NOAA-NCEI SPC Input from Steering Committee and Planning Partnership
Severe Winter Storm (heavy snow, blizzards, ice storms)	Yes	Yes	The New York State HMP identifies ice storms and snowstorms as hazards of concern for New York State. Lewis County was included in ten severe winter storm-related disaster declarations: - EM-3027; January 29, 1977; Snowstorms - DR-527; February 5, 1977; Snowstorms - DR-898; March 3-4, 1990; Snowstorms - EM-3107; March 13–16, 1993; Severe Blizzard - DR-1196; January 5-17, 1998; Snowstorms	NYSDHSES FEMA NOAA-NCEI Input from Steering Committee and Planning Partnership

Hazard	In Lewis County		Why was this determination made?	Sources
	May Occur	Poses Significant Threat		
			- EM-3136; January 1–15, 1999; New York Winter Storm - EM-3195; January 28–31, 2004; Snowstorms - EM-3273; February 2–12, 2007; Snowstorms - DR-4204; November 17–26, 2014; New York Severe Winter Storm, Snowstorm, and Flooding - EM-3589; November 18–21, 2022; New York Severe Winter Storm and Snowstorm Based on previous occurrences and input from the Steering Committee and Planning Partnership, severe winter storm is identified as a hazard of concern for Lewis County.	
Snowstorm	Yes	Yes	Please see Severe Winter Storm	
Tornado	Yes	Yes	Please see Severe Storm	
Wildfire	Yes	Yes	The New York State HMP identifies wildfire as a hazard of concern for New York State. Lewis County was not included in any FEMA wildfire-related disaster declarations. Wildfires have occurred within Lewis County. The County's agriculture industry could be severely impacted by a large wildfire. Based on previous occurrences and input from the Steering Committee and Planning Partnership, wildfire is identified as a hazard of concern for Lewis County.	NYSDHSES FEMA Input from Steering Committee and Planning Partnership
Wind	Yes	Yes	Please see Severe Storm	

Note: 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; NYSDEC = New York State Department of Environmental Conservation; NYSDHSES = 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

Based on the review of potential hazards of concern, 10 hazards of concern were identified as significant hazards affecting at least some part of the County, to be addressed at the County level in this plan (shown here in alphabetical order):

- Agricultural product spill
- Drought
- Earthquake
- Extreme temperature
- Flood
- Hazardous materials
- Landslide
- Severe storm
- Severe winter storm
- Wildfire

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

Individual municipalities each have their own assessment of which of these hazards are of high enough concern for that jurisdiction to warrant the development of mitigation actions, based on a number of factors, as outlined in the jurisdictional annexes in Volume II of this plan. Hazards identified as being of low concern were generally not targeted for mitigation action development, but may nevertheless be mitigated by actions proposed in Volume II. Flood is included as a hazard of concern for all jurisdictions to meet planning requirements regarding critical facility protection and high hazard potential dams.

Note that although ten hazards were identified as hazards of concern within Lewis County, the County as a jurisdiction did not identify all hazards as high concern on the whole. Landslides, for instance, were of low concern to all jurisdictions, except the Village of Port Leyden, where landslides are of medium concern.

5.2 HAZARD DESCRIPTIONS

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

- 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 2024 HMP considers the heat island effect that occurs within developed areas.
- The flood hazard includes riverine flooding, flash flooding, ice jam flooding, urban drainage flooding, and stormwater 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 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 snowstorms that often entail a variety of other influencing weather conditions, including ice storms and sleet. For this HMP update, severe winter storm includes heavy snow, sleet, blizzards, and ice storms.
- 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.

These summaries are the same as those provided by FEMA (FEMA 2001, FEMA 2023d) and take into consideration the hazard grouping in the NYS HMP.

6. AGRICULTURAL PRODUCT SPILL

6.1 HAZARD PROFILE

This section provides a hazard profile and vulnerability assessment of the agricultural product spill hazard for the Lewis County HMP. In Lewis County, this hazard includes milk and manure spills.

6.1.1 Hazard Description and Location

This section provides profile information including the description, location, extent, previous occurrences and losses, probability of future occurrences, and climate change impacts, as well as the vulnerability assessment for the agricultural product spill hazard in Lewis County.

Agriculture involving livestock can often involve the storage, processing, and disposal of milk and manure. Should an accident occur that results in a spill of milk and manure, the results can be hazardous if they are released in large quantities or in sensitive locations. Over the course of 1 day, month, or year, the likelihood of some of these substances spilling onto the ground is likely very high (Wisconsin DNR 2002).

Manure

Manure-related spills can occur in a variety of locations including a tanker during transport, a spreader that malfunctions, or in a storage facility due to equipment failure (Wisconsin DNR 2002). Evaluation of spills in Iowa by the Iowa Environmental Council and Iowa Farm Bureau found that most spills occur during transportation of manure and are caused by human error or equipment failure. The development of manure spills is affected by numerous factors, including snow fall, cold temperatures, storage volume, farm size, and conveyance method (Sell 2015).

Manure storage facilities should be professionally designed and evaluated for performance. Most manure is stored in tanks, but larger, open-surface storage facilities have also been used. Liquid manure is often conveyed via pumps, drag hose, or piping. Because the conveyance step involves transport of manure underground or in exposed conditions, the risk of leakage remains high (Sell 2015).

Waste Milk

Waste milk originates from a variety of sources in dairy farms and can include leftover milk in pipelines and bulk tanks; colostrum and transitional milk; mastitic milk; and milk from antibiotic-treated cows, spills, bulk tank failures, and rejected milk loads (Payer and Holmes n.d.). Waste milk types are defined below:

- **Pipeline and Bulk Tank Residual Milk**—Leftover milk that remains in pipelines and receiver groups after milking. This milk is usually flushed out during the rinse cycle and ends up in wastewater. This is the major source of milk entering drains. Flushing residual pipeline milk down drains is the most common cause of milking center wastewater treatment failure.
- **Colostrum and Transitional Milk**—Colostrum is the first milk after freshening and is an important source of nutrients for newborn calves. Transitional milk is produced over the next 4 to 5 days following birth. Neither colostrum nor transitional milk is legally saleable.
- **Milk from Antibiotic-Treated Cows and Mastitic Milk**—Milk from cows with mastitis or cows recently treated with antibiotics is not legally saleable.

- Milk Spills, Bulk Tank Failures—Pipeline ruptures and inadvertent valve openings can lead to milk spills.
- Rejected Bulk Tank Loads—Cooling system failure or bulk tanks contaminated by antibiotic-treated cows can generate rejected bulk tank loads (Holmes n.d.)

Sources of waste milk have recommended control and disposal options, which are described in Table 6-1.

Table 6-1. Sources of Dairy Waste Milk and Recommended Control and Disposal Options

Source	Recommended control and disposal options
Pipeline and bulk tank residual milk	• Collect with pre-rinse prior to cleaning • Feed to non-lactating stock if not too watery or contaminated with cleaning chemicals • Land spread
Colostrum and transitional milk	• If good quality, feed fresh, frozen, or fermented to livestock • Land spread
Mastitic and antibiotic contaminated milk	• Decrease amount through herd health management • Feed to stock if it looks normal, is not from a cow with a fever, and at least one milking has occurred since antibiotic treatment • Land spread
Milk spills, bulk tank failures, and rejected bulk tank loads	• Remove from treatment system immediately if milk has entered drains and system is not designed to handle large milk loads • Land spread

Source: (Holmes n.d.)

Prevention

Agricultural product spills are preventable with proper design, operation, and upkeep. Farm managers should strive for minimal transportation from production to end use. Doing so limits the duration inside piping and vehicles and will decrease the potential impact area (Sell 2015). Other ways to avoid agricultural product spills include:

- Keeping manure covered during transportation
- Inspecting lines and hoses regularly
- Using safety containers to transport milk and manure
- Ensuring that all valves are closed, hoses are empty, and pumps are turned off after use
- Examining equipment for kinks, excessive wear, abrasions on hoses, or any other damage that could result in a spill or leak
- Keeping a written record of condition of equipment (Wisconsin DNR 2002)

Response

If spills do occur, actions should be taken to limit the impacts. These include:

- Stopping the spill from getting bigger by clamping the hose, plugging the leak, etc.
- Stopping the spill from spreading by building a dike around the area or using absorbent materials
- Isolating contaminated soil by digging up the soil and storing in a container or on a tarp
- Protecting the area from runoff by using a tarp or diverting runoff from contact (Wisconsin DNR 2002)

6.1.2 Extent

With such a large agricultural focus on cattle in Lewis County, agricultural product spills are likely to occur throughout the County. Milk and manure spills are most likely to take place on farms, at storage facilities, and on roadways used for transport in Lewis County. Spills that reach surface waters can spread downstream.

Lewis County has significant exposure vulnerability to the agricultural product hazard. According to the 2017 Census of Agriculture, Lewis County has 625 farms, including 182,457 acres. The average farm size is 292 acres. The market value of products sold in 2017 was \$153 million. Crop sales accounted for \$21.1 million (14 percent) while livestock sales accounted for \$131.9 million (86 percent). Milk from cows made up the largest portion of sales (\$113.9 million), followed by cattle and calves (\$17.4 million). The 2017 inventory of cattle and calves was 60,565 (USDA 2017).

Surface water is particularly vulnerable to the impacts of agricultural product spills and can supply a conduit for spreading spills to create a larger area of impact. Approximately 1.5 percent of Lewis County is comprised of surface waters (U.S. Census 2010).

6.1.3 Previous Occurrences and Impacts

The Steering Committee and jurisdictional representatives reported that although this hazard remains a risk there have been no incidents of note since the 2020 Lewis Hazard Mitigation Plan update.

6.1.4 Cascading Impacts

Agricultural product spill in New York State, including Lewis County, can create a range of cascading impacts that affect water quality, ecosystems, agriculture, and public health.

6.2 COMMUNITY ASSETS AT RISK

This section discusses Lewis County's vulnerability, in a qualitative nature, to the hazard of agricultural product spills.

6.2.1 People and Communities

Overall Population

Spills that contaminate drinking water supplies could leave significant portions of Lewis County without safe drinking water. Spills on roadways could lead to shutdown of roads. Spills involving milk and manure often happen as a result of traffic accidents. Prior to clean up, spills on roadways caused by traffic accidents increase the risk of additional accidents. In addition, equipment failure of transport vehicles driving on roadways can also cause traffic accidents.

Socially Vulnerable Population

Socially vulnerable populations may be impacted by agricultural product spill events differently than others. For example, in the event of an impacted area, younger and older populations and those with disabilities may have mobility issues or rely on others (i.e., parents, aides) to get around. Low-income households have less disposable

capital to pay for temporary shelter (i.e., hotels) should their place of occupancy become unlivable due to a spill. Individuals who do not speak English very well, or speak another language, may receive warning notices but not understand them.

Economy

Economic costs from agricultural product spills are difficult to quantify in Lewis County. Economic impacts would largely be the result of agricultural shutdowns, shutdown of roadways where spills occur, shutdowns of water supplies, and the costs of advanced drinking water treatment. Fines resulting from spills could also force farm shutdowns, impacting local workers.

6.2.2 General Building Stock

An agricultural product spill event is not expected to directly affect any structures. The extent of damage to the general building stock depends on the scale of the spill incident. Potential losses may include inaccessibility, loss of service, and/or contamination. Agricultural product spills and specifically manure related spills can pose a serious threat to property requiring cleanup.

6.2.3 Community Lifelines and Other Critical Facilities

Spills impacting surface water or groundwater sources that serve as water supplies could lead to shut down of drinking water facilities. Large volumes of milk can have detrimental impacts on wastewater treatment facilities that rely on aerobic processes due to milk's high biochemical oxygen demand (BOD). As little as 2 gallons of milk per day discharged with wastewater can deplete enough oxygen to cause treatment systems to fail. Milk also has high organic solid content that can form organic mats that plug leach fields, grass filter strips, and other wastewater treatment systems. Milk fats and proteins form "fat cakes" inside containment facilities such as holding and septic tanks that further contribute to system failure (Holmes n.d.).

6.2.4 Natural Resources

Many of the adverse consequences of improper milk disposal or spills are due to milk's high BOD. In streams and Agricultural product spill substances are rich in nutrients like nitrogen and phosphorus, which, when introduced into waterways, can lead to eutrophication, harmful algal blooms, and oxygen depletion. This can result in fish kills and long-term degradation of aquatic ecosystems. Waste milk has a high biochemical oxygen demand (BOD), meaning it consumes large amounts of oxygen as it decomposes. This can be even more damaging than manure when it enters surface waters, as it rapidly depletes oxygen levels, threatening aquatic life. Wetlands and riparian zones, which serve as critical habitats for many species and natural water filtration systems, are especially vulnerable to these impacts.

lakes, bacteria would need the dissolved oxygen from 1,600 gallons of water to break down the organic matter in one pint of milk. Because it depletes oxygen levels, milk spills in surface water can upset biological communities and kill fish (Holmes n.d.).

Milk contains high levels of phosphorus, which can promote the growth of algae and aquatic plants. Milk spills that enter surface waters can promote algal blooms. Because algal blooms also consume oxygen, the likelihood of fish kills is further increased (Holmes n.d.).

Surface Water and Wetlands

Too much manure can pollute lakes, streams, and rivers. Excess nutrients from manure and milk spills can raise the amount of nitrogen or phosphorus in the water and can lead to algal blooms, which lower oxygen levels. Wetlands are important water sources and habitats for fish and wildlife, provide natural flood control, and improve water quality. Excessive nutrients and sediment from manure can change the natural function of wetlands and harm plant communities, leading to habitat loss for plants, animals, fish, and birds (Wisconsin DNR 2015).

Groundwater

Manure may pollute groundwater through wells, sinkholes, and exposed bedrock. Once in groundwater, pollutants are very difficult to remove. Contaminated groundwater can threaten drinking water sources (Wisconsin DNR 2015).

6.2.5 Historic and Cultural Resources

Historic sites in Lewis County, many of which are listed on state or national registers, are at risk from nearby agricultural spills. These sites often lack modern protective infrastructure and are constructed with materials that are highly susceptible to chemical and biological degradation. A spill near a historic structure can lead to contamination of building materials, soil, and groundwater, potentially causing irreversible damage.

Because these properties are protected under preservation laws, any remediation or structural reinforcement must comply with strict regulatory standards, making cleanup efforts more complex and costly. For example, if a spill affects a historic farmstead or battlefield, restoration may require specialized conservation techniques and oversight from heritage agencies.

Agricultural product spills can pose a serious long-term threat to cultural resources, particularly if the spill is on, near, or adjacent to a cultural site. These sites often cannot be easily moved or upgraded without getting special permits if on a cultural registry. As with historic sites, cultural properties often require special permits for any alterations, complicating mitigation or adaptation efforts.

6.3 FUTURE OCCURRENCES AND PROJECTED CHANGES IN RISK

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

6.3.1 Probability of Future Occurrences

Though the occurrence of agricultural product spills can be reduced through proper maintenance and safety procedures, spills are still likely to occur in the future. Information on previous agricultural product spill occurrences in the County was used to calculate the probability of future occurrence of such events. Based on the event records and input from the Steering Committee, the probability of occurrence for agricultural product spill in the County is considered “occasional.”

6.3.2 Climate Change Projections and Likely Impacts

Climate change is already impacting New York State and is projected to intensify in the coming decades. Rising temperatures, shifting precipitation patterns, and more frequent extreme weather events are expected to affect both natural and human systems. In rural counties like Lewis County, where agriculture, particularly dairy farming, is a cornerstone of the local economy, these changes pose specific risks.

New York is projected to experience an overall increase in annual precipitation, but this will occur primarily through more intense and less frequent storm events. These heavy downpours can overwhelm existing agricultural infrastructure, such as manure storage lagoons, particularly those with earthen walls. Increased rainfall intensity raises the risk of structural failure, leading to potential manure spills that can contaminate surface and groundwater.

Rising temperatures intensify the water cycle, increasing both evaporation and the potential for sudden, heavy rainfall. This dynamic can lead to longer dry periods punctuated by intense storms, which not only stress crops and livestock but also increase the likelihood of runoff and erosion. Sediment erosion can further destabilize manure storage systems, compounding the risk of spills.

Additionally, the increasing frequency of extreme weather events due to climate change—such as heavy rainfall—can exacerbate the risk of spills by overwhelming manure storage systems or causing runoff from recently fertilized fields (Yale School of the Environment 2014).

Manure management is a significant source of greenhouse gas emissions in New York, accounting for approximately 15% of agricultural emissions. As climate change increases the frequency of extreme weather, the risk of accidental releases of manure and waste milk during storage or land application also rises. These spills can have serious environmental consequences, including nutrient loading in water bodies and public health risks (NYSERDA 2024).

Lewis County's rural landscape and concentration of dairy farms make it particularly vulnerable to these climate-driven risks. Farms located in low-lying or flood-prone areas are at heightened risk of manure lagoon overflow or structural failure during storm events. Additionally, the consolidation of the dairy industry and increased herd sizes may strain existing waste management infrastructure (NYSERDA 2024).

6.3.3 Projected Changes in Development and Population

Areas targeted for future growth and development have been identified across the County. Any areas of growth could be impacted by the agricultural product hazard. Increase in traffic would also increase the risk of transportation accidents that may involve milk or manure transport vehicles, leading to possible spills.

Lewis County has experienced a slight decrease in population since 2010. According to the U.S. Census Bureau, the County's population decreased by approximately -0.19 percent between 2010 and 2020. Cornell University's Program on Applied Demographics produced populations projections by County from 2016 to 2040. According to these projections, Lewis County is projected to have a population of 26,156 by 2030 and 25,618 by 2040 as the population decrease is expected to continue (Cornell University 2018). Changes in the density of the population can impact the number of persons exposed to agricultural product spills.

6.3.4 Changes in Vulnerability Since 2020 HMP

The previous HMP identified agricultural product spills as a hazard. It appears likely that agricultural product spills will continue to pose a hazard in the future.

7. DROUGHT

7.1 HAZARD PROFILE

7.1.1 Hazard Description and Location

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 (NDMC 2013):

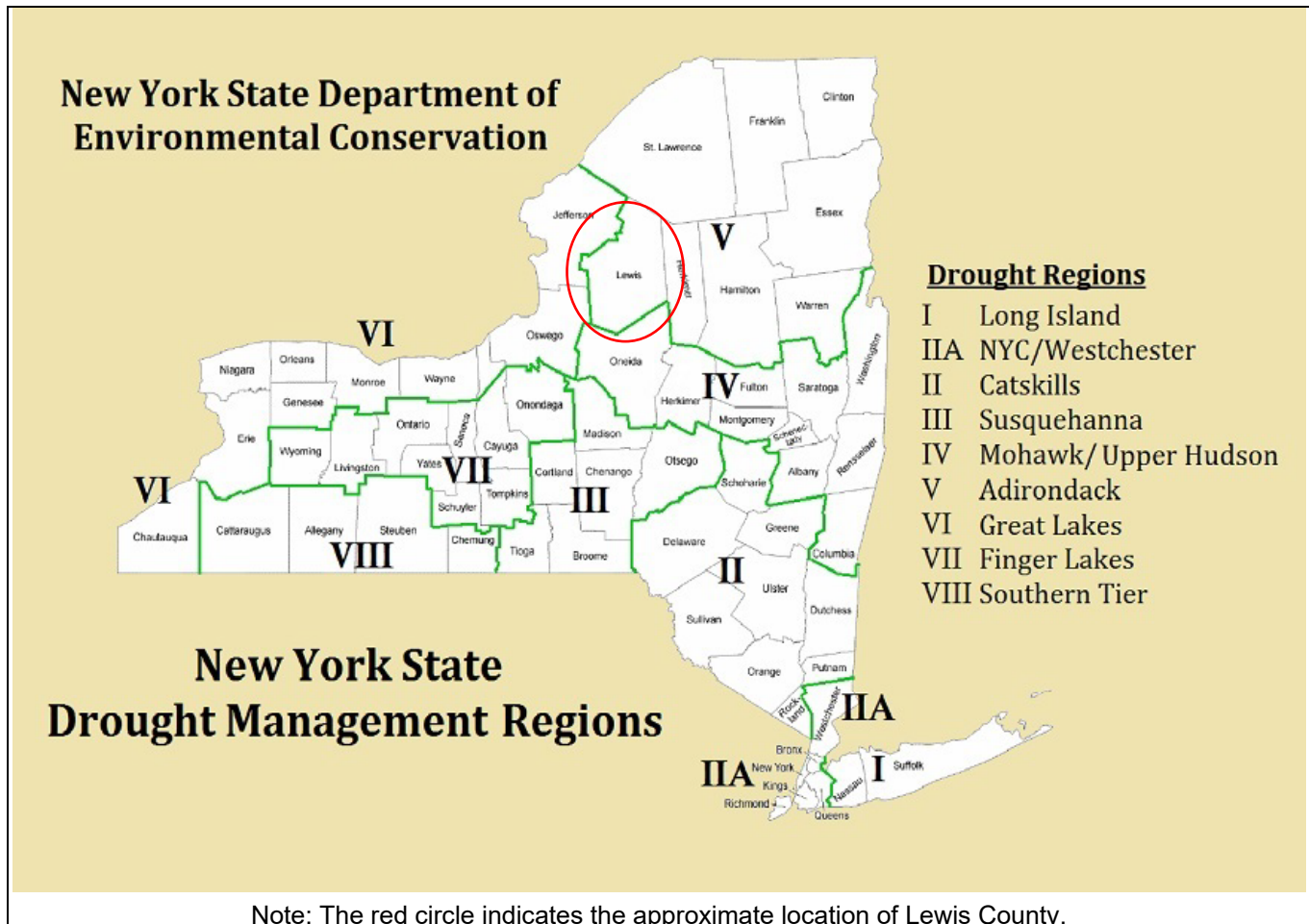
- **Meteorological** drought is a measure of the departure of precipitation from normal. It is defined solely by the relative degree of dryness. Due to climatic differences, what might be considered a drought in one location of the country may not be a drought in another location.
- **Agricultural** 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 droughts 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

Droughts can occur in all parts of the United States and any time of the year. Drier regions are more susceptible to long-term or extreme drought conditions, while other areas tend to be more susceptible to short-term, less severe droughts. Variations in the precipitation amounts can lead to periods of dry weather and drought. In the State of New York, average precipitation amounts range from 60 inches in the Catskills to 28 inches in the Lake Champlain Valley (NYSDEC 2023).

The National Oceanic and Atmospheric Administration (NOAA) has divided the United States into 344 climate divisions. According to NOAA, New York State is made up of 10 climate divisions: Western Plateau, Eastern Plateau, Northern Plateau, Coastal, Hudson Valley, Mohawk Valley, Champlain Valley, St. Lawrence Valley, Great Lakes, and Central Lakes (NOAA date unknown). Lewis County is located in the Northern Plateau Climate Division.

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). Lewis County is identified as NYSDEC Drought Management Region V, the Adirondack Region (Figure 7-1).

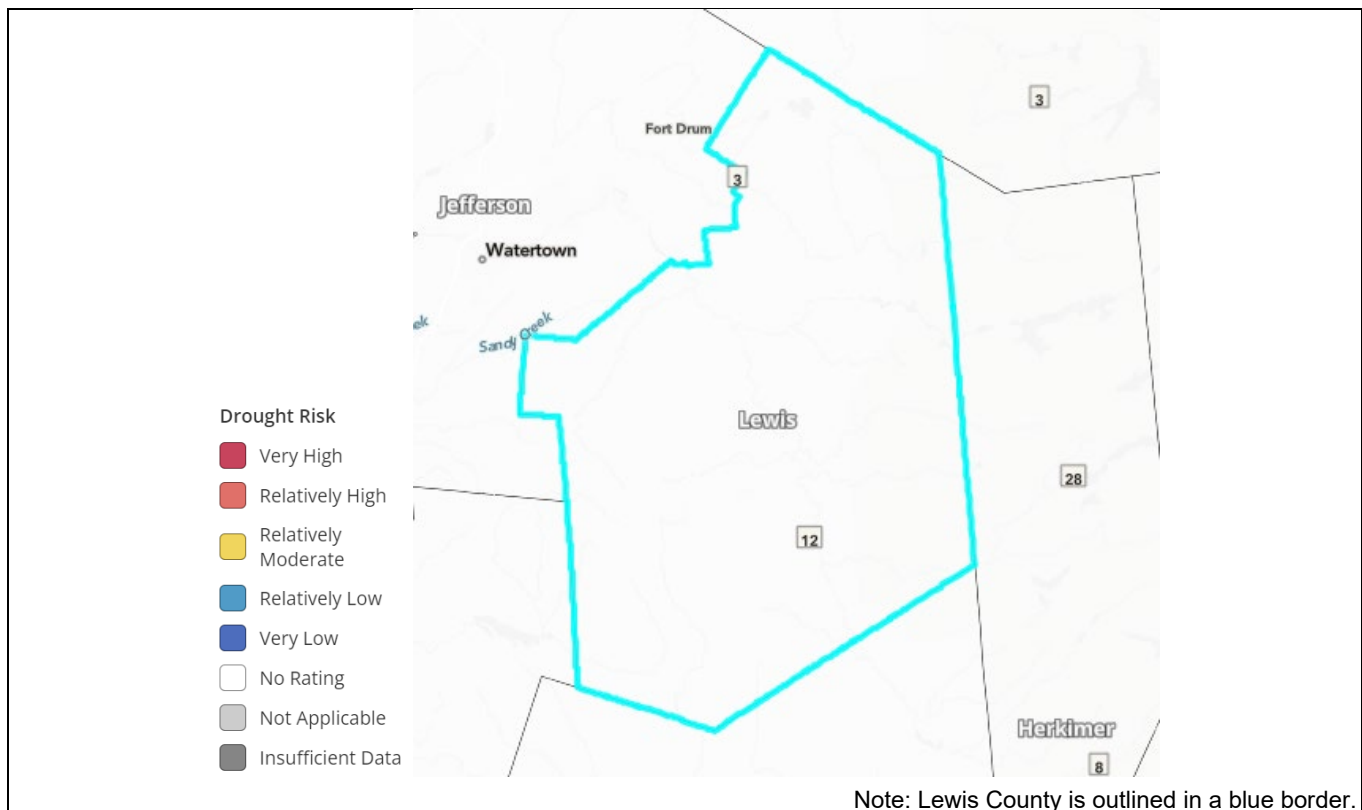
Figure 7-1. NYSDEC Drought Management Regions of New York State



Source: NYSDEC 2022

Figure 7-2 shows the Drought Risk Index for Lewis County on the county tract scale. This index helps to understand the susceptibility of the County to drought. According to the FEMA National Risk Index, the County does not have a drought risk index rating along with no expected annual losses for drought events (FEMA 2019). The National Risk Index for drought in Lewis County notes that for the 2000-2021 timeframe there are no drought events on record. Notably, the surrounding counties to Lewis also have a no rating drought risk index due to a low regional risk of drought related impacts.

Figure 7-2. National Risk Index, Drought Risk Index



Source: FEMA 2024

7.1.2 Extent

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

The New York State Department of Environmental Conservation (NYSDEC) has divided the State into nine drought management regions based on drainage basins and county lines. NYSDEC monitors precipitation, lake and reservoir levels, stream flow, and groundwater level at least monthly in each region and more frequently during periods of drought. NYSDEC and the New York State Drought Management Task Force use this data to assign each region one of the following four drought stages (NYSDEC 2023):

- **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.

The State of New York uses two primary methodologies to determine the various drought stages. The Palmer Drought Severity Index (PDSI) is a commonly used drought indicator and is primarily based on soil conditions. These are typically the first indicators that a moisture deficit is present. These values range from negative five to positive five, where positive values indicate wetter conditions, and negative values represent drier conditions (NYSDEC 2023). Table 7-1 lists the Palmer Drought Severity Index (PDSI) classifications.

Table 7-1. PDSI Classifications

Palmer Classifications	Description
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 second methodology used by the State was developed by the NYSDEC and is referred to as the State Drought Index (SDI). The SDI evaluates drought conditions on a more comprehensive basis by measuring whether numerous indicators reach dire thresholds. The data collected is compared against critical threshold values to show a normal or changeable drought condition. The indicators are weighted on a regional basis to reflect the unique circumstances of each drought management region (NYSDEC 2023). It is through this SDI that New York State determines if various regions are experiencing the various levels of drought conditions detailed above. Table 7-2 lists the SDI index range within the Normal stage and the three drought stages.

Table 7-2. 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: NYSDHSES 2014

The State of New York also tracks the Standardized Precipitation Evapotranspiration Index (SPEI) as an additional drought measurement tool. The SPEI, along with the PDSI, can be used to evaluate the levels of soil moisture and forecast potential impacts to agriculture within the State. The PDSI and SPEI are monitored to help the State understand potential impacts of drought on agricultural conditions (NYSDEC 2023).

7.1.3 Previous Occurrences and Impacts

Based on previous occurrences in Lewis County, the Expected Annual Loss associated with drought events in the County is \$0 per MitigateNY.

FEMA and USDA Disaster Declarations

Between 1954 and 2024, Lewis County was included in 1 major disaster (DR) or emergency (EM) declarations for drought-related events (FEMA 2023). Table 7-3 lists this declaration.

Table 7-3. FEMA Declarations for Drought Events in Lewis County (1954 to 2024)

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

Source: NOAA NCEI 2025

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 contiguous counties. Between 2019 and 2024, Lewis County was included in zero USDA drought-related agricultural disaster declarations.

Previous Events Below Disaster Declaration Threshold

There were zero known hazard events that impacted Lewis County between January 2015 and April 2025 according to the NOAA storm events database. Table 7-4 details the hazards recorded by the U.S. Drought Monitor. For events prior to 2015, refer to the 2020 Lewis County HMP.

Table 7-4. Drought Events in Lewis County (2019 to 2024)

Event Date	Declaration or Proclamation Number	Description
August 27 – September 2, 2019	N/A	Conditions held at a D0, or “abnormally dry” status across Lewis County.
May 19 – July 6, 2020	N/A	Conditions held at a D0, or “abnormally dry” status across Lewis County.
July 7 – October 5, 2020	N/A	Conditions worsened to a D1, or “moderate drought” status across Lewis County.
October 6 – November 16, 2020	N/A	Conditions worsened to a D2, or “severe drought” status across Lewis County.
November 17 – December 28, 2020	N/A	Conditions improved to a D1, or “moderate drought” status across Lewis County.
December 29 – June 14, 2021	N/A	Conditions improved to a D0, or “abnormally dry” status across Lewis County.
June 15 – July 19, 2021	N/A	Conditions worsened to a D1, or “moderate drought” status across Lewis County.
July 20 – August 2, 2021	N/A	Conditions improved to a D0, or “abnormally dry” status across Lewis County.
October 12 – November 1, 2021	N/A	Conditions held at a D0, or “abnormally dry” status across Lewis County.
February 8 – March 14, 2022	N/A	Conditions held at a D0, or “abnormally dry” status across Lewis County.
October 25 – November 14, 2022	N/A	Conditions held at a D0, or “abnormally dry” status across Lewis County.
June 6 – July 17, 2023	N/A	Conditions held at a D0, or “abnormally dry” status across Lewis County.
November 5, 2024 – January 6, 2025	N/A	Conditions held at a D0, or “abnormally dry” status across Lewis County.

Source: NOAA-NCEI 2024; USDA 2024; U.S. Drought Monitor 2024

Note: N/A = Not applicable; NRCC = Northeast Regional Climate Center; NWS = National Weather Service; USDA = U.S. Department of Agriculture

7.1.4 Cascading Impacts

Drought in New York State, including Lewis County, can create a range of cascading impacts that affect water availability, ecosystems, agriculture, infrastructure, and public health. Here are some of the potential cascading impacts of drought in the region:

Water Shortages and Restrictions: Prolonged droughts reduce water availability in reservoirs, rivers, and aquifers, leading to restrictions on water use for households, businesses, and agriculture. This can affect daily life, reduce agricultural output, and hinder industrial processes that rely on large water supplies.

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

Agricultural Losses and Food Price Increases: Drought stresses crops and livestock, reducing yields and increasing the risk of crop failure. This can lead to financial losses for farmers, disruptions in food supply, and higher prices for consumers. New York's dairy and apple industries, for instance, may face challenges during drought conditions.

Ecosystem Disruption and Loss of Biodiversity: Reduced water flow in rivers, streams, and wetlands can harm fish and wildlife, disrupt migration patterns, and damage habitats. Aquatic species, including fish populations in the Hudson River and its tributaries, may experience population declines due to low water levels and poor water quality.

Increased Energy Costs and Strain on Power Systems: Drought affects hydroelectric power generation, which is an important energy source in New York. With lower water levels, hydroelectric plants may produce less electricity, potentially increasing reliance on other sources and driving up energy costs. Additionally, water is needed for cooling in fossil fuel and nuclear power plants, which may also face operational constraints during droughts.

Soil Degradation and Reduced Land Productivity: Drought depletes soil moisture, making it more susceptible to erosion and reducing its fertility. Over time, this can lead to lower land productivity, especially for crops requiring high moisture. Soil degradation may also contribute to dust storms, which can further reduce air quality.

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

Public Health Concerns: Drought can reduce the availability of clean drinking water, leading to reliance on alternative sources that may be less safe. Additionally, poor air quality from wildfires or dust storms can exacerbate respiratory conditions. Lower water availability can also reduce sanitation and hygiene standards, increasing the risk of disease.

Pressure on Municipal Water Systems: Lower water levels can concentrate pollutants in drinking water supplies, increasing treatment costs and putting pressure on municipal water systems. Aging infrastructure may be strained as cities and towns attempt to meet water demand, which can further reduce water quality or increase the risk of water shortages.

Social and Mental Health Impacts: Financial stress, reduced agricultural output, and potential displacement from impacted areas can contribute to mental health issues, such as anxiety and depression. Communities dependent on agriculture or outdoor recreation may experience additional social and economic strain.

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

Refer to Chapter 15 for more information on wildfire risk.

7.2 COMMUNITY ASSETS AT RISK

This section discusses Lewis County's vulnerability, in a qualitative nature, to the drought hazard.

7.2.1 People and Communities

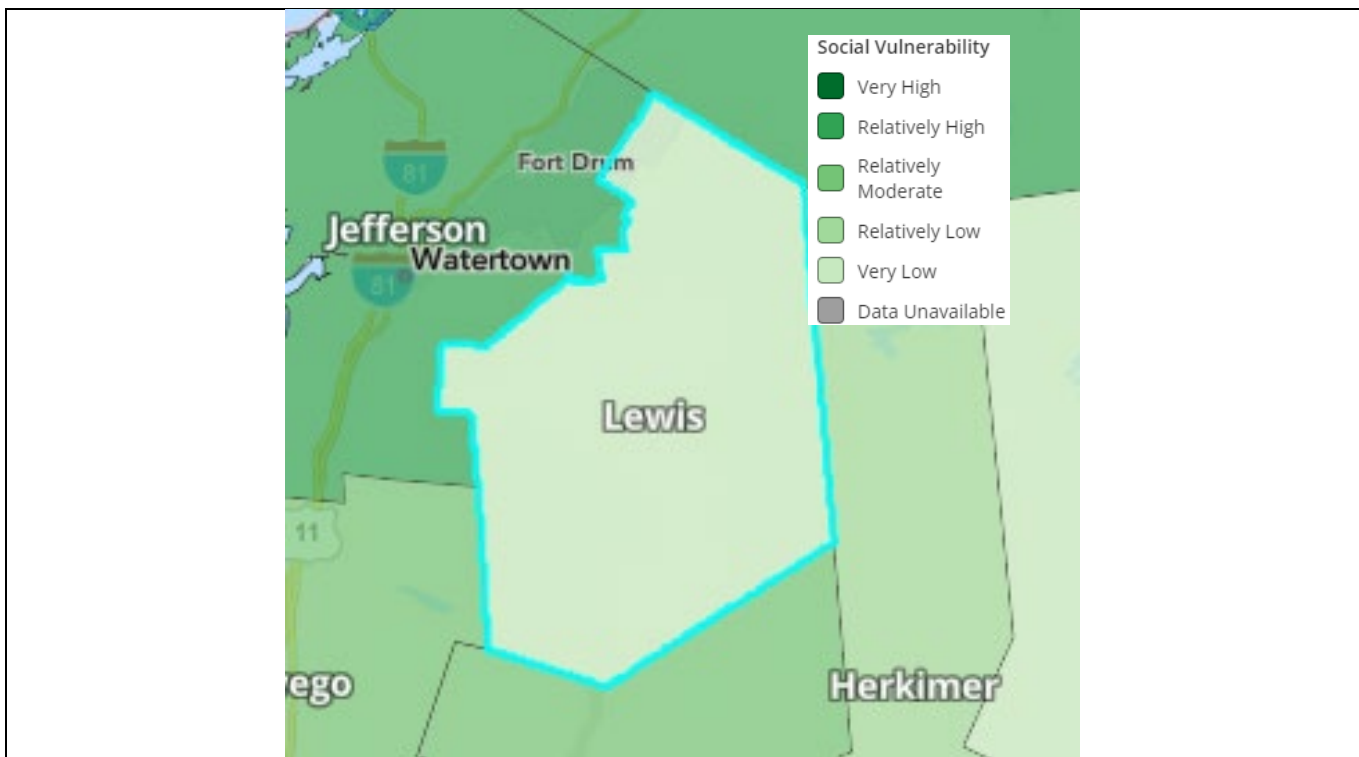
Overall Population

The entire population of Lewis County is vulnerable to drought events. According to the 2020 U.S. Census, the county had a population of 26,875. 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).

Socially Vulnerable Population

Socially vulnerable populations are most susceptible to drought events based on several factors, including their physical and financial ability to react or respond during a drought. Vulnerable populations include homeless persons, elderly (over 65 years old), low income or linguistically isolated populations, people with life-threatening illnesses, and residents that may have limited access to water as is. The population over the age of 65 is also more vulnerable. They may require extra water supplies or need assistance to obtain water and are more likely to need medical attention. According to the 2023 ACS, there are 3,265 total persons living below the poverty level, 5,347 persons over the age of 65 years, 1,635 persons under the age of five years, 29 non-English speakers, and 3,972 persons with a disability in Lewis County. Figure 7-3 displays the FEMA National Risk Inventory's Social Vulnerability Index for Lewis County, which is identified as "very low" for the drought hazard type.

Figure 7-3. FEMA Social Vulnerability Index for Natural Hazards



Source: FEMA n.d.

Economy

Drought can produce a range of impacts that span many economic sectors and can reach beyond an area experiencing physical drought. As previously discussed, water withdrawals are not only used for potable water but for use in the commercial/industrial/mining sectors and power generation.

One impact of drought is its impact on water supply. When drought conditions persist with little to no relief, water restrictions may be put into place by local or state governments. These restrictions may include placing limitations on when or how frequent lawns can be watered, car washing services, or any other recreational/commercial outdoor use of water supplies. In exceptional drought conditions, watering of lawns may not be an option (NC State University 2013).

Increased demand for water and electricity can also result in shortages and higher costs for these resources. Industries that rely on water for business could be impacted the most (e.g., landscaping businesses). Although most businesses will still be operational, they may be impacted aesthetically. These aesthetic impacts are most significant within the recreation and tourism industry. Moreover, droughts within another area could impact the food supply and price of food for residents within the County.

7.2.2 General Building Stock

A drought event is not expected to directly affect any structures. However, droughts contribute to conditions conducive to wildfires and reduce fire-fighting capabilities. Risk to life and property is greatest within those areas where forested areas adjoin urbanized areas (high-density residential, commercial, and industrial) or wildland urban interface (WUI). 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 Chapter 15 for more information on wildfire risk.

7.2.3 Community Lifelines and Other Critical Facilities

Drought events generally do not impact buildings; however, droughts have the potential to impact agriculture-related facilities and critical facilities that are associated with water supplies such as potable water used with fire-fighting services.

Drought affects groundwater sources, but generally not as quickly as surface water supplies. Groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams also. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest.

7.2.4 Natural Resources

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

7.2.5 Historic and Cultural Resources

The primary impacts on historic resources from drought would be an increased risk of wildfires, which could threaten these assets, and impacts on structure foundations from the shrink-swell cycle of expansive soils.

The primary impacts on cultural resources from drought would be an increased risk of wildfires, which could threaten these assets, and impacts on structure foundations from the shrink-swell cycle of expansive soils.

Droughts may impact the traditional and customary practices of Indigenous persons, who rely on healthy terrestrial ecosystems. These practices may include the collection of plants, animals, and minerals and other practices. Drought and its secondary impacts on watersheds and nearshore waters may impair, diminish, or impede the exercise of traditional and customary practices.

7.3 FUTURE OCCURRENCES AND PROJECTED CHANGES IN RISK

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

7.3.1 Probability of Future Occurrences

Information on previous drought occurrences in the County was used to calculate the probability of future occurrence of such events, as summarized in Table 7-5. Based on historical records and input from the Steering Committee, the probability of occurrence for drought in the County is considered “occasional.”

Table 7-5. Probability of Future Drought Events in Lewis County

Hazard Type	Number of Occurrences Between 1996 and 2024	Percent Chance of Occurring in Any Given Year
Drought	12	42.86%

Source: NOAA 2024

Note: Due to limitations in data, not all drought events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is calculated using the number of occurrences between 1996 and 2023

7.3.2 Climate Change Projections and Likely Impacts

Figure 7-4 is sourced from the 2023 New York State HMP, Mitigate NY, and outlines the effects climate change is projected to have on hazard location, intensity, frequency, and duration. The level of geographic specificity available in models and studies is also noted.

Figure 7-4. Mitigate NY Drought Climate Change Impacts

DROUGHT	Geographic Specificity	State/Regional
	Climate Effects	Yes
	Location	Droughts may become more common in the Northeast but intra-NYS changes in location are not clear.
	Intensity	Climate change may increase the intensity of droughts in NYS, in part due to increased variability in precipitation.
	Frequency	Droughts may become more frequent.
	Duration	Late-summer, short-duration droughts may become more common due to climate change.
	Overview: It is anticipated that climate change may increase the frequency and intensity of droughts in New York State (REF157). Warmer temperatures will increase evaporation and reduce surface water levels, leading to drier soil (REF158). Additionally, the variability of precipitation may increase, meaning there will be more periods of extreme precipitation and more periods of little-to-no precipitation, the latter of which can spur a drought (REF158, REF159). Some studies project that late-summer, short-duration droughts will become more common due to climate change (REF160). Currently, climate change has yet to meaningfully affect drought occurrence in New York; drought frequency in the Northeast has stayed relatively constant, decreasing only slightly (REF161). Models have shown that increases in temperature have been counteracted by increases in humidity, resulting in negligible impacts to drought trends in the Northeast between 1980 and 2020. It is unclear to what extent increases in humidity are caused by global climate change versus more localized environmental effects (REF162).	

7.3.3 Projected Changes in Development and Population

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 of this plan.

Lewis County has experienced a slight decrease in population since 2010. According to the U.S. Census Bureau, the County's population decreased by approximately -0.19 percent between 2010 and 2020. Cornell University's Program on Applied Demographics produced populations projections by County from 2016 to 2040. According to these projections, Lewis County is projected to have a population of 26,156 by 2030 and 25,618 by 2040 as the population decrease is expected to continue (Cornell University 2018). Changes in the density of the population can impact the number of persons exposed to drought and the draw upon water resources.

7.3.4 Changes in Vulnerability Since 2020 HMP

Since 2020, Lewis County has experienced relatively low drought risk and minimal drought impacts. While there may have been short-term dry spells or abnormally dry periods in the past decade, there is no indication of long-term or severe drought trends in Lewis County. The county has generally maintained adequate water supply and streamflow, with no major drought-related agricultural or public health impacts reported. The county experienced its 39th wettest April and 22nd wettest year-to-date (January–April 2025) in the past 131 years, indicating above-average precipitation (NIDIS n.d.).

8. EARTHQUAKE

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 of the earthquake hazard.

8.1.1 Hazard Description and Location

An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of tectonic plates beneath the Earth's surface, a volcanic eruption, or by a manmade explosion (FEMA 2023). 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.

The intensity of ground shaking depends on several factors, including the amount of released energy, the depth of the earthquake beneath the earth's surface, the distance from the fault, and the type of underlying soil or bedrock. Volcanic eruptions, landslides, avalanches, rushing rivers, and explosions from demolition or mining can all cause a release of energy to generate seismic waves and potentially cause an earthquake to occur.

Aftershocks are normally smaller than the initial mainshock, and can continue for a period of weeks, months, or years after the initial shock occurs. Earthquakes come without warning and can last a few to several minutes. The shaking of the ground can lead to buildings being damaged and/or collapsing. People are most at risk from buildings collapsing or partially collapsing. Other structures like highway bridges can be damaged and potentially injure travelers. Landslides and tsunamis are not always caused by earthquakes, but when they occur, they present a real danger to people and structures.

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

- Surface faulting—Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 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.

Earthquakes in New York

As noted in the 2019 New York State Hazard Mitigation Plan (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).

Since the first recorded earthquake on December 19, 1737, New York has had over 550 earthquakes centered within its state boundaries. Several of these are highlighted below. The state has also experienced strong ground shaking from earthquakes centered in nearby U.S. states and Canadian provinces. Most of the earthquakes in New York have taken place in the greater New York City area, the Adirondack Mountains region, and the western part of the state (New York State 2023).

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).

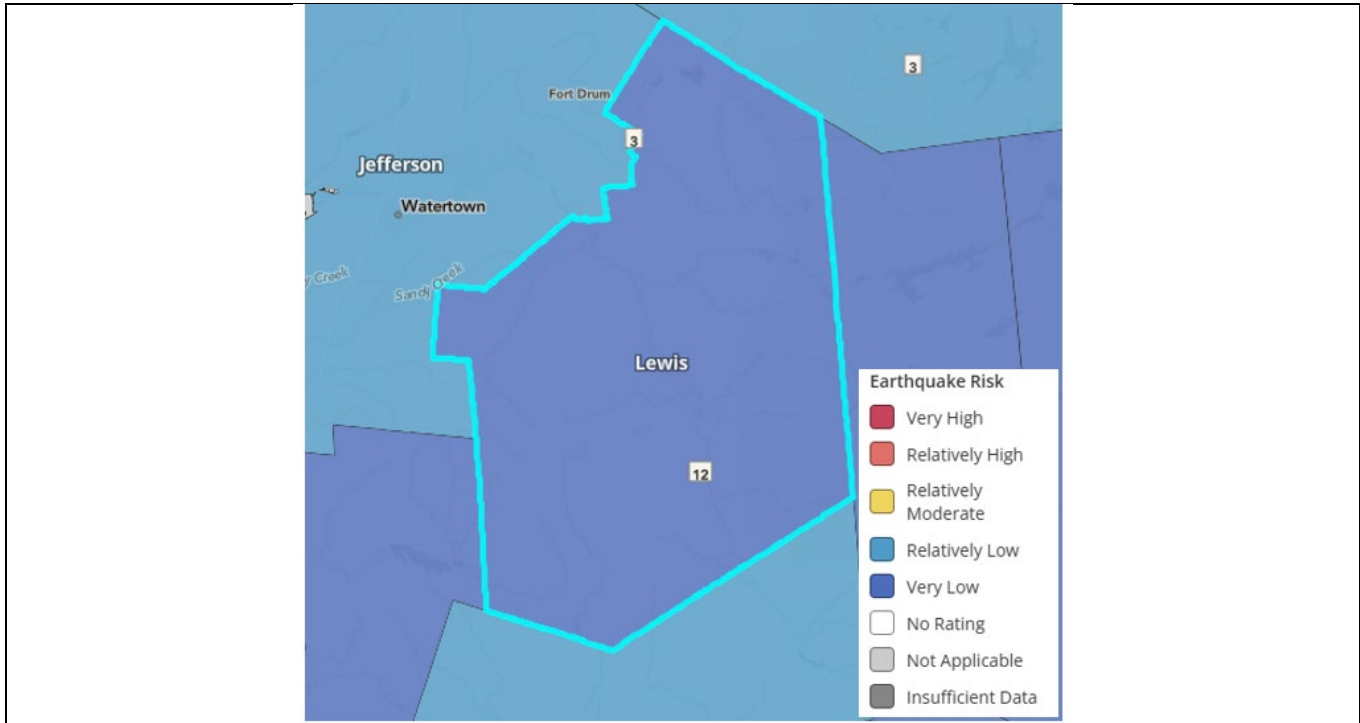
There are two major fault lines within New York State's borders: the Ramapo Fault Zone that extends from New Jersey into southeastern New York, and the Clarendon-Linden fault system in western New York State. Numerous smaller fault lines run throughout New York City and the Adirondack Mountains, where some of New York's biggest earthquakes have occurred (New York State 2023).

Earthquake Risk in Lewis County

Lewis County has not been identified as an area with increased risk of earthquake events and according to multiple sources, Lewis County faces a very low risk of earthquake events (ThinkHazard 2023). Figure 8-1 shows the Earthquake Risk Index for Lewis County on the county tract scale. This index helps to understand the susceptibility of the County to earthquakes. According to the National Risk Index, on the county scale, the County has a very low risk to earthquakes (FEMA 2025). Despite this low earthquake risk, notably a few small fault lines run through Lewis County and the surrounding area, as illustrated in Figure 8-2.

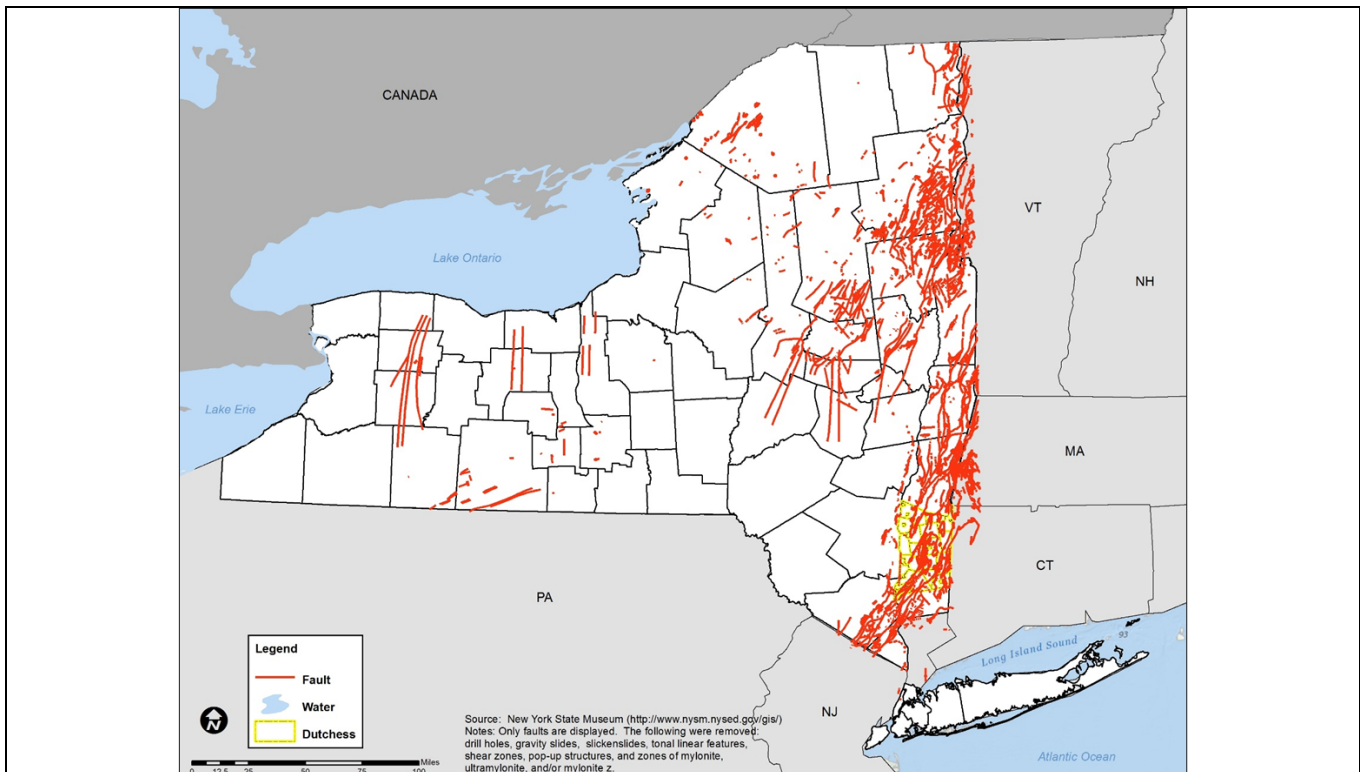
The Lamont-Doherty Cooperative Seismographic Network (LCSN) monitors earthquakes that occur primarily in the northeastern United States. The goal of the project is to compile a complete earthquake catalog for this region, to assess the earthquake hazards, and to study the causes of the earthquakes in the region. The LCSN operates 52 seismographic stations in the following seven states: Connecticut, Delaware, Maryland, New Jersey, New York, Pennsylvania, and Vermont. There are no seismic stations in Lewis County; however, there are several within the vicinity of the County (LCSN 2014).

Figure 8-1. FEMA National Risk Index, Earthquake Risk Index Score Using the County Scale



Source: FEMA n.d.

Figure 8-2: Faults in Lewis County



Source: New York State Museum 2023

In addition to the Lamont-Doherty Seismic Stations, the USGS operates a global network of seismic stations (GSN) to monitor seismic activity. While no seismic stations are in New York State, nearby stations are positioned in State College, Pennsylvania and Oak Ridge, Massachusetts. The Advanced National Seismic System (ANSS) is also run by USGS. When earthquakes strike, ANSS delivers real-time information, providing situational awareness for emergency response personnel. In regions with sufficient seismic stations, that information includes –within minutes–a ShakeMap showing the distribution of potentially damaging ground shaking, information used to target post-earthquake response efforts. ANSS stations are operated within the State at Lake Ozonia and Binghamton (USGS 2018).

Earthquake-Sensitive Soils

The New York State Geological Survey conducted seismic shear-wave tests of the State’s surficial geology (glacial deposits). Surficial materials are those at or near Earth’s surface and in the case of New York State, these come in the form of sediment (such as rock, soil, gravel, etc.) that are deposited by glaciers (UC Davis n.d.). Based on these test results, the surficial geologic materials of the State of New York were categorized according to the National Earthquake Hazard Reduction Program’s (NEHRP) Soil Site Classifications. 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 A to E, as noted in Table 8-1, 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.

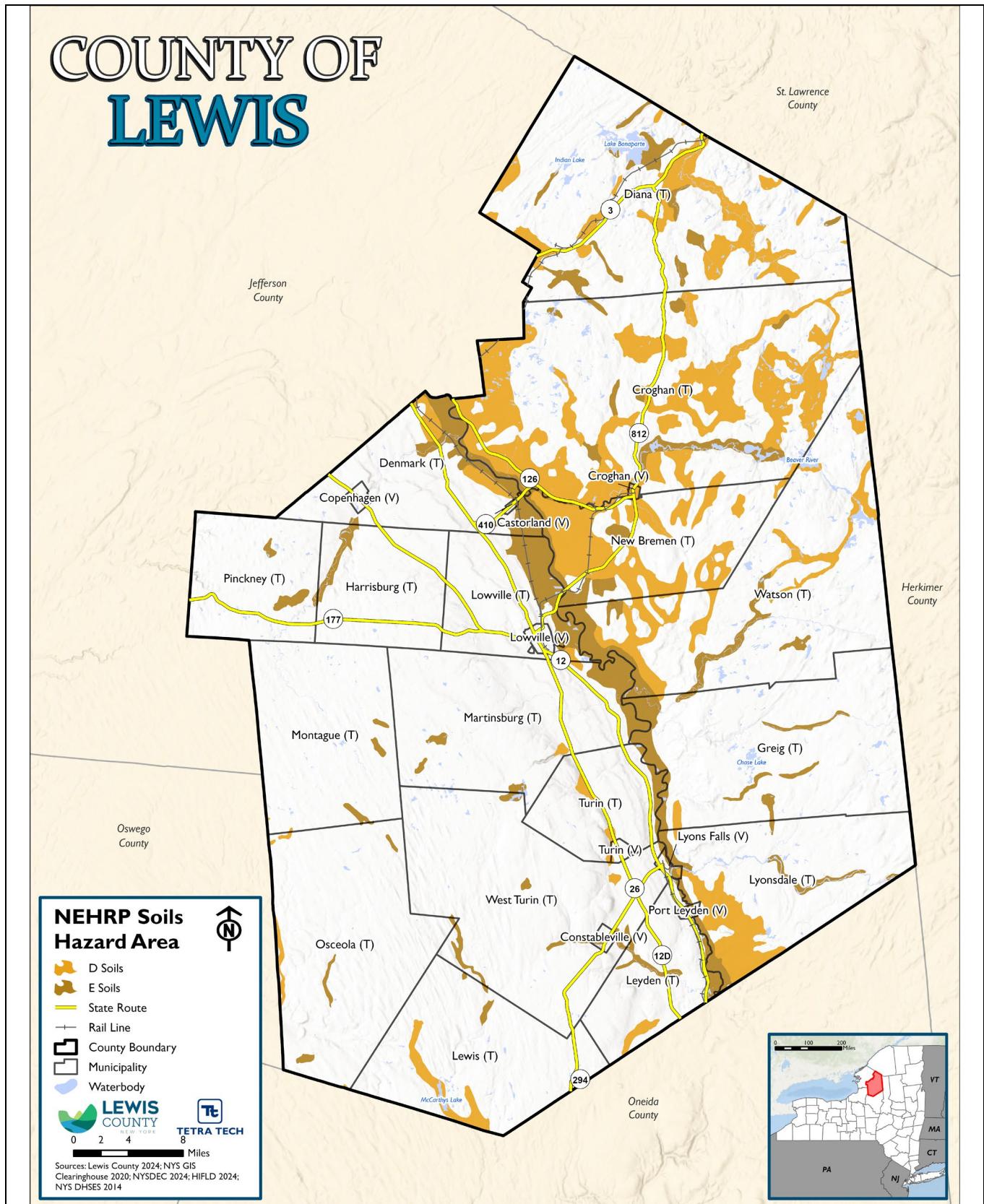
Table 8-1. NEHRP Soil Classifications

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

Source: FEMA 2016

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 2016). The locations of the most earthquake-sensitive soils (NEHRP Classes D and E) in Lewis County are shown in Figure 8-3.

Figure 8-3. NEHRP Soils in Lewis County



8.1.2 Extent

Magnitude

An earthquake's 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 is expressed by ratings on the Richter scale and/or the moment magnitude scale. The Richter Scale conveys the shaking felt by an event but does not measure damage (USGS 2023). Table 8-2 presents the Richter scale magnitudes. The Richter Scale is no longer commonly used but is often referred to when discussed past events.

Table 8-2. Richter Magnitude Scale

Richter Magnitude	Earthquake Effects
2.5 or less	Usually not felt, but can be recorded by seismograph
2.5 or 5.4	Often felt, but causes only minor damage
5.5 or 6.0	Slight damage to buildings and other structures
6.1 or 6.9	May cause a lot of damage in very populated areas
7.0 or 7.9	Major earthquake; serious damage
8.0 or greater	Great earthquake; can totally destroy communities near the epicenter

Source: Michigan Tech 2023

The moment magnitude provides an estimate of earthquake size that is valid over the complete range of magnitudes, a characteristic that was lacking in other magnitude scales. For very large earthquakes, moment magnitude gives the most reliable estimate of earthquake size. Moment is a physical quantity proportional to the slip on the fault multiplied by the area of the fault surface that slips; it is related to the total energy released in the earthquake. The moment can be estimated from seismograms (and from geodetic measurements). The moment is then converted into a number like other earthquake magnitudes by a standard formula. The result is called the moment magnitude (USGS n.d.).

Intensity

Intensity describes the overall severity of shaking felt during the event. Earthquake intensity is based on the observed effects of ground shaking on people, buildings, and natural features, and varies across affected locations. The Modified Mercalli (MMI) scale expresses how strong a shock was felt at a particular location. Table 8-3 summarizes earthquake intensity as expressed by the Modified Mercalli scale.

Peak ground elevation (PGA) measures how hard the earth shakes, or accelerates, in each geographic area. PGA is expressed as a percent acceleration force of gravity (%g). For example, 10%g PGA means that the ground is accelerating at a rate that is 10% that of gravity (USGS 2019). Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Table 8-4. Figure 8-4 shows the 500-Year Earthquake PGA (%g). For the 500-Year Earthquake event, the entire county is projected to experience a *VI – Moderate* acceleration.

Table 8-5 describes the MMI scale alongside PGA equivalents to provide a more holistic picture of earthquake extent as it relates to ground acceleration. Building construction, type of structure, building materials, and other factors will play a role in determining the extent of earthquake damage within the planning area.

Table 8-3. 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 motor cars may rock slightly. Vibrations 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 motor cars 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	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	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	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	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: USGS 2023

Table 8-4. Damage Levels Experienced in Earthquakes (PGA)

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.
< 10%g	Usually causes only slight damage, except in unusually vulnerable facilities.
10 - 20%g	May cause minor-to-moderate damage in well-designed buildings, with higher levels of damage in poorly designed buildings. At this level of ground shaking, only unusually poor buildings would be subject to potential collapse.
20 - 50%g	May cause significant damage in some modern buildings and very high levels of damage (including collapse) in poorly designed buildings.
≥50%g	May causes higher levels of damage in many buildings, even those designed to resist seismic forces.

Source: USGS 2005

Note: %g: Peak Ground Acceleration (PGA)

Figure 8-4. 500-Year Earthquake PGA (%g)

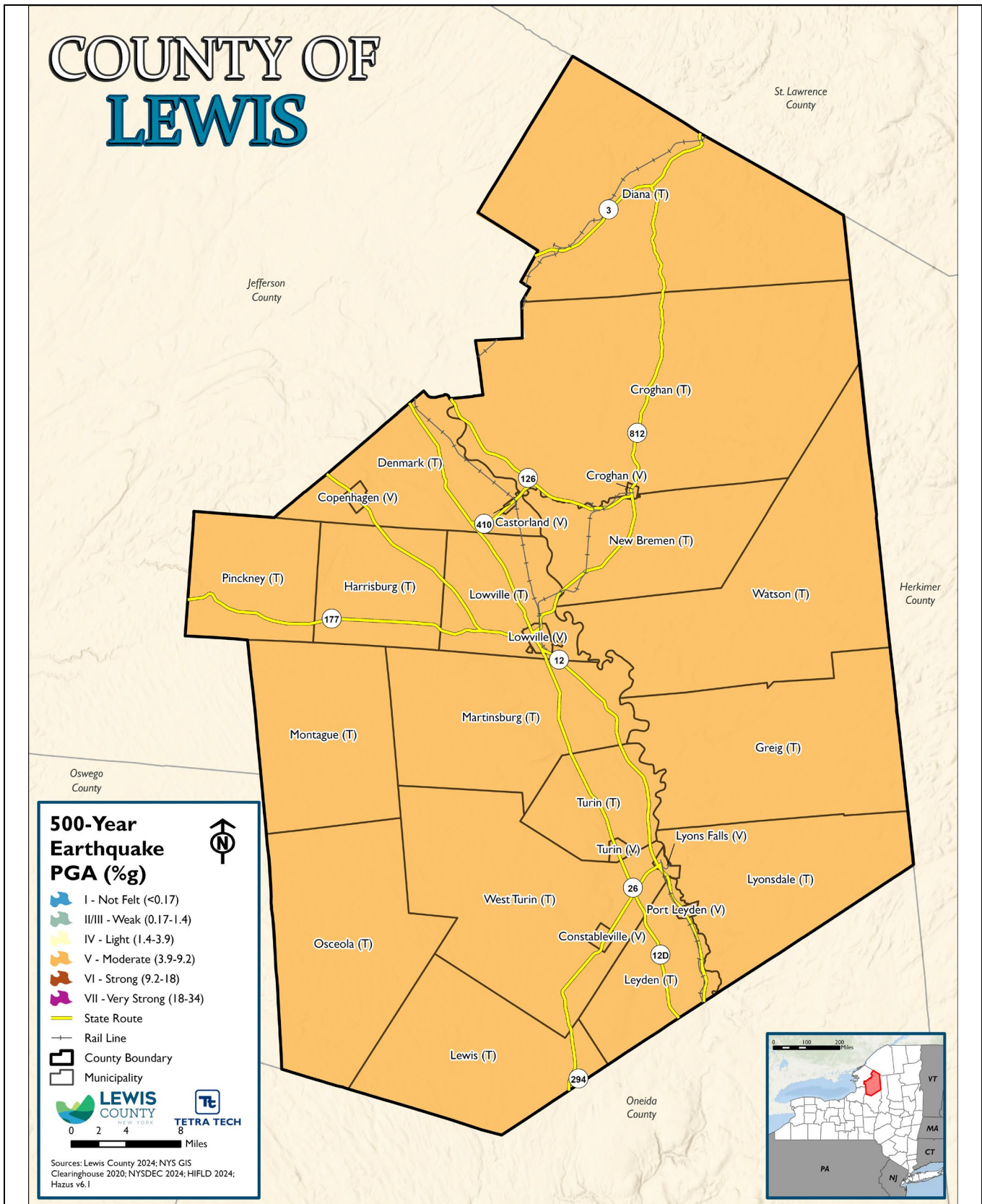
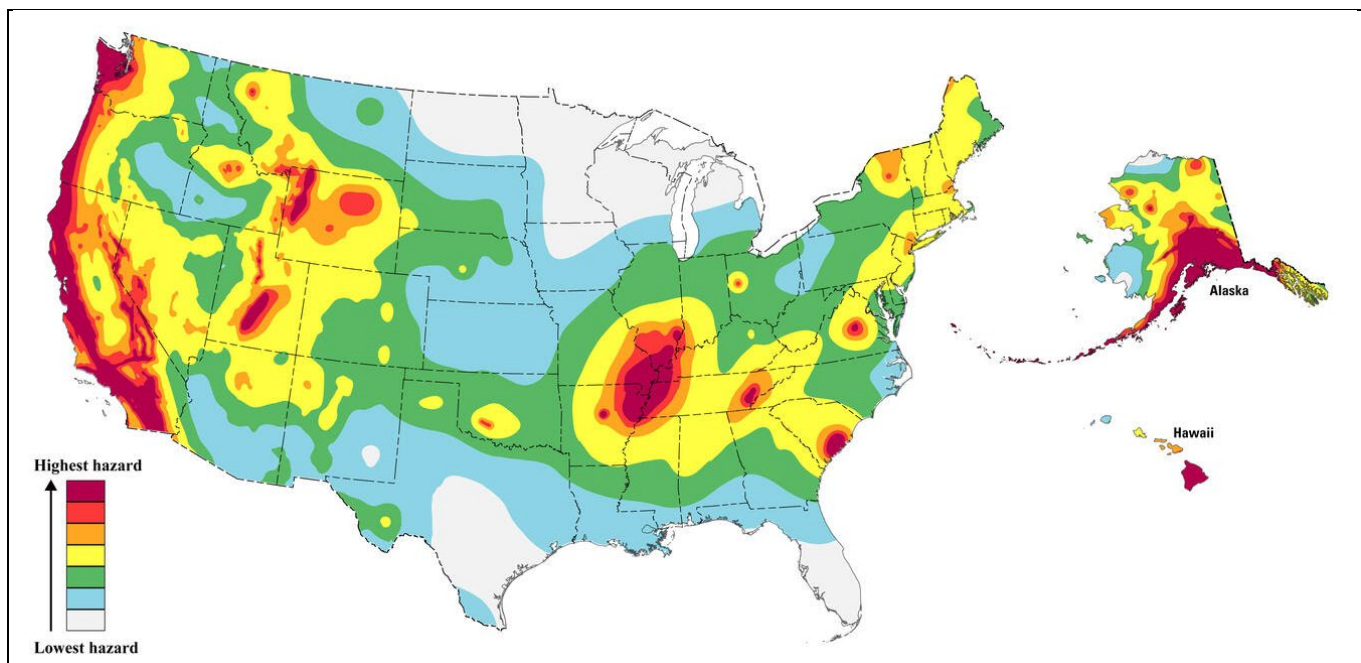


Table 8-5. Modified Mercalli Intensity and PGA Equivalents

Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	< 0.17	Not Felt	None
II – III	0.17 – 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
VIII	34 – 65	Severe	Moderate to Heavy
IX	65-124	Violent	Heavy
X	>124	Extreme	Very Heavy

Source: Freeman 2004

National maps of earthquake shaking hazards provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown 2001). The USGS updated the National Seismic Hazard Maps in 2023. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps. Figure 8-5 represents the best available data, as determined by the USGS.

Figure 8-5. USGS National Seismic Hazard for Lewis County


Source: USGS

8.1.3 Previous Occurrences and Impacts

As noted in the 2023 New York State Hazard Mitigation Plan, although the probability of damaging earthquakes in the State is low, earthquakes do occur on a regular basis in New York. According to the MitigateNY, since 1996, only one earthquake in New York State has caused any recorded damages. The 2002 quake measured at a 5.1 on the Richter Scale, caused approximately \$2.5 million in damage, and resulted in a presidential disaster declaration. This event affected six counties – Clinton, Essex, Franklin, Hamilton, Warren, and Washington.

The National Risk Index Expected Annual Loss (EAL) associated with damaging earthquake events in Lewis County is \$ \$135,248, a EAL rating of “very low.”

FEMA and USDA Disaster Declarations

Between 1954 and 2024, Lewis County was included in no major disaster (DR) or emergency (EM) declarations for geological-related events (FEMA 2024). There has been one federally declared disaster in New York State due to an earthquake, following an event of Magnitude 3.1 that occurred in the far northeastern part of the state in April 2002 (with aftershocks in May 2002). Lewis County was not affected by this event.

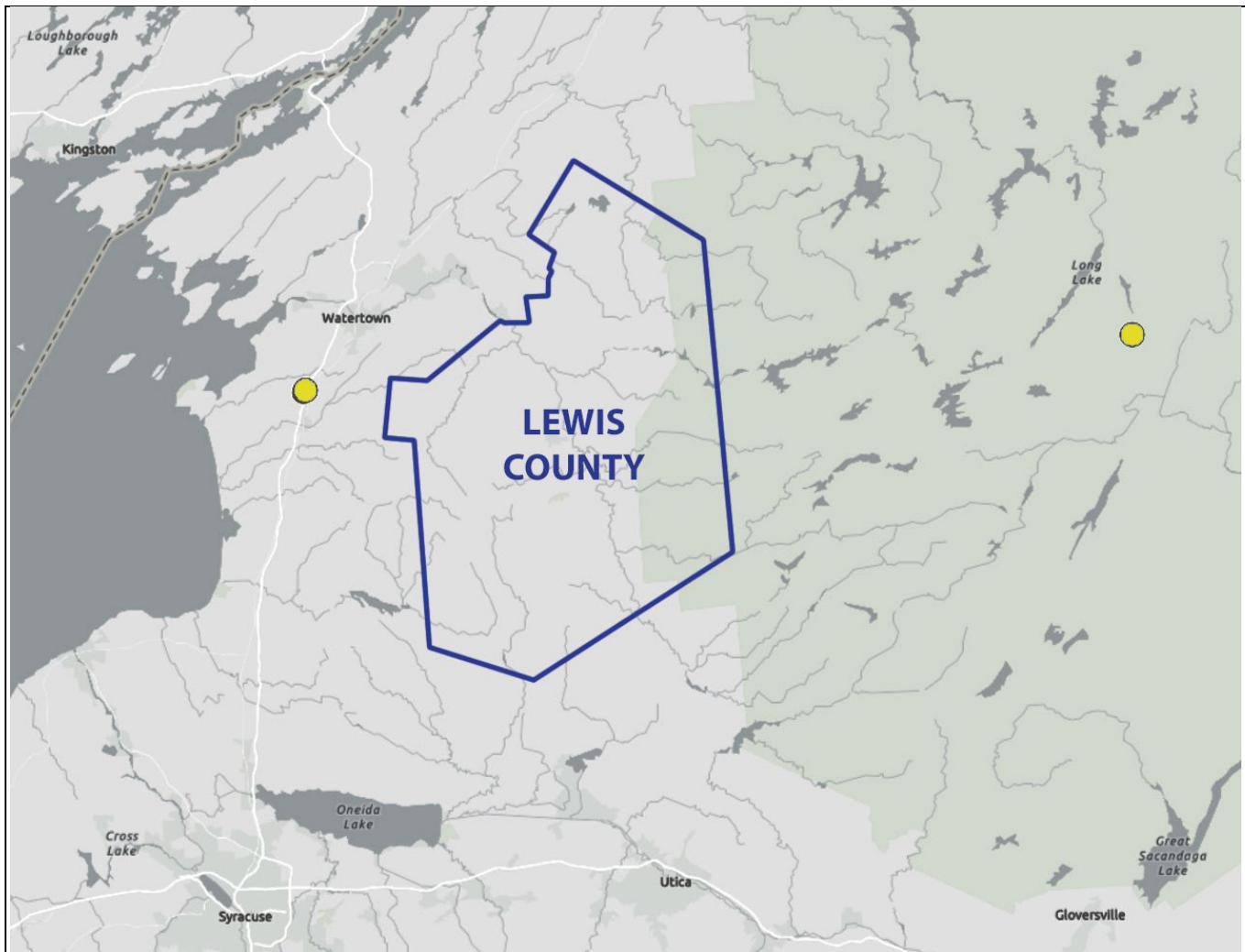
The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2012 and 2024, Lewis County was not included in any USDA geologic-related agricultural disaster declarations.

Previous Events

Figure 8-6 illustrates historic earthquake epicenters across Lewis County and the surrounding area between 2000 and 2024. According to this figure, there have been no earthquakes with epicenters in Lewis County during this timeframe. In addition to these earthquakes in Lewis County, there have been numerous events originating outside of New York State that have been felt within the State. 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 (NYSDHSES 2014).

Known hazard events that impacted Lewis County between January 2009 and April 2025 were evaluated, and USGS sources noted no earthquake events in Lewis County during this timeframe. For events prior to 2009, refer to the 2020 Lewis County HMP.

The New York State Geological Survey records a total of 329 significant landslide events that occurred in New York State between 1837 and 2007. Three of these events are recorded as having occurred in Lewis County, as noted in Table 8-6.

Figure 8-6. Earthquake Epicenters in the Vicinity of Lewis County 2000 to 2024


Source: USGS 2025

Table 8-6. Earthquake Events in Lewis County (1837 to 2024)

Event Date	Declaration or Proclamation Number	Location Impacted	Description
March 12, 1853	N/A	Lowville	An earthquake with a magnitude of 4.5. Machinery was knocked down at Lowville, about 100 km northeast of Syracuse.
June 6, 1980	N/A	Port Leyden	An earthquake with a magnitude of 3.5 and a depth of 1.0 kilometers
July 31, 1997	N/A	Lyons Falls	An earthquake with a magnitude of 3.2 and a depth of 5.0 kilometers.

Source: USGS 2024; FEMA 2024

Note: All magnitudes refer to the Richter Scale, unless otherwise specified.

8.1.4 Cascading Impacts

Earthquakes can trigger surface ruptures, volcanic activity, tsunamis, landslides, and sloshing water in closed basins. Earthquakes come without warning and can last a few to several minutes. The shaking of the ground can lead to buildings being damaged and/or collapsing. People are most at risk from buildings collapsing or partially collapsing. Other structures like highway bridges can be damaged and potentially injure travelers. Landslides and tsunamis are not always caused by earthquakes, but when they occur, they present a real danger to people and structures.

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

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

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.

8.2 COMMUNITY ASSETS AT RISK

To complete the vulnerability assessment for the earthquake hazard, areas delineating the Class D and E NEHRP soils were sourced from NYSDHSES and represented the hazard area boundary. Population, structures, critical facilities, and lifelines located in these hazard areas may be more susceptible to earthquakes in Lewis County.

A probabilistic assessment was conducted for the 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 4 (Risk Assessment Methodology and Tools) for additional details on the methodology used to assess earthquake risk.

As noted in the HAZUS-MH Earthquake User Manual, “Uncertainties are inherent in any loss estimation methodology. They arise in part from incomplete scientific knowledge concerning earthquakes and their effects upon buildings and facilities. They also result from the approximations and simplifications that are necessary for comprehensive analyses. Incomplete or inaccurate inventories of the built environment, demographics and economic parameters add to the uncertainty. These factors can result in a range of uncertainty in loss estimates produced by the HAZUS Earthquake Model, possibly at best by a factor of two or more” (FEMA 2015). 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.

8.2.1 People and Communities

The entire County may experience an earthquake. However, the degree to which Lewis County residents are affected by potential earthquakes or landslides depends on many factors including the age and type of construction people live in, the soil type homes are located on, and the intensity of the earthquake. Whether directly or indirectly impacted, residents could be faced with business closures, road closures that could isolate populations, and loss of function of critical facilities and utilities.

Overall Population

Overall, the risk to public safety and loss of life from an earthquake in the County is minimal for low magnitude events. However, there is a higher risk to public safety for those inside buildings due to structural damage or people walking below building ornamentations and chimneys that may be shaken loose and fall because of an earthquake. While the entire population of Lewis County can experience impacts from the earthquake hazard, those living in vulnerable areas are more susceptible. An exposure analysis was performed using the NEHRP soils data and the 2023 ACS population data. The sum of the population by jurisdiction impacted by a 500-year MRP earthquake event is listed below. Populations living on NEHRP Class D and E soil types were calculated as summarized in Table 8-7. Overall, 28.2 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.

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. An analysis was performed to estimate the number of households displaced, and population that may require short-term sheltering as a result of the 500- MRP earthquake event; results are presented in Table 8-8.

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 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., with peak commute time at 5:00 p.m. Whether directly impacted or indirectly impact, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could prevent people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself. Overall, Hazus estimates that there are no injuries or casualties caused by the 100-year MRP event. Table 8-9 summarizes the estimated number of injuries or casualties caused by the 500-year MRP event.

Table 8-7. Population in the NEHRP Soils (Class D & E) Hazard Area

Jurisdiction	Total Population (2023 ACS)	Population in the NEHRP Soils (Class D and E) Hazard Area	
		Number of Persons	% of Jurisdiction Total
Castorland (V)	414	126	30.4%
Constableville (V)	356	79	22.2%
Copenhagen (V)	652	0	0.0%
Croghan (T)	2,911	1,669	57.3%
Croghan (V)	642	618	96.3%
Denmark (T)	1,589	366	23.0%
Diana (T)	1,503	755	50.2%
Greig (T)	1,020	119	11.7%
Harrisburg (T)	515	0	0.0%
Lewis (T)	801	91	11.4%
Leyden (T)	1,235	130	10.5%
Lowville (T)	1,442	365	25.3%
Lowville (V)	3,432	0	0.0%
Lyons Falls (V)	478	202	42.3%
Lyonsdale (T)	885	353	39.9%
Martinsburg (T)	1,232	112	9.1%
Montague (T)	159	0	0.0%
New Bremen (T)	2,436	1,487	61.0%
Osceola (T)	140	4	2.9%
Pinckney (T)	246	4	1.6%
Port Leyden (V)	680	106	15.6%
Turin (T)	827	142	17.2%
Turin (V)	312	13	4.2%
Watson (T)	1,888	803	42.5%
West Turin (T)	1,178	50	4.2%
Lewis County (Total)	26,974	7,594	28.2%

Source: U.S. Census Bureau 2023 ACS; NYSDHSES 2014

Table 8-8. 500-Year Mean Return Period Earthquake Event Impacts

Jurisdiction	Total Population (2023 ACS)	500-Year Mean Return Period Earthquake Event	
		Displaced Households	Persons Seeking Short-Term Sheltering
Castorland (V)	414	0	0
Constableville (V)	356	0	0
Copenhagen (V)	652	0	0
Croghan (T)	2,911	0	0
Croghan (V)	642	0	0
Denmark (T)	1,589	0	0
Diana (T)	1,503	0	0
Greig (T)	1,020	0	0
Harrisburg (T)	515	0	0
Lewis (T)	801	0	0
Leyden (T)	1,235	0	0
Lowville (T)	1,442	0	0
Lowville (V)	3,432	0	0
Lyons Falls (V)	478	0	0
Lyonsdale (T)	885	0	0
Martinsburg (T)	1,232	0	0
Montague (T)	159	0	0
New Bremen (T)	2,436	0	0
Osceola (T)	140	0	0
Pinckney (T)	246	0	0
Port Leyden (V)	680	0	0
Turin (T)	827	0	0
Turin (V)	312	0	0
Watson (T)	1,888	0	0
West Turin (T)	1,178	0	0
Lewis County (Total)	26,974	0	0

Source: U.S. Census Bureau 2023 ACS; Hazus v6.1

Table 8-9. Estimated Number of Injuries and Casualties Caused by the 500-Year MRP Earthquake Event

Level of Severity	Time of Day - 500-Year Mean Return Period		
	2:00 AM	2:00 PM	5:00 PM
Injuries	0	1	0
Hospitalization	0	0	0
Casualties	0	0	0

Source: Hazus v6.1

Socially Vulnerable Population

Socially vulnerable populations, including the elderly (persons over age 65) and individuals living below the poverty threshold, are most susceptible to earthquakes due to decreased mobility and financial ability to react or respond during a hazard, and the location and construction quality of their housing. Table 8-10 shows the total number of vulnerable persons living in areas of Class D and E soils.

Table 8-10. Vulnerable Persons Located in the NEHRP Soils (Class D and E) Hazard Area

Jurisdiction	Estimated Number of Vulnerable Persons Located in the NEHRP Soils (Class D and E) Hazard Area									
	Persons Over 65		Persons Under 5		Non-English Speaking Persons		Persons with a Disability		Persons in Poverty	
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
Castorland (V)	18	29.0%	10	28.6%	0	0.0%	20	29.4%	22	30.6%
Constableville (V)	13	21.7%	11	20.8%	0	0.0%	11	21.2%	7	20.0%
Copenhagen (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Croghan (T)	249	57.3%	106	56.9%	0	0.0%	225	57.3%	256	57.3%
Croghan (V)	130	95.6%	33	94.3%	0	0.0%	81	95.3%	107	95.5%
Denmark (T)	88	22.9%	25	22.9%	0	0.0%	45	22.8%	55	22.8%
Diana (T)	142	50.0%	14	48.3%	0	0.0%	140	50.0%	112	50.2%
Greig (T)	28	11.7%	5	11.6%	2	8.3%	17	11.6%	13	11.1%
Harrisburg (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lewis (T)	10	10.6%	3	8.6%	0	0.0%	11	11.0%	4	10.8%
Leyden (T)	18	10.4%	10	10.4%	0	0.0%	13	10.3%	22	10.6%
Lowville (T)	122	25.3%	15	24.2%	0	0.0%	48	25.3%	55	25.0%
Lowville (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lyons Falls (V)	56	42.1%	11	39.3%	0	0.0%	28	41.2%	17	41.5%
Lyonsdale (T)	80	39.7%	19	39.0%	0	0.0%	98	39.7%	55	39.5%
Martinsburg (T)	27	9.0%	4	7.8%	0	0.0%	18	9.1%	8	8.5%
Montague (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
New Bremen (T)	227	60.8%	161	60.8%	0	0.0%	144	61.0%	81	60.7%
Osceola (T)	1	2.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Pinckney (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Port Leyden (V)	27	15.5%	11	15.5%	0	0.0%	20	15.3%	22	15.5%
Turin (T)	34	17.0%	7	15.2%	0	0.0%	19	16.5%	10	16.9%
Turin (V)	3	3.2%	0	0.0%	0	0.0%	3	3.5%	0	0.0%
Watson (T)	168	42.3%	31	42.5%	2	41.7%	109	42.2%	65	41.9%
West Turin (T)	11	4.2%	4	3.6%	0	0.0%	6	4.3%	4	3.6%
Lewis County (Total)	1,452	27.2%	480	29.4%	4	13.9%	1,056	26.6%	915	28.0%

Source: U.S. Census Bureau 2023 ACS Vulnerable Population Totals; NYSDHSES 2014

Economy

Earthquakes also have impacts on the economy, including loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair/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).

This analysis did not include damage estimates for individual roadway segments and railroad tracks, but it is assumed these features would sustain damage due to ground failure, resulting in interruptions of regional transportation and of distribution of materials.

Earthquake events can also significantly affect 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 building standards in place at times of construction.

Geologic hazards also have broader economic impacts, including loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair or replacement of buildings. According to FEMA's Hazus modeling, building-related economic losses include both income losses (wage, rental, relocation, and capital-related losses) and capital stock losses (structural, non-structural, content, and inventory losses). While this analysis does not include damage estimates for individual roadway segments or rail lines, it is assumed that these features would sustain damage due to ground failure, resulting in interruptions to regional transportation and distribution networks.

8.2.2 General Building Stock

Buildings located in areas of Class D or Class E soils are more susceptible to earthquake impacts. Table 8-11 summarizes the number and replacement cost value of buildings in Lewis County on NEHRP Soil Classes D and E. There are an estimated 11,312 buildings within the NEHRP Soils Class D and E Hazard Areas, representing 27.1 percent of the County's total general building stock inventory replacement cost value. The Village of Croghan has the greatest number of its buildings located in areas of Class D and E soils (2,585 buildings or 56.6 percent of its total building stock). Table 8-12 displays the buildings by general occupancy located within the NEHRP Classes D and E hazard areas.

Potential building damage was evaluated by Hazus across the following damage categories (none, minor, moderate, severe, and destruction). The potential damage is the modeled loss that could occur to the exposed inventory measured by the structural and content replacement cost value. Table 8-13 provides definitions of the five categories of damage for a light wood-framed building; definitions for other building types are included in Hazus technical manual documentation. Table 8-14 shows the respective expected damage counts for the 500-year MRP.

Table 8-11. Buildings in the NEHRP Soils (Class D and E) Hazard Area

Jurisdiction	Jurisdiction Total Buildings		Buildings in the NEHRP Soils (Class D and E) Hazard Area			
			Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Castorland (V)	237	\$209,754,520	80	33.8%	\$112,553,003	53.7%
Constableville (V)	331	\$214,011,340	78	23.6%	\$54,649,794	25.5%
Copenhagen (V)	502	\$470,894,543	0	0.0%	\$0	0.0%
Croghan (T)	4,564	\$2,716,704,006	2,585	56.6%	\$1,731,481,531	63.7%
Croghan (V)	516	\$406,813,941	492	95.3%	\$392,104,056	96.4%
Denmark (T)	2,262	\$1,683,271,436	499	22.1%	\$413,974,146	24.6%
Diana (T)	3,305	\$1,337,032,416	1,618	49.0%	\$620,350,566	46.4%
Greig (T)	2,962	\$1,160,581,336	441	14.9%	\$162,637,965	14.0%
Harrisburg (T)	863	\$533,636,646	4	0.5%	\$1,012,876	0.2%
Lewis (T)	1,495	\$722,393,059	153	10.2%	\$70,074,982	9.7%
Leyden (T)	1,988	\$1,065,963,460	173	8.7%	\$98,824,120	9.3%
Lowville (T)	1,752	\$1,762,819,749	284	16.2%	\$233,879,018	13.3%
Lowville (V)	2,332	\$1,966,304,011	0	0.0%	\$0	0.0%
Lyons Falls (V)	568	\$376,848,099	252	44.4%	\$158,505,904	42.1%
Lyonsdale (T)	1,614	\$656,114,259	658	40.8%	\$257,173,054	39.2%
Martinsburg (T)	2,180	\$1,847,174,778	185	8.5%	\$108,915,150	5.9%
Montague (T)	616	\$232,283,519	2	0.3%	\$1,352,593	0.6%
New Bremen (T)	3,030	\$1,662,197,383	1,851	61.1%	\$1,049,591,740	63.1%
Osceola (T)	1,190	\$395,966,698	38	3.2%	\$12,241,003	3.1%
Pinckney (T)	807	\$275,136,312	11	1.4%	\$2,611,497	0.9%
Port Leyden (V)	525	\$266,540,832	82	15.6%	\$34,902,556	13.1%
Turin (T)	1,094	\$881,477,564	194	17.7%	\$119,788,487	13.6%
Turin (V)	249	\$167,575,852	13	5.2%	\$3,662,539	2.2%
Watson (T)	3,311	\$1,308,062,188	1,532	46.3%	\$627,848,725	48.0%
West Turin (T)	1,869	\$1,005,138,588	87	4.7%	\$49,524,817	4.9%
Lewis County (Total)	40,162	\$23,324,696,534	11,312	28.2%	\$6,317,660,123	27.1%

Source: Lewis County 2024; NYS GIS 2024; NYSDHSES 2014; RS Means 2024

Table 8-12. Buildings in the NEHRP Soils (Class D & E) Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the NEHRP Soils (Class D and E) Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Other ^a
Castorland (V)	33	35	6	6
Constableville (V)	31	32	1	14
Copenhagen (V)	0	0	0	0
Croghan (T)	1,059	1,166	73	287
Croghan (V)	234	220	5	33
Denmark (T)	163	230	1	105
Diana (T)	932	643	11	32
Greig (T)	197	228	0	16
Harrisburg (T)	0	2	0	2
Lewis (T)	67	85	1	0
Leyden (T)	80	62	10	21
Lowville (T)	118	95	1	70
Lowville (V)	0	0	0	0
Lyons Falls (V)	109	135	5	3
Lyonsdale (T)	284	343	8	23
Martinsburg (T)	68	80	1	36
Montague (T)	2	0	0	0
New Bremen (T)	728	855	32	236
Osceola (T)	23	15	0	0
Pinckney (T)	6	4	0	1
Port Leyden (V)	42	34	6	0
Turin (T)	66	106	0	22
Turin (V)	5	8	0	0
Watson (T)	773	674	8	77
West Turin (T)	37	21	0	29
Lewis County (Total)	5,057	5,073	169	1,013

Source: Lewis County 2024; NYS GIS 2024; NYSDHSES 2014

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

Table 8-13. Example of Structural Damage State Definitions for a Light Wood-Framed Building

Damage Category	Description
Minor	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.
Severe	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.
Destruction	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

Table 8-14. Severity of Expected Damage for the 500-Year MRP Earthquake Event

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 500-Year Mean Return Period	
			Building Count	% Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	17,899	NONE	17,577	98.2%
		MINOR	267	1.5%
		MODERATE	55	0.3%
		SEVERE	1	<0.1%
		DESTRUCTION	0	0.0%
Commercial Buildings	16,927	NONE	16,813	99.3%
		MINOR	100	0.6%
		MODERATE	13	0.1%
		SEVERE	0	0.0%
		DESTRUCTION	0	0.0%
Industrial Buildings	450	NONE	433	96.2%
		MINOR	12	2.7%
		MODERATE	4	1.0%
		SEVERE	1	0.1%
		DESTRUCTION	0	0.0%
Government, Religion, Agricultural, and Education Buildings	4,886	NONE	4,795	98.1%
		MINOR	85	1.7%
		MODERATE	6	0.1%
		SEVERE	0	0.0%
		DESTRUCTION	0	0.0%

Source: Lewis County 2024; NYS GIS 2024; Hazus v6.1; RS Means 2024

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 8-15 summarizes the estimated damage. Hazus estimates that residential structures in the County will face the largest amount of damage from a 500-year earthquake event.

Hazus also estimates the volume of debris that may be generated as a result of an earthquake to enable the community to prepare for and efficiently manage debris removal and disposal. Debris estimates are divided into two categories: reinforced concrete and steel that require special equipment to break it up before it can be transported; and brick, wood, and other debris that can be loaded directly onto trucks with bulldozers (FEMA 2020). For the 500-year MRP events, Hazus estimates a total of 1,273 tons of debris will be generated county-wide, respectively. Table 8-16 summarizes the estimated debris generated by municipality.

8.2.3 Community Lifelines and Other Critical Facilities

All critical facilities and lifelines in Lewis County are considered exposed to this hazard. All facilities and community lifelines located in areas of Class D or Class E soils are more susceptible to earthquake impacts. Table 8-17 summarizes the number of community lifelines exposed to the earthquake hazard. In total, 253 lifelines (23.4 percent of the total facilities in the County) are vulnerable to earthquakes. Of the 253 community lifelines located in the earthquake hazard area, Transportation, Safety & Security, and Other Critical Facilities have the highest amount of facilities impacted at 61, 58, and 44 facilities respectively.

Table 8-15. 500-Year Mean Return Period – Estimated Losses

Jurisdiction	Total Replacement Cost Value (RCV)	500-Year Mean Return Period - Estimated Losses				
		All Buildings		Residential	Commercial	Other Occupancies
		Loss	Percent of Total RCV			
Castorland (V)	\$209,754,520	\$42,319	<0.1%	\$13,358	\$7,099	\$21,862
Constableville (V)	\$214,011,340	\$58,880	<0.1%	\$24,736	\$13,632	\$20,513
Copenhagen (V)	\$470,894,543	\$89,638	<0.1%	\$28,294	\$15,037	\$46,307
Croghan (T)	\$2,716,704,006	\$1,286,032	<0.1%	\$559,739	\$313,393	\$412,900
Croghan (V)	\$406,813,941	\$141,151	<0.1%	\$61,155	\$35,075	\$44,922
Denmark (T)	\$1,683,271,436	\$403,908	<0.1%	\$127,494	\$67,758	\$208,657
Diana (T)	\$1,337,032,416	\$982,219	0.1%	\$418,941	\$234,128	\$329,150
Greig (T)	\$1,160,581,336	\$451,578	<0.1%	\$282,470	\$122,985	\$46,122
Harrisburg (T)	\$533,636,646	\$155,866	<0.1%	\$50,171	\$27,092	\$78,603
Lewis (T)	\$722,393,059	\$265,938	<0.1%	\$111,721	\$61,568	\$92,649
Leyden (T)	\$1,065,963,460	\$353,636	<0.1%	\$148,563	\$81,872	\$123,201
Lowville (T)	\$1,762,819,749	\$509,279	<0.1%	\$140,201	\$104,103	\$264,976
Lowville (V)	\$1,966,304,011	\$751,250	<0.1%	\$201,688	\$157,573	\$391,989
Lyons Falls (V)	\$376,848,099	\$99,451	<0.1%	\$42,355	\$23,974	\$33,122
Lyonsdale (T)	\$656,114,259	\$261,742	<0.1%	\$141,086	\$76,991	\$43,665
Martinsburg (T)	\$1,847,174,778	\$452,961	<0.1%	\$150,175	\$91,032	\$211,754
Montague (T)	\$232,283,519	\$114,116	<0.1%	\$40,127	\$22,481	\$51,508
New Bremen (T)	\$1,662,197,383	\$746,175	<0.1%	\$335,931	\$186,476	\$223,768
Osceola (T)	\$395,966,698	\$211,683	0.1%	\$88,929	\$49,008	\$73,747
Pinckney (T)	\$275,136,312	\$146,544	0.1%	\$47,602	\$25,890	\$73,053
Port Leyden (V)	\$266,540,832	\$90,514	<0.1%	\$39,068	\$22,676	\$28,770
Turin (T)	\$881,477,564	\$197,790	<0.1%	\$77,612	\$43,029	\$77,149
Turin (V)	\$167,575,852	\$44,293	<0.1%	\$18,608	\$10,255	\$15,431
Watson (T)	\$1,308,062,188	\$460,636	<0.1%	\$294,022	\$117,293	\$49,321
West Turin (T)	\$1,005,138,588	\$332,467	<0.1%	\$139,670	\$76,971	\$115,826
Lewis County (Total)	\$23,324,696,534	\$8,650,068	<0.1%	\$3,583,716	\$1,987,387	\$3,078,964

Source: Lewis County 2024; NYS GIS 2024; Hazus v6.1; RS Means 2024

Table 8-16. Debris Generated by 500-Year Mean Return Period

Jurisdiction	Debris Generated by 500-Year Mean Return Period	
	Brick/Wood (tons)	Concrete/Steel (tons)
Castorland (V)	7	1
Constableville (V)	9	2
Copenhagen (V)	14	2
Croghan (T)	143	27
Croghan (V)	15	3
Denmark (T)	63	10
Diana (T)	114	22
Greig (T)	41	7
Harrisburg (T)	23	4
Lewis (T)	41	8
Leyden (T)	55	11
Lowville (T)	62	11
Lowville (V)	87	16
Lyons Falls (V)	16	3
Lyonsdale (T)	38	7
Martinsburg (T)	59	10
Montague (T)	15	3
New Bremen (T)	79	14
Osceola (T)	33	6
Pinckney (T)	22	4
Port Leyden (V)	15	3
Turin (T)	29	5
Turin (V)	7	1
Watson (T)	37	6
West Turin (T)	52	10
Lewis County (Total)	1,077	196

Source: Lewis County 2024; NYS GIS 2024; Hazus v6.1

Table 8-17. Number of Facilities in NEHRP Soils (Class D and E) Hazard Area, by Lifeline Category

Jurisdiction	Number of Facilities in NEHRP Soils (Class D and E) Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Castorland (V)	0	0	0	0	1	4	0	1	0	6	75.0%
Constableville (V)	0	0	1	0	1	2	3	1	1	9	56.3%
Copenhagen (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Croghan (T)	4	13	1	3	2	14	11	3	13	64	79.0%
Croghan (V)	1	0	0	0	1	2	3	4	5	16	100.0%
Denmark (T)	3	0	0	0	0	1	3	0	3	10	12.3%
Diana (T)	5	1	0	0	3	6	10	0	6	31	56.4%
Greig (T)	0	0	0	0	0	0	2	0	0	2	5.9%
Harrisburg (T)	0	1	0	0	0	0	0	0	0	1	0.8%
Lewis (T)	0	0	0	0	0	2	1	0	0	3	12.5%
Leyden (T)	0	4	0	0	0	1	5	2	0	12	34.3%
Lowville (T)	0	1	0	0	0	0	2	1	3	7	8.0%
Lowville (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Lyons Falls (V)	0	2	0	2	0	2	3	2	3	14	53.8%
Lyonsdale (T)	3	1	0	0	0	4	1	1	0	10	27.8%
Martinsburg (T)	1	0	0	0	1	2	1	1	0	6	3.6%
Montague (T)	0	0	0	0	0	0	0	0	0	0	0.0%
New Bremen (T)	0	6	0	2	1	10	7	1	4	31	81.6%
Osceola (T)	0	0	0	0	0	1	0	0	0	1	4.8%
Pinckney (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Port Leyden (V)	0	4	0	0	0	3	1	0	0	8	32.0%
Turin (T)	0	0	0	0	0	0	1	0	1	2	11.1%
Turin (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Watson (T)	0	2	1	0	0	4	3	1	5	16	59.3%
West Turin (T)	0	0	0	0	0	0	4	0	0	4	14.8%
Lewis County (Total)	17	35	3	7	10	58	61	18	44	253	23.4%

Source: Lewis County 2020, 2024; NYSDEC 2023, 2024; NYS GIS 2024; HIFLD 2024; US Energy Atlas 2024; NYSDHSES 2014

The Hazus earthquake model was used to assign the range or average probability of each damage state category to the critical facilities in Lewis County for the 500-year MRP events. In addition, Hazus estimates the time to restore critical facilities to fully functional use. Results are presented as a probability of being functional at specified time increments (days after the event). For example, Hazus might estimate that a facility has 5% chance of being fully functional at Day 3, and a 95% chance of being fully functional at Day 90. The tables below present the percent probability of sustaining damage, the minimum and maximum damage estimated value for that facility type for the 500-Year MRP.

As a result of a 500-year MRP event, Hazus estimates that community lifelines will remain nearly 100 percent functional. Slight damage will be received to facilities in each lifeline category, with the Water Systems lifeline sustaining the most damage. View Table 8-18 for a full summary.

8.2.4 Natural Resources

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

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

8.2.5 Historic and Cultural Resources

Depending on the magnitude and distribution, events affecting the County could bring devastating loss of life and property to the area in and around historical or cultural landmarks. The primary impacts on historic resources from earthquake would be an increased risk of historical assets, including impacts on structure foundations from the shrink-swell cycle of expansive soils.

Table 8-18. Community Lifelines Average Percent Probability of Sustaining Earthquake Damage for the 500-Year Mean Return Period

Name	Average Percent Probability of Sustaining Damage 500-Year Mean Return Period					Average Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Lifelines									
Communications	96.5%	2.6%	0.8%	0.1%	<0.1%	96.4%	99.0%	99.8%	99.9%
Energy	97.3%	2.0%	0.6%	0.1%	<0.1%	97.2%	99.3%	99.9%	99.9%
Food, Hydration, Shelter	97.1%	2.2%	0.7%	0.1%	0.0%	97.0%	99.2%	99.9%	99.9%
Hazardous Materials	97.0%	2.3%	0.7%	0.1%	<0.1%	96.9%	99.2%	99.9%	99.9%
Health and Medical	99.6%	0.4%	<0.1%	0.0%	0.0%	99.5%	99.9%	99.9%	99.9%
Safety and Security	96.2%	2.8%	0.9%	0.1%	<0.1%	96.2%	98.9%	99.8%	99.9%
Transportation	96.0%	2.9%	0.9%	0.1%	<0.1%	96.0%	98.9%	99.8%	99.9%
Water Systems	95.9%	3.0%	1.0%	0.1%	<0.1%	95.8%	98.8%	99.8%	99.9%

Source: Lewis County 2020, 2024; NYSDEC 2023, 2024; NYS GIS 2024; HIFLD 2024; US Energy Atlas 2024; Hazus v6.1

8.3 FUTURE OCCURRENCES AND PROJECTED CHANGES IN RISK

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

8.3.1 Probability of Future Occurrences

The 2023 State Hazard Mitigation Plan 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 Lewis County (NYS DHSES 2023).

While it is certainly possible for landslides to occur within Lewis County, the current readily available data regarding historic occurrences does not permit any estimation of the frequency of future occurrences. The overall probability of future occurrence is assumed to be low for most of the County.

Based on historical records and input from the Steering Committee, the probability of occurrence for geologic hazards in the County is considered “rare.”

8.3.2 Climate Change Projections and Likely Impacts

Because the impacts of climate change on earthquakes are not well understood, a change in the County's vulnerability as the climate continues to change is difficult to determine. The causes of earthquakes are largely unaffected by atmospheric changes brought on by climate change. Earthquakes are not discussed in local, regional, or national climate impact assessments, highlighting that climate change is not expected to impact their frequency or intensity in the U.S. However, climate change has the potential to magnify secondary impacts of earthquakes and landslides. The County is expected to see an increase in average annual temperatures and precipitation due to climate change. Increased severe storm and heavy rainfall events may elevate the likelihood of a landslide occurring in steep sloped areas because precipitation may fall faster or in larger quantities than the soil can absorb in a given timeframe. However, these changes depend on to what degree steep sloped areas are developed and other climate trends, such as seasonal precipitation and drought, which affect vegetation growth. As a result of the climate change projections discussed above, County's assets located on areas of saturated soils and on or at the base of steep slopes, are at a higher risk of landslides/mudslides because of seismic activity.

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.

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.

8.3.3 Projected Changes in Development and Population

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. Development built in areas with softer NEHRP soil classes, liquefaction, and landslide-susceptible areas may experience shifting or cracking in the foundation during earthquakes because of the loose soil characteristics of these soil classes. However, 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 to lower construction standards.

Lewis County has experienced a slight decrease in its population since 2010. According to the U.S. Census Bureau, the County's population decreased by approximately -0.19 percent between 2010 and 2020. Cornell University's Program on Applied Demographics produced populations projections by County from 2016 to 2040. According to these projections, Lewis County is projected to have a population of 26,156 by 2030 and 25,618 by 2040 as the population decrease is expected to continue (Cornell University 2018). Changes in the density of the population can impact the number of persons exposed to landslide hazards in the area.

8.3.4 Changes in Vulnerability Since 2020 HMP

Lewis County remains a region with low seismic risk, and there have been no significant changes in earthquake risk or major impacts reported since 2020.

9. EXTREME TEMPERATURE

9.1 HAZARD PROFILE

This section provides profile information including description, extent, location, previous occurrences and losses, and the probability of future occurrences.

9.1.1 Hazard Description and Location

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

According to the 2023 New York State HMP, the location of New York State and the typical air masses, combined with the atmospheric circulation, provides general climatic controls for the region, making the entire state susceptible to extreme temperatures. Changes in land elevations and landscape, and its close proximity to large bodies of water play a significant role in the temperatures of New York State. Extended periods of either extreme cold or warm temperatures are a result from movement of great high-pressure systems into and through the eastern United States (DHSES 2023).

Extreme Cold

Extreme cold events are when temperatures drop well below normal in an area. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered “extreme cold.” Extreme cold temperatures are characterized by the ambient air temperature dropping to approximately 0 degrees Fahrenheit (°F) or below (Service 2015). Extensive exposure to extreme cold temperatures can cause frostbite or hypothermia and can become life threatening. Infants and the elderly are most susceptible to the effects of extreme changes in temperatures. Extreme cold also can cause emergencies in susceptible populations, such as those without shelter, those who are stranded, or those living in poorly insulated homes or homes without heat. Infants and the elderly are particularly at risk; however, anyone can be affected (C. f. (CDC) 2007). 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 0° C (NYSERDA 2014). Several health hazards are related to extreme cold temperatures and include wind chill, frostbite, and hypothermia.

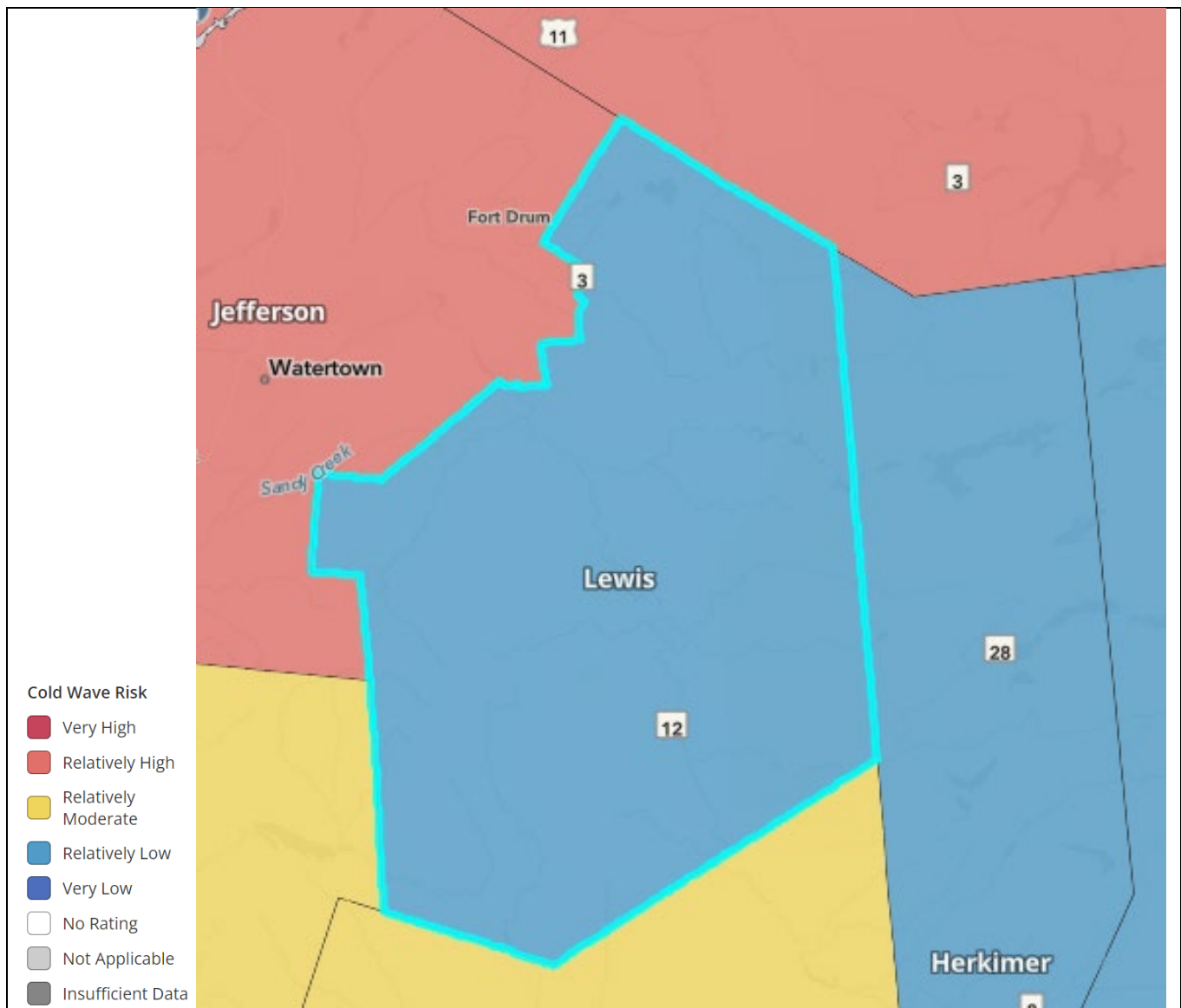
- Wind chill is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature.
- Frostbite is damage to body tissue caused by extreme cold. A wind chill of -20 °F will cause 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 cold in Lewis County can encompass frigid temperatures, heavy snowfall, ice storms, and bitter wind chills. The northeastern location of the state makes it highly susceptible to extreme cold. Varying land elevations, character of the landscape, and large bodies of water play a significant role in the state’s temperatures. Extreme cold temperatures occur throughout most of the winter season and generally accompany most winter storm

events throughout the state. Extensive periods of extreme cold result when great high-pressure systems move into and through the eastern US. Combined with the presence of Arctic air masses, high atmospheric pressure can cause extreme cold conditions to over the State of New York. These conditions typically manifest when arctic air masses under high atmospheric pressure move southward from central Canada or the Hudson Bay, making the State's location in the northeast highly susceptible to extreme cold (NYS DHSES 2019, Cornell University n.d.).

Figure 9-1 shows the Cold Wave, or cold temperatures, Risk Index for Lewis County on the county scale. This index helps to understand the susceptibility of the County to cold temperatures. According to the National Risk Index, on the county scale, the County has a relatively low risk to cold temperatures (FEMA 2019).

Figure 9-1. National Risk Index Score Using the County Scale



Source: FEMA 2025

Extreme Heat

The National Weather Service generally defines a heat wave as a period of abnormally hot weather (typically 10°F or more above average temperatures) generally lasting more than two consecutive days (REF269). Extreme heat-related events can occur during all seasons. However, an extreme heat event in the winter is very different from one in the summer, as what is “extreme” is relative to historical averages for that specific time. Whereas extreme heat events in the winter can result in significant damages to winter crops, summer extreme heat events are more likely to cause health challenges and deaths.

The National Weather Service issues heat advisories, excessive heat warnings and excessive heat watches based on the heat index, along with related communications that inform state and local emergency response and preparations. The heat index, occasionally referred to as the apparent temperature, is a relative measure of humidity and temperature to more accurately reflect physiological experiences of extreme heat than absolute air temperature alone (NYS DHSES 2023).

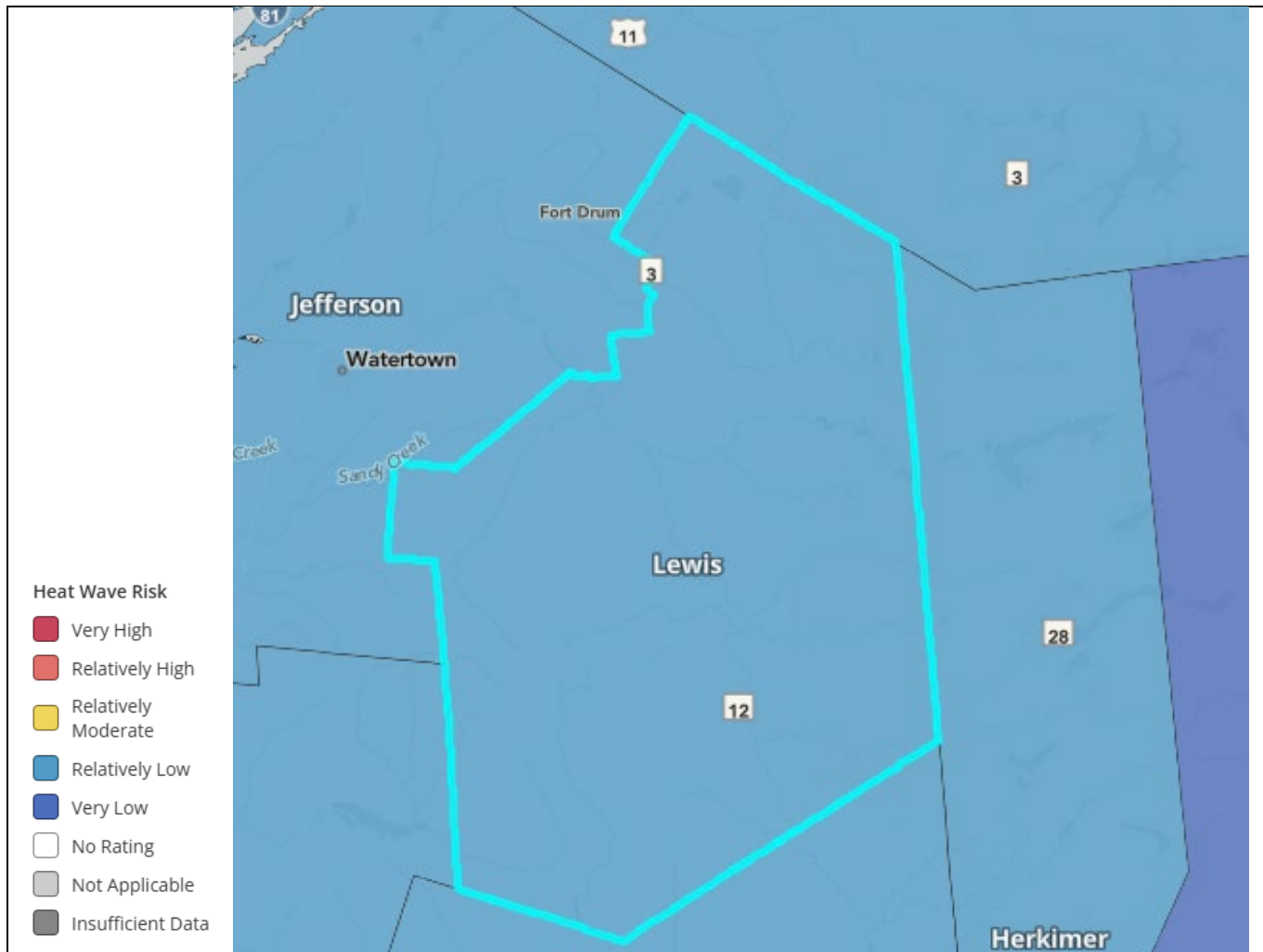
For New York State, heat advisories are issued at the county level when the heat index is predicted to remain above 95°F for 2 or more consecutive days or above 100°F for any period of time (NYS DHSES 2023). Excessive heat warnings are issued at the county level when the heat index is at or above 105°F for 2 hours or more at any location within the affected county or counties. A heat warning means that some people can be seriously affected by heat if precautions are not taken. Mortality begins to increase exponentially as the heat increases or stays above a heat index of 104°F (NYS DHSES 2023). Excessive heat watches are issued one to two days in advance, when the probability the excessive heat warning criteria will be met is 50 to 79 percent (NYS DHSES 2023).

The *urban heat island effect* is a term used to describe higher air and structure temperatures in an urban setting as opposed to the lower temperatures found in more rural areas. With fewer trees in cities and large communities, solar energy is more readily absorbed into manmade structures, causing higher urban area temperatures. The urban heat island effect contributes to higher ambient temperatures, air pollution, greater demands on cooling systems, and health problems related to heat and pollution.

Depending on severity, duration, and location, extreme heat events can create or provoke secondary hazards; these hazards include, but are not limited to, dust storms, droughts, wildfires, water shortages, and power outages (CDC 2017). These secondary hazards could result in a broad and far-reaching set of impacts throughout a local area or 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 ((Adams n.d.); (Meehl 2004); (CDC 2017); (NYSERDA 2014)).

Extreme heat events can occur anywhere in New York State and usually cover a large area, such as an entire county. Risk to extreme heat is based on a combination of sensitivity, exposure, and ability to adapt to extreme heat, meaning people with certain medical conditions, outdoor workers, and those living in isolation and/or lacking access to air conditioning may be particularly vulnerable. Figure 9-2 shows the Heat Wave Risk Index for Lewis County on the county scale. This index helps to understand the susceptibility of the County to extreme heat. According to the National Risk Index, on the county scale, the County has a relatively low risk to extreme heat (FEMA 2019).

Figure 9-2. National Risk Index Score Using the County Scale



Source: FEMA 2025

Extreme heat is one of the leading weather-related causes of death in the United States. On average, 113 people die each year from excessive heat. Figure 9-3 shows the number of weather fatalities based on both a 10-year average and a 30-year average. Heat has the highest average of weather-related fatalities between 1994 and 2023.

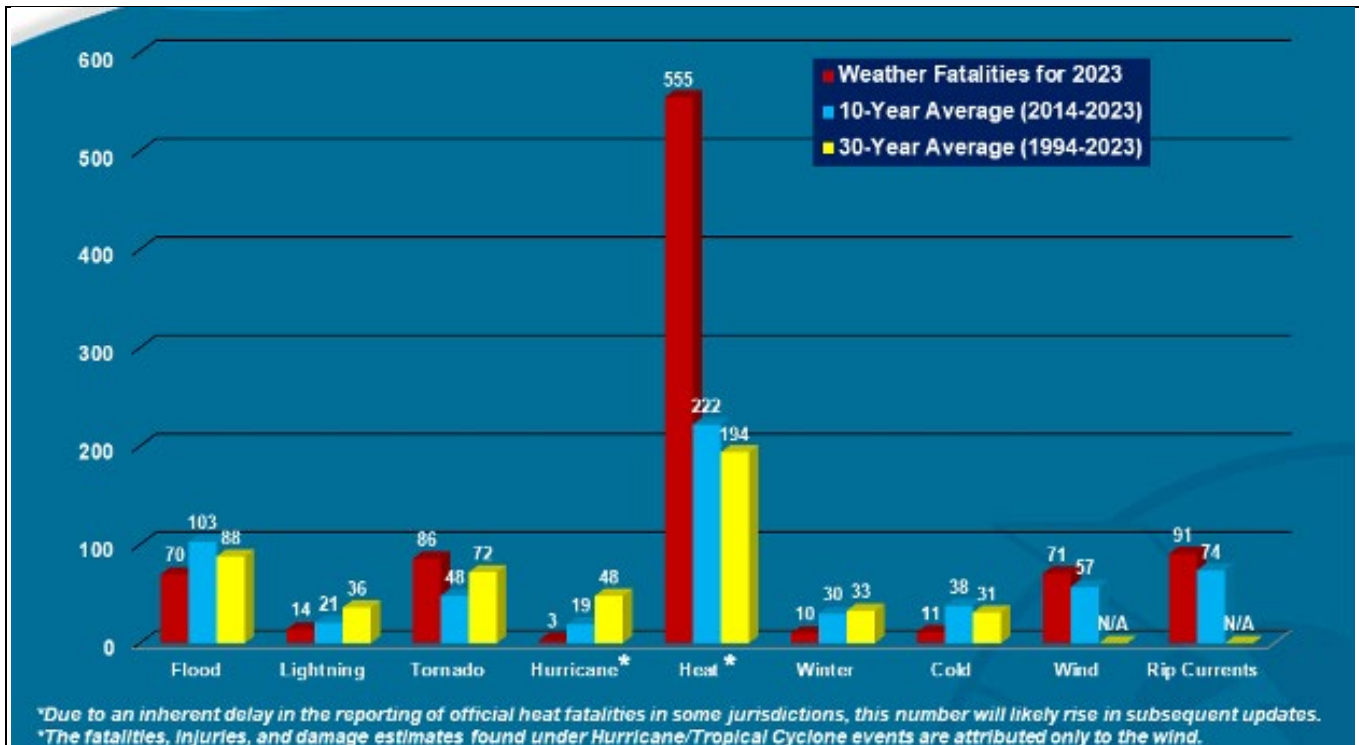
Lewis County is susceptible to both extreme cold and extreme heat temperature events. Extreme temperatures are a function of varying land elevation, topography, and proximity to water bodies, among other factors.

9.1.2 Extent

Extreme Cold

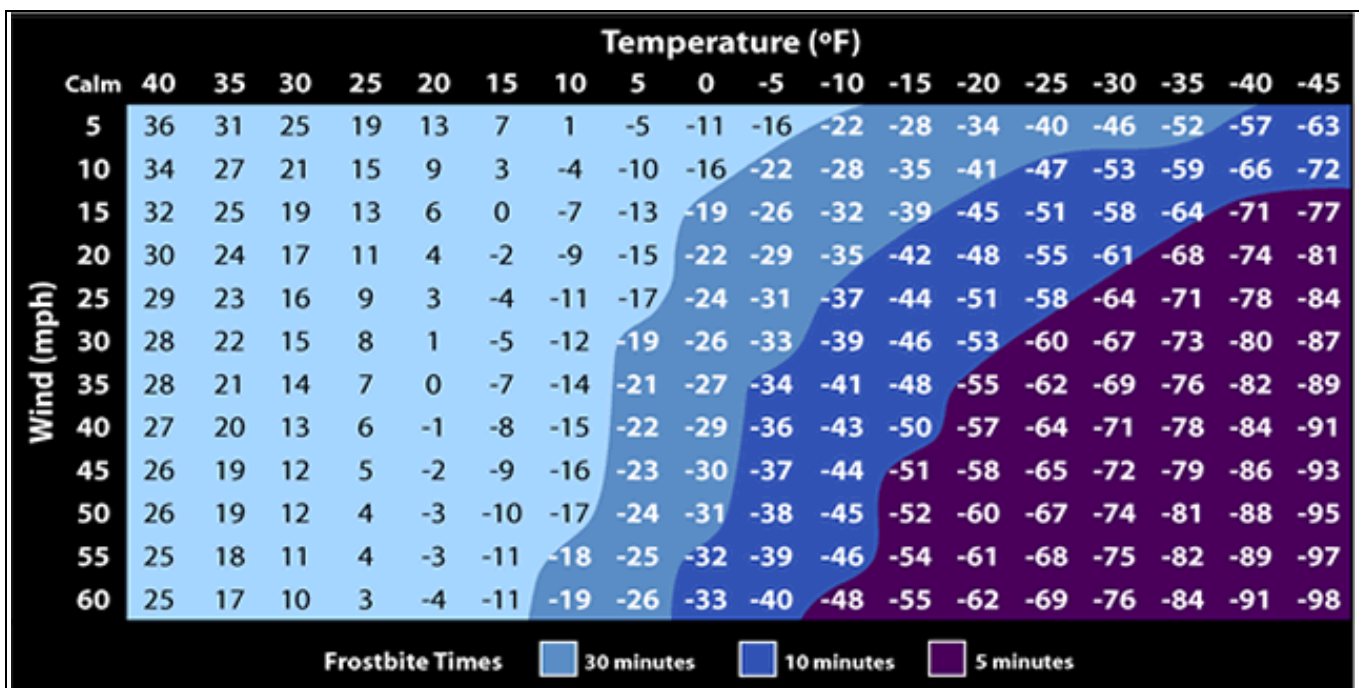
The extent of extreme cold temperatures is generally measured through the Wind Chill Temperature (WCT) Index. The WCT indicates the danger from winter winds and freezing temperatures using a three-factor time-based scale (30 min, 10 min, 5 min). The WCT is presented in Figure 9-4.

Figure 9-3. Average Number of Weather-Related Fatalities in the U.S. in 2023



Source: NWS 2023

Figure 9-4. NWS Wind Chill Index



Source: NWS

The National Weather Service (NWS) issues the nation's Wind Chill Warning, Watch, and Advisory:

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

The NWS issues the nation's Freeze Warning, Freeze Watch, and Frost Advisory:

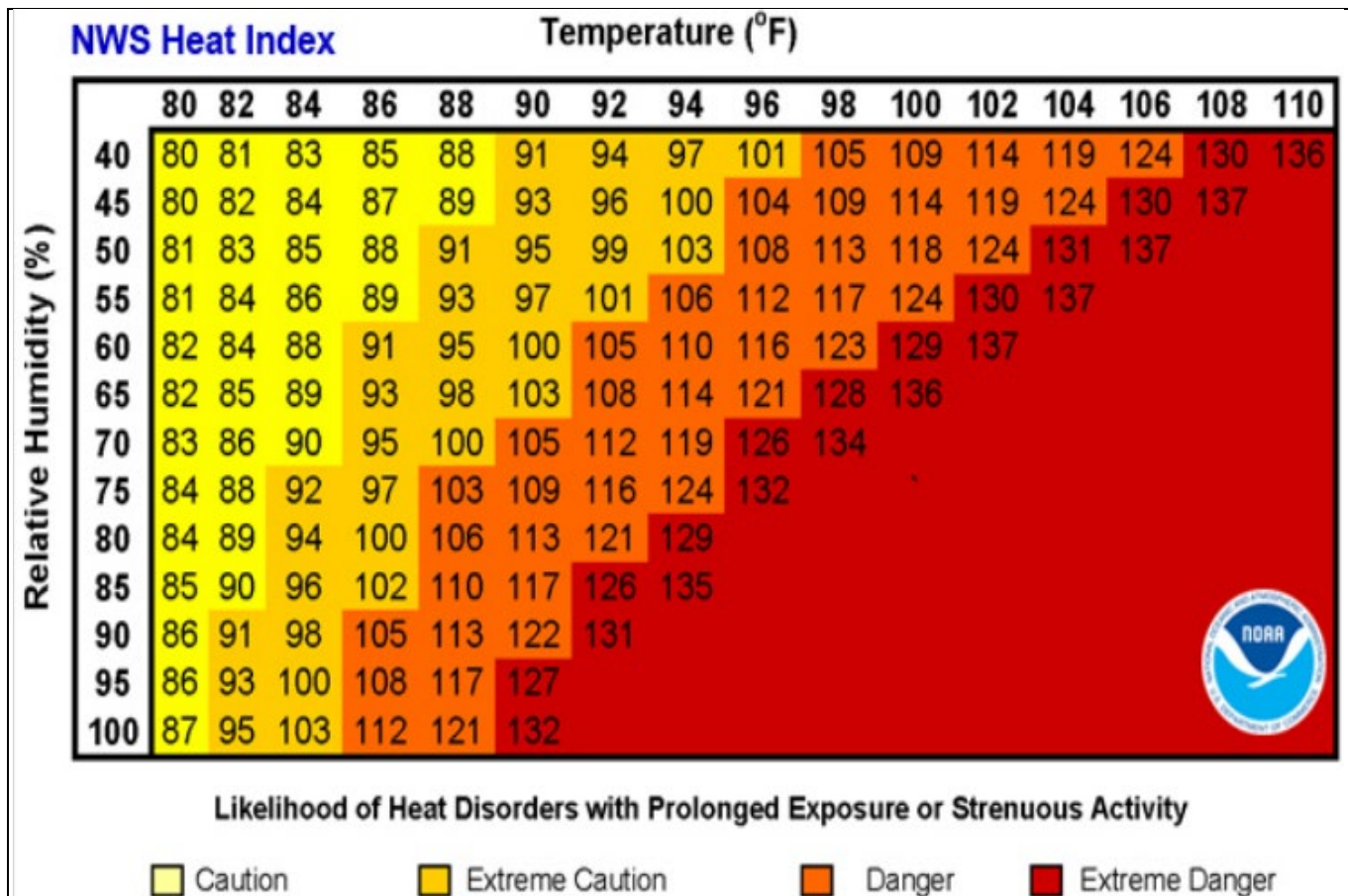
- Hard Freeze Warning—issued when temperatures are expected to drop below 28°F for an extended period, killing most types of commercial crops and residential plants.
- Freeze Warning—issued when temperatures are forecasted to go below 32°F for a long period of time. This temperature threshold kills some types of commercial crops and residential plants.
- Freeze Watch—issued when there is a potential for significant, widespread freezing temperatures within the next 24–36 hours. A freeze watch is issued in the autumn until the end of the growing season and in the spring at the start of the growing season.
- Frost Advisory—A frost advisory means areas of frost are expected or occurring, posing a threat to sensitive vegetation.

Extreme Heat

The extent of extreme heat temperatures is generally measured through the Heat Index, identified in Figure 9-5. Created by the National Weather Service (NWS). The Heat Index chart shown here indicates how hot it really feels when relative humidity is factored in with the actual air temperature. As an example, if the air temperature is 96°F and the relative humidity is 65%, the heat index--how hot it feels--is 121°F. The red area without numbers indicates extreme danger. Since heat index values were devised for shady, light wind conditions, exposure to full sunshine can increase heat index values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous. This provides a measure of how temperatures actually feel to a person; however, the values are devised for shady, light wind conditions. Exposure to full sun can increase the Heat Index by up to 15 degrees (NYSERDA 2014).

The combination of heat and humidity can have even greater impacts on human health than high temperatures alone, especially for people who are particularly vulnerable to extreme heat. The heat index is one way of expressing an “apparent temperature” that combines the effects of temperature and humidity. The National Weather Service urges “extreme caution” with heat index values above 90°F, and it classifies values above 103°F as “dangerous” and values above 125°F as “extremely dangerous.” As a result of climate change, the maximum heat index and the number of days with a potentially harmful heat index are projected to increase across the state (NYS DHSES 2023). Recent research observed increased heat-health risks at temperatures much lower than the current NWS criteria for the study region (NYS DHSES 2023); the New York State Department of Health urges caution at a heat index of 85°F. Figure 9-6 describes the adverse effects that prolonged exposure to heat and humidity can have on an individual.

Figure 9-5. Heat Index Chart



Source: NWS

Figure 9-6 Adverse Effects of Prolonged Exposures to Heat on Individuals

Category	Heat Index	Health Hazards
Extreme Danger	130 °F – Higher	Heat Stroke / Sunstroke is likely with continued exposure.
Danger	105 °F – 129 °F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Extreme Caution	90 °F – 105 °F	Sunstroke, muscle cramps, and/or heat exhaustions possible with prolonged exposure and/or physical activity.
Caution	80 °F – 90 °F	Fatigue possible with prolonged exposure and/or physical activity.

Source: NYSDHSES 2014

The NWS provides alerts when Heat Indices approach hazardous levels. Table 9-1 explains these alerts. In the event of an extreme heat advisory, the NWS 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. Additionally, the NWS includes heat index values in weather forecasts and also provides assistance to the state and local health officials in preparing Civil Emergency Messages during severe heat waves (NYSDHSES n.d.).

Table 9-1. National Weather Service Alerts

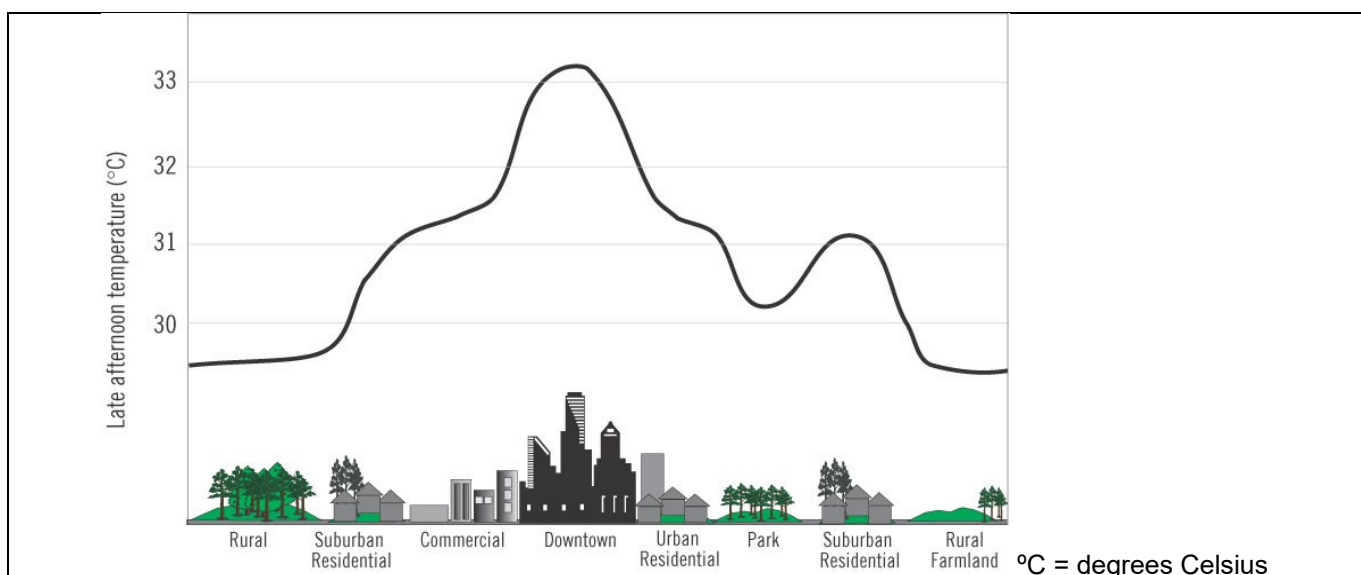
Alert	Criteria
Heat Advisory	Issued 12 hours of the onset of the following conditions: maximum daytime heat index values are to reach between 100°F to 104°F for at least 2 consecutive hours
Excessive Heat Watch	Issued when conditions are favorable for excessive heat in the next 24 to 72 hours
Excessive 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 face elevated risks during an extreme heat event, compared to rural and suburban areas. When natural areas are developed, open land and vegetation is replaced with buildings, roads, and other infrastructure which absorb more solar radiation than the natural land. Additionally, 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 2023). Lewis County is a rural county, with very little urban, developed area.

A heat island refers to built-up areas that are hotter than nearby outlying areas. The annual mean air temperature of a city with more than 1 million people can be between 1.8 °F and 5.4°F warmer than surrounding areas. In the evening, the difference in air temperatures can be as high as 22°F. Heat islands occur on the earth's surface and in the atmosphere. On a hot, sunny day, the sun can heat dry, exposed urban surfaces to temperatures 50°F to 90°F 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 rates of water quality degradation (EPA 2023).

Figure 9-7 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 (EPA 2022).

Figure 9-7. Urban Heat Island Profile


Source: EPA 2019

9.1.3 Previous Occurrences and Impacts

In Lewis County, the Expected Annual Loss associated with extreme cold events is \$62,411, and for extreme heat events it is \$15,164.

FEMA and USDA Disaster Declarations

Between 1954 and 2024, Lewis County was not included in any major disaster (DR) or emergency (EM) declarations for extreme temperature-related events (FEMA 2024).

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 contiguous counties. Between 2020 and 2024, Lewis County was included in there were no USDA extreme temperature-related agricultural disaster declarations.

Previous Events below Disaster Declaration Threshold

Known hazard events that impacted Lewis County between January 2020 and April 2025 are discussed in Table 9-2. For events prior to 2020, refer to the 2020 Lewis County HMP.

Table 9-2. Extreme Temperature Events in Lewis County (2020 to 2024)

Event Date	Description
January 11 – 15, 2022	Jefferson, Lewis, and occasionally Oswego counties experienced nearly nightly sub-zero temperatures with multiple incidents of wind chill values below -30 °F. On January 11, this included Alexandria Bay and Copenhagen at -30 °F. On January 15, this included Croghan at -53 °F, Watertown at -31 °F, Fort Drum at -33 °F, and Osceola at -48 °F.
January 21 – 24, 2022	In Jefferson and Lewis counties, wind chill factors dropped below -30 °F on multiple occasions. On January 21, this included Philadelphia at -46 °F, Watertown at -32 °F, Harrisburg at -38 °F, and Copenhagen at -37 °F. On January 24, this included Philadelphia at -44 °F, Watertown at -37 °F, and Copenhagen at -36 °F.
January 26 – 30, 2022	In Jefferson and Lewis counties, wind chill factors dropped below -30 °F on multiple occasions. On January 26, this included Watertown at -36 °F, Cape Vincent at -31 °F, and Copenhagen at -33 °F. On January 27, this included Philadelphia at -36 °F and Watertown at -32 °F. On January 30, this included Watertown at -39 °F, Belleville at -35 °F, and Copenhagen at -35 °F.

Source: NOAA NCEI 2022

Weather Alerts History

The National Weather Service issues heat advisories when dangerous heat conditions are expected within 24 hours. This could mean temperatures of at least 100 °F or a heat index of at least 105 °F. Heat advisories are issued when conditions are expected to cause significant discomfort or inconvenience but could become life threatening if caution isn't taken.

The National Weather Service issues excessive heat watch alerts when conditions are favorable for an excessive heat event in the next 12 to 48 hours. This means that the risk of a heat wave has increased, but the exact timing and occurrence is still uncertain. The heat index is expected to reach a high of 110°F and not fall below 75°F for at least 48 hours.

Changes in 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 of this plan.

Changes in Population

Lewis County has experienced a slight decrease in population since 2010. According to the U.S. Census Bureau, the County's population decreased by approximately -0.19 percent between 2010 and 2020. Cornell University's Program on Applied Demographics produced populations projections by County from 2016 to 2040. According to these projections, Lewis County is projected to have a population of 26,156 by 2030 and 25,618 by 2040 as the population decrease is expected to continue (Cornell University 2018).

Population change is not expected to have a measurable effect on the overall vulnerability of the County's population over time. However, increases in less densely populated areas of the County may require utility system upgrades to keep up with demands (e.g., water, electricity) during extreme temperature events to prevent increased stresses on these systems. Additionally, by increasing development, green space preservation will need to continue to be a priority to mitigate increased heat islands. Refer to Chapter 3 for a detailed discussion on population changes.

9.1.4 Cascading Impacts

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 Chapter 13 (Severe Storm), Chapter 14 (Severe Winter Storm), and Chapter 15 (Wildfire) for more information about these hazards of concern.

Extreme cold in Lewis County can lead to a variety of cascading impacts that affect infrastructure, public health, economic activity, and the environment. Some of these potential impacts include:

- **Physical and Mental Health Risks**—Exposure to extreme cold can lead to hypothermia, frostbite, and exacerbation of preexisting respiratory and cardiovascular conditions. Elderly individuals, young children, and those without access to adequate heating are particularly vulnerable. Additionally, icy sidewalks and roads increase the risk of falls and injuries. Prolonged cold spells can increase stress, anxiety, and isolation, particularly for individuals already struggling with financial challenges or inadequate housing. Short days and extended periods of staying indoors due to the cold can also contribute to seasonal affective disorder (SAD) and depression.
- **Stress on Emergency and Health Services:** Health services face increased demand for cold-related health issues, such as frostbite, heart attacks, and respiratory problems. Emergency services may

also be strained by road accidents, increased fire risks, and assistance calls related to heating failures or power outages.

- **Energy Demand Surges and Power Outages**—Extreme cold leads to increased demand for heating, potentially overwhelming the energy grid and causing power outages. Outages during extreme cold can be dangerous, leaving residents without heat and increasing the risk of hypothermia or frostbite, particularly among vulnerable populations.
 - **Increased Heating Costs:** Extended periods of cold weather drive up heating costs, which can strain household budgets and increase energy poverty. This is particularly challenging for low-income residents, who may struggle to afford adequate heating, leading to health risks or reduced spending on other essentials.
 - **Increased Risk of House Fires:** Many people use alternative heat sources like space heaters or fireplaces during extreme cold, which can increase the risk of house fires. Power outages also encourage candle use, which can lead to accidental fires. Fire departments may be strained in responding due to icy conditions and increased call volumes.
- **Water Pipe Bursts and Infrastructure Damage**—Freezing temperatures can cause pipes in homes and public infrastructure to burst, leading to water damage, costly repairs, and potential disruptions in water service. Municipal water systems and road infrastructure can also suffer damage, leading to longer-term repair needs and financial strain on local government.
- **Transportation Disruptions**—Extreme cold can create hazardous road conditions due to ice, affecting road safety and slowing traffic. It can also disrupt public transportation, freeze railways, and even delay flights, impacting daily commutes, emergency response times, and the local economy.
- **Impacts on Agriculture and Livestock**—Extreme cold can damage winter crops and threaten livestock, especially if heating systems for animal shelters are disrupted. This can result in economic losses for farmers and impact on the local agricultural sector, which is significant in Lewis County.
- **Environmental Impacts**—Extreme cold can freeze water bodies, affecting fish and other aquatic species that may not survive under extended frozen conditions. It can also stress wildlife that is unprepared for prolonged cold, potentially affecting local biodiversity.
- **Business Disruptions and Economic Losses**—Retail, service industries, and outdoor workers may face closures or reduced hours, leading to income loss and economic strain on local businesses. Construction, which is often seasonal, may experience delays, increasing costs and impacting timelines for community projects.

Extreme heat in Lewis County can create a variety of cascading impacts that affect public health, infrastructure, energy systems, agriculture, and the local economy. Key cascading impacts associated with prolonged or intense heat events in the region include:

- **Increased Energy Demand and Power Outages:** Higher temperatures lead to greater demand for air conditioning, potentially overwhelming the electrical grid. This can result in power outages that leave homes and businesses without cooling, which can be particularly dangerous during heatwaves, as people have limited ways to cool down.
 - **Increased Cooling Costs and Financial Strain on Households:** As residents use more energy for air conditioning, utility bills increase, creating financial pressure for low-income households. This can lead to a choice between cooling and other essentials, heightening the risk of heat-related illness.
- **Physical and Mental Health Risks**—Extreme heat poses a serious risk for heat-related illnesses, including heat exhaustion and heatstroke. Vulnerable populations, such as the elderly, young children, those with preexisting health conditions, and individuals without access to air conditioning, are particularly at risk.

High heat also exacerbates respiratory and cardiovascular issues, increasing emergency calls and hospital admissions. Prolonged heat can lead to stress, anxiety, and irritability, especially when combined with financial strain or limited access to cooling. Research shows that extreme heat can exacerbate mental health conditions, leading to higher rates of aggression, anxiety, and even hospitalizations.

- **Water Supply Strain**—Prolonged heat can reduce water levels in reservoirs, rivers, and wells due to increased evaporation and water demand. This puts stress on the water supply, affecting residential use, agriculture, and firefighting efforts. Water restrictions may be enforced, affecting everyday activities and agricultural irrigation.
- **Increased Wildfire Risk**—Dry, hot conditions elevate the risk of wildfires, especially in wooded or rural areas. Even small fires can spread quickly under extreme heat, posing risks to homes, infrastructure, and public safety. Wildfire smoke also worsens air quality, which can lead to respiratory issues and further health impacts.
- **Public Health System Strain**—Hospitals and emergency services may face increased demand due to heat-related illnesses and complications from preexisting conditions worsened by heat. Emergency services can be overwhelmed during severe heat events, particularly if power outages or water shortages also occur.
- **Transportation Disruptions and Infrastructure Damage**—Extreme heat can cause roads to buckle, warp rail tracks, and damage pavement, which leads to increased maintenance costs and travel delays.
- **Hazardous Work Conditions**—High temperatures can make it hazardous for outdoor workers. Heat stress can immediately impact workers on the job, leading to illnesses such as heat exhaustion, heatstroke, and even death. In the longer term, workers can develop serious and debilitating chronic diseases, impacting the cardiovascular and respiratory systems, as well as the kidneys.
- **Economic Impacts and Business Disruptions**—Businesses, especially those in construction, outdoor services, and agriculture, may reduce hours or halt operations to avoid the health risks of extreme heat. This can lead to lost productivity, reduced revenue, and higher labor costs due to added protective measures or schedule changes.
- **Agricultural Losses**—Heat stress can damage crops, reduce yields, and increase water needs, impacting local agriculture and leading to potential losses for farmers. Livestock may also suffer from heat stress, impacting milk production, weight gain, and reproductive health. This can drive up food prices and affect the local economy.
- **Air Quality Deterioration**—High temperatures increase ground-level ozone, worsening air quality and creating health risks, particularly for individuals with asthma or other respiratory issues. Air pollution can have both immediate health effects and long-term impacts on lung health.
- **Environmental Stress and Ecosystem Disruption**—Heat can increase water temperatures, reducing oxygen levels in rivers and lakes, which harms fish and aquatic life. Prolonged heat also stresses trees and plants, which can lead to die-off, reducing biodiversity and impacting natural landscapes.

9.2 COMMUNITY ASSETS AT RISK

For the extreme temperature hazard, the entire County has been identified as exposed; therefore, all assets are potentially vulnerable. This section discusses potential impacts of extreme temperatures on Lewis County.

9.2.1 People and Communities

Population

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 due to 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 (e.g., with heart disease or high blood pressure); (4) low-income persons that 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 (C. f. (CDC) 2017).

According to NOAA, 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 (NYSERDA 2014).

Across the state, New Yorkers are already experiencing increasingly common and severe effects of extreme heat events, and these events are projected to become widespread, more frequent, severe and prolonged as climate change progresses. Extreme heat impacts unfold unevenly across New York's communities. Heat deaths occur primarily among communities of color, Indigenous Peoples, low-income communities, the rural poor, and people living in isolation. Additionally, exposed indoor and outdoor workers, people experiencing homelessness and housing insecurity, seniors, young children, and pregnant women are particularly vulnerable to impacts (State 2024)

Exposure to excessive heat can pose a number of health risks to individuals. Table 9-3 identifies different health hazards related to extreme heat conditions.

Table 9-3. Health Effects of Extreme Heat

Health Hazard	Symptoms
Sunburn	Redness and pain. In severe cases: swelling of skin, blisters, fevers, and headaches
Dehydration	Excessive thirst, dry lips and slightly dry mucous membranes
Heat Cramps	Painful spasms, usually in muscles of legs and abdomen, and possible heavy sweating
Heat Exhaustion	Heavy sweating; weakness; cold, pale and clammy skin; weak pulse; possible fainting and vomiting
Heat Stroke	High body temperature (104°F or higher), hot and dry skin, rapid and strong pulse, and possible coma

Source: NYSDHSES 2014

Meteorologists can accurately forecast extreme heat event development and the severity of the associated conditions with several days of lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations, implement short-term emergency response actions, and focus on surveillance and relief efforts for those at greatest risk. Adhering to extreme temperature warnings can significantly reduce the risk of temperature-related deaths.

Extreme heat can cause psychological stress and anxiety over a changing climate and associated natural disasters. Additionally, individuals living with mental health challenges may be at increased risk of heat-related morbidity and mortality (State 2024). Outdoor workers and some indoor workers are at a high risk of heat-related illness. As New York State experiences more frequent extreme heat days due to climate change, outdoor workers, such as those in construction, agriculture, and transportation, are at greater risk for heat illnesses.

Overall, heat-related death rates correlate with a range of environmental and social factors including a prevalence of poor housing conditions, poverty, impervious land cover, high land-surface temperatures, and lower access to air conditioning (State 2024).

Economy

Extreme temperature events, both heat and cold, pose growing economic risks to Lewis County. These risks are particularly acute in the agricultural sector, which is central to the county's economy, and in rural infrastructure and small businesses, which are more vulnerable to climate-related disruptions.

Agriculture is a cornerstone of Lewis County's economy, with dairy farming, hay, and corn production being dominant. This sector is highly sensitive to temperature extremes. Extreme heat can reduce milk production in dairy cattle, increase livestock mortality, and stress crops, especially during dry spells or drought-like conditions (NYSDEC n.d.). Extreme cold can damage equipment, increase feed and energy costs, and disrupt transportation of goods. These impacts can lead to reduced yields, higher operating costs, and long-term financial strain for farmers, many of whom operate on thin margins.

Rural poverty in Lewis County exacerbates the economic risks of extreme heat. Many residents work in outdoor or physically demanding jobs (e.g., agriculture, construction, forestry), where heat stress can reduce productivity and increase health risks. Climate-sensitive health problems, including those related to reduced worker productivity, can have broader impacts on the economy. Studies show lower productivity during heat waves. Assuming a pathway toward a 1.5°C rise in global temperature by the end of the twenty-first century, the International Labor Organization "projected that 2.2% of total working hours will be lost to high temperatures globally in 2030—a productivity loss equivalent to 80 million full-time jobs" (State 2024). When temperatures are high, industries may cut labor hours and pay, which requires some workers to put their health at risk by choosing or being pressured to work on extremely hot days to avoid decreasing earnings, which is a significant challenge given rural poverty in New York State.

Extreme cold events can lead to burst pipes, heating system failures, and power outages, resulting in unexpected repair costs and business interruptions. Similarly, extreme heat can cause electrical grid strain, leading to telecommunications and cooling system failures, especially in older or poorly insulated buildings.

In Lewis County, where many businesses are small and locally owned, these disruptions can result in lost revenue, damaged inventory, and increased utility costs. Businesses without backup power or climate control systems are particularly vulnerable to service interruptions during extreme weather.

9.2.2 General Building Stock

All the building stock in the County is exposed to the extreme temperature hazard. Refer to Section 3 (County Profile), which summarizes the building inventory in Lewis County. Extreme heat generally does not impact buildings; however, elevated summer temperatures increase the energy demand for cooling. Losses can be associated with the overheating of heating, ventilation, and air conditioning (HVAC) systems. Extreme cold temperature events can damage buildings through freezing/bursting pipes and freeze/thaw cycles, as well as increasing vulnerability to home fires. Additionally, manufactured homes (mobile homes) and antiquated or poorly constructed facilities can have inadequate capabilities to withstand extreme temperatures.

9.2.3 Community Lifelines and Other 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. Additionally, designating and developing emergency cooling or heating facilities can also enhance the resilience and safety of communities.

9.2.4 Natural Resources

Extreme temperature events—particularly freeze-thaw cycles and prolonged heat waves—are increasingly affecting Lewis County’s natural systems. The county’s forests, rivers, and wetlands are sensitive to these fluctuations. Freeze-thaw cycles have become more erratic due to warming winters, leading to soil destabilization, increased erosion, and stress on native vegetation. Earlier snowmelt and warming periods are altering streamflow patterns in the Black River and its tributaries, which can affect aquatic habitats and water availability. Additionally, extreme heat events have been linked to fish kills and aquatic plant die-offs in shallow lakes and streams, particularly during low-flow periods. These conditions also increase the risk of harmful algal blooms (HABs), which have been observed in nearby counties and pose a growing threat to water quality and recreation ¹.

These disruptions can destabilize food webs, reduce biodiversity, and impair ecosystem services that support agriculture, tourism, and public health.

9.2.5 Historic and Cultural Resources

Lewis County is home to numerous historic buildings, churches, and farmsteads, many of which are vulnerable to extreme temperatures. Extreme cold can cause pipes to freeze and burst, especially in older, uninsulated structures. Repeated freeze-thaw cycles can degrade masonry, roofing, and foundations. Extreme heat can overload HVAC systems, increasing the risk of mechanical failure or fire, particularly in buildings not designed for high temperatures. These risks threaten the structural integrity and preservation of the county’s historic assets.

9.3 FUTURE OCCURRENCES AND PROJECTED CHANGES IN RISK

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

9.3.1 Probability of Future Occurrences

Information on previous extreme temperature occurrences in the County was used to calculate the probability of future occurrence of such events, as summarized in Table 9-4. Based on historical records and input from the Steering Committee, the probability of occurrence for extreme temperatures in the County is considered “frequent.”

Table 9-4. Probability of Future Extreme Temperature Events in Lewis County

Hazard Type	Number of Occurrences Between 1996 and 2024	Percent Chance of Occurring in Any Given Year
Excessive Heat	0	0.00%
Heat	0	0.00%
Extreme Cold/Wind Chill	11	39.29%
Cold/Wind Chill	1	3.57%
Total	12	42.86%

Source: NOAA NCEI 2025

Note: Probability was calculated using the available data provided in the NOAA-NCDC storm events database.

Based on the historic and more recent extreme temperature events in Lewis County, and the future climate projections for this region, the County has a moderate probability of future extreme temperature events. It is anticipated that Lewis 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 Lewis County.

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 in the County increases the share of residents particularly susceptible to this hazard.

9.3.2 Climate Change Projections and Likely 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 sea level rise are already being felt in the state. 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).

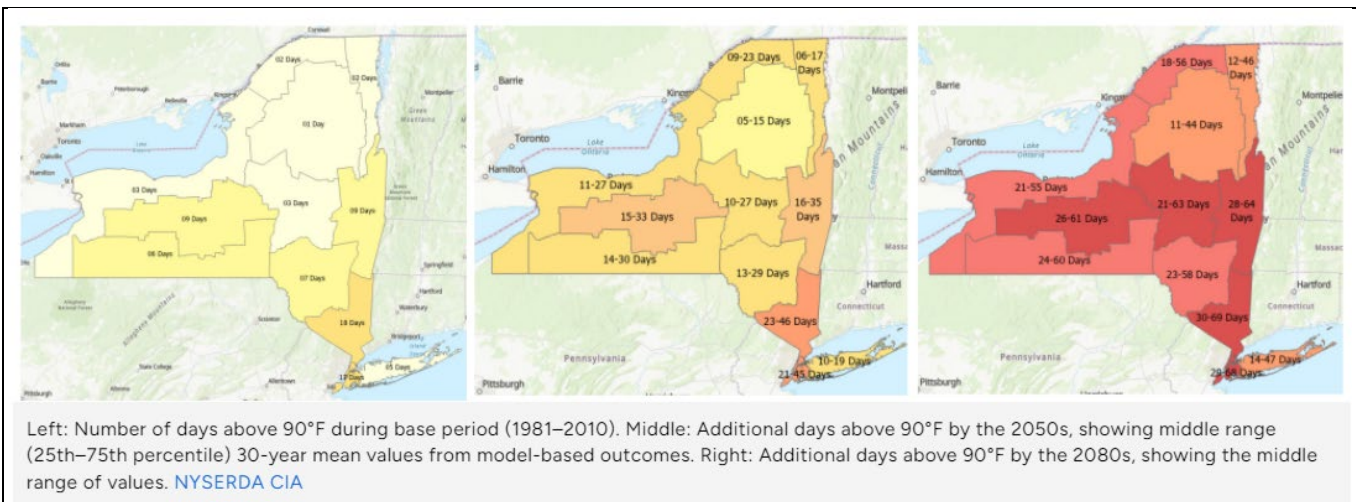
The Northeast is warming faster than many other U.S. regions. Extreme cold events will likely become less frequent because of this and have already become milder (NYS DHSES 2023). For much of North America, including the Northeast, extreme cold events have become less severe over time due to warming temperatures. High-profile severe cold events have still occurred in recent years, but this is likely due to natural variability (NYS DHSES 2023). Impacts from climate change on the duration of individual cold waves are uncertain currently.

Climate change will significantly increase the frequency, severity, and duration of extreme heat events, including multi-day events, in every region of the state, with an expected corresponding increase in impacts without adequate adaptation. Statewide, New York is expected to see a five-fold increase in heat wave days by 2050. By that same year, different regions of New York State are projected to experience between 11 and 30 additional days above 90°F per year, above the 1981–2010 baseline. The number of extreme heat events (periods of three or more days above 90°F) per year in different regions is expected to rise from a baseline of zero to two per year (1981–2010) by an additional one to four extreme heat events per year by the 2050s (NYS DHSES 2023).

In areas where heat events occur less frequently now, extreme heat impacts will occur more frequently and become more widespread by mid-century. Due to the relatively rapid change in frequency, severity, and duration of extreme heat events, New York State will experience new impacts while existing impacts may be significantly exacerbated if no adaptive measures are taken.

NYSERDA's Climate Impacts Assessment (CIA) projects changes in heat-related extremes across 12 regions, each described in Figure 9-8. The CIA provides projections for the following heat-related extremes: days over 90°F, days over 95°F, number of heat waves, average length of heat waves, maximum heat index, days heat index is over 85°F, and days heat index is over 95°F.

Figure 9-8. NYS Heat Projections by CIA Region



By the 2050s, different regions of New York State are projected to experience an additional five to 46 days above 90°F per year above their 1981–2010 baselines (NYSERDA). The Adirondack region which includes Warren, Essex, Franklin, St. Lawrence, Hamilton, Herkimer, and Lewis counties has relatively low baseline levels for extreme heat-related events. The region is projected to experience more days over 95°F and heat waves within the next decade, but not to a significant extent. By the 2050s, it may have significantly more of these events under a high-end estimate. The average length of heat waves is not projected to meaningfully change (NYS DHSES 2023).

The shifts in temperatures could also result in hotter extreme heat events. With increased temperatures, vulnerable populations could face increased susceptibility to extreme heat and 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. Thus, building efficiency and upgrading heating and cooling technology/HVAC will become an increasingly important issue for businesses and homeowners over the coming years.

9.3.3 Projected Changes in Development and Population

Areas targeted for future growth and development have been identified across Lewis County. Any areas of growth could be potentially impacted by the extreme temperature hazard because the entire County is exposed and potentially vulnerable. 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 of this plan.

9.3.4 Changes in Vulnerability Since 2020 HMP

Data from the NOAA Storm Events Database show a decline in the frequency and severity of extreme cold events in Lewis County since 2020. While cold snaps still occur, record-breaking low temperatures have become less common, and cold durations are shorter. Winter storm impacts (e.g., ice storms, snow squalls) remain a concern, though not always tied to extreme cold.

According to the New York State Heat Risk and Illness Dashboard, extreme heat is the leading cause of weather-related deaths in New York State. The frequency of days with high heat index values (above 90°F) has increased in upstate counties, including Lewis County, particularly during the summer months (May–September).

Emergency department visits and EMS calls for heat-related illnesses (e.g., heat exhaustion, heat stroke) have shown an upward trend statewide, with rural counties like Lewis seeing increased vulnerability due to limited cooling infrastructure (NYSDOH 2025).

10. FLOOD

10.1 HAZARD PROFILE

10.1.1 Hazard Description and Location

Flooding is one of the most common and recurrent hazards affecting New York State, and Lewis County is no exception. Flooding in Lewis County typically results from heavy rainfall over short or extended periods, rapid snowmelt, or ice jams on rivers and streams. Additional causes include blockages in drainage infrastructure and, more rarely, the failure of dams or other water control structures. Flood events can occur during any season and may result in impacts, including damage to homes and infrastructure, erosion, loss of agricultural productivity, disruption of transportation networks, and public health threats.

Because much of Lewis County is rural and mountainous with a network of rivers and streams—including the Black River, Moose River, Beaver River, and Indian River—many communities, roadways, and agricultural lands are located in or near flood-prone areas. Flooding is particularly hazardous in areas with steep slopes, narrow valleys, and older infrastructure not designed for current storm intensities.

In recent years, flooding has been exacerbated by climate change, which has increased the frequency and intensity of extreme precipitation events. Culverts, bridges, and drainage ditches originally designed for smaller storms are increasingly unable to handle new extremes, leading to more frequent flash flooding and road washouts.

The following flood types are included in this hazard profile for Lewis County:

- Riverine
- Flash
- Ice JAM
- Pluvial (local stormwater, drainage and urban flooding)
- Dam failure

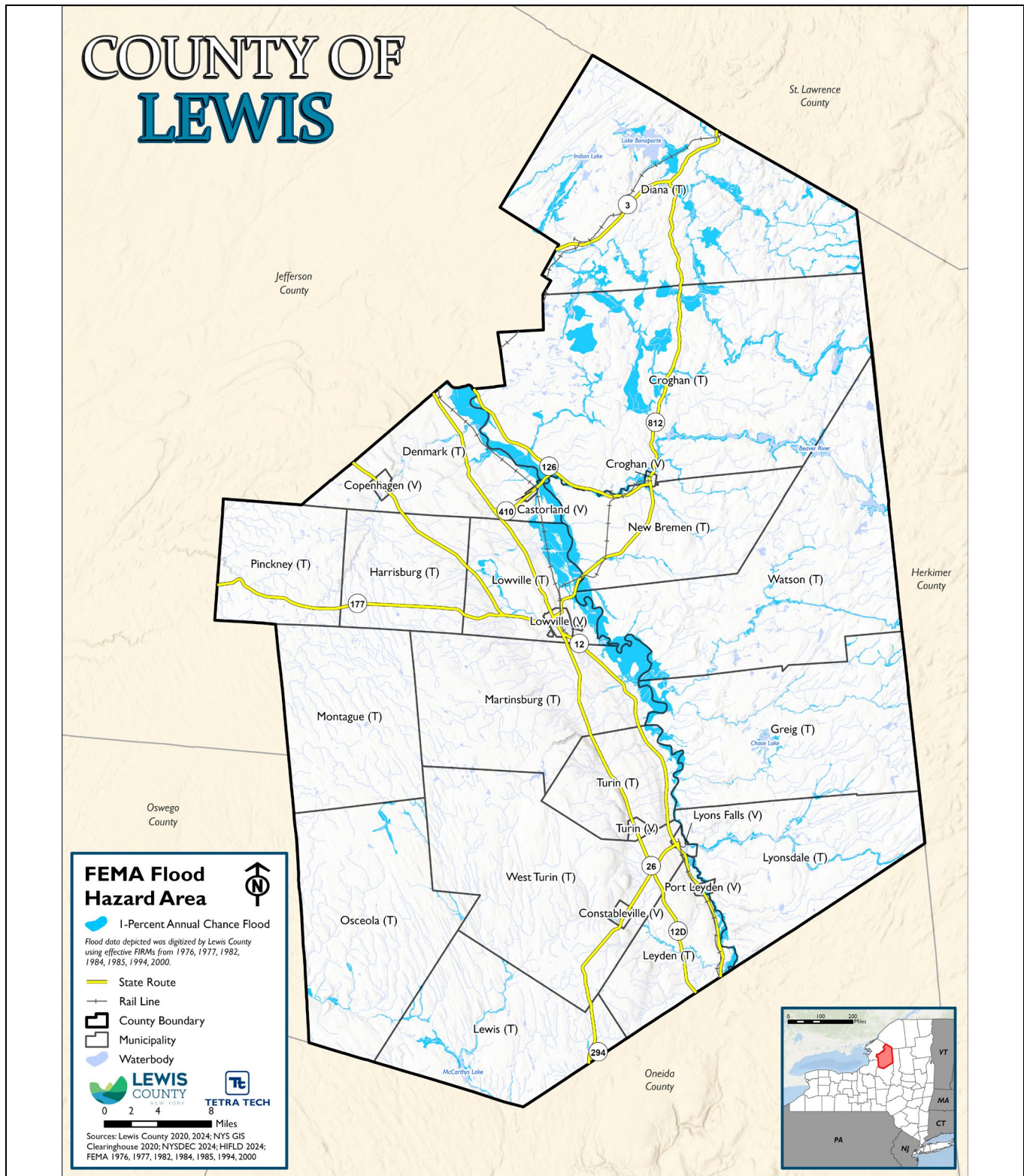
Riverine Flooding

Riverine flooding occurs when rivers or streams overflow their banks due to heavy rainfall, snowmelt, or a combination of both. This type of flooding is common throughout New York. Historically, many communities have settled along large rivers, including the Black River, Moose River, Beaver River, and their narrow tributaries. Many flood-prone areas are located where streams pass through narrow valleys or low-lying agricultural areas. Riverine flooding includes both overbank flooding, which develops more gradually from prolonged rainfall or snowmelt, and flash flooding, which occurs rapidly due to intense rainfall over a short period. (FEMA 2019).

Floodplains

A floodplain is an area that inundates when floodwater exceeds the capacity of the main channel, or water escapes the channel through bank erosion. These areas are typically flat land adjacent to a river, creek, or stream that is subject to periodic inundation. In Lewis County, floodplains are commonly found along rivers and streams. (refer to Figure 10-1).

Figure 10-1. Flood Hazard Areas in Lewis County



Note: The map only depicts the 100-year flood event, as data was unavailable for the 500-year flood event.

Floodplain boundaries may change over time due to development, changes in impervious surface area, placement of structures in floodways, altered precipitation and runoff patterns, advancements in topographic measurement, or the use of updated hydrologic and hydraulic modeling techniques.

The floodplain describes the area inundated by the “100-year” flood, or a flood that has a 1-percent chance in any given year of being equaled or exceeded. 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 (FEMA 2020). Additional definitions relating to flood maps can be seen in Table 10-1.

Table 10-1. Flood Map Terms

Term	Description
Special Hazard Flood Areas (SFHAs)	Labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30.
Zone B or Zone X (shaded)	Moderate flood hazard areas 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 2020

A floodplain is made up of the following components (FEMA 2019, US DHS 2019):

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

Floodplain mapping is based on riverine and coastal flooding conditions. Urban and stormwater flooding and future conditions (e.g., sea level rise and rainfall areas) are not reflected in FEMA floodplain mapping. As such, FEMA floodplain maps may underestimate flood risk in many areas in the region. As a result, the public may also underestimate risk.

In FEMA maps, floodplains areas are identified as Special Flood Hazard Area (SFHA). SFHAs are defined as the area that will be inundated by the flood event that has a 1-percent chance of being equaled to or exceeded in any given year. It should be noted that areas located outside of the SFHA can be subject to flooding and may even act as an unofficial floodplain. Flooding outside of the SFHA area may include stormwater or urban flooding and flash flooding.

Local communities such as Lyons Falls and Croghan are particularly vulnerable due to their proximity to major waterways and floodplains. Agricultural land along the Black River valley is also at high risk. Some key areas most vulnerable to riverine flooding in Lewis County:

- Black River Corridor

- Towns of Denmark, Lowville, New Bremen, and Croghan
- Villages of Lowville, Carthage, and Castorland
- Repeated flooding impacts agricultural lands, county roads, and the Black River Trail corridor
- Beaver River and Tributaries:
 - Communities such as Croghan, Beaver Falls, and Naumburg
 - Flashy river response to snowmelt and rainfall due to steep terrain and forested watersheds
- Moose River Basin (southern Lewis County):
 - Particularly within the Town of Lyonsdale, near Lyons Falls
 - Risk of combined flooding from tributaries and the main river channel
- Indian River Watershed (northern Lewis County):
 - Including areas in Towns of Diana and Croghan
 - Vulnerability increases near confluences and bridge constraints
- Mill Creek and Otter Creek Areas:
 - Includes Town of Greig and Turin
 - Narrow valleys contribute to overbank flooding and culvert overtopping

These areas have experienced recurring flood events, road washouts, and agricultural damage. Continued development near stream banks and undersized infrastructure heightens the risk.

Flash Flooding

Flash floods are characterized by rapid-onset flooding that occurs within minutes or hours of excessive rainfall. According to the National Weather Service (NWS), flash floods generally result from heavy or excessive precipitation within a six-hour period but can also occur due to dam or levee failures, or sudden releases caused by ice or debris jams (National Weather Service 2009). These floods often create dangerous, high-velocity torrents that sweep through river valleys, steep terrain, and urban areas with limited warning.

The highest number of flood-related fatalities in the U.S. are caused by flash floods. There are rarely any warning signs prior to flash flooding, making it extremely dangerous. As little as six (6) inches of moving water can knock a person down, and two (2) feet of moving water can sweep a vehicle away (NYS DHSES 2023). A flash flood can wash away stream banks, roads, people, and vehicles, carve out new water channels, rip trees and other vegetation out of the ground, wash out culverts, and destroy buildings and bridges as it sweeps through an area.

Most flash flooding is caused by slow-moving or stalled thunderstorms, by thunderstorms repeatedly moving over the same area, or by heavy rains from hurricanes and tropical storms. Heavy, sustained rain can create rapid flooding within a few hours or even minutes, and flooding can occur miles away from where the rain fell (NYS DHSES 2023).

Lewis County's steep terrain and forested landscape make it especially vulnerable to flash flooding in narrow stream alleys and undeveloped areas. Storms producing 2 inches or more of rainfall in short duration have historically overwhelmed drainage systems and caused localized damage in both rural hamlets and forested road corridors. Many roads and culverts in the western and southern portions of the county are prone to overtopping or washout during such events.

Local roads near Otter Creek, Deer River, and Mill River have been impacted by recent flash floods, especially during spring and summer thunderstorms or following rapid snowmelt.

Some of the areas with higher flash flood risk include:

- Beaver River Corridor (Croghan, Beaver Falls, Naumburg)—Narrow valleys and steep topography contribute to rapid runoff and debris blockage.
- Mill Creek Watershed (Greig and Watson)—Flash flooding along rural roads and culverts during late spring and summer storms.
- Otter Creek (Turin, West Turin)—Fast response to rainfall due to slope and channel construction near road crossings.
- Moose River Valley (Lyonsdale, Lyons Falls)—Vulnerable to high water velocities, culvert blowouts, and overtopped roads.
- Fish Creek Tributaries (Osceola Area)—Minimal development but high susceptibility to washouts and trail erosion.
- Route 812 Corridor (between Lowville and Croghan)—Stormwater overwhelm in low points where roads cross small tributaries.
- East Road and Number Four Road (Lowville and Watson)—Repeated reports of flooding and erosion from quick-moving summer storms.

Even outside of mapped flood zones, Lewis County's terrain, culvert limitations, and rapid precipitation response make flash flooding a significant hazard. Flash floods are often difficult to predict and may cause severe damage with little to no warning.

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 (NESEC 2021). 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. For example, 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 (FEMA 2023).

The process of ice jam formation typically involves the following steps:

- Freezing—As temperatures drop, the surface of the river or stream begins to freeze, forming a layer of ice.
- Ice Accumulation—As the winter continues, more ice accumulates and thickens on the river's surface.

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.

Source: Invalid source specified.

- **Breaking and Movement**—Fluctuations in water flow or warming temperatures cause the ice to break apart and move downstream.
- **Obstruction and Accumulation**—The moving ice encounters obstacles, such as bends in the river or debris, causing it to pile up and form a jam.
- **Backwater Effect**—As the ice jam grows, it can create a temporary dam effect upstream, causing water to back up and leading to localized flooding.

Once an ice jam forms, it can persist until it breaks apart or melts due to rising temperatures. The breaking of an ice jam can result in a rapid surge of water downstream, leading to flooding in affected areas.

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).

Ice jam flooding in Lewis County, New York, is most likely to occur along rivers and creeks that experience freeze-thaw cycles and have obstructions, bends, or bridges that can trap ice. This type of flooding typically occurs in late winter or early spring when ice begins to break up but is blocked by narrow points in a waterway.

Pluvial Flooding (Local Stormwater, Drainage, and Urban Flooding)

Pluvial flooding occurs when rainfall overwhelms the capacity of natural or man-made drainage systems, leading to ponding or flowing water in areas not adjacent to defined rivers or streams. This type of flooding is increasingly common in both urban and rural areas of Lewis County, particularly during high-intensity rainfall events or when ground conditions prevent adequate infiltration.

In urban environments, pluvial flooding—often referred to as urban flooding—is typically caused by impervious surfaces such as roads, sidewalks, rooftops, and parking lots, which reduce the land’s natural ability to absorb water. As a result, rainwater runs off quickly, accumulating in low-lying areas, roadways, and drainage basins. When stormwater systems are undersized, blocked, or otherwise unable to handle the volume of water, localized flooding can occur.

Stormwater flooding is a subset of pluvial flooding that stems from inadequate or overwhelmed stormwater management systems. Localized stormwater flooding refers to flooding that occurs within the built environment (e.g., certain streets, parking lots, intersections) and can result from even minor storms. In some areas of Lewis County, aging infrastructure or limited stormwater controls have contributed to repeated nuisance flooding, especially during heavy downpours or spring thaw. During winter or early spring, frozen or saturated ground conditions further reduce infiltration, increasing the risk of surface water accumulation and basement seepage.

Stormwater runoff overloads drainageways and flows into the streets and low-lying areas. Sewers back up; yards are inundated. Homes and businesses are flooded, especially basements and the lower part of first floors. Localized flooding poses most of the same problems caused by larger floods, but because it typically has an impact on fewer people and affects small areas, it tends to bring less state or federal involvement such as funding, technical help, or disaster assistance. As a result, the community and the affected residents or business owners are left to cope with the problems on their own. Flooding of this type tends to recur and present small impacts that accumulate over time and become substantial problems for communities (NYS DHSES 2023).

Drainage system flooding can be caused by a variety of influences. If an area experiences significant rainfall, culvert capacity may be exceeded. If this occurs, drainage ditches may fill and flood into the road and other areas. Drainage systems can also be blocked by debris and sediment, which can lead to further flooding due to debris reducing or blocking the flow of water in drainage ditches and culverts.

Urban flooding refers to the inundation of urban areas, such as cities and towns, caused by heavy rainfall or the overflowing of drainage systems. Unlike rural areas with more natural land cover and porous surfaces, urban environments have extensive impervious surfaces like roads, pavements, and buildings that limit the natural infiltration of rainwater into the ground. This results in increased surface runoff, which can overwhelm drainage systems and lead to flooding in urban areas. Additionally, urbanization often alters natural watercourses and wetlands, further reducing the area available for water storage and drainage.

According to the National Weather Service (2009), urban flooding includes the inundation of streets, underpasses, and storm drains, and can occur far from mapped floodplains. This flooding may develop quickly during extreme precipitation events and can damage property, block critical roadways, and overwhelm emergency response systems. Unlike riverine flooding, pluvial flooding is often poorly mapped and underrepresented in risk assessments.

Urban development compounds these risk by increasing runoff and shortening the time it takes for water to reach nearby streams or storm drains. This accelerated runoff may also contribute to downstream flooding. With climate change contributing to more frequent and intense rainfall events, communities in Lewis County may face growing challenges related to pluvial flooding (Center for Disaster Resilience, 2018).

In many cases, urban flooding has little to do with bodies of water and happens in places that are well outside of mapped floodplains. Even small amounts of rain can overwhelm the deteriorated or inadequate infrastructure found in many urban areas, especially in impoverished, neglected, and/or socioeconomically isolated urban communities (NYS DHSES 2023). Flood waters can cause sewage lines to back up, potentially exposing individuals to bacteria that can make them sick. With limited or no drainage, flood waters can sit stagnant for long periods of time, exacerbating the potential damage to buildings and infrastructure in the flooded area.

Local stormwater and drainage flooding in Lewis County, New York, is most likely in areas where stormwater systems are either insufficient for large volumes of runoff or poorly maintained. This type of flooding typically occurs in areas with significant urban development, poor drainage infrastructure, or low-lying spots that naturally accumulate water. Key areas include low-lying areas, commercial and residential developments, rural roadways and intersections, and suburban developments with older infrastructure.

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 2007).

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 (USGS 2016).

Dam Failure

A dam is an artificial barrier allowing storage of water, wastewater, or liquid-borne materials for many reasons (flood control, human water supply, irrigation, livestock water supply, energy generation, containment of mine tailings, recreation, or pollution control). Many dams fulfill a combination of these stated functions (Association of State Dam Safety Officials 2023). Dam failure is any malfunction or abnormality outside of the design that adversely affects a dam's primary function of impounding water and potentially leads to a sudden, rapid, and uncontrolled release of water (USSD 2023). The risks that are associated with dams must always be minimized and maintained properly, including safety inspections, technical review of a proposed new dam, monitoring and enforcement of dam safety criteria and emergency preparedness (NYSDEC n.d.).

Man-made dams can be classified by the type of construction material used, methods applied in construction, slope, or cross-section of the dam, how a dam resists forces of water pressure behind it, means used to control seepage, and occasionally, purpose of the dam. Materials used for construction of dams include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, miscellaneous materials (plastic or rubber), and any combination of these materials (Association of State Dam Safety Officials 2023). Dams are built for the purpose of power production, agriculture, water supply, recreation, and flood protection.

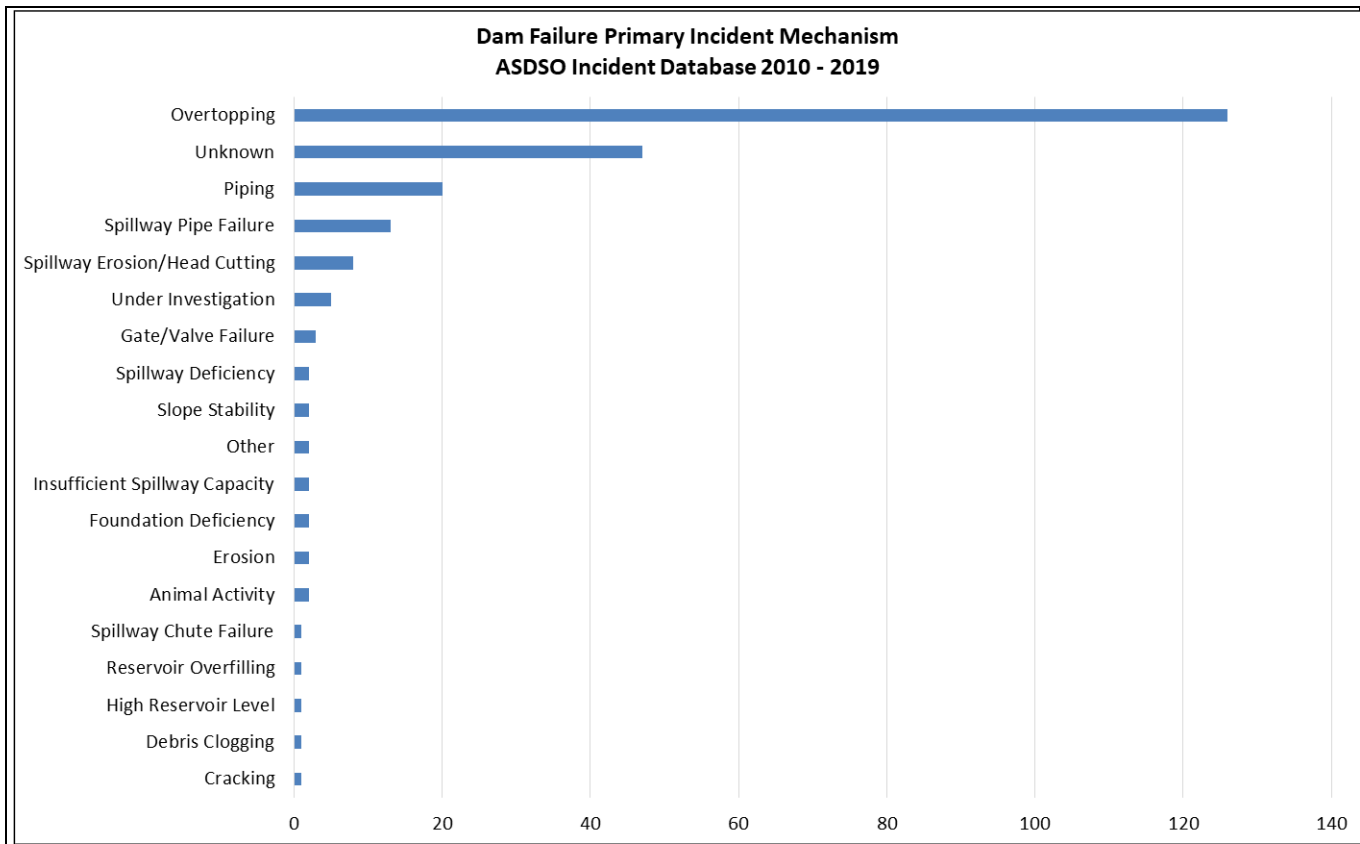
More than a third of the nation's dams are at least 50 years old. Approximately 15,000 of those dams pose a significant hazard to life and property if failure occurs. About 2,000 unsafe dams are dispersed throughout the United States in almost every state.

Dams typically fail when spillway capacity is inadequate and excess flow overtops the dam or when internal erosion (piping) through the dam or foundation occurs. Complete failure occurs if internal erosion or overtopping results in a complete structural breach, releasing a high-velocity wall of debris-filled water that rushes downstream, damaging or destroying anything in its path (FEMA 2018).

Figure 10-1 shows the primary causes of dam failures, nationally. Dam failures can result from one or a combination of the following (ASDSO 2024):

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

Figure 10-2. Dam Failure Causes



Source: (ASDSO 2024)

Regulatory Oversight of Dams

Potential for catastrophic flooding caused by dam failures led to passage of the NDSP (Public Law 92-367). For 30 years, the NDSP has protected Americans from dam failure. NDSP is a partnership among the states, federal agencies, and other stakeholders that encourages individual and community responsibility for dam safety. Under FEMA's leadership, state assistance funds have allowed all participating states to improve their programs through increased inspections, emergency action planning, and purchase of needed equipment. FEMA has also expanded existing training programs and initiated new training programs (FEMA 2022). Grant assistance from FEMA provides support for improvement of dam safety programs that regulate most dams in the United States (FEMA 2023).

The State of New York has a comprehensive dam safety program through which three governmental authorities regulate dam safety throughout the state:

NYSDEC—Environmental Conservation Law (ECL) Article 15, Part 673

FERC—18 Code of Federal Regulations (CFR) 12.22-24

USACE—EP 1110-2-13, Dam Safety Preparedness

Dam safety EAPs are formal dam failure procedures written by the dam owner/operator. EAPs are site-specific plans and relate only to the facility's procedures to prevent/mitigate occurrence of a catastrophic dam failure. USACE is responsible for submitting an EAP for each dam it owns, operates, and maintains. EAPs for

hydroelectric dams fall under the purview of FERC, and NYSDEC regulates dam safety and EAPs for all dams in New York.

New York State Department of Environmental Conservation

The New York State Department of Environmental Conservation's (NYSDEC) Dam Safety Section is responsible for safety inspection of dams, technical review of proposed dam construction or modification, monitoring of remedial work for compliance with dam safety criteria, and emergency preparedness for all dams in the state. NYSDEC is responsible for more than 100 flood control projects throughout the state, most of which were constructed by US Army Corps of Engineers (USACE) and are operated and maintained by NYSDEC (in some cases with local municipal partners) (NYSDEC 2014).

The State inspects high hazard dams every two years and moderate hazard dams every four years. To support emergency planning efforts and raise awareness among local officials and emergency managers, a copy of each inspection report is sent to the chief executive of the community in which the dam is located. Municipal officials or emergency managers from any municipality in the dam's inundation area may receive a copy of the inspection report upon request (NYSDEC 2023).

United States Army Corps of Engineers Dam Safety Program

USACE is responsible for safety inspections of some federal and non-federal dams in the United States that meet size and storage limitations specified in the National Dam Safety Act, including the 80 dams identified in the USACE National Inventory of Dams (NID). USACE has inventoried dams and has surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of dams. USACE has also developed guidelines for inspection and evaluation of dam safety (USACE 2014).

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) has the largest dam safety program in the United States. FERC cooperates with many federal and state agencies to ensure and promote dam safety and, more recently, homeland security. FERC staff inspect hydroelectric projects on an unscheduled basis to investigate the following (FERC 2020):

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

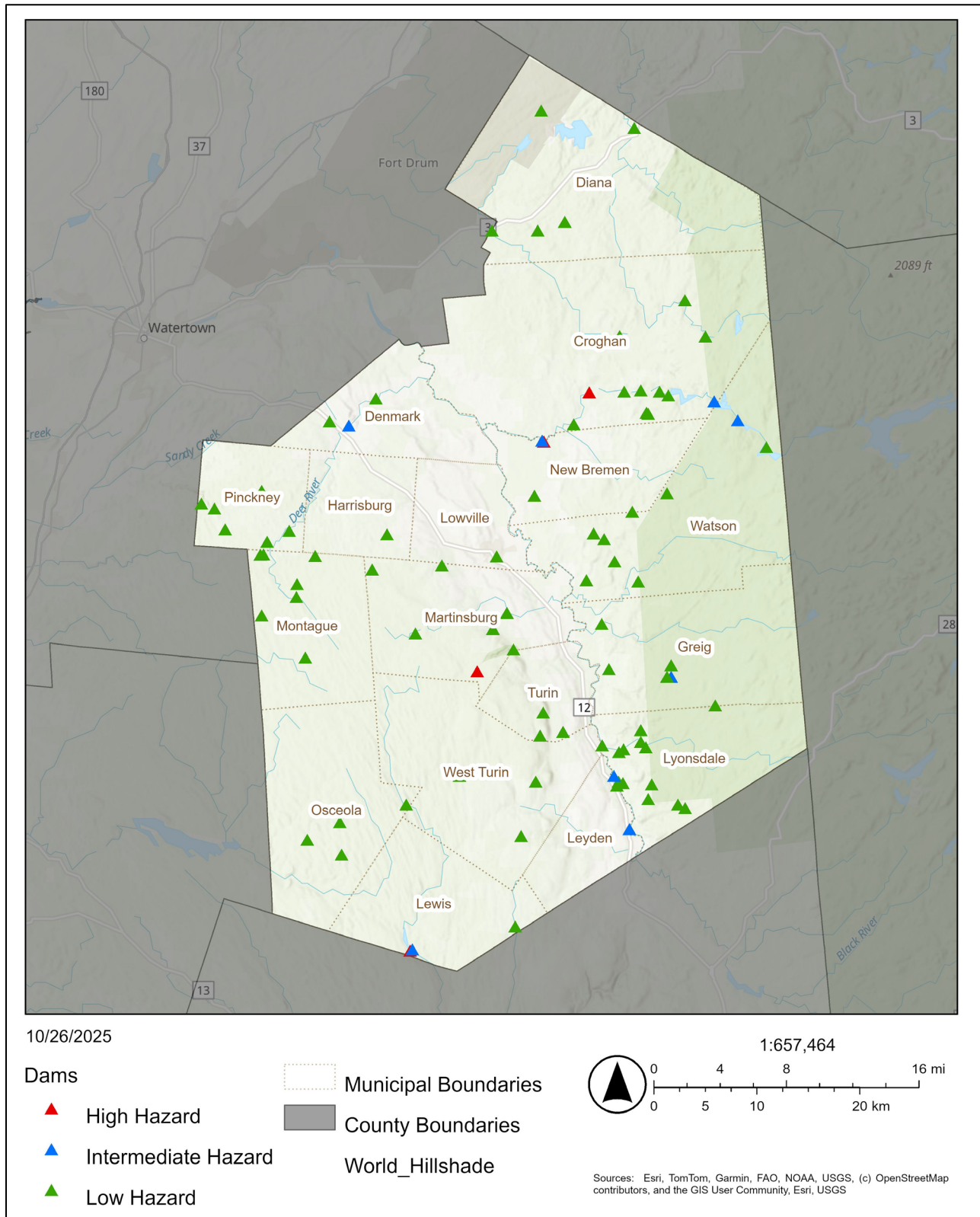
Every five years, an independent FERC-approved consulting engineer must inspect and evaluate projects with dams higher than 32.8 feet (10 meters) or with total storage capacity of more than 2,000 acre-feet (FERC 2020).

FERC monitors and evaluates seismic research in geographic areas where seismic activity is a concern. This information is applied to investigate and analyze structures of hydroelectric projects within these areas. FERC staff also evaluates effects of potential and actual large floods on safety of dams. FERC staff visit dams and licensed projects during and after floods, assess extents of damage, and direct any studies or remedial measures the licensee must undertake. FERC's *Engineering Guidelines for the Evaluation of Hydropower Projects* guides its engineering staff and licensees in evaluations of dam safety. The publication is frequently revised to reflect current information and methodologies (FERC 2020).

FERC requires licensees to prepare Emergency Action Plans (EAP) and conducts training sessions on developing and testing these plans. The plans outline an early warning system in the event of an actual or potential sudden release of water from a dam failure. The plans include operational procedures that may be implemented during regulatory measures, such as reducing reservoir levels and downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that all applicable parties are informed of the proper procedures in emergencies (FERC 2020).

Figure 10-2 shows the location and hazard category of dams in Lewis County.

Figure 10-3. Dam Locations in Lewis County



Source: NYSDEC Inventory of Dams

Table 10-2. Dams Located in Lewis County

Dam Name	Waterbody Name	Nearest City Name	Dam Owner	Owner Type	Dam Function	Dam Classification
Boise Cascade Upper Dam	Beaver River	Beaver Falls	Eagle Creek Hydro Power, LLC	Private	Hydroelectric	High
High Falls Dam	Beaver River	Croghan	Erie Boulevard Hydropower, Lp/Brookfield Renewable	Private	Hydroelectric	High
Whetstone Gulf Storage Dam	Whetstone Creek	Glendale	NYS OPRHP Thousand Islands Region	State	Flood Control And Storm Water Management, Recreation	High
Rome City Dam	Fish Creek	Town of Lewis	City of Rome	Local Government	Water Supply (primary)	High
Eagle Falls Dam	Beaver River	Soft Maple	Erie Boulevard Hydropower, Lp/Brookfield Renewable	Private	Hydroelectric	Intermediate
Soft Maple Terminal Dam	Beaver River	Soft Maple	Erie Boulevard Hydropower, Lp/Brookfield Renewable	Private	Hydroelectric	Intermediate
Boise Cascade Lower Dam	Beaver River	Beaver Falls	Eagle Creek Hydro Power, LLC	Private	Hydroelectric	Intermediate
Adirondack Acres Dam A	Brantingham Lake Outlet	Greig	Lake Of The Pines Land Owners Association, Inc.	Private	Recreation	Intermediate
Denley Dam	Black River	Port Leyden	Central Rivers Power, LLC	Private	Hydroelectric	Intermediate
Port Leyden Lower Dam	Black River	Lyons Falls	Central Rivers Power, LLC	Private	Hydroelectric	Intermediate
High Falls Dam At Copenhagen	Deer River	Deer River	Central Rivers Power, LLC	Private	Hydroelectric	Intermediate
Nys Dec Marsh Dam	Tr-Deer River	New Boston	NYS DEC	State	Fire Protection, Stock, Or Small Farm Pond	Low
Nys Dec Marsh Dam #3	Tr-Fish Creek	Babbitts Corners	NYS DEC	State	Fire Protection, Stock, Or Small Farm Pond	Low
Effley Falls Dam	Beaver River	Belfort	Erie Boulevard Hydropower, Lp/Brookfield Renewable	Private	Hydroelectric	Low

Dam Name	Waterbody Name	Nearest City Name	Dam Owner	Owner Type	Dam Function	Dam Classification
Elmer Falls Dam	Beaver River	Belfort	Erie Boulevard Hydropower, Lp/Brookfield Renewable	Private	Hydroelectric	Low
Taylorville Dam	Beaver River	Belfort	Erie Boulevard Hydropower, Lp/Brookfield Renewable	Private	Hydroelectric	Low
Belfort Dam	Beaver River	Croghan	Erie Boulevard Hydropower, Lp/Brookfield Renewable	Private	Hydroelectric	Low
Lyonsdale Dam	Moose River	Lyons Falls	Lyonsdale Associates, LLC	Private	Hydroelectric	Low
Mud Pond Dam	W. Br. Oswegatchie	None Identified	Nys Dec Division Of Lands & Forests	State	Recreation	Low
Agers Falls Dam	Moose River	Kosterville	Eony Generation Ltd.	Private	Hydroelectric	Low
Harrisville Dam	W Branch Oswegatchie River	Harrisville	Eony Generation Ltd.	Private	Hydroelectric, Other	Low
Gagnon Pond Dam	Tr - Olmstead Brook	None Identified	Raynard And Robin Gagnon	Private	Recreation	Low
Croghan Island Dam	Beaver River	Croghan	Beaverite Corporation, Vaughn Zehr, Croghan Island Mill Lumber Corporation	Private	Other	Low
Kosterville Lower Dam	Moose River	Lyons Falls	Northbrook Lyons Falls LLC	Private	Hydroelectric	Low
Gouldtown Mill # 5 Dam	Moose River	Lyons Falls	Northbrook Lyons Falls LLC	Private	Hydroelectric	Low
Lyons Falls Mill 3 Dam	Black River	Lyons Falls	Northbrook Lyons Falls LLC	Private	Hydroelectric	Low
Edwards Pond Dam	Trib - Fish Creek	None Identified	Tom Edwards	Private	Fish And Wildlife Pond, Recreation	Low
Turin Reservoir Dam	Mill Creek	Turin	Village Of Turin	Local Government	Other	Low
Croghan Reservoir Dam	Sandy Creek	None Identified	Village Of Croghan	Local Government	Water Supply - Primary	Low

Dam Name	Waterbody Name	Nearest City Name	Dam Owner	Owner Type	Dam Function	Dam Classification
Terry Smith Dam	Miller Brook	None Identified	Terry Smith	Private	Recreation	Low
Long Level Dam	W Br Oswegatchie River	None Identified	Nys Dec	State	Other	Low
Port Leyden Upper Dam	Black River	Port Leyden	Lyonsdale Hydroelectric Company Inc	Private	Hydroelectric	Low
S L Meda Fish Pond Dam	Paint Creek	None Identified	Lowdale Club Inc.	Private	Other	Low
John Plunkett Pond Dam	Schoolhouse Creek	None Identified	John F Plunkett	Private	Other	Low
Reimiller Dam	East Branch Mohawk River	West Leyden	West Leyden Fire Department	Private	Other	Low
Port Leyden Power Dam	Cold Brook	Port Leyden	Alan Scouten	Private	Recreation	Low
Rock Island Dam	Black River	Port Leyden	Central Rivers Power, LLC	Private	Hydroelectric	Low
Turin Recreation Pond Dam	Tr-Mill Creek	Turin	Village Of Turin	Local Government	Recreation	Low
Crystal Creek Dam	Crystal Creek	New Bremen	NYS DOT- Region 7	State	Recreation	Low
Whetstone Gulf State Park Dam	Whetstone Creek	GLENDALE	NYS OPRHP Thousand Islands Region	State	Recreation	Low
Beaver Meadow Brook Dam	Beaver Meadow Brook	Number Four	William Reed	Private	Recreation	Low
John Teal Recreational Pond Dam	Drunkard Creek	Port Leyden	Mary H Teal	Private	Recreation	Low
Richard Trombley Pond Dam	Miller Brook	None Identified	Richard Trombley	Private	Recreation	Low
Brantingham Lake Dam	Tr-Fish Creek	None Identified	Edward Warner	Private	Recreation	Low
Crystal Lake Dike	Crystal Creek	None Identified	N Merrel & J Miller	Private	Hydroelectric, Recreation	Low

Dam Name	Waterbody Name	Nearest City Name	Dam Owner	Owner Type	Dam Function	Dam Classification
Port Leyden Water Supply Dam	Tr-Cold Brook	Port Leyden	Village Of Port Leyden	Local Government	Water Supply - Primary	Low
Port Leyden Reservoir Dam	Tr-Cold Brook	Port Leyden	Village Of Port Leyden	Local Government	Water Supply - Primary	Low
Croghan Reservoir #2 Dam	Sandy Creek	Croghan	Village Of Croghan	Local Government	Water Supply - Primary	Low
Chase Lake Dam	Chase Lake Outlet	Glenfield	Chase Lake Property Owners Association	Private	Other	Low
Lowville Reservoir Dam	Crystal Creek	New Bremen	Village Of Lowville	Local Government	Water Supply - Primary	Low
Lyons Falls Water Supply Dam #4	Beauty Creek	Goulds Mill	Village Of Lyons Falls	Local Government	Water Supply - Primary	Low
Carthage Dam	Indian River	Indian River	Village Of Carthage	Local Government	Water Supply - Primary	Low
C Harry Edick Pond Dam	Tr-Black River	None Identified	C Harry Edick	Private	Recreation	Low
Grieg Dam	Tr-Black River	Grieg	Mrs Loie Grieg	Private	Recreation	Low
Passengers Pond Dam	South Branch Crystal Creek	Petries Corners	Lowville Lodge 134 F & A M	Private	Recreation	Low
Otter Creek Dam	Otter Creek	Glenfield	Silver Street Hydro Llc	Private	Hydroelectric	Low
Wilfers Mill Dam	Crystal Creek	Petries Corners	Jesse H Wilder	Private	Other	Low
Glenn Creek Dam	Glen Creek	None Identified	A L Marcellus	Private	Other	Low
Cahill Brothers Farm Pond Dam	Tr-Hogsback Creek	Bartlett Corners	Cahill Brothers	Private	Other	Low
Alpina Dam	Bonaparte Creek	Ft Drum Military Rsrvt	Niagara Mohawk Power Corporation	Public Utility	Other	Low
Village Of Turin Water Supply Dam	Millcreek	Turin	Village Of Turin	Local Government	Other	Low

Dam Name	Waterbody Name	Nearest City Name	Dam Owner	Owner Type	Dam Function	Dam Classification
Blanchard Pond Dam	Blanchard Creek	Natural Bridge	Charles Burge	Private	Recreation	Low
Kearns Mill Dam	Atwater Creek	Martinsburg	Mrs J Kearns	Private	Hydroelectric	Low
Nohles Mill Dam	Mill Creek	Lowville	C W Nohle	Private	Hydroelectric	Low
Glendale Mill Dam	Whetstone Creek	Glendale	John McCullen	Private	Hydroelectric	Low
Martinsburg Reservoir Dam	Atwater Creek	Martinsburg	Town Of Martinsburg	Local Government	Water Supply - Primary	Low
Natural Bridge Power Dam	Indian River	Natural Bridge	St Lawrence Talc Company	Private	Hydroelectric	Low
Constableville Fish & Game Club Dam	Little Alder Creek	None Identified	Constableville Fish & Game Club	Private	Recreation	Low
Jeffrey Beyer Dam	Tr-Mill Creek	Lowville	Jeffrey Beyer	Private	Fish And Wildlife Pond	Low
Roaring Brook Dam	Roaring Brook	None Identified	Roaring Brook Fish & Game Club	Private	Recreation	Low
Gould Paper Co Dam	Fish Creek	None Identified	Gould Paper Company	Private	Other	Low
Edward C Yancey Pond Dam	Tr-Mill Creek	Windecker	Edward C Yancey	Private	Recreation	Low
Kings Falls Dam	Deer River	Deer River	Tug Hill Energy Inc.	Private	Hydroelectric	Low
Unkurt Dam		None Identified	E. J. Unkurt	Private	Recreation	Low
Smith Brook Lower Dam	Smith Brook	Osceola	Johnston & Son & Elmer Beruier	Private	Other	Low
Upper Smith Brook Dam	Smith Brook	None Identified	Johnston & Son & Elmer Beruier	Private	Flood Control And Storm Water Management	Low
Murrock Marsh Dam	Tr-Stebbins Creek	Copenhagen	Macklin Murrock	Private	Recreation	Low

Dam Name	Waterbody Name	Nearest City Name	Dam Owner	Owner Type	Dam Function	Dam Classification
H Farrington Young Pond Dam	Tr-Deer River	Liberty Corners	H Farrington Young	Private	Recreation	Low
E J Strodel Pond Dam	Fall Brook	Osceola	E J Strodel	Private	Recreation	Low
William J Tucker Dam	West Branch Deer River	None Identified	William J Tucker	Private	Recreation	Low
Millard Pond Dam	Tr-Deer River	None Identified	Foster Millard	Private	Recreation	Low
Marcellus Mill Dam	Deer River	None Identified	Chas Zawdski	Private	Hydroelectric	Low
Neil Burns Marsh Dam	Tr-Deer River	New Boston	Wesley J & Mildred K Burns	Private	Recreation	Low
Birch Wildlife Pond Dam #2	Tr-Gulf Creek	Barnes Corners	Arthur & Florence Birchenough	Private	Recreation	Low
Perrigo Creek Dam	Perrigo Creek	None Identified	Millard & Rice	Private	Hydroelectric	Low
Nys Dec/Joans Marsh Dam	Tr-North Branch Gulf Creek	Barnes Corners	Nys Dec	State	Fire Protection, Stock, Or Small Farm Pond	Low
Birch Wildlife Pond Dam #1	Tr-Gulf Creek	Barnes Corners	Arthur & Florence Birchenough	Private	Recreation	Low
Hodkinson Wildlife Pond Dam	Tr-Fish Creek	Bulluck Corners	Wineford And Mary Hodkinson	Private	Fire Protection, Stock, Or Small Farm Pond	Low
Nys Dec Marsh Dam #2	Tr-Fish Creek	Babbitts Corners	Nys Dec	State	Fire Protection, Stock, Or Small Farm Pond	Low
Adirondack Acres Dam B	Tr-Fish Creek	None Identified	Lake Of The Pines Land Owners Association, Inc.	Private	Recreation	Low
Constableville Dam	Tr-Sugar River	Constableville	Village Of Constableville	Local Government	Water Supply - Primary	Low

10.1.2 Extent

The extent of flooding refers to the anticipated range of intensities and impacts associated with different types of flood events. The severity is influenced by the volume and duration of precipitation or meltwater, the terrain and soil conditions, proximity to water bodies, and the capacity of natural and built drainage systems. Flood severity is generally assessed on:

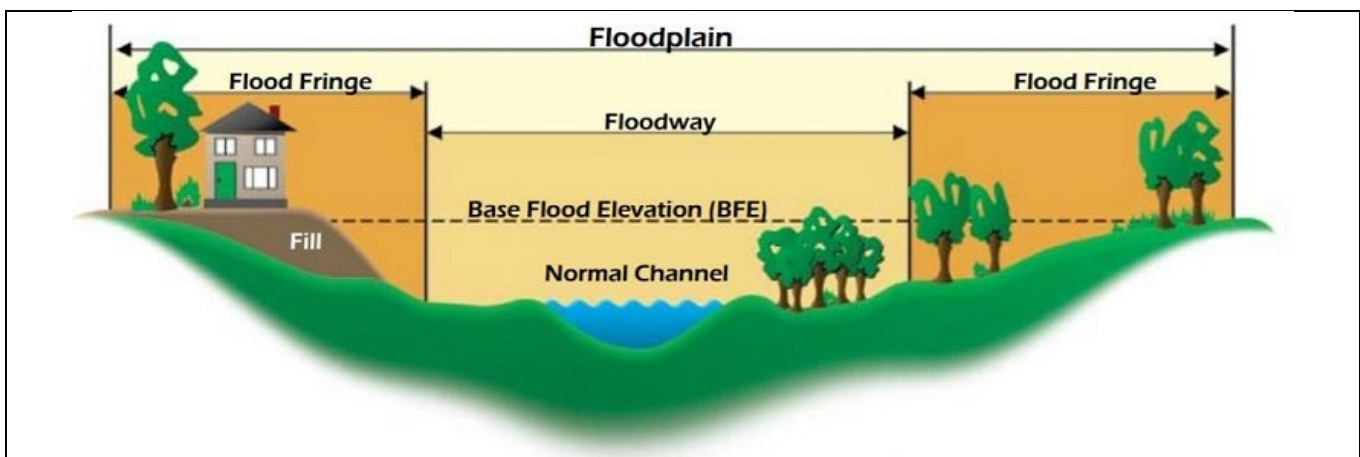
- Depth and velocity of floodwaters
- Duration of inundation
- Extent of property damage and infrastructure disruption
- Risk to public safety and access to emergency services

Riverine Flooding

A floodplain is flat land adjacent to a river, creek, or stream that is subject to periodic inundation (refer to Figure 10-3). The floodplain describes the area inundated by the “100-year” flood, or a flood that has a 1-percent chance in any given year of being equaled or exceeded. A floodplain is designated when floodwater exceeds the capacity of the main channel, or water escapes the channel through bank erosion.

Floodplain mapping is based on riverine and coastal flooding conditions. Urban and stormwater flooding is not reflected in floodplain mapping. Future flooding conditions (from factors such as sea level rise and changes in rainfall) are not included in FEMA’s development of floodplain mapping. As such, floodplain maps may underestimate flood risk in many areas in the region. As a result, the public may also underestimate risk.

Figure 10-4. Characteristics of a Floodplain



Source: FEMA 2022

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 (FEMA 2020). Additional definitions relating to flood maps are as follows:

- 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.

It should be noted that areas located outside of the SFHA can be subject to flooding and may even act as an unofficial floodplain. Flooding outside of the SFHA area may include stormwater/urban flooding 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. Severity depends not only on the amount of water that accumulates in a period, 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.

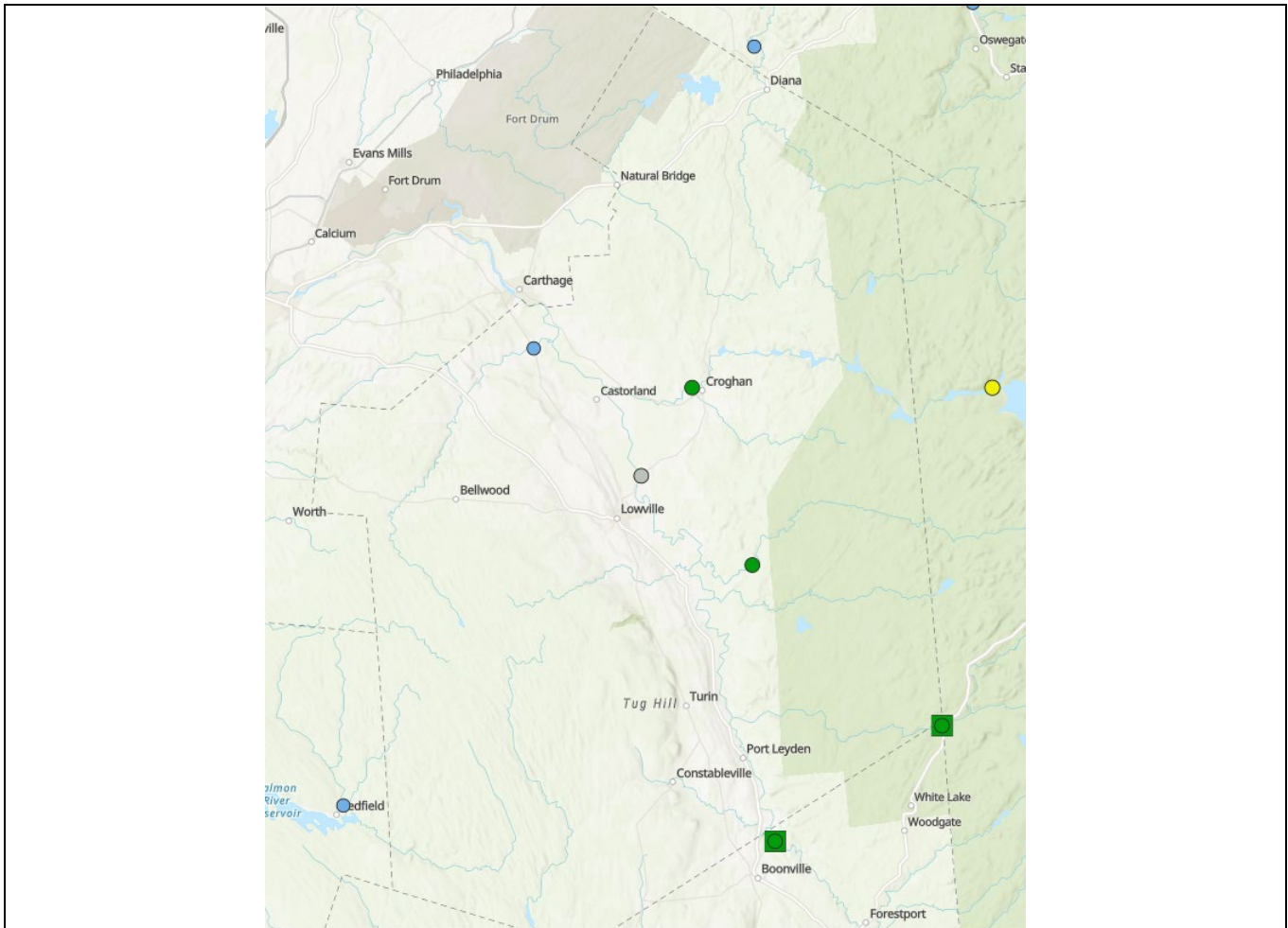
In the case of riverine or flash flooding, once a river reaches flood stage, the flood extent or severity categories used by the NWS include minor flooding, moderate flooding, and major flooding. Each category has a definition based on property damage and public threat (NWS 2011):

- **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.

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 Lewis County, in addition to others just outside of the County's boundary, that provide critical flood data for waterways affecting the County.

There are two stream gages in the County, as shown in Figure 10-4. Table 10-2 lists the stream gages in the County and details about each gage. The NWS provides the different flood stages for the gages.

Figure 10-5. Stream Gages in Lewis County



Source: (NWS 2024)

Table 10-3. Gages in Lewis County

Gage Site Number	Site Name	Flood Stage Height (feet)	Record Flood Height (Feet)
04256000	Independence River at Donnattsburg	8.0 feet	4.73 feet
04258000	Beaver River at Croghan	5.0 feet	3.49 feet

Source: USGS 2023; NWS 2024

Flash Flood

Flash floods are rapid-onset events typically occurring within six hours of intense rainfall, dam failure, or sudden water releases (e.g. ice jam breakups). Severity is similar to riverine flooding but may be more localized and sudden.

- May include rapid water rise, high velocity, debris-laden flows, and destruction of culverts, roads, or structures.
- Particularly hazardous in urban zones, steep terrain, or narrow valleys.

Extent categories follow the same NWS flood severity framework (minor, moderate, major) as riverine but are often more difficult to forecast due to short lead times.

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).

Ice Jam extent is influenced by:

- Thickness and duration of river ice cover
- Rate of snowmelt and rainfall
- River geometry (bends, constrictions, bridges)
- Existing obstructions or modifications

Ice jam floods can lead to:

- Sudden upstream inundation behind the jam
- Flash flooding downstream if the jam breaks
- Property and infrastructure damage in low-lying river corridors

Although unpredictable, ice jam flood severity often mirrors flash floods in intensity with shorter lead times. The U.S. Army Corps of Engineers (USACE) has recorded over 1,600 ice jam events in New York, making it one of the most frequently impacted states (USACE CRREL, 2024).

Pluvial (Local Stormwater, Drainage and Urban Flooding)

Pluvial flooding occurs when rainfall overwhelms surface drainage systems, resulting in water accumulation on roads, parking lots, basements, or low-lying developed areas. Unlike riverine flooding, it is not tied to waterbody overflow and often happens outside mapped floodplains. There are currently no standardized metrics for classifying pluvial flood severity, but extent is typically measured by:

- Flood depth (e.g. ponding <6 inches, >12 inches)
- Areal coverage (e.g. multiple streets or blocks affected)
- Infrastructure performance (e.g. capacity exceedance, clogged drains)
- Repetitive Loss Locations

Urban flooding in Lewis County may be localized in developed areas and tends to occur during high-intensity rainfall events or when snowmelt/frozen ground impedes infiltration.

Dam Failure

According to the Association of State Dam Safety Officials, there are five main causes of dam failure: overtopping, foundation defects, cracking, inadequate maintenance and upkeep, and piping. Overtopping is the most frequent

cause, accounting for approximately 34% of all dam failures (NYS DHSES 2023). Dam failures can be totally unpredictable and can occur so rapidly there is essentially no warning or time to evacuate.

While dam and levee failures are a rare occurrence, the sudden, uncontrolled release of water can have catastrophic consequences to people and the built and natural environments. Buildings and infrastructure in the path of this kind of flood could suffer minor damage or be destroyed. When a dam or levee breaks, it can kill large populations of wildlife and demolish their natural habitats.

Dam failures can occur suddenly, without warning, and may occur during normal operating conditions. This is referred to as a “sunny day” failure. Dam failures may also occur during a large storm event. Significant rainfall can quickly inundate an area and cause floodwaters to overwhelm a reservoir. If the spillway of the dam cannot safely pass the resulting flows, water will begin flowing in areas not designed for such flows, and a failure may occur. New York has seen significant property damage including damage or loss of dams, bridges, roads, and buildings because of storm events and dam failures.

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 (NYSDEC 2009):

- *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.

10.1.3 Previous Occurrences and Impacts

While the past cannot predict the future, especially as climate change is causing more frequent and intense events, it can give an idea of what might happen and what is at risk. How often, and where, a hazard has happened in the past gives plan participants an opportunity to closely review the impacts of those events, can

help define problem areas and leads to developing actions to mitigate these risks. In Lewis County, the Expected Annual Loss associated with flood hazards is \$379,630 (NYS DHSES 2023).

FEMA Major Disaster and Emergency Declarations

Between 1953 and 2024, Lewis County was included in 4 presidentially declared disasters (DR) associated with flood-related events (FEMA 2024). Table 10-3 lists these declarations. Figure 10-5 shows the flooding impacts across the county from the July 2024 flooding event.

Table 10-4. FEMA Declarations for Flood Events in Lewis County (1996 to 2024)

Event Date	Declaration Date	Declaration Number	Description
March 20, 1985	March 20, 1985	DR-733	Flood
January 19 - 30, 1996	January 24, 1996	DR-1095	Flood
April 26 - May 8, 2011	June 10, 2011	DR-1993	Flood
July 10 - 11, 2024	August 29, 2024	DR-4814	Flood

Source: FEMA 2024

USDA Declarations

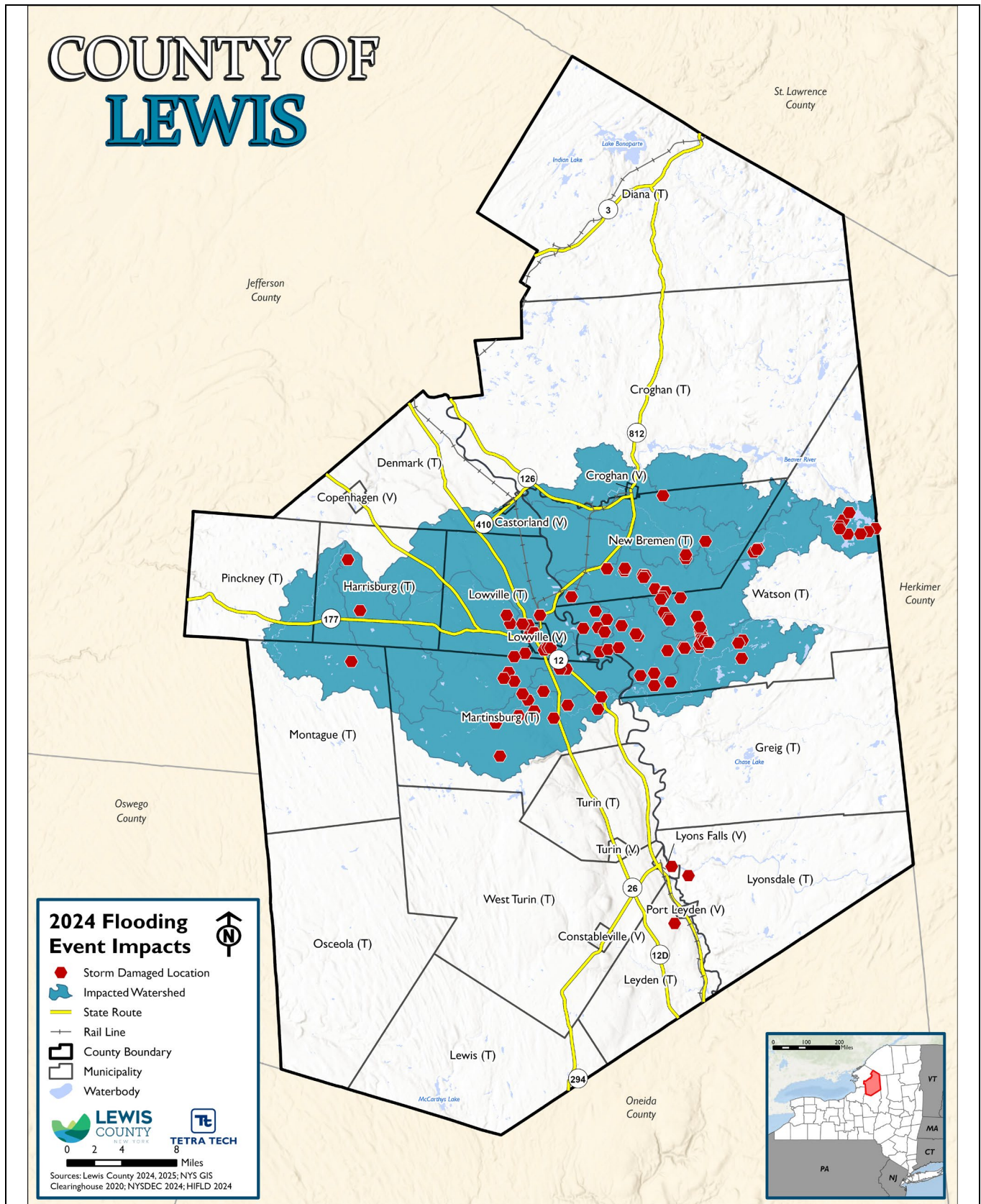
The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2019 and 2024, Lewis County was included in 2 USDA flood-related agricultural disaster declarations (USDA 2024). For declarations that occurred between 2019 and 2024, refer to Table 10-4.

Table 10-5. USDA Declarations for Flood Events in Lewis County (2019 to 2024)

Event Date	USDA Declaration Number	Description
April 15, 2019	S4626	Excessive rain, flash flooding, and flooding
July 10-16, 2024	S5739	Tornado, Hurricane, High Wind, Flash Flood, Excessive Rain, Hail

Source: USDA 2024

Figure 10-6. 2024 Flood Event Impacts in Lewis County



Previous Events below Disaster Declaration Threshold

Known hazard events that impacted Lewis County between January 2015 and December 2024 are discussed in Table 10-5. For events prior to 2015, refer to the 2020 Lewis County HMP.

Table 10-6. Flood Events in Lewis County (2015 to 2024)

Event Date	Description
October 31 – November 1, 2019	While a large and powerful storm system rolled toward the state, a low-topped convective event unfolded. Overhead, 65 knots of flow was present as this convective line crossed the North Country. Instability was modest but enough to channel large scale flow ahead of the convective line of heavy showers. Our area fell at the northern fringe of the convective activity, and while there was no thunder or lightning present, isolated wind damage was reported in Lewis County.
August 17-18, 2021	The remnants of Tropical Storm Fred were forecast to move across the region. Out ahead of the remnants of Fred, a slow-moving frontal zone and tropical moisture spreading north ahead of Fred allowed for a pre-cursory heavy rainfall event on August 17. This set the stage for later flooding as moisture more specifically associated with Fred advanced into the area during the next two days. A large swath of moderate to heavy rain moved in on August 17 and continued through the next morning. This resulted in impressive 24 hour totals across the area with greatest amounts in Allegany, Ontario, Wayne, and Lewis counties.

Previous Occurrences – Dams

10.1.4 Cascading Impacts

Flooding rarely occurs in isolation. As climate change intensifies the frequency and severity of extreme precipitation events, the secondary impacts of flooding are becoming increasingly consequential for Lewis County and its municipalities. These cascading effects extend across sectors, compounding the direct damage caused by floodwaters. Cascading impacts of floods are secondary consequences that extend beyond immediate water damage, affecting communities, infrastructure, economies, and ecosystems. Key cascading impacts include:

- **Widespread Property and Infrastructure Damage**—Floods can damage homes, buildings, roads, bridges, railways, and other infrastructure, leading to long-term transportation disruptions. Damaged infrastructure can hinder emergency response and disrupt the movement of goods, leading to economic losses.
 - Housing and Homelessness: Flood damage to homes can displace residents, creating temporary or prolonged homelessness. Limited housing availability after a flood can also strain shelters and social services.
 - Disrupted Transportation and Supply Chains: Flooding disrupts local and regional supply chains, delaying the distribution of essential goods like food, fuel, and medicine. These interruptions can have ripple effects on broader markets and economies.
- **Power Outages and Utility Disruptions**—Flooding can damage power lines, substations, and other utilities, causing power outages. This can also disrupt water and wastewater treatment facilities, leading to water contamination or shortages, and affect telecommunications systems. Hydroelectric dam failure may lead to power disruption as well.
- **Contaminated Potable Water**—Floods can contaminate potable (drinking) water through several mechanisms that introduce harmful pollutants and pathogens into water sources, making it unsafe for human consumption. Ways that flood events can contaminate potable water include,

- **Overflow of Sewage Systems:** Floodwaters can overwhelm sewage systems and treatment plants, causing raw sewage to mix with floodwaters and enter rivers, lakes, or groundwater sources. This contamination can introduce bacteria, viruses, and other pathogens into drinking water supplies.
- **Runoff from Agricultural Land:** Floodwaters can sweep through agricultural areas, carrying animal waste, pesticides, and fertilizers into water sources. This runoff introduces harmful bacteria (such as *E. coli*), nitrates, and chemicals that can be dangerous if ingested.
- **Chemical Spills from Industrial Sites:** Industrial areas are often home to hazardous chemicals, oils, and heavy metals stored in containers or barrels. Floodwaters can cause these containers to leak, spilling toxic substances into nearby water sources. This can lead to contamination with heavy metals (e.g., lead, mercury) and chemicals harmful to human health.
- **Inundation of Septic Systems:** Septic tanks can overflow or leak during flooding, releasing untreated waste into floodwaters. This contamination introduces pathogens that can spread disease and contaminate groundwater, especially in rural areas reliant on wells.
- **Saline Intrusion in Coastal Flooding:** In coastal regions, storm surge or saltwater flooding can push seawater into freshwater aquifers or reservoirs, increasing salinity levels in potable water sources. High salinity makes water unsafe for drinking and can corrode plumbing systems.
- **Disturbance of Soil and Sediment:** Flooding can dislodge soil and sediments, increasing turbidity in water supplies. Sediment can carry organic material, pollutants, and heavy metals, leading to contamination. Dams often hold back sediment, so if they fail, depending on the nature of the failure, they could send additional sediment downstream.
- **Other Health and Safety Risks:**
 - **Mental Health Impacts:** Floods can lead to stress, anxiety, and trauma, particularly when people lose homes, livelihoods, or loved ones. The psychological impact of prolonged recovery can have lasting effects on communities.
 - **Mold Growth:** 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 to 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 n.d.).
 - **Disease Outbreaks:** Floodwaters often carry pollutants, pathogens, and debris, increasing the risk of disease outbreaks. Standing water can also create breeding grounds for mosquitoes, raising the risk of vector-borne diseases.
 - Flooding also heightens the likelihood of injury or fatalities from swift-moving water or structural collapses.
- **Strain on Emergency and Public Services**—Recovery efforts can overwhelm emergency services, fire departments, and law enforcement, particularly if resources are diverted from regular operations to manage storm damage. Prolonged strain on public services can reduce their availability for routine emergencies and slow overall recovery.
- **Economic Losses**—Businesses may face long closures, lost inventory, and property damage. Disruptions to transportation and supply chains can further strain local and regional economies. Losses in agriculture, tourism, and manufacturing are common in heavily impacted areas.

- **Environmental Degradation**—Floods can erode soil, destroy habitats, and spread pollutants from industrial sites, affecting water quality and ecosystems. Wetlands and forests may be damaged, altering local biodiversity and affecting natural flood defenses.
- **Educational Disruptions**—Schools may close or be repurposed as emergency shelters during floods, leading to interruptions in education that can last for weeks or months, impacting students' academic progress and well-being.
- **Dam Failure**—Many impacts of flooding and other hazards can lead to dam failure. Flooding upstream of a dam can overtop the dam and increase the stress on the dam structure. Floods and rains can also erode land around a dam, weakening the dam or reducing its effectiveness, including by depositing debris and sediment in the reservoir. Dams can be vulnerable to hazards such as earthquakes (causing structural damage), landslides (either reducing reservoir capacity or impacting the dam's structure), or drought (primarily a risk for earthen dams that could crack as soil dries).
If a dam fails in such a way that its capacity to protect areas downstream from flooding (e.g., a sustained overflow, cracking, piping, etc.), a cascading impact could be an increased vulnerability to flooding. Dams that hold water for agricultural or municipal water supply can increase vulnerability to drought if their failure reduces the amount of water in the reservoir.

The cascading impacts of floods reveal how interconnected systems are and underscore the need for planning to address not only immediate flood damage but also these far-reaching secondary effects.

10.2 COMMUNITY ASSETS AT RISK

Lewis County analyzed the results of the 100-year flood event, but not the 500-year flood event, as data for the impacts of the 500-year flood event was not available.

10.2.1 People and Communities

Population in flood-prone zones—particularly in areas adjacent to the Black River, Moose River, Beaver River, and Lake Bonaparte shoreline—face elevated risks during flooding events. Emergency access is a major concern in more rural towns where flooding can isolate homes or prevent first responders from reaching those in need.

Overall Population

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 annual chance flood events, the FIRM flood boundaries were used. Based on the spatial analysis, there are an estimated 1,581 residents living in the 1-percent annual chance floodplain or 5.9 percent of the County's total population. The Town of Croghan has the greatest number of residents living in the floodplain, with approximately 441 residents living in the Special Flood Hazard Area (SFHA). Table 10-6 shows the population exposed to the flood hazard by jurisdiction.

Using 2023 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 589 individuals will be displaced, and 175 people will seek short-term sheltering. These statistics, by jurisdiction, are presented in Table 10-7.

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.

Table 10-7. Estimated Population in the 1-percent Annual Chance Flood Hazard Area

Jurisdiction	Total Population (2023 ACS)	Population in the 1-Percent Annual Chance Flood Hazard Area	
		Number of Persons	% of Jurisdiction Total
Castorland (V)	414	7	1.7%
Constableville (V)	356	0	0.0%
Copenhagen (V)	652	0	0.0%
Croghan (T)	2,911	441	15.1%
Croghan (V)	642	21	3.3%
Denmark (T)	1,589	112	7.0%
Diana (T)	1,503	190	12.6%
Greig (T)	1,020	149	14.6%
Harrisburg (T)	515	0	0.0%
Lewis (T)	801	15	1.9%
Leyden (T)	1,235	99	8.0%
Lowville (T)	1,442	148	10.3%
Lowville (V)	3,432	5	0.1%
Lyons Falls (V)	478	0	0.0%
Lyonsdale (T)	885	43	4.9%
Martinsburg (T)	1,232	51	4.1%
Montague (T)	159	0	0.0%
New Bremen (T)	2,436	77	3.2%
Osceola (T)	140	1	0.7%
Pinckney (T)	246	0	0.0%
Port Leyden (V)	680	17	2.5%
Turin (T)	827	15	1.8%
Turin (V)	312	5	1.6%
Watson (T)	1,888	184	9.7%
West Turin (T)	1,178	1	0.1%
Lewis County (Total)	26,974	1,581	5.9%

Source: U.S. Census Bureau 2023 ACS; Lewis County 2020; FEMA 1976, 1977, 1982, 1984, 1985, 1994, 2000

Table 10-8. 1-percent Annual Chance Flood Hazard Impacts on the Population

Jurisdiction	Total Population (2023 ACS)	1-Percent Annual Chance Flood Impacts on People	
		Displaced Population	Persons Seeking Short-Term Shelter
Castorland (V)	414	3	3
Constableville (V)	356	5	1
Copenhagen (V)	652	0	0
Croghan (T)	2,911	164	30
Croghan (V)	642	6	5
Denmark (T)	1,589	7	5
Diana (T)	1,503	59	35
Greig (T)	1,020	61	36
Harrisburg (T)	515	0	0
Lewis (T)	801	6	2
Leyden (T)	1,235	36	5
Lowville (T)	1,442	54	3
Lowville (V)	3,432	13	9
Lyons Falls (V)	478	3	2
Lyonsdale (T)	885	16	3
Martinsburg (T)	1,232	24	9
Montague (T)	159	0	0
New Bremen (T)	2,436	42	8
Osceola (T)	140	2	0
Pinckney (T)	246	0	0
Port Leyden (V)	680	3	3
Turin (T)	827	2	0
Turin (V)	312	7	4
Watson (T)	1,888	76	12
West Turin (T)	1,178	0	0
Lewis County (Total)	26,974	589	175

Source: U.S. Census Bureau 2023 ACS; Lewis County 2020; FEMA 1976, 1977, 1982, 1984, 1985, 1994, 2000; Hazus v6.1

Socially Vulnerable Population

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. 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 need medical attention that may not be available due to isolation during a flood event, and they may have more difficulty evacuating. Table 10-8 shows the socially vulnerable populations living in the mapped flood hazard area.

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. Lewis County's overall score is 15.15, indicating that its communities have a very low level of social vulnerability (CDC 2018). This score indicates that some County residents may not have enough resources to respond to flood events.

Table 10-9. Vulnerable Persons Located in the 1-Percent Annual Chance Flood Hazard Area

Jurisdiction	Estimated Number of Vulnerable Persons Located in the 1-Percent Annual Chance Flood Hazard Area									
	Persons Over 65	% of Total	Persons Under 5	% of Total	Non-English Speaking Persons	% of Total	Persons with a Disability	% of Total	Persons in Poverty	% of Total
Castorland (V)	1	1.6%	0	0.0%	0	0.0%	1	1.5%	1	1.4%
Constableville (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Copenhagen (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Croghan (T)	65	14.9%	28	15.0%	0	0.0%	59	15.0%	67	15.0%
Croghan (V)	4	2.9%	1	2.9%	0	0.0%	2	2.4%	3	2.7%
Denmark (T)	27	7.0%	7	6.4%	0	0.0%	13	6.6%	17	7.1%
Diana (T)	35	12.3%	3	10.3%	0	0.0%	35	12.5%	28	12.6%
Greig (T)	35	14.6%	6	14.0%	3	12.5%	21	14.3%	17	14.5%
Harrisburg (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lewis (T)	1	1.1%	0	0.0%	0	0.0%	1	1.0%	0	0.0%
Leyden (T)	13	7.5%	7	7.3%	0	0.0%	10	7.9%	16	7.7%
Lowville (T)	49	10.2%	6	9.7%	0	0.0%	19	10.0%	22	10.0%
Lowville (V)	1	0.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lyons Falls (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lyonsdale (T)	9	4.5%	2	4.1%	0	0.0%	12	4.9%	6	4.3%
Martinsburg (T)	12	4.0%	2	3.9%	0	0.0%	8	4.0%	3	3.2%
Montague (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
New Bremen (T)	11	2.9%	8	3.0%	0	0.0%	7	3.0%	4	3.0%
Osceola (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Pinckney (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Port Leyden (V)	4	2.3%	1	1.4%	0	0.0%	3	2.3%	3	2.1%
Turin (T)	3	1.5%	0	0.0%	0	0.0%	2	1.7%	1	1.7%
Turin (V)	1	1.1%	0	0.0%	0	0.0%	1	1.2%	0	0.0%
Watson (T)	38	9.6%	7	9.6%	0	0.0%	25	9.7%	15	9.7%
West Turin (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lewis County (Total)	309	5.8%	78	4.8%	3	10.4%	219	5.5%	203	6.2%

Source: U.S. Census Bureau 2023 ACS; Lewis County 2020; FEMA 1976, 1977, 1982, 1984, 1985, 1994, 2000

Economy

Flood events can significantly impact the local and regional economy. This includes but is not limited to general building stock damage 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. Section 10.2.2 discusses direct impacts on buildings in Lewis 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 10-9 summarizes the countywide debris estimates for the 1-percent annual chance flood event. Overall, Hazus estimates that there will be 11,163 tons of debris generated during the 1-percent annual chance flood event in Lewis County.

Table 10-10. Estimated Debris Generated from the 1-percent Annual Chance Flood Event

Jurisdiction	Estimated Debris Created During the 1-Percent Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Castorland (V)	1	1	<1	<1
Constableville (V)	40	8	18	14
Copenhagen (V)	0	0	0	0
Croghan (T)	5,503	646	2,846	2,010
Croghan (V)	7	6	1	1
Denmark (T)	23	11	7	5
Diana (T)	1,050	308	457	285
Greig (T)	1,520	431	674	415
Harrisburg (T)	0	0	0	0
Lewis (T)	109	23	50	36
Leyden (T)	759	133	351	276
Lowville (T)	209	49	85	74
Lowville (V)	154	38	70	47
Lyons Falls (V)	140	26	64	50
Lyonsdale (T)	336	73	151	111
Martinsburg (T)	270	131	62	77
Montague (T)	0	0	0	0
New Bremen (T)	258	67	107	83
Osceola (T)	47	14	20	13
Pinckney (T)	0	0	0	0
Port Leyden (V)	2	2	<1	<1
Turin (T)	41	10	17	14
Turin (V)	45	15	17	12
Watson (T)	648	161	302	185
West Turin (T)	<1	<1	<1	<1
Lewis County (Total)	11,163	2,155	5,299	3,709

Source: Lewis County 2020, 2024; NYS GIS 2024; FEMA 1976, 1977, 1982, 1984, 1985, 1994, 2000; Hazus v6.1

The debris estimates represent only structural debris generated by flooding and do 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.

10.2.2 General Building Stock

Lewis County contains over 40,162 structures valued at more than \$23 billion in total replacement cost, spanning residential, commercial, industrial, institutional, and agricultural uses. The county's varied landscape including river valleys and low-lying interior terrain places many of these buildings at risk of flooding or erosion related hazards. Buildings exposed to flooding and coastal erosion are vulnerable to:

- Structural damage from inundation, foundation undermining, and wave action
- Interior damage from water infiltration, mold, and prolonged moisture exposure
- Loss of function for critical facilities (e.g. utilities, schools, emergency response buildings)
- Economic disruption, especially for small businesses and agricultural producers in flood-prone valleys

Older housing stock and buildings with basements or slab-on-grade construction are particularly susceptible to flooding. Repetitive loss properties and uninsured or underinsured homes in socially vulnerable areas face heightened risk of long-term displacement and disrepair following events.

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 2,396 buildings located in the 1-percent annual chance flood event hazard area. This represents approximately 6.0 percent of the County's total general building stock inventory replacement cost value with a cost of \$1.3 billion. The Town of Croghan has the greatest number of its buildings located in the 1-percent annual chance floodplain (632 buildings or 13.8 percent of its total building stock). Refer to Table 10-10 for the estimated exposure of the 1-percent flood events by jurisdiction. Refer to Table 10-11 for the buildings in the 1-percent annual chance flood hazard area by jurisdiction, for residential, commercial, industrial and other occupancy structures, respectively.

Hazus estimates the expected damage in terms of dollar losses to the general building stock as a result of the 1 percent annual chance flood. Results for Lewis County by jurisdiction are shown in Table 10-12.

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

Jurisdiction	Jurisdiction Total Buildings		Buildings in the 1-Percent Annual Chance Flood Hazard Area			
			Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Castorland (V)	237	\$209,754,520	9	3.8%	\$4,884,611	2.3%
Constableville (V)	331	\$214,011,340	4	1.2%	\$458,345	0.2%
Copenhagen (V)	502	\$470,894,543	0	0.0%	\$0	0.0%
Croghan (T)	4,564	\$2,716,704,006	632	13.8%	\$526,448,820	19.4%
Croghan (V)	516	\$406,813,941	17	3.3%	\$19,233,242	4.7%
Denmark (T)	2,262	\$1,683,271,436	119	5.3%	\$36,411,745	2.2%
Diana (T)	3,305	\$1,337,032,416	342	10.3%	\$103,203,559	7.7%
Greig (T)	2,962	\$1,160,581,336	345	11.6%	\$132,019,797	11.4%
Harrisburg (T)	863	\$533,636,646	0	0.0%	\$0	0.0%
Lewis (T)	1,495	\$722,393,059	30	2.0%	\$13,516,028	1.9%
Leyden (T)	1,988	\$1,065,963,460	111	5.6%	\$42,049,546	3.9%
Lowville (T)	1,752	\$1,762,819,749	156	8.9%	\$79,518,453	4.5%
Lowville (V)	2,332	\$1,966,304,011	5	0.2%	\$4,329,331	0.2%
Lyons Falls (V)	568	\$376,848,099	4	0.7%	\$5,688,333	1.5%
Lyonsdale (T)	1,614	\$656,114,259	83	5.1%	\$73,097,299	11.1%
Martinsburg (T)	2,180	\$1,847,174,778	89	4.1%	\$98,496,579	5.3%
Montague (T)	616	\$232,283,519	0	0.0%	\$0	0.0%
New Bremen (T)	3,030	\$1,662,197,383	106	3.5%	\$32,187,819	1.9%
Osceola (T)	1,190	\$395,966,698	18	1.5%	\$6,474,057	1.6%
Pinckney (T)	807	\$275,136,312	0	0.0%	\$0	0.0%
Port Leyden (V)	525	\$266,540,832	10	1.9%	\$3,268,677	1.2%
Turin (T)	1,094	\$881,477,564	18	1.6%	\$7,933,024	0.9%
Turin (V)	249	\$167,575,852	6	2.4%	\$2,446,700	1.5%
Watson (T)	3,311	\$1,308,062,188	291	8.8%	\$98,132,830	7.5%
West Turin (T)	1,869	\$1,005,138,588	1	0.1%	\$271,035	<0.1%
Lewis County (Total)	40,162	\$23,324,696,534	2,396	6.0%	\$1,290,069,829	5.5%

Source: Lewis County 2020, 2024; NYS GIS 2024; FEMA 1976, 1977, 1982, 1984, 1985, 1994, 2000; RS Means 2024

Table 10-12. Estimated Building Stock Potential Loss by Occupancy to the 1-percent Annual Chance Flood Event

Jurisdiction	Buildings in the 1-Percent Annual Chance Flood Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Other ^a
Castorland (V)	2	5	2	0
Constableville (V)	0	4	0	0
Copenhagen (V)	0	0	0	0
Croghan (T)	280	234	87	31
Croghan (V)	8	8	1	0
Denmark (T)	50	53	2	14
Diana (T)	235	101	5	1
Greig (T)	247	92	4	2
Harrisburg (T)	0	0	0	0
Lewis (T)	11	16	2	1
Leyden (T)	61	45	4	1
Lowville (T)	48	49	1	58
Lowville (V)	2	2	1	0
Lyons Falls (V)	0	1	3	0
Lyonsdale (T)	35	24	13	11
Martinsburg (T)	31	41	1	16
Montague (T)	0	0	0	0
New Bremen (T)	38	55	6	7
Osceola (T)	9	9	0	0
Pinckney (T)	0	0	0	0
Port Leyden (V)	7	1	2	0
Turin (T)	7	9	0	2
Turin (V)	2	3	0	1
Watson (T)	177	89	19	6
West Turin (T)	1	0	0	0
Lewis County (Total)	1,251	841	153	151

Source: Lewis County 2020, 2024; NYS GIS 2024; FEMA 1976, 1977, 1982, 1984, 1985, 1994, 2000

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

Table 10-13. Estimated Losses for the 1-percent Annual Chance Flood Event

Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Building Loss Due to 1-Percent Annual Chance Flood				
		All Occupancies		Residential	Commercial	Other Occupancies
		Damage	% of Total RCV			
Castorland (V)	\$209,754,520	\$5,531	<0.1%	\$0	\$5,531	\$0
Constableville (V)	\$214,011,340	\$1,469	<0.1%	\$0	\$1,469	\$0
Copenhagen (V)	\$470,894,543	\$0	0.0%	\$0	\$0	\$0
Croghan (T)	\$2,716,704,006	\$77,906,258	2.9%	\$22,651,220	\$11,924,941	\$43,330,097
Croghan (V)	\$406,813,941	\$118,105	<0.1%	\$44,289	\$73,816	\$0
Denmark (T)	\$1,683,271,436	\$1,198,006	0.1%	\$145,257	\$190,026	\$862,724
Diana (T)	\$1,337,032,416	\$10,777,195	0.8%	\$5,732,747	\$3,627,950	\$1,416,498
Greig (T)	\$1,160,581,336	\$21,681,723	1.9%	\$13,719,087	\$6,905,155	\$1,057,481
Harrisburg (T)	\$533,636,646	\$0	0.0%	\$0	\$0	\$0
Lewis (T)	\$722,393,059	\$3,189,173	0.4%	\$651,823	\$335,201	\$2,202,150
Leyden (T)	\$1,065,963,460	\$5,636,979	0.5%	\$2,251,163	\$1,591,286	\$1,794,530
Lowville (T)	\$1,762,819,749	\$1,347,279	0.1%	\$339,974	\$302,084	\$705,221
Lowville (V)	\$1,966,304,011	\$161,169	<0.1%	\$115,973	\$45,196	\$0
Lyons Falls (V)	\$376,848,099	\$1,672,789	0.4%	\$0	\$53,813	\$1,618,976
Lyonsdale (T)	\$656,114,259	\$27,426,466	4.2%	\$1,285,724	\$786,893	\$25,353,849
Martinsburg (T)	\$1,847,174,778	\$4,603,037	0.2%	\$1,570,862	\$1,145,009	\$1,887,166
Montague (T)	\$232,283,519	\$0	0.0%	\$0	\$0	\$0
New Bremen (T)	\$1,662,197,383	\$1,673,315	0.1%	\$473,383	\$130,489	\$1,069,443
Osceola (T)	\$395,966,698	\$588,751	0.1%	\$183,595	\$405,157	\$0
Pinckney (T)	\$275,136,312	\$0	0.0%	\$0	\$0	\$0
Port Leyden (V)	\$266,540,832	\$70,541	<0.1%	\$5,124	\$0	\$65,417
Turin (T)	\$881,477,564	\$0	0.0%	\$0	\$0	\$0
Turin (V)	\$167,575,852	\$38,330	<0.1%	\$0	\$31,535	\$6,795
Watson (T)	\$1,308,062,188	\$6,773,490	0.5%	\$3,587,965	\$1,204,127	\$1,981,398
West Turin (T)	\$1,005,138,588	\$0	0.0%	\$0	\$0	\$0
Lewis County (Total)	\$23,324,696,534	\$164,869,609	0.7%	\$52,758,185	\$28,759,680	\$83,351,745

Source: Lewis County 2020, 2024; NYS GIS 2024; FEMA 1976, 1977, 1982, 1984, 1985, 1994, 2000; Hazus v6.; RS Means 2024

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). The 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 and be at least 10 days apart. Only losses since January 1, 1978 that are closed are considered.

SRLs were then examined for Lewis 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 or 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 10-14 through Table 10-17 summarizes NFIP policies, claims, and repetitive loss statistics for Cattaraugus County as of November 2024. According to FEMA, Table 10-14 summarizes occupancy classes of RL properties in Lewis County.

Table 10-14. Occupancy Class of Repetitive Loss Structures in Lewis County

Occupancy Class	Total Number of Repetitive Loss Properties
Single Family	2
Condo	0
2-4 Family	0
Other Residential	0
Business-Non-Residential	0
Other Non-Residential	1
Lewis County Total	3

Source: FEMA Region 2 2024

Table 10-15. Occupancy Class of Repetitive Loss Structures in Lewis County by Municipality

Municipality	Repetitive Loss Properties					
	Single Family	Condo	2-4 Family	Other Residential	Business-Non-Residential	Other Non-Residential
Castorland (V)	0	0	0	0	0	1
Constableville (V)	0	0	0	0	0	0
Copenhagen (V)	0	0	0	0	0	0
Croghan (T)	0	0	0	0	0	0
Croghan (V)	0	0	0	0	0	0
Denmark (T)	0	0	0	0	0	0
Diana (T)	0	0	0	0	0	0
Greig (T)	1	0	0	0	0	0
Harrisburg (T)	0	0	0	0	0	0
Lewis (T)	0	0	0	0	0	0
Leyden (T)	1	0	0	0	0	0
Lowville (T)	0	0	0	0	0	0
Lowville (V)	0	0	0	0	0	0
Lyons Falls (V)	0	0	0	0	0	0
Lyonsdale (T)	0	0	0	0	0	0
Martinsburg (T)	0	0	0	0	0	0
Montague (T)	0	0	0	0	0	0
New Bremen (T)	0	0	0	0	0	0
Osceola (T)	0	0	0	0	0	0
Pinckney (T)	0	0	0	0	0	0
Port Leyden (V)	0	0	0	0	0	0
Turin (T)	0	0	0	0	0	0
Turin (V)	0	0	0	0	0	0
Watson (T)	0	0	0	0	0	0
West Turin (T)	0	0	0	0	0	0

Municipality	Repetitive Loss Properties					
	Single Family	Condo	2-4 Family	Other Residential	Business-Non-Residential	Other Non-Residential
Lewis County	2	0	0	0	0	1

Source: FEMA Region 2 2024

Notes: Policies, claims, repetitive loss and severe repetitive loss statistics provided by FEMA Region 2, and current as of November 2024.

Table 10-16. Lewis County NFIP Summary of Policy and Claim Statistics

# Policies	44
# Claims (Losses)	48
Total Loss Payments	\$528,216.18
# Repetitive Loss Properties (NFIP definition)	3
# Repetitive Loss Properties (FMA definition)	0
# Severe Repetitive Loss Properties	0

Source: FEMA National Flood Insurance Program 2024

10.2.3 Community Lifelines and Other 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 a rapid flow of water. Loss of these utilities could create additional isolation issues for the flooded areas.

Major roadways that may be impacted by the 1-percent annual chance flood event include New York State Routes 3, 12, 26, and 812 and various 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 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 10-13 summarizes the number of critical facilities exposed to the 1-percent flood inundation areas by jurisdiction. Of the 173 critical facilities located in the 1-percent annual chance flood event boundary, all 59 are considered lifelines for the County. Refer to Chapter 3 for more information about the critical facilities and lifelines in Lewis County.

Table 10-17. Number of Critical Facilities Located in the 1-percent Annual Chance Flood Hazard Area

Jurisdiction	Number of Facilities in 1-Percent Annual Chance Flood Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Castorland (V)	0	0	0	0	0	0	0	1	0	1	12.5%
Constableville (V)	0	0	0	0	0	0	3	0	0	3	18.8%
Copenhagen (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Croghan (T)	0	10	0	1	0	9	15	3	1	39	48.1%
Croghan (V)	0	0	0	0	0	1	3	1	0	5	31.3%
Denmark (T)	0	2	0	0	0	1	2	0	0	5	6.2%
Diana (T)	0	1	0	0	0	1	10	0	0	12	21.8%
Greig (T)	0	1	0	0	0	4	12	0	1	18	52.9%
Harrisburg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Lewis (T)	0	0	0	0	1	3	6	0	0	10	41.7%
Leyden (T)	0	4	0	0	0	1	6	0	0	11	31.4%
Lowville (T)	0	1	0	0	0	0	9	1	0	11	12.6%
Lowville (V)	0	0	0	1	0	0	3	0	0	4	5.8%
Lyons Falls (V)	0	1	0	0	0	1	2	1	0	5	19.2%
Lyonsdale (T)	2	3	0	1	0	4	6	1	0	17	47.2%
Martinsburg (T)	0	0	0	0	0	0	2	1	0	3	1.8%
Montague (T)	0	0	0	0	0	0	0	0	0	0	0.0%
New Bremen (T)	0	4	0	0	0	1	5	0	0	10	26.3%
Osceola (T)	0	0	0	0	0	0	3	0	0	3	14.3%
Pinckney (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Port Leyden (V)	0	4	0	0	0	3	1	0	0	8	32.0%
Turin (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Turin (V)	0	0	0	0	0	1	1	0	0	2	20.0%

Jurisdiction	Number of Facilities in 1-Percent Annual Chance Flood Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Watson (T)	0	0	1	0	0	2	2	1	0	6	22.2%
West Turin (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Lewis County (Total)	2	31	1	3	1	32	91	10	2	173	16.0%

Source: Lewis County 2020, 2024; NYSDEC 2023, 2024; NYS GIS 2024; HIFLD 2024; US Energy Atlas 2024; FEMA 1976, 1977, 1982, 1984, 1985, 1994, 2000

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 Volume II of this plan.

10.2.4 Natural Resources

As Lewis 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 Lewis County's natural and local environment.

Furthermore, the environmental impacts 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.

10.2.5 Historic and Cultural Resources

Historic places and institutions are vulnerable to impacts from flooding. Historic buildings face structural damage during flood events. Historic structures often are not built to modern building code requirements, including design flood elevation and construction standards. Historic resources and structures were often built close to waterways, increasing their flood risk.

Cultural institutions, parks and open spaces, community facilities, and religious institutions are all vulnerable to impacts from flooding. Venues such as museums face structural damage during flood events, with additional risk of damage to important cultural artifacts housed within them. Parks, recreation, and community space closures due to flood events can disrupt residents' lives and hinder access to community services. Parks and recreational areas are often located near waterways. Although these facilities often experience flooding, they are positioned with flooding in mind, as many parks are considered as open space to disallow development.

10.3 FUTURE OCCURRENCES AND PROJECTED CHANGES IN RISK

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

10.3.1 Probability of Future Occurrences

Based on historical records, as summarized in Table 10-14, and input from the Steering Committee, the probability of occurrence for floods in the County is considered "frequent."

Table 10-18. Probability of Future Flood Events in Lewis County

Hazard Type	Number of Occurrences, 1996 – 2024	Percent Chance of Occurring in Any Given Year
Flash Flood	40	142.86%
Flood	27	96.43%
Total	67	239.29%

Source: NOAA NCEI Storm Events Database

Note: Due to limitations in data, not all flood events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is calculated using the number of occurrences between 1996 and 2024.

10.3.2 Climate Change Projections and Likely Impacts

Climate change is increasing flood risks in New York, including Lewis County, by raising temperatures and intensifying rainfall. Higher temperatures allow the air to retain more moisture, leading to sudden, severe rainfall events that stress local infrastructure and threaten communities. Rising sea levels also worsen coastal flooding risks. Flood types are primarily affected by climate change through precipitation and sea-level rise. The Intergovernmental Panel on Climate Change (IPCC) projects more intense, short-duration rainfall in the Northeast, increasing flash flood risks with higher volumes and peak rainfall rates. Urban flooding will likely worsen as existing drainage systems struggle to handle increased runoff.

Climate change affects ice jam flooding differently, as warmer temperatures shorten ice cover seasons and shift snowmelt timing, potentially reducing ice jam frequency but increasing mid-winter breakups, which can be more damaging. The New York State Climate Impacts Assessment projects an increase in extreme precipitation, potentially worsening flood risks (see Table 10-15). In Lewis County, average temperatures could rise by 2.5 – 16.4 °F by 2100, with precipitation varying by up to 9%, leading to more severe and frequent flooding that threatens residents' safety and quality of life (NOAA n.d.). Lewis County may experience an increase in the number of days with over 1 and 2 inches of precipitation, as soon as the 2030s and continuing through the 2050s and beyond. However, the number of days per year with over 3 inches of precipitation is projected to remain constant through the 2050s.

Table 10-19. Total Precipitation Projections for Lewis County

	Baseline	2030s		2050s	
		Lower Emissions Estimate	Higher Emissions Estimate	Lower Emissions Estimate	Higher Emissions Estimate
Days over 1 inch precipitation	3.6	3.6	3.5	4	4.4
Days over 2 inches precipitation	0.2	0.2	0.1	0.2	0.3
Days over 3 inches precipitation	0.1	0.1	0.1	0.1	0.1

Source: NOAA Climate Explorer Projections

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. Less frequent rainfall during the summer months may impact the potable water availability. A secondary impact of flooding which could occur due to climate

change includes impacts from increasing water temperatures in rivers and streams which will affect aquatic health and reduce the capacity of streams to assimilate effluent wastewater treatment plants (Stevens & Lamie 2024).

As summarized in Figure 10-6 and Figure 10-7, the New York State HMP outlines the effects climate change is projected to have on hazard location, intensity, frequency, and duration. The level of geographic specificity available in models and studies is also noted.

Figure 10-7. Climate Impacts on Flooding

FLOODING	Geographic Specificity	Local/State/Regional/Global/non-U.S.
	Climate Effects	Yes
	Location	While all flooding is expected to become more common in NYS, localized increases in short-duration extreme rainfall may be heightened above and beyond what would be expected from temperature increase alone, possibly due to convective cloud feedback.
	Intensity	Precipitation has increased across all seasons, with extreme precipitation events increasing significantly over historical levels. The volume and peak rates of rainfall are expected to increase.
	Frequency	All precipitation types are expected to become more common, including extreme precipitation events. Short-duration, high-intensity rainfall that causes flash flooding is expected to occur more frequently.
	Duration	Precipitation events are projected to become longer in duration.
Overview: Climate change directly affects precipitation, and with it, flooding. Extreme precipitation events have become more common as temperatures have warmed due to the increased capacity of warm air to hold water (REF167). Precipitation has increased across the Northeast in all seasons, while the heaviest precipitation events have increased 60% since 1958, leading to more frequent flood events (REF167). New York has already experienced a significant increase in two-inch extreme precipitation events over historical levels (REF168). Going forward, precipitation is generally expected to become more frequent, intense, and longer in duration, while extreme precipitation events will also become more common (REF169). This will lead to more flooding across the state.		

Figure 10-8. Climate Impacts on Coastal Hazards

COASTAL HAZARDS	Geographic Specificity	Local/State
	Climate Effects	Yes
	Location	Sea levels have risen faster than the global average in NYS and are projected to continue doing so. Sea-level rise is projected to be greatest in the lower Hudson and Long Island regions. Lake Erie, Lake Ontario, and the Long Island Sound are expected to see significant coastal erosion.
	Intensity	High rates of sea-level rise will exacerbate storm surge height and extent. Marine heat waves are expected to worsen in the New York area.
	Frequency	The number of tidal flooding days has already increased due to climate change and is projected to continue doing so.
	Duration	Studies have shown that marine heat waves have increased in duration due to climate change.
Overview: Climate change is estimated to cause the sea level along the coast of New York City to rise anywhere from one to three and a half (1-3.5) feet by 2080. Storm surges affecting shoreline properties will also increase by as much as 15 feet in that same time frame. Widespread coastal flooding, accelerated beach erosion, and the disappearance of important barrier and recreational beaches are all predicted to occur as a result of rising sea level (REF156).		

10.3.3 Projected Changes in Development and Population

Potential or Planned Development

Although Lewis County is largely rural, targeted development is expected near major transportation corridors and in proximity to Lowville, Copenhagen, Port Leyden, and Harrisville. Ongoing or potential development includes residential subdivisions, commercial expansions, and supporting infrastructure for growing population centers.

Many of these areas include or border mapped 1-percent annual chance flood hazard zones, and without strong local floodplain management practices, new development could inadvertently increase runoff volumes or introduce new structures into vulnerable areas. Municipalities participating in the National Flood Insurance

Program (NFIP) must carefully consider base flood elevations, setbacks, and drainage standards when review new development proposals.

Projected Changes in Population

Lewis County has experienced a slight decrease in its population since 2010. According to the U.S. Census Bureau, the County's population decreased by approximately -0.19 percent between 2010 and 2020. Cornell University's Program on Applied Demographics produced populations projections by County from 2016 to 2040. According to these projections, Lewis County is projected to have a population of 26,156 by 2030 and 25,618 by 2040 as the population decrease is expected to continue (Cornell University 2018). Changes in the density of the population can impact the number of persons exposed to flood hazards in the area.

Any increase in population - particularly in low-lying communities - can result in expanded exposure to flood hazards if not carefully planned. Future population shifts also influence emergency shelter needs, evacuation planning, and infrastructure capacity during extreme events.

10.3.4 Change of Vulnerability Since 2020 HMP

The entire County continues to be vulnerable to the flood hazard. Since the 2020 analysis, population statistics have been updated using the 2023 American Community Survey. The general building stock was also updated using RS Means 2024 building valuations that estimated replacement cost value for each building in the inventory. This provides an up-to-date look at the entire building stock for Lewis County and gives more accurate results for the exposure and loss estimation analysis. Additionally, the 2020 critical facility dataset was updated by the County and includes FEMA community lifelines. A Hazus v6.1 riverine flood analysis of Lewis County was based on the most current and best available data, including building and critical facility inventories, and the FEMA 2016 effective FIRM that was used in the last HMP to develop the 1-percent annual chance flood event depth grid and boundary.

11. HAZARDOUS MATERIALS

11.1 HAZARD PROFILE

This section provides a hazard profile (description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment of the hazardous materials (HazMat) hazard for the Lewis County HMP.

11.1.1 Hazard Description and Location

Defining Hazardous Materials

Hazardous materials consist of substances 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) (Superfund Law). Many are commonly used substances that are harmless in their normal uses but quite dangerous if released. The Superfund Law designates more than 800 substances as hazardous and identifies many more as potentially hazardous due to their characteristics and depending on the circumstances of their release (U.S. Environmental Protection Agency (USEPA) 2016).

Hazardous materials can include explosives, flammable and combustible substances, radioactive materials, toxic chemicals (poisonous vapors, aerosols, liquids and solids that have toxic effects on people, animals or plants), infectious substances, and hazardous wastes. The EPA identifies more than 800 substances as hazardous and many more as potentially hazardous depending on their characteristics and the circumstances of their release. CERCLA defines a hazardous substance as any of the following materials (EPA 2013):

- Any element, compound, mixture, solution, or substance designated as hazardous under Section 102 of CERCLA.
- Any hazardous substance designated under Section 311(b)(2)(a) of the Clean Water Act (CWA), or any toxic pollutant listed under Section 307(a) of the CWA.
- Any hazardous waste having the characteristics identified or listed under Section 3001 of the Resource Conservation and Recovery Act.
- Any hazardous air pollutant listed under Section 112 of the Clean Air Act.
- Any imminently hazardous chemical substance or mixture for which the EPA Administrator has taken action under Section 7 of the Toxic Substances Control Act.

Such materials are present in nearly every county in facilities that produce, store, or use them, and they are transported along interstate highways and railways daily. A common example is a water treatment plant, which uses chlorine on-site to eliminate bacterial contaminants. Many products containing hazardous materials are used and stored in homes. Even the natural gas used in homes and businesses is a dangerous substance when a leak occurs.

Causes and Types of Incidents

Hazardous materials can be released due to accident, human neglect, intentional acts, or natural hazards. They can affect nearby populations and contaminate critical or sensitive environmental areas. When caused by natural hazards, these incidents are considered to be secondary events. The hazardous materials hazard for this HMP

refers to accidental incidents related to the manufacture, transportation, storage, and use of hazardous materials. Hazardous material incidents most commonly occur as one of the following types:

- **A fixed-facility hazardous materials incident** is the uncontrolled release of materials from a fixed site capable of posing a risk to health, safety, and property. It is possible to identify and prepare for a fixed-site incident because laws require facilities to notify state and local authorities about what is being used or produced at the site.
- **A hazardous materials transportation incident** is an event resulting in uncontrolled release of hazardous materials during transport that can pose a risk to health, safety, and property. Hazardous materials transportation incidents can occur anywhere, although most occur on interstate highways, major federal or state highways, or major rail lines. Many incidents occur in sparsely populated areas and affect very few people. Hazardous products are shipped daily on highways, railroads, waterways, and pipelines. Transportation incidents are difficult to prepare for because there is little, if any, notice about what materials could be involved should an accident happen.

Regulations

Hazardous materials at fixed sites are regulated nationally by the U.S. Environmental Protection Agency (EPA) and in New York by the New York Department of Environmental Conservation (NYSDEC). The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration is responsible for ensuring the safe movement of hazardous materials to industry and consumers by all modes of transportation.

The EPA regulates hazardous materials under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly referred to as "Superfund." Congress established the Superfund program in 1980 to clean up sites where hazardous materials incidents occur. The CERCLA and the Superfund Amendments and Reauthorization Act (SARA) required that a National Priorities List (NPL) of sites throughout the United States be maintained and revised at least annually (EPA 1989). SARA, signed into law on October 17, 1986, is a federal law that applies nationwide.

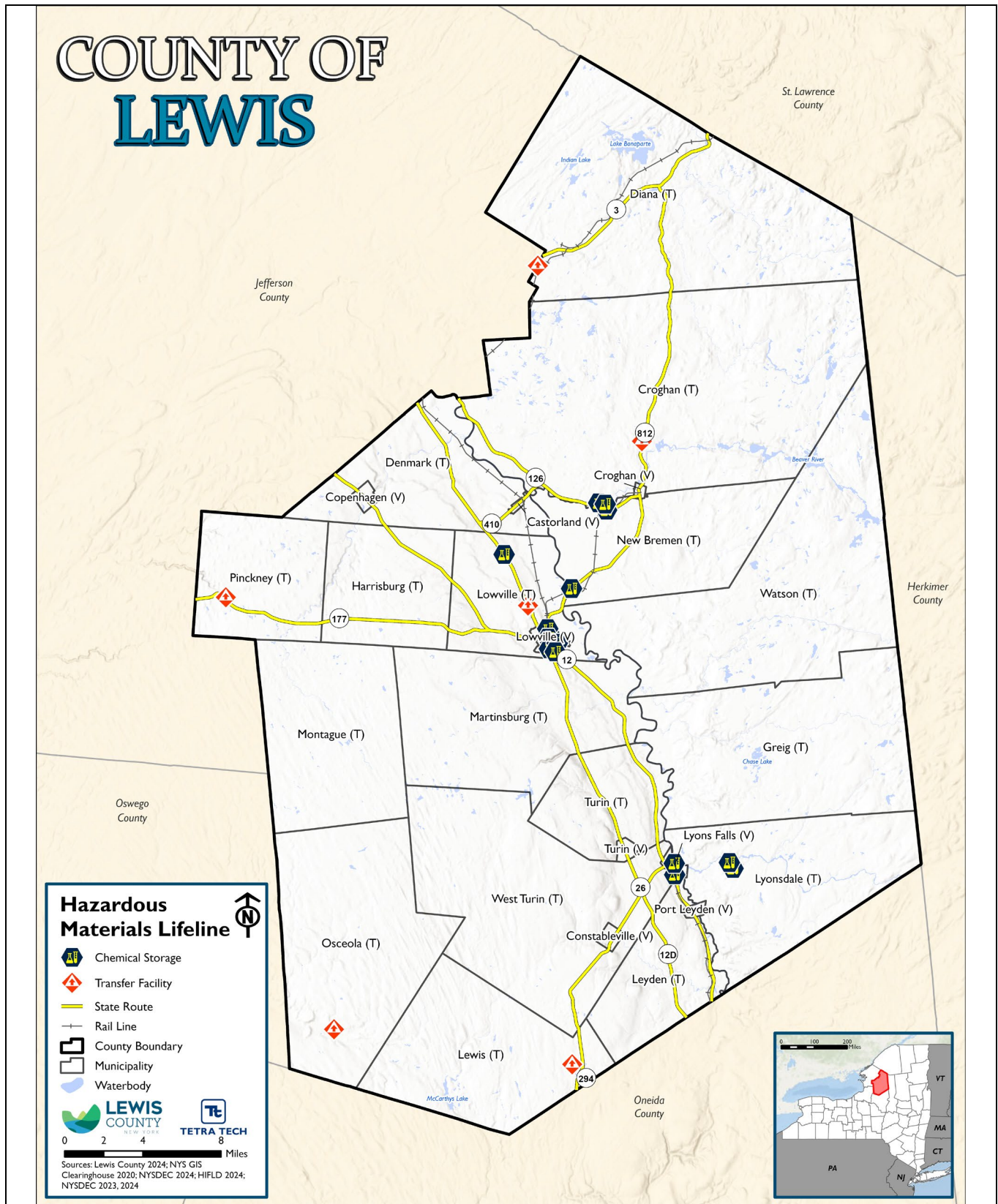
The EPA administers the Superfund program in cooperation with individual states. The NYSDEC's Inactive Hazardous Waste Disposal Site (IHWDS) Program is the State of New York's program for identifying, investigating, and cleaning up sites where consequential amounts of hazardous waste have been disposed. These sites go through a process of investigation, evaluation, cleanup, and monitoring.

Fixed-Facility Sites in Lewis County

Lewis County hosts agricultural operations and small manufacturing facilities that store and use hazardous substances. The County contains at least 24 hazardous materials sites, as shown in Figure 11-1. These facilities pose localized risks, especially in the event of spills, fires, or storage failures.

Historically, hazardous materials were dumped on the ground or in rivers or left out in the open by public and private companies. As a result, thousands of uncontrolled or abandoned contaminated sites were created nationwide. These sites include abandoned warehouses, manufacturing facilities, processing plants, and landfills. Fixed-site facilities that use, manufacture, or store hazardous materials in Lewis County pose risk and must comply with Title III of SARA.

Figure 11-1. Hazardous Material Sites in Lewis County



Fixed-site facilities that use, manufacture, or store hazardous materials in Lewis County pose risk and must comply with Title III of the federal SARA. SARA was signed into law on October 17, 1986, and is a federal law that applies nationwide. This law is linked to 42 U.S. Code Chapter 116 – Emergency Planning and Community Right-To-Know (EPCRA). SARA requires the governor of each state to establish a State Emergency Response Commission (SERC). New York’s SERC was established by Executive Law, Article 2-B in 1978. The signing of this legislation also established the Disaster Preparedness Commission in 1978. SARA also requires establishment of emergency planning districts by SERC and specifies that these districts can be existing political subdivisions. The function of the emergency planning district is to facilitate preparation and implementation of emergency plans.

Lewis County is home to three Toxic Release Inventory (TRI) facilities. Additionally, EPA identifies 125 fixed facilities that are EPA regulated (EPA 2025). For security purposes, they are not mapped in this profile. TRI facilities are required to report annually how much of each chemical is recycled, combusted for energy recovery, treated for destruction, and disposed of or otherwise released on-site and off-site. In 2023, the TRI facilities in Lewis County reported a total of 710 pounds of on-site and off-site disposal or other releases. All reported releases were by air, not water, and consisted of Xylene (mixed isomers) (EPA 2023).

Resource Conservation and Recovery Act (RCRA) of 1976

Several reporting mechanisms and databases exist to support the RCRA, which considers solid waste and hazardous waste management. RCRAInfo is a comprehensive information system and has replaced the Resource Conservation and Recovery Information System (RCRIS) and Biennial Reporting System (BRS) previously used to gather data. RCRAInfo tracks many types of information about the regulated hazardous waste handlers, including facility status, regulated activities, and compliance histories. It also captures data on hazardous waste generation from large-quantity generators and waste management practices, including treatment, storage, and disposal facilities. As of June 2025, 220 facilities had reported information to RCRAInfo (USEPA n.d.).

Superfund

In response to the health and environmental risks caused by improper storage and disposal of hazardous waste, Congress established the Superfund program to clean up the uncontrolled or abandoned warehouses, manufacturing facilities, processing plants, and landfill sites where wastes had been dumped or left out in the open. The Superfund program was established in 1980 and is administered by EPA in cooperation with individual states.

Superfund is a program administered by 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 one Superfund site is present in Lewis County in Lowville (U.S. Environmental Protection Agency (USEPA) n.d.).

In New York State, the Department of Environmental Conservation (NYSDEC) Inactive Hazardous Waste Disposal Site Program oversees the Superfund program (NYSDEC 2015). Federal regulations, including CERCLA and the Superfund Amendments and Reauthorization Act (SARA), require maintenance and (minimally) annual revision of a National Priorities List (NPL) of the worst hazardous waste sites throughout the United States (US EPA 2018).

Nuclear Sites

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. The western half of Lewis County is within the 50-mile Emergency Planning Zone (EPZ) for the Nine Mile Point plant (U.S. Energy Information Administration (EIA) n.d.); (U.S. Nuclear Regulatory Commission (NRC) 2016).

Hazardous Materials in Transit

A hazardous material is any solid, liquid, or gas that, when released, can harm people, the environment, or property (FEMA 2019). The Department of Transportation (DOT) classifies hazardous materials in transit as follows (FEMA 2019):

- **Class 1**—Explosives
- **Class 2**—Gases
- **Class 3**—Flammable liquids (and combustible liquids)
- **Class 4**—Flammable solids; substances liable to spontaneous combustion, substances that emit flammable gases on contact with water
- **Class 5**—Oxidizing substances and organic peroxides
- **Class 6**—Toxic (poisonous) substances
- **Class 7**—Radioactive materials
- **Class 8**—Corrosive substances
- **Class 9**—Miscellaneous dangerous goods/hazardous materials and articles

Hazardous materials can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. An accident involving a vehicle carrying hazardous materials becomes a HazMat incident if the hazardous material leaks or is involved in a fire, or if potential for release, fire, or another hazard exists (NFPA 2022).

Lewis County is intersected by major transportation routes, including State Routes 12 and 26, which are used for the transport of hazardous materials such as fuels, agricultural chemicals, and industrial solvents. Hazardous materials are shipped daily on highways, railroads, waterways, and pipelines. If released or misused, hazardous materials can cause death, serious injury, long-lasting health effects, and damage to structures and other properties as well as to the environment. Figure 11-2 shows the major transportation routes and railways in Lewis County. Figure 11-3 shows the extent and location of pipelines in the County.

Transportation of hazardous materials on highways involves tanker trucks or trailers, which are responsible for the greatest number of hazardous substance release incidents. Lewis County's roads cross rivers and streams; hazardous substance spills on roads could pollute watersheds that serve as domestic water supplies for areas within Lewis 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, releases of hazardous substances could occur when the pipes are damaged during excavation, incorrect operation, or by other forces. When hazardous materials are transported by aircraft or by watercraft, hazards can be posed by crashes, spills of materials, or fires on these vessels.

Figure 11-2. Major Transportation Routes and Railways in Lewis County

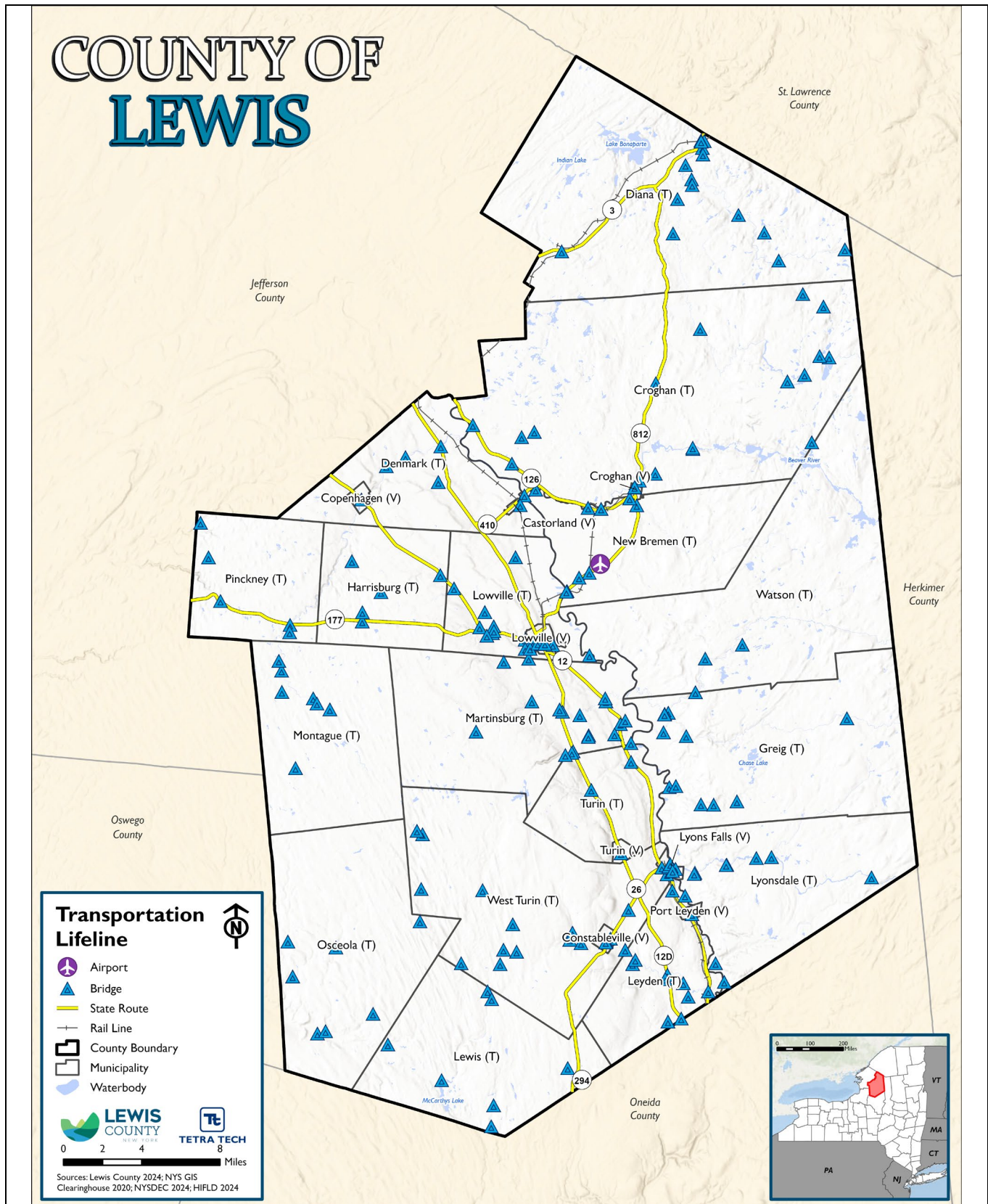
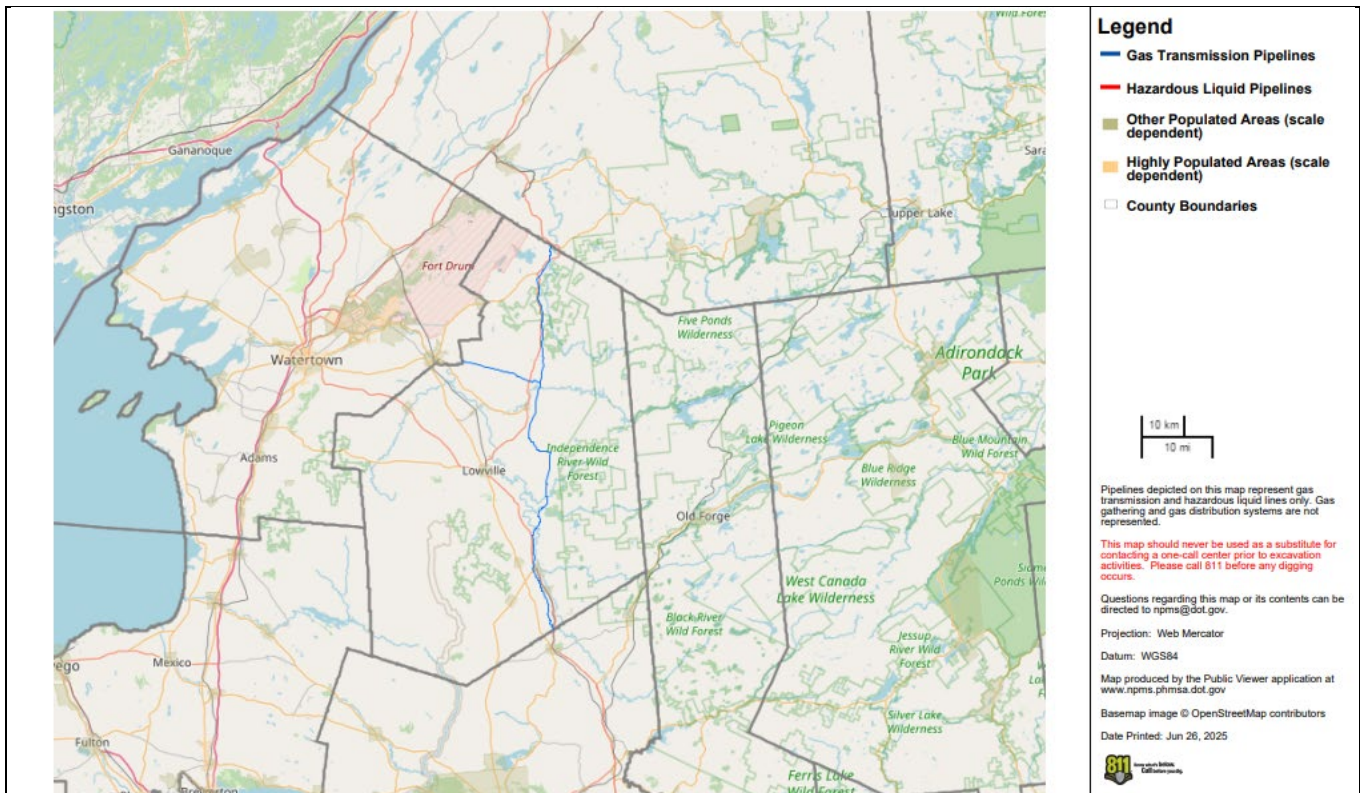


Figure 11-3. Lewis County Pipelines – National Pipeline Mapping System



Source: National Pipeline Mapping System 2025

Highways

Incidents involving hazardous materials in transit can occur anywhere in Lewis County. Transportation corridors within Lewis County that carry hazardous materials 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 hazardous materials. Transport vehicles do not typically travel through residential areas unless in route to destinations such as gasoline service stations or storage facilities.

Hazardous substance releases in navigable waterways are not a significant concern for Lewis County; per U.S. Coast Guard (USCG) determinations, there are no navigable waterways within the County (U.S. Coast Guard (USCG) 2016). The U.S. Army Corps of Engineers (USACE) only finds one waterway within the County as navigable and requiring permits: all areas of the Indian River below the ordinary high water mark of the Indian River extending from the upstream limits at NYS Route 812 in the Village of Indian River, Town of Croghan, Lewis County to the downstream confluence with Black Lake in the Town of Macomb, St. Lawrence County, and includes Indian River Lake and Narrow Lake in Lewis County (U.S. Army Corps of Engineers (USACE) n.d.).

Major transportation routes through Lewis County include State Routes (S.R.) 812, 177, 970J, and 12D. Potential for a spill also exists on routes used for industrial and business purposes. Section 3 of this HMP discusses roadways in the County.

Railways

HazMat incidents may occur along railways in Lewis County. Rail lines that may carry hazardous materials cross the Town of Diana, from to Town of Denmark to the Town of Lowville and the Town of Lyden. Rail lines that may carry hazardous materials include the Mohawk, Adirondack, and Northern Railroad, the Lowville and Beaver River Railroad, and CSX Transportation. However, at the time of writing, the operational status of these freight lines was unclear, and this infrastructure is considered underutilized if not abandoned altogether. New York State Department of Transportation (NYSDOT) 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 hazardous materials are of concern because an accident or release could pose a public safety hazard to the community.

Pipelines

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, some of which pass through Lewis County. The pipelines operating in Lewis County are owned by Dominion Transmission, Inc. and National Fuel Gas Supply Corporation (NFGSC). Contact information for each company can be located on the National Pipeline Mapping System website (National Pipeline Mapping System (NPMS) 2025).

11.1.2 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 or injuries. Dispersion can occur rapidly when the hazardous substance is transported by water and wind. While often accidental, releases can occur as a result of human carelessness, intentional acts, or natural hazards. Hazardous releases caused by natural hazards are known as secondary events. Hazardous materials 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 the ways in which the hazard occurs and develops
- Micro-meteorological effects of buildings and terrain, which alter dispersion of hazardous materials 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

As discussed earlier, 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 agent, 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 Federal Motor Carrier Safety Administration, there are nine classes of HazMat incidents (FMCSA 2013):

- Class 1—Explosives
- Class 2—Gases
- Class 3—Flammable Liquid and Combustible Liquid
- Class 4—Flammable Solid, Spontaneously Combustible, and Dangerous When Wet
- Class 5—Oxidizer and Organic Peroxide
- Class 6—Poison (Toxic) and Poison Inhalation Hazard
- Class 7—Radioactive
- Class 8—Corrosive
- Class 9—Miscellaneous

An incident occurring at an on-site or fixed facility may be sudden and without any warning, such as an explosion, or slowly developing, such as a leaking container. 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 the need to evacuate the public or to advise sheltering in place.

The amount of warning time for incidents associated with hazardous substances in transit (or off-site events) varies based on the nature of the incident, the scope of the incident, and the characteristics of the substance released. If an explosion does not occur immediately following an accident, there may be time for warning of adjacent neighborhoods and enough time to facilitate appropriate protective actions.

11.1.3 Previous Occurrences and Impacts

Historical information regarding previous occurrences and losses associated with hazardous substance incidents throughout Lewis County came from many sources. Given the many sources reviewed for the purpose of this HMP, information regarding loss from and impact of many events could vary depending on the source. Notably, monetary amounts cited in this HMP are based only on the available information identified during research for this HMP.

Between 1954 and 2024, the State of New York was included in two FEMA-declared emergencies related to hazardous substance incidents. Typically, EMs cover a wide region and could impact many counties. Not all counties in New York State were included in the two emergencies cited above. Lewis County was not included in either emergency.

The U.S. Department of Transportation (USDOT) Pipeline and HazMat Safety Administration (PHMSA) provides an incident report database with information on incidents throughout the United States. The data are from HazMat incident reports. According to this database, 16 incidents occurred in Lewis County between 1976 and 2024, releasing fuel oil, acetic acid, ink, diesel fuel, and kerosene (PHMSA 2023). HazMat incidents onsite or in transit

occur frequently across the State and in Lewis County. These incidents are typically small, localized events. The NYSDEC Spill Incidents Database lists 1,813 spill incidents throughout the County from May 19, 1985, through June 26, 2025, with an average of about 50 incidents per year (NYSDEC n.d.).

For this HMP, major HazMat incidents were summarized from 1965 to 2024 in Table 11-1. The complete data from the NYSDEC Spills Incidents Database has not been included in the hazard incident table below due to the large the number of events reported for this period.

Table 11-1. Hazardous Materials Incidents in Lewis County, 1965 to 2024

Date(s) of Event	Event Type	FEMA Declaration Number	Losses/Impact
May 24, 1991	Ink Spill	N/A	An ink spill took place in Lewis. 55 gallons broke open on the bottom during transit due to metal fatigue.
March 3, 1993	Fuel Oil Spill	N/A	A fuel oil spill took place in Lyons Falls. A tank overfill from an aboveground storage tank resulted in 50 gallons being spilled. The spill was contained in the tanks steel dyke. Cleanup involved vacuuming the fuel out of the dyke.
February 24, 1996	Fuel Oil Spill	N/A	A fuel oil spill took place in Lowville at the Lewis County Hospital. During delivery of fuel to the hospital tank, an employee did not monitor the tank, resulting in 5,500 gallons being forced out the vent pipe and into a storm drain. The hospital called New York State Department of Environmental Conservation (NYSDEC) who arranged for the cleanup.
April 27, 2007	Acetic Acid Spill	N/A	An acetic acid spill took place in Lowville. While unloading, it was discovered that one carton was punctured and leaking. The affected material was placed in a salvage drum for disposition.
September 2, 2008	Kerosene Spill	N/A	A kerosene spill took place in Lowville. A delivery driver overfilled the third compartment on his truck. An outside contractor cleaned up the spill.
January 19, 2009	Fuel Oil Spill	N/A	A fuel oil spill took place in Lyons Falls. A driver in training overfilled a tank, spilling less than two gallons of fuel oil from the vent pipe to the ground. Griffith Technician cleaned up the spill.
January 23, 2008	Kerosene Spill	N/A	A kerosene spill took place in Constableville. A customer's tank vent failed to operate properly causing 3 gallons of kerosene to foam out of the fill pipe. The driver cleaned up the spill.
February 4, 2009	Fuel Oil Spill	N/A	A fuel oil spill took place in Lowville. A driver overfilled a tank, forcing 2 gallons of fuel oil out of the tank top fittings and onto the ground. Griffith Energy cleaned up initial spill with an outside contractor dispatched for testing and final remediation.
April 1, 2009	Diesel Fuel Spill	N/A	A diesel fuel spill took place in Lowville. A driver filled a tank too quickly, allowing the product to blowback out of the fill port, spilling 4 gallons to the gravel below. Griffith Energy cleaned up the spill.
January 20, 2010	Fuel Oil Spill	N/A	A fuel oil spill took place in Castorland. A driver failed to differentiate the whistle from fuel oil flow sounds and overfilled a tank, forcing 10 gallons of fuel oil from the vent to the gravel driveway below. The driver soaked up the available oil and an outside contractor handled the remaining remediation.

Date(s) of Event	Event Type	FEMA Declaration Number	Losses/Impact
March 10, 2010	Diesel Fuel Spill	N/A	A diesel fuel spill took place in Lowville. The valve on the third compartment of a tank wagon failed while the truck was parked in a lot. 8 gallons of diesel spilled onto the frozen soil. An outside contractor handled remediation.
June 11, 2010	Diesel Fuel Spill	N/A	A diesel fuel spill took place in Lowville. A driver in training started a conversation with the trainer and stopped paying attention to the rack while loading compartments, allowing overfill of 5 gallons of diesel to spill. The driver and trainee cleaned up the spill.
October 18, 2010	Kerosene Spill	N/A	A kerosene spill took place in Lowville. A driver knocked the power takeoff (PTO) switch accidentally. The nozzle flew from the pump spraying 2-3 gallons of kerosene. An outside contractor handled remediation.
October 7, 2011	Fuel Oil Spill	N/A	A fuel oil spill took place in Lowville. A driver overfilled a tank due to a weak whistle. Approximately 1 gallon of fuel oil spilled. Technicians responded to clean up the spill and drain the product in the tank to a safe level.
October 24, 2011	Fuel Oil Spill	N/A	A fuel oil spill took place in Copenhagen. A driver switched tank compartments without turning off the nozzle. The tank overfilled while the driver was still in the truck, forcing 2 gallons of fuel oil from the vent to the concrete pad and grass.
May 23, 2017	Fuel Oil Spill	N/A	A fuel oil spill took place in Lewis. The driver arrived to offload a 9,000-gallon delivery of waste oil fuel to the customers 15 000-gallon tank. Before beginning the offload, he was told by facility personnel that the tank gauge showed there to be sufficient space for the entire load. In the process of unloading the driver noticed the tank gauge giving a much higher reading than was expected at the point. While in the process of verifying his remaining load and re checking the facility tank gauge some distance away the facility tank was over filled. The original tank gauge reading was found to be incorrect. All of the released fuel oil was captured in containment with no release to soil or water. A field service crew equipped with the correct personal protective equipment (PPE) was dispatched to pump out the fuel oil from containment and fully degrease and remediate the containment structure. All generated cleanup waste was drummed and manifested to the appropriate waste stream for disposal.
April 8, 2018	Fuel Oil Spill	N/A	A jet fuel spill took place in Lowville due to a traffic accident. 59 gallons of fuel were recovered.
March 12, 2019	Fuel Oil Spill	N/A	Equipment failure resulted in a commercial/industrial fuel spill in Lyons Falls.
February 13, 2020	Hazardous Material Spill	N/A	A sodium hypochlorite spill at a Chemical Bulk Storage Facility occurred due to equipment failure. This occurred in Beaver Falls.
June 19, 2021	Transformer Oil Spill	N/A	An equipment failure in a Martinsburg commercial facility resulted in a transformer oil spill.
November 3, 2021	Sulfuric Acid Spill	N/A	An equipment failure at a Beaver Falls commercial/industrial facilities resulted in a sulfuric acid spill. All materials were recovered.

Date(s) of Event	Event Type	FEMA Declaration Number	Losses/Impact
November 15, 2023	Pavement Sealer Spill	N/A	An equipment failure at a commercial/industrial facility in Castorland resulted in a spill.
November 29, 2024	Fuel Oil Spill	N/A	A fuel oil spill took place in Glenfield due to an equipment failure.
December 12, 2024	Diesel Spill	N/A	A traffic accident in Denmark resulted in a diesel spill from a commercial vehicle.

Source: PHMSA 2025

11.1.4 Cascading Impacts

Hazardous materials releases have the potential to cause major disruptions to local businesses that house hazardous materials and to other major businesses in the vicinity. Depending on the severity of the release event, this could result in additional economic impacts to the region, such as prolonged business closures or supply chain disruptions.

11.2 COMMUNITY ASSETS AT RISK

Regarding the HazMat hazard, all of Lewis 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 3), are vulnerable to HazMat incidents.

Overall, potential losses from HazMat incidents are difficult to quantify due to the many variables and human elements. Human safety and welfare can be compromised as a result of negative health effects of poisoning or exposure to toxic substances, fires, or explosions.

Effects from a radiological incident at a fixed facility would vary depending on the product released (type of radiation), amount of radiation released, current weather conditions, and time of day. The priority following an incident at any facility within the State of New York is life and safety of all individuals within the area impacted. Secondary to health and safety would be effects on critical infrastructure, environment, property, and the economy.

11.2.1 People and Communities

Overall Population

Depending on the type and quantity of chemicals released and weather conditions, an incident can affect larger areas that cross jurisdictional boundaries. When hazardous materials are released into the air, 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 on 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 different hazardous materials and waste sites in Lewis County render the entire County vulnerable to the HazMat incident hazard. Populations particularly vulnerable to effects of HazMat incidents are those residing

along major transportation routes because significant quantities of chemicals are transported along these major thoroughfares.

Hazardous materials incidents can cause acute and chronic health issues and have an impact on long-term public health. People near facilities producing, storing, or transporting hazardous substances are at higher risk of exposure, with populations downstream, downwind, and downhill of a released substance at particular risk. Depending on the substance released, people in a larger area may be in danger from explosion, absorption, injection, ingestion, or inhalation. People outside the immediate affected area may be evacuated for precautionary reasons or told to shelter-in-place, depending on the release type and wind conditions.

Exacerbating conditions, characteristics that can enhance or magnify the effects of a hazardous material release, include the following factors:

- Weather conditions, which affect how the hazard occurs and develops
- Micro-meteorological effects of buildings and terrain, which affect dispersion of hazardous materials
- Non-compliance with applicable codes (such as building or fire codes)
- Maintenance failures (such as fire protection and containment features), which can substantially increase the damage to the facility itself and to surrounding buildings.

Socially Vulnerable Population

Socially vulnerable populations may be impacted by hazardous material events differently than others. For example, in the event of an evacuation, younger and older populations and those with disabilities may have mobility issues or rely on others (i.e., parents, aides) to get around. Low-income households have less disposable capital to pay for temporary shelter (i.e., hotels) should their place of occupancy become unlivable. Individuals who do not speak English very well, or speak another language, may receive warning or evacuation notices but not understand them.

While the poverty threshold is typically used as a standard for identifying low-income populations, households may be above the poverty threshold but still struggle financially, making them socially vulnerable to hazard events. Costs associated with hazard events could exceed the financial capacity of these households, making them highly vulnerable to hazard events.

Economy

If a significant hazardous materials release occurred, not only would life, safety, and building stock be at risk, but the economy of the County may be impacted as well. A significant incident in a developed area may force businesses to close for an extended period of time because of contamination or direct damage. The potential losses to existing development vary because of the variable nature of hazardous material spills, but costs from product loss, property damage and decontamination, and other costs can add up to millions of dollars.

Hazardous material incidents can cause major economic disruptions. Not only do these events impact the companies transporting the materials, but the incidents may also impact facilities surrounding the location of the incident. A hazardous materials event can become costly quickly due to the cost of responders, response equipment, and clean-up.

Hazardous material incidents can lead to extended business closures that greatly affect the local economy. As businesses close and tourists are prohibited from entering the affected area, tourism may decline, and public perception of the area may be permanently affected.

The closure of railroads, airports, and highways as a result of a hazardous materials incident has the potential to impact the ability to deliver goods and services efficiently. Potential impacts may be local, regional, or statewide, depending on the magnitude of the event and level of service disruptions.

11.2.2 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. Hazardous materials can pose a serious long-term threat to property, particularly to the fixed-site facilities where hazardous materials are stored.

The impact of a fixed-facility incident will often be localized to the property where it occurs. It is difficult to determine potential losses to surrounding development because of the variable nature of a hazardous material spill. For example, a very small chemical spill in a less populated area would be much less costly and possibly limited to remediation of soil. Local building stock characteristics and the type of substance released during a spill will greatly affect the extent of property damage.

11.2.3 Community Lifelines and Other 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. Section 3 (County Profile) summarizes the number and type of critical facilities in Lewis County.

Most community lifelines house and store hazardous materials and thus are vulnerable to possible incidents. Potential impacts to community lifelines may include inaccessibility, loss of service, contamination, and/or potential damage to the structure or contents if an explosion related to a hazardous materials release occurs. Hospitals often store large quantities of hazardous materials and may face elevated risk in the event of a spill. If an incident were to occur in a hospital setting, patients would be jeopardized, and accessibility issues could prevent them from being moved and first responders from gaining access to the building. Patients who are moved may influx surrounding hospitals in addition to any new patients from the incident.

Hazardous material incidents have the potential to lead to major transportation route closures in the County. The closure of railroads, airports, and highways as a result of hazard material release incidents has the potential to impact the ability to deliver goods and services.

11.2.4 Natural Resources

Hazardous materials incidents can have obvious, direct environmental impact as well as long-term, hidden environmental damage. If spilled, hazardous substances can contaminate wells, kill wildlife, and impact ecosystems. Water pollution is an immediate concern for direct human consumption, recreation, crop irrigation, and fish and wildlife consumption. Depending on the material, pollutants can bio-accumulate to differing degrees, affecting animals high on the food chain long after a spill. Hazardous wastes can also leach into soils and travel with wind, which not only impacts the localized habitat but also can create issues for surrounding communities.

Strict disposal regulations have been defined by the EPA to ensure that the environment and community are protected from these types of events (EPA 2023). Hazardous material incidents would not likely affect geology but could significantly impact soils and farmlands, requiring expensive remediation.

11.2.5 Historic and Cultural Resources

Hazardous materials can pose a serious long-term threat to historic and cultural resources, particularly if the incident is on, near, or adjacent to a historic site. Historic sites are typically not built to modern building codes, making them susceptible to damage. These sites often cannot be easily moved or upgraded without getting special permits if on a historic registry.

11.3 FUTURE OCCURRENCES AND PROJECTED CHANGES IN RISK

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

11.3.1 Probability of Future Occurrences

Predicting future hazardous substance incidents in Lewis County is difficult. This type of incident can occur at any time and any location 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 the probability of occurrences of these events is high. Risk of a major incident within a given year is small.

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.

Information on previous hazardous materials occurrences in the County was used to calculate the probability of future occurrence of such events, as summarized in Table 11-2. Small spills, both fixed site and in-transit, occur throughout the year. It is estimated that the County will continue to experience direct and indirect impacts of hazardous material incidents annually that may induce secondary hazards such as infrastructure deterioration or failure, water quality and supply concerns, and transportation delays, accidents, and inconveniences. Based on historical records and input from the Steering Committee, the probability of occurrence for hazardous materials-related events in the County is considered “frequent.”

Table 11-2. Probability of Future Hazardous Material Events in Lewis County

Hazard Type	Number of Occurrences, 2015 – 2024	Percent Chance of Occurring in Any Given Year
Hazardous Materials	393	100%

Source: NYSDEC 2025

Note: Due to limitations in data, not all hazardous material events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is calculated using the number of occurrences between 2015 and 2024.

Climate change is leading to an increase in the frequency and intensity of precipitation events which is also leading to an increase in flooding events. Increased flooding may lead to unintentional releases and increased

movements of hazardous chemicals due to disrupted or damaged infrastructure. Severe weather events may also result in more dangerous traveling conditions, potentially leading to more accidents and unintentional releases of hazardous materials in transit.

11.3.2 Climate Change Projections and Likely Impacts

Climate change can impact HazMat and solid waste management (which often includes materials that are or have the potential to be hazardous) in multiple ways. Table 11-3 summarizes data collected from a report on climate change impacts on solid waste management. While not all impacts will increase the risk of a HazMat incident (discussed further in the Vulnerability section), the longevity of hazardous substances in the community may increase. Further study on the impacts of climate change on hazardous substances must be conducted to verify the potential impacts below and explore other impacts of climate change on HazMat incidents.

Table 11-3. Climate Change Impacts on Solid Waste Management

Climate Variable	Potential Impacts
Higher Temperatures	Alter waste decomposition rate
	Lead to reduced water availability, alter site hydrology and leachate production
	Waste may enhance disease transmission, by giving rise to increased vermin and increased risk of odor nuisance
	Increase dust potentials (in composting)
	Increase combustion risk
Increased Precipitation	Alter waste decomposition rate
	Alter site hydrology
	Increase leachate strength
	Increase flooding occurrence on-site due to saturated waste and rising groundwater
	Lead to disruption to transport infrastructure (road and rail) due to flooding and impact delivery of waste
	Increase slope stability risks
Sea Level Rise	Lead to inundation of sites
Reduced Cloud Cover	Adverse impact on the life of exposed materials

Source: Ifeanyi 2010

Note: Only those impacts related to solid waste management as it relates to hazardous materials have been listed.

It can be assumed that the projected increase in temperatures may impact the storage and ultimately transportation of hazardous materials. If stored improperly or if storage methods are not adapted to withstand extreme temperatures, hazardous materials may have an adverse reaction, leading to a potential hazardous materials incident (OSHA 2016).

Similarly, the increase in frequency and magnitude of flood and severe weather events may impact hazardous materials at fixed sites and during transit. The County experiences significant flooding events already, and based on future climate projections, these events may become more frequent and intense. If not properly stored, hazardous materials could mix with flood waters and cause adverse impacts (EPA 2021). Hazardous materials in-transit would be at risk, varying by mode of transport. Transport by rail and highway would need to be aware of flooding conditions and visibility during severe storms; transport by water would need to be aware of wave action and water elevation levels; transport by pipeline would need to be aware of potential excess soil saturation, which could influence the integrity of pipelines during extreme conditions.

11.3.3 Projected Changes in Development and Population

Potential or Planned Development

As discussed in Chapter 3 (County Profile) and Volume II (Jurisdictional Annexes), areas targeted for future growth and development have been identified across Lewis County. Any areas of growth could be impacted by hazardous material incidents because the entire County is vulnerable. The number and types of hazardous chemicals stored in and transported through the County may increase as the County and its municipalities continue to develop available land. Specific areas of development are indicated in the jurisdictional annexes in Volume II of this plan.

Development near the transit routes for hazardous materials and facilities will increase the County's overall risk. Therefore, the County and its municipalities should take precautions with the location of new development and the development's proximity to hazardous material facilities and transit routes. The County and its municipalities may want to consider implementing designs into new development that enable improved evacuation or protection from residual impacts of hazardous materials.

Projected Changes in Population

Lewis County has experienced a slight decrease in population since 2010. According to the U.S. Census Bureau, the County's population decreased by approximately -0.19 percent between 2010 and 2020. Cornell University's Program on Applied Demographics produced populations projections by County from 2016 to 2040. According to these projections, Lewis County is projected to have a population of 26,156 by 2030 and 25,618 by 2040 as the population decrease is expected to continue (Cornell University 2018). An increase in population density and future development can increase the exposure to a hazardous substance incident, so areas within the county with population increases should be aware of this increased exposure potential.

11.3.4 Changes in Vulnerability Since 2020 HMP

The volume of hazardous materials transported through rural counties like Lewis has increased due to regional supply chain shifts and fuel distribution routes. Extreme weather events, such as flooding or snowstorms, can increase the likelihood of transportation-related HazMat incidents, especially on rural roads with limited emergency access (FEMA 2019).

12. LANDSLIDE

12.1 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 landslide hazard, which includes an analysis of landslide risks and impacts.

12.1.1 Hazard Description and Location

According to the U.S. Geological Survey (USGS), the term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on an over-steepened slope is the primary reason for a landslide, there are other contributing factors that include:

- Erosion by rivers, glaciers, or ocean waves create over-steepened slopes
- Rock and soil slopes are weakened through saturation by snowmelt or heavy rains
- Earthquakes create stresses that make weak slopes fail
- Earthquakes of magnitude 4.0 and greater have been known to trigger landslides
- Volcanic eruptions produce loose ash deposits, heavy rain, and debris flows
- Excess weight from accumulation of rain or snow, stockpiling of rock or ore, from waste piles, or from man-made structures may stress weak slopes to failure and other structures (USGS date unknown).

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 generally prone to landslide hazards include previous landslide areas, bases of steep slopes, bases of drainage channels, developed hillsides, and areas recently burned by forest and brush fires (NYSDHSES 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 falling 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 (U.S. Geological Survey [USGS] 2013).

Landslide materials may be composed of natural rock, soil, artificial fill, or a combination of these materials. They can be caused by numerous factors such as volcanic eruptions, earthquakes, fire, storms, and by human land modifications. Landslides can transpire quickly with little to no warning. Depending on the location of a landslide, they can pose significant risks to health, safety, transportation, as well as other services. Annually, landslides in the U.S. cause approximately \$3.5 billion in damages and between 25 and 50 fatalities (NYSDHSES 2014).

The potential for landslides exists across the northeastern United States. Scientific and historical data for New York State indicates that some areas of the State have a substantial landslide risk. Lewis County is in the western foothills of the Adirondack Mountains, an area characterized by steep slopes, glacial soils, and seasonal precipitation patterns—all of which contribute to landslide susceptibility. According to the U.S. Geological Survey (USGS) Landslide Susceptibility Map, portions of Lewis County are classified as having moderate to high susceptibility to landslides, particularly in areas with steep terrain and near river valleys (USGS 2025). Such areas are shown in Figure 12-1.

12.1.2 Extent

The potential for landslides exists across the entire State and the entire northeast region of the US. Scientific and historical data for the State of New York indicates that some areas of the State have a substantial landslide risk. Landslide incidence is the number of landslides that have occurred in a geographic area (DOROTHY H. RADBRUCH-HALL 1982). Refer to Table 12-1 for the degrees of landslide incidence. It is estimated that 80% of the State has a low susceptibility to the landslide hazard. In general, the highest potential for landslides can be found along major rivers and lake valleys that were formerly occupied by glacial lakes resulting in glacial lake deposits and usually associated with steeper slopes (for example, the Hudson and Mohawk River Valleys). Some natural variables, such as soil properties, topographic position and slope, and historical incidence, all contribute to determining the overall risk of landslide activity in any area (NYS 2019).

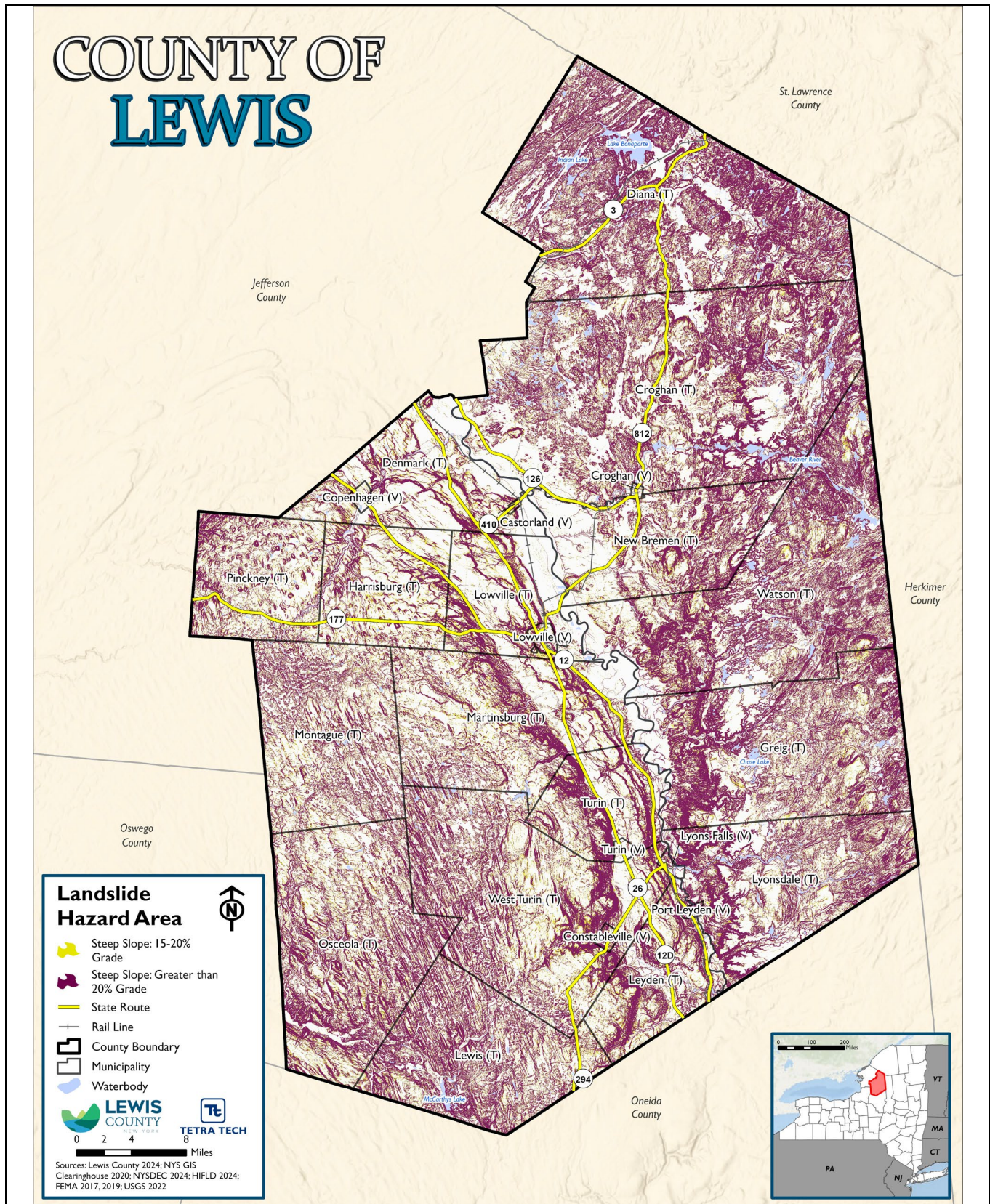
Table 12-1. Degrees of Landslide Incidence and Susceptibility

Degree of Incidence	Degree of Susceptibility	Total Area of Landslide (%)
High Incidence	High Susceptibility	15%
Medium Incidence	Medium Susceptibility	1.5% to 15%
Low Incidence	Low Susceptibility	< 1.5%

Source: Dorothy H. Rudbruch-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. Unusually high precipitation or changes in existing conditions can initiate landslide movement in areas where rocks and soils have experienced numerous 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 land sliding.

Figure 12-1. Lewis County Landslide Hazard Area



The severity of a landslide depends in large part on the degree of development in the area in which it occurs and the geographic area of slide itself. Landslides can result in devastating consequences, but only in very localized areas. A landslide occurring in an undeveloped area would be less severe because lives and property would not be affected; the impacts would be to land, vegetation, and possibly some wildlife. On the contrary, a landslide occurring in a developed area could have devastating effects, ranging from structure and infrastructure damage to injury and/or loss of life. Structures or infrastructure built on susceptible land would likely collapse as their footings slide downhill, while development below the land failure could be crushed. Landslides around roadways could damage or destroy vehicles or cause car accidents.

12.1.3 Previous Occurrences and Impacts

Regarding landslides, NYSGS estimates that 90% of landslides that occur in New York state are under 2 acres in size. Between 1953 and 2024, New York State was included in one landslide major disaster declaration (DR-487). It was classified as a severe storm, heavy rain, landslides, and flooding. Lewis County was not included in the declared counties for that event (FEMA 2018).

There are no known landslide hazard events that impacted Lewis County between January 2020 and May 2025. For events prior to 2009, refer to the 2020 Lewis County HMP. Additionally, there are no National Centers for Environmental Information (NCEI) landslide reported events for Lewis County, also noted in MitigateNY.

For this 2025 plan update, landslide events that occurred in the County between 2020 and 2024 were researched. However, specific information regarding any landslide events was not identified. For events prior to 2019, refer to the 2020 version of the HMP.

The New York State Geological Survey records a total of 329 significant landslide events that occurred in New York State between 1837 and 2007. None of these events are recorded as having occurred in Lewis County, and mapping of the New York State Geological Survey Landslide Inventory in the 2023 New York State Plan HMP does not include any individual landslide events in Lewis County prior to 1990.

12.1.4 Cascading Impacts

Secondary impacts of landslides 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.

12.2 COMMUNITY ASSETS AT RISK

To assess Lewis County's risk to the landslide hazard, an exposure analysis was conducted for the County's assets (population, building stock, critical facilities) using slope data extracted from the countywide 1-meter digital elevation model, obtained from USGS and FEMA, which approximates areas that are vulnerable to this hazard. For the purposes of this plan, the Vulnerability Assessment define high landslide incidence hazard area as areas with over 15 percent of the area is involved in land sliding. The asset data (population, building stock, critical facilities, new development) were used to support an evaluation of assets exposed and potential impacts and losses associated with this hazard. As an example, to identify assets exposed to landslides, available and appropriate GIS data were overlaid upon the hazard area.

Vulnerability to landslide hazards is a function of location, type of human activity, use, and frequency of landslide events. The effects of landslides on people and structures can be lessened by total avoidance of landslide hazard areas or by restricting, prohibiting, or imposing conditions on hazard-zone activity. Local governments can reduce landslide effects through land use policies and regulations. Individuals can reduce their exposure to hazards by educating themselves on past hazard history of the site and by making inquiries to planning and engineering departments of local governments.

The vulnerable portions of the county include the 15-20% grade and greater than 20% hazard areas, which include 12.2% and 28.8% of the County population respectively. The total number of buildings in the 15-20% grade hazard area is 4,950 throughout the county, representing 10.1% of the buildings in the County. The total number of buildings in the greater than 20% grade hazard area is 12,396 throughout the county, representing 30.9% of the buildings in the County.

In general, the built environment within high susceptibility zones, as well as population, structures, and infrastructure downslope, are vulnerable to this hazard. In addition to causing damages to residential and non-residential buildings, landslides can block off major roadways and inhibit travel for emergency responders or populations trying to evacuate the area. Refer to the Impact on Economy section for a description on the direct and indirect impacts from landslides.

12.2.1 People and Communities

Overall Population

The entire County may experience a landslide. However, the degree to which Lewis County residents are affected by potential landslides depends on many factors including the age and type of construction people live in, the soil-type homes are located on, and the location of the landslide. Whether directly or indirectly impacted, residents could be faced with business closures, road closures that could isolate populations, and loss of function of critical facilities and utilities.

Generally, a landslide event is an isolated incidence and impacts the populations within the immediate area of the incident. Specifically, the population located downslope of high landslide incidence hazard areas are particularly vulnerable. In addition to causing damage to residential buildings and displacing residents, landslide events can block off or damage major roadways and inhibit travel for emergency responders or populations trying to evacuate the area.

Table 12-2 and Table 12-3 summarize the estimated population exposed to the landslide hazard by municipality. Based on the analysis, an estimated 3,294 residents, or 12.2 percent of the County's population, are in the 15-20% grade hazard area and 7,770 residents, or 28.8 percent of the County's population, are in the greater than 20% grade hazard area. Overall, the Village of Lowville has the greatest number of individuals located in the 15-20% grade hazard area (577 people) and the Village of Lowville has the greatest number of individuals located in the greater than 20% grade hazard area (971 people).

Table 12-2. Estimated Population in the Steep Slope: 15-20% Hazard Area by Municipality

Jurisdiction	Total Population (2023 ACS)	Population in the Steep Slope: 15-20% Grade Hazard Area	
		Number of Persons	% of Jurisdiction Total
Castorland (V)	414	91	22.0%
Constableville (V)	356	30	8.4%
Copenhagen (V)	652	63	9.7%
Croghan (T)	2,911	351	12.1%
Croghan (V)	642	76	11.8%
Denmark (T)	1,589	164	10.3%
Diana (T)	1,503	133	8.8%
Greig (T)	1,020	87	8.5%
Harrisburg (T)	515	88	17.1%
Lewis (T)	801	99	12.4%
Leyden (T)	1,235	157	12.7%
Lowville (T)	1,442	133	9.2%
Lowville (V)	3,432	577	16.8%
Lyons Falls (V)	478	40	8.4%
Lyonsdale (T)	885	83	9.4%
Martinsburg (T)	1,232	160	13.0%
Montague (T)	159	29	18.2%
New Bremen (T)	2,436	284	11.7%
Osceola (T)	140	24	17.1%
Pinckney (T)	246	39	15.9%
Port Leyden (V)	680	106	15.6%
Turin (T)	827	118	14.3%
Turin (V)	312	20	6.4%
Watson (T)	1,888	190	10.1%
West Turin (T)	1,178	152	12.9%
Lewis County (Total)	26,974	3,294	12.2%

Source: U.S. Census Bureau 2023 ACS; FEMA 2017, 2019; USGS 2022

Table 12-3. Estimated Population in the Steep Slope: >20% Hazard Area by Municipality

Jurisdiction	Total Population (2023 ACS)	Population in the Steep Slope: >20% Grade Hazard Area	
		Number of Persons	% of Jurisdiction Total
Castorland (V)	414	180	43.5%
Constableville (V)	356	100	28.1%
Copenhagen (V)	652	73	11.2%
Croghan (T)	2,911	945	32.5%
Croghan (V)	642	84	13.1%
Denmark (T)	1,589	328	20.6%
Diana (T)	1,503	708	47.1%
Greig (T)	1,020	432	42.4%
Harrisburg (T)	515	119	23.1%
Lewis (T)	801	297	37.1%
Leyden (T)	1,235	328	26.6%
Lowville (T)	1,442	309	21.4%
Lowville (V)	3,432	971	28.3%
Lyons Falls (V)	478	145	30.3%
Lyonsdale (T)	885	240	27.1%
Martinsburg (T)	1,232	312	25.3%
Montague (T)	159	49	30.8%
New Bremen (T)	2,436	547	22.5%
Osceola (T)	140	46	32.9%
Pinckney (T)	246	58	23.6%
Port Leyden (V)	680	185	27.2%
Turin (T)	827	295	35.7%
Turin (V)	312	28	9.0%
Watson (T)	1,888	669	35.4%
West Turin (T)	1,178	322	27.3%
Lewis County (Total)	26,974	7,770	28.8%

Source: U.S. Census Bureau 2023 ACS; FEMA 2017, 2019; USGS 2022

Socially Vulnerable Population

Economically disadvantaged populations are more vulnerable to landslides 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 and those living with a disability are also more vulnerable because they are more likely to need medical attention that may not be available due to isolation during a landslide event, and they may have more difficulty evacuating. Those under 5 may be more vulnerable because they are dependent on others for essential needs and mobility. Individuals that are not proficient in English may be unable to interpret emergency warning messages to evacuate or providing resources to protect or mitigate damage to themselves and/or their property.

Table 12-4 and Table 12-5 present the socially vulnerable populations in the 15-20% and greater than 20% grade hazard areas. In the 15-20% grade hazard area, there are 629 persons over the age of 65 years, 189 persons under the age of five years, 2 non-English speakers, 471 persons with a disability, and 293 living in poverty. In the greater than 20% grade hazard area, there are 1,515 persons over the age of 65 years, 434 persons under the age of five years, 11 non-English speakers, 1,136 persons with a disability, and 925 living in poverty.

Table 12-4. Estimated Number of Vulnerable Persons Located in the Steep Slope: 15-20% Grade Hazard Area

Jurisdiction	Estimated Number of Vulnerable Persons Located in the Steep Slope: 15-20% Grade Hazard Area									
	Persons Over 65	% of Total	Persons Under 5	% of Total	Non-English Speaking Persons	% of Total	Persons with a Disability	% of Total	Persons in Poverty	% of Total
Castorland (V)	13	21.0%	7	20.0%	0	0.0%	15	22.1%	16	22.2%
Constableville (V)	5	8.3%	4	7.5%	0	0.0%	4	7.7%	3	8.6%
Copenhagen (V)	5	8.8%	3	9.1%	0	0.0%	13	9.3%	10	9.6%
Croghan (T)	52	12.0%	22	11.8%	0	0.0%	47	12.0%	53	11.9%
Croghan (V)	16	11.8%	4	11.4%	0	0.0%	10	11.8%	13	11.6%
Denmark (T)	39	10.2%	11	10.1%	0	0.0%	20	10.2%	24	10.0%
Diana (T)	25	8.8%	2	6.9%	0	0.0%	24	8.6%	19	8.5%
Greig (T)	20	8.3%	3	7.0%	2	8.3%	12	8.2%	10	8.5%
Harrisburg (T)	9	15.8%	8	16.0%	0	0.0%	14	16.7%	9	15.8%
Lewis (T)	11	11.7%	4	11.4%	0	0.0%	12	12.0%	4	10.8%
Leyden (T)	21	12.2%	12	12.5%	0	0.0%	16	12.6%	26	12.5%
Lowville (T)	44	9.1%	5	8.1%	0	0.0%	17	8.9%	20	9.1%
Lowville (V)	109	16.8%	19	16.2%	0	0.0%	95	16.7%	76	16.7%
Lyons Falls (V)	11	8.3%	2	7.1%	0	0.0%	5	7.4%	3	7.3%
Lyonsdale (T)	18	8.9%	4	8.2%	0	0.0%	23	9.3%	13	9.3%
Martinsburg (T)	38	12.7%	6	11.8%	0	0.0%	25	12.6%	12	12.8%
Montague (T)	3	14.3%	0	0.0%	0	0.0%	2	13.3%	1	11.1%
New Bremen (T)	43	11.5%	30	11.3%	0	0.0%	27	11.4%	15	11.2%
Osceola (T)	7	16.7%	0	0.0%	0	0.0%	2	11.8%	2	14.3%
Pinckney (T)	6	14.6%	4	14.3%	0	0.0%	4	13.3%	3	14.3%
Port Leyden (V)	27	15.5%	11	15.5%	0	0.0%	20	15.3%	22	15.5%
Turin (T)	28	14.0%	6	13.0%	0	0.0%	16	13.9%	8	13.6%
Turin (V)	6	6.4%	1	4.3%	0	0.0%	5	5.8%	1	5.3%
Watson (T)	40	10.1%	7	9.6%	0	0.0%	25	9.7%	15	9.7%
West Turin (T)	33	12.7%	14	12.6%	0	0.0%	18	12.8%	14	12.7%
Lewis County (Total)	629	11.8%	189	11.6%	2	6.9%	471	11.9%	392	12.0%

Source: U.S. Census Bureau 2023 ACS Vulnerable Population Totals; FEMA 2017, 2019; USGS 2022

Table 12-5. Estimated Number of Vulnerable Persons Located in the Steep Slope: >20% Grade Hazard Area

Jurisdiction	Estimated Number of Vulnerable Persons Located in the Steep Slope: >20% Grade Hazard Area									
	Persons Over 65	% of Total	Persons Under 5	% of Total	Non-English Speaking Persons	% of Total	Persons with a Disability	% of Total	Persons in Poverty	% of Total
Castorland (V)	26	41.9%	15	42.9%	0	0.0%	29	42.6%	31	43.1%
Constableville (V)	16	26.7%	14	26.4%	0	0.0%	14	26.9%	9	25.7%
Copenhagen (V)	6	10.5%	3	9.1%	0	0.0%	15	10.7%	11	10.6%
Croghan (T)	141	32.4%	60	32.2%	0	0.0%	127	32.3%	145	32.5%
Croghan (V)	17	12.5%	4	11.4%	0	0.0%	11	12.9%	14	12.5%
Denmark (T)	79	20.6%	22	20.2%	0	0.0%	40	20.3%	49	20.3%
Diana (T)	133	46.8%	13	44.8%	0	0.0%	131	46.8%	105	47.1%
Greig (T)	101	42.1%	18	41.9%	10	41.7%	62	42.2%	49	41.9%
Harrisburg (T)	13	22.8%	11	22.0%	0	0.0%	19	22.6%	13	22.8%
Lewis (T)	34	36.2%	12	34.3%	0	0.0%	37	37.0%	13	35.1%
Leyden (T)	46	26.6%	25	26.1%	0	0.0%	33	26.0%	55	26.5%
Lowville (T)	103	21.4%	13	21.0%	0	0.0%	40	21.1%	47	21.4%
Lowville (V)	183	28.2%	33	28.2%	0	0.0%	160	28.2%	129	28.3%
Lyons Falls (V)	40	30.1%	8	28.6%	0	0.0%	20	29.4%	12	29.3%
Lyonsdale (T)	54	26.8%	13	26.7%	0	0.0%	67	27.1%	37	26.6%
Martinsburg (T)	75	25.1%	12	23.5%	0	0.0%	50	25.3%	23	24.5%
Montague (T)	6	28.6%	0	0.0%	0	0.0%	4	26.7%	2	22.2%
New Bremen (T)	83	22.2%	59	22.3%	0	0.0%	53	22.4%	29	21.7%
Osceola (T)	13	31.0%	1	25.0%	0	0.0%	5	29.4%	4	28.6%
Pinckney (T)	9	22.0%	6	21.4%	0	0.0%	7	23.3%	4	19.0%
Port Leyden (V)	47	27.0%	19	26.8%	0	0.0%	35	26.7%	38	26.8%
Turin (T)	71	35.5%	16	34.8%	0	0.0%	41	35.7%	21	35.6%
Turin (V)	8	8.5%	2	8.7%	0	0.0%	7	8.1%	1	5.3%
Watson (T)	140	35.3%	25	34.2%	1	20.8%	91	35.3%	54	34.8%
West Turin (T)	71	27.3%	30	26.9%	0	0.0%	38	27.1%	30	27.3%
Lewis County (Total)	1,515	28.3%	434	26.5%	11	38.2%	1,136	28.6%	925	28.3%

Source: U.S. Census Bureau 2023 ACS Vulnerable Population Totals; FEMA 2017, 2019; USGS 2022

Economy

Landslide hazards also have impacts on the economy, including loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair/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).

This analysis did not include damage estimates for individual roadway segments and railroad tracks, but it is assumed these features would sustain damage due to ground failure, resulting in interruptions of regional transportation and of distribution of materials.

Landslide hazard events can also significantly affect 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 building standards in place at times of construction.

12.2.2 General Building Stock

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 4,950 buildings in the 15-20% grade hazard area, representing approximately 10.1 percent of the County's total general building stock inventory replacement cost value. The Town of Montague has the greatest number of its buildings located in the 15-20% grade hazard area (113 buildings or 18.3 percent of its total building stock). Refer to Table 12-6 through Table 12-9 for the estimated exposure of the 15-20% and greater than 20% grade hazard areas by jurisdiction.

There are an estimated 12,396 buildings in the greater than 20% grade hazard area, representing approximately 30.9 percent of the County's total general building stock inventory replacement cost value. The Town of Diana has the greatest number of its buildings located in the greater than 20% grade hazard area (1,456 buildings or 44.1 percent of its total building stock).

Table 12-6. Buildings in the Steep Slope: 15-20% Grade Hazard Area

Jurisdiction	Jurisdiction Total Buildings		Buildings in the Steep Slope: 15-20% Grade Hazard Area			
			Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Castorland (V)	237	\$209,754,520	41	17.3%	\$25,722,101	12.3%
Constableville (V)	331	\$214,011,340	24	7.3%	\$13,263,836	6.2%
Copenhagen (V)	502	\$470,894,543	54	10.8%	\$34,167,944	7.3%
Croghan (T)	4,564	\$2,716,704,006	597	13.1%	\$268,628,709	9.9%
Croghan (V)	516	\$406,813,941	50	9.7%	\$36,474,272	9.0%
Denmark (T)	2,262	\$1,683,271,436	256	11.3%	\$154,060,957	9.2%
Diana (T)	3,305	\$1,337,032,416	340	10.3%	\$122,670,944	9.2%
Greig (T)	2,962	\$1,160,581,336	278	9.4%	\$104,461,590	9.0%
Harrisburg (T)	863	\$533,636,646	136	15.8%	\$62,582,833	11.7%
Lewis (T)	1,495	\$722,393,059	198	13.2%	\$94,094,138	13.0%
Leyden (T)	1,988	\$1,065,963,460	265	13.3%	\$122,295,014	11.5%
Lowville (T)	1,752	\$1,762,819,749	206	11.8%	\$158,448,178	9.0%
Lowville (V)	2,332	\$1,966,304,011	347	14.9%	\$200,085,725	10.2%
Lyons Falls (V)	568	\$376,848,099	51	9.0%	\$50,672,185	13.4%
Lyonsdale (T)	1,614	\$656,114,259	141	8.7%	\$50,205,620	7.7%
Martinsburg (T)	2,180	\$1,847,174,778	290	13.3%	\$160,656,129	8.7%
Montague (T)	616	\$232,283,519	113	18.3%	\$41,014,569	17.7%
New Bremen (T)	3,030	\$1,662,197,383	376	12.4%	\$172,223,498	10.4%
Osceola (T)	1,190	\$395,966,698	189	15.9%	\$56,677,732	14.3%
Pinckney (T)	807	\$275,136,312	139	17.2%	\$40,984,278	14.9%
Port Leyden (V)	525	\$266,540,832	74	14.1%	\$37,793,901	14.2%
Turin (T)	1,094	\$881,477,564	151	13.8%	\$72,935,721	8.3%
Turin (V)	249	\$167,575,852	16	6.4%	\$8,609,247	5.1%
Watson (T)	3,311	\$1,308,062,188	367	11.1%	\$133,502,808	10.2%
West Turin (T)	1,869	\$1,005,138,588	251	13.4%	\$124,171,448	12.4%
Lewis County (Total)	40,162	\$23,324,696,534	4,950	12.3%	\$2,346,403,376	10.1%

Source: Lewis County 2024; NYS GIS 2024; FEMA 2017, 2019; USGS 2022; RS Means 2024

Table 12-7. Buildings in the Steep Slope: >20% Grade Hazard Area

Jurisdiction	Jurisdiction Total Buildings		Buildings in the Steep Slope: >20% Grade Hazard Area			
			Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Castorland (V)	237	\$209,754,520	114	48.1%	\$45,806,392	21.8%
Constableville (V)	331	\$214,011,340	91	27.5%	\$42,737,561	20.0%
Copenhagen (V)	502	\$470,894,543	73	14.5%	\$140,966,462	29.9%
Croghan (T)	4,564	\$2,716,704,006	1,532	33.6%	\$964,001,913	35.5%
Croghan (V)	516	\$406,813,941	85	16.5%	\$37,077,063	9.1%
Denmark (T)	2,262	\$1,683,271,436	513	22.7%	\$254,984,614	15.1%
Diana (T)	3,305	\$1,337,032,416	1,456	44.1%	\$517,716,973	38.7%
Greig (T)	2,962	\$1,160,581,336	1,123	37.9%	\$420,950,805	36.3%
Harrisburg (T)	863	\$533,636,646	208	24.1%	\$82,974,999	15.5%
Lewis (T)	1,495	\$722,393,059	535	35.8%	\$214,270,993	29.7%
Leyden (T)	1,988	\$1,065,963,460	557	28.0%	\$233,741,428	21.9%
Lowville (T)	1,752	\$1,762,819,749	473	27.0%	\$256,023,767	14.5%
Lowville (V)	2,332	\$1,966,304,011	727	31.2%	\$410,079,322	20.9%
Lyons Falls (V)	568	\$376,848,099	206	36.3%	\$94,363,787	25.0%
Lyonsdale (T)	1,614	\$656,114,259	472	29.2%	\$188,445,182	28.7%
Martinsburg (T)	2,180	\$1,847,174,778	527	24.2%	\$223,481,582	12.1%
Montague (T)	616	\$232,283,519	191	31.0%	\$63,336,205	27.3%
New Bremen (T)	3,030	\$1,662,197,383	762	25.1%	\$380,882,573	22.9%
Osceola (T)	1,190	\$395,966,698	401	33.7%	\$127,362,853	32.2%
Pinckney (T)	807	\$275,136,312	202	25.0%	\$50,724,612	18.4%
Port Leyden (V)	525	\$266,540,832	169	32.2%	\$59,955,108	22.5%
Turin (T)	1,094	\$881,477,564	321	29.3%	\$209,937,249	23.8%
Turin (V)	249	\$167,575,852	27	10.8%	\$13,512,648	8.1%
Watson (T)	3,311	\$1,308,062,188	1,063	32.1%	\$380,928,575	29.1%
West Turin (T)	1,869	\$1,005,138,588	568	30.4%	\$277,865,825	27.6%
Lewis County (Total)	40,162	\$23,324,696,534	12,396	30.9%	\$5,692,128,491	24.4%

Source: Lewis County 2024; NYS GIS 2024; FEMA 2017, 2019; USGS 2022; RS Means 2024

Table 12-8. Buildings in the Steep Slope: 15-20% Grade Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the Steep Slope: 15-20% Grade Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Government, Religion, Agricultural, and Education
Castorland (V)	24	14	0	3
Constableville (V)	12	12	0	0
Copenhagen (V)	25	25	1	3
Croghan (T)	223	293	14	67
Croghan (V)	29	17	0	4
Denmark (T)	73	107	0	76
Diana (T)	165	168	1	6
Greig (T)	145	122	1	10
Harrisburg (T)	44	53	0	39
Lewis (T)	73	105	3	17
Leyden (T)	96	126	3	40
Lowville (T)	43	61	1	101
Lowville (V)	199	130	4	14
Lyons Falls (V)	22	28	1	0
Lyonsdale (T)	67	72	1	1
Martinsburg (T)	97	110	2	81
Montague (T)	77	33	0	3
New Bremen (T)	139	183	4	50
Osceola (T)	122	66	0	1
Pinckney (T)	58	67	0	14
Port Leyden (V)	42	31	0	1
Turin (T)	55	67	0	29
Turin (V)	8	7	0	1
Watson (T)	183	165	3	16
West Turin (T)	111	104	0	36
Lewis County (Total)	2,132	2,166	39	613

Source: Lewis County 2024; NYS GIS 2024; FEMA 2017, 2019; USGS 2022

Table 12-9. Buildings in the Steep Slope: >20% Grade Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the Steep Slope: >20% Grade Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Government, Religion, Agricultural, and Education
Castorland (V)	47	59	3	5
Constableville (V)	39	34	1	17
Copenhagen (V)	29	34	1	9
Croghan (T)	600	715	86	131
Croghan (V)	32	46	2	5
Denmark (T)	146	234	6	127
Diana (T)	874	546	20	16
Greig (T)	715	391	5	12
Harrisburg (T)	59	91	0	58
Lewis (T)	218	289	2	26
Leyden (T)	201	258	6	92
Lowville (T)	100	162	4	207
Lowville (V)	335	367	4	21
Lyons Falls (V)	78	122	4	2
Lyonsdale (T)	193	251	23	5
Martinsburg (T)	189	204	5	129
Montague (T)	129	54	0	8
New Bremen (T)	268	354	23	117
Osceola (T)	228	167	0	6
Pinckney (T)	85	95	0	22
Port Leyden (V)	73	92	4	0
Turin (T)	137	140	0	44
Turin (V)	11	14	0	2
Watson (T)	644	366	22	31
West Turin (T)	234	241	1	92
Lewis County (Total)	5,664	5,326	222	1,184

Source: Lewis County 2024; NYS GIS 2024; FEMA 2017, 2019; USGS 2022

12.2.3 Community Lifelines and Other Critical Facilities

Landslides have the potential to cause significant physical damage to critical facilities and community lifelines that may interrupt key services and resources in the region. Landslides can cause significant damage to buildings and the supply chains that provide health and medical, public safety and security, and food, water, and shelter services. If these facilities and lifelines are not functional during or after an emergency, the County may experience cascading impacts, like additional injuries or health issues or prolonged economic impacts, if a significant number of displaced individuals cannot access temporary or transitional housing.

Access to major roads is crucial to life-safety after a disaster event and to response and recovery operations. Landslides can block egress and ingress on roads and bridge, causing isolation for neighborhoods, traffic problems, and delays for public and private transportation. This can result in economic losses for businesses. Mass movements can knock out bridge abutments or significantly weaken the soil supporting them, making them hazardous for use. Similar to roads, rail lines are important for response and recovery operations after a disaster. Landslides can block travel along the rail lines, which would become especially troublesome, because it would not be as easy to detour a rail line as it is on a local road or highway. Many residents rely on public transport to get to work around the County and into New York City, and a landslide event could prevent travel to and from work.

Additionally, power lines are generally elevated above steep slopes; but the towers supporting them can be subject to landslides. A landslide could trigger failure of the soil underneath a tower, causing it to collapse and ripping down the lines. Power and communication failures due to landslides can create problems for vulnerable populations and businesses. For example, for individuals that rely on medical equipment, a prolonged power outage can present serious health risks or complications. Similarly, water systems can become dammed or contaminated by landslide materials.

Table 12-10 and Table 12-11 summarize the number of community lifelines exposed to the landslide hazard area. Of the 102 community lifelines located in the 15-20% grade hazard area, the Town of Martinsburg has the most facilities (19). Of the 303 community lifelines located in the greater than 20% grade hazard area, the Town of Croghan has the most facilities (36). Refer to Section 3 (County Profile) for more information about the critical facilities and lifelines in Lewis County.

Table 12-10. Number of Facilities in the Steep Slope: 15-20% Grade Hazard Area by Lifeline Category

Jurisdiction	Number of Facilities in the Steep Slope: 15-20% Grade Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Castorland (V)	0	0	0	0	0	1	0	0	0	1	12.5%
Constableville (V)	0	0	1	0	0	0	0	1	0	2	12.5%
Copenhagen (V)	0	0	0	0	0	0	0	0	1	1	7.1%
Croghan (T)	2	0	0	0	0	2	5	1	2	12	14.8%
Croghan (V)	0	0	0	0	0	0	0	0	1	1	6.3%
Denmark (T)	0	1	0	0	0	0	0	0	1	2	2.5%
Diana (T)	0	0	0	0	1	0	1	0	0	2	3.6%
Greig (T)	1	1	0	0	0	2	2	0	0	6	17.6%
Harrisburg (T)	2	2	0	0	0	0	0	0	0	4	3.4%
Lewis (T)	0	0	0	0	0	4	1	0	1	6	25.0%
Leyden (T)	3	0	0	0	0	0	3	0	0	6	17.1%
Lowville (T)	0	1	0	0	0	1	0	1	0	3	3.4%
Lowville (V)	1	0	0	0	0	0	0	0	2	3	4.3%
Lyons Falls (V)	0	0	0	0	0	1	0	0	0	1	3.8%
Lyonsdale (T)	0	0	0	1	0	1	0	0	0	2	5.6%
Martinsburg (T)	0	13	1	0	0	2	3	0	0	19	11.3%
Montague (T)	2	0	0	0	0	1	2	0	0	5	23.8%
New Bremen (T)	0	0	0	0	0	3	2	0	2	7	18.4%
Osceola (T)	0	0	0	0	0	1	3	0	0	4	19.0%
Pinckney (T)	0	0	0	0	0	0	0	0	1	1	3.6%
Port Leyden (V)	0	0	0	0	0	1	0	0	1	2	8.0%
Turin (T)	0	0	1	0	0	0	0	0	0	1	5.6%
Turin (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Watson (T)	3	0	0	0	0	2	0	0	1	6	22.2%
West Turin (T)	0	0	0	0	0	1	4	0	0	5	18.5%
Lewis County (Total)	14	18	3	1	1	23	26	3	13	102	9.4%

Source: Lewis County 2020, 2024; NYSDEC 2023, 2024; NY GIS 2024; HIFLD 2024; US Energy Atlas 2024; FEMA 2017, 2019; USGS 2022

Table 12-11. Number of Facilities in the Steep Slope: >20% Grade Hazard Area by Lifeline Category

Jurisdiction	Number of Facilities in the Steep Slope: >20% Grade Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Castorland (V)	0	0	0	0	0	1	0	2	0	3	37.5%
Constableville (V)	1	0	0	0	0	0	3	0	2	6	37.5%
Copenhagen (V)	0	1	0	0	0	1	1	0	2	5	35.7%
Croghan (T)	4	11	0	2	0	9	7	2	1	36	44.4%
Croghan (V)	0	0	0	0	0	1	2	1	0	4	25.0%
Denmark (T)	4	3	0	0	0	1	4	0	0	12	14.8%
Diana (T)	4	1	0	0	1	7	8	3	1	25	45.5%
Greig (T)	5	1	1	0	0	3	5	0	1	16	47.1%
Harrisburg (T)	0	2	0	0	0	1	4	0	0	7	5.9%
Lewis (T)	0	0	0	0	0	2	5	0	1	8	33.3%
Leyden (T)	1	4	0	0	0	0	7	1	0	13	37.1%
Lowville (T)	2	2	0	0	1	3	10	0	0	18	20.7%
Lowville (V)	0	0	0	3	0	4	4	1	3	15	21.7%
Lyons Falls (V)	0	1	0	1	1	1	3	1	1	9	34.6%
Lyonsdale (T)	0	4	0	1	0	6	4	1	0	16	44.4%
Martinsburg (T)	1	12	0	0	0	3	11	2	1	30	17.9%
Montague (T)	1	0	0	0	0	2	3	0	1	7	33.3%
New Bremen (T)	0	6	0	1	0	2	2	0	1	12	31.6%
Osceola (T)	3	0	0	1	0	3	2	0	0	9	42.9%
Pinckney (T)	3	0	0	0	0	5	5	0	0	13	46.4%
Port Leyden (V)	0	4	0	0	0	3	1	0	1	9	36.0%
Turin (T)	0	0	0	0	0	2	2	0	0	4	22.2%
Turin (V)	0	0	0	0	0	2	1	0	0	3	30.0%
Watson (T)	0	2	0	0	0	5	2	1	1	11	40.7%
West Turin (T)	2	0	0	0	0	1	8	0	1	12	44.4%
Lewis County (Total)	31	54	1	9	3	68	104	15	18	303	28.0%

Source: Lewis County 2020, 2024; NYSDEC 2023, 2024; NY GIS 2024; HIFLD 2024; US Energy Atlas 2024; FEMA 2017, 2019; USGS 2022

12.2.4 Natural Resources

According to USGS, landslides can cause damage to the surface of the Earth in various forms depending on the magnitude and distribution of the event. Ruptures and slides can have a direct impact on the landscape and natural environment because they can disconnect habitats for miles isolating animal species or tear apart plant roots (USGS n.d.).

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

12.2.5 Historic and Cultural Resources

Depending on the magnitude and distribution, landslides affecting the County could bring devastating loss of life and property to the area in and around historical or cultural landmarks.

12.3 FUTURE OCCURRENCES AND PROJECTED CHANGES IN RISK

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

12.3.1 Probability of Future Occurrences

As indicated in the New York State HMP, and given the history of landslides in NYS, future landslides are likely to occur, but the severity of these landslides cannot be determined. Since documentation on landslides in Lewis County is sparse, predicting the extent of future landslides in the County is difficult. Based on historical records and input from the Planning Partnership, probability of occurrence of landslides in Lewis County is considered “occasional” (hazard event likely to occur within 100 years).

12.3.2 Climate Change Projections and Likely Impacts

According to the 2023 New York State HMP there has not been any research showing a direct link between climate change and current or historic landslide events in New York State. Landslides may be impacted by climate change in the future, however. The underlying conditions and causes of landslides, such as bedrock stability and heavy rain events, are influenced by climate-related trends like temperature increases, sea level rise, and extreme precipitation events. Unseasonably warm days leading to rapid snowmelt, or extreme precipitation events, can make the ground overly saturated. This in turn creates an unstable environment on steep slopes, which can cause landslides (NYSDHSES 2023).

Additionally, warming temperatures could increase the occurrence and duration of droughts, leading to an increased risk of wildfire. Wildfire reduces the vegetation that helps to support steep slopes and could increase the probability of landslide occurrences.

12.3.3 Projected Changes in Development and Population

As discussed, and illustrated in Section 3 (County Profile), areas targeted for future growth and development have been identified across the County. Development built in areas with softer NEHRP soil classes, liquefaction, and landslide-susceptible areas may experience shifting or cracking in the foundation during geologic events because of the loose soil characteristics of these soil classes. Any areas of growth located in areas with low landslide incidence could be potentially impacted by the landslide hazard even if the likelihood is low.

Lewis County has experienced a slight decrease in population since 2010. According to the U.S. Census Bureau, the County's population decreased by approximately -0.19 percent between 2010 and 2020. Cornell University's Program on Applied Demographics produced populations projections by County from 2016 to 2040. According to these projections, Lewis County is projected to have a population of 26,156 by 2030 and 25,618 by 2040 as the population decrease is expected to continue (Cornell University 2018). Changes in the density of the population can impact the number of persons exposed to landslide hazards in the area.

12.3.4 Changes in Vulnerability Since 2020 HMP

Increased precipitation intensity and more frequent freeze-thaw cycles have elevated the risk of slope instability. These conditions can trigger shallow landslides and debris flows, especially in spring and fall. Earlier snowmelt and heavier rain-on-snow events have increased soil saturation, a key landslide trigger in the region.

13. SEVERE STORM

13.1 HAZARD PROFILE

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 severe storm hazard in Lewis County.

13.1.1 Hazard Description and Location

Severe storm events are a common occurrence in Lewis County and the whole County is vulnerable to the impacts of hailstorms, high winds, lightning, thunderstorms, tornadoes, hurricanes/tropical storms, and Nor'easters which are defined below.

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).

All of Lewis County is vulnerable to hail. Hail in New York occurs mainly during the warmer months and can lead to extensive risks and damages. Hail poses a threat to agriculture, with crops and yields at risk due to hailstone damage, potentially resulting in financial losses. Property owners face threats to structures and vehicles, necessitating potentially costly repairs. The natural environment is also vulnerable, as hail can disrupt forest ecosystems, damage trees, and harm wildlife habitats. The severity of hail events range based on size of hail, wind, and vulnerabilities in the path of a hailstorm.

The National Risk Index's Expected Annual Loss associated with damaging wind events in Lewis County is \$34,688 (NYS DHSES 2023).

Hailstorms can form anywhere; however, they are more likely to fall in areas that have the most thunderstorms. The longer a hailstone spends in the clouds, the larger it becomes as more droplets continue to freeze. Hail falls when it becomes heavy enough to overcome the strength of the thunderstorm updraft and is pulled to the earth by gravity. Smaller hailstones may be blown away from the updraft by horizontal winds, so larger hail typically falls closer to the updraft than smaller hail (NOAA n.d.).

According to the National Risk Index, on the county scale, the County has a very low risk to hail; on the census tract scale, the County ranges from a very low risk to a relatively low risk (FEMA 2019).

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, but may occur independently (NWS 2012). The following are descriptions of types of damaging winds (NOAA n.d.):

- **Straight-line Wind**—Used to define thunderstorm wind which is not linked with rotation and is mainly used to differentiate from tornadic winds. When straight-line winds meet or exceed 58 miles per hour they are classified as severe by the National Weather Service. Straight-line wind intensity can be as powerful as a tornado.
- **Down Draft**—A small-scale column of air that sinks towards the ground
- **Macroburst**—An outward burst of strong winds that are more than 2.5 miles in diameter
- **Microburst**—A small, concentrated downburst which produces an outward burst of relatively strong winds near the surface
- **Downburst**—General term to describe macro and microbursts
- **Gust Front**—Leading edge of rain-cooled air which clashes with a warm thunderstorm inflow
- **Derecho**—Long lived windstorm associated with rapidly moving precipitation or thunderstorms. If wind damage swatch is more than 240 miles and includes gusts of wind that reach 58 mph or greater, then the event can be classified as a derecho

Since 1996, nineteen (19) presidential disaster declarations in New York State were at least in part due to extreme winds, accounting for more than \$82M worth of damage over that time. Notably though, more than 17,500 wind events that did not result in a presidential declaration have collectively resulted in more than \$466M in damage across the state since 1996 (NYS DHSES 2023). The National Risk Index's Expected Annual Loss associated with damaging wind events in Lewis County is \$114,691 (NYS DHSES 2023).

All of Lewis County is subject to high winds from thunderstorms, hurricanes/tropical storms, tornadoes, and other severe weather events. According to FEMA Winds Zones of the United States map, Lewis County is located in Wind Zone II, where wind speeds can reach up to 160 mph. The County is not located in the Hurricane Susceptible Region, which extends along the entire east coast from Maine to Florida, the Gulf Coast, and Hawaii. According to the National Risk Index, on the county scale, the County has a very low risk to strong winds (FEMA 2019).

Lightning and Thunderstorms

A thunderstorm is a local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder (NOAA-NSSL n.d.). 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 at 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 to generate tornadoes, hailstorms, strong winds, flash flooding, and lightning.

Typical thunderstorms are 15 miles in diameter and last an average of 30 minutes. The National Weather Service (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 n.d.). An estimated 100,000 thunderstorms occur each year in the U.S., with approximately 10% of them classified as severe (U.S. Department of Commerce; NOAA; NWS 1994). During the warm season, thunderstorms are responsible for most of the rainfall.

Lightning is a bright flash of electrical energy produced by a thunderstorm. Lightning strikes occur when strong negative charges build up within a thunderstorm cloud while strong positive charges on the ground move up tall objects, such as buildings, trees, and telephone poles (NYS 2023). 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, which can be very dangerous. It ranks as one of the top weather killers in the nation and kills approximately 20 people and injures hundreds each year (NWS n.d.). Lightning can occur anywhere there is a thunderstorm.

There are four different types of lightning:

- **Cloud to Sky** lightning is a discharge jumping from a cloud into the surrounding sky.
- **Intra-cloud** lightning is the most common. Intra-cloud lightning occurs when oppositely charged centers within the same cloud ignite and cause a bright flash.
- **Inter-cloud** lightning occurs between oppositely charged areas of different clouds.
- **Cloud to Ground** lightning is the most dangerous to people and therefore the most researched. It occurs when the negative charge of the bottom of a cloud travels to the positively charged ground below (NYS DHSES 2023)

Lightning is a common hazard, and lightning strikes can occur anywhere within New York State, including anywhere in Lewis County. The risk of lightning is highest in the summer months, when thunderstorms are more common. The risk is also higher in areas located in or near mountains, as these areas are more prone to thunderstorms.

Lightning alone is not a hazard that leads to a presidential disaster declaration. Lightning can contribute to substantive damage during a hurricane or other extreme weather event. Since 1996, New York State has had more than 500 lightning events that have collectively resulted in about \$12M in damages across the state. The National Risk Index's Expected Annual Loss associated with damaging lightning events in Lewis County is \$25,481 (NYS DHSES 2023).

Thunderstorms and lightning affect relatively small, localized areas, rather than large regions like winter storms and hurricane events. Thunderstorms and lightning can strike anywhere, but they are most common in the central and southern US. The atmospheric conditions in these regions of the country are ideal for generating these powerful storms. It is estimated that there are as many as 40,000 thunderstorms each day worldwide (NOAA 2023). The most thunderstorms are seen in the southeast United States, with Florida having the highest incidences (80 to over 100 thunderstorm days each year). The risk of lightning is highest in the summer months, when thunderstorms are more common.

Tornadoes

NOAA defines a tornado as a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground (NOAA 2011). Because wind is invisible, it is hard to see a tornado unless it forms a condensation funnel made up of water droplets, dust, and debris. A tornado's wind speeds can range from 65 mph to 300 mph, and they can be among the most violent of all atmospheric phenomena and can cause devastating destruction. Most tornadoes advance west-to-east, but tornadoes can often move southwest to northeast, at an average speed of 30 mph (NYS DHSES 2023). Tornadoes can topple mobile homes, lift cars, snap trees, and turn objects into destructive missiles. Among the most unpredictable of weather phenomena, tornadoes can occur at any time of day, in any state in the union, and in any season. While the majority of tornadoes cause little or no damage, some are capable of tremendous destruction, reaching wind speeds of 200 mph or more (NOAA 2023).

Tornadoes can occur anywhere in Lewis County. The National Risk Index's Expected Annual Loss associated with damaging tornado events in the County is \$164,966 (NYS DHSES 2023).

Approximately 1,200 tornadoes occur in the US each year, with the central portion of the country experiencing the most (NOAA-NSSL n.d.). Tornadoes can occur at any time of the year, with peak seasons at different times for different states. The peak season for southern Plains (Texas, Oklahoma, Kansas, etc.) is from May into early June. The Gulf coast experiences tornado seasons during the spring. For the northern Plains and upper Midwest region (North and South Dakota, Nebraska, Iowa, etc.) tornado seasons are generally seen June through July (NOAA-NSSL n.d.).

The entire State of New York is susceptible to tornado activity and vulnerable to tornado impacts. Based on statistics from 1996 to 2018, it was found that on average eight tornadoes ranging from F0 to F4 occurred each year in the State (NYS 2023). This resulted in an average of \$6.5 million in annualized loss from tornadoes for the State of New York. Approximately 142 injuries and six fatalities were recorded from 1996 to 2018 as a result of tornado impacts (NYS 2023). The entirety of Lewis County is vulnerable to tornado impacts and can experience a tornado at any time when suitable conditions are present.

According to the National Risk Index, on the county scale, the County has a very low risk to tornadoes (FEMA 2019).

Tropical Storms and Hurricanes

A hurricane is a tropical storm that attains hurricane status when its wind speed reaches 74 or more mph. 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 and impact the eastern seaboard or move into the US through the states along the Gulf Coast, bringing wind and rain as far north as New England before moving offshore and heading east.

A tropical storm system is characterized by a low-pressure center and numerous thunderstorms that produce strong winds and heavy rain. Compared to a hurricane, these storms tend to have slower wind speeds. Tropical storms 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. They are fueled by a different heat mechanism than other cyclonic windstorms such as Nor'easters and polar lows. The characteristic that separates tropical cyclones from other cyclonic systems is that at any height in the atmosphere, the center of a tropical cyclone will be warmer than its surroundings, a phenomenon called "warm core" storm systems (NOAA 2023).

Tropical cyclones (hurricanes and tropical storms) are an organized system of clouds and thunderstorms originating in tropical or subtropical waters. Tropical cyclones are classified based on wind speeds (NHC n.d.):

- Tropical depressions have maximum sustained winds of 38 mph or less
- Tropical storms have maximum sustained winds of 39 to 73 mph
- Hurricanes have maximum sustained winds of 74 to 110 mph
- Major hurricanes have maximum sustained winds of 111 mph or greater

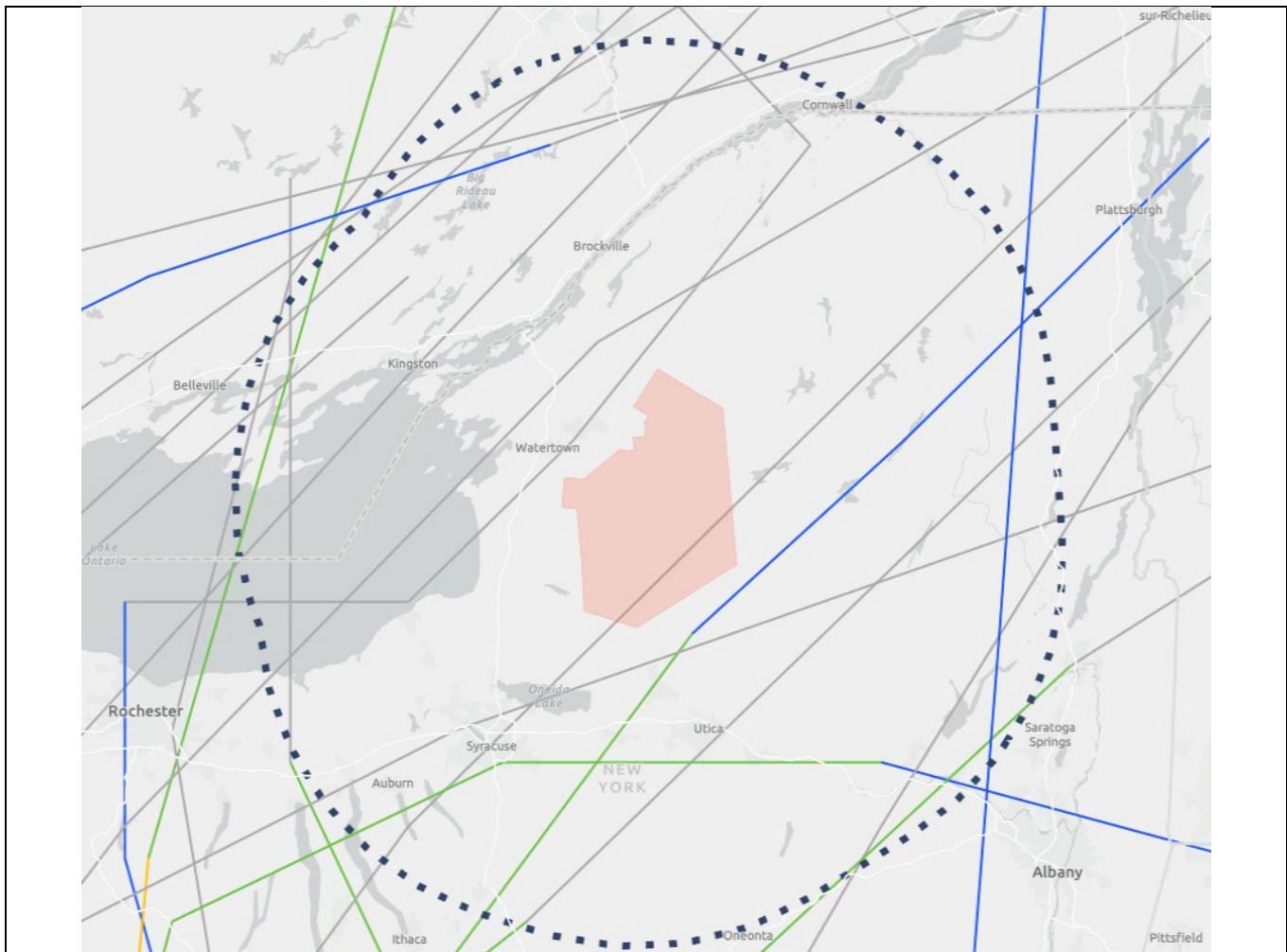
"Hurricane Season" begins on June 1 and ends on November 30, although hurricanes can, and have, occurred outside of this time frame (NYS DHSES 2023). NOAA's National Hurricane Center predicts and tracks these massive storm systems, which occur, on average, 12 times a year in the Atlantic basin (NYS DHSES 2023). The National Risk Index Expected Annual Loss associated with hurricane events in Lewis County is \$74.376 (NYS DHSES 2023).

The official hurricane season for the eastern US, including the State of New York, is from June to November. Hurricanes and tropical storms are most likely to affect the State between late July to early due to the coolness of the Atlantic Ocean (NYS 2019).

Lewis County is vulnerable to the impacts of hurricanes and tropical storms. However, it depends on the storm's track. All of Lewis County is at risk for flooding due to the heavy rain and winds produced by hurricanes and tropical storms. The majority of damage from these events often results from residual wind damage and inland flooding, most recently experienced during Hurricane Irene in August 2011.

NOAA's Historical Hurricane Tracks tool is a public interactive mapping application that displays Atlantic Basin and East-Central Pacific Basin tropical cyclone data. This interactive tool catalogs tropical cyclones that have occurred from 1950 to 2024 (latest date available from data source). Between 1950 and 2024, nineteen tropical cyclones tracked within 60 nautical miles of Lewis County (NOAA 2021). Figure 13-1 displays the tropical cyclone tracks for Lewis County that tracked with 60 nautical miles. One tropical cyclone had a direct pathway through the county, which was Tropical Storm Debby in August 2024. According to the National Risk Index, on the county scale, the County has a very low risk to hurricanes (FEMA 2019).

Figure 13-1. Historical Tropical Storm and Hurricane Tracks from 1950 to 2024



Source: NOAA NHC 2025

Nor'easters

A Nor'easter is a cyclonic storm that moves along the East Coast of North America. It is called a Nor'easter because the damaging winds over coastal areas blow from a northeasterly direction. Nor'easters can occur any time of the year but are most frequent and strongest between September and April. These storms usually develop between Georgia and New Jersey within 100 miles of the coastline and typically move from southwest to northeast along the Atlantic Coast of the United States (NWS n.d.). To be classified as a Nor'easter, a storm must have the following conditions, as per the Northeast Regional Climate Center (NRCC):

- Persist for at least a 12-hour period
- Have a closed circulation
- Be located within the quadrilateral bounded at 45°N by 65° and 70°W and at 30°N by 85°W and 75°W
- Show general movement from the south-southwest to the north-northeast
- Contain wind speeds greater than 23 mph)

A Nor'easter event can cause storm surges, waves, heavy rain, heavy snow, wind, and coastal flooding. Nor'easters have diameters that can span 1,200 miles, impacting large areas of coastline. The forward speed of a Nor'easter is usually much slower than a hurricane, so with the slower speed, a Nor'easter can linger for days and cause tremendous damage to those areas impacted. Approximately 40 Nor'easters occur in the northeastern US every year (NPS 2023). The intensity of a Nor'easter can rival that of a tropical cyclone in that, on occasion, it may flow or stall off the mid-Atlantic coast resulting in prolonged episodes of precipitation, coastal flooding, and high winds.

According to the New York State Hazard Mitigation Plan, the coastal region of the State of New York is extremely vulnerable to Nor'easters; however, these storms can impact the entire state. Therefore, the entire County is exposed and vulnerable to Nor'easters.

13.1.2 Extent

Hailstorms

The severity of hail is measured by duration, hail size, and geographic extent. Size is often estimated by comparing a hailstone to a familiar object (Table 13-1). Most hailstorms are made up of a mix of different sizes, and only the very largest hailstones pose serious risk to people caught in the open (NSSL 2021).

Table 13-1. Hail Size

Description	Diameter (in inches)	Description	Diameter (in inches)
Pea	0.25	Golf Ball	1.75
Marble or Mothball	0.50	Tennis Ball	2.5
Penny or Dime	0.75	Baseball	2.75
Nickel	0.88	Tea Cup	3.00
Quarter	1.00	Softball	4.00
Ping Pong Ball	1.25	Grapefruit	4.50

Source: National Oceanic and Atmospheric Administration 2023

High Winds

Table 13-2 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.

Table 13-2. 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

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, wind warnings and advisories for New York State are as follows (NWS 2020):

- **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 issued 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.

As shown in Figure 13-2 peak winds with a 500-year recurrence likelihood in Lewis County are in the range of tropical storm winds: 39 to 73 mph.

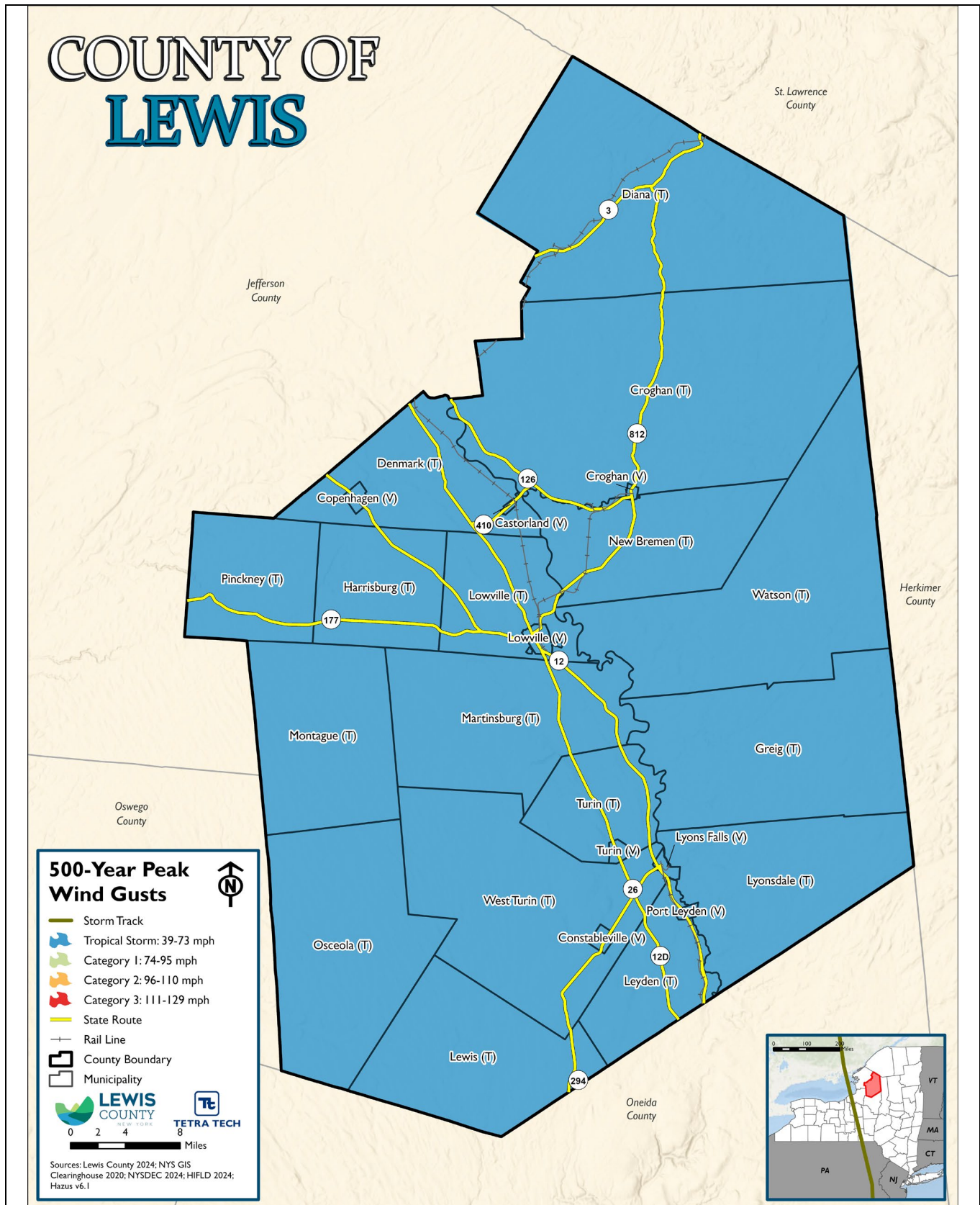
Lightning and Thunderstorms

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).

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 13-2. 500-Year Peak Wind Gusts



The NWS has five risk categories for severe weather: marginal, slight, enhanced, moderate, and high. The probabilistic forecast directly expresses the best estimate of a severe weather event occurring within 25 miles of a point (NWS 2022). Figure 13-3 presents the severe thunderstorm risk categories, as provided by the SPC.

Figure 13-3. Severe Thunderstorm Risk Categories

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

Source: NOAA SPC 2017

Tornadoes

The Enhanced Fujita Scale (EF-Scale) is the standard used to measure the strength of a tornado. It is used to assign tornadoes a rating based on estimated wind speeds and related damage. When tornado-related damage is surveyed, it is compared to a list of Damage Indicators (DI) and Degree of Damage (DOD), which help better estimate the range of wind speeds produced by the tornado. From that, a rating is assigned, similar to that of the F-Scale, with six categories from EF0 to EF5, representing increasing degrees of damage. The EF-Scale was revised from the original F-Scale to reflect better examinations of tornado damage surveys. This new scale considers how most structures are designed (NWS n.d.). Figure 13-4 illustrates the relationship between EF ratings, wind speed, and expected tornado damage. Lewis County typically experience tornadoes ranging from EF0 to EF1.

NOAA Storm Prediction Center issues watch and warning alerts for tornado activities. A tornado watch is when conditions are favorable for a tornado to form. A watch can cover parts of a state or span several states (NOAA-NSSL n.d.). A tornado warning is when a tornado is spotted by a radar and indicated action should be taken to ensure safety and shelter. Warnings can cover parts of counties or several counties, depending on the tornadoes path (NOAA-NSSL n.d.). The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible (NWS n.d.).

Figure 13-4. Explanation of EF-Scale Ratings

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

Source: NWS n.d.

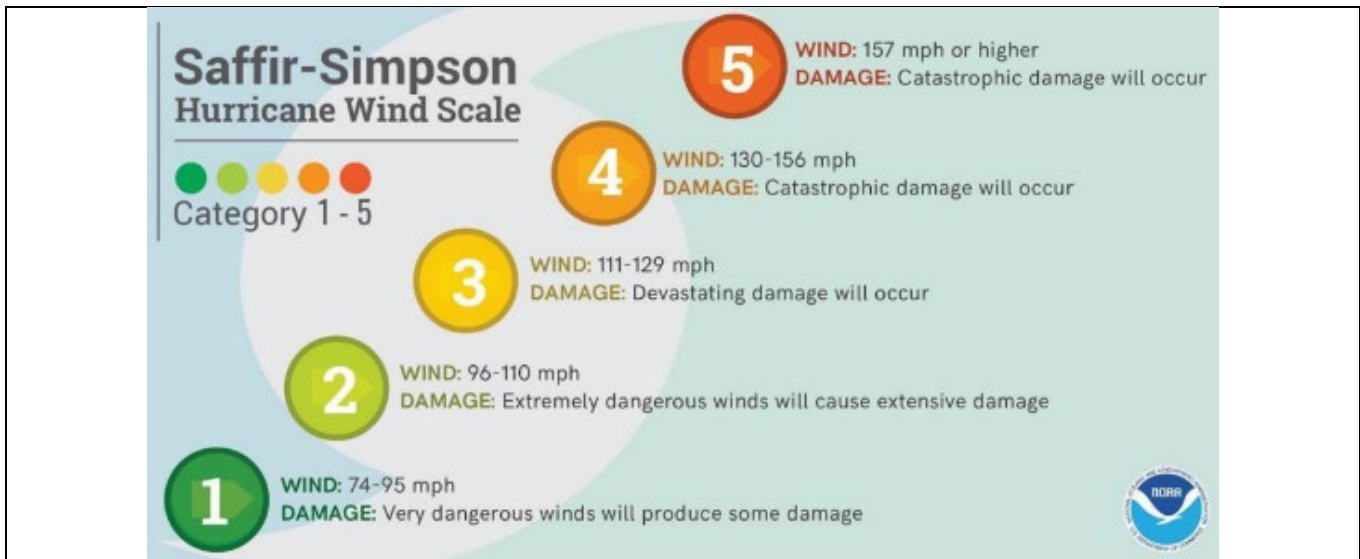
Tropical Storms and Hurricanes

Hurricanes are classified according to the Saffir-Simpson Hurricane Wind Scale from a Category 1 to Category 5 by sustained wind intensity. Figure 13-5 shows the categories and the type of damage they produce.

The NWS issues hurricane and tropical storm watches and warnings. These watches and warnings are issued or will remain in effect after a tropical cyclone becomes post-tropical, when such a storm poses a significant threat to life and property. The NWS allows the National Hurricane Center (NHC) to issue advisories during the post-tropical stage (NHC NOAA 2010):

- A Hurricane Watch is issued when hurricane force winds are possible within 48 hours. People can prepare by boarding up windows and moving loose items indoors and by having an emergency supply kit ready.
- A Hurricane Warning is issued when hurricane force winds are expected within 36 hours. People should seek shelter in a sturdy structure or evacuate if ordered.

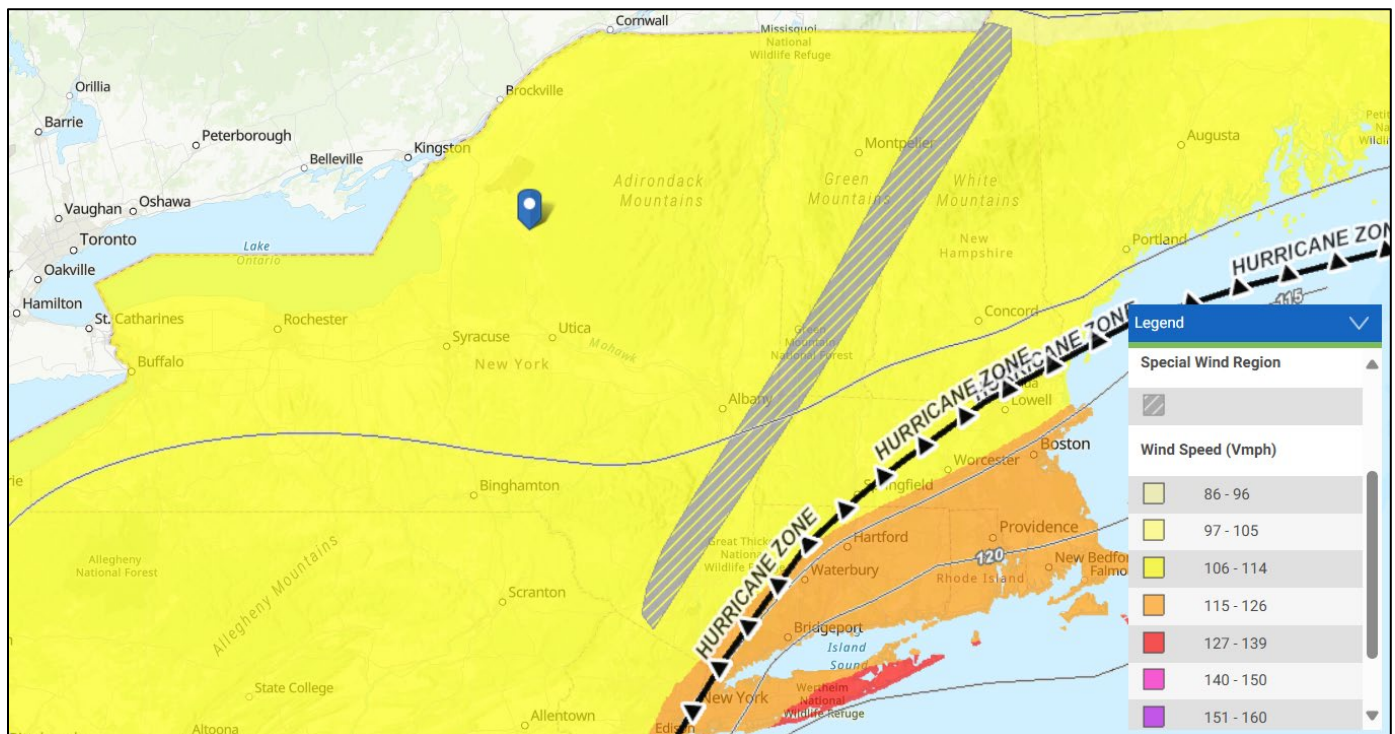
Figure 13-5. Saffir-Simpson Hurricane Wind Scale



Source: NWS 2022

According to the FEMA Winds Zones of the United States map, Lewis County is located within Wind Zone II where wind speeds can reach up to 130 mph. Figure 13-6 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 13-6. ASCE Design Winds for Risk Category II Structures



Source: (ASCE 2025)

Nor'easters

Nor'easters have the potential to impact society to a greater extent than hurricanes and tornadoes. These storms often have a diameter three to four times larger than a hurricane and therefore impact much larger areas. The severity of a Nor'easter depends on several factors including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day (e.g., weekday versus weekend), and season.

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 13-3 lists the five categories.

Table 13-3. Regional Snowfall Index 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+

Source: NOAA-NCDC 2011

13.1.3 Previous Occurrences and Impacts

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, Lewis County was included in 12 major disaster (DR) or emergency (EM) declarations for severe storm-related events (FEMA 2024). Table 13-4 lists these declarations.

Table 13-4. FEMA Declarations for Severe Storm Events in Lewis County (2009 to 2024)

Event Date	Declaration Number	Description
May 3 – August 2, 2000	DR-1335-NY	New York Severe Storms
May 13 – June 17, 2004	DR-1534-NY	New York Severe Storms and Flooding
April 26 – May 8, 2011	DR-1993-NY	Severe storms, flooding, tornadoes, straight line winds
August 28, 2011	DR-4020-NY, EM-3328	High wind
September 13, 2011	DR-4020-NY	Thunderstorm Wind
September 8, 2012	DR-4031-NY, EM-3341	Thunderstorm Wind
October 29, 2012	DR-4085-NY, EM-3351	High wind
May 13 – 22, 2014	DR-4180-NY	Severe Storms and Flooding
October 31 – November 1, 2019	DR-4472-NY	Severe Storms, Straight-line Winds, and Flooding
August 18 – 19, 2021	DR-4625-NY	Remnants of Tropical Storm Fred
July 10 – 11, 2024	DR-4814-NY	Severe Storm, Tornadoes, and Flooding
August 18 – 19, 2024	DR-4839-NY	New York Severe Storm and Flooding

Source: FEMA 2025; 2023 MitigateNY

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 contiguous counties. Between 2019 and 2024, Lewis County was included in 3 USDA severe storm-related agricultural disaster declarations (USDA 2024). For declarations that occurred between 2019 and 2024, refer to Table 13-5.

Table 13-5. USDA Declarations for Severe Storm Events in Lewis County (2019 to 2024)

Event Date	USDA Declaration Number	Description
August 8, 2023	S5640	Tornado and Excessive Rain
July 10 – 16, 2024	S5739	Tornado, Hurricane, High Wind, Flash Flood, Excessive Rain, Hail
August 5 – 10, 2024	S5875	Hurricane Debby

Source: USDA 2025

Previous Events below Disaster Declaration Thresholds

Known hazard events that impacted Lewis County between January 2019 and June 2025 are discussed in Table 13-6. For events prior to 2019, refer to the 2020 Lewis County HMP. Events listed are only those for which a minimum of \$1,000 in either property or crop damages occurred or fatalities or injuries were reported.

Table 13-6. Severe Storm Events in Lewis County (2019 to 2024)

Event Date	Location Impacted	Description
January 1, 2019	Countywide	The new year was rung in by damaging wind gusts along the Lake Erie shoreline and across the Niagara Frontier and northern Finger Lakes. The early morning saw gusts reported up to 61 mph.
February 25, 2019	Countywide	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. The track of the strong surface low was a classic high wind track for our region. The wind aloft was extremely strong, at 70 to 80 knots just off the deck. In addition, ice pushes off of the frozen Lake Erie lead to substantial pushing inland of ice on the Lake Erie shore as well as ice intrusion over the Buffalo ice boom. This resulted in ice jams on the Niagara River and flash flooding in Grand Island as a result. As colder air moved in behind it, lake effect snow developed east of the lakes with the best fetch for intense snow bands combined with wind resulting in blizzard conditions east of Lake Ontario. Selected peak wind gusts included 80 mph at Oswego, 74 mph at Niagara Falls International Airport, 69 mph at Buffalo-Niagara International Airport, 69 mph in Batavia, 74 mph in Dunkirk, 66 mph at Rochester, 60 mph at Fort Drum, and 59 mph in Orchard Park. Damage was reported in every county in the forecast area from the wind. Snow totals in the lake effect wind storm induced blizzard included 10 inches in Redfield, 7.4 inches in Fulton, and 7 inches in Constableville.

Event Date	Location Impacted	Description
March 10, 2019	Countywide	A strong area of low pressure moved through the central Great Lakes before reaching western Quebec. Ahead of the low, a strong 70 knot SSE low level jet crossed the area. This resulted in southeast downslope winds along the Lake Erie shore, with the low level jet nearly perpendicular to the terrain and a steep inversion located near ridge top to duct the higher winds down the lee slopes. The setup was also favorable for warning criteria gusts for the north facing slopes of the Tug Hill and the Black River Valley for downslope winds. The second phase of the event was a more typical post cold frontal southwest wind event to the northeast of Lake Erie and Lake Ontario. Model guidance continues showed about 55 knots off the deck as lapse rates steepened in the cold advection, which forced a marginal high wind event. Maximum wind speeds had difficulty reaching high wind warning criteria on a widespread basis with peak gusts of 63 mph at Fort Drum, 57 mph at the Buffalo-Niagara International Airport, and 57 mph at Batavia, however damage from wind gusts was scattered about several counties on a more localized basis.
May 19, 2019	Croghan	The first very warm, humid air mass of the season moved into the area with surface temperatures in the low to mid 80s and dewpoints in the mid-60s inland from the lakes. This contributed to a very unstable atmosphere. Deep layer shear was sufficient for storm organization with 35-40 knots of bulk shear. A subtle mid-level shortwave moved around the western periphery of the upper-level ridge over the southeast states and crossed the eastern Great Lakes from late morning through late afternoon. The increase in large scale ascent combined with moderate instability and convergence focused on a lake breeze boundary just south of the Lake Ontario shore and supported the strongest convection. One cluster of storms intensified just northeast of Buffalo late morning. Following a brief break, subsequent storms developed across much of the Genesee Valley, western Finger Lakes, and points southeast and east of Lake Ontario. Most of the storms struggled to intensify, with the exception of those that latched onto the lake breeze boundary from Wayne to Oswego counties.
October 31, 2019	Countywide	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. This system brought recorded breaking Halloween rains to our region, damaging wind gusts, a large Lake Erie seiche, a smaller Lake Ontario seiche, and river flooding in the North Country (Cayuga, Black and Moose River). Southwest winds increased dramatically on Halloween evening following a cold frontal passage. 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. Thousands of power outages occurred across the area, and pervasive wind-related damage closed hundreds of roads and did countless tree damage across a vast swath of the area. A seiche occurred on Lake Erie, with water rising to just over 9 feet above low water datum just past 8 pm at Buffalo. A second push brought the lake up to 10.67 feet above low water datum with the tropopause fold induced winds. Lakeshore flooding inundated Canalside in Downtown Buffalo, portions of Grand Island, Hoover Beach in Hamburg, and caused over \$5.5 million in damage to homes and property in Erie County alone. Substantial damage was done to the Buffalo break wall as well as continued destruction of the Dunkirk breakwater from the previous high water event on the lake from October 27. 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. High winds and lakeshore flooding continued into November 1.

Event Date	Location Impacted	Description
November 1, 2019	Countywide	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. This system brought recorded breaking Halloween rains to our region, damaging wind gusts, a large Lake Erie seiche, a smaller Lake Ontario seiche, and river flooding in the North Country (Cayuga, Black and Moose River). Southwest winds increased dramatically on Halloween evening following a cold frontal passage. 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. Thousands of power outages occurred across the area, and pervasive wind-related damage closed hundreds of roads and did countless tree damage across a vast swath of the area. A seiche occurred on Lake Erie, with water rising to just over 9 feet above low water datum just past 8 pm at Buffalo. A second push brought the lake up to 10.67 feet above low water datum with the tropopause fold induced winds. Lakeshore flooding inundated Canalside in Downtown Buffalo, portions of Grand Island, Hoover Beach in Hamburg, and caused over \$5.5 million in damage to homes and property in Erie County alone. Substantial damage was done to the Buffalo break wall as well as continued destruction of the Dunkirk breakwater from the previous high water event on the lake from October 27. 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. Wind speeds peaked near and just after midnight on November 1 across most of the area. The maximum values included 61 mph in Fredonia, 59 mph at the Buffalo Airport, 63 mph in Cape Vincent, and 62 mph at Niagara Falls.
March 20, 2020	Countywide	A deepening surface low tracked from Georgian Bay to southern Quebec, slowly deepening with time. A trailing cold front swept east across the eastern Great Lakes. All of this was driven phasing short waves in the northern and southern streams. While the track of the low fit the climatology for high wind events in our area, the thermodynamics were atypical. The strong winds aloft and best wind potential were primarily in the warm sector. By the time strong cold advection and pressure rises arrived, wind speeds aloft weakened substantially. The steepening of lapse rates in the warm sector coincided with an advancing mid-level dry slot, allowing for the best wind to mix down in the warm sector. The window of strong winds was very brief. Coincidentally, the warm sector destabilized enough that when it reached the eastern portions of the area, high shear, low CAPE, thunderstorms developed east of the Finger Lakes. This produced localized damage in Oswego County.
April 13, 2020	Countywide	Low pressure strengthened rapidly as it tracked from the mid-Mississippi River Valley across the central Great Lakes. Winds increased to around 70 knots and mixed behind the front. This lead to high wind gusts and a seiche developing on Lake Erie that peaked at 9.11 feet above low water datum. The maximum wind gusts reported across the area were 65 mph at the Fredonia mesonet station and 61 mph at the Brant mesonet station.

Event Date	Location Impacted	Description
November 15, 2020	Countywide	A rapidly intensifying low pressure system advanced through the western Great Lakes and eventually spun up toward James Bay. This 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. Lake Erie topped 11.13 feet at Buffalo due to the first seiche with the frontal boundary thunderstorms then secondarily topped 10.34 feet with the non-convective wind increase in the evening. This resulted in flooding and some evacuations in Angola, Hamburg, and the Old First Ward in Buffalo. Selected peak wind gusts during the afternoon and evening include 60 mph at Wellsville, 69 mph in Fredonia, 69 mph at the Buffalo Coast Guard, 67 mph at the Buffalo Niagara International Airport, 58 mph in Batavia, 58 mph at Fort Drum, 60 mph in Brockport, 62 mph at Niagara Falls Airport, and 59 mph in Warsaw.
December 11, 2021	Countywide	Two Pacific shortwave troughs promoted the formation and deepening of a surface low that tracked from the Great Plains, across southern Lake Michigan, and eventually to near James Bay while deepening below 980 mb. This pushed a strong cold front crossed our region. Selected peak wind gusts included 57 mph in Wyoming, 68 mph in Fredonia, 71 mph at the Buffalo Waterfront, 66 mph at Buffalo-Niagara International Airport, 70 mph at Batavia, 66 mph at Fort Drum, 65 mph in Harrisburg, 59 mph in York. 63 mph in Brockport, 60 mph at Rochester Airport, 74 mph at Niagara Falls Airport, 65 mph at Clifton Springs, 61 mph in Medina, 61 mph in Pultneyville, and 71 mph in Warsaw. 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. The water level in downtown Buffalo rose to 10.6 feet above low water datum.
May 21, 2022	Constableville & Port Leyden	A cold front was to our west and stalled out. A highly unstable air mass in place. Two rounds of severe weather occurred. The first was over the North Country and St. Lawrence Valley and aided by a well-developed vortex that had traversed the Toronto area early in the afternoon. The lake breeze off of Lake Erie protected the Buffalo metro area, but it ultimately interacted with the lake breeze and instability to the east of Lake Ontario. These storms produced mostly large hail. A second round of severe storms occurred later in the evening as a couple of passing waves triggered thunderstorms due to very high instability. Wind damage and heavy rain with some flooding were the main issues. Most of this was from the Genesee Valley to the west as thunderstorms weakened once they pushed eastward after midnight.
July 13, 2023	Lowville	A cold front crossing the region along with building instability resulted in a line of severe thunderstorms sweeping east from the Genesee valley and northern Finger Lakes on into the North Country during the afternoon. Numerous reports of wind damage were received.

Event Date	Location Impacted	Description
August 7, 2023	Countywide	A weak surface low tracked across western NY to the northeast of Lake Ontario from the afternoon to the late evening hours. Building instability and increased wind shear ahead of the low supported clusters of severe thunderstorms beginning late in the afternoon across the northern Finger Lakes. Additional northward moving severe storms that exhibited low-level rotation formed early in the evening in a narrow corridor from central New York to areas east of Lake Ontario. In addition to wind damage and large hail, two tornadoes occurred over northeast portions of Oswego County and southern portions of Lewis County during the evening. Eventually, storm surveys confirmed that one of these tornadoes near West Leyden New York to Turin New York tracked 16 miles with observed damage indicating peak winds up to of 140 mph or EF-3 strength. After the tornadic storms diminished, additional storms with very heavy rain tracked over portions of Oswego and Lewis counties from late evening into the overnight hours. These storms which trained over similar areas produced 3 to 4 inches of rain with multiple roads flooded and a few roads entirely washed out.
January 9, 2024	Countywide	A strong area of low pressure crossed the central Great Lakes producing a period of damaging winds across the region. Damaging wind gusts caused damage in every zone of the NWS Buffalo County Warning Area. Notable wind gusts include: 79 MPH at the Watertown Airport ASOS, 74 MPH at the Dunkirk Airport ASOS and 70 MPH at the Buffalo Airport ASOS. Damage during this event included two tractor trailers that rolled over due to strong winds, and numerous trees and wires down across all of Western and North Central NY.
January 12, 2024	Countywide	A powerful storm impacted the region with damaging winds. Behind the passing cold front, strong winds continued as rain changed to snow, eventually becoming lake enhanced and then lake effect. Peak wind gusts observed during the event include: 68 MPH at the Buffalo Airport, 66 MPH at the Batavia New York State Mesonet site and 63 MPH at the Niagara Falls Airport. Damage from this event included numerous trees and wires down across much of western and north central New York.
February 28, 2024	Countywide	A powerful cold front extending south out of Canada crossed the region on the afternoon of February 28th, causing temperatures to plunge to the teens and 20s through the rest of the day. Strong to damaging winds along and behind the cold front caused numerous trees and wires to be downed. Additionally, several reports of 50 knot winds or greater occurred with this event. Notable winds gusts for this event includes: 63 mph in Oswego, 62 mph in Clifton Springs, 59 mph in Pultneyville, Watertown Airport and Glenfield. Damage during this event includes numerous trees and wires down across the warned areas which included all forecast zone from Monroe and Ontario counties eastward. A large tree also fell onto a house in Fairport.

Event Date	Location Impacted	Description
July 10, 2024	Glenfield	On July 10, 2024, most of western and central New York were impacted by the remnants of tropical cyclone Beryl. The event brought every type of warm season severe hazard, including 10 tornadoes across the entire state, numerous reports of wind damage, hail and significant flash flooding. As the remnants of Beryl approached the region, a warm front out ahead of/associated with the system provided one of the main focus points for the severe weather. The front, draped from west to east across the state, generally along/near I90 remained nearly stationary through the day, moving only slowly north. Instability increased greatly along and south of the front. With the system being of tropical origin, it was highly dynamic with strong shear, especially along and just north of the warm front across the area. A passing mid-level trough during the event also helped to increase the severe potential for the day. The event resulted in numerous tornado warnings issued across western and central New York with 10 tornadoes confirmed for the day. Wind damage from thunderstorms was also widespread across the area, mainly from near Lake Erie, northeast to Rochester and the northern Finger Lakes, to the north country. Other than the tornadoes during this event, the most significant issue was flash flooding that occurred in Lewis County. Significant flash flooding occurred in the Town of Lowville, where roads washed out, water rescues were required and numerous buildings were flooded, including the Lowville Academy and Central School. Rainfall amounts in Lowville were nearly 6.50 inches. Flood damage in Lowville totaled \$50 million.
July 10, 2024	Countywide	On July 10, 2024, most of western and central New York were impacted by the remnants of tropical cyclone Beryl. The event brought every type of warm season severe hazard, including 10 tornadoes across the entire state, numerous reports of wind damage, hail and significant flash flooding. As the remnants of Beryl approached the region, a warm front out ahead of/associated with the system provided one of the main focus points for the severe weather. The front, draped from west to east across the state, generally along/near I90 remained nearly stationary through the day, moving only slowly north. Instability increased greatly along and south of the front. With the system being of tropical origin, it was highly dynamic with strong shear, especially along and just north of the warm front across the area. A passing mid-level trough during the event also helped to increase the severe potential for the day. The event resulted in numerous tornado warnings issued across western and central New York with 10 tornadoes confirmed for the day. Wind damage from thunderstorms was also widespread across the area, mainly from near Lake Erie, northeast to Rochester and the northern Finger Lakes, to the north country. Other than the tornadoes during this event, the most significant issue was flash flooding that occurred in Lewis County. Significant flash flooding occurred in the Town of Lowville, where roads washed out, water rescues were required and numerous buildings were flooded, including the Lowville Academy and Central School. Rainfall amounts in Lowville were nearly 6.50 inches. Flood damage in Lowville totaled \$50 million.

Source: NOAA 2024

13.1.4 Cascading Impacts

Severe storms, characterized by heavy rain, high winds, hail, lightning, and sometimes tornadoes, can trigger a range of cascading hazards. These secondary or tertiary hazards arise from the direct impacts of the storm and are often interconnected, amplifying their effects. Primary cascading hazards that can occur from a severe storm include:

- **Wildfire**—Lightning strikes during storms can ignite wildfires, especially in dry conditions. Power line damage from wind can spark fires, particularly in forested or drought-prone areas.
- **Flash Flooding**—Intense rainfall can overwhelm drainage systems, rivers, and creeks, leading to rapid and localized flooding.
- **River Flooding**—Prolonged heavy rainfall can cause rivers to overflow, inundating surrounding areas.
- **Urban Flooding**—Impervious surfaces in urban areas can exacerbate runoff, causing flooding in streets, homes, and businesses.
- **Dam and Levee Breaches**—Excessive water pressure can cause dams or levees to fail, resulting in catastrophic downstream flooding.
- **Landslides and Mudslides**—Heavy rain saturates soil, destabilizing slopes and triggering landslides or mudslides, especially in hilly or mountainous areas. Additionally, Erosion from storms can weaken the structural integrity of land, increasing susceptibility to future slides.
- **Coastal and Inland Erosion**—Storm surges and heavy rainfall can erode coastlines and riverbanks, threatening infrastructure and natural habitats. Additionally, erosion may increase sedimentation in rivers and reservoirs, affecting water quality.

13.2 COMMUNITY ASSETS AT RISK

The entire County has been identified as exposed for severe storms. Therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 3), are exposed and vulnerable to severe storm events.

13.2.1 People and Communities

Overall Population

The entire population of Lewis County (26,875) is exposed to this hazard; however, the impact of these events can have on life, health, and safety are dependent upon several factors, including the severity of the event and whether adequate warning time was provided to residents (Census 2020).

Outdoor workers are vulnerable to severe weather events. Employers should prepare for the hazards associated with adverse weather conditions that may require special facilities and safety equipment being provided to employees, or in some instances, work stoppage to ensure the safety and health of workers. Wet weather and high wind conditions can pose a greater threat to employees working in the construction and shipbuilding industries. For instance, workers in the construction industry are bound to work in open spaces, at heights, with electrical equipment and metals, in excavation areas and trenches, and may handle hazardous materials as a work task, thereby causing exposure to a myriad of safety hazards (Hawwoper OSHA 2020).

As a result of a significant hurricane event, 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. Hazus estimates that there will not be any displaced households or persons seeking short-term shelter from the 100-year and 500-year MRP event.

Intense winds and hail can damage homes, buildings, and infrastructure, leading to high repair and rebuilding costs. Tornadoes and hurricanes may destroy structures and infrastructure, displacing residents and creating severe short- and long-term impacts, especially in underserved communities.

Damaged schools and infrastructure force students to relocate or miss school, disrupting education and impacting learning outcomes. These delays can set back student progress, especially in low-resource districts already facing educational challenges.

The trauma from experiencing or witnessing severe storms can lead to mental health challenges, such as anxiety, depression, and post-traumatic stress disorder (PTSD). Long-term recovery stress can exacerbate these issues, particularly if housing, employment, or health services are impacted.

Severe storm damage to homes can displace residents, creating temporary or prolonged homelessness. Limited housing availability after a flood can also strain shelters and social services.

Socially Vulnerable Population

Socially vulnerable populations are most susceptible due to their physical and financial ability to react and respond during extreme severe summer weathers. This population includes the elderly, young, and individuals with disabilities or access or functional needs who may be unable to evacuate in the event of an emergency. The elderly are considered most vulnerable because they require extra time or outside assistance during evacuations and are more likely to need medical attention that might not be readily available due to isolation during a storm event.

The vulnerable population also includes those who would not have adequate warning from an emergency warning system (e.g., television or radio); this would include residents and visitors. The population adversely affected by severe storms may also include those beyond the disaster area that rely on affected roads for transportation.

Economically disadvantaged people are at high risk for bracing severe summer weathers because of the potential inability to afford up-to-code homes and buildings that are deemed safe from storms passing through. They also may pose health issues, such as exposure to mold and other health issues that water seepage may cause. These populations may also lack access to vehicles for any necessary evacuations. The vulnerable population also includes those who would not have adequate warning from an emergency warning system (e.g., television or radio); this would include residents and visitors. The population adversely affected by severe summer weathers may also include those beyond the disaster area that rely on affected roads for transportation.

According to the 2022 five-year American Community Survey (ACS) population estimate, there are 3,265 total persons living below the poverty level, 5,347 persons over the age of 65 years, 1,635 persons under the age of five years, 29 non-English speakers, and 3,972 persons with a disability living in Lewis County.

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, such as a ditch during a tornado, will decrease a person's vulnerability.

Residents may be displaced or require temporary or long-term sheltering. In addition, downed trees, damaged buildings and debris carried by high winds can lead to injury or loss of life. 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.

Economy

Severe weather 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.

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. High winds, flooding, and hail can destroy crops, soil, and livestock, leading to food shortages and increased prices.

Hazus also estimates the volume of debris that may be generated as a result of a hurricane event to enable the study region to prepare and rapidly and efficiently manage debris removal and disposal. For the 500-year MRP event, Hazus estimates a total of 20,348 tons of debris will be generated county-wide, with the Town of Croghan producing the most estimated debris. Table 13-7 summarizes the estimated debris for the 500-Year MRP by municipality.

Table 13-7. Estimated Debris Created During the 500-Year MRP Hurricane Event

Jurisdiction	Estimated Debris Created During the 500-Year Mean Return Period Hurricane Wind Event			
	Brick and Wood (tons)	Concrete and Steel (tons)	Tree (tons)	Eligible Tree Volume (tons)
Castorland (V)	2	0	189	113
Constableville (V)	2	0	0	0
Copenhagen (V)	4	0	400	240
Croghan (T)	<1	0	4,112	2,056
Croghan (V)	<1	0	513	256
Denmark (T)	17	0	1,803	1,082
Diana (T)	<1	0	2,928	1,464
Greig (T)	2	0	744	744
Harrisburg (T)	6	0	710	446
Lewis (T)	8	0	0	0
Leyden (T)	10	0	0	0
Lowville (T)	15	0	675	430
Lowville (V)	20	0	618	407
Lyons Falls (V)	3	0	51	51
Lyonsdale (T)	2	0	644	644
Martinsburg (T)	15	0	1,462	1,023
Montague (T)	4	0	466	326
New Bremen (T)	1	0	2,774	1,490
Osceola (T)	6	0	0	0
Pinckney (T)	6	0	674	431
Port Leyden (V)	2	0	92	92
Turin (T)	6	0	327	229
Turin (V)	1	0	0	0
Watson (T)	4	0	1,023	1,022
West Turin (T)	10	0	0	0
Lewis County (Total)	145	0	20,203	12,547

Source: Lewis County 2024; NYS GIS 2024; Hazus v6.1

13.2.2 General Building Stock

All buildings are exposed to severe weather hazards such as hailstorms and lightning strikes. Refer to Section 3 (County Profile) for summaries of the building inventory in Lewis County. An extreme hailstorm event can carry hail stones traveling at speeds greater than 100 miles per hour and all infrastructure is vulnerable to a lightning straight (NWS 2019). This could cause structural damage for the general building stock in the County.

Severe summer weather that causes lightning could be a threat to the County's general building stock if the lightning starts a fire. Over 22,000 fires caused by lightning occurred annually throughout the U.S. between 2007 and 2011, which was valued at approximately \$450 million of damages per year (NFPA 2013).

Potential building damage was evaluated by Hazus across the following damage categories: none, slight, moderate, extensive, and complete. Table 13-8 provides definitions of the categories of damage for a light wood-framed building. Definitions for other building types are included in the Hazus technical manual documentation. The results of potential damage states for buildings in Lewis County categorized by general occupancy classes (i.e., residential, commercial, industrial, etc.) from Hazus are zero dollars in damages for the 100-year MRP event.

Table 13-8. 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: FEMA 2022

Table 13-9 and Table 13-10 summarize the damage to structures for the 500-year MRP event, which estimates that there will be \$3,566,230 in total damages to structures, with the estimated residential damage being the most expensive at \$3,055,741, with 7 dwellings expected to sustain minor damages. The Town of Croghan is projected to sustain the most damages to buildings at \$315,956 in damages for the 500-year MRP.

Table 13-9. 500-Year MRP Hurricane Event Impacts to Lewis County

Jurisdiction	Building Loss - 500-Year Mean Return Period Hurricane				
	All Occupancies	Residential	Commercial	Industrial	Other Occupancies
Castorland (V)	\$32,711	\$26,815	\$1,748	\$211	\$3,937
Constableville (V)	\$23,000	\$18,002	\$2,434	\$48	\$2,516
Copenhagen (V)	\$69,287	\$56,798	\$3,704	\$446	\$8,339
Croghan (T)	\$315,956	\$315,837	\$3	\$0	\$116
Croghan (V)	\$37,941	\$37,927	\$0	\$0	\$14
Denmark (T)	\$312,207	\$255,932	\$16,688	\$2,010	\$37,577
Diana (T)	\$232,897	\$232,809	\$2	\$0	\$86
Greig (T)	\$165,042	\$149,860	\$10,211	\$1,636	\$3,335
Harrisburg (T)	\$121,717	\$101,055	\$6,329	\$588	\$13,746
Lewis (T)	\$103,883	\$81,309	\$10,995	\$215	\$11,363
Leyden (T)	\$138,140	\$108,122	\$14,621	\$286	\$15,110
Lowville (T)	\$216,030	\$158,782	\$19,394	\$5,956	\$31,897
Lowville (V)	\$276,911	\$195,279	\$28,265	\$9,649	\$43,719
Lyons Falls (V)	\$42,281	\$33,980	\$4,237	\$287	\$3,777
Lyonsdale (T)	\$111,310	\$98,482	\$8,715	\$2,762	\$1,350
Martinsburg (T)	\$291,739	\$242,652	\$17,495	\$1,590	\$30,001
Montague (T)	\$84,545	\$72,083	\$4,452	\$51	\$7,959
New Bremen (T)	\$239,990	\$235,637	\$2,864	\$169	\$1,320
Osceola (T)	\$82,690	\$64,721	\$8,752	\$171	\$9,045
Pinckney (T)	\$114,987	\$96,028	\$5,901	\$470	\$12,589
Port Leyden (V)	\$41,576	\$34,149	\$3,969	\$447	\$3,012
Turin (T)	\$105,294	\$86,558	\$7,991	\$131	\$10,614
Turin (V)	\$17,302	\$13,542	\$1,831	\$36	\$1,893
Watson (T)	\$258,920	\$237,728	\$14,162	\$834	\$6,196
West Turin (T)	\$129,871	\$101,650	\$13,746	\$269	\$14,206
Lewis County (Total)	\$3,566,230	\$3,055,741	\$208,510	\$28,263	\$273,716

Source: Lewis County 2024; NYS GIS 2024; Hazus v6.1; RS Means 2024

Table 13-10. 500-Year Hurricane MRP Building Damages by Occupancy Class

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	500-Year Mean Return Period Hurricane	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	17,898	NONE	17,891	99.9%
		MINOR	7	<0.1%
		MODERATE	0	0.0%
		SEVERE	0	0.0%
		DESTRUCTION	0	0.0%
Commercial Buildings	16,927	NONE	16,856	99.6%
		MINOR	70	0.4%
		MODERATE	1	<0.1%
		SEVERE	0	0.0%
		DESTRUCTION	0	0.0%
Industrial Buildings	450	NONE	448	99.6%
		MINOR	2	0.4%
		MODERATE	0	0.0%
		SEVERE	0	0.0%
		DESTRUCTION	0	0.0%
Government, Religion, Agricultural, and Education Buildings	4,886	NONE	4,876	99.8%
		MINOR	9	0.2%
		MODERATE	1	<0.1%
		SEVERE	0	0.0%
		DESTRUCTION	0	0.0%

Source: Lewis County 2024; NYS GIS 2024; Hazus v6.1

13.2.3 Community Lifelines and Other Critical Facilities

All critical facilities in the County are exposed to the severe weather hazard with similar risks as discussed for the general building stock. It is essential that critical facilities remain operational during natural hazard events. Backup power is recommended for critical facilities and infrastructure. Where backup power is needed for critical facilities that provide essential services, municipalities identified mitigation actions in Volume II (Jurisdictional Annexes).

Critical facilities are also 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. 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 unless backup power and fuel sources are available. Loss of power can impact other public utilities, including potable water, wastewater treatment, and communications. In addition to public water services, property owners with private wells might not have access to potable water until power is restored.

The Hazus hurricane model was used to assign the range or average probability of each damage state category to the critical facilities and lifelines in Lewis County for the 100-year and 500-year MRP events. For percent probability of sustaining damage, the minimum and maximum damage estimated value for that facility type is presented.

As a result of a 500-year MRP event, Hazus estimates that no structures will sustain any severe or complete damages. As a result of a 500-year MRP event, Hazus estimates that transportation and food, hydration, and shelter facilities have the greatest chance of sustaining minor damage, at 0.6 percent of damages. No facilities are estimated to incur more than minor damages. Table 13-11 summarizes the damage state probabilities for critical facilities during the 500-year MRP event.

Table 13-11. 500-Year Hurricane MRP Damages per Lifeline Type

	Loss of Days	Average Percent Probability of Sustaining Damage 500-Year Mean Return Period Hurricane			
		Minor	Moderate	Severe	Complete
Communications	0	0.3%	<0.1%	0.0%	0.0%
Energy	0	0.5%	<0.1%	0.0%	0.0%
Food, Hydration, Shelter	0	0.6%	<0.1%	0.0%	0.0%
Hazardous Materials	0	0.4%	<0.1%	0.0%	0.0%
Health and Medical	0	0.1%	0.0%	0.0%	0.0%
Safety and Security	0	0.5%	<0.1%	0.0%	0.0%
Transportation	0	0.6%	<0.1%	0.0%	0.0%
Water Systems	0	0.4%	0.0%	0.0%	0.0%

Source: Lewis County 2020, 2024; NYSDEC 2023, 2024; NYS GIS 2024; HIFLD 2024; US Energy Atlas 2024; Hazus v6.1

High winds, lightning, and falling trees often damage power lines and substations, causing extensive power outages. Without electricity, households and businesses lose heating, cooling, and access to essential services. Power outages also disrupt hospitals, emergency services, and critical infrastructure, potentially worsening public health crises.

Storms can damage roads, bridges, railways, and airports, causing long-lasting disruptions in transportation and supply chains. Blocked or damaged routes delay the delivery of goods, including food, fuel, and medical supplies, impacting businesses and local economies. These interruptions can have ripple effects on broader markets and economies.

Response and recovery efforts can overwhelm emergency services, fire departments, and law enforcement, particularly if resources are diverted from regular operations to manage storm damage. Prolonged strain on public services can reduce their availability for routine emergencies and slow overall recovery.

Water contamination can occur if floodwaters from storms carry sediment, pollutants, sewage, and hazardous chemicals into water supplies, posing health risks and causing disruptions in service.

Storms can damage industrial sites, storage facilities, and wastewater treatment plants, causing hazardous materials to leak. This can lead to contamination of local soil, air, and water sources, requiring costly cleanup efforts and creating long-term environmental risks.

13.2.4 Natural Resources

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 the 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 Lewis County.

13.2.5 Historic and Cultural Resources

Winds associated with severe weather can cause damage or destruction to historical or cultural infrastructure. Historical buildings that are not built to modern building code standards to withstand high winds are more vulnerable than other infrastructure. Outdoor events are likely to be postponed or cancelled as the result of severe weather conditions.

Cultural heritage sites, particularly those exposed to the elements, are subject to weathering. Climate change is a potential threat to these sites as it exacerbates the expected rates of decay and contributes to the appearance of new decay. Climatic changes may aggravate the physical, chemical, and biological mechanisms causing degradation by affecting the structure or composition of building materials. Changes in temperature, precipitation, atmospheric moisture, and wind intensity, in addition to sea-level rise, desertification, and the interaction between climatic changes and air pollution, have been identified as concerns by the United Nations Educational, Scientific and Cultural Organization (Sesana, et al. 2021).

13.3 FUTURE OCCURRENCES AND PROJECTED CHANGES IN RISK

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

13.3.1 Probability of Future Occurrences

Information on previous severe storm occurrences in the County was used to calculate the probability of future occurrence of such events, as summarized in Table 13-12. Based on historical records and input from the Steering Committee, the probability of occurrence for severe storms in the County is considered “frequent.”

Table 13-12. Probability of Future Severe Storm Events in Lewis County

Hazard Type	Number of Occurrences Between 1950 and 2024	Percent Chance of Occurring in Any Given Year
Funnel Cloud	0	0%
Hail	22	29.73%
Heavy Rain	4	5.41%
High/Strong Wind	44	59.46%
Lightning	0	0%
Hurricane/Tropical Storms	3	4.05%
Thunderstorm Wind	196	264.86%
Tornado	8	10.81%
Total	277	374.32%

Source: NOAA NCEI 2024

13.3.2 Climate Change Projections and Likely Impacts

As discussed in previous sections, most studies project that the County will see an increase in average annual temperatures and precipitation. As the climate warms and other changes in climate continue to unfold, the intensity of summer weather may change, producing more ideal conditions for severe storms to form. It is anticipated that the County will continue to experience direct and indirect impacts of severe weather 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.

In Lewis County, and the Adirondacks region, temperatures are estimated to increase by 4.6 °F to 6.6 °F by the 2050s, 6.1 °F to 10.6 °F by the 2080s, relative to the 1981-2010 base period. Projected increases in precipitation in the region is likely to raise flood risks along river valleys (Stevens & Lamie 2024).

Projected changes in storm intensity and frequency depend on the type of storm. Heavy rainstorms are projected to happen more often and can become more intense as the climate continues to warm, 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. Hurricanes and tropical storms have become more intense since the mid 1990's and their winds and associated flooding are expected to increase. The number of hurricanes and tropical storms in the Atlantic basin may not increase but storms that do form are projected to be stronger and shift farther north (Stevens & Lamie 2024). The length of hurricane season is also likely to expand due to rising water temperatures. Research also suggests that there is a greater risk of more off-season tornadoes in a warmer future climate, which suggests that more tornadic activity may occur when people are least expecting it (NOAA 2023).

As summarized in Figure 13-7 through Figure 13-11, the New York State HMP outlines the effects climate change is projected to have on hazard location, intensity, frequency, and duration. The level of geographic specificity available in models and studies is also noted.

13.3.3 Projected Changes in Development and Population

Lewis County has experienced a slight decrease in population since 2010. According to the U.S. Census Bureau, the County's population decreased by approximately -0.19 percent between 2010 and 2020. Cornell University's Program on Applied Demographics produced populations projections by County from 2016 to 2040. According to these projections, Lewis County is projected to have a population of 26,156 by 2030 and 25,618 by 2040 as the population decrease is expected to continue (Cornell University 2018). Changes in the density of the population can impact the number of persons exposed to severe storm events.

The ability of new development to withstand severe storm hazard impacts lies in sound land use practices, building design considerations (e.g., Leadership in Energy and Environmental Design [LEED]), 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. Surfaces that were once permeable and moist are now impermeable and dry, potentially making them more susceptible to fires caused by lightning.

Any areas of growth located in the County could be susceptible to severe storms. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in Volume II (Annexes) of this plan.

Figure 13-7. Climate Change Impacts on Hurricane

HURRICANE	Geographic Specificity	Regional/National/Global
	Climate Effects	Yes
	Location	Some studies have suggested that as the world warms, a greater percentage of tropical storms in the Atlantic will form closer to the coast than is historically the case, and as a result, more will make landfall, particularly along the East Coast. A more granular study reported similar findings, and also asserted that tropical cyclones may travel closer to Boston and Norfolk, V.A. than to New York City.
	Intensity	Climate change will make hurricanes intensify more rapidly, cause heavier rainfall, and result in more severe storm surges. The most powerful hurricanes will also become more common.
	Frequency	Hurricane frequency is projected to decrease overall, but the proportion of Category 4 and 5 hurricanes may increase. The hurricane season has been starting increasingly earlier in the year in the North Atlantic.
	Duration	Hurricane intensity decay is expected to slow, meaning that hurricanes maintain more of their strength after making landfall than has previously been typical. Hurricane movement has also slowed, leading to more rainfall and wind damage after landfall.
Overview: Climate change will make hurricanes intensify more rapidly, cause heavier rainfall, and result in more severe storm surges. Hurricane intensity decay is also anticipated to continue slowing (REF172, REF167). Models suggest that hurricane frequency will decrease, but that the proportion of Category 4 and 5 hurricanes will increase. However, this finding has mixed-to-low certainty (REF167). Some studies have suggested that as the world warms, a greater percentage of tropical storms in the Atlantic will form closer to the coast than is historically the case, and as a result, more will make landfall, particularly along the East Coast (REF173). A more granular study reported similar findings, and also asserted that tropical cyclones may travel closer to Boston and Norfolk, V.A. than to New York City (REF174). However, there is not yet a scientific consensus on this finding and most papers on the potential climate-induced geographic shifts in tropical cyclones include significant caveats and low-confidence findings (REF175). Hurricane intensity typically lessens, or decays, as it moves inland. This is because hurricanes gain intensity from ocean moisture. However, studies have shown that the decay in intensity has lessened proportionally with increased sea surface temperatures, meaning that hurricanes are maintaining more of their destructiveness as they move further inland compared to historic levels (REF172). Hurricanes have also slowed, causing more rainfall, wind damage, and other impacts; while trends since 1979 suggest that hurricane season in the North Atlantic is starting increasingly earlier in the year (REF167).		

Figure 13-8. Climate Change Impacts on Lightning

LIGHTNING	Geographic Specificity	Regional/National/Global/non-U.S.
	Climate Effects	Yes - limited study
	Location	Largely uncertain, but certain types of lightning flashes may become more common in the Northeast.
	Intensity	Uncertain
	Frequency	Climate change may make lightning more common because it occurs more frequently in warmer temperatures.
	Duration	Long-continuing-current lightning flashes, intense lightning flashes that are longer in duration and more likely to spark fires than other types of lightning, may become more common, though not significantly so in the Northeast.

Overview: Research on how climate change may affect lightning is limited. One model projected the number of lightning strikes in the U.S. will increase 12% for every degree increase of global average air temperatures (REF179). A more recent study in Europe projected the impacts of climate change on lightning would be location-specific, with some areas experiencing more lightning strikes and some experiencing less, largely based on latitude (REF180). While projections of changes to intensity and duration remain limited, one study suggested that long-continuing-current lightning flashes, intense lightning flashes that are longer in duration and more likely to spark fires than other types of lightning, may become more common, though not significantly so in the Northeast (REF181). Ultimately, while specific impacts to lightning remain uncertain, lightning occurs more frequently in warmer temperatures, so it may be reasonable to see some level of increased lightning occurrence with projected climate change (REF179).

As of early 2023, there is no clear change in lightning frequency or intensity in the U.S. While there have been an increasing number of lightning-caused fires in the West, this is largely due to dry conditions, rather than a change in the frequency or intensity of lightning itself (REF167).

Figure 13-9. Climate Change Impacts on Tornado

TORNADO	Geographic Specificity	Regional
	Climate Effects	Yes - limited study
	Location	Tornadoes may become more common in New York.
	Intensity	Tornadoes may experience an increase in intensity due to climate change.
	Frequency	Tornadoes may become more common in New York.
	Duration	Uncertain
Overview: The connection between climate change and tornadoes is unclear (REF167). Because tornadoes are short-term events, lack reliable historical data, and have a localized nature that is difficult to integrate into climate models, projecting the effects of climate change on them is difficult (REF188). However, a recent study used models to project that supercells, thunderstorms that most tornadoes are produced from, will become more frequent and intense, become more common in the late winter and early spring, may be more likely to produce tornadoes, and become somewhat more common in New York (REF189, REF190). The researchers hypothesized that because of this, tornadoes would become increasingly frequent and intense (REF189). Changes in tornado duration due to climate change, if any, remain uncertain.		

Figure 13-10. Climate Change Impacts on Wind

WIND	Geographic Specificity	Global
	Climate Effects	Uncertain
	Location	Uncertain
	Intensity	Generally, the Intergovernmental Panel on Climate Change (IPCC) projects that surface winds will weaken over time in our region due to climate change.
	Frequency	Uncertain
	Duration	Uncertain
Overview: The understanding of the relationship between climate change and wind is still emerging (REF167). The impacts climate change may have on wind location, frequency, and duration appear to be uncertain. Nonetheless, the Intergovernmental Panel on Climate Change (IPCC) projects that surface winds will weaken over time in our region due to climate change (REF192). Despite this projection, wind speeds have strengthened over the past decade, reversing a roughly 30-year stilling trend. However, it is unclear if this is linked to climate change (REF193).		

Figure 13-11. Climate Change Impacts on Hail

HAIL	Geographic Specificity	Regional/National
	Climate Effects	Yes - limited study
	Location	The specific locational changes in hailstorms within New York is unclear, but they are expected to become less frequent overall in this region, although large hailstone events will become more common.
	Intensity	Climate change may make hailstones bigger and hailstorms more intense.
	Frequency	The number of hail days is expected to decrease in the Northeast.
	Duration	Uncertain.
Overview: Climate change will potentially make hailstones bigger and hailstorms more intense but less frequent in North America. This holds true in the Northeast, where the overall number of hail days is projected to drop, along with small- and medium-sized hail events. Nonetheless, in the Northeast, models show that very large hailstones will become more common (REF170). Ultimately, while hail is projected to become less frequent but more severe, these models remain uncertain (REF171). Effects of climate change on the duration of hail events, if any, are uncertain at this time.		

13.3.4 Change of Vulnerability Since 2020 HMP

Overall, the County's vulnerability has not changed, and the entire County will continue to be vulnerable to severe storm events. As existing development and infrastructure continue to age, they can be at increased risk from failed utility and transportation systems if they are not properly maintained and do not adapt to the changing environment.

14. SEVERE WINTER STORM

14.1 HAZARD PROFILE

14.1.1 Hazard Description and Location

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, the three basic components needed to make a winter storm include the following (NOAA 2021):

- 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 (orographic lifting).
- Moisture to form clouds and precipitation, such as air blowing across a large lake or the ocean.

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. Lewis 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 Chapter 9.

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°F 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 2023). Average annual snowfall in the county ranges from 101 to 250 inches per NOAA annual average snowfall data.

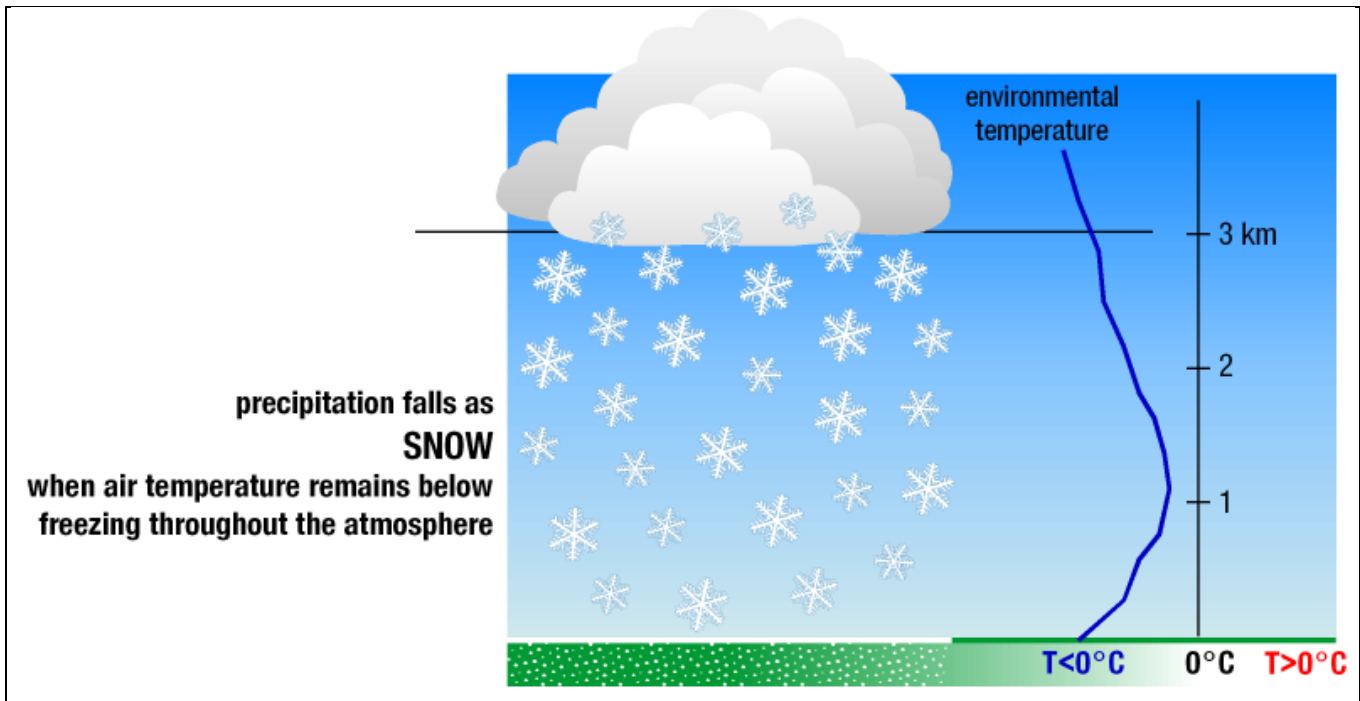
Heavy Snow

According to the National Oceanic and Atmospheric Administration (NOAA), 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 (NOAA 2024). Figure 14-1 depicts snow creation.

Sleet

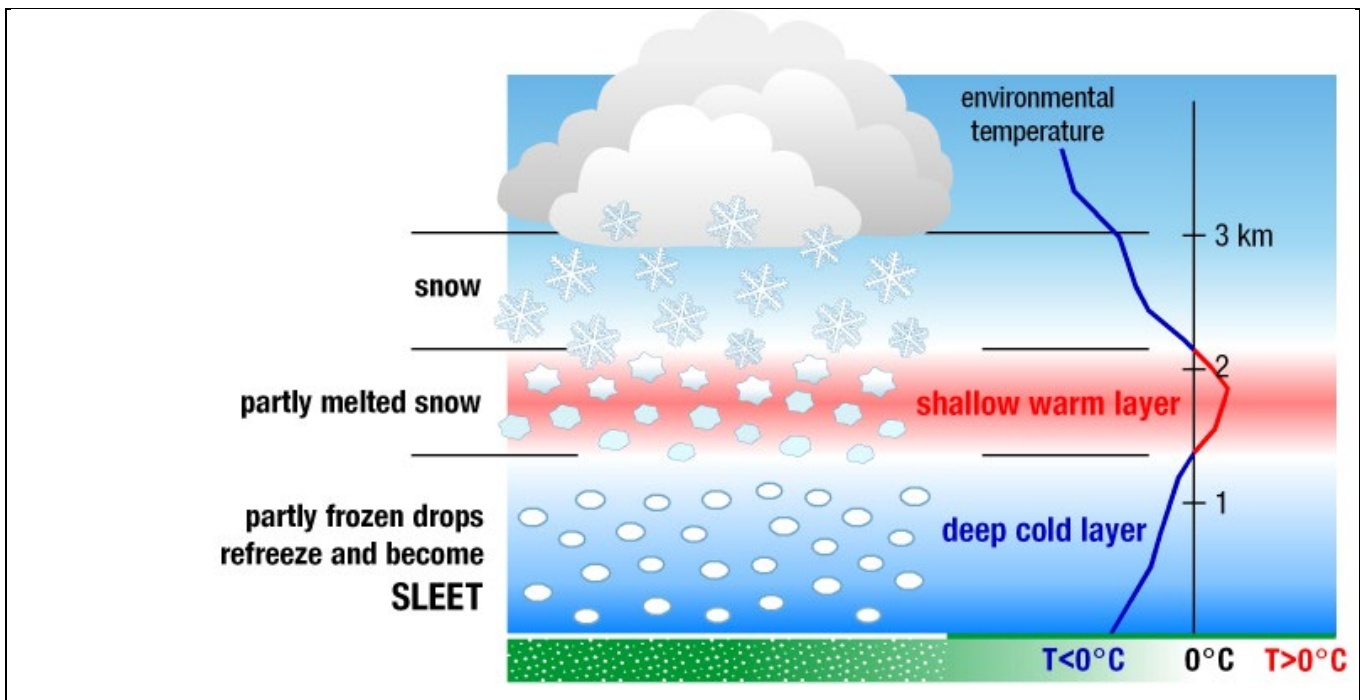
Sleet happens when snowflakes fall through a shallow layer of warm air and partially melt. The slushy drops refreeze as they hit a deeper layer of freezing air above the ground. The resulting frozen pellets bounce when they finally hit a surface, and they are usually smaller than 0.30 inches in diameter (NSSL 2021). Figure 14-2 depicts sleet creation.

Figure 14-1. Snow Creation



Source: NOAA-NSSL 2015

Figure 14-2. Sleet Creation



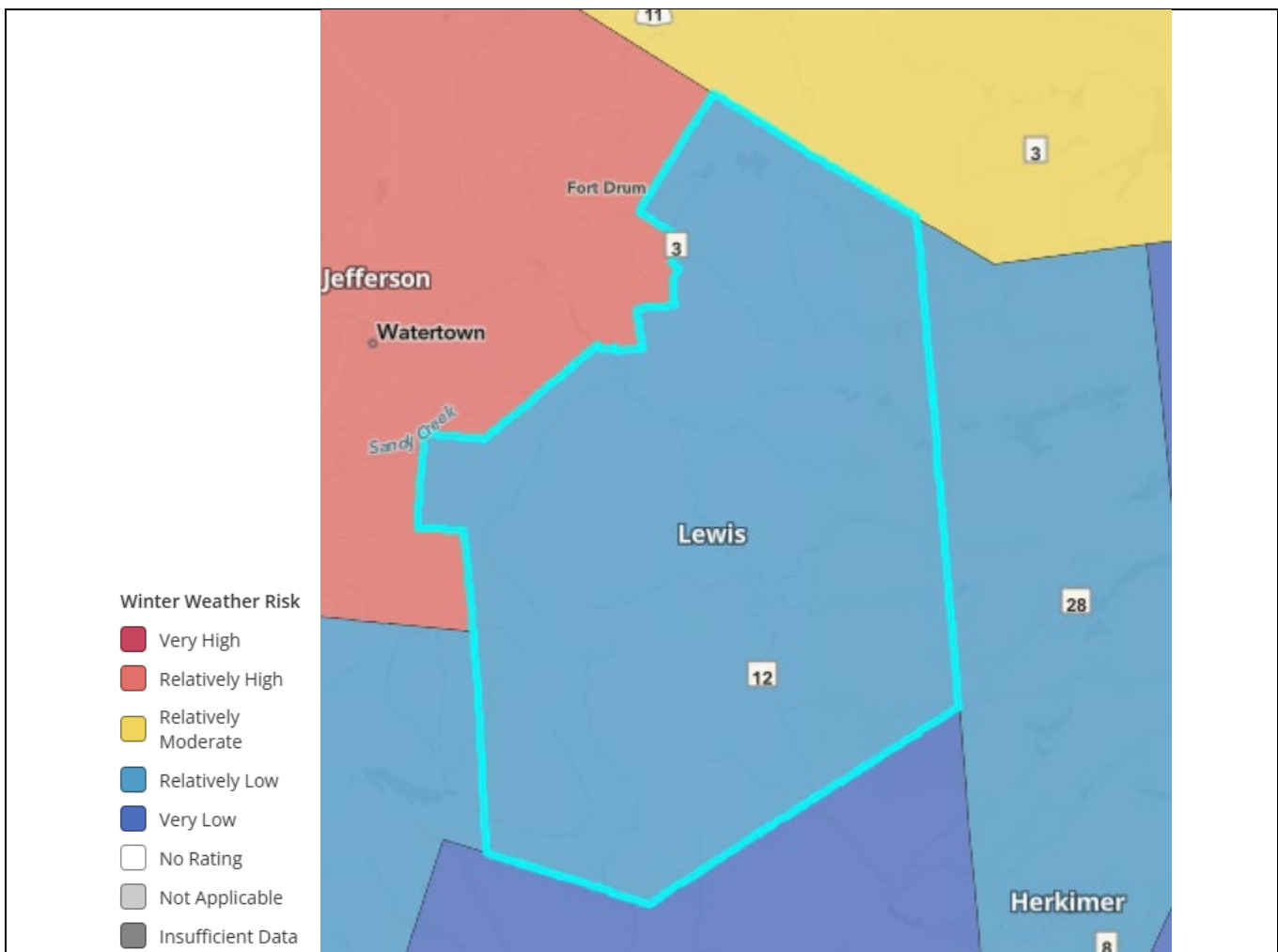
Source: NOAA-NSSL 2020

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, moist air from the south. Blizzard conditions often develop on the northwest side of an intense storm system. The difference between the lower pressure in the storm 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).

Figure 14-3 shows the Winter Weather Risk Index for Lewis County on the county scale. This index helps to understand the susceptibility of the County to winter weather. According to the National Risk Index, on the county scale, Lewis County has a relatively moderate risk to winter weather (FEMA 2025).

Figure 14-3. National Risk Index, Winter Weather Risk Index Score Using the County Scale



Source: FEMA 2025

Snow Storms

Severe winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. The severity of a winter storm depends on temperature, wind speed, type of precipitation (snow, sleet, freezing rain, etc.), accumulation rate and length of the storm which can last a few hours or several days. Winter storms, including blizzards and nor'easters, can bring extreme cold, freezing rain, snow, ice and high winds.

A Nor'easter is a storm along the East Coast, so called because the winds over the coastal area are typically from the northeast. These storms may occur at any time of year but are most frequent and most violent between September and April. They nearly always bring precipitation in the form of heavy rain or snow, as well as winds of gale force, rough seas, and, occasionally, coastal flooding to the affected regions. Past Nor'easters have been responsible for billions of dollars in damage; severe economic, transportation, and human disruption; and in some cases, disastrous coastal flooding.

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. Lewis 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 Chapter 9.

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). New York State receives an average seasonal amount of 40 inches of snow or more, with southern portion of the state occasionally exceeding 20 inches (NYSERDA 2014).

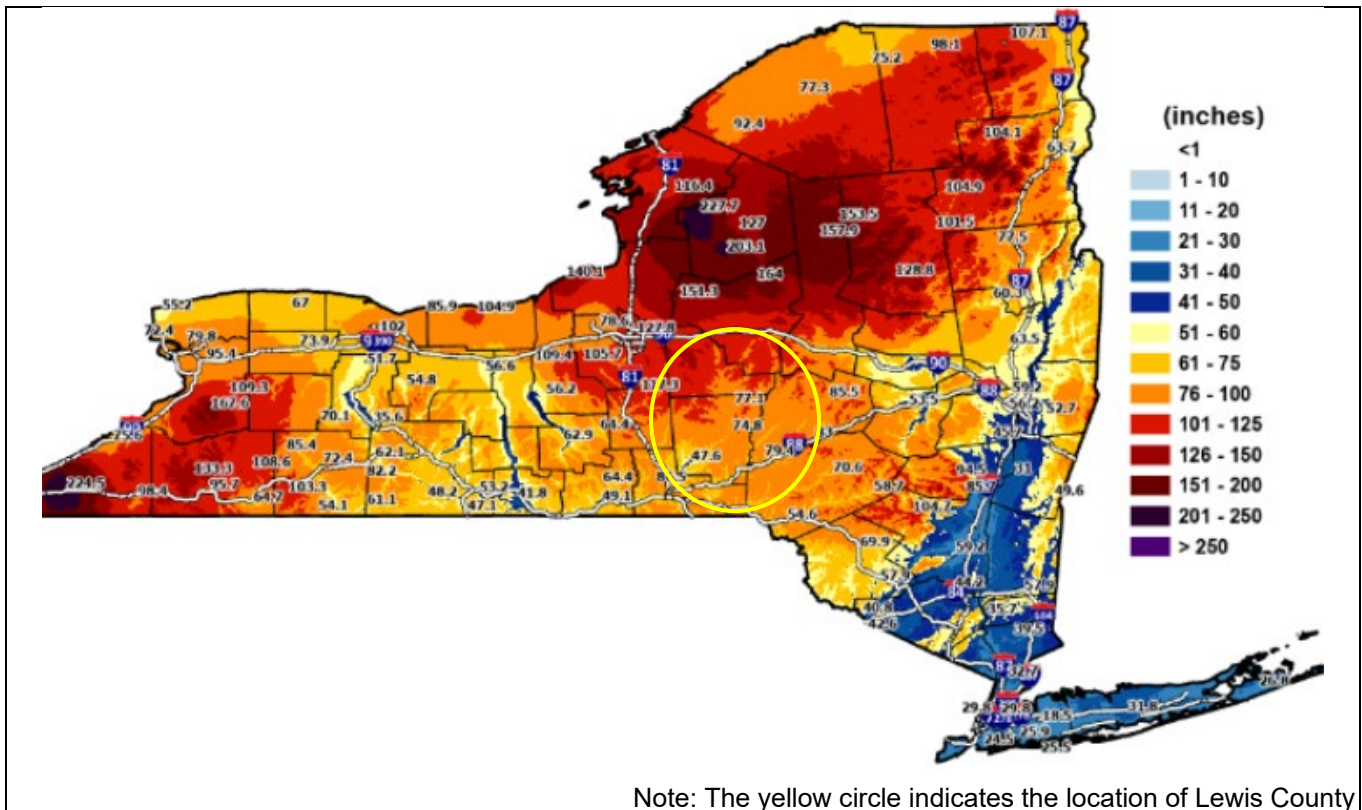
Figure 14-4, an annual average snowfall map, illustrates the annual average snowfall totals over a 50-year period for New York State. Lewis County's annual average snowfall over the 50-year span ranges from 60 inches to 220 inches.

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 14-5 depicts freezing rain creation.

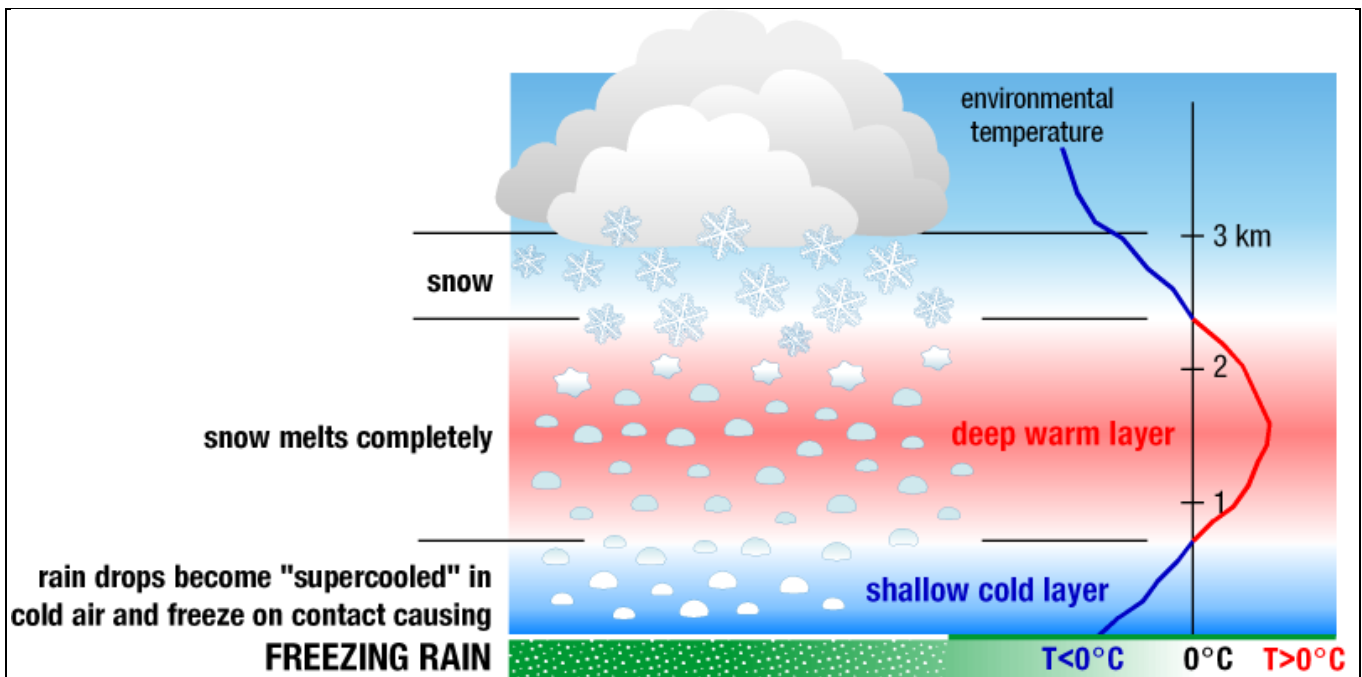
Figure 14-6 shows the Ice Storm Risk Index for Lewis County on the county scale. This index helps to understand the susceptibility of the County to ice storms. According to the National Risk Index, on the county scale, the County has a relatively moderate risk to ice storms (FEMA 2025).

Figure 14-4. New York Annual Average Snowfall, 1991-2020

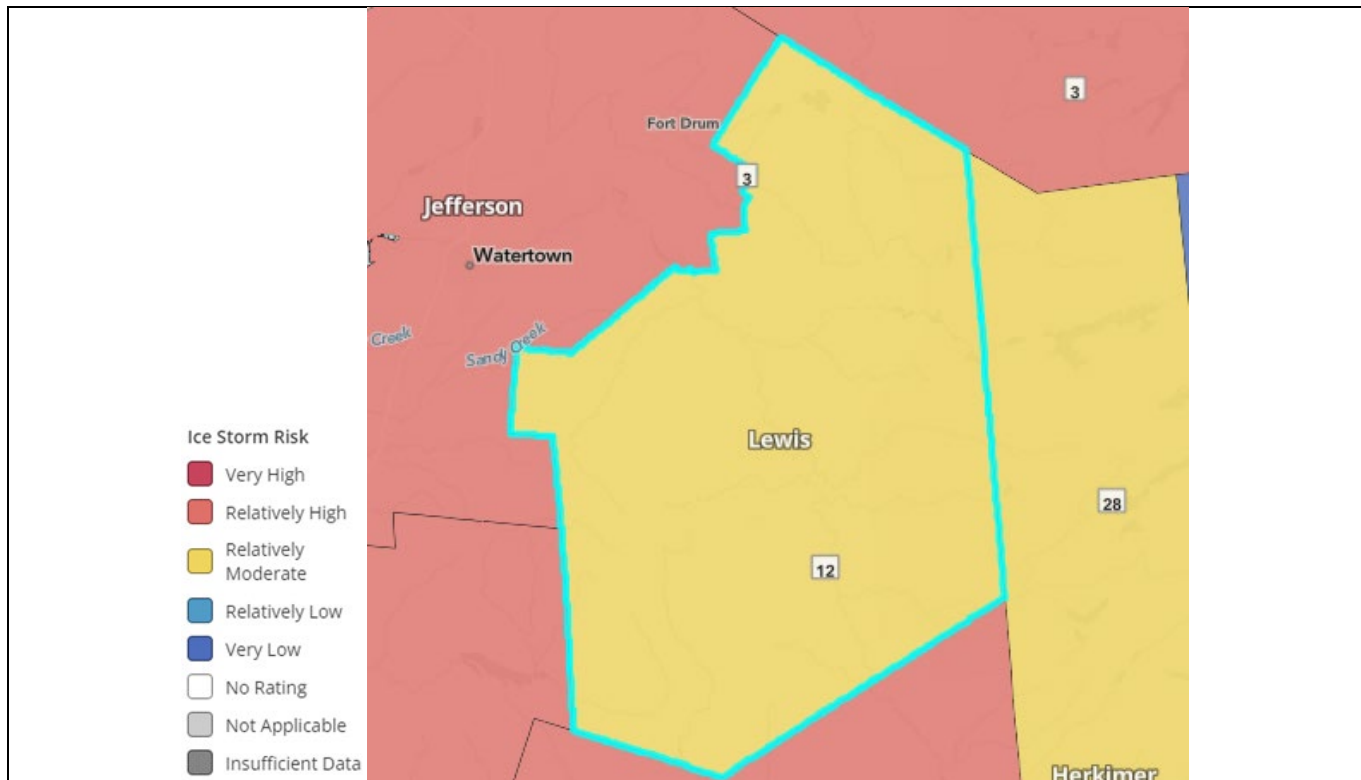


Source: NOAA 2025

Figure 14-5. Freezing Rain Creation



Source: NOAA-NSSL 2020

Figure 14-6. National Risk Index, Ice Storm Risk Index Score Using the County Scale


Source: FEMA 2025

14.1.2 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 14-1 presents the five RSI ranking categories.

Table 14-1. 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

The National Weather Service (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 classified into five main categories by event type, shown in Table 14-2.

Table 14-2. Winter Storm Category Thresholds

Winter Storm Event	Threshold
Heavy Snowstorm	Accumulations of 4 inches or more of snow in a 6-hour period, or 6 inches of snow in a 12-hour period.
Sleet Storm	Significant accumulations of solid pellets that form from the freezing of raindrops or partially melted snowflakes causing slippery surfaces, posing a hazard to pedestrians and motorists.
Ice Storm	Significant accumulation of rain or drizzle freezing on objects (trees, power lines, roadways) as it strikes them, causing slippery surfaces and damage from sheer weight of ice accumulations.
Blizzard	Wind velocity of 35 mph or more, temperatures below freezing, considerable blowing snow with visibility frequently below one-quarter mile prevailing over an extended period.
Severe Blizzard	Wind velocity of 45 mph, temperatures of 10 °F or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period.

Source: NWS 2021

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 14-7 for the warning thresholds.

Figure 14-7. Winter Storm Warning Thresholds



Source: NWS 2023

14.1.3 Previous Occurrences and Impacts

Since 1954, nine presidential disaster declarations in New York State were partly due to snowstorms, accounting for over \$187M worth of damage over that time. Notably though, more than 11,113 non-declared snowstorm events that did not result in a presidential declaration have collectively resulted in more than \$207M in damage across the state (NYS DHSES 2023). The National Risk Index Expected Annual Loss associated with winter weather events in Lewis County is \$69,027 (FEMA 2025).

Since 1996, two (2) presidential disaster declarations in New York State were partly due to ice storms. These declared events account for at least \$65M worth of damage. Notably though, close to 300 ice storm events that did not result in a presidential declaration have collectively resulted in more than \$78M in damage across the state since 1996 (NYS DHSES 2023). The National Risk Index Expected Annual Loss associated with damaging ice storm events in Lewis County is \$190,602 (FEMA 2025).

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, Lewis County was included in 14 major disaster (DR) or emergency (EM) declarations for severe winter storm-related events (FEMA 2024). Table 14-3 lists these declarations.

Table 14-3. FEMA Declarations for Severe Winter Storm Events in Lewis County (1954 to 2024)

Event Date	Declaration Number	Description
January 29, 1977	EM-3027-NY	Snowstorm
February 5, 1977	DR-527-NY	Snowstorm
March 3-4, 1990	DR-898-NY	Severe Storm, Winter Storm
March 13-17, 1993	EM-3107-NY	Severe Blizzard
January 5-17, 1998	DR-1196-NY	Severe Winter Storms
January 1-15, 1999	EM-3136-NY	Winter Storm
January 28-31, 2004	EM-3195-NY	Snowstorm
February 2, 2007	EM-3273-NY	Snowstorm
February 25, 2010	DR-1957-NY	Winter Storm
February 8, 2013	DR-4111-NY	Heavy Snow
November 17, 2014	DR-4204-NY	Lake Effect Snow
November 20, 2014	DR-4204-NY	Lake Effect Snow
March 14, 2017	DR-4322-NY	Winter Storm
November 18-21, 2022	EM-3589-NY	Severe Winter Storm and Snowstorm

Source: FEMA 2025

USDA Disaster 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 contiguous counties. Between 2019 and 2024, Lewis County was included in 4 USDA severe winter storm-related agricultural disaster declarations (USDA 2024). For declarations that occurred between 2019 and 2024, refer to Table 14-4. For events prior to 2019, refer to the 2020 Lewis County HMP.

Table 14-4. USDA Declarations for Severe Winter Storm Events in Lewis County (2019 to 2024)

Event Date	USDA Declaration Number	Description
April 1 – June 1, 2020	S4903	Freeze and Frost
April 15 – June 1, 2020	S4904	Freeze
May 14-25, 2023	S5485	Freeze and Frost
April 22-27, 2024	S5698	Frost and Freeze

Source: USDA 2025

Previous Events below Declaration Thresholds

Known hazard events that impacted Lewis County between January 2019 and December 2024 are discussed in Table 14-5. For events prior to 2019, refer to the 2020 Lewis County HMP.

Table 14-5. Severe Winter Storm Events in Lewis County (2019 to 2024)

Event Date	Location Impacted	Description
January 9-10, 2019	Countywide	A cold front crossed the region and pushed a milder air mass that had resided across the area eastward, allowing for wintry weather to return. Temperatures behind the cold front dropped to -12 to -14 °C over the open waters of the lakes that were around -3 °C. Layer moisture was sufficient for the formation of lake snow bands, which helped to overcome the shorter wind fetch of northwesterly flow. Snow along the passing cold front did not manage to account for much, however lake effect snow bands behind the front, with upstream connections to the upper Great Lakes prompted warnings downwind of Lake Erie and Lake Ontario. While northwest upslope flow resulted in largely synoptic snows over the North Country, snows from Oswego County to the south and west were largely lake effect. Snow totals included 13.5 inches in Cattaraugus, 9.5 inches in Sardinia, 22.5 inches in Celoron, 10 inches in Osceola, 9 inches in Port Byron, 7.4 inches in Macedon, 16.6 inches in Redfield, 7.6 inches in Wyoming, and 10 inches in West Carthage.
January 19-20, 2019	Countywide	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. Snow totals included 29.2 inches in Rochester, 13 inches in West Conesus, 14 inches in Sardinia, 17.5 inches in West Seneca, 18.5 inches in Forestville, 18 inches in Little Valley, 15 inches in Lowville, 14 inches in Warsaw, 16.8 inches in Lockport, 12.1 inches in Medina, 16 inches in Bristol Mountain, 12.9 inches in South Watertown, 26.6 inches in Walworth, 20.6 inches in Minetto, 10.2 inches in Alfred, and 15.0 inches in Pavilion.

Event Date	Location Impacted	Description
January 28-31, 2019	Countywide	Due to a warm January, very little ice cover existed on Lake Erie and by extension, Lake Ontario. While water temperatures were cold, open water combined with the influx of the first Arctic outbreak of the season combined with nearly stationary flow for two days yielded strong lake effect snow bands behind the passage of a cold front. Very gusty conditions allowed for these bands to develop localized blizzard conditions for large portions of the day in the Buffalo and Watertown areas before the wind settled down to just below blizzard criteria again. During the strongest portion of the event, wind gusts in heavy snow were reported up to 47 mph at the Buffalo Niagara International Airport, 45 mph in Wyoming, 40 mph at Niagara Falls Airport, and 43 mph at the Watertown Airport with consistent visibilities during a period around the highest gusts of one quarter of a mile or less as observed on webcams or automated observations. Total snowfall over the multi-day event was 37.6 inches in Watertown, 19 inches in Harrisville, 11.7 inches in North Boston, 20 inches in Attica, 14 inches in Corfu, and 21 inches in Buffalo. A massive snow removal effort was mobilized utilizing state resources from as far away as Long Island to cope with widespread blowing and drifting snow that made the already heavy snow amounts extreme difficult to deal with, particularly given that temperatures had fallen off toward 0 degrees by the end of the event.
January 30-31, 2019	Countywide	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 -35 in Wellsville, -32 in Olean, -20 in Port Byron, -32 in Jamestown, -27 in Springville, -26 in Batavia, -26 in Calcium, -31 in Copenhagen, -28 in Livonia, -25 in Irondequoit, -30 in Niagara Falls, -35 in Wine Valley, -23 in Holley, -24 in Lacona, -24 in Newark, and -33 in Wyoming.
January 30, 2019	Countywide	Due to a warm January, very little ice cover existed on Lake Erie and by extension, Lake Ontario. While water temperatures were cold, open water combined with the influx of the first Arctic outbreak of the season combined with nearly stationary flow for two days yielded strong lake effect snow bands behind the passage of a cold front. Very gusty conditions allowed for these bands to develop localized blizzard conditions for large portions of the day in the Buffalo and Watertown areas before the wind settled down to just below blizzard criteria again. During the strongest portion of the event, wind gusts in heavy snow were reported up to 47 mph at the Buffalo Niagara International Airport, 45 mph in Wyoming, 40 mph at Niagara Falls Airport, and 43 mph at the Watertown Airport with consistent visibilities during a period around the highest gusts of one quarter of a mile or less as observed on webcams or automated observations. Total snowfall over the multi-day event was 37.6 inches in Watertown, 19 inches in Harrisville, 11.7 inches in North Boston, 20 inches in Attica, 14 inches in Corfu, and 21 inches in Buffalo. A massive snow removal effort was mobilized utilizing state resources from as far away as Long Island to cope with widespread blowing and drifting snow that made the already heavy snow amounts extreme difficult to deal with, particularly given that temperatures had fallen off toward 0 degrees by the end of the event.

Event Date	Location Impacted	Description
February 12-13, 2019	Countywide	A strong and complex low moved out of the Midwest and into the central Great Lakes that passed just north of our area while secondary cyclogenesis occurred off the Middle Atlantic coast. The track of the low brought snow across the area that changed to mixed precipitation and eventually rain south of the Thruway. The warm nose aloft did not make it all the way up into the North Country, thus heavier snow fell there. This resulted in a longer duration synoptic snow that ended as a bit of lake effect off of the lakes, but due to ice cover on Lake Erie, the snow totals downstream of Lake Ontario were far greater. Additionally, in the wake of the cold front, gusty winds brought marginally strong winds into areas just east of Lake Erie. Snow totals included 15 inches in Constableville, 12 inches in Redfield, and 7.9 inches in Watertown. The strongest winds were back in Erie County, where 59 mph was measured at the Buffalo-Niagara International Airport.
February 25, 2019	Countywide	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. The wind aloft was extremely strong with 70-80 knots just off the deck. In addition, ice pushes off of the frozen Lake Erie lead to substantial pushing inland of ice on the Lake Erie shore as well as ice intrusion over the Buffalo ice boom. This resulted in ice jams on the Niagara River and flash flooding in Grand Island as a result. As colder air moved in behind it, lake effect snow developed east of the lakes with the best fetch for intense snow bands combined with wind resulting in blizzard conditions east of Lake Ontario. Selected peak wind gusts included 80 mph at Oswego, 74 mph at Niagara Falls International Airport, 69 mph at Buffalo-Niagara International Airport, 69 mph in Batavia, 74 mph in Dunkirk, 66 mph at Rochester, 60 mph at Fort Drum, and 59 mph in Orchard Park. Damage was reported in every county in the forecast area from the wind. Snow totals in the lake effect windstorm induced blizzard included 10 inches in Redfield, 7.4 inches in Fulton, and 7 inches in Constableville.
March 22-23, 2019	Countywide	A deep low off the eastern seaboard forced cold advection and the circulation of deep synoptic moisture around the backside of this low into our region. This resulted in rain changing to snow across the higher terrain with fairly efficient snow accumulation in the overnight hours of the 22nd into the 23rd. By morning, accumulation ended as the late season sun inhibited further accumulation. Selected snow totals included 12 inches in Redfield, 12 inches in Harrisville, and 12 inches in Antwerp.
December 1-2, 2019	Countywide	An upper level low traversing the country brought freezing rain and snow across our region. While precipitation started as freezing rain over western New York, it quickly shifted to rain. Easterly flow locked colder air east and southeast of Lake Ontario where predominately snow fell. This event occurred on the busy travel Sunday after the Thanksgiving holiday, meaning impacts to transportation were of keen interest. Storm total accumulations of heavy, wet, ice-rimed snow included 8.8 inches in Minetto, 7.4 inches in Fulton, 7 inches in Osceola, 7.1 inches in Geneva, and 7 inches at East Bay Park.
February 6-7, 2020	Countywide	Warmer air aloft resided over the area before the arrival of a system that bombed out as it moved into the Middle Atlantic states. Widespread freezing drizzle and freezing rain resided over the area until deeper lift from the deformation zone of this aforementioned system allowed for dynamic cooling to affect the column overhead from the Finger Lakes toward the areas east of Lake Ontario. This allowed for a swath of heavy snow across the region, however upslope and lake enhanced snows in its wake weren't as impressive and largely over-forecast. Selected snow totals for the event include 13 inches in Redfield, 10.4 inches in Watertown, and 14.7 inches in Lowville. Amounts near or over one foot were common east of Lake Ontario.

Event Date	Location Impacted	Description
February 27, 2020	Countywide	Surface low pressure advanced from the Ohio Valley toward central New York. Model guidance waffled all over with the track of this system in the days before its arrival, eventually placing the low on a more southerly track. This resulted in widespread snow across the area rather than a mix, and it also yielded an extended period of west-northwesterly flow lake effect snow in its wake. Because of a lack of cold air outbreaks during the course of the winter, both Lake Erie and Ontario were nearly ice free, resulting in heavy snow squalls with very gusty conditions across the Southern Tier and Tug Hill regions. Widespread accumulations of 2-3 feet occurred east of Lake Ontario with 1-2 feet common east of Lake Erie. Selected specific snow accumulations include 8.9 inches in Lockport, 31.2 inches in Redfield, 48 inches in Carthage, 28.5 inches in Copenhagen, 14.5 inches in Warsaw, 12.5 inches in Jamestown, 20.3 inches in Perrysburg, and 25 inches in Springville. Selected wind gusts included measured gusts of 62 mph at Fredonia, 60 mph at Oswego, 60 mph at Watertown, and 56 mph at Hamburg. In addition to snow and wind, lakeshore flooding with the passage of the system became a problem on Lake Erie. The biggest seiche of the month occurred during the event, bringing the lake level up to nearly 7.5 feet above low water datum at Buffalo on the 27th.
May 12-14, 2020	Countywide	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 on May 12 included 29 in Alfred, 29 in Dunkirk, 31 in Buffalo, 32 in Theresa, 30 in Highmarket, 27 in Avon, 30 in Rochester, 24 in Niagara Falls, 30 in Victor, 30 in Webster, 32 in Little Valley, and 26 in Warsaw.
September 18, 2020	Countywide	Unseasonably cold air settled over the region in a clear and dry air mass. Localized frost and freezing temperatures were reported in many portions of the area, however the only killing freeze occurred in Lewis County where lows of 23 in Croghan, 25 in Glenfield, 26 in Lowville, and 29 in Copenhagen were reported.
January 16-17, 2021	Countywide	Stacked low pressure near Indiana slowly moved the area during the period. A surface low redeveloped along the coast and tracked across New England. Initially, most precipitation was rain in our area, but it gradually changed over to snow. The snow began as synoptic snow before transitioning to lake effect as colder air advected into the region. Selected snow totals for the event included 12 inches in Redfield, 12 inches in Barnes Corners, 14 inches in Highmarket, and 14 inches in Lowville.
February 2-3, 2021	Countywide	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. Selected snow totals during the event included 11.7 inches in Watertown, 12 inches on Croghan, 15 inches in Lacona, 9.5 inches in Williamson, 10 inches in Fairport, and 10 inches in Geneva.

Event Date	Location Impacted	Description
January 11, 2022	Countywide	The large-scale weather pattern shifted greatly beyond the first week of January such that Arctic air was migrating into the Great Lakes after a fairly warm start to the winter. This left almost all of the Great Lakes ice free coming into the period, and as a result, while most of western New York was quite cold, attenuation of the Arctic air was an ongoing process for most areas due to extensive open water and warming from the Great Lakes. This wasn't the case, however, in the North Country, where Jefferson, Lewis, and occasionally even Oswego counties experienced nearly nightly sub-zero temperatures with multiple incidents of wind chill values below -30 degrees Fahrenheit. On January 11, this included Alexandria Bay and Copenhagen at -30. On January 15, this included Croghan at -53, Watertown at -31, Fort Drum at -33, and Osceola at -48.
January 15, 2022	Countywide	The large scale weather pattern shifted greatly beyond the first week of January such that Arctic air was migrating into the Great Lakes after a fairly warm start to the winter. This left almost all of the Great Lakes ice free coming into the period, and as a result, while most of western New York was quite cold, attenuation of the Arctic air was an ongoing process for most areas due to extensive open water and warming from the Great Lakes. This wasn't the case, however, in the North Country, where Jefferson, Lewis, and occasionally even Oswego counties experienced nearly nightly sub-zero temperatures with multiple incidents of wind chill values below -30 degrees Fahrenheit. On January 11, this included Alexandria Bay and Copenhagen at -30. On January 15, this included Croghan at -53, Watertown at -31, Fort Drum at -33, and Osceola at -48.
January 21, 2022	Countywide	The continued influx of Arctic air into the area resulted in yet another period of brutally cold wind chills in the North Country. The Great Lakes were continuing to cool from the warmer than average early winter, so a lack of ice cover resulted in attenuation of the cold air over most of western New York. This was not the case in Jefferson and Lewis counties, however, as wind chill factors dropped below -30 degrees Fahrenheit on multiple occasions. On January 21, this included Philadelphia at -46, Watertown at -32, Harrisburg at -38, and Copenhagen at -37. On January 24, this included Philadelphia at -44, Watertown at -37, and Copenhagen at -36.
January 24, 2022	Countywide	The continued influx of Arctic air into the area resulted in yet another period of brutally cold wind chills in the North Country. The Great Lakes were continuing to cool from the warmer than average early winter, so a lack of ice cover resulted in attenuation of the cold air over most of western New York. This was not the case in Jefferson and Lewis counties, however, as wind chill factors dropped below -30 degrees Fahrenheit on multiple occasions. On January 21, this included Philadelphia at -46, Watertown at -32, Harrisburg at -38, and Copenhagen at -37. On January 24, this included Philadelphia at -44, Watertown at -37, and Copenhagen at -36.
January 26, 2022	Countywide	The continued influx of Arctic air into the area resulted in yet another period of brutally cold wind chills in the North Country. The Great Lakes were continuing to cool from the warmer than average early winter, so a lack of ice cover resulted in attenuation of the cold air over most of western New York. This was not the case in Jefferson and Lewis counties, however, as wind chill factors dropped below -30 degrees Fahrenheit on multiple occasions. On January 26, this included Watertown at -36, Cape Vincent at -31, and Copenhagen at -33. On January 27, this included Philadelphia at -36 and Watertown at -32. On January 30, this included Watertown at -39, Belleville at -35, and Copenhagen at -35.

Event Date	Location Impacted	Description
January 30, 2022	Countywide	The continued influx of Arctic air into the area resulted in yet another period of brutally cold wind chills in the North Country. The Great Lakes were continuing to cool from the warmer than average early winter, so a lack of ice cover resulted in attenuation of the cold air over most of western New York. This was not the case in Jefferson and Lewis counties, however, as wind chill factors dropped below -30 degrees Fahrenheit on multiple occasions. On January 26, this included Watertown at -36, Cape Vincent at -31, and Copenhagen at -33. On January 27, this included Philadelphia at -36 and Watertown at -32. On January 30, this included Watertown at -39, Belleville at -35, and Copenhagen at -35.
February 3-4, 2022	Countywide	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. Selected reports include 16.5 inches in Lockport, 12.5 inches in Kenmore, 12.3 inches in Gerry, 16.8 inches in Perrysburg, 13.6 inches in Sardinia, 10.2 inches in Medina, 15 inches in Webster, 12 inches in Batavia, 13 inches in Attica, 12.6 inches in Dansville, 10.8 inches in Alfred, 14 inches in Marion, 11.5 inches in Fulton, 8.3 inches in Watertown, 11.5 inches in Constableville, and 9.2 inches in Bristol Harbor.
February 25, 2022	Countywide	Surface low pressure over southeast Ohio tracked northeast into western New York. Large scale ascent from an approaching shortwave trough with an upper-level dual jet structure overhead aided in deepening the surface low. The low was tracking quickly as it transitioned to a larger coastal storm. Warm air advection ahead of the low led to a mix of snow, sleet, and freezing rain across western New York. The corridor of sleet and freezing rain reached as far north as the Niagara Frontier and Lower Genesee Valley. As the surface low moved into central New York, any sleet or freezing rain transitioned to snow. Another area of snow across Michigan moved into western New York behind the first round, however additional accumulations from this were inconsequential. The heaviest snow totals were in the North Country and include 7.1 inches in Natural Bridge, 8.8 inches in Mexico, and 8 inches in Lowville.
April 18-19, 2022	Countywide	A deep mid-level trough crossed the region with an associated deep surface low that lifted northward across New England. Widespread and heaviest snow clipped Lewis County, while lake enhanced, and upslope snow occurred east of both lakes. Little if any accumulating snowfall fell at the lower elevations due to marginal surface temperatures. Likewise, temperatures off the ground were also only marginally supportive of snow. Between the synoptic and lake enhanced snow, amounts reached around 5 inches to the east of both lakes. Reports of 19.8 inches in Highmark and 19.0 inches in Constableville were the most impressive in Lewis County. Tree damage in Lewis County was also extensive due to the water-laden nature of the snow and the sheer volume of snow on the trees.
September 30, 2022	Countywide	Skies cleared as high pressure moved into the area behind one of the first strong cold fronts of the season. Temperatures fell off across the area with widespread frost in the Southern Tier and North Country. Freezing temperatures were also widespread in Lewis County. Selected low temperatures included 29 in Croghan, 30 in Highmarket, and 32 in Copenhagen.
October 2, 2022	Countywide	As high clouds from the remnants of Hurricane Ian cleared during the evening, winds lightened, and temperatures summarily plummeted. Frost was widespread across the area away from the urban centers, and freezing conditions occurred in the majority of Jefferson and Lewis counties. Selected low temperatures included 25 in Philadelphia, 28 in Watertown, 31 at Fort Drum, 27 in Harrisburg, and 30 in Lowville.

Event Date	Location Impacted	Description
December 15-16, 2022	Countywide	A deepening coastal storm brought a glancing blow of widespread wet snow to inland portions of the eastern Lake Ontario region the evening of the 15th through the midafternoon hours on the 16th. The heaviest snow accumulations were over the higher elevations of the Tug Hill. Otherwise, this system produced a wintry mix with little snowfall over the rest of north central New York and western New York. Selected snow totals included measurements of 9.7 inches and 8.5 inches on portions of the northern Tug Hill.
December 23-27, 2022	Countywide	he historic blizzard and lake effect snow event spanned five days and included the Christmas holiday. This high impact event led to school and government closures on Friday, December 23, impossible travel, and widespread power outages across the Buffalo and Watertown Metro areas. The blizzard led to the loss of lives in Niagara and Erie counties. The halt to the transportation sector included closures on the New York State Thruway (I-90) from Rochester, NY, to the Pennsylvania state line and travel bans across Niagara and Erie counties that lasted 1-2 days after blizzard conditions ended. The Buffalo and Watertown Airports closed for multiple days during the holiday weekend. Selected storm total snowfall reports from this five day event include 59.7 inches in North Tonawanda, 51.9 inches at the Buffalo Airport, 48.3 inches at Henderson Harbor, 47.2 inches in Watertown, 50.8 inches in Deferiet, 14.4 inches in Highmarket, 9 inches in Richland, 8.2 inches in Brockport, 19.3 inches in Warsaw, 16 inches in Batavia, 44.6 inches in Lake View, 37 inches in Orchard Park, 32.5 inches in Kenmore, and 9.6 inches in Mayville. Additionally, with the extremely strong wind gusts, the fourth largest seiche on record on Lake Erie occurred. A notable seiche was evident on Lake Ontario, as well. Heavy freezing spray from the lake ensconced lakeshore homes with ice, and water ended up closing Route 5 in Hamburg. Lake Erie at Buffalo peaked at 10.7 feet and was in flood for 17 hours. The seiche on Lake Ontario likewise raised the water level 2 feet at Cape Vincent.
March 3-4, 2023	Countywide	A weakening low gave way to a stronger coastal low. Heavy snow impacted areas mainly east of Lake Ontario. The greatest snowfall occurred at higher elevations on the Tug Hill Plateau with Constableville measuring 9.6 inches and Highmarket seeing a total of 7.4 inches.
March 13-15, 2023	Countywide	A deepening coastal low brought snow again to the region, this time more widespread from the northern Finger Lakes to the eastern Lake Ontario region. The heaviest snow occurred during the daytime and evening hours of the 14th. Selected snowfall totals included 16.0 inches at Constableville, 15.2 inches at Highmarket, 14.0 inches at Mexico, and 8.0 inches at Wolcott.
May 17-18, 2023	Countywide	There were marginally freezing temps behind a cold front toward daybreak on 5/17. Some of the lower temperatures reported were 30 degrees at both Boonville and Highmarket along with 32 degrees at Chases Lake. A hard freeze occurred over all of western and north central New York on May 18. The freezing temperatures damaged many apple orchards and grape vineyards across the region, especially across the Finger Lakes. Damage to crops and buds for the grape crop is estimated in some areas to be at least 50 percent. Many growers some that have been doing this nearly 40 years said it was the worst frost damage they have ever seen. A preliminary estimate for monetary damages caused by the hard freeze is 250-500K dollars. A sampling of lowest temperatures recorded included 24 degrees in Allegany, 25 degrees in Belmont, 26 degrees in Bethany, Calcium, Honeoye Falls, East Bloomfield, Hastings and Walworth, 27 degrees in Frewsburg, Copenhagen and York, 28 degrees in Lockport and Middleport along with 29 degrees in East Aurora and Albion.

Event Date	Location Impacted	Description
January 13-15, 2024	Countywide	A powerful storm impacted the region with damaging winds. Behind the passing cold front, strong winds continued as rain changed to snow, eventually becoming lake enhanced and then lake effect. Lake effect snow became heavier later Saturday evening causing brief periods of near blizzard conditions. Winds weakened through the middle of the weekend as heavy lake effect snow lingered into Monday morning. The cold air mass behind the passing front resulted in the coldest temperatures of the winter. Peak wind gusts observed during the event include: 68 MPH at the Buffalo Airport ASOS, 66 MPH at the Batavia New York State Mesonet site and 63 MPH at the Niagara Falls Airport ASOS. Damage from this event included numerous trees and wires down across much of western and north central New York. Notable snowfall amounts for the snow portion of the event include: 41.3 inches in Hamburg, 37.0 inches in West Seneca, 17.0 inches in Lockport, 21.5 inches in Black River, and 24.5 inches in Harrisville.
February 15-16, 2024	Countywide	An occluding area of low pressure tracking east across the region brought accumulating snow east of Lake Ontario on the afternoon of February 15th through the morning of February 16th. Notable snowfall amounts reported included: 12.5 inches in Constableville, 12.0 inches in Osceola, 11.8 inches in Orwell, and 7.0 inches in Copenhagen.
March 10-11, 2024	Countywide	A strong area of low pressure tracking along the coast brought a brief shot of cold, wind, and snow to the region. The greatest snow amounts were found across the higher terrain east of Lake Ontario and southeast of Lake Erie, with lighter accumulations elsewhere. Windy conditions also added to the impacts of the winter storm. Notable snowfall amounts include: 6.4 inches in Cattaraugus, 6.0 inches in Jamestown and 5.0 inches in Croghan. Notable wind reports include: 47 mph in Clymer, 44 mph in Osceola and 44 mph in Delevan.
March 19-20, 2024	Countywide	A storm system tracking north of the Buffalo County Warning Area caused a widespread light snow to fall across much of western and north central New York. Heavier snow fell east of Lake Ontario due to lake enhancement and the higher terrain. Passing mid and upper troughs also helped aid in prolonging the snowfall across much of the region, including the warned areas. Snow started on the morning of March 19 and continued into the afternoon on March 20. Notable snowfall amounts include: 11.5 inches in Constableville, 11.0 inches in Highmarket, 10.0 inches in Parish and 9.8 inches in Mexico.
March 22-23, 2024	Countywide	A late season winter storm passing over the eastern Great Lakes produced a widespread wintry mix for western New York and heavy snow for areas east of Lake Ontario. Precipitation initially started as snow across the entire area, but as warm air pushed north into the western Southern Tier and the Finger Lakes, snow started to mix with or change to sleet, freezing rain and rain, especially south of Interstate 90. Areas east of Lake Ontario remained primarily all snow, but some mixing did occur, limiting snow amounts some. The most notable snowfall amount was 7.0 inches in Constableville.

Event Date	Location Impacted	Description
December 4-8, 2024	Countywide	For the period of December 4th through 8th, an area of low pressure tracking north of the Great Lakes caused widespread snow to track across most of the Buffalo forecast area early in the event, which was then followed by lake snow off of both Lake Erie & Ontario. East of Lake Ontario, the synoptic snow was enhanced by upsloping and then transitioned to lake enhancement and finally lake effect. East of Lake Erie, snow transitioned to mainly lake effect after a more noticeable break in the more widespread synoptic snow. The heaviest snowfall occurred east to southeast of both lakes, where amounts of up to 20 inches fell east of Lake Erie and amounts up to 30 inches fell east of Lake Ontario. Notable snowfall amounts reported include: 31.3 inches in Highmarket, 30.0 inches in Lacona, 26.0 inches in Constableville, 21.6 inches in Cattaraugus, 20.9 inches in Springville, 20.1 inches in Colden, 19.0 inches in Pulaski, 18.1 inches in Attica, 17.5 inches in Little Valley, 16.9 inches in Warssaw, 14.0 inches in Stow and 12.2 inches in La Fargeville.

Source: NOAA NCEI 2025

Note: Events included are only those that incurred \$15,000 or more in damages or incurred over 12 inches of snow. Data from 2019-2024 is limited and not as location specific but is the best available data at the time of this update.

14.1.4 Cascading Impacts

Severe winter weather events may exacerbate flooding. 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 Chapter 10 for more information about the flood hazard of concern. Winter storms are often accompanied by extreme cold. Refer to Chapter 9 for more information about the extreme cold hazard of concern.

14.2 COMMUNITY ASSETS AT RISK

For the severe winter storm hazard, all of Lewis County has been identified as the hazard area. Therefore, all assets in the County (population, structures, critical facilities, and lifelines) are vulnerable to a winter storm event.

14.2.1 People and Communities

Overall Population

The entire population of Lewis County (26,875) 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. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. Risks to people and communities include:

- Hypothermia and Frostbite—Prolonged exposure to extreme cold can result in hypothermia, frostbite, and increased mortality, especially among vulnerable populations like the elderly or homeless.
- Respiratory and Cardiac Strain—Cold weather can exacerbate chronic conditions like asthma and increase the risk of heart attacks, often linked to the physical strain of snow shoveling.

- **Carbon Monoxide Poisoning**—Improper use of generators or indoor heating devices can lead to toxic exposures during power outages.
- **Increased Accidents**—Slippery conditions contribute to vehicle collisions, falls, and injuries, straining emergency response systems.

Socially Vulnerable Population

People who experience homelessness, are over the age of 65, and under the age of 5 are considered to be the most susceptible to this hazard. Older adults are 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. Young children are at risk from experiencing hypothermia or other cold related illnesses due to their inability to care for themselves and their dependency on others. Individuals who experience homelessness are at risk from hypothermia due to lack of a warming shelter from the cold temperatures that are associated with winter weather. Those that are at or around the poverty level in the County are dependent on their limited income and may not be able to afford staying at an alternative shelter, such as a hotel, and may not be able to afford to miss work, regardless of the weather conditions. People who are non-English speaking may not be able to interpret public emergency warnings and signage which puts them at an increased risk.

According to the 2023 five-year American Community Survey (ACS) population estimate, there are 3,265 total persons living below the poverty level, 5,347 persons over the age of 65 years, 1,635 persons under the age of five years, 29 non-English speakers, and 3,972 persons with a disability living in Lewis County. FEMA's National Risk Inventory social vulnerability index for Lewis County is identified as "very low."

Economy

Depending on the severity and duration of the severe winter weather event, damage to the general building stock, critical facilities, and community lifelines can include roof damage from heavy snow loads, structural damage from downed trees, and power outages.

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.

Additional economic risks include:

- **Business Interruptions**—Transportation and power disruptions can force businesses to close, particularly those reliant on just-in-time supply chains. 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.
- **Agricultural Losses**—Ice storms can damage crops, orchards, and livestock infrastructure, impacting local and regional food supplies.
- **Removal costs**—The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources.
- **Recovery Costs**—Infrastructure repair can place significant financial burdens on local governments and taxpayers.

- **Economic Recovery Challenges**—Struggling small businesses or municipalities with limited resources may take years to recover from severe storm impacts.

14.2.2 General Building Stock

The entire general building stock inventory is exposed and vulnerable to the severe winter storm hazard and could be more at risk from aging infrastructure. An extreme blizzard or snowstorm event can carry and deposit significant amounts of snow that are heavy enough to knock down power and telephone lines as well as damage roofs and aging buildings, some of which are critical facilities and community lifelines. In general, the structural impacts include partial damages to roofs and building frames, rather than an entire building.

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.

- **Structural Damage**—Ice and snow accumulation on roofs can lead to collapses, particularly in older buildings or those not designed to withstand such loads.
- **Water Supply Issues**—Frozen pipes can burst, leading to water supply disruptions and costly repairs.

14.2.3 Community Lifelines and Other 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 often 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.

The following are infrastructure and utility impacts commonly associated with severe winter storms:

- **Power Outages**—Ice accumulation can weigh down power lines and utility poles, causing widespread outages that may last for days or weeks in severe cases. Ongoing full functionality of critical facilities and services such as police, fire, and medical is essential – without backup power these lifelines are at risk.
- **Transportation Disruptions**—Snow and ice can make roads impassable, lead to accidents, and disrupt public transit systems (trains, buses, and subways). Airports may shut down due to unsafe flying conditions.
- **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.
- **Communication Breakdowns**—Ice storms can damage telecommunications infrastructure, limiting emergency communication and access to information.

- **Food and Fuel Shortages**—Supply chain disruptions can lead to shortages of essential goods, exacerbating challenges for isolated or underserved communities.

14.2.4 Natural Resources

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 (NSIDC n.d.).

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. Road-salt runoff can cause groundwater salinization, modify the soil structure, and result in loss or reduction in lake turnover. Additionally, road salt can cause changes in the composition of aquatic invertebrate assemblages and pose threats to birds, roadside vegetation, and mammals (Tiwari and Rachlin 2018).

Other risks to the natural environment include:

- **Tree Damage**—Ice storms can break branches or uproot entire trees, causing long-term damage to forests and urban green spaces.
- **Water Quality Issues**—Melting snow and ice can carry road salt, debris, and other pollutants into rivers, lakes, and groundwater systems.
- **Wildlife Stress**—Heavy snow and ice can limit access to food and shelter for wildlife, increasing mortality rates.
- **Ecosystem Changes**—Repeated severe storms can alter local ecosystems, affecting biodiversity and increasing susceptibility to future storms.

14.2.5 Historic and Cultural Resources

Historic sites are at risk from the extreme cold or freeze hazard. Historic buildings may be susceptible to damage from severe winter weather conditions. Proper strategies help safeguard buildings and their contents. Sudden and dramatic fluctuations in heating or cooling should be minimized. Slower heating and cooling give building materials and stored contents time to acclimate to new temperatures in the building and corresponding new humidity levels (CCAHA 2019).

Cultural heritage sites, particularly those exposed to the elements, are subject to weathering. Climate change is a potential threat to these sites as it exacerbates the expected rates of decay and contributes to the appearance of new decay. Climatic changes may aggravate the physical, chemical, and biological mechanisms causing degradation by affecting the structure or composition of building materials. Changes in temperature, precipitation, atmospheric moisture, and wind intensity, in addition to the interaction between climatic changes and air pollution, have been identified as concerns by the United Nations Educational, Scientific and Cultural Organization (Sesana, et al. 2021).

14.3 FUTURE OCCURRENCES AND PROJECTED CHANGES IN RISK

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

14.3.1 Probability of Future Occurrences

Based on historical records and input from the Steering Committee, the probability of occurrence for severe winter storms in the County is considered “frequent.”

Table 14-6. Probability of Future Severe Winter Storm Events in Lewis County

Hazard Type	Number of Occurrences Between 1996 and 2024	Percent Chance of Occurring in Any Given Year
Blizzard	3	10.71%
Cold/Wind Chill	1	3.57%
Extreme Cold/Wind Chill	11	39.29%
Frost/Freeze	26	92.86%
Heavy Snow	104	371.43%
Ice Storm	3	10.71%
Lake Effect Snow	113	403.57%
Sleet	0	0%
Winter Storm	54	192.86%
Winter Weather	0	0%
Total	315	1,125.0%

Source: NOAA 2025

Note: Due to limitations in data, not all severe winter storm events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is calculated using the number of occurrences between 1996 and 2024.

14.3.2 Climate Change Projections and Likely Impacts

The State of New York will see an increase in average annual temperatures and precipitation. Climate change has the ability to make winter weather events less frequent, but more severe when they do happen. 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 (The Climate Reality Project 2022).

In the Northeast, while snow events may become less common and snow season may be shorter due to higher average temperatures, extreme snowstorms (including lake-effect snowstorms) may increase in frequency relative to historical levels (NYS DHSES 2023). However, this trend may not hold toward the end of the century as warming continues to increase (NYS DHSES 2023). One study suggested that, while snowstorms will likely become less common due to atmospheric warming, when temperatures are cold enough, they will produce more

snow than has historically been the case (NYS DHSES 2023). Climate-linked changes to snowstorm duration are unclear at this time.

14.3.3 Projected Changes in Development and Population

Lewis County has experienced a slight decrease in population since 2010. According to the U.S. Census Bureau, the County's population decreased by approximately -0.19 percent between 2010 and 2020. Cornell University's Program on Applied Demographics produced populations projections by County from 2016 to 2040. According to these projections, Lewis County is projected to have a population of 26,156 by 2030 and 25,618 by 2040 as the population decrease is expected to continue (Cornell University 2018). Any increase in growth across certain areas of the county 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. Chapter 3 includes a more thorough discussion about population trends for 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).

14.3.4 Changes in Vulnerability Since 2020 HMP

Overall, the County's exposure and vulnerability have not changed, and the entire County will continue to be exposed and vulnerable to severe winter storm events.

15. WILDFIRE

15.1 HAZARD PROFILE

15.1.1 Hazard Description and Location

According to the 2023 New York State Hazard Mitigation Plan, MitigateNY, a wildfire is any fire that is not planned, controlled, or supervised in a natural area such as a forest, grassland, or prairie. Wildfires include those commonly referred to as forest fires, brush fires, grass fires, range fires, or ground fires. These events often begin unnoticed and spread quickly. Wildfires that burn or threaten to burn buildings and other structures are referred to as wildland urban interface fires.

The term wildfire typically excludes agricultural fires, which are intentional fires to manage croplands. Another category of wildland fire is so-called beneficial fire, which are wildland fires intentionally set or intentionally allowed to burn for cultural, ecosystem, or public-safety purposes. Common types of beneficial fire include cultural fire, which can be part of indigenous cultural practices, and prescribed burns, which are conducted in a controlled manner to simulate the fires an ecosystem has evolved to require or to remove dangerous fuel loads from near communities.

Wildfire Causes

The interaction of three conditions determines how a wildfire will grow once ignited: fuel, weather, and topography (MitigateNY 2018). Fuels are anything that will burn and include vegetation and structures. The weather, such as high temperatures, low humidity and high winds increase the likelihood that a wildfire will spread. Topography affects speed at which a wildfire will spread. A fire will move more quickly uphill which causes hot gases to rise in front of it. These gases, in turn, pre-heat and dry vegetation ahead of the wildfire causing it to catch fire more rapidly (MitigateNY 2018).

There are three different classes of wildfires: surface fires, ground fires, and crown fires. Surface fires are the most common type and burns along the forest floor, moving slowly and killing or damaging trees. Ground fires are usually started by lightning and burns on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along the tops of trees. While they are not confined to any specific geographic location and can vary greatly in terms of size, location, intensity, and duration, wildfires are most likely to occur in open grasslands. The threat to people and property is greater in the fringe areas where developed areas meet open grasslands (U.S. Forest Service 2020). Many areas in the State, particularly those that are heavily forested or contain large tracts of brush and shrubs, are prone to fires.

Most wildfires in New York State are human caused, resulting from activities such as debris burning, campfires, equipment use, smoking and arson. Lightning is the second most common ignition source. The likelihood of a lightning strike starting a wildfire depends on the intensity of the strike and the type and dryness of the fuel it contacts. Once ignited, the spread of a wildfire is primarily influenced by fuel moisture content. Wildfires cause both short-term and long-term losses. Short-term losses can include destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and the destruction of cultural and economic resources and community infrastructure.

Wildfires are most likely to occur in open grasslands, shrublands, and forested areas, and the risk increases in wildland-urban interface (WUI) zones—areas where development meets undeveloped wildland. These fringe

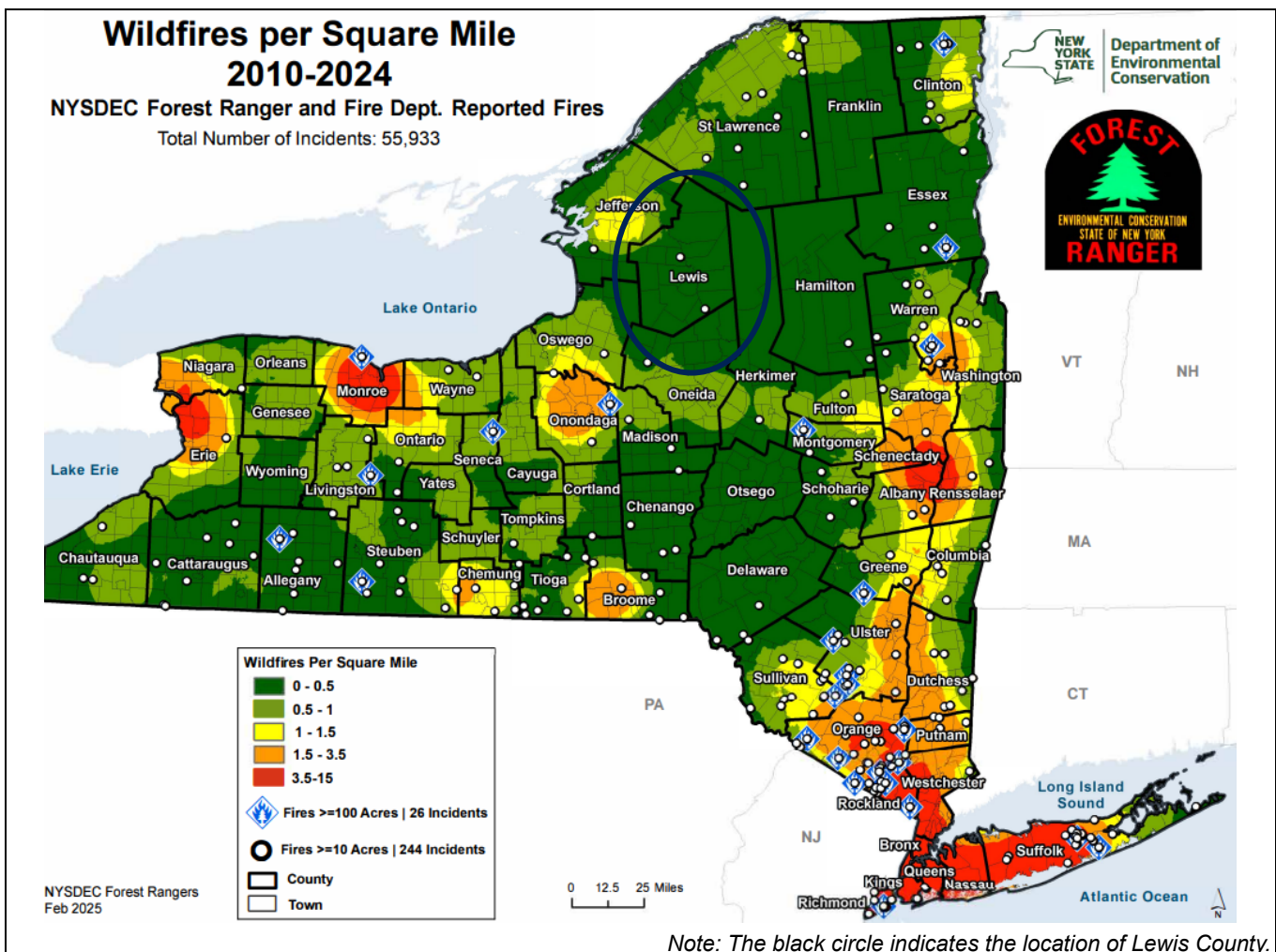
zones are particularly vulnerable because they combine flammable vegetation with human structures and activities.

There are two major fire seasons in New York, one in the spring and one in the fall. Typically, the spring fire season is the larger of the two, with a more abbreviated fall fire season. Those times in particular fuel fires, when there's an increase of dead grass and leaves on the ground, combined with leaves off the trees, allowing for more direct sunlight to hit the dry ground. Additionally, spring and fall weather patterns sometimes lead to extended dry periods, drying the fire fuels, dead grass and leaves further.

Wildfire Risk by Region

According to the U.S. Fire Administration (USFA), wildfire risk in the United States varies by region due to factors such as climate, vegetation, socioeconomic conditions, and land use patterns ¹. In New York State, wildfires are not as frequent or intense as in the western U.S., but they still pose a significant hazard, particularly in areas with dense forests, brush, and grasslands. The New York State Hazard Mitigation Plan identifies wildfire as a recurring hazard, especially in rural and forested regions. Figure 15-1 shows the distribution of wildfires per square mile across the state from 2010 to 2024.

Figure 15-1. Wildfires per Square Mile in the State of New York, 2010 – 2024



Source: NYSDEC Forest Rangers

The State of New York is divided into 10 fire danger rating areas (FDRAs). FDRAs are defined by areas of similar vegetation, climate, and topography in conjunction with agency regional boundaries, National Weather Service (NWS) fire weather zones, political boundaries, fire occurrence history, and other influences. The Forest Ranger Division issues daily fire danger warnings when the fire danger rating is at high or above in one or more FDRAs. Dutchess County is in the Hudson Valley FDRA. This is discussed further in the Extent section of this profile.

Wildland-Urban Interface

The wildland-urban interface (WUI) is an area where human development meets or mixes with undeveloped wildland. In these areas, wildfires pose a particular risk to humans. The WUI is divided into two categories: WUI intermix and WUI interface.

- The WUI intermix is a geographical area where structures and wildlands intermingle, with no clear boundary between the two. In an intermix area, homes and other structures are scattered throughout a wildland area. These structures are often surrounded by trees and vegetation and are only accessible by narrow roads. This makes it difficult to reach these areas if a fire occurs.
- The WUI interface is the area where human development is adjacent to natural environments, such as forests, grasslands, or shrublands.

Wildfires are of particular concern in the WUI because they bring humans—the primary cause for wildfire ignition in the United States—into greater contact with flammable wildlands. The WUI grows nationwide by approximately 2 million acres each year as communities continue to expand, often due to the pressures of high housing costs in more densely populated areas.

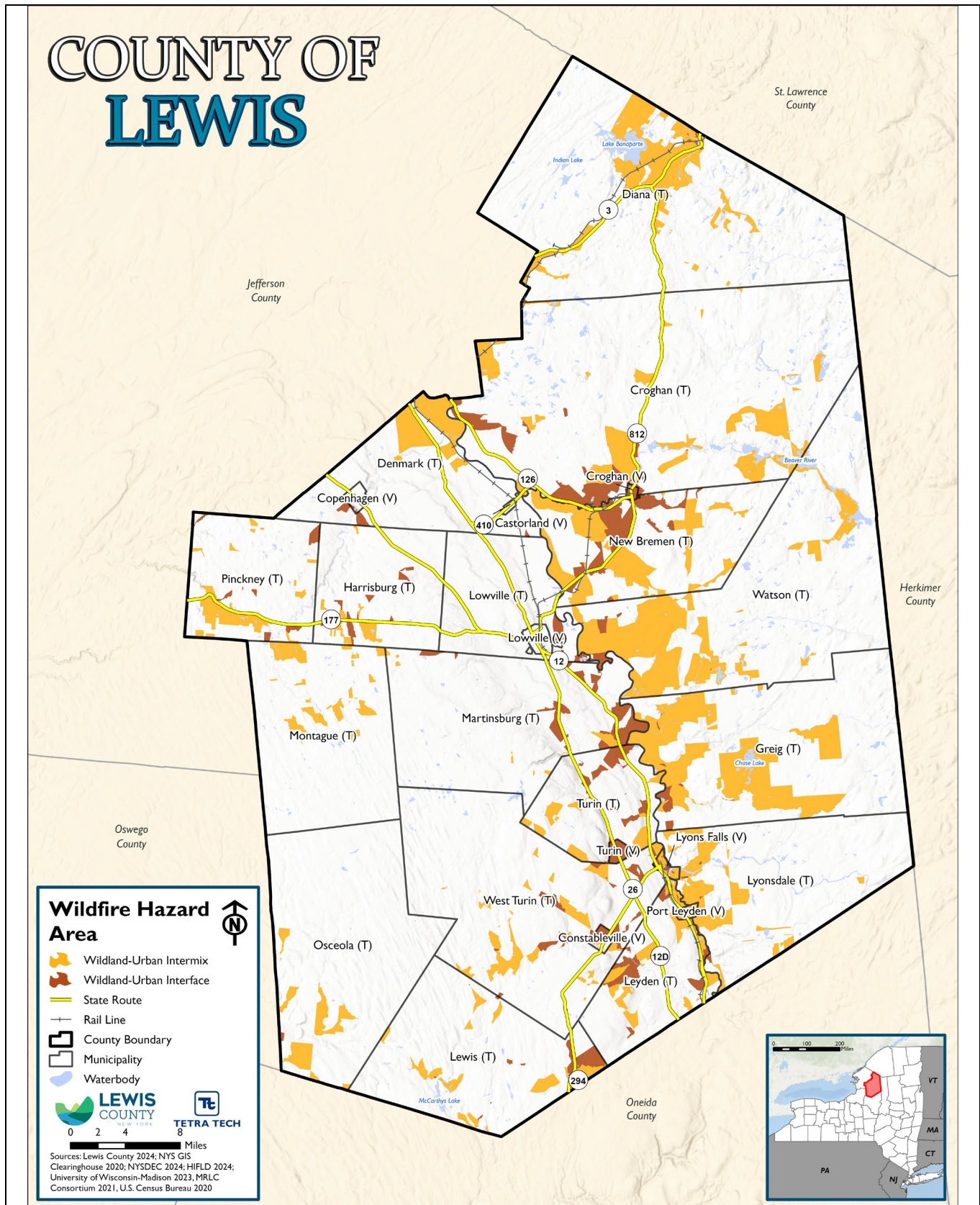
Recent WUI maps show that almost every county in New York State has both interface and intermix zones (REF354). In the State of New York, 27.2 percent (38,489 square miles) of the state is located in the WUI; with 5.4 percent (7,599 square miles) is located in the WUI interface and 21.9 percent (30,890 square miles) is located in the WUI intermix (Radeloff, et al. 2020). Refer to Figure 15-2 for WUI areas in Lewis County.

Wildfire Smoke

Wildfire smoke refers to smoke from wildland fires, both planned beneficial wildfire and unplanned hazardous wildfire. Planned burns, including prescribed burns, generate smoke, but such burns can be carried out in a way that mitigates adverse health impacts, such as by planning for days with specific weather patterns and by notifying the public in advance.

Wildfire smoke arrives in New York State when weather patterns blow wildfire smoke in our direction. The duration of smoke impacts is therefore set by a combination of the size and duration of the fires that create smoke and the duration of the weather pattern bringing the smoke into the state. Major fires that create enough smoke to reach New York tend to have durations of weeks or longer.

Figure 15-2. WUI in Lewis County



15.1.2 Extent

Wildfire events can range in size and intensity. The extent (that is, magnitude or severity) of wildfires depends on weather and human activity. There are several tools available to estimate fire potential, extent, danger, and growth, several of which are described in the following section.

Wildfire Behavior

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 managers 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 2013).

Weather / Air Mass

Air mass 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).

Ratings and Indices

There are several tools available to estimate fire potential, extent, danger, and growth, several of which are described in the following section.

Wildland Fire Assessment System

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. It was developed by the Fire Behavior unit at the Fire Sciences Laboratory in Missoula, Montana and is currently supported and maintained at the National Interagency Fire Center (NIFC) in Boise, Idaho (WFAS 2023).

National Fire Danger Rating System

Each day during the fire season, national maps of selected fire weather and fire danger components of the National Fire Danger Rating System (NFDRS) are produced by the WFAS. Fire Danger Rating level considers current and antecedent weather, fuel types, and both live and dead fuel moisture. This information is provided by local station managers (WFAS 2023). Table 15-1 shows the fire danger rating and color code, which is also used by the NYSDEC to update their fire danger rating maps, which is identified later in this section.

Fire Potential Index

The Fire Potential Index (FPI) is a moisture-based vegetation flammability indicator. The FPI indicates the estimated proportion (percentage) of the vegetation that is dry enough to burn, thus the FPI is highest when dead fuel moistures and vegetation greenness are low. The FPI is calculated once daily for the continental US at a resolution of 1 square kilometer. Although these maps provide a relative measure of fuel flammability across the nation, they do not indicate the chance that a large fire will occur (USFS 2016) (USGS 2023).

Fuel Moisture

Fuel Moisture (FM) is a measure of the amount of water in a fuel (vegetation) available to a fire and is expressed as a percent of the dry weight of that specific fuel. When fuel moisture content is high, fires do not ignite readily, or at all, because heat energy must be used to evaporate and drive water from the plant before it can burn. When the fuel moisture content is low, fires start easily and will spread rapidly because all the heat energy goes directly into the burning flame itself. When the fuel moisture content is less than 30 percent, that fuel is essentially considered to be dead. Dead fuels respond solely to current environmental conditions and are critical in determining fire potential (NOAA 2023).

Table 15-1. Description of Fire Danger Ratings in New York State

Adjective Rating Class and Color Code	Class Description
Red Flag	A short-term, temporary warning, indicating the presence of a dangerous combination of temperature, wind, relative humidity, fuel, or drought conditions that can contribute to new fires or rapid spread of existing fires. A Red Flag Warning can be issued at any Fire Danger level.
Extreme (Red)	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous, except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks until the weather changes, or the fuel supply lessens.
Very High (orange)	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
High (yellow)	All fine dead fuels ignite readily, and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly, and short-distance spotting is common. High intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Moderate (blue)	Fires can start from most accidental causes but, with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur but is not persistent. Fires are not likely to become serious and control is relatively easy.
Low (green)	Fuels do not ignite readily from small firebrands, although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting.

Source: NYSDHSES 2022

Fuels are classified into four categories which respond to changes in moisture. This response time is referred to as a time lag. A fuel's time lag is based upon how long it would take for two-thirds of the dead fuel to respond to atmospheric moisture. Table 15-2 outlines these four fuel classifications.

Table 15-2. Fuel Moisture Classifications

1-hour fuels	10-hour fuels	100-hour fuels	1000-hour fuels
Up to ¼-inch diameter – fine, flashy fuels that respond quickly to weather changes. Computed from observation time, temperature, humidity, and cloudiness.	¼-inch to one-inch in diameter - computed from observation time, temperature, humidity, and cloudiness or can be an observed value.	One-inch to three-inch in diameter - computed from 24-hour average boundary condition composed of day length (daylight hours), hours of rain, and daily temperature/humidity ranges.	Three-inch to eight-inch in diameter - computed from a seven-day average boundary condition composed of day length, hours of rain, and daily temperature/humidity ranges.

Source: NPS 2023

Keetch-Byram Drought Index

The Keetch-Byram Drought Index (KBDI) assesses the risk of fire by representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers. The KBDI attempts to measure the amount of precipitation necessary to return the soil to full field capacity. The index ranges from zero, the point of no moisture deficiency, to 800, the maximum drought that is possible, and represents a moisture regime from zero to eight inches of water through the soil layer. At eight inches of water, the KBDI assumes saturation. At any point along the scale, the index number indicates the amount of net rainfall that is required to reduce the index to zero, or saturation (NIDIS 2023).

Haines Index

The Haines Index, also known as the Lower Atmosphere Stability Index, was developed for fire use. It is used to indicate the potential for wildfire growth by measuring the stability and dryness of the air over a fire. It is calculated by combining the stability and moisture content of the lower atmosphere into a number that correlates well with large fire growth. The stability term is determined by the temperature difference between two atmospheric layers; the moisture term is determined by the temperature and dew point difference. This index has been shown to be correlated with large fire growth on initiating and existing fires where surface winds do not dominate fire behavior. The drier and more unstable the lower atmosphere is, the higher the index. See Table 15-3.

Table 15-3. Haines Index

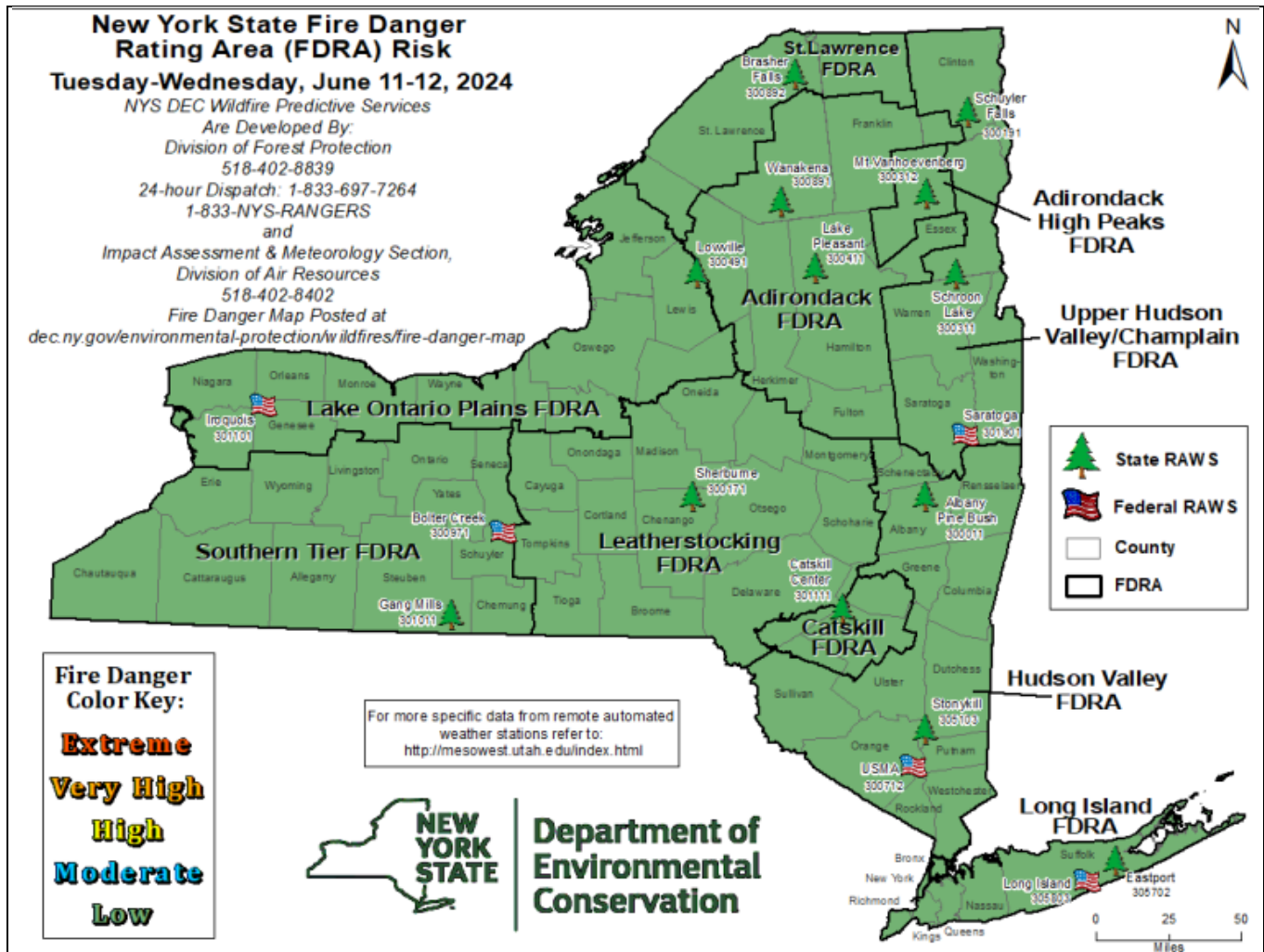
Haines Index	Potential for Large Fire Growth
2 or 3	Very Low
4	Low
5	Moderate
6	High

Source: NOAA n.d.

NYSDEC Fire Danger Rating Map

A current fire danger rating map is updated daily on the NYSDEC website (NYSDEC 2023). The map is developed by information obtained from the Division of Forest Protection and Division of Air Resources (impact assessment and meteorology section). Figure 15-3 shows the FDRAs in the State of New York and an example of fire danger risk for each of the areas (captured on June 12, 2024). The figure is color coded and indicates where there were red flag warning areas at the time the map was issued.

Figure 15-3. The State of New York FDRAs



Source: NYSDEC 2024

15.1.3 Previous Occurrences and Impacts

Between 1996 and 2024, New York State had 32 wildfire events captured in the National Center for Environmental Information (NCEI) storm events database that have collectively resulted in approximately \$218K in damages. The National Risk Index Expected Annual Loss associated with damaging wildfire events in Lewis County is \$14,501 (MitigateNY 2023).

FEMA and USDA Disaster Declarations

Between 1954 and 2024, Lewis County was included in one major disaster declared September 11, 2001 (DR-1391) for wildfire-related events (FEMA 2023) due to fire from the New York terrorist attack.

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 contiguous counties. Between 2020 and May 2025, Lewis County was not included in any USDA wildfire-related agricultural disaster declarations.

Previous Events

For this 2025 HMP update, known hazard events that impacted Lewis County between 2020 and April 2025 are discussed in Table 15-4. Many sources provided wildfire information regarding previous occurrences and losses associated with wildfire throughout the State of New York and Lewis County.

Table 15-4. Wildfire Events in Lewis County (2019 to 2024)

Event Date	Location Impacted	Description
May 24, 2020	Diana	Jayville Road fire – campfire, 1.2 acres
July 5, 2020	Leyden	Golden Road Fire – private property, 0.1 acres
June 26, 2020	Croghan	Route 812 fire – campfire, 1.3 acres
April 9, 2021	Diana	Texas Road fire – debris burning, 0.1 acres
June 11, 2021	Pickney	Tug Hill fire – brush fire, 0.1 acres
May 10, 2022	Watson	Meat Market fire – campfire, 0.2 acres
May 11, 2022	Diana	Incendiary fire – private property, 0.1 acres
May 11, 2022	Croghan	Old State Road – campfire, 0.3 acres
July 12, 2022	Lyonsdale	Sand Flats SF – campfire, 3.7 acres
July 31, 2022	Greig	Fish Creek fire – debris burning, 0.3 acres
October 29, 2022	Croghan	812 Ash fire – private property, 0.1 acres
April 14, 2023	Watson	Cornstalk fire – 5.3 acres
April 21, 2023	Turin	Payne Fire – Debris burning, 2.0 acres
May 23, 2023	Watson	Watson wildfire – Debris burning, 0.5 acres
May 29, 2023	Greig	Woodcock Lane – debris burning, 2.7 acres
October 5, 2023	Montague	Montague fire – campfire, 0.5 acres

Source: NYS Forest Ranger Database

Additionally, in June 2023, more than 250 wildfires burned out of control in Canada and created hazardous air quality conditions across New York State and the greater tri-state area. Research showed that on June 7, more Americans were exposed to unhealthy air quality due to wildfire smoke than at any time since 2006 (MitigateNY 2023). New York City's air pollution ranked the worst of any city in the world on June 7 as wildfire smoke from Canada continued to drift over the area and shattered previous records for air quality in the city (MitigateNY 2023).

The June 2023 wildfire smoke plumes also directly caused economic damage. Wildfire smoke delayed flights at large New York area airports and led to the cancellation of Major League Baseball games and major Broadway productions, the closure of restaurants and other businesses, and the cancellation of various events. At time of writing, the total economic toll is not yet known for this event.

Wildfire occurrence reporting in New York is based on two data sources: State of New York Forest Ranger Division data and National Fire Incident Reporting System (NFIRS) reporting. The State of New York Forest Ranger force has fought fires and retained records since 1891. Between 1993 and 2017, Division records indicate that rangers suppressed 5,423 wildfires that burned a total of 52,580 acres. This averages 217 fires burning 2,103 acres per year; however, the State does not have a consistent wildfire season. The State of New York's fire history indicates periods of time when wildfires are much more numerous and destructive than the 25-year average would indicate. The years 1988, 1989, 1991, 1995, 1998, 1999, 2002, and 2008 were all above average year, including with 11,730 acres burned in 1989 alone.

According to the Ranger Division wildfire occurrence data from 1993 through 2017, 95 percent of wildfires in the State were caused by humans, while lightning was responsible for 5 percent of wildfires. Of the wildfires in the State of New York during this period, debris burning accounts for 33 percent, incendiary fires account for 16 percent, campfires cause 16 percent, children are responsible for 4 percent, and smoking, equipment, railroads, and other miscellaneous causes contribute to the remaining 25 percent of wildfires (NYSDEC 2017).

Between 2015 and 2019, the State of New York reported 338,139 fires to NFIRS. Lewis County reported 324 fires to NFIRS, with approximately 18.5 percent of these events being classified as “outside fires.” Alongside these reported fires, over 37.7 percent of residential building fires in Lewis County were caused by heating issues (FEMA 2021).

15.1.4 Cascading Impacts

Cascading impacts of wildfires are secondary and tertiary effects that result from the primary wildfire event. While wildfires in New York State are relatively less frequent and severe compared to Western states, their impacts can still be significant, particularly due to increasing climate variability and the presence of wildland-urban interfaces. Here are some potential cascading impacts of wildfires in New York State:

- **Environmental Impacts**
 - **Air Quality Degradation**—Wildfire smoke releases fine particulate matter (PM2.5) and harmful gases (e.g., carbon monoxide, nitrogen oxides), leading to poor air quality across large areas.
 - **Soil Degradation and Erosion**—High-intensity fires can destroy vegetation and organic matter, reducing soil stability and leading to erosion, sedimentation in waterways, and loss of soil fertility.
 - **Water Quality Decline**—Ash and debris from burned areas can wash into streams and rivers, increasing turbidity and contaminating water supplies with chemicals and heavy metals.
- **Community Service and Public Health Impacts**
 - **Utility Disruptions**—Wildfires can damage power lines, transformers, and other critical infrastructure, leading to outages and repair costs.
 - **Agricultural Losses**—Crops, livestock, and farmland can be destroyed, disrupting the local food supply and economy.
 - **Tourism Decline**—Popular natural and recreational areas, such as the Adirondacks, may become inaccessible or less attractive to visitors post-fire.
 - **Evacuations and Displacement**—Communities in affected areas may face temporary or prolonged displacement, creating challenges for housing and social services.
 - **Loss of Cultural Resources**—Wildfires can destroy historic sites, cultural landmarks, and sacred spaces.
 - **Strain on Emergency Services**—Increased demands on firefighters, EMS, and public health services during and after a wildfire event.
 - **Respiratory Issues**—Exposure to smoke can exacerbate respiratory diseases such as asthma, bronchitis, and COPD.
 - **Heat Stress**—Combined with extreme heat events, wildfires can increase risks of heat-related illnesses.
 - **Mental Health Strain**—Anxiety, depression, and PTSD can arise from evacuation, property loss, and environmental devastation.

- Secondary Natural Hazards
 - **Flooding**—Loss of vegetation increases runoff and reduces soil absorption, heightening flood risks, especially in areas with heavy rainfall following a fire.
 - **Landslides**—Burned hillsides may become unstable, especially in the Catskill and Adirondack mountain regions.
 - **Invasive Species Proliferation**—Disturbed ecosystems are more susceptible to colonization by invasive plant and animal species.
 - **Carbon Emissions**—Wildfires release significant amounts of greenhouse gases, contributing to climate change and increasing the likelihood of future extreme weather events.
 - **Altered Ecosystems**—Changes in vegetation and habitat can reduce biodiversity and affect ecosystem services.

15.2 COMMUNITY ASSETS AT RISK

15.2.1 People and Communities

For the wildfire risk assessment, WUI interface and intermix data was sourced from the University of Wisconsin-Madison to be analyzed as the hazard area. The high-, medium-, and low-density WUI interface areas were combined and used as the “Interface” hazard area, and the high-, medium-, and low-density WUI intermix areas were combined and used as the “Intermix” hazard areas. Asset data (population, building stock, and critical facilities) presented in the County Profile were used to support an evaluation of assets exposed and potential impacts and losses associated with this hazard. To determine what assets are exposed to wildfire, available and appropriate GIS data were overlaid with the hazard area.

Overall Population

Wildfires have the potential to impact human health and life of residents and responders, structures, infrastructure, and natural resources. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

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, nitrogen oxides), and toxics (formaldehyde, 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.

The duration of smoke impacts is set by a combination of the size and duration of the fires that create smoke and the duration of the weather pattern bringing the smoke into the state or moving it within the state. Major fires that create enough smoke to reach New York tend to have durations of weeks or longer.

Table 15-5 and Table 15-6 summarize the estimated population exposed to the wildfire hazard by municipality. Based on the analysis, an estimated 8,358 residents, or 31.0 percent of the County's population, are in the WUI intermix hazard area. Overall, the Town of Watson has the greatest number of individuals located in the WUI intermix hazard area (1,888 persons). An estimated 4,523 residents, or 16.8 percent of the County's population, are in the WUI interface hazard area. Overall, the Village of Croghan has the greatest number of individuals located in the WUI interface hazard area (641 persons).

Table 15-5. Estimated Population in the WUI Intermix Hazard Area in Lewis County

Jurisdiction	Total Population (2023 ACS)	Population in the WUI Intermix Hazard Area	
		Number of Persons	% of Jurisdiction Total
Castorland (V)	414	0	0.0%
Constableville (V)	356	30	8.4%
Copenhagen (V)	652	0	0.0%
Croghan (T)	2,911	873	30.0%
Croghan (V)	642	0	0.0%
Denmark (T)	1,589	360	22.7%
Diana (T)	1,503	944	62.8%
Greig (T)	1,020	844	82.7%
Harrisburg (T)	515	107	20.8%
Lewis (T)	801	233	29.1%
Leyden (T)	1,235	397	32.1%
Lowville (T)	1,442	30	2.1%
Lowville (V)	3,432	2	0.1%
Lyons Falls (V)	478	299	62.6%
Lyonsdale (T)	885	570	64.4%
Martinsburg (T)	1,232	51	4.1%
Montague (T)	159	70	44.0%
New Bremen (T)	2,436	1,095	45.0%
Osceola (T)	140	51	36.4%
Pinckney (T)	246	92	37.4%
Port Leyden (V)	680	451	66.3%
Turin (T)	827	179	21.6%
Turin (V)	312	0	0.0%
Watson (T)	1,888	1,409	74.6%
West Turin (T)	1,178	271	23.0%
Lewis County (Total)	26,974	8,358	31.0%

Source: U.S. Census Bureau 2023 ACS; University of Wisconsin-Madison 2023, MRLC Consortium 2021; U.S. Census Bureau 2021

Table 15-6. Estimated Population in the WUI Interface Hazard Area in Lewis County

Jurisdiction	Total Population (2023 ACS)	Population in the WUI Interface Hazard Area	
		Number of Persons	% of Jurisdiction Total
Castorland (V)	414	0	0.0%
Constableville (V)	356	306	86.0%
Copenhagen (V)	652	10	1.5%
Croghan (T)	2,911	568	19.5%
Croghan (V)	642	641	99.8%
Denmark (T)	1,589	31	2.0%
Diana (T)	1,503	123	8.2%
Greig (T)	1,020	21	2.1%
Harrisburg (T)	515	74	14.4%
Lewis (T)	801	92	11.5%
Leyden (T)	1,235	227	18.4%
Lowville (T)	1,442	139	9.6%
Lowville (V)	3,432	0	0.0%
Lyons Falls (V)	478	178	37.2%
Lyonsdale (T)	885	39	4.4%
Martinsburg (T)	1,232	429	34.8%
Montague (T)	159	0	0.0%
New Bremen (T)	2,436	615	25.2%
Osceola (T)	140	1	0.7%
Pinckney (T)	246	36	14.6%
Port Leyden (V)	680	223	32.8%
Turin (T)	827	220	26.6%
Turin (V)	312	309	99.0%
Watson (T)	1,888	101	5.3%
West Turin (T)	1,178	140	11.9%
Lewis County (Total)	26,974	4,523	16.8%

Source: U.S. Census Bureau 2023 ACS; University of Wisconsin-Madison 2023, MRLC Consortium 2021; U.S. Census Bureau 2021

Socially Vulnerable Population

According to the 2023 ACS, Lewis County has 3,265 total persons living below the poverty level, 5,347 persons over the age of 65, 1,635 persons under the age of 5, 29 non-English speakers, and 3,972 persons with a disability. FEMA's National Risk Index Inventory's Social Vulnerability Index for Lewis County is "very low."

As shown in Table 15-7, there are 8,358 persons located in the wildfire intermix hazard area. Table 15-7 presents the estimated socially vulnerable populations located in the wildfire intermix hazard area. Of the 8,358 persons located in the wildfire intermix hazard area, there are 1,644 persons over the age of 65 years, 503 persons under the age of five years, 22 non-English speakers, 1,224 persons with a disability, and 956 living in poverty.

As shown in Table 15-8, there are 4,523 persons located in the wildfire interface hazard area. Table 15-8 presents the estimated socially vulnerable populations located in the wildfire interface hazard area. Of the 4,523 persons located in the wildfire interface hazard area, there are 918 persons over the age of 65 years, 325 persons under the age of five years, 0 non-English speakers, 654 persons with a disability, and 514 living in poverty.

Table 15-7. Estimated Number of Vulnerable Persons in the WUI Intermix Hazard Area

Jurisdiction	Estimated Number of Vulnerable Persons Located in the WUI Intermix Hazard Area									
	Persons Over 65	% of Total	Persons Under 5	% of Total	Non-English Speaking Persons	% of Total	Persons with a Disability	% of Total	Persons in Poverty	% of Total
Castorland (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Constableville (V)	5	8.3%	4	7.5%	0	0.0%	4	7.7%	3	8.6%
Copenhagen (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Croghan (T)	130	29.9%	55	29.5%	0	0.0%	117	29.8%	134	30.0%
Croghan (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Denmark (T)	87	22.7%	24	22.0%	0	0.0%	44	22.3%	54	22.4%
Diana (T)	178	62.7%	18	62.1%	0	0.0%	175	62.5%	140	62.8%
Greig (T)	198	82.5%	35	81.4%	19	79.2%	121	82.3%	96	82.1%
Harrisburg (T)	11	19.3%	10	20.0%	0	0.0%	17	20.2%	11	19.3%
Lewis (T)	27	28.7%	10	28.6%	0	0.0%	29	29.0%	10	27.0%
Leyden (T)	55	31.8%	30	31.3%	0	0.0%	40	31.6%	66	31.8%
Lowville (T)	10	2.1%	1	1.6%	0	0.0%	4	2.1%	4	1.8%
Lowville (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lyons Falls (V)	83	62.4%	17	60.7%	0	0.0%	42	61.8%	25	61.0%
Lyonsdale (T)	129	64.1%	31	63.6%	0	0.0%	159	64.3%	89	63.9%
Martinsburg (T)	12	4.0%	2	3.9%	0	0.0%	8	4.0%	3	3.2%
Montague (T)	9	42.9%	1	33.3%	0	0.0%	6	40.0%	4	44.4%
New Bremen (T)	167	44.7%	119	44.9%	0	0.0%	106	44.9%	59	44.2%
Osceola (T)	15	35.7%	1	25.0%	0	0.0%	6	35.3%	5	35.7%
Pinckney (T)	15	36.6%	10	35.7%	0	0.0%	11	36.7%	7	33.3%
Port Leyden (V)	115	66.1%	47	66.2%	0	0.0%	87	66.4%	94	66.2%
Turin (T)	43	21.5%	9	19.6%	0	0.0%	24	20.9%	12	20.3%
Turin (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Watson (T)	296	74.6%	54	74.0%	3	62.5%	192	74.4%	115	74.2%
West Turin (T)	59	22.7%	25	22.4%	0	0.0%	32	22.8%	25	22.7%
Lewis County (Total)	1,644	30.7%	503	30.8%	22	76.4%	1,224	30.8%	956	29.3%

Source: U.S. Census Bureau 2023 ACS Vulnerable Population Totals; University of Wisconsin-Madison 2023, MRLC Consortium 2021; U.S. Census Bureau 2021

Table 15-8. Estimated Number of Vulnerable Persons in the WUI Interface Hazard Area

Jurisdiction	Estimated Number of Vulnerable Persons Located in the WUI Interface Hazard Area									
	Persons Over 65	% of Total	Persons Under 5	% of Total	Non-English Speaking Persons	% of Total	Persons with a Disability	% of Total	Persons in Poverty	% of Total
Castorland (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Constableville (V)	51	85.0%	45	84.9%	0	0.0%	44	84.6%	30	85.7%
Copenhagen (V)	0	0.0%	0	0.0%	0	0.0%	2	1.4%	1	1.0%
Croghan (T)	85	19.5%	36	19.3%	0	0.0%	76	19.4%	87	19.5%
Croghan (V)	136	100.0%	35	100.0%	0	0.0%	85	100.0%	112	100.0%
Denmark (T)	7	1.8%	2	1.8%	0	0.0%	3	1.5%	4	1.7%
Diana (T)	23	8.1%	2	6.9%	0	0.0%	22	7.9%	18	8.1%
Greig (T)	4	1.7%	0	0.0%	0	0.0%	3	2.0%	2	1.7%
Harrisburg (T)	8	14.0%	7	14.0%	0	0.0%	12	14.3%	8	14.0%
Lewis (T)	10	10.6%	4	11.4%	0	0.0%	11	11.0%	4	10.8%
Leyden (T)	31	17.9%	17	17.7%	0	0.0%	23	18.2%	38	18.3%
Lowville (T)	46	9.5%	5	8.1%	0	0.0%	18	9.5%	21	9.5%
Lowville (V)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lyons Falls (V)	49	36.8%	10	35.7%	0	0.0%	25	36.8%	15	36.6%
Lyonsdale (T)	9	4.5%	2	4.1%	0	0.0%	11	4.5%	6	4.3%
Martinsburg (T)	104	34.8%	17	33.3%	0	0.0%	69	34.8%	32	34.0%
Montague (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
New Bremen (T)	94	25.2%	66	24.9%	0	0.0%	59	25.0%	33	24.7%
Osceola (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Pinckney (T)	6	14.6%	4	14.3%	0	0.0%	4	13.3%	3	14.3%
Port Leyden (V)	57	32.8%	23	32.4%	0	0.0%	43	32.8%	46	32.4%
Turin (T)	53	26.5%	12	26.1%	0	0.0%	30	26.1%	15	25.4%
Turin (V)	93	98.9%	22	95.7%	0	0.0%	85	98.8%	18	94.7%
Watson (T)	21	5.3%	3	4.1%	0	0.0%	13	5.0%	8	5.2%
West Turin (T)	31	11.9%	13	11.7%	0	0.0%	16	11.4%	13	11.8%
Lewis County (Total)	918	17.2%	325	19.9%	0	0.0%	654	16.5%	514	15.7%

Source: U.S. Census Bureau 2023 ACS Vulnerable Population Totals; University of Wisconsin-Madison 2023, MRLC Consortium 2021; U.S. Census Bureau 2021

All persons exposed to the wildfire hazard are potentially vulnerable to wildfire impacts. 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. In addition, wildfire may threaten the health and safety of those fighting the fires. First responders are exposed to dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

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 need medical attention that may not be available due to isolation during a wildfire event, and they may have more difficulty evacuating.

Economy

Wildfire events can have major economic impacts from the initial loss of structures and the subsequent loss of business revenue. These events may cost thousands of taxpayer dollars to suppress and control; hundreds of operating hours on fire apparatus; and thousands of volunteer man hours from the volunteer firefighters.

15.2.2 General Building Stock

Buildings located within the wildfire intermix and interface hazard areas are exposed and considered vulnerable to the wildfire hazard. Buildings constructed of wood or vinyl siding are generally more likely to be impacted by the fire hazard than buildings constructed of brick or concrete. Table 15-9 and Table 15-10 summarize the buildings located in the WUI interface hazard area and the WUI intermix hazard areas per occupancy class.

Table 15-11 and Table 15-12 show the estimated number and replacement cost value (RCV) of buildings in the wildfire hazard areas by jurisdiction. There are an estimated 13,730 buildings in the wildfire intermix hazard area, representing approximately 25.3 percent of the County's total general building stock inventory replacement cost value. The Town of Watson has the greatest number of its buildings located in the wildfire intermix hazard area (2,445 buildings or 73.8 percent of its total building stock). There are an estimated 5,751 buildings in the wildfire interface hazard area, representing approximately 16.6 percent of the County's total general building stock inventory replacement cost value. The Town of Croghan has the greatest number of its buildings located in the wildfire interface hazard area (815 buildings or 27.2 percent of its total building stock).

Table 15-9. Buildings in the WUI Intermix Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the WUI Intermix Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Other ^a
Castorland (V)	0	0	0	0
Constableville (V)	12	12	0	7
Copenhagen (V)	0	0	0	0
Croghan (T)	554	502	41	56
Croghan (V)	0	0	0	0
Denmark (T)	160	199	3	21
Diana (T)	1,165	732	28	19
Greig (T)	1,398	981	7	41
Harrisburg (T)	53	62	0	8
Lewis (T)	171	176	0	9
Leyden (T)	243	229	5	51
Lowville (T)	10	3	0	0
Lowville (V)	1	1	0	0
Lyons Falls (V)	161	185	1	1
Lyonsdale (T)	458	394	20	14
Martinsburg (T)	31	33	3	7
Montague (T)	184	64	0	9
New Bremen (T)	536	607	20	63
Osceola (T)	253	119	0	7
Pinckney (T)	136	129	0	14
Port Leyden (V)	178	148	4	3
Turin (T)	83	83	0	26
Turin (V)	0	0	0	0
Watson (T)	1,356	1,009	17	63
West Turin (T)	197	121	0	33
Lewis County (Total)	7,340	5,789	149	452

Source: Lewis County 2024; NYS GIS 2024; University of Wisconsin-Madison 2023, MRLC Consortium 2021; U.S. Census Bureau 2021

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

Table 15-10. Buildings in the WUI Interface Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the WUI Interface Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Other ^a
Castorland (V)	0	0	0	0
Constableville (V)	119	125	0	28
Copenhagen (V)	4	3	0	1
Croghan (T)	361	326	40	88
Croghan (V)	243	233	4	33
Denmark (T)	14	11	0	16
Diana (T)	152	132	0	5
Greig (T)	35	27	0	9
Harrisburg (T)	37	41	0	12
Lewis (T)	68	92	1	29
Leyden (T)	139	191	0	37
Lowville (T)	45	34	0	18
Lowville (V)	0	0	0	0
Lyons Falls (V)	96	111	3	9
Lyonsdale (T)	32	44	0	9
Martinsburg (T)	260	264	4	141
Montague (T)	0	0	0	0
New Bremen (T)	301	316	9	153
Osceola (T)	7	5	0	1
Pinckney (T)	53	46	0	2
Port Leyden (V)	88	88	0	9
Turin (T)	102	90	0	54
Turin (V)	118	108	0	21
Watson (T)	98	80	0	6
West Turin (T)	102	92	0	76
Lewis County (Total)	2,474	2,459	61	757

Source: Lewis County 2024; NYS GIS 2024; University of Wisconsin-Madison 2023, MRLC Consortium 2021; U.S. Census Bureau 2021

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

Table 15-11. Number and RCV of Buildings in the WUI Intermix Hazard Area

Jurisdiction	Jurisdiction Total Buildings		Buildings in the WUI Intermix Hazard Area			
			Number of Buildings		RCV	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Castorland (V)	237	\$209,754,520	0	0.0%	\$0	0.0%
Constableville (V)	331	\$214,011,340	31	9.4%	\$21,208,439	9.9%
Copenhagen (V)	502	\$470,894,543	0	0.0%	\$0	0.0%
Croghan (T)	4,564	\$2,716,704,006	1,153	25.3%	\$529,538,577	19.5%
Croghan (V)	516	\$406,813,941	0	0.0%	\$0	0.0%
Denmark (T)	2,262	\$1,683,271,436	383	16.9%	\$225,403,477	13.4%
Diana (T)	3,305	\$1,337,032,416	1,944	58.8%	\$827,326,626	61.9%
Greig (T)	2,962	\$1,160,581,336	2,427	81.9%	\$945,871,702	81.5%
Harrisburg (T)	863	\$533,636,646	123	14.3%	\$40,977,717	7.7%
Lewis (T)	1,495	\$722,393,059	356	23.8%	\$179,998,263	24.9%
Leyden (T)	1,988	\$1,065,963,460	528	26.6%	\$231,413,340	21.7%
Lowville (T)	1,752	\$1,762,819,749	13	0.7%	\$6,028,254	0.3%
Lowville (V)	2,332	\$1,966,304,011	2	0.1%	\$638,358	<0.1%
Lyons Falls (V)	568	\$376,848,099	348	61.3%	\$208,827,212	55.4%
Lyonsdale (T)	1,614	\$656,114,259	886	54.9%	\$318,719,194	48.6%
Martinsburg (T)	2,180	\$1,847,174,778	74	3.4%	\$35,656,685	1.9%
Montague (T)	616	\$232,283,519	257	41.7%	\$96,469,329	41.5%
New Bremen (T)	3,030	\$1,662,197,383	1,226	40.5%	\$590,597,773	35.5%
Osceola (T)	1,190	\$395,966,698	379	31.8%	\$124,739,052	31.5%
Pinckney (T)	807	\$275,136,312	279	34.6%	\$84,986,547	30.9%
Port Leyden (V)	525	\$266,540,832	333	63.4%	\$149,688,714	56.2%
Turin (T)	1,094	\$881,477,564	192	17.6%	\$196,367,883	22.3%
Turin (V)	249	\$167,575,852	0	0.0%	\$0	0.0%
Watson (T)	3,311	\$1,308,062,188	2,445	73.8%	\$940,951,300	71.9%
West Turin (T)	1,869	\$1,005,138,588	351	18.8%	\$155,173,385	15.4%
Lewis County (Total)	40,162	\$23,324,696,534	13,730	34.2%	\$5,910,581,825	25.3%

Source: Lewis County 2024; NYS GIS 2024; University of Wisconsin-Madison 2023, MRLC Consortium 2021; U.S. Census Bureau 2021; RS Means 2024

Table 15-12. Number and RCV of Buildings in the WUI Interface Hazard Area

Jurisdiction	Jurisdiction Total Buildings		Buildings in the WUI Interface Hazard Area			
			Number of Buildings		RCV	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Castorland (V)	237	\$209,754,520	0	0.0%	\$0	0.0%
Constableville (V)	331	\$214,011,340	272	82.2%	\$173,123,805	80.9%
Copenhagen (V)	502	\$470,894,543	8	1.6%	\$4,842,258	1.0%
Croghan (T)	4,564	\$2,716,704,006	815	17.9%	\$738,031,206	27.2%
Croghan (V)	516	\$406,813,941	513	99.4%	\$404,864,361	99.5%
Denmark (T)	2,262	\$1,683,271,436	41	1.8%	\$36,915,853	2.2%
Diana (T)	3,305	\$1,337,032,416	289	8.7%	\$111,652,932	8.4%
Greig (T)	2,962	\$1,160,581,336	71	2.4%	\$42,563,138	3.7%
Harrisburg (T)	863	\$533,636,646	90	10.4%	\$33,511,936	6.3%
Lewis (T)	1,495	\$722,393,059	190	12.7%	\$90,847,140	12.6%
Leyden (T)	1,988	\$1,065,963,460	367	18.5%	\$171,602,851	16.1%
Lowville (T)	1,752	\$1,762,819,749	97	5.5%	\$105,236,043	6.0%
Lowville (V)	2,332	\$1,966,304,011	0	0.0%	\$0	0.0%
Lyons Falls (V)	568	\$376,848,099	219	38.6%	\$167,525,138	44.5%
Lyonsdale (T)	1,614	\$656,114,259	85	5.3%	\$33,657,890	5.1%
Martinsburg (T)	2,180	\$1,847,174,778	669	30.7%	\$547,106,448	29.6%
Montague (T)	616	\$232,283,519	0	0.0%	\$0	0.0%
New Bremen (T)	3,030	\$1,662,197,383	779	25.7%	\$489,276,360	29.4%
Osceola (T)	1,190	\$395,966,698	13	1.1%	\$4,650,152	1.2%
Pinckney (T)	807	\$275,136,312	101	12.5%	\$27,127,541	9.9%
Port Leyden (V)	525	\$266,540,832	185	35.2%	\$112,676,421	42.3%
Turin (T)	1,094	\$881,477,564	246	22.5%	\$194,013,288	22.0%
Turin (V)	249	\$167,575,852	247	99.2%	\$166,862,187	99.6%
Watson (T)	3,311	\$1,308,062,188	184	5.6%	\$71,732,984	5.5%
West Turin (T)	1,869	\$1,005,138,588	270	14.4%	\$155,408,446	15.5%
Lewis County (Total)	40,162	\$23,324,696,534	5,751	14.3%	\$3,883,228,378	16.6%

Source: Lewis County 2024; NYS GIS 2024; University of Wisconsin-Madison 2023, MRLC Consortium 2021; U.S. Census Bureau 2021; RS Means 2024

15.2.3 Community Lifelines and Other Critical Facilities

Wildfires can impact water supplies throughout the County because of residual pollutants like char or debris landing in water resources which can clog wastewater pipes, culverts, etc. Wildfires may also impact transportation routes, blocking residents and commuters from getting in and out of the County during a wildfire event because of char and debris polluting the air making it difficult to drive, or the flames having proximity to the roadways making the route an unsafe passageway. In general, roads and bridges surrounding the areas of fire risk are important because they provide ingress and egress to large areas and, in some cases, to isolated neighborhoods. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. If a wildfire reached the following critical facilities, their vulnerability could complicate response and recovery efforts during and following an event:

- **Hazardous Materials and Fuel Storage**—During a wildfire event, these materials could rupture due to excessive heat and act as fuel for the fire, causing rapid spreading and escalating the fire to unmanageable levels. In addition, they could leak into surrounding areas, saturating soils, and seeping into surface waters, and have a disastrous effect on the environment.
- **Communication Facilities**—If these facilities are damaged and become inoperable, it would exacerbate already difficult communication in the planning area.
- **Fire Stations**—If fire stations were compromised during a wildfire event, it would make fire suppression and support services even more challenging.

Table 15-13 and Table 15-14 summarize the number of community lifelines exposed to the wildfire hazard areas. Of the 184 community lifelines located in the wildfire intermix hazard area, Safety & Security has the majority of facilities (50). Of the 162 community lifelines located in the wildfire interface hazard area, Other Critical Facilities has the majority of facilities (50). Refer to Section 3 for more information about the critical facilities and lifelines in Lewis County.

15.2.4 Natural Resources

Wildfires are a necessary part of ecosystem health, but intense wildfires severely damage the environment, including burning and killing of plant and animal life. Intense fires can also heat narrow and shallow waterways, resulting in damage to aquatic systems.

Surface fuels are defined by fire behavior fuel models. A fuel model contains the parameters required by the surface fire spread model to compute surface fire behavior characteristics, including rate of spread, flame length, fire line intensity, and other fire behavior metrics. As the name might suggest, surface fuels account only for surface fire potential and surface fuels are generally defined to be less than six feet in height off the ground. Surface fuels typically are categorized into one of six primary fuel types based on the primary carrier of the surface fire: 1) Grass, 2) Grass/Shrub, 3) Shrub, 4) Timber/Understory, 5) Timber Litter and 6) Slash. These surface fuel models provide the input parameters needed to compute surface fire behavior.

According to the USGS, post-fire runoff polluted with debris and contaminants can be extremely harmful to terrestrial ecosystems and aquatic life (USGS 2023). Studies show that urban fires in particular are more harmful to the environment compared to forest fires (Harvard University 2022). The age and density of infrastructure within Lewis 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 stormwater, contaminate nearby streams, and impair aquatic life.

Intense wildfire events that destroy existing ecosystems can result in an increase in invasive species that may be able to move into an area with a lack of natural competitors (U.S. Department of the Interior 2012).

15.2.5 Historic and Cultural Resources

Historic and cultural documents and physical artifacts that must be stored in a climate-controlled facility are at risk from wildfires. Additionally, the factors that can spur a wildfire, such as severe storms and high winds, can impact the structural integrity of historically or culturally significant buildings. Many historically or culturally significant structures are made of weakened materials and not up to current building codes, which increases the risk of incurring damage.

Table 15-13. Critical Facilities in the WUI Interface Hazard Area

Jurisdiction	Number of Facilities in WUI Interface Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Castorland (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Constableville (V)	1	0	1	0	0	2	1	0	5	10	62.5%
Copenhagen (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Croghan (T)	0	1	1	4	2	4	4	3	8	27	33.3%
Croghan (V)	1	0	0	0	1	2	3	4	5	16	100.0%
Denmark (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Diana (T)	1	0	0	0	0	1	1	0	3	6	10.9%
Greig (T)	0	0	0	0	0	0	2	0	0	2	5.9%
Harrisburg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Lewis (T)	2	0	0	0	0	0	0	0	2	4	16.7%
Leyden (T)	3	0	0	0	0	0	3	0	0	6	17.1%
Lowville (T)	0	0	0	0	0	0	1	0	1	2	2.3%
Lowville (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Lyons Falls (V)	0	2	0	2	3	3	3	1	4	18	69.2%
Lyonsdale (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Martinsburg (T)	1	0	1	0	2	6	4	3	5	22	13.1%
Montague (T)	0	0	0	0	0	0	0	0	0	0	0.0%
New Bremen (T)	0	5	0	1	1	5	5	1	6	24	63.2%
Osceola (T)	0	0	0	0	0	0	0	0	1	1	4.8%
Pinckney (T)	0	2	0	0	0	0	1	0	0	3	10.7%
Port Leyden (V)	0	0	0	0	1	2	0	0	5	8	32.0%
Turin (T)	0	0	0	0	0	0	1	0	1	2	11.1%
Turin (V)	0	0	0	0	1	4	1	0	4	10	100.0%
Watson (T)	0	0	0	0	0	0	0	0	0	0	0.0%
West Turin (T)	0	0	0	0	0	0	1	0	0	1	3.7%
Lewis County (Total)	9	10	3	7	11	29	31	12	50	162	15.0%

Source: Lewis County 2020, 2024; NYSDEC 2023, 2024; NYS GIS 2024; HIFLD 2024; US Energy Atlas 2024; University of Wisconsin-Madison 2023, MRLC Consortium 2021; U.S. Census Bureau 2020

Table 15-14. Critical Facilities in the WUI Intermix Hazard Area

Jurisdiction	Number of Facilities in WUI Intermix Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Castorland (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Constableville (V)	0	0	1	0	1	1	1	0	0	4	25.0%
Copenhagen (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Croghan (T)	0	4	0	0	0	2	6	0	2	14	17.3%
Croghan (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Denmark (T)	4	2	0	0	0	1	1	0	1	9	11.1%
Diana (T)	7	1	1	1	3	7	8	2	4	34	61.8%
Greig (T)	4	2	0	0	1	6	4	0	4	21	61.8%
Harrisburg (T)	0	0	0	0	0	0	2	0	0	2	1.7%
Lewis (T)	1	0	1	0	1	2	2	0	1	8	33.3%
Leyden (T)	0	1	0	0	0	0	1	2	0	4	11.4%
Lowville (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Lowville (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Lyons Falls (V)	1	0	0	0	0	0	4	1	2	8	30.8%
Lyonsdale (T)	0	2	0	1	0	6	0	1	2	12	33.3%
Martinsburg (T)	0	1	0	0	0	1	1	0	0	3	1.8%
Montague (T)	1	0	0	0	0	1	2	0	0	4	19.0%
New Bremen (T)	0	0	0	1	0	5	1	0	1	8	21.1%
Osceola (T)	1	0	0	1	0	0	2	0	1	5	23.8%
Pinckney (T)	6	0	0	0	0	3	2	1	2	14	50.0%
Port Leyden (V)	0	0	1	0	0	5	0	0	4	10	40.0%
Turin (T)	0	0	0	0	0	4	0	0	0	4	22.2%
Turin (V)	0	0	0	0	0	0	0	0	0	0	0.0%
Watson (T)	0	2	0	0	0	6	2	1	5	16	59.3%
West Turin (T)	0	0	0	0	0	0	4	0	0	4	14.8%
Lewis County (Total)	25	15	4	4	6	50	43	8	29	184	17.0%

Source: Lewis County 2020, 2024; NYSDEC 2023, 2024; NYS GIS 2024; HIFLD 2024; US Energy Atlas 2024; University of Wisconsin-Madison 2023, MRLC Consortium 2021; U.S. Census Bureau 2020

15.3 FUTURE OCCURRENCES AND PROJECTED CHANGES IN RISK

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

15.3.1 Probability of Future Occurrences

It is likely that the State of New York will experience small wildfires throughout the state on a yearly basis (as the State has regularly experienced in the past). However, advanced methods of wildfire management and control and a better understanding of the fire ecosystems should help in reducing the number of devastating fires in the future.

Estimating the approximate number of wildfires to occur in Lewis County is difficult to predict in a probabilistic manner. This is due to several factors impacting the potential for a fire to occur and because some conditions (for example, ongoing land use development patterns, location, fuel sources, and construction sites) exert increasing pressure on the WUI zone. Based on available data, wildfires will continue to present a risk to Lewis County. Given the numerous factors that can impact urban fire and wildfire potential, the likelihood of a fire event starting and sustaining itself should be gauged by professional fire managers on a continuous basis.

Information on previous wildfire occurrences in the County was used to calculate the probability of future occurrence of such events, as summarized in Table 15-15. Based on historical records and input from the Steering Committee, the probability of occurrence for wildfire in the County is considered “rare.”

Table 15-15. Probability of Future Wildfire Events in Lewis County

Hazard Type	Number of Occurrences Between 2020 and 2024	Percent Chance of Occurring in Any Given Year
Wildfire	16	<1%

Source: NYS Forest Ranger Database

15.3.2 Climate Change Projections and Likely Impacts

Climate change associated with warmer temperatures, changes in rainfall, and increased periods of drought may create an atmospheric and fuel environment that is more conducive to large, severe fires (United Nations 2021). Changes in climate patterns may impact the distribution and perseverance of insect outbreaks that create dead trees (increase fuel). When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain and are more likely to expand into residential neighborhoods.

While large-scale wildfires are less common in New York due to its temperate climate and effective forest management practices, the state is not immune. Climate change increases the likelihood of droughts, prolonged fire seasons, and extreme heat, which can exacerbate wildfire risks and cascading impacts. Proactive mitigation strategies, such as forest thinning, controlled burns, and public education, are critical to reducing these risks and their subsequent effects.

According to the Fourth National Climate Assessment, climate change is contributing to longer fire seasons, increased drought frequency, and more extreme heat events, all of which can elevate wildfire risk ¹. Warmer temperatures and reduced soil moisture can dry out vegetation, making it more flammable and increasing the likelihood of ignition and rapid fire spread.

In New York, climate models project:

- Warmer average temperatures, especially in spring and summer
- More frequent and intense heatwaves
- Earlier snowmelt and longer dry periods
- Increased variability in precipitation, including both droughts and heavy rainfall events (NOAA n.d.)

These changes may lead to a longer and earlier wildfire season, particularly in areas with dense vegetation and limited moisture retention. While New York is not expected to experience the same scale of wildfire activity as western states, the frequency and intensity of wildfires are projected to increase modestly (NOAA n.d.).

Climate change will lead to more frequent and intense wildfires in many states. Some studies project that the Northeast's fire season may start earlier and last longer due to warming temperatures. The risk of air quality impacts from wildfire smoke from local and regional wildfire events will increase if the fire season starts earlier and lasts longer (Stevens & Lamie 2024).

The New York State Hazard Mitigation Plan (2023) acknowledges that while wildfires are not currently a top-tier hazard in the state, climate change may shift this risk profile, especially in rural and forested counties like Lewis. Lewis County contains large tracts of deciduous and mixed forest, particularly in the western and eastern parts of the county outside of the more developed central portion of the county. These areas are already identified as having moderate wildfire risk, and climate change could exacerbate this by drying out forest fuels earlier in the season; increasing the number of high fire danger days; and raising the likelihood of human-caused ignitions during recreational use. Although wildfire exposure in Lewis County is currently limited due to low population density in high-risk areas, the potential for smoke-related health impacts, transportation disruptions, and ecological damage may increase under future climate scenarios.

Additionally, warmer winters may reduce snowpack and allow for earlier vegetation growth, which can dry out and become fuel for spring wildfires. The spring burn ban (March 16–May 14) enforced by the New York State Department of Environmental Conservation (NYSDEC) is likely to remain a critical tool in managing this risk.

15.3.3 Projected Changes in Development and Population

As discussed in Chapter 3, areas targeted for future growth and development have been identified across the County. Any changes in development can impact the County's risk to the wildfire hazard of concern, especially new development occurring in WUI areas. Therefore, the County should implement wildfire management strategies in existing building code to protect structures against the residual impacts from wildfire such as heat, debris, and char. Furthermore, development should be built with access to transit routes that will enable easier evacuation during a wildfire event.

The severity of the hazard is greatest in areas of high fuel loading and steep slopes. Areas that are typically considered to be safe from wildfires include highly urbanized, developed areas that are not contiguous with vast areas of wild lands. Areas typically considered to be prone to wildfires include large tracts of wild lands containing heavier fuels with high continuity such as those forested areas in many parts of the study region. Pressure to

develop some forested areas and open land adjacent to forested areas, especially for residential use, will generally result in increases to the wildland-urban interface and the value of improved property within these areas in most jurisdictions, and hence an increased risk of future property damage and public danger due to wildfires.

Lewis County has experienced a slight decrease in population since 2010. According to the U.S. Census Bureau, the County's population decreased by approximately -0.19 percent between 2010 and 2020. Cornell University's Program on Applied Demographics produced populations projections by County from 2016 to 2040. According to these projections, Lewis County is projected to have a population of 26,156 by 2030 and 25,618 by 2040 as the population decrease is expected to continue (Cornell University 2018). Changes in the density of the population can impact the number of persons exposed to wildfires and the draw upon water resources. Fire suppression capabilities are high at the State and local levels. However, new development and changes in population with a mix of additional structures, ornamental vegetation, and wildland fuels will require continued assessment of the hazard and mitigation risk.

15.3.4 Changes in Vulnerability Since 2020 HMP

Wildfire risk and impacts in Lewis County have remained relatively low and stable since 2020, with no major wildfire events or significant increases in risk reported.

16. RISK RANKING

As part of the 2025 Hazard Mitigation Plan (HMP) update, each jurisdiction within Lewis County actively participated in a structured, collaborative process to evaluate and rank the hazards of concern identified by the County and the HMP Steering Committee. This process was designed to ensure that local knowledge, priorities, and vulnerabilities were fully integrated into the County-wide risk assessment.

Each municipality formed a local hazard mitigation planning team composed of municipal officials, emergency responders, public works staff, and other key stakeholders. These teams conducted a comprehensive review of how each identified hazard could impact their community, considering a wide range of factors, including:

- Damage potential to buildings and critical facilities
- Vulnerability of transportation and utility infrastructure
- Disruption to essential services and community assets
- Impacts on local populations, including vulnerable and underserved groups
- Economic consequences and continuity of local government operations
- Geospatial risk assessment outputs developed by GIS specialists using the best available data specific to Lewis County and its municipalities

In addition to reviewing historical data on past hazard events, jurisdictions evaluated the frequency, severity, and consequences of previous occurrences. They also incorporated climate change projections and emerging hazard trends to better understand how risks may evolve over time. Each jurisdiction also conducted a self-assessment of its capabilities to prepare for, respond to, and recover from hazard events. This included evaluating:

- Local emergency response capacity
- Existing planning and regulatory tools
- Public education and outreach programs
- Past and ongoing mitigation investments

Based on this comprehensive analysis, each community assigned a hazard ranking, Low, Medium, or High, to each hazard of concern, reflecting the perceived level of risk specific to their locality. These rankings are documented in *Section X.4.7: Hazard Ranking* of each Jurisdictional Annex (Volume II). Hazards ranked as High are addressed with targeted mitigation actions in accordance with state and federal guidance, detailed in *Section X.8.4: Proposed Hazard Mitigation Actions* of each annex.

In a small number of cases, jurisdictions assigned a Low and Medium ranking to all hazards. These determinations were based on a combination of quantitative GIS-based risk data and local experience. A low ranking does not imply immunity from hazard impacts; rather, it reflects that:

- Past events have had minimal or no significant consequences
- The community perceives a low likelihood of future impacts
- The jurisdiction may be geographically small (e.g., less than one square mile), with limited population and no mapped floodplain
- The community has strong existing capabilities and proactive risk management practices in place

Importantly, the participation of all jurisdictions, regardless of their size or perceived risk, adds critical value to the planning process. Their insights ensure that the County's HMP reflects a comprehensive and inclusive understanding of risk, capacity, and vulnerability across all jurisdictions in Lewis County, New York.

Table 16-1. Hazard Risk Ranking for all Jurisdictions

Municipality	Ag. Product Spill	Dam Failure	Drought	Earthquake	Extreme Temps	Flood	Hazardous Materials	Landslide	Severe Storms	Severe Winter Storm	Wildfire
Lewis County	L	M	M	L	L	H	L	L	H	H	M
Castorland (V)	L	L	L	L	L	L	L	L	L	M	L
Constableville (V)	L	M	L	L	M	H	L	L	M	H	L
Copenhagen (V)	H	L	H	M	H	M	H	L	H	H	M
Croghan (T)	M	L	M	M	M	M	M	L	H	H	L
Croghan (V)	H	H	M	H	H	L	M	L	H	H	H
Denmark (T)	H	L	M	M	H	M	M	L	M	M	M
Diana (T)	L	H	L	L	L	H	L	L	H	H	M
Greig (T)	L	M	L	L	L	M	L	L	M	M	L
Harrisburg (T)	M	L	M	L	L	M	M	L	H	H	H
Lewis (T)	L	L	M	L	M	M	M	L	H	H	L
Leyden (T)	H	M	M	L	M	H	M	L	H	H	M
Lowville (T)	M	M	M	M	M	H	M	L	H	H	L
Lowville (V)	L	L	M	L	L	H	M	L	H	H	L
Lyons Falls (V)	L	L	L	L	M	M	L	L	H	H	L
Lyonsdale (T)	H	M	M	H	H	M	M	L	H	H	H
Martinsburg (T)	H	H	M	L	L	M	M	L	H	H	L
Montague (T)	L	L	M	L	L	L	L	L	H	H	M
New Bremen (T)	L	H	L	L	L	H	L	L	H	H	L
Osceola (T)	L	L	M	M	H	M	M	L	H	H	H
Pinckney (T)	M	M	M	M	M	L	M	L	H	H	M
Port Leyden (V)	L	H	L	L	M	H	L	M	H	H	L
Turin (T)	L	L	M	L	L	L	L	L	L	L	L
Turin (V)	H	L	M	L	H	M	M	L	H	H	H
Watson (T)	H	H	L	L	L	M	L	L	H	H	L
West Turin (T)	M	L	M	L	M	M	M	L	M	H	L

PART 3: CAPABILITY ASSESSMENT

17. CAPABILITY ASSESSMENT

A capability assessment is an inventory of a community's missions, programs, and policies and an analysis of its capacity to carry them out (FEMA 2003). This assessment is an integral part of the planning process. It enables identification, review, and analysis of current local and state programs, policies, regulations, funding, and practices that could either facilitate or hinder mitigation. Through assessing its capabilities, a jurisdiction learns how or whether it can 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 that are infeasible because they are outside the scope of current capabilities
- Types of mitigation actions that may be technically, legally, administratively, politically, or fiscally challenging or infeasible
- Opportunities to enhance local capabilities to support long-term mitigation and risk reduction

This chapter presents a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, local) that reduce hazard risks and support hazard mitigation within the planning area. These capabilities are presented in three categories:

- Planning and regulatory capabilities
- Administrative and technical capabilities
- Fiscal capabilities

Each Planning Partner's annex in Volume II also includes a capability assessment specific to those jurisdictions. In addition to the above categories, the annexes review capabilities in the more localized categories of adaptive capacity and education and outreach.

17.1 CAPABILITY ASSESSMENT PROCESS

Jurisdiction specific capabilities are assessed in each jurisdictional annex in Volume II. All participating jurisdictions were tasked with developing or updating their capability assessment for this update, evaluating the effectiveness of their capabilities in supporting hazard mitigation and identifying opportunities to enhance local capabilities. Each jurisdiction identified how it has integrated hazard mitigation into its existing planning, regulatory, and operational/administrative framework and how it intends to promote ongoing integration.

The contracted consultant met with Lewis County and each jurisdiction virtually to review the capability assessment from the 2020 HMP and update accordingly. The consultant also reviewed plans, codes, and ordinances to enhance the information provided by the jurisdictions.

17.2 PLANNING AND REGULATORY CAPABILITIES

Planning and regulatory capabilities are based on ordinances, policies, local laws, state statutes, plans, and programs that relate to managing growth and development. Planning and regulatory capabilities refer not only to current plans and regulations, but also to the jurisdiction's ability to change and improve those plans and

regulations as needed. This section summarizes planning and regulatory capabilities for Lewis County. Further information is provided in the jurisdictional annexes in Volume II.

17.2.1 Federal

Biggert Waters National Flood Insurance Reform Act of 2012

Under the Biggert-Waters National Flood Insurance Reform Act of 2012, long-term changes to the National Flood Insurance Program have been adopted that have increased rates overall to reflect the flood risk more accurately to buildings in flood hazard areas. This has significantly influenced construction and reconstruction within flood hazard areas.

Property owners are encouraged to consider long-term insurance costs when undertaking reconstruction or elevation of damaged buildings. An investment to reconstruct the lowest floor of a building an additional foot or two higher today may translate into significant future flood insurance savings.

Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004

The Flood Insurance Reform Act of 2004 amended the 1994 National Flood Insurance Reform Act of 1968 to reduce losses to properties for which repetitive flood insurance claim payments have been made. This Act established a program for mitigation of severe repetitive loss properties and gave FEMA the authority to fund mitigation activities for individual repetitive loss claims properties. The Act provides additional coverage for compliance with land-use and control measures.

The New York State Department of Environmental Conservation (NYSDEC) is the lead coordinator of New York's NFIP efforts. NYSDEC is the agency working with New York communities with severe repetitive loss properties. This Statute helps New York residents with affordable flood insurance and gives additional tools to the states and communities to mitigate severe repetitive loss properties.

Community Risk and Resiliency Act

On September 22, 2015, Governor Andrew Cuomo signed bill A06558/S06617-B, the Community Risk and Resiliency Act (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 (NYSDEC 2020):

- Official Sea-Level Rise Projections—CRRA requires the NYSDEC 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 NYSDEC 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 NYSDEC, 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 NYSDEC, to develop model local laws that include consideration of future risk due to sea-level rise, storm surge and/or flooding. These model local laws must be based on available data predicting the likelihood of extreme weather events, including hazard risk analysis.

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, NYSDEC 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).

Code of Federal Regulations, Standard State Mitigation Plans (44 CFR PART 201.4)

FEMA has prepared policies and procedures for FEMA's review and approval of state and local emergency all-hazard mitigation plans.

The New York State HMP provides actions based on risk assessments and capabilities of the State to achieve and fund mitigation activities based on those actions. Both the law and regulations have encouraged the counties to prepare plans.

Disaster Mitigation Act of 2000

The Disaster Mitigation Act (DMA) is the current federal legislation addressing hazard mitigation planning. 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 (the Act) by repealing the previous mitigation planning provisions (Section 409) and replacing them with a new set of mitigation plan requirements (Section 322). This new section emphasizes the need for state, tribal, and local entities to closely coordinate mitigation planning and implementation efforts. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Assistance grant funds are available to communities. HMPs designed to meet the requirements of DMA will remain eligible for future FEMA Hazard Mitigation Assistance funds. This plan is designed to meet the requirements of DMA, improving eligibility for future hazard mitigation funds.

The New York State Division of Homeland Security and Emergency Services (NYSDHSES) is the lead agency within New York to promote mitigation planning. The law sets forth a more granular review of mitigation planning. Once approved, the applicant is eligible to apply for federal funds for mitigation of hazards. The rules provide detailed guidance on what applicants should include in a plan.

Disaster Recovery Reform Act

This bill amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) to modify the Pre-Disaster Hazard Mitigation Grant Program to permit the use of technical and financial assistance to establish and carry out enforcement activities to implement codes, specifications, and standards that incorporate the latest

hazard-resistant designs; direct the President to establish a National Public Infrastructure Pre-Disaster Mitigation Fund; authorize the President's contribution to the cost of hazard mitigation measures to be used to increase resilience in any area affected by a major disaster; and direct FEMA to issue a final rulemaking that defines the terms "resilient" and "resiliency".

From a mitigation perspective of the Act, the NYSDHSES is the lead agency that reviews, submits, and administers federal funding to programs that mitigate hazards. These programs help find projects that are cost beneficial to help reduce damages from hazards.

Emergency Support Function #14, Long-Term Recovery Planning

Long-Term Community Recovery provides a mechanism for coordinating federal support to state, tribal, regional, and local governments, nongovernmental organizations (NGOs), and the private sector to enable community recovery from the long-term consequences of extraordinary disasters. Emergency Support Function (ESF) #14 accomplishes this by identifying and facilitating availability.

ESF #14 may be activated for incidents that require a coordinated federal response to address significant long-term impacts (e.g., impacts on housing, government operations, agriculture, businesses, employment, community infrastructure, the environment, human health, and social services) to foster sustainable recovery (FEMA 2008).

Actions coordinated under ESF #14 include pre-incident planning and coordination, immediately prior to the incident, post-event planning, and operations (FEMA 2008).

Through ESF 14, Long-Term Recovery Planning, NYSDHSES works to have a plan for long-term planning and recovery prior to a disaster or emergency. One of the areas of planning includes mitigation. This coordination allows for another statewide plan to incorporate mitigation principles and planning.

Homeowner's Flood Insurance Affordability Act

This 2014 law repeals and modifies certain provisions of the Biggert-Waters Flood Insurance Reform Act, which was enacted in 2012, and makes additional program changes to other aspects of the program not covered by that Act. The new law lowers the recent rate increases on some policies, prevents some future rate increases, and implements a surcharge on all policyholders. The Act also repeals certain rate increases that have already gone into effect and provides for refunds to those policyholders. The Act also authorizes additional resources for the National Academy of Sciences (NAS) to complete the affordability study.

FEMA, Congress, private insurance companies, and other stakeholders work together to implement these Congressionally mandated reforms and to work toward shared goals of helping families maintain affordable flood insurance, ensuring the financial stability of the NFIP, and reducing the risks and consequences of flooding nationwide.

National Flood Insurance Program

The U.S. Congress established the National Flood Insurance Program (NFIP) with the passage of the National Flood Insurance Act of 1968 (FEMA's 2002 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. The flood hazard profile in Chapter 10 provides further information on the NFIP as implemented in Lewis County.

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 percent less damage annually than those not built in compliance (FEMA 2007).

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 percent less damage annually than those not built in compliance (FEMA 2008).

Municipal compliance with the NFIP is described in each of the jurisdictional annex in Volume II (Jurisdictional Annexes). The participating 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. Additional information on the NFIP program and its implementation throughout the County may be found in the flood hazard profile (Chapter 10, Flood).

The state and municipalities within it may adopt higher regulatory standards when implementing the provisions of the NFIP. Specifically identified are the following:

- **Base Flood Elevation (BFE):** The elevation of surface water due to flooding that has a 1 percent chance of being equaled or exceeded in any given year.
- **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 2 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 historical flood records or a hydraulic study, that elevation must be used. If the development consists of more than 5 acres or more than 50 lots, the permit applicant must develop a base flood elevation and build accordingly (NYSDEC 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 percent 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

As an additional component of the NFIP, the Community Rating System (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 June 2025, none of the communities within Lewis County participate in the CRS program. Lewis County is exploring the program requirements of the Community Rating System (CRS) through technical expertise and will provide assistance to guide interested municipalities through the application process.

Presidential Policy Directive 8

Presidential Policy Directive 8 (PPD-8) requires that a Threat Hazard Identification and Risk Assessment (THIRA) be developed for a state to remain eligible for Homeland Security Grant Program (HSGP) and Emergency Management Program Grant (EMPG) funding. The NYSDHSES is the lead agency in preparing the State's THIRA.

Risk Mapping, Assessment, and Planning

FEMA works with federal, state, tribal, and local partners across the nation to identify flood risk and promote informed planning and development practices to help reduce that risk through the Risk Mapping, Assessment, and Planning (Risk MAP) program. Risk MAP provides high-quality flood maps and information, tools to better assess the risk from flooding, and planning and outreach support to communities to help them take action to reduce (or mitigate) flood risk. Each Risk MAP flood risk project is tailored to the needs of each community and may involve different products and services.

According to the Risk MAP Progress interactive map available online at the time of this plan update, there are numerous active Risk MAP projects taking place throughout New York (FEMA 1997). FEMA coordinates and works directly with municipal floodplain managers during the Risk MAP project process. The State NFIP Coordinator is kept apprised of project activities and consults as needed.

Risk Rating 2.0: Equity in Action

FEMA introduced Risk Rating 2.0: Equity in Action to consider specific characteristics of a building to provide a more modern, individualized, and equitable flood insurance rates. The new rating methodology considers frequency of flooding, multiple flood types, proximity to flood sources, and building characteristics such as first floor heights and costs to rebuilt. Homeowners that elect to drop NFIP insurance policies will no longer have access to Flood Mitigation Assistance (FMA) funding for future mitigation efforts.

Across the country, officials are finding it to be increasingly difficult to communicate the benefits of mitigation to some property owners where insurance rates are likely to stay high even after mitigation due to factors such as proximity to flood sources and frequency of flooding. Continued shifts in flood insurance costs, coverage, impacts to mitigation of flood prone properties, and potential updates to Risk Rating 2.0 will be monitored by Lewis County throughout the period of performance of the 2025 HMP.

Robert T. Stafford Disaster Relief and Emergency Assistance Act

The Act provides an orderly and continuing means of assistance by the federal government to state and local governments in carrying out their responsibilities to alleviate the suffering and damage that results from disasters. The provisions of the Act include (1) revising and broadening the scope of existing disaster relief programs; (2) encouraging the development of comprehensive disaster preparedness and assistance plans, programs, capabilities, and organizations by state and local governments; (3) achieving greater coordination and responsiveness of disaster preparedness and relief programs; (4) encouraging individuals, and state and local governments to protect themselves by obtaining insurance coverage to supplement or replace governmental assistance; (5) encouraging hazard mitigation measures to reduce losses from disasters, including development of land-use and construction regulations; and (6) providing federal assistance programs for both public and private losses sustained in disasters.

From a mitigation perspective of the Act, the NYSDHSES is the lead agency that reviews, submits, and administers federal funding to programs that mitigate hazards. These programs help find projects that are cost beneficial to help reduce damages from hazards.

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 59 nationwide permits, and they authorize a wide variety of activities, including linear transportation projects, bank stabilization activities, residential development, commercial and industrial developments, aids to navigation and certain maintenance activities (USDA 2017).

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 (USACE Buffalo District n.d.).

17.2.2 State

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.

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.

New York Power Authority

The New York Power Authority (NYPA) is America’s largest state power organization, with 16 generating facilities and more than 1,400 circuit-miles of transmission lines. State and federal regulations shape NYPA’s diverse customer base, which includes large and small businesses, not-for-profit organizations, community-owned electric systems, rural electric cooperatives, and government entities. NYPA provides the lowest-cost electricity in New York State and is the only statewide electricity supplier.

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 2023).

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 General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems. The permit requires development of a Stormwater Management Program (SWMP) (NYSDEC 2023).

17.2.3 County

Lewis County Agriculture Enhancement Plan, 2021

The foundation of this Plan is from input received from farmers and farmland owners, agri-businesses, farm support agencies, and organizations, and from young people who hope to be the next generation of farmers which was critical to ensure that this plan addresses needs specific to Lewis County including information about current agricultural conditions, a vision for the future, and a detailed set of strategies to be implemented over the next decade. In support of that, the plan also includes maps, information about agriculture (including economic characteristics, and farm and farmland activities and resources), analysis of farmland conversion pressure, and projections of weather changes that may impact farming (Lewis County 2021).

Lewis County Housing Needs Assessment, 2022

The Lewis County Housing Needs Assessment includes a baseline housing initiatives report, which reviews Lewis County’s existing documentation, plans, studies, and efforts related to housing, demographic and economic data

relevant to population, households, housing and employment in Lewis County. The assessment also includes a current housing inventory that provides metrics on housing conditions, type, availability, and overall trends; a market analysis that studies residential real estate trends for all housing types; and strategies to implement recommended approaches to address housing needs. The purpose of the assessment is to understand and quantify the housing challenges facing the County and to develop or address strategies and recommendations to alleviate these challenges (Lewis County Housing Strategy 2022).

Lewis County Design Guidelines, 2024

The purpose of the Lewis County Downtown Design Guidelines is to provide guidance on how to best preserve the community's character, illustrate some of the current downtown regulations, and provide examples of best practices that can meet the needs of various state grant programs and historic preservation tax credits. Throughout the document are diagrams and summaries of the town's existing signage laws, as well as zoning references to help guide developers and current residents towards projects that respect and leverage the authentic character of the downtown (Lewis County Downtown Design Guide 2024).

Comprehensive Plan, 2009

The Comprehensive Plan provides a necessary level of continuity and consistency to assist county officials and staff in working towards common objectives on topics such as tourism, recreation, economic development, infrastructure and regional coordination, among others. At the county level, future decisions and investments are considered in conjunction with the Comprehensive Plan, as it is the adopted policy of Lewis County. Furthermore, by state law, all plans for capital projects at the local, county, and state level take the contents of this Plan into consideration prior to action or implementation. The second functional level of the plan is guidance and recommendations on issues common to all communities. Plan policies provide recommendations on opportunities for county municipalities to work together in leveraging resources, learning from each other, and solving problems collectively. The plan uncovers opportunities seldom discussed at the individual town or village level for intermunicipal cooperation or the leveraging of common resources. Grant funded has been secured, and an update will commence in 2025 (Lewis County Planning 2009).

Continuity of Operations Plan, 2024

The Continuity of Operations Plan aims to ensure that essential services can be sustained during and following an emergency or disaster event. The plan includes plans and procedures that delineate essential functions, document lines of succession, ensure safekeeping of vital records, identify alternative operating facilities and ensures strength of capabilities through tests, trainings and exercises.

Lewis County Emergency Preparedness Assessment, 2021

Lewis County participates in the NY State County Emergency Preparedness Assessment (CEPA) when called upon, which supports the State THIRA. This assessment is administered by Fire & Emergency Management and NY State Office of Emergency Management. The CEPA is managed and facilitated by NY State OEM, with stakeholders from all applicable local, county, and community partners. The intent of the CEPA is to inform the State on their Statewide THIRA. Identified hazards and the applicable preparedness, mitigation, response, and recovery capabilities are evaluated and rated, with improvement metrics identified. One key component of a CEPA is in-person or virtual meetings between State and local subject matter experts (SMEs) to discuss and analyze a county's risk and capabilities using a standardized methodology. Potential response limitations and funding gaps, as well as resource needs, are also discussed. Information documented during the CEPA enables the State to better understand county-level capabilities and potential gaps in preparedness and allows DHSES to

develop or modify existing programs and initiatives and support the agency's mission to protect, prepare for, respond to, and recover from disasters.

Lewis County Comprehensive Emergency Management Plan, 2019

The County Comprehensive Emergency Management Plan results from the recognition on the part of local government and state officials that a comprehensive plan is needed to enhance the County's ability to manage emergency/disaster situations. It was prepared by County officials working as a team in a planning process recommended by the New York State Emergency Management Office. The plan constitutes an integral part of a statewide emergency management program and contributes to its effectiveness. Authority to undertake this effort is provided by both Article 2-B of State Executive Law and New York State Defense Emergency Act (Comprehensive Emergency Management Plan 2019).

The development of the plan included an analysis of potential hazards that could affect the county and an assessment of the capabilities existing in the county to deal with potential hazards. County departments' and agencies' emergency management responsibilities are outlined in this plan. Assignments are made within the framework of the present County capability and existing organizational responsibilities. The Lewis County Emergency Management Office is designated to coordinate all emergency management activities of the County (Comprehensive Emergency Management Plan 2019).

Lewis County Debris Management Plan, 2015

The purpose of the Debris Management Plan is to provide for coordination of efforts in the clean-up, removal, and disposal of debris following a major emergency or disaster in Lewis County. The plan serves as the master plan for the county and contains guidance regarding organization, responsibilities, documentation, contracting, activation of the county plan, temporary debris storage sites, informational fact sheets, and samples of agreements and contracts. The plan also contains guidance to local jurisdictions for development of local plans that will identify the local jurisdiction's debris management organization, assignment of duties, designation of temporary debris storage sites and other items as the jurisdictions desire (Lewis County Debris Management Plan 2015).

Naturally Lewis Strategic Plan, 2021-2023

The Naturally Lewis Strategic Plan's purpose is to focus on creating a solid and sustainable economic base by supporting practical, realistic programs and policies that advance businesses through diversification and by expanding markets locally, nationally and internationally. The plan focuses on developing partnerships, developing policies, research and education, outreach and visibility, and strategic funding development and spending. Site developments, manufacturing expansions, encouraging entrepreneurship, leveraging recreation and agriculture, and market living, working and building in Lewis County are the major opportunities that the County wants to encourage (Lewis County IDA n.d.).

Black River Nine Element Watershed Management Plan, 2016

The Black River Watershed attracted early use and industrialization due to its abundant natural and recreational resources and as development and industrialization increased through the 1900's, the water quality and natural resources of the watershed became increasingly degraded. In 2010, a Black River Watershed Management Plan was developed to document guidelines to continue efforts to restore and remediate past activities, protect resources, restore degraded habitats, enhance water quality and natural resources to ensure potable water. The 2016 update makes the plan consistent with the requirements to be approved by NYSDEC as a nine-element

watershed plan by incorporating the nine key elements identified by the EPA. An update to this plan is currently in progress. Future updates could better integrate specific hazard mitigation actions (NYSDEC 2016).

Mohawk River Watershed Plan, 2015

The Mohawk River Watershed Management Plan, developed through a collaborative effort, recommends actions that communities can take to restore and preserve the watershed. The Plan has been developed as a living document, one that will change as current issues are resolved and new issues are encountered. The Plan serves as a guide to effective actions to protect and restore the quality of the watershed and enhance quality of life for its residents. The Plan is designed to serve as a roadmap for protecting the vital natural resources the watershed provides while balancing the need for economic growth and development among the watershed's communities. Preparation of the Mohawk River Watershed Management Plan follows the approach jointly developed by the NYS Department of State and NYS Department of Environmental Conservation and described in the guidebook Watershed Plans: Protecting and Restoring Water Quality (Mohawk River Watershed Coalition 2015).

Human Services Coordinated Transportation Plan, 2021

The Transportation Plan provides a documentation of past and current efforts toward the creation of a public transit-human service transportation coordinated plan, and to provide the outline for future efforts to improve community mobility and quality of life for the residents of Lewis County. The plan also considers persons with disabilities, senior citizens and low-income individuals. The plan was prepared in accordance with the regulations of the Federal Transportation, Safe, Accountable, Flexible, Efficient Transportation Equity Act - Legacy for Users (SAFETEA-LU) mandate (Lewis County Planning and Community Development Department 2021).

Lewis County Health System COVID-19 Response Plan and Policy

This plan will be used as a road map for future emergencies, such as infection outbreaks, seasonal influenza vaccine shortages, and other natural disasters. The Lewis County Health System (LCHS) COVID-19 Response Annex to the Infectious Disease Outbreak Response Plan provides incident-specific guidance to enable LCHS to prepare for, and respond to, a COVID-19 outbreak. The guidelines are consistent with activities described in the New York State Department of Health (NYSDOH) and Center for Disease Control (CDC) guidelines.

Lewis County Public Health Emergency Preparedness Program

Lewis County Public Health has an all-hazard plan in place and conducts exercises periodically to ensure we are prepared, as a community, to respond quickly and effectively to threats endangering the health of the citizens of Lewis County. Lewis County Public Health has the ability to set up Point of Distribution Sites also known as "PODS" in order to distribute countermeasures to disease and illness outbreaks.

17.2.4 Local

Comprehensive Master Plans

Comprehensive planning is a process for achieving community goals and aspirations through community development. The outcome of comprehensive planning is a comprehensive plan, general plan, or master plan that directs 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.

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. State law provides 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 of New York. 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).

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 Volume II. 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.

Section 239 of New York State General Municipal Law requires the referral of certain local planning actions to the Lewis County Planning Board for the examination of possible intermunicipal impacts. The Lewis 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 Lewis County Comprehensive Plan to direct recommendations on municipal land use referrals and to review proposed County capital improvement projects.

17.3 ADMINISTRATIVE AND TECHNICAL CAPABILITIES

This section summarizes administrative and technical capabilities in Lewis County. Further information is provided in the jurisdictional annexes in Volume II.

17.3.1 Federal

Federal Emergency Management Agency

FEMA is responsible for providing assistance before, during, and after disasters. FEMA is the federal reviewer of hazard mitigation plans and sets federal standards for local and state hazard mitigation plans.

Community Assistance Visits and Community Assistance Contacts

FEMA evaluates NFIP minimum compliance through compliance audits known as Community Assistance Visits (CAVs) or Community Assistance Contacts (CACs). CAVs and CACs are performed to ascertain community compliance with the NFIP, at entry into the CRS, and to maintain participation in the CRS. FEMA may conduct these with Region 2 staff, with NYSDEC staff under the Compliance Assistance Program–State Support Services Element (CAP-SSSE) grant, or with private contractors. While there is some flexibility in how a CAV or a CAC is conducted, CAVs are generally more rigorous than CACs.

FEMA evaluates the following key areas in a compliance audit:

- The Community's Flood Damage Prevention Ordinance
- Mapping Products and other Ordinances used to regulate floodplain development
- Floodplain Development Permitting Procedures
- Floodplain Permit Applications and other Forms/Records, including Substantial Damage and Improvement Determinations
- Floodplain Development Review and Performance Standards
- Floodplain Development Permits Issued to Applicants

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) has the largest dam safety program in the United States, cooperating with many federal and state agencies to ensure and promote dam safety and, more recently, homeland security, on dams associated with hydropower. Every five years, an independent consulting engineer, approved by the FERC, must inspect and evaluate projects with dams higher than 32.8 feet (10 meters) or with a total storage capacity of more than 2,000 acre-feet.

HURREVAC

HURREVAC is the decision support tool of the National Hurricane Program, administered by FEMA, the United States Army Corps of Engineers (USACE), and the National Atmospheric and Oceanic Administration (NOAA) National Hurricane Center used for tracking hurricanes (HURREVAC n.d.). HURREVAC permits governmental agencies to work as a unified team, coordinate notification, communication, activations, public warning, and evacuation and sheltering efforts. By operating together, the government agencies serve the public better by providing the same advisories and actions.

National Weather Service (NWS)

The NWS monitors weather and delivers weather forecasting for New York. The state is serviced by five weather forecast offices (WFO)—Albany (NY), Binghamton (NY), Buffalo (NY), Burlington (VT), and New York (NY). Allegany, Cattaraugus, Cayuga, Chautauqua, Erie, Genesee, Jefferson, Lewis, Livingston, Monroe, Niagara,

Chautauqua, Orleans, Oswego, St. Lawrence, Wayne, Wyoming, and Yates County are covered by the Buffalo WFO. NYSDHSES uses conference calling with the NWS and county OEMs to share specific information and needs when severe storms are forecasted. The NWS also offers various education and training programs on weather-related hazards (FEMA 2024).

StormReady Program

The NWS operates the StormReady program, which encourages communities to take a new, proactive approach to improving local hazardous weather operations by providing emergency managers with clear-cut guidelines on how to improve their hazardous weather operations. To be recognized by the program, a community must establish a 24-hour warning point and emergency operations center; have more than one way to receive severe weather warnings and forecasts and to alert the public; create a system that monitors weather conditions locally; promote the importance of public readiness through community seminars; and develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) works to strengthen the nation's security by building and maintaining America's infrastructure and providing military facilities where servicemembers train, work, and live. Projects include dredging, storm damage reduction, and ecosystem restoration in and near waterways (USACE n.d.). New York is serviced by the Buffalo, Pittsburgh, and New York districts, with Lewis County represented by the Buffalo District. USACE has numerous initiatives to support hazard mitigation measures, including the Silver Jackets, planning assistance, and inspections and repair of flood control structures. USACE also maintains the National Inventory of Dams and the National Levee Database.

Silver Jackets

Silver Jackets, developed by USACE, is the state-level implementation program for the National Flood Risk Management Program. The program's goals are to leverage information and resources from federal, state, and local agencies to improve flood risk management; improve public risk communication through a united effort; and create a mechanism to collaboratively solve issues and implement initiatives beneficial to local communities.

Climate Preparedness and Resilience Community of Practice

The Practice develops and implements practical, nationally consistent, and cost-effective approaches and policies to reduce potential vulnerabilities to the nation's water infrastructure resulting from climate change and variability (USACE n.d.).

Planning Assistance to States Program

Section 22 of the 1974 Water Resources Development Act provides authority for the USACE to assist states, local governments, Native American Tribes, and other non-federal entities in the preparation of comprehensive plans for the development and conservation of water and related land resources. Types of work that can be done include Water Quality Studies, Wetland Evaluation Studies, Flood Plain Management Studies, Coastal Zone Management/Protection Studies, Harbor/Port Studies, or other water resource planning investigations. The individual non-federal sponsors determine the needed planning assistance (USACE n.d.).

Flood Plain Management Services Program

Section 206 of the 1960 Flood Control Act (PL 86-645), as amended, provides the authority for the USACE to provide assistance and guidance on all aspects of floodplain management planning. The program develops or interprets site-specific data on obstructions to flood flows, flood formation, and timing and the extent, duration, and frequency of flooding. Upon request, program services are provided to the state, regional, and local governments, Native American Tribes, and other non-federal public agencies without charge (USACE n.d.).

Inspection of Completed Works Program

Civil works structures whose failure, or partial failure, could jeopardize the operational integrity of the project, endanger the lives and safety of the public, or cause substantial property damage, are periodically inspected, and evaluated to ensure their structural stability, safety, and operational adequacy. For those structures constructed by the USACE and turned over to others for operation and maintenance, the operating entity is responsible for periodic inspection and evaluation. The USACE may conduct the inspection on behalf of the project sponsor provided appropriate reimbursement to the USACE is made. However, the USACE may participate in the inspection with the operating entity at the government's expense.

Rehabilitation and Inspection Program

The Rehabilitation and Inspection Program is a USACE program that provides for inspection of flood control projects, the rehabilitation of damaged flood control projects, and the rehabilitation of federally authorized and constructed hurricane or shore protection projects.

Dam Safety Program

The USACE is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams and has surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams. USACE has also developed guidelines for inspection and evaluation of dam safety.

U.S. Geological Survey

U.S. Geological Survey (USGS) maintains a network of gauges across New York that continuously measure lake, reservoir table, stream, and tidal levels. These data sets are transmitted to the USGS and made available over the Internet. As project needs and funding levels change, gauges may be added or deactivated, and deactivated gauges may be reactivated (USGS 2023). USGS provides data to the Department of Environmental Protection for drought determinations. USGS also recovers high water marks post-coastal flooding (USGS 2018).

17.3.2 State

New York State Division of Homeland Security and Emergency Services

For more than 50 years, NYSDHSES (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, economic well-being, and the environment from natural and human-caused disasters and emergencies. NYSDHSES 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.

NYSDHSES 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. NYSDHSES prepared the current state HMP working with input from other State agencies, authorities, and organizations. It was approved by FEMA in 2023, 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 2023 New York State HMP was used as guidance in completing the Lewis County HMP Update (NYSDEC n.d.).

For the purpose of this HMP, representatives from NYSDHSES provided technical assistance and data and attended planning partnership meetings.

New York State Department of Environmental Conservation Region 6

NYSDEC Region 6 is located in northern New York and includes Herkimer, Jefferson, Lewis, Oneida and St. Lawrence counties. The main Department of Environmental Conservation Region 6 office is located in Watertown with sub-offices in Utica, Lowville, Herkimer, and Potsdam. 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 2023).

New York State Department of Environmental Conservation Division of Water—Bureau of Dam Safety, Coastal & Flood Protection

Within the NYSDEC Division of Water, the Bureau of Flood Protection and Dam Safety cooperates with federal, state, regional, and local partners to protect lives and property from floods, coastal erosion and dam failures through floodplain management and both structural and nonstructural means; and provides support for information technology needs in the division (NYSDEC 2023). The bureau consists of the following sections (NYSDEC 2023):

- **Coastal Erosion and Flooding:** 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 Protection and Floodplain Management:** Works with communities throughout the state in finding ways to reduce or protect against physical and property damage caused by flooding.

The NYSDEC's Mission is "To conserve, improve and protect New York's natural resources and environment and to prevent, abate and control water, land and air pollution, in order to enhance the health, safety and welfare of the people of the state and their overall economic and social well-being."

NYSDEC's goal is to achieve this mission through the simultaneous pursuit of environmental quality, public health, economic prosperity, and social well-being, including environmental justice and the empowerment of individuals to participate in environmental decisions that affect their lives (NOAA n.d.).

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 output and create extreme precipitation projections for New York State. These projections will ultimately be incorporated into climate change adaptation planning. NRCC develops products for use by municipal officials, researchers, planners, highway departments, and other decision-makers who need to take future storm events into account (NRCC 2014).

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 n.d.). This tool can be used by municipalities to assist them in the design and feasibility assessment of future projects and allow them to see the future intensity and frequency of rain events (NRCC 2022).

Department of State's Division of Building Standards and Codes

The New York State Department of State's Division of Building Standards and Codes provides a variety of services related to the development, administration, and enforcement of the Uniform Fire Prevention and Building Code (Uniform Code) and Energy Conservation Construction Code (Energy Code). These codes provide for the construction of safe, resilient, and energy-efficient buildings throughout New York State.

The statutory responsibility for developing and maintaining the Uniform Code and the Energy Code is vested in the State Fire Prevention and Building Code Council (Code Council). If the Code Council decides to amend either code, it commences a process for rulemaking set forth in the State Administrative Procedure Act. The Code Development Unit administers statutory functions and evaluates proposed changes to the codes.

Executive Law §379 authorizes the legislative body of a local government to enact or adopt local laws and ordinances that impose standards for construction that are more restrictive than the corresponding standards imposed by the Uniform Code. Energy Law §11-109 allows counties, cities, towns, villages, school districts, or district corporations to promulgate local energy conservation construction codes that are more stringent than the state Energy Code. The Code Council is empowered to approve these more restrictive standards and codes when they comply with Executive Law §379 and Energy Law §11-109. The Code Development Unit assists with reviewing the technical aspects of these local laws and ordinances and reporting its findings to the Code Council.

The Division of Building Standards and Codes' Code Enforcement Disaster Assistance Response (CEDAR) Program provides requesting communities with post-disaster assistance under the leadership of the DHSES Office of Emergency Management and in accordance with Executive Law 2-B. The program's initial disaster response focuses on performing rapid evaluation safety assessments of damaged structures in affected communities for use as part of the application process to request federal disaster assistance through FEMA. The CEDAR program's long-term disaster response provides a unified method for communities to access the range of resources available within and beyond the Department of State.

New York State Department of Transportation

It is the mission of the New York State Department of Transportation (NYSDOT) to provide a safe, reliable, equitable, and resilient transportation system that connects communities, enhances quality of life, and supports the economic well-being of New York State. Lewis County is served by the North Country, Region 7 NYSDOT office, which is based out of Watertown, NY.

NYSDOT offers a variety of grant, education, and training opportunities; has several environmental initiatives and programs; issues permits for traffic signals, driveways, advertisements, and other permitting needs; provides statistical roadway information; and provides information on community resources, such as scenic highways and fishing access sites.

New York State Office of Planning, Development and Community Infrastructure

The New York State Office of Planning, Development and Community Infrastructure works with communities to increase their resilience to climate change impacts, particularly coastal flooding. The Office employs key resilience principles that help communities understand their vulnerabilities, advance resilience measures that reduce risk, including using natural infrastructure and natural processes, and avoid investments that are not highly adapted to a changing climate.

Resilient NY

In November 2018, New York State launched the Resilient NY program. The overall goal of the program is to improve community resiliency to extreme weather events that result in flooding and ice jam formations.

NYSDEC and NYS OGS retained two consulting firms to prepare the Resilient NY studies. The consultants will work with NYSDEC experts, municipalities, and interested stakeholders to collect relevant information about flooding and ice jam formations in each priority watershed and use this information to develop specific mitigation projects and actions.

New York State Department of Environmental Conservation Division of Water—Bureau of Flood Protection and Dam Safety

Within the NYSDEC Division of Water, the Bureau of Flood Protection and Dam Safety 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 (NYS DHSES 2014). The bureau consists of the following sections (NYSERDA 2024):

- **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.

Grant funding is available to assist eligible dam owners with infrastructure repair costs. Funding is provided through the FEMA's High Hazard Potential Dam grant program. NYSDEC accepts applications for grants to assist with technical, planning, design, and other pre-construction activities associated with the rehabilitation of eligible dams classified as High Hazard dams.

New York State Department of State's Division of Building Standards and Codes

Technical Bulletins for the 2020 Codes of New York State

The Department of State Division of Building Standards and Codes (DBSC) publishes 14 technical bulletins, including 2 recent bulletins with guidance related to flood hazard areas: Electrical Systems and Equipment in Flood-damaged Structures and Accessory Structures. One archived bulletin from October 31, 2017, Flood Venting in Foundations and Enclosures Below Design Flood Elevation, provides clarification on the requirements for flood vents in foundations and enclosures located below the design flood elevation and in flood hazard areas.

Forms and Publications

The DBSC in conjunction with the Division of Homeland Security & Emergency Services–Office of Fire Prevention and Control (OFPC) has implemented a joint outreach program that is intended to guide and educate code users. The program will provide concise, easily digestible information on:

- New topics that code users must be aware of
- Frequently overlooked or misunderstood code requirements
- Concerns relating to the administration and enforcement of the Uniform Code and Energy Code

The DBSC and OFPC hope the program will continue to foster professional growth and support the efforts of the code enforcement community and provide helpful guidance to all code users.

The Code Outreach Program publications are expected to be distributed at the beginning of every month. If you have ideas for future topics to be addressed by the Code Outreach Program, email Cop.Codes@dos.ny.gov.

The DBSC 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).

17.3.3 County, Local, and Regional

Lewis County Planning and Community Development Department

The mission of the Lewis County Planning and Community Department, at the direction of the Lewis County Board of Legislators, is to provide services to our municipalities and citizens to ensure that carefully planned and successful development occurs within the County in accord with the Lewis County Comprehensive Plan. The Planning and Community Development Department also deals with agricultural needs and concerns, the broadband expansion initiative, solar development, housing information on the housing hub, houses the County Planning Board, Grant Headquarters, and Sustainably Lewis.

County Planning Board

Municipalities with projects that require County Planning Board review, must submit their referral to the Lewis County Planning Department at least 12 days prior to the regularly scheduled monthly meeting in order for the project to appear on the agenda and be reviewed. Once the recommendations are made, the referrals are sent back to the municipalities, and the final determinations are made. The County Planning Board plays an advisory role, not a regulatory role.

Sustainably Lewis

Lewis County became a designated bronze Climate Smart Community (CSC) in October 2023. Lewis County passed the CSC pledge as a municipal resolution on December 2, 2020, to join the program and become a Registered Climate Smart Community. The CSC program supports local governments in New York State in leading their communities to reduce greenhouse gas emissions, adapt to the effects of climate change, and thrive in a green economy. The CSC Task Force promotes and supports climate action, mitigation, and adaptation across Lewis County government and in the community. Task Force members include community volunteers, nonprofit organizations, municipal officials, and staff from various County departments.

Lewis County Community Services Board

Each county in New York State is required under NYS Mental Hygiene Law to have a Community Services Board (CSB). The primary function of the CSB is to develop and approve the local services plan and advocate for services in Lewis County. Members are appointed by the County Legislature and shall represent the community interest in all the problems of persons with mental disabilities and shall include representatives from community agencies for persons with mental illness, developmental disabilities, alcoholism and substance use.

Lewis County Office for the Aging

The Lewis County Office for the Aging is a federally designated Area Agency on Aging (AAA). The role of AAA is to plan, coordinate, advocate and develop a comprehensive service system to meet the short and long-term needs of older adults in the County. AAAs work with Federal, State, and local officials, senior constituents, and service providers to coordinate existing services and to stimulate new ones. Each AAA prepares a multi-year Area Plan which identifies the needs of that area's older adults and specifies which services will be provided to meet those needs.

The mission of the Lewis County Office for the Aging is to promote the well-being of the older adults of Lewis County through coordinated services that enhance their independence, dignity, and quality of life. This office distributes newsletters and advertises resources that may be of use for older adults, including senior classes and public transportation routes.

Lewis County Youth Bureau Advisory Board

The Lewis County Youth Bureau Advisory Board was established February 5, 1997. It was created by resolution and adopted by the Lewis County Board of Legislators. The board is made up of members from government, non-government, and student representatives from Lewis County School Districts. The role of the Youth Bureau Advisory Board is to make recommendations to the Lewis County Board of Legislators and county departments regarding the provision of services to youth in Lewis county.

Building & Fire Codes

Code enforcement enforces the NYS Uniform Fire Prevention and Building Code, reviews building plans, issues building permits, conducts construction and fire safety inspections and investigates violations and complaints in relation to permitting or construction. Code enforcement also ensures that zoning and land use laws are being followed throughout the County and enforces local Flood Damage Prevention Laws.

Lewis County Public Works

The County Public Works is made up of the Highway Department and the Solid Waste Department. The Highway Department is devoted to the maintenance of roads, bridges, culverts and drainage structures under County jurisdiction. The Solid Waste Department handles recycling and disposal for the County, including the disposal of hazardous waste.

Lewis County Public Transportation

Since the launch of Lewis County Public Transportation, the County has been able to solve many of the past transit issues faced by low-income residents with their affordable fixed route systems and long-range connector routes. The County offers a fixed route transportation system which offers both residents and visitors with 5 fixed route year-round options Monday-Friday which are detailed on a color-coded map. The Utica Connector offers low fare transportation to and from Utica, NY, with some routes that specifically run during spring and fall semester time. The JCC Connector Route allows access to Port Leyden, Lyons Falls, Glenfield, Lowville, Croghan, Carthage, Deer River and Copenhagen to the JCC Campus, Salmon Run Mall or Fort Drum. The Fort Drum Circuit Route offers transportation from Lowville, Carthage, and Croghan to Fort Drum seven days a week. The Old Forge Route offers residents and visitors transportation from Harrisville (call ahead needed), Croghan, Lowville, Glenfield, Lyons Falls, Port Leyden and Boonville to Old Forge seven days a week. Finally, the Dial-A-Ride service is for those who may not be able to travel to the scheduled bus stop locations.

Lewis County Public Health

Lewis County Public Health promotes and protects health through community partnerships including youth special needs programs, immunizations for children and adults, lead poisoning prevention, lead and hemoglobin testing, communicable disease control, rabies prevention and control, mosquito and tick disease prevention, diabetes prevention program, and emergency preparedness and response.

Lewis County Emergency Management

Lewis County Emergency Management is charged with supporting and promoting an organized, systematic approach to Emergency Planning, Preparedness, Mitigation, Response and Recovery in the event of a natural or manmade disaster in Lewis County, and to support the day-to-day operations of the many Emergency Service, Public Service, Public Safety, and Emergency Management organizations. County Emergency Management also houses fire management services as well as flood resources and assistance for residents.

Lewis County Legislature

The Legislature serves as the governing body of the County and consists of ten legislators elected from ten legislative districts for two-year terms. It is the specific duty of the County Legislature to conduct the peoples' business as a vital unit of local government, assuming responsibility for planning, financing, and operating municipal services Countywide.

Lewis County Sheriff's Office

The Sheriff's Department in Lewis County, NY is a law enforcement agency responsible for the management of Lewis County jails and inmates and promoting public peace and safety through policing. Sheriff's Offices are tasked with patrolling areas not within the jurisdiction of the local Police Department. The Department is responsible for managing local court orders and judgments, including foreclosures, tax delinquencies, subpoenas, and repossessions.

Lewis County Recreation, Forestry, and Parks

The mission of the Department of Recreation, Forestry and Parks is to manage the County Reforestation parcels for a sustainable future while providing recreational and community access. The department works with the local ATV Clubs, the community, local municipalities as well as other Counties to promote and attain access to the OHV (Off Highway Vehicle) Trail System. In addition, aid is provided to the local Snowmobile Clubs with administration of the NYS OPRHP Snowmobile Grant.

Lewis County Soil & Water Conservation District

The Lewis County Soil & Water Conservation District's mission is to protect and promote the health, safety, and general welfare of the present and future generations of Lewis County residents through the conservation and enhancement of soil, water, air, flora, and fauna through the delivery of science-based technical and educational assistance. District involvement includes, but is not limited to, work with landowners, land managers, local government agencies, and other local interests in addressing a broad spectrum of resource concerns: erosion control, flood prevention, water conservation and use, wetlands, ground water, water quality and quantity, non-point source pollution, forestland protection, wildlife, recreation, wastewater management and community development.

17.4 FISCAL CAPABILITIES

This section summarizes fiscal capabilities in Lewis County. Further information is provided in the jurisdictional annexes in Volume II. The State Capabilities section of the 2023 New York State HMP features a section on mitigation-related funding administered by state agencies that eligible jurisdictions can use to fund mitigation actions.

17.4.1 Federal

FEMA

Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (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 HMP.

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 NYSDHSES 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.

Federal Hazard Mitigation Funding Opportunities

As noted on the FEMA hazard mitigation assistance (HMA) website (FEMA n.d.), 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, and the Pre-Disaster Mitigation (PDM) Program. Table 17-1 provides an overview of program funding eligibility and cost share.

Table 17-1. FEMA HMA Grant Cost Share Requirements

Programs	Cost Share (Percent of Federal/Non-Federal Share)
HMGP	75/25
HMGP Post Fire	75/25
FMA (community flood mitigation, project scoping, individual mitigation of insured properties, and planning grants)	75/25
FMA—repetitive loss property⁽²⁾	90/10
FMA—severe repetitive loss property⁽²⁾	100/0
PDM	75/25
PDM—small and impoverished community	Up to 90/10

Source: FEMA 2023; FEMA 2023

Subapplicants should consult their State Hazard Mitigation Officer (SHMO) for the amount of percentage of HMGP subrecipient management cost funding their State has determined to be passed through subrecipients.

To be eligible for an increased federal cost share, a FEMA-approved state or tribal (standard or enhanced) mitigation plan that addressed repetitive loss properties must be in effect at the time of award, and the property is being submitted for consideration must be a repetitive loss property.

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 (FEMA 2023).

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.

Individual homeowners and business owners may not apply directly to FEMA. Eligible local governments may apply on their behalf (FEMA 2023).

Federal mitigation grant funding is available to all communities with a current HMP (this plan); however, most of these grants require a “local share” in the range of 10–25 percent of the total grant amount. The FEMA mitigation grant programs are described below.

Flood Mitigation Assistance Program

The Flood Mitigation Assistance (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 NYSDHSES serves as the grantee and program administrator for the FMA program.

Rehabilitation of High Hazard Potential Dams 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

Extraordinary Circumstances

For 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 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 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 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).

Assistance to Firefighters Grant Program

The goal of the Assistance to Firefighters Grants 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.

Emergency Management Performance Grants Program

The Emergency Management Performance Grant (EMPG) provides state, local, tribal, and territorial emergency management agencies with the resources required for implementation of the National Preparedness System and works toward the national preparedness goal of a secure and resilient nation. The EMPG's allowable costs support efforts to build and sustain core capabilities across the prevention, protection, mitigation, response, and recovery mission areas.

Homeland Security Grant Program

The Homeland Security Grant Program (HSGP) 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. Together, these grant programs fund a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration.

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

Individual Assistance (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.

Public Assistance

Public Assistance (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.

Small Business Administration Loans

The Small Business Administration (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.

National Park Service

Land and Water Conservation Fund

The Land and Water Conservation Fund (LWCF) was established by Congress in 1964 to fulfill a bipartisan commitment to safeguard natural areas, water resources, and cultural heritage, and to provide recreation opportunities. Using no taxpayer dollars, the LWCF invests earnings from offshore oil and gas leasing to help strengthen communities, preserve history, and protect the national endowment of lands and waters. The LWCF program is divided into the "State Side," which provides grants to State and local governments, and the "Federal Side," which is used to acquire lands, waters, and interests therein necessary to achieve the natural, cultural,

wildlife, and recreation management objectives of federal land management agencies. The LWCF was permanently reauthorized in 2019 and permanently funded in August 2020.

Restore America's Estuaries

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
- Contaminants of emerging concern found in coastal and estuarine waters such as pharmaceuticals, personal care products, and microplastics

U.S. Department of Agriculture

Community Facilities Direct Loan and Grant Program

This program provides 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. Funds can be used to purchase, construct, and/or improve essential community facilities, purchase equipment, and pay related project expenses. Rural areas including cities, villages, townships, towns, and federally recognized tribal lands, with no more than 20,000 residents according to the latest U.S. Census, are eligible for this program.

Emergency Loan Program

The Emergency Loan Program is triggered when a natural disaster is designated by the Secretary of Agriculture, or a natural disaster or emergency is declared by the President under the Stafford Act. These loans help producers who suffer qualifying farm-related losses directly caused by the disaster in a county declared or designated as a primary disaster or quarantine area. Also, farmers located in counties that are contiguous to the declared, designated, or quarantined area may qualify for emergency loans.

For production losses, a 30 percent reduction in a primary crop in a designated or contiguous county is required. Losses to quality, such as receiving a 30 percent reduced price for flood-damaged crops, may be eligible for assistance, too.

Emergency Watershed Protection Program

The Emergency Watershed Protection (EWP) Program, a federal emergency recovery program, helps local communities recover after a natural disaster. The EWP program offers technical and financial assistance to help local communities relieve imminent threats to life and property caused by floods, fires, windstorms, and other natural disasters that impair a watershed. EWP does not require a disaster declaration by federal or state government officials for program assistance to begin. The Natural Resources Conservation Service (NRCS) state conservationist can declare a local watershed emergency and initiate EWP program assistance in cooperation with an eligible sponsor. The sponsor must sign a cooperative agreement with NRCS. The EWP program offers financial and technical assistance for various activities, including the following:

- Remove debris from stream channels, road culverts, and bridges
- Reshape and protect eroded streambanks
- Correct damaged or destroyed drainage facilities
- Establish vegetative cover on critically eroding lands
- Repair levees and structures
- Repair certain conservation practices
- Buyouts

Additional information regarding the EWP is detailed below and available on the website:

<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/>.

EWP–Recovery

The EWP–Recovery program is aimed at relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. Public and private landowners are eligible for assistance but must be represented by a project sponsor that 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 will pay up to 75 percent of the construction cost of emergency measures. The remaining 25 percent must come from local sources and can be in the form of cash or in-kind services.

EWP–Recovery work is not limited to any one set of measures. The program is designed for the installation of recovery measures to safeguard lives and property as a result of a natural disaster. NRCS completes a Damage Survey Report, which provides a case-by-case investigation of the work necessary to repair or protect a site. Watershed impairments that the 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

Privately owned lands or lands owned by local and state governments might be eligible for participation in the EWP–Floodplain Easement program. 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 that would contribute to the restoration of flood storage and flow, provide for control of erosion, or improve the practical management of the floodplain easement

- Lands that would be inundated or adversely impacted as a result of a dam breach

Through this program, easements are restored to the natural environment to the extent practicable. Work can include both structural and nonstructural practices to restore flood storage and flow, control erosion, and improve the practical management of the easement.

Structures, including buildings, within the floodplain easement must be demolished and removed or relocated outside the 100-year floodplain or dam breach inundation area.

Regional Conservation Partnership Program

The Regional Conservation Partnership Program promotes coordination of NRCS conservation activities with partners that offer value-added contributions to expand the collective ability to address on-farm, watershed, and regional natural resource concerns. Through this program, NRCS seeks to co-invest with partners to implement projects that demonstrate innovative solutions to conservation challenges and provide measurable improvements and outcomes tied to the resource concerns they seek to address.

U.S. Department of Health and Human Services

Social Services Block Grant Program

The Social Services Block Grant (SSBG) is a flexible funding source that allows states and territories to tailor social service programming to their population's needs. Through the SSBG, states provide essential social services that help achieve a myriad of goals to reduce dependency and promote self-sufficiency; protect children and adults from neglect, abuse, and exploitation; and help individuals who are unable to take care of themselves to stay in their homes or to find the best institutional arrangements.

U.S. Department of Housing and Urban Development

Community Development Block Grants

Community Development Block Grants (CDBG) are federal funds intended to provide low and moderate-income households with viable communities, including decent housing, 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. Additional information regarding CDBG is available on the website:

<https://www.hudexchange.info/programs/cdbg-entitlement/>.

Community Development Block Grant Disaster Recovery (CDBG-DR) grant funds are appropriated by Congress and allocated by HUD to rebuild disaster-impacted areas and provide crucial seed money to start the long-term recovery process. These flexible grants help cities, counties, Indian tribes, and States recover from presidentially declared disasters, especially in low-income areas, subject to the availability of supplemental appropriations. Since CDBG-DR assistance may fund a broad range of recovery activities, HUD can help communities and neighborhoods that otherwise might not recover due to limited resources.

Disaster Housing Assistance Program

The Disaster Housing Assistance Program provides emergency assistance for housing, including minor repairs of the home to establish livable conditions, mortgage, and rental assistance.

HOME Investment Partnerships Program

The HOME Investment Partnerships Program (HOME) provides grants to states and localities that communities use—often in partnership with local nonprofit groups—to fund a wide range of activities, including building, buying, and/or rehabilitating affordable housing for rent or homeownership or providing direct rental assistance to low-income people. HOME is the largest federal block grant to state and local governments designed exclusively to create affordable housing for low-income households. HOME funds are awarded annually as grants to participating jurisdictions. The program's flexibility allows states and local governments to use HOME funds for grants, direct loans, loan guarantees or other forms of credit enhancements, or rental assistance or security deposits.

The program's requirement that participating jurisdictions match 25 cents of every dollar in program funds mobilizes community resources in support of affordable housing.

Section 108 Loan Guarantee Program

The Section 108 Loan Guarantee Program (Section 108) provides communities with a source of low-cost, long-term financing for economic and community development projects. Section 108 financing provides an avenue for communities to undertake larger, more costly projects, where they may have limited resources to invest upfront.

Section 108 can fund economic development, housing, public facilities, infrastructure, and other physical development projects, including improvements to increase resilience against natural disasters. This flexibility of use makes it one of the most potent and important public investment tools that HUD offers to states and local governments.

Section 108 assistance can be deployed in two ways:

- Directly by the community or its governmental or non-profit partner to carry out an eligible project
- Indirectly with a community or its partner re-lending (or, in limited circumstances, granting) the funds to a developer or business to undertake an eligible project

U.S. Department of Transportation

Federal Highway Administration Emergency Relief

Federal Highway Administration (FHWA) Emergency Relief is a grant program that can be used for the repair or reconstruction of federal-aid highways and roads on federal lands that have suffered serious damage as a result of a disaster. New York State serves as the liaison between local municipalities and FHWA, making the municipalities sub-applicants of New York State. The program is appropriated \$100 million annually. For information regarding the FHWA Emergency Relief Program, refer to:

<https://www.fhwa.dot.gov/programadmin/erelief.cfm>

Federal Transit Administration Emergency Relief

Federal Transit Authority (FTA) Emergency Relief is a grant program that funds capital projects to protect, repair, reconstruct, or replace equipment and facilities of public transportation systems. Administered by the FTA and directly allocated to mass transit and port authorities, this transportation-specific fund was created as an alternative to FEMA's PA. Additional information regarding the FTA Emergency Relief Program is available on the website: <https://www.transit.dot.gov/funding/grant-programs/emergency-relief-program/emergency-relief-program>.

Federal Highway Administration Recreational Trails

The Recreational Trails Program is an assistance program of the FHWA that provides funds to states to develop and maintain recreational trails and trail-related facilities for both nonmotorized and motorized recreational trail uses. The program requires that states use 30 percent of funds for non-motorized recreation, 30 percent for motorized recreation, and 40 percent for diverse recreational trail use.

In New York State, the Recreational Trails Program is administered by the Office of Parks, Recreation, and Historic Preservation.

Rebuilding American Infrastructure with Sustainability and Equity Grant Program

The Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant program provides an opportunity for the U.S. Department of Transportation (USDOT) to invest in road, rail, transit, and port projects that promise to achieve national objectives. The RAISE program enables USDOT to examine these projects on their merits to help ensure that taxpayers are getting the highest value for every dollar invested.

The eligibility requirements of RAISE allow project sponsors at the state and local levels to obtain funding for multi-modal, multi-jurisdictional projects that are more difficult to support through traditional USDOT programs. RAISE can provide funding directly to any public entity, including municipalities, counties, port authorities, tribal governments, or others, in contrast to traditional federal programs that provide funding to very specific groups of applicants (mostly state departments of transportation and transit agencies). This flexibility allows RAISE and USDOT partners at the state and local levels to work directly with a host of entities that own, operate, and maintain much of that nation's transportation infrastructure but otherwise cannot turn to the federal government for support.

U.S. Economic Development Administration

The U.S. Economic Development Administration (USEDA) is an agency of the U.S. Department of Commerce that supports regional economic development in communities around the country. It provides funding to support comprehensive planning and makes strategic investments that foster employment creation and attract private investment in economically distressed areas of the United States. Through its Public Works Program, USED A 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, USED A 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.

Public Works Program

Through its Public Works Program, USEDA invests in key public infrastructure, such as traditional public works projects, including water and sewer system improvements, expansion of port and harbor facilities, brownfields, multitenant manufacturing and other facilities, business and industrial parks, business incubator facilities, redevelopment technology-based facilities, telecommunications facilities, and development facilities.

Economic Adjustment Program

Through its Economic Adjustment Program, USEDA administers its Revolving Loan Fund Program, which supplies small businesses and entrepreneurs with the gap financing needed to start or expand their business in areas that have experienced or are under threat of serious structural damage to the underlying economic base.

U.S. Environmental Protection Agency

Smart Growth Implementation Assistance Program

The Smart Growth Implementation Assistance program focuses on complex issues such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, green building, and climate change. Applicants can submit proposals under four categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design, or medical and social service facilities siting.

Clean Water Act Section 604(b) Water Quality Planning Grants

Water Quality Planning Grants provide funding to implement regional comprehensive water quality management planning activities as described in Section 604(b) of the federal Clean Water Act. Funds are to be used for water quality management planning activities, including tasks to determine the nature, extent, and causes of point and nonpoint source water pollution problems, and to develop plans to resolve these problems.

U.S. Fish and Wildlife Service

Partners for Fish and Wildlife

The Partners for Fish and Wildlife Program provides free technical and financial assistance to landowners, managers, tribes, corporations, schools, and nonprofits interested in improving wildlife habitat on their land. These projects range in size from a wetland of a few acres to a grassland restoration covering several hundred thousand acres.

Many Partners for Fish and Wildlife projects take place on working landscapes such as forests, farms, and ranches. Efforts are focused on areas of conservation concern, such as upland forests, wetlands, native prairies, marshes, rivers, and streams. Projects are designed to benefit federal trust species including migratory birds and endangered, threatened, or at-risk species.

17.4.2 State

Empire State Development Local Waterfront Revitalization Program

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 (NYS ESD 2023).

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 an 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 (NYS DOS 2023).

New York State Department of Archives Local Government Records Management Improvement Fund

The Local Government Records Management Improvement Fund provides grants to assist local governments in establishing records management programs or developing new program components. Funds come from fees collected by county clerks and the New York City Office of the City Register. These fees are collected during the recording of certain documents and when county clerks assign index numbers for certain court cases. The amount of grant funding available each year depends on the number of documents recorded and index numbers assigned that year. Project categories include the following:

- Disaster management
- Document conversion and access
- Files management
- Historical records
- Inactive records

Application types include:

- Individual (up to \$75,000)
- Shared services (up to \$150,000)
- New York City Department of Records

New York State Department of Environmental Conservation

Clean Water State Revolving Fund

The Clean Water State Revolving Fund (CWSRF) provides interest-free or low-interest rate financing for wastewater and sewer infrastructure projects to municipalities throughout New York State. Projects eligible for financing include construction or restoration of sewers and wastewater treatment facilities, stormwater management, landfill closures, and habitat restoration and protection projects.

The New York State Environmental Facilities Corporation (EFC) provides both short- and long-term financing—interest-free or low-interest—to accommodate municipalities of all population sizes with varying financial needs. When communities repay their financings, it allows EFC to finance new projects, and the funds “revolve” over time.

Climate Smart Communities Grant Program

Climate Smart Community (CSC) grants support mitigation and adaptation projects to reduce greenhouse gas emissions and prepare for the effects of climate change. The CSC program enables high-performing registered communities to achieve recognition for their leadership. Designed around 10 pledge elements, the certification program recognizes communities achieving any of over 130 total possible actions through a rating system leading to four levels of award: Certified, Bronze, Silver, and Gold. Recertification of completed actions is required every five years.

Competitive grants ranging from \$25,000 to \$100,000 provide support for local governments to become certified CSCs. All counties, cities, towns, and villages of New York State are eligible to receive funding. The CSC grant program will provide 50/50 matching grants for eligible projects. It offers free technical support on energy and climate and guidance tailored to New York State communities. Funding is available for the following:

- Implementation projects that advance climate adaptation and mitigation actions, including the following:
 - Construction of natural 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
- Certification projects that advance actions aligned with CSC certification requirements, including the following:
 - Right-sizing government fleets
 - Developing natural resource inventories
 - Conducting vulnerability assessments
 - Developing climate adaptation strategies
 - Updating hazard mitigation plans to address changing conditions and reduce climate vulnerability

As of June 2025, 440 communities have committed to acting on climate through the CSC program. In Lewis County, two communities, other than the County, are registered in the program but are not certified:

- Village of Harrisville
- Town of Diana

Environmental Protection Fund

New York State's Environmental Protection Fund (EPF) is a source of funding for capital projects that protect the environment and enhance communities. Capital projects are usually large projects that purchase land or construct facilities. Most projects that receive grants of EPF money combine it with other funding sources that require matching funds.

The EPF also supports the stewardship of public lands, including state parks and millions of acres of public lands throughout the state. Through partnerships with volunteer organizations, state agencies use stewardship funding to manage trails and lands, protect natural resources, preserve wildlife habitats, make critical capital improvements at parks and campgrounds, educate students about conservation, and provide access to persons with disabilities.

Volunteer Fire Assistance Grants

This 50/50 matching funds program makes funds available to rural fire companies for the purchase of wildland firefighting equipment such as portable backpack pumps, Nomex protective clothing, hand tools, hard hats, hoses, portable radios, and dry hydrants.

Wastewater Infrastructure Engineering Planning Grant

The Wastewater Infrastructure Engineering Planning Grant assists municipalities with the engineering and planning costs of CWSRF-eligible water quality projects. Eligibility for municipalities is based on median household income as follows:

- Median household income of \$65,000 or less in the Regional Economic Development Council (REDC) regions of Capital District, Southern Tier, North Country, Mohawk Valley, Central New York, Finger Lakes, or Western New York (Lewis County is located in the North Country New York region)
- Median household income of \$85,000 or less in REDC regions of Long Island, New York City, or Mid-Hudson

Grants with a 20 percent required local match could finance activities, including engineering and consultant fees for engineering and planning services to produce an engineering report. Funding priorities go to projects that have one of the following qualities:

- Required by an executed order on consent
- Required by a draft or final State Pollutant Discharge Elimination System permit
- Upgrading or replacing an existing wastewater system
- Constructing a wastewater treatment and/or collection system for an area with failing onsite septic systems
- Identified in a total maximum daily load implementation plan

The goal of the Engineering Planning Grant program is to advance water quality projects to construction, so successful applicants can use the engineering report funded by the grant to seek financing through the CWSRF program, Water Quality Improvement Project program, or other funding entities to further pursue the identified solution.

Water Quality Improvement Project Program

The Water Quality Improvement Project (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 (Stevens & Lamie 2024):

- 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)

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 are awarded through a competitive process and support all phases of project development. Projects selected for funding under the BRIDGE NY Initiative are 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 on the following website: <https://www.dot.ny.gov/BRIDGENY>.

New York State Division of Homeland Security and Emergency Services Revolving Loan

The New York State Emergency Services Revolving Loan Account was established under the State Finance Law to make loans to cities, villages, fire districts, counties, towns, and not-for-profit fire/ambulance corporations at an annual fixed interest rate of 2.5 percent. The loan supports the repair of firefighting apparatus, ambulances, or rescue vehicles and the renovation, rehabilitation, or repair of facilities that house firefighting equipment, ambulances, rescue vehicles, and related equipment. Principal and interest payments made by recipients are deposited in the revolving loan account and loaned once again to new applicants. Therefore, funding levels in the account vary throughout the year depending upon the amount of repayment money, interest accrued, and number of new loans made.

New York State Office of Parks, Recreation, and Historic Preservation Recreational Trails Grant Program

The Recreational Trails Program (RTP) provides funds to the states to develop and maintain recreational trails and trail-related facilities for both nonmotorized and motorized recreational trail uses. The RTP is an assistance program of the U.S. Department of Transportation's Federal Highway Administration (FHWA). In New York State, the RTP is administered by the Office of Parks, Recreation and Historic Preservation (OPRHP).

The RTP legislation requires that States use 30 percent of funds for non-motorized recreation, 30 percent for motorized recreation, and 40 percent for diverse recreational trail use.

17.4.3 County, Local, and Regional

Lewis County and individual jurisdictions are (legally, not necessarily practically) able to fund mitigation projects through existing local budgets, local appropriations (including referendums and bonding), and a variety of federal and state loan and grant programs. Many jurisdictions noted throughout the planning process that they are faced with increasing fiscal constraints, including decreasing revenues, budget constraints, and tax caps. In an effort to overcome these fiscal challenges, jurisdictions have continued to leverage the sharing of resources and combining available funding with grants and other sources and note that plans and interjurisdictional cooperation are beneficial in obtaining grants.

PART 4: MITIGATION STRATEGY

18. MITIGATION STRATEGY

This chapter presents mitigation strategies for Lewis County to reduce potential vulnerability and losses identified as concerns in the risk assessment portion of this plan. The Steering Committee reviewed the risk assessment and capability assessment to identify and develop these mitigation strategies.

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.

18.1 PAST MITIGATION ACCOMPLISHMENTS

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 Lewis County HMP. The current planning process represents the regulatory five-year plan update process, which includes the participation of 24 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 Lewis County have been reviewed and incorporated into this plan update as appropriate, as discussed in Chapter 2 (Planning Process) and References.

18.2 REVIEW AND UPDATE OF MITIGATION GOALS AND OBJECTIVES

This section documents describes the process of updating hazard mitigation goals and objectives for reducing or avoiding long-term vulnerabilities to identified hazards. For the purposes of this plan, goals and objectives are defined as follows:

“The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.”

44 CFR 201.6(c)(3)(i)

- **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. Broadly defined mitigation objectives were eliminated from the updated strategy unless accompanied by discrete actions.

The Steering Committee reviewed the 2020 goals and objectives and made revisions for the 2025 update based on the following considerations:

- Hazard events and losses since the 2020 plan
- The updated hazard profiles and risk assessment
- The goals and objectives established in the New York State 2023 HMP
- The Planning Partnership's interests in integrating this plan with other planning mechanisms, including Lewis County and local risk management plans
- Direct input from the Steering Committee, stakeholders, and the public on how the County and jurisdictions need to move forward to best manage their hazard risk
- Discussions and research on existing authorities, policies, programs, resources
- Support for mitigation through the protection of natural systems

As a result of this review process, the goals and objectives were expanded. Objective 2-6, Goal 4 and its objectives and Goal 5 and its objectives are new additions to Lewis County's mitigation strategy in the 2025 HMP update. The new goals and objectives are:

- Goal 1: Reduce the likelihood and impacts of hazards on life, property, and the environment.
 - Objective 1-1: Develop and/or update local regulations based on current information and best practices.
 - Objective 1-2: Maintain natural systems to reduce the impacts of hazards.
- Goal 2: Protect life, property, critical infrastructure, the environment, and the economy from hazard impacts.
 - Objective 2-1: Acquire, retrofit, or relocate structures from flood-prone areas.
 - Objective 2-2: Retrofit critical infrastructure to protect against hazard impacts.
 - Objective 2-3: Enhance stormwater management infrastructure.
 - Objective 2-4: Ensure that critical facilities can continue to function during and after hazard impacts.
 - Objective 2-5: Encourage residents and business owners to insure their property against hazard impacts, including through flood insurance through the National Flood Insurance Program (NFIP).
 - Objective 2-6: Develop and implement countywide mitigation recommendations tailored to identified hazards, including flooding and other natural events.
- Goal 3: Educate the public, officials, and other stakeholders about the hazards they face and what can be done to mitigate hazard impacts.
 - Objective 3-1: Ensure that local officials attend current training on regulatory issues and best practices.
 - Objective 3-2: Provide information to individuals throughout the county on the hazards they face and what property protection measures they can take.
- Goal 4: Assess and Mitigate Risks Associated with Dam Structures
 - Objective 4-1: Conduct a comprehensive inventory of dams across the county and evaluate the accuracy and appropriateness of existing NYSDEC hazard classifications.
 - Objective 4-2: Increase awareness among the public, local officials, and stakeholders (especially private dam owners) regarding the risks of deferred dam maintenance and available funding opportunities.

Objective 4-3: Develop and pursue a countywide strategy for dam maintenance, repair, and removal, as appropriate, to reduce risk and enhance public safety.

- Goal 5: Improve Flood and Hazard Mapping Across the County
 - Objective 5-1: Provide stakeholders, including the public and local officials, with accurate, detailed, and current information on flood and hazard risks, surpassing the limitations of existing FEMA floodplain maps.
 - Objective 5-2: Collaborate with state and federal regulatory agencies to ensure proper classification, oversight, and safety of dam structures within Lewis County.

18.3 MITIGATION STRATEGY DEVELOPMENT AND UPDATE

18.3.1 Update of Local Jurisdiction Mitigation Strategies

Review of Previous Actions

To evaluate progress on local mitigation actions, each planning partner was provided with a Mitigation Action Plan Review Worksheet, pre-populated with the actions identified for their jurisdiction in the prior (2020) plan. The Planning Partners were asked to indicate the status of each action (“No Progress/Unknown,” “In Progress/Not Yet Complete,” “Continuous,” “Completed,” “Discontinued”). They were requested to provide comments to quantify the extent of progress and provide reasons for the level of progress or why actions were discontinued. This information is included in the jurisdictional annexes.

FEMA defines **Mitigation Actions** as specific actions that help to achieve the mitigation goals and objectives.

Mitigation actions identified as “Complete” or “Discontinued” have been removed from the Planning Partners’ updated mitigation strategies. Actions identified as “No Progress/Unknown” or “In Progress/Not Yet Complete” have been carried forward in their local updated mitigation strategies. Planning partners were asked to provide further details on these projects to help better define the projects, identify benefits and costs, and improve implementation.

Certain continuous or ongoing actions (Ongoing Capabilities) from the previous plan that represent programs that are now fully integrated into the normal operational and administrative framework of the community are identified in the capabilities assessment of each annex and removed from the updated mitigation strategy (marked as “Discontinued”).

Identifying New Actions

At the kickoff and during subsequent local level planning meetings, all participating jurisdictions were further surveyed to identify completed mitigation actions, in progress actions, or ongoing capabilities, as well as potential new actions. Communities also were made aware of potential new mitigation actions as such actions became evident during the plan update process (e.g., through the capability assessment, risk assessment, or the public and stakeholder outreach process).

Developing the Overall Strategy

Beginning in August 2022, members of the Steering Committee and contract consultants worked directly with each jurisdiction (by phone, email, or virtual meetings) to update their annex with mitigation strategies that focus on well-defined, implementable projects that meet the definition or characteristics of mitigation. Mitigation actions

were selected with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).

Three annex support meetings were held for Planning Partners to assist in the development of additional actions, foster collaboration between neighboring jurisdictions for mitigation actions, discuss actions that involve cooperation between the County and jurisdictions, and identify steps needed to complete the jurisdictional annexes.

Addressing Known Vulnerabilities

To help support the selection of an appropriate risk-based mitigation strategy, each annex includes a summary of hazard vulnerabilities. These were identified during the plan update process by planning partner representatives, through review of available plans and reports, or through the hazard profiling and risk assessment process.

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 provide a detailed description of a problem area, including its impacts on the jurisdiction; past damage; loss of service; etc. An effort was made to include the street address of the problem 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 on each community, and the development of actionable mitigation strategies.

Incorporating a Range of Action Types

Concerted efforts were made to ensure that Planning Partners develop updated mitigation strategies that cover the range of mitigation action types described in recent FEMA planning guidance (FEMA “Local Mitigation Planning Handbook” March 2013):

- **Local Plans and Regulations**—These actions include government authorities, policies or codes that influence the way land and buildings are developed and built.
- **Structure and Infrastructure Project**—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 community lifelines and other critical facilities. This type of action also involves projects to construct structures to reduce the impact of hazards.
- **Natural Systems Protection**—These are actions that minimize damage and losses to natural systems and preserve or restore their functions.
- **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, Community Rating System, StormReady (NOAA), and Firewise (NFPA) Communities.

Efforts were also made to develop mitigation strategies that cover the range of mitigation action types described in recent CRS guidance (FEMA 2018):

- **Preventative Measures**—Government, administrative or regulatory actions, or processes that influence the way land and buildings are developed and built. Examples include planning and zoning, floodplain local laws, capital improvement programs, open space preservation, and storm water management regulations.

- **Property Protection**—These actions include public activities to reduce hazard losses or actions that involve (1) modification of existing buildings or structures to protect them from a hazard or (2) removal of the structures from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.
- **Public Information**—Actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and educational programs for school-age children and adults.
- **Natural Resource Protection**—Actions that minimize hazard loss and also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- **Structural Flood Control Projects**—Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, setback levees, floodwalls, retaining walls, and safe rooms.
- **Emergency Services**—Actions that protect people and property during and immediately following a disaster or hazard event. Services include warning systems, emergency response services, and the protection of essential facilities

Protecting Critical Facilities

Planning partner mitigation actions that address vulnerable critical facilities have been proposed in consideration of protection against 500-year events or worst-case scenarios. However, in the case of projects 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, local jurisdiction discretion must be recognized. Further, it must be recognized that the County and jurisdictions have limited authority with regard to mitigation at any level of protection over privately owned critical facilities.

Accounting for Climate Change

As discussed in the hazard profiles in this HMP, the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards (e.g., flood, severe storm, severe winter storm, and wildfire). Communities are working to evaluate and recognize these long-term implications and to incorporate their mitigation strategies into planning and capital improvement updates.

18.3.2 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 2020 HMP using a process similar to that used to review local jurisdiction 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 2020 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 regional agencies

As discussed within the hazard profiles in this HMP, 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, 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.

18.3.3 Mitigation Strategy Evaluation and Prioritization

Section 201.c.3.iii of 44 CFR establishes how mitigation strategies are to be prioritized, implemented, and administered by local jurisdictions. For this plan update, each mitigation strategy was prioritized using criteria suitable for evaluating hazard mitigation strategies. This method provided a systematic approach that considered the opportunities and constraints of implementing each mitigation action. The Steering Committee chose a set of 14 evaluation criteria for this process:

1. Life Safety—How effective will the action be at protecting lives and preventing injuries? Will the proposed action adversely affect one segment of the population?
2. Property Protection—How significant will the action be at eliminating or reducing damage to structures and infrastructure? For example: development in the floodplain or high-risk areas?
3. Cost-Effectiveness—Are the costs to implement the action commensurate with the benefits achieved?
4. Political—Is there overall public support for the action? Is there the political will to support it? Is the action at odds with development pressures?
5. Legal—Does the jurisdiction have the authority to implement the action?
6. Fiscal—Can the action be funded under existing program budgets (i.e., is this action currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
7. Environmental—What are the potential environmental impacts of the action? Will it comply with environmental regulations? Are there co-benefits of this action?
8. Social Vulnerability—Does the action benefit socially vulnerable populations and underserved communities? Additional considerations can include appropriate numerical measures of social vulnerability.

9. Administrative—Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary? Does the scale and scope of the action align with the jurisdiction’s capabilities?
10. Hazards of Concern—Does the action address one or more of the jurisdiction’s high-ranked hazards?
11. Climate Change—Does the action incorporate climate change projections? Is the action designed to withstand/address long-term conditions?
12. Timeline—Can the action be completed in less than five years?
13. Community Lifelines—Does this action benefit community lifelines?
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 prioritize their identified mitigation actions. For each mitigation action, the jurisdictions assigned a numeric score for each of the 14 evaluation criteria:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Jurisdictions were asked to provide a brief summary of the rationale behind the numeric rankings assigned. The numerical results were totaled and then used by each jurisdiction to help prioritize the action or strategy as *low*, *medium*, or *high*. Actions that had a numerical value between 0 and 6 were categorized as *low priority*; actions with numerical values between 7 and 10 were categorized as *medium priority*; and actions with numerical values between 11 and 14 were categorized as *high priority*. While this provided a consistent, systematic methodology to support the evaluation and prioritization of mitigation actions, jurisdictions may have additional considerations that could influence their overall prioritization of mitigation actions.

It is noted that jurisdictions may be carrying forward mitigation actions from prior mitigation strategies that were prioritized using a different, but not inherently contrary, approach. Mitigation actions in the prior (2020) Lewis 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 actions 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 actions that are seen by the community as the most effective approaches to advance their local mitigation goals and objectives within their capabilities. In addition, each planning partner was asked to develop problem statements. With active support from NYSDHSES planning staff, the partners were able to develop action-oriented and achievable mitigation strategies. For that reason, many of the actions in the updated mitigation strategy were ranked as *high* or *medium* priority, as reflective of the community’s clear intent to implement them, available resources notwithstanding. In general, actions that would have had *low* priority rankings were appropriately screened out during the local action evaluation process.

18.3.4 Benefit/Cost Review

Section 201.6.c.3iii of 44 CFR requires the prioritization of the mitigation strategy to emphasize the extent to which benefits are maximized according to a benefit/cost review of the proposed projects. For all actions identified in the local strategies, jurisdictions identified the associated costs and benefits as follows:

- **Costs** presented include the total project estimation. This can include administrative, construction (engineering, design, and permitting), and maintenance costs.
- **Benefits** are the savings from losses avoided 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. Where estimates of costs and benefits were available, the ratings were defined follows:

Low < = \$10,000

Medium = \$10,000 to \$100,000

High > = \$100,000

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 qualitative *high*, *medium*, and *low* ratings based on the definitions in Table 18-1.

Table 18-1 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 Lewis County actions identified, the Planning Partnership may seek financial assistance under FEMA's Hazard Mitigation Assistance (HMA) programs. These programs require detailed benefit/cost analysis as part of the application process. The benefit/cost review applied for the prioritization of actions in this update did not include the level of detail required by FEMA for project grant eligibility under HMA grant programs. These analyses will be performed when funding applications are prepared, using FEMA's Benefit-Cost Analysis model.

The Planning Partnership is committed to implementing mitigation strategies with benefits that exceed costs. For projects not seeking financial assistance from grant programs that require this sort of analysis, the Planning Partnership reserves the right to define benefits according to parameters that meet its needs and the goals and objectives of this plan.

PART 5: PLAN MAINTENANCE

19. PLAN MAINTENANCE AND IMPLEMENTATION PROCEDURES

This chapter details the formal process that will ensure that the Hazard Mitigation Plan remains an active and relevant document and that the Planning Partnership maintains its eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan in five years. In addition, this chapter describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this 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.

19.1 HMP COORDINATOR AND PLANNING PARTNER POINTS OF CONTACT

The HMP Coordinator is assigned to manage the maintenance and update of the plan during its approval period (the five-year period between FEMA's approval of the plan and its expiration), with the following responsibilities:

- Convene the Planning Partnership.
- Be the prime point of contact for questions regarding the plan and its implementation.
- Coordinate the incorporation of additional information into the plan.
- Manage the monitoring, evaluation, and updating responsibilities identified in this chapter.

Currently, the Lewis County HMP Coordinator is designated as:

Lauryn Tabolt, Community Development Specialist
Lewis County
7660 North State Street
Lowville, NY 13367
315-376-5780
Email: lauryntabolt@lewiscounty.ny.gov

Each jurisdictional annex in Volume II identifies planning partners' primary and secondary representatives (points of contact) as of the date of this plan. It will be the responsibility of each planning partner to inform the HMP Coordinator of any changes in representation.

19.2 MAINTENANCE AND IMPLEMENTATION TASKS

The procedures for maintaining and implementing the plan are detailed in the sections below and summarized in Table 19-1.

Table 19-1. Plan Maintenance Matrix

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring	Planning partners to recommend update of mitigation strategies, report progress toward implementation of actions, identify new actions, and update information on funding opportunities.	Each June or after the occurrence of a presidentially declared disaster	Jurisdictional points of contact identified in Volume II	Jurisdictional implementation lead identified in Volume II
Integrating	Distribute the safe growth worksheet (see Table 19-2) for annual review and update by all planning partners.	Each June, with interim email reminders to address integration in county and municipal activities	HMP Coordinator and planning partner points of contact identified in Volume II	HMP Coordinator
Evaluating	Review the status of previous actions, as submitted by the monitoring task lead, and assess the effectiveness of the plan; compile and finalize update of mitigation strategy.	Updated progress report completed by September 30 of each year	Planning partner points of contact identified in Volume II	Alternate jurisdictional points of contact
Updating	Reconvene the planning partners to guide a comprehensive update to the plan.	Every 5 years, or upon major update to comprehensive plan, or after the occurrence of a major disaster	HMP Coordinator	Jurisdictional points of contacts identified in Volume II
Grant Monitoring	Notify planning partners about grant opportunities, maintain a list of eligible jurisdiction-specific projects for funding consideration, and notify planning partners of fiscal year mitigation priorities.	Continuously and as grant opportunities are identified	HMP Coordinator	Jurisdictional points of contacts identified in Volume II
Public Involvement	Maintain the HMP, inform the public of hazard events via social media outlets, promote educational workshops on hazard topics, and track and file public comments received regarding the HMP.	Continuously	HMP Coordinator and planning partner points of contact identified in Volume II	Alternate jurisdictional points of contact

19.2.1 Monitoring

The Planning Partnership will be responsible for monitoring and documenting annual progress on the plan. Each year, beginning one year after plan development, Lewis County and local Planning Partnership representatives will collect and process information from the persons responsible for overseeing mitigation projects in each department, agency, and organization involved in implementing mitigation actions identified in the jurisdictional annexes. In the first year of the approval period, this will be accomplished using an online performance progress reporting system (the BAToolSM), which will enable each planning partner to do the following:

- Directly access mitigation actions.
- Update the status of each project.
- Document successes or obstacles to implementation.
- Add or delete projects to maintain mitigation strategy implementation.

Planning partners will be prompted by the tool to update progress on a quarterly basis, encouraging them to refresh their mitigation strategies and to continue implementation of actions. This reporting system facilitates the sorting and prioritization of projects and will support the submittal of an increased number of project grant fund applications. Planning Partnership representatives will be expected to document the following:

- Progress on the implementation of mitigation actions
- Obstacles or impediments to implementation of actions
- Grant applications filed on behalf of the planning partners
- Hazard events and losses occurring in their jurisdiction
- Additional mitigation actions believed to be appropriate and feasible
- Public and stakeholder input

Plan monitoring for years 2 through 4 of the approval period will be addressed via the BAToolSM or manually.

19.2.2 Integrating the HMP into Municipal Planning Mechanisms

Hazard mitigation is sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. Integrating hazard mitigation into a community's existing plans, policies, codes, and programs leads to development or redevelopment that reduces risk from known hazards. The jurisdictional annexes in Volume II describe how hazard mitigation is being integrated into existing planning mechanisms for each planning partner. Many partners have recognized the importance and benefits of incorporating hazard mitigation into future local planning and regulatory processes.

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

The capability assessment (Chapter 16) provides a summary and description of existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, and local) that support hazard mitigation in the County. In the jurisdictional annexes in Volume II, each planning partner identified how it has integrated hazard risk management into its existing planning, regulatory, and administrative framework ("existing integration") and how it intends to promote this integration further ("opportunities for future integration").

It is the intention of the planning partners to incorporate mitigation planning as an integral component of daily government operations. Planning Partnership representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. The sample adoption resolution (Appendix A – Adoption Resolution) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and operations. By doing so, the Planning Partnership anticipates the following:

- Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts.
- The HMP, comprehensive plans, emergency management plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of county residents.

Other planning processes and programs to be coordinated with the recommendations of the HMP include the following:

- Emergency response plans
- Training and exercise of emergency response plans
- Debris management plans
- Recovery plans
- Capital improvement programs
- Municipal codes
- Drainage and culvert upgrades
- Redundant power for critical facilities
- Community design guidelines
- Stormwater management programs
- Water system vulnerability assessments
- Comprehensive flood hazard management plans
- Resiliency plans
- Educational programs
- Continued interagency coordination

During the HMP annual review process, each planning partner will be asked to document how it is incorporating the HMP into day-to-day operations and planning and regulatory processes. Each planning partner 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 checklist in Table 19-2, adapted from FEMA's 2013 Local Mitigation Handbook, will help each community analyze how hazard mitigation is integrated into local plans, ordinances, regulations, and policies. Completing the checklist will help planning partners identify areas that currently integrate hazard mitigation and where to make improvements to reduce vulnerability of future development.

Table 19-2. Safe Growth Check List

Planning Mechanisms	Yes	No	How is it being done or how will this be utilized in the future?
Operating, Municipal, and Capital Improvement Program Budgets			
When constructing upcoming budgets, are hazard mitigation actions funded as budget allows?			
Are construction projects evaluated to see if they meet the hazard mitigation goals?			
Does the municipality review mitigation actions when allocating funding during annual budget adoption processes?			
Do budgets limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?			
Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?			

Planning Mechanisms	Yes	No	How is it being done or how will this be utilized in the future?
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 actions or other efforts to reduce natural hazard risk?			
Building and Zoning Ordinances			
Prior to zoning changes or development permitting, does the municipality review the HMP and other hazard analyses to ensure consistent and compatible land use?			
Does the zoning ordinance discourage development or redevelopment within natural areas, including wetlands, floodways, and floodplains?			
Does the zoning ordinance contain natural overlay zones that set conditions			
Does the zoning ordinance require developers to take additional actions to mitigate natural hazard risk?			
Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?			
Does the zoning ordinance prohibit development within or filling of wetlands, floodways, and floodplains?			
Subdivision Regulations			
Do subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?			
Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources?			
Do the regulations allow density transfers where hazard areas exist?			
Comprehensive Plan			
Are the goals and policies of the plan related to those of the HMP?			
Does the future land use map clearly identify natural hazard areas?			
Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			
Land Use			
Does the future land use map clearly identify natural hazard areas?			
Do the land use policies discourage development or redevelopment in natural hazard areas?			
Transportation Plan			
Does the transportation plan limit access to hazard areas?			
Is transportation policy used to guide growth to safe locations?			
Are transportation systems designed to function under disaster conditions (e.g., evacuation)?			
Environmental Management			
Are environmental systems that protect development from hazards identified and mapped?			
Do environmental policies maintain and restore protective ecosystems?			
Do environmental policies provide incentives to development located outside protective ecosystems?			

Planning Mechanisms	Yes	No	How is it being done or how will this be utilized in the future?
Grant Applications			
Are data and maps used as supporting documentation in grant applications?			
Municipal Ordinances			
Is hazard mitigation a priority when updating municipal ordinances?			
Economic Development			
Does the local economic development group take into account information regarding identified hazard areas when assisting new businesses in finding a location?			
Public Education and Outreach			
Does the municipality have any public outreach mechanisms/ programs in place to inform citizens about natural hazards, risk, and ways to protect themselves during such events?			

19.2.3 Evaluating

Evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, whether the HMP goals are being achieved, and whether changes are needed. The HMP Coordinator will consult with the Planning Partnership members to evaluate the effectiveness of the plan implementation and to reflect changes that could affect mitigation priorities or available funding.

The status of the HMP will be discussed and documented at an annual plan review meeting of the Planning Partnership to be held either in person or via teleconference approximately one year from the date of local adoption of this update and successively thereafter. The HMP Coordinator will be responsible for calling participants and coordinating the annual plan review meeting and soliciting input regarding progress toward meeting plan goals and objectives. At least two weeks before the annual plan review meeting, the HMP Coordinator will advise Planning Partnership members of the meeting date, agenda, and expectations of the members. These evaluations will assess whether:

- Goals and objectives address current and expected conditions.
- The nature or magnitude of the risks has changed.
- Current resources are appropriate for implementing the HMP and if different or additional resources are now available.
- Actions were cost effective.
- Schedules and budgets are feasible.
- Implementation problems are present, such as technical, political, legal, or coordination issues with other agencies.
- Outcomes have occurred as expected.
- Changes in local resources impacted plan implementation (e.g., funding, personnel, and equipment).
- New agencies, departments, and staff are included, involving other local governments as defined under 44 CFR 201.6.

Specifically, the Planning Partnership will review the mitigation goals, objectives, and activities using performance-based indicators, including:

- New agencies/departments
- Project completion
- Underspending/overspending
- Achievement of the goals and objectives
- Resource allocation
- Timeframes
- Budgets
- Lead/support agency commitment
- Resources
- Feasibility

The Planning Partnership will evaluate how other programs and policies have conflicted with or augmented planned or implemented mitigation actions and will identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions (“Implementation of Mitigation Plan through Existing Programs” subsection below discusses this process). Other programs and policies can include those that address:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and safety
- Recreation
- Land use and zoning
- Public education and outreach
- Transportation

The Planning Partnership should refer to evaluation forms in the FEMA 386-4 guidance document to assist in the evaluation process (Worksheets #2 and #4; see Appendix F–Plan Maintenance 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 HMP Coordinator will be responsible for preparing an annual HMP progress report for each year of the approval period based on the information provided by the Planning Partners and other information as appropriate. These annual reports will provide data for the 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 actions are completed, which are no longer feasible, and which require additional funding.

Following any major disasters, the HMP will be evaluated and revised to determine if the recommended actions remain relevant and appropriate. The risk assessment will also be revisited to see if any changes are necessary based on the pattern of disaster damage or if data listed in the hazard profiles of this 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.

19.2.4 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 certain mitigation-related federal benefits. It is the intent of the Lewis County HMP Planning Partnership to update this plan on a five-year cycle from the date of initial plan adoption.

To facilitate the update process, the HMP Coordinator, with support of the Planning Partnership, will use the second annual Planning Partnership meeting to develop and commence the implementation of a detailed plan update program. Prior to the 5-year update, the HMP Coordinator will invite representatives from the New York State Division of Homeland Security and Emergency Services to provide guidance on plan update procedures. At a minimum, this will establish who will be responsible for managing and completing the 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.

19.2.5 Grant Monitoring and Coordination

Lewis County intends to be a resource to the Planning Partnership in the support of project grant writing and development. The degree of this support will depend on the level of assistance requested by the planning partners during openings for grant applications. As part of grant monitoring and coordination, Lewis 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.

19.2.6 Continued Public Involvement

The planning partners are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will continue to be posted online at the following link: [Lewis County, NY Hazard Mitigation Plan Update 2025 \(https://tinyurl.com/zceestbm\)](https://tinyurl.com/zceestbm). In addition, public outreach and dissemination of the HMP will include the following:

- Links to the plan on local websites of each planning partner with capability
- Continued utilization of existing social media outlets (Facebook, X [formerly known as Twitter]) to inform the public of natural hazard events, such as floods and severe storms; the public can be educated via the planning partner websites on how these applications can be used in an emergency situation
- Promotion of articles or workshops on hazards to educate the public and keep them aware of the dangers of hazards

The HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. The public will have an opportunity to comment on the plan via the hazard mitigation website at any time. The HMP Coordinator will ensure that:

- Public and stakeholder comments and input on the plan, and hazard mitigation in general, are collected, recorded, and addressed as appropriate.
- The Lewis 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.

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ACRONYMS AND DEFINITIONS

%	Percent
ACOE	Army Corps of Engineers
ACS	American Community Survey
ADA	Americans with Disabilities Act
AICP	American Institute of Certified Planners
ACE	Annual Chance Exceedance
ANSS	Advanced National Seismic System
APA	Approval Pending Adoption
ARC	American Red Cross
ASCE	American Society of Civil Engineers
ALICE	Asset Limited, Income Constrained, Employed
ASDSO	Association of State Dam Safety Officials
BCA	Benefit Cost Analysis
BCEGS	Building Code Effectiveness Grading Schedule
BFE	Base Flood Elevation
BOA	Brownfield Opportunity Area
BOCES	Board of Cooperative Educational Services of New York State
BUI	Buildup Index
C	City
CBS	Chemical Bulk Storage
CAC	Community Assistance Contacts
CAP-SSSE	Compliance Assistance Program – State Support Services Element
CAV	Community Assisted Visit
CCAHA	Conservation Center for Art and Historic Artifacts

CCE	Cornell Cooperative Extension
CDBG	Community Development Block Grant
CDBG-DR	Community Development Block Grant Disaster Recovery
CDC	Centers for Disease Control
CDMS	Comprehensive Data Management System
CEDAR	Code Enforcement Disaster Assistance Response
CEMP	Comprehensive Emergency Management Program
CEO	Chief Executive Officer
CFR	Code of Federal Regulations
CIP	Capital Improvement Plan
CMP	Coastal Management Program
COOP/COG	Continuity of Operations/Continuity of Government
COAD	Community Organizations Active in Disaster
CPC	Climate Prediction Center
C-PUD	Commercial Planned Unit Development
CRREL	Cold Regions Research and Engineering Laboratory
CRS	Community Rating System
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSC	Climate Smart Communities (NYSDEC)
CSD	Central School District
COVID	Coronavirus Disease
CPR	Cardiopulmonary Resuscitation
CRRA	Community Risk and Resiliency Act
CWA	Clean Water Act
CWSRF	Clean Water State Revolving Fund

DBSC	Division of Building Standards and Codes
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Map
DHS	Department of Homeland Security
DI	Damage Indicators
DOD	Degree of Damage
DMA 2000	Disaster Mitigation Act of 2000
DPW	Department of Public Works
DCPW	Deputy Commissioner of Public Works
DR	Major Disaster Declaration (FEMA)
DRI	Downtown Revitalization Initiative
DOH	Department of Health
DOS	Department of State
DOT	Department of Transportation
EAB	Emerald Ash Borer
EAP	Emergency Action Plan
ECL	Environmental Conservation Law
EDD	Early Detection and Distribution
EF	Enhanced Fujita Scale
EFC	Environmental Facilities Corporation
EM	Emergency Declaration (FEMA)
EMPG	Emergency Management Program Grant
EMS	Emergency Medical Services
EPF	Environmental Protection Fund
EOC	Emergency Operation Center
EOP	Emergency Operation Plan

EPA	Environmental Protection Agency
ESF	Emergency Support Function
ESRI	Environmental Systems Research Institute
EWP	Emergency Watershed Protection Program
FAA	Federal Aviation Administration
FD	Fire Department
FDRA	Fire Danger Rating Areas
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIA	Flood Insurance Administration
FIS	Flood Insurance Study
FM	Fuel Moisture
FMA	Flood Mitigation Assistance
FMCSA	Federal Motor Carrier Safety Administration
FPA	Floodplain Administrator
FPI	Fire Potential index
FTA	Federal Transit Authority
FY	Fiscal Year
GCM	Global Climate Model
GIS	Geographic Information System
GML	General Municipal Law
GOSR	Governor's Office for Storm Recovery
GSN	Global Seismographic Network
GP	General Permit

HAB	Harmful Algal Bloom
HAZMAT	Hazardous Materials
HAZUS	Hazards U.S.
HAZUS-MH	Hazards U.S. Multi-Hazard
HHPD	High Hazard Potential Dam
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HSGP	Homeland Security Grant Program
HUC	Hydrologic Unit
HUD	U.S. Department of Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
IA	Individual Assistance
ICS	National Incident Command System
IDA	International Development Association
IHWDS	Inactive Hazardous Waste Disposal Site
ISO	Insurance Service Office
IT	Information Technology
JC	Johnson City
JSTP	Joint Sewage Treatment Plant
KBDI	Keetch-Bryam Drought Index
LCSN	Lamon-Doherty Cooperative Seismographic Network
LAMP	Levee Analysis and Mapping Process
LSAC	Levee Safety Action Classification
LEED	Leadership in Energy and Environmental Design
LEPC	Local Emergency Planning Committee
LWCF	Land and Water Conservation Fund

LWRP	Local Waterfront Revitalization Program
LLC	Limited Liability Company
LOP	Letter of Permission
MCI	Mass Causality Incident
MERS	Middle East Respiratory Syndrome
MOSF	Major Oil Storage Facilities
MGD	Million Gallons per Day
Mi	Mile
MMI	Modified Mercalli Intensity Scale
Mph	Miles per Hour
MRCC	Midwest Regional Climate Center
MRP	Mean Return Period
MRLC	Multi-Resolution Land Characteristics
N/A	Not Applicable
NA	Not Available
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NAC-AAA	National Avalanche Center – American Avalanche Association
NCDC	National Climate Data Center
NCEI	National Centers for Environmental Information
NCI	North Central Institute
NEHRP	National Earthquake Hazards Reduction Program
NEP	National Estuary Program
NESIS	Northeast Snowfall Impact Scale
NFDRS	National Fire Danger Rating System
NFIA	National Flood Insurance Act

NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NHC	National Hurricane Center
NHD	National Hydrography Dataset
NHTSA	National Highway Traffic Safety Administration
NID	National Inventory of Dams
NIDIS	National Integrated Drought Information System
NIMS	National Incident Management System
NLD	National Levee Database
NOAA	National Oceanic and Atmospheric Administration
NPDP	National Performance of Dams Program
NPL	National Priorities List (EPA)
NRCC	Northeast Regional Climate Center
NRCS	Natural Resources Conservation Service
NRDC	Natural Resources Defense Council
NSIDC	National Snow and Ice Data Center
NSSL	National Severe Storms Library
NTSB	National Transportation Safety Board
NWP	Nationwide Permit
NWS	National Weather Service
NY	New York
NYIS	New York Invasive Species Network
NYCRR	New York Codes, Rule, and Regulations
NYPA	New York Power Authority
NYRCR	New York Rising Community Reconstruction
NYS	New York State

NYSDHSES	New York State Division of Homeland Security and Emergency Services
NYS ESD	New York State Empire State Development
NYS GIS	New York State Geographic Information System
NYS OFP&C	New York State Office of Fire Prevention and Control
NYSDAM	New York State Department of Agriculture and Markets
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
NYSDPC	New York State Disaster Preparedness Commission
NYSEG	New York State Electric and Gas
NYSERDA	New York State Energy Research and Development Authority
NYSHMP	New York State Hazard Mitigation Plan
NYSFSMA	New York State Floodplain and Stormwater Managers
NYSOEM	New York State Office of Emergency Management
OES	Office of Emergency Services
OFA	Office for Aging
OFPC	Office of Fire Prevention and Control
OPRHP	Office of Parks, Recreation and Historic Preservation
OPSG	Operation Stonegarden
OSHA	Occupational Safety and Health Administration
PA	Public Assistance
PBS	Petroleum Bulk Storage
PD	Police Department
PDM	Pre-Disaster Mitigation Program
PDSI	Palmer Drought Severity Index
PFIS	Preliminary Flood Insurance Study

PE	Professional Engineer
PGA	Peak Ground Acceleration
PHMSA	Pipeline and Hazardous Materials Safety Administration
POC	Point of Contact
POE	Point of Entry
Pop.	Population
PPD	Presidential Policy Directive
PW	Public Works
RAISE	Rebuilding American Infrastructure with Sustainability and Equity
RC	Red Cross
RCV	Replacement Cost Value
REDC	Regional Economic Development Council
RL	Repetitive Loss
RLF	Revolving Loan Fund
RMC	Registered Municipal Clerk
ROW	Right of Way
RSI	Regional Snowfall Index
RTE	Route
RTP	Recreational Trails Program
SARA	Superfund Amendments and Reauthorization Act
SBA	Small Business Administration
SEQRA	State Environmental Quality Review Act
SDI	State Drought Index (NYSDEC)
SF	Square Feet
SFHA	Special Flood Hazard Area
SFRMG	State Flood Risk Management Guidance

SHMP	State Hazard Mitigation Plan
SHMO	State Hazard Mitigation Officer
SHSP	State Homeland Security Program
SILVIS	Spatial Analysis for Conservation and Sustainability
SPC	Storm Prediction Center
SPEI	Standardized Precipitation Evapotranspiration Index
SPDES	State Pollutant Discharge Elimination System
SUNY	State University of New York
Sq. Mi.	Square mile
SRL	Severe Repetitive Loss
SSBG	Social Services Block Grant
SVI	Social Vulnerability Index
SWCD	Soil and Water Conservation District
SWMP	Stormwater Management Program
SWOO	Strengths, Weaknesses, Obstacles and Opportunities
SWPPP	Stormwater Pollution Prevention Plan
T	Town
TBD	To Be Determined
TD	Tropical Depression
THIRA	Threat Hazard Identification and Risk Assessment
TS	Tropical Storm
UASI	Urban Areas Security Initiative
UCAR	University Corporation for Atmospheric Research
UHS	United Health Services
USACE	United States Army Corps of Engineers
US	United States

USDA	United States Department of Agriculture
USDM	United States
USEDA	United States Economic Development Administration
USEIA	United States Energy Information Administration
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
USRT	Underwater Search and Recovery
UTV	Utility Task Vehicle
V	Village
VA	Vulnerability Assessment
WWTP	Waste Water Treatment Plant
WCT	Wind Chill Index
WFAS	Wildland Fire Assessment System
WFO	Weather Forecast Office
WQIP	Water Quality Improvement Project
WUI	Wildland/Urban Interface
WW	Wastewater
WHO	World Health Organization
ZBA	Zoning Board of Appeals